D11 INFRASTRUCTURE MANAGERS VIEWS ON INFRASTRUCTURE COST ALLOCATION

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Acknowledgement and foreword

We are indebted to the Committees’ members who gave their time willingly to contribute to discussions and to who fill the questionnaires for the survey. Whilst this report is an outcome of the meetings of the group the opinions and conclusions expressed within are those of the authors. They cannot be assumed to represent those of each expert group member, their organisation or the European Commission. The same can be said for the questionnaires of the survey: the opinions expressed in are personal, and cannot in any way be labelled as official position of the organizations the respondents belong to. A particular acknowledgement for the valuable material provided goes to Pascaline Cousin, Director of Transport Economics at SETRA (Technical Department for Transport, Roads and Bridges Engineering and Road Safety of the French ministry of Ecology, Energy, Sustainable Development and Town and Country Planning).
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EXECUTIVE SUMMARY

This deliverable summarises the Infrastructure managers (IM) feedback concerning the possibility to implement the CATRIN recommendations. The background activities carried out by the CATRIN IMs in preparation of this report have been:

1. A survey among IMs, in which the CATRIN IMs have reviewed the current pricing principles and have expressed their positions concerning the adoption of other principles in the formulation and implementation of pricing policies.
2. Interviews with the IMs in order to discuss cost allocation methods in use, for which the review of current practices has led to the identification and discussion of the most relevant issues at stake, problems, uncertainties and achievements.
3. Meetings with IMs in which the CATRIN IMs have provided input to the case studies and discussed the possibility to implement the CATRIN recommendations, as emerged from the CATRIN case studies.

Rail
Concerning the relevance of marginal cost measurement, it was agreed that the measurement of short run marginal cost provided important information for the infrastructure manager. Short run marginal cost can in fact be considered as the floor below which infrastructure charges should not be set, although they may have to be considerably higher on average unless the government provides sufficient funding to cover all fixed costs. It is therefore more important to obtain accurate measures of marginal cost in locations and sectors where prices are close to marginal costs than where they are well above them. From the point of view of future planning, long run marginal cost are also very important, according to IM.

With reference to the accuracy of the CATRIN results, it was commented that, although the best information available, the CATRIN results remained affected by considerable uncertainty. This is particularly true of renewals costs, where little evidence is available. Whilst it is not possible to provide formal confidence intervals, the uncertainty surrounding the relevant elasticity should therefore always be emphasised. Concerning the CATRIN recommendations, it was recognised that these provide a suitable methodology for estimating short run marginal costs where data are not available for an in depth study, and that, being based on good data and state of the art methodology, adopting the recommended methodology is to be preferred to relying on a superficial study. However, where a good ad hoc study is undertaken its results are likely to be more accurate than transferring those of CATRIN.

Regarding the insights from the engineering models, it was agreed that the engineering approach provides the possibility of differentiating charges in great detail by type of rolling stock. It was seen as important to give train operators appropriate incentives regarding the type of rolling stock they used. Some countries do not even differentiate charges between trains according to gross tonne kilometres, which is the obvious first step. Concerning charging for scarcity, the discussions stressed the fact that most countries do not currently charge for capacity; for instance in the Netherlands capacity is allocated according to the relative social benefits of alternative uses and
pricing plays no part in this process. However, the high reservation charges on congested routes in France may be seen as a sort of capacity charge somewhat in line with the CATRIN recommendations.

Furthermore, it has been noted that the opening up of the market does not only require non discriminatory access to tracks, but also to other facilities such as freight terminals, marshalling yards and maintenance depots. Charges for such services also need further examination.

In the light of the feedback received from IMs, the CATRIN outcomes can be usefully applied, both in a short and a longer term perspective. In the short term:
- To adopt shortcut instruments (transfer of values) for the assessment of marginal wear and tear infrastructure costs (if country-based studies are not available)
- To reconcile short-run marginal costs assessments with the issue of the overall full cost coverage, including State funding
- To provide information on the differentiation of charging by route and by type of vehicle, so as to offer train operators appropriate incentives in relation to the type of rolling stock used

In the longer term, it appears that:
- Further support and enhancement of the CATRIN recommendations about how to generalize the findings should be pursued, notably through the comparison with specific rail cost allocation studies for different countries.
- The EC should not force more differentiated charges, leaving it to the infrastructure managers. The industry in fact supports research, dissemination but not imposition of yet more rules on how to calculate infrastructure charges.

Road
Concerning cost allocation studies, the CATRIN IMs, have shed light on methods and procedures for assessing the avoidable costs on pavement structure, where avoidable costs are intended to be the costs individually attributable to specific vehicles (HGV and light cars). In the French case, the concept of HGV aggressiveness has been used, and its implications simulated with specific software accounting for each HGV technical characteristic, e.g. weight and axles. The French IM contribution confirms, however, that there is still no single solution to allocate road infrastructure costs. Sensitivity to specific, national based costs structures is high and can influence the final results.

The sensitteness of the infrastructure road charging to the proper evaluation of pavement damage, in the first place, confirms the relevance of the EURODEX (EUropean ROad Damage EXperiment) objectives as stressed by the CATRIN research, to the extent that they aim at consolidating a reliable and improved basis for a sustainable and fair transport pricing on European roads.

In particular, the Swedish Road Infrastructure manager has stressed the importance for the road administrations in Europe to benefit from cooperation, which would provide cheaper and more efficient research insights if they could join research efforts through a dedicated call on this issue.
Concerning **data availability**, the research carried out in CATRIN has emphasized, i) the need for complete, disaggregated, road section data in some case on several years basis. But data are often scarce, incomplete and even inaccessible. ii) That the trend towards privatization and outsourcing for large road sections to save maintenance costs may lead the IMs (regulators) to lose control over maintenance data on selected small road sections. In addition, data collected by private operators may be regarded as confidential, and become de facto unavailable for public research. iii) As for traffic data counting, the need to have frequent traffic counting for refining the analysis may impose additional data collection costs upon the IM.

The feedback received from the IM contributes to addressing the above challenges. The issue of data collection in a form suitable to be usable within the marginal costs approach may be hampered by institutional settings. For example in Switzerland, it was noted that roads are built either by the confederation, the cantons or by the communities. This may be accompanied by different data collection formats, calling for time and resource consuming post processing. Furthermore, and more importantly, data collection at all levels is not focussing on marginal costs, but on full costs. This implies that necessary information for marginal cost estimates may be missed and often lost in aggregation.

The issue of privatization and its impacts on data collection deserves attention. It has in fact been acknowledged that privatization, once implemented and permitted by national legislations, might make data collection more difficult. Concerning the costs for data collection, e.g. traffic counting, it has been agreed that they are, at least in comparison to the other costs for building, maintaining and operating the roads, rather limited.

Ultimately, recommendations based on the short- and long term implications arising from the discussion with the road IMs can be summarised as follows.

In the short term:
- To further develop cost allocation studies, taking stock of the international approaches and methods, and assuming the EC Eurovignette Directive 2006/38 as reference, i.e. comparing the new estimations with the equivalence factors indicated by the Directive. The most important factors requiring further analysis are the impacts of vehicles on the pavement structures.

In the long term:
- To develop the potentialities of new technologies for improving data collection, e.g. on-board vehicle equipments
- To take account of the potential problems in data collection arising from the growing trend toward privatization and private public partnerships (PPP), e.g. through ad hoc contractual obligations in concessions agreements and incentives for data collection

**Air**

The CATRIN research has shown that there are important **economies of scale** in airport operations, and, thus, that the current trend of capacity expansion programs observed in major hubs can be justified. Within the current technological frontier, it has been said, the world’s leading airports will continue to benefit from scale economies in the
provision of infrastructure for air transportation and commercial activities until they reach between two or three times their current scales.

The Irish CATRIN air IM in the Dublin Airport has pointed out that the existence of scale economies crucially depends on the elasticity assumptions. In fact, in order to assess the existence of scale economies in airport operations it is important to separate out scale effects from genuine efficiency effects. The regulator, the Dublin Airport Authority, acknowledged that in broad terms there are some opportunities within the airport sector for reaping the benefits of economies of scale. Economies of scale in fact will be determined largely by the fact that a certain portion of the Airport’s operating cost base is fixed in the short term. However in order for an airport to capture the benefits of scale economies it is essential that there is adequate spare capacity in the critical areas such as terminal, runway and airfield. When an airport experiences capacity shortages in its key infrastructural areas this will put upward pressure on operating costs as expenditure is incurred in dealing with congestion and its associated costs, reducing the opportunities for scale economies and in fact potentially leading to diseconomies of scale.

Concerning the relationships between aviation costs and commercial activities, the CATRIN research found that economies of scale are highly dependent on the cost complementarities between aviation and commercial activities. In particular, it was noted that some airports may, in the near future, encounter decreasing returns to scale when considering only the aviation sector. In spite of that, these airports could still enjoy scale economies if they were in charge of the development of commercial activities.

The CATRIN IMs (the Irish and the Swedish members) warned that the consideration of the actual elasticity between passenger growth and commercial revenues must be carefully scrutinized. In forecasting commercial revenues the regulator of the Dublin Airport has made an assumption about the relationship between changes in passenger volumes growth and commercial revenue growth, i.e. the elasticity of commercial revenues. The weighted average elasticity across all commercial revenue categories used by the regulator in 2005 was approximately 1.0, implying a one for one relationship between passenger growth and commercial revenue growth. However, the Dublin Airport witnessed a 21% decrease in commercial revenues on a per passenger basis, as an effect of declining performance over time.

Hence, the CATRIN air IMs stressed the fact that the relationships between passenger growth and operating costs as well as commercial revenues must be carefully scrutinized and that the conclusions of the case study in terms of future scale economies from air transportation and commercial activities must be accompanied by explicit caveats. Furthermore, the CATRIN research found that airport charges are always closer to the estimates of the long-run approach rather than to those of the short-run approach.

The short term recommendation arising from the IMs contribution to the debate is to develop the analysis of elasticity between aviations costs and cost drivers, e.g. passenger growth, in order to provide an assessment of any scale effects when analysing the airport operating expenditures performance.
Maritime
The CATRIN waterborne IMs found the report making a strong case for transnational co-operation in icebreaking in the Baltic Sea area (the Finnish member). A good model and strong proof of the importance and value added of co-operation in icebreaking is the already existing co-operation between Sweden and Finland. It was further concluded that important preconditions should be met in the pursuance of a joint icebreaker fleet:

- All member nations should follow the HELCOM recommendation 25/7 “Safety of winter navigation in the Baltic Sea Area” in their traffic restriction policy. Different levels would in fact lead to imbalance in icebreaker assistance.
- All member nations should have access to IB-net, the real time data system of icebreaker, on their vessels.
- The efficiency of the icebreaker is depending to a large extent on the skill of commanding officers in charge of the icebreaker. Under-skilled officers entail longer assisting times of the icebreakers themselves, thus increasing fuel consumption and waiting times for merchant vessels.

Another important aspect of the case study is the relationship between icebreaking services and the TEN-T network. The common European interest in winter navigation has been acknowledged by that the inclusion of icebreaking in the TEN-T future guidelines, while Member States have received EU TEN-T funds for icebreaking purposes. However, the Finnish IM remarked that icebreaking is already included in the current TEN-T guidelines. In fact, Finland has received EU TEN-T funds in the end of the 1990’s. It is important that icebreaking continues to be regarded as a part of the TEN-T (i.e. important infrastructure) also under the new forthcoming guidelines. Also the rules for applying EU funding for icebreaking should be clarified in the new guidelines.
1. The Knowledge Base for Pricing the Use of Transport Infrastructure

This chapter summarises state-of-the-art approaches and views from the Infrastructure Managers (IMs) on the transport infrastructure costs allocation. The combination of theoretical approaches and good practices intends to outline the knowledge base for pricing the use of transport infrastructure.

In order to pursue this objective, we take stock of the results of the research stream focussed on pricing the use of transport infrastructure, which benefits from a long standing tradition in the EU funded European projects. In this context, the following topics are of particular relevance:

- establishing a bridge between the research on transport infrastructure pricing and policy implementation;
- enhancing the dialogue with the IMs in order to reach a common understanding of the key issues behind the pricing of transport infrastructure.

The most recent examples of this research stream are the IMPRINT-EUROPE Thematic Network (http://www.imprint-eu.org/project.htm), developed in the context of the EC Fifth Framework RTD (2001-2004) and the IMPRINT-NET Coordination Action (http://www.imprint-net.org), developed in the context of the EC Sixth Framework RTD (2005-2008).

Both projects aimed at setting up and running a discussion platform for stakeholders (policy makers, industry, operators) in order to exchange views on the implementation of new pricing regimes, cost calculation methods and charge determination, and possibly reach consensus on major policy relevant aspects:

- IMPRINT-EUROPE focussed on the key issues arising from the implementation of pricing reforms based on a system of fair and efficient prices, the definition of which is rooted in the abundant series of research projects (e.g. PETS, QUITS, TRENEN, MC-ICAM, RECORDIT, UNITE) that were launched following the 1995 Green Paper “Towards fair and Efficient Pricing in Transport” (EC, 1995)
- IMPRINT-NET further updated the knowledge base emerging from EU research (GRACE, REVENUE, DIFFERENT…), and staged a comprehensive discussion on the technical and political aspects of pricing transport infrastructure (e.g. use of revenues, cost drivers, measurement issues, etc) involving stakeholders and IMs through targeted discussions, meetings, seminars and conferences.

The conclusions and the findings of the two projects, which benefited from the active contribution of many of the CATRIN consortium members have been an important input to the discussion with IMs. They have represented in fact the background issues against which the input from the CATRIN IMs has been elicited and assembled.
All in all, the CATRIN activity involving IMs has featured a survey, a series of targeted meetings and of interviews, allowing:

- to update the conclusions of past research, adding new insights on the most controversial issues while highlighting, on the other hand, those issues for which a general consensus may be reached
- to raise issues for which further research is deemed necessary.

In order to facilitate the presentation of the results, the conclusions of the CATRIN IMs activity have been split in the following three topics:

4. **Pricing principles**, in which the CATRIN IMs have reviewed the current pricing principles and have expressed their positions concerning the adoption of such principles in the formulation and implementation of pricing policies.

5. **Cost allocation methods in use**, for which the review of current practices has led to the identification and discussion of the most relevant issues at stake, problems, uncertainties and achievements.

6. **The existence and availability of databases**, focussing on the current situation of data availability for pricing the use of transport infrastructure

The relevant accompanying material of the CATRIN IMs activity, i.e. minutes of the meetings, questionnaires of the survey and the background material discussed during the meetings, can be found in the annexes to this report.

### 1.1 Pricing principles

**Road**

The CATRIN road IMs have stressed that the principles underpinning road pricing policy arise from the combination of three different objectives:

- Financial, i.e. to pursue the funding of road infrastructure maintenance and construction
- Social and environmental, i.e. to take due account of the transport external costs (congestion, noise and air pollution)
- Economic efficiency, i.e. introducing km-based charging schemes allowing to charge transport activities on the basis of transport performance (the level corresponds in fact directly to the number of kilometres travelled) and as far as possible at “the point of use” through the use of on-board units for positioning the vehicle

As the review of the CATRIN IMs practices has shown, the three objectives may in some cases be achieved through the same charge, as in the example of the Swiss HVF km-based charge, addressing both economic efficiency and financial objectives (the HVH charge will thus become the most important means of funding the new rail links through the Alps (NEAT).
In other cases, the different objectives are addressed through different charges, as in the Swedish case, in which environmental objectives, i.e. congestion and environment, are basically addressed through urban road charging schemes (in Stockholm and Göteborg), while the financial objectives are covered through co-financing from regions.

Concerning the **financial** objective, the CATRIN road IMs have underlined the importance of budget financing instruments (mainly taxes and charges, but in some cases also tolls and vignette if they are not directly allocated to the road sector but to the general budget) to fund road infrastructure maintenance and construction.

This is particularly true in the light of the composition of the CATRIN road IMs, participants of a group of countries from North and Centre Europe (Sweden, Switzerland, UK and Austria) that seem to be reluctant to use concession contracts for the construction and maintenance of road networks that remain under public control.

But even in the case of user financing models where the private sector plays a major role as in Southern and Mediterranean countries, the financial objective is of paramount importance. In fact, in such schemes - the User Financed Models (concessions) - the private partner within a Public Private Partnership scheme is responsible for the design, construction, maintenance and operation of the road infrastructure, including the financing of these tasks. The private partner is remunerated by user charges, which it is allowed (generally by law) to collect directly from the users.

In both cases, i.e. with or without private concessionaire (or when the concessions are public firms that manage such concessions, as in Austria), the **full cost** recovery of infrastructure costs is the key pricing principle.

This is also confirmed by the recent Directive 2006/38/EC, amending the 1999 ‘Eurovignette’ Directive 1999/62/EC, setting the rules for road infrastructure charges of heavy vehicles in which the full cost principle is clearly indicated.

The Directive 2006/38/EC (art 9) states in fact that: “Tolls shall be based on the principle of the recovery of infrastructure costs only. Specifically the weighted average tolls shall be related to the construction costs and the costs of operating, maintaining and developing the infrastructure network concerned. The weighted average tolls may also include a return on capital or profit margin based on market conditions.”. Furthermore (art 1) is specified that “Construction costs means the costs related to construction, including, where appropriate, the financing costs, of: new infrastructure or new infrastructure improvements (including significant structural repairs)”.

Concerning the **environmental** objectives, the CATRIN Road IMs discussed the general objective of internalising external costs and, in such a context, the importance of Directive 2006/38/EC and of the current insights from the European road pricing schemes to serve as background references for the identification of underlying pricing principles.
The Directive 2006/38/EC is considered as a potential reference framework for the introduction of charging principles addressing external costs. The same consideration was put forward by the Swedish IM, indicating in the application of km-charging schemes the most efficient way to address environmental issues.

The combination of environmental objectives with the pursuing of economic efficiency through the application of km-based charging schemes, has been emphasized as one of the most promising approach. This may introduce the principle of the estimation of marginal charges in road pricing, including infrastructure wear and tear, as stated in the Eurovignette Directive 2006/38, concerning the Heavy Goods Vehicles.

For example, the EC proposal for the application of the methodology for the determination of a “generally applicable, transparent and comprehensible model for assessing the external costs of transport, such as pollution and congestion”, part of the strategy towards the internalization of external costs, includes the principle of charging the use of road infrastructure according to the damage caused by the marginal (additional) vehicle; in particular for noise and congestion.

In the context of the environmental objectives, another important principle is the application of the ‘user pays’ principle; i.e. the ability to apply the ‘polluter pays’ principle, for instance through the variation of tolls to take account of the environmental performance of vehicles. All the CATRIN IMs have in fact underlined the importance of charge differentiation criteria based on the vehicle emissions standard class.

In general, the contributions of the CATRIN road IMs have emphasized the strong attitude towards the full exploitation of new technologies for the implementation of advanced charging schemes and cost allocation schemes.

The CATRIN road IMs have provided examples of the importance of the new technologies in the current and future road charging:

- the fully electronic multilane free flow toll collection system operating in Austria since 2004. The system is based on a DSRC 5,8 GHz microwave communication
- the programmes in place to develop industry’s capability on more sophisticated charging, the ability to charge by time, distance and place driven, planned in UK. The programmes intend to test a series of progressively more challenging Demonstration Projects over the next two years, addressing the key challenges characterising the longer-term evolution of charging, such as how to achieve accuracy and fairness and how to protect privacy
- the distance based charging technologies applied in the Swiss Heavy Vehicle Fees (HVF), calculated through the electronic recording device On-Board-Unit.
The composition of the CATRIN rail IMs included 6 infrastructure managers (France, Germany, Italy, Switzerland, Austria, Latvia), the European Infrastructure Managers Association and UIC. It also included the regulators for Britain, Netherlands and Sweden, which play a very important part in determining infrastructure charges, particularly in Britain, where ORR is central in determining methodology and promoting research on this issue.

The charging principles reviewed in the CATRIN rail IMs range from the short run marginal cost pricing approach (in Switzerland) to the full cost recovery less State subsidy in France, Italy and Germany, or a combination of the two (the Netherlands, the UK and Austria).

In the Swiss approach, the Swiss federal Council is responsible for the determination of the marginal charge. The charge is composed of two factors: 1) the Minimum Price and 2) the Contribution Margin. The minimum price includes the components related to the marginal costs (performance-related maintenance, train operation service, additional staff and maintenance costs, etc). The Contribution margin depends on the type of train, and the type of the network.

It is important to consider that the marginal costs charge for the use of infrastructure (short period) leaves resources to be covered by the State budget with reference to the full cost (investment and renewal).

The French charging principle does not mention the marginal approach, in fact it is determined on the basis of the principle laid out in the recent “contrat de performance” between RFF and the French state for which the charging principle is full price recovery minus subsidies, on a national basis.

However, the marginal approach is mentioned in the incoming reform of the infrastructure charges, in 2010, when the charges are calculated in such a way as not to be under marginal costs (marginal components of maintenance, renewal, signalling).

It is interesting to examine the mixed approach. In the UK, for example, the charging principle is a combination of the short run cost principles and the full cost recovery, depending on the type of user. The charging principle for open access passenger and freight operators is broadly based on short run marginal cost pricing. For franchised passenger operators the principle is closest to full cost recovery less state subsidy: the “variable usage charge” is based on the short run marginal cost principle but there is full cost recovery through the “fixed charge”, though – to support government accounting aims – some of the fixed charge is converted into “network grant”, paid directly by government to the infrastructure manager Network Rail.

Concerning the Dutch case, ProRail uses a combination of the short run marginal cost pricing and full cost recovery less state subsidy. The short run marginal costs cover the...
variable costs incurred to the IM for operation, maintenance and management of the rail network. The fixed budgeted costs are covered by State subsidies.

Concerning the mark-up, the Swiss case includes it in the contribution margin component, leaving the infrastructure managers to mark-up according to the market conditions: generally the factors considered are the line’s technical standards, gross tonne-kms, path occupation, etc.

In the French case too, the charge increases above the marginal costs as much as the “market can bear it”. This is the case for example for High speed trains, where the infrastructure charge is close to full cost recovery.

In urban areas too a significant mark up on top of marginal cost is added, in order to take into account scarcity. Charges are in fact close to full price recovery for the most densely populated area (Ile de France / Paris region). Mark-ups are added for time and local capacity bottlenecks in the Austrian case as well.

Concerning the Dutch approach, the mark up is the result of a negotiation process with the RUs. However, it has been stressed that transparency may be insufficient (asymmetric information problem). It may in fact be unclear what the minimum charge is (marginal costs), and what is the mark up above it (the object of the negotiation).

Concerning the methods for charging determination, the CATRIN rail IMs approaches use econometric and engineering methods, or a combination of them, as shown in the following table. A particular importance in the charge determination is left “to what the market can bear” (market approach in the German case)

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<tr>
<th>IM</th>
<th>Econometric approach</th>
<th>Engineering approach</th>
<th>Both approaches</th>
<th>Other</th>
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<td>SBB (Switzerland)</td>
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<td>RFF (France)</td>
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<td>OBB (Austria)</td>
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An important indication emerged during the CATRIN rail IMs dialogue about the rail pricing principles addresses the role to be assigned to the short run marginal assessments in relation to the full cost recovery (budget constraints for the IMs). It was ultimately agreed that the measurement of short run marginal cost can provide important information for the infrastructure managers.
Short run marginal cost can be considered as the floor below which infrastructure charges should not be set, although they may have to be considerably higher on average unless the government provides sufficient funding to cover all fixed costs. It is therefore more important to obtain accurate measures of marginal costs in those locations and sectors where prices are close to marginal costs than where they are well above them.

Air

The CATRIN air IMs underlined that the key pricing principle underlying the determination of airport charges is **full cost recovery**. In that, following the ICAO guidelines: “The cost to be shared is the full cost of providing the airport and its essential ancillary services, including appropriate amounts for cost of capital and depreciation of assets, as well as the costs of maintenance, operation, management and administration” (ICAO, 2004).

The CATRIN air IMs reviewed the ways in which airport charges are traditionally regulated: i.e. through a rate of return or a cost plus basis. Three categories of regulative approaches have been identified: a) cost based regulation, b) pure and hybrid price caps and c) revenue sharing agreements. Furthermore, the choice between the single-till and the double-till approach in cost evaluation (and charge determination) turned out to be another important issue to be considered concerning the model of regulation.

The cost based structure of charges implies that each charge should reflect the corresponding costs, i.e. the charges should create just enough revenues to cover total costs including the depreciation of capital and a normal rate of return on capital. In Europe many of the public airport systems like in Greece and Finland set their charges according to this principle, which is also in line with the ICAO principles of cost relatedness.

On the other hand, it has been stressed that the problems with the cost based regulation are twofold. Firstly, the incentives may be set for an inefficient choice of inputs, in particular, there is the lack of pressures towards cost reduction. Secondly, cost based regulation may lead to an inefficient price structure. For example, under cost based regulation the airport may have no incentive to adopt peak pricing, but rather to lower the price of capital intensive peak demand in order to justify more capital assets, and charge a monopoly price at off-peak times to realize a profit that greater capital will justify.

Diversely, price cap regulations tend to set incentives for cost reduction. The gains from cost reduction can be kept by the regulated airport within the regulation period and might then be passed on to the users via lower charges in the next period. Quality might be monitored or regulated since the airport might try to achieve cost reductions by lowering quality.

According to the CATRIN air IMs, price cap formula is the prevailing method for setting charges. In setting the charges under a price cap approach, as in the Dublin...
Airport, in general the regulator follows the principle of economic efficiency seeking, where possible, to incentivise the achievement of operational efficiencies and to provide capital investment in an efficient manner.

In formulating the price cap, the regulator applies a ‘building blocks’ approach. This process involves calculating the following ‘building blocks’, which are used to determine the price cap:

- The level of return that the airport can earn on its regulated assets;
- The depreciation to be remunerated in respect of the regulated assets;
- The level of allowable operating expenditure;
- The levels of commercial revenues that the airport is expected to earn; and, the forecast of passengers flow

Under a rate-of-return formula, as in the Spanish case, the competitive market dictates the rates. In the Spanish case, efforts are made to keep the 12% rate of return, however in the competitive market some time lowers rates are to be considered, however, not too much low in order to avoid the EBITDA (Earnings before Interest, Tax, Depreciation and Amortisation) dilution.

The Swedish IM stressed that short term investments are needed to maintain, upgrade or expand the tangible assets of airports, such as terminals, runways, access roads and car parks. Such investments contribute decisively to determine the charge level. In order to cover total costs (including capital expenditures), the commercial revenues are considered to be necessary, supporting in such a way a single till framework in charge determination.

It is however important to underline that the single till approach is by no means the standard approach in Europe.

The single-till mechanism, whereby the entire airport’s revenues are taken into account when setting charges, may represent a disincentive to maximising non-aeronautical revenues (reducing the airport’s incentive to minimise non-aeronautical costs). As a consequence, some important allocative inefficiencies may appear in very congested airports, because the lower aeronautical charges artificially exacerbate the scarcity costs of slots. Furthermore, it may distort investment decisions, because the existence of cross-subsidies makes it difficult to estimate the “true” returns on the aeronautical assets.

The alternative mechanism to regulate prices in airports is the dual-till approach in which commercial revenues are not factored into the charges equation, resulting in higher, un-subsidized, prices for airlines. This method may be more consistent with the user-pays principle, under which prices should exactly reflect the marginal cost of using the facilities.
The CATRIN waterborne IMs group included both inland waterways and Port IMs (respectively in Belgium and The Netherlands for inland waterways and in Poland for Ports) and regulators in Sweden. The charging principles reviewed mainly concern maritime transport, given that in the case of inland waterways, the legislative context, e.g. The Mannheim Convention for the navigation on the Rhine, or the lack of significant examples, may prevent the analysis of charging principle.

The CATRIN inland waterways IMs stressed that no charges are paid by the users for the maintenance of inland waterways, the expenditure of which are funded through the general taxation.

Concerning maritime transport, charging at full costs according to the cost recovery principle is the standard framework behind the determination of charges in Ports.

However, the CATRIN waterborne IMs underlined the existence of substantial differences between the respective funding and pricing practices applied in ports across Europe. This diversity is deeply rooted in different legal and cultural traditions and reflects differences in port management style and the related issues of competencies and degree of autonomy.

The discussion with the CATRIN waterborne IMs allowed to review the charging principles for fairway dues (from the open sea to port areas and to inland waterways, where specific measures, like dredging and aids to navigation, are needed) and pilotage in Sweden and Finland (in particular, also icebreaking maintenance costs have been considered).

An interesting and promising characteristic of the charging principle in the Swedish and Finnish case is their environmental differentiation. The fairways charges in Sweden (in Finland they are considered a tax) are differentiated according to the environmental performances of the vessel.

The structure of the charges has been designed in order to be revenue-neutral for the administration: the more polluting vessels in fact pay for the most environmental ones, that benefit of discounts in the payment of the charge.

The charging principle is oriented towards the cost recovery principle: for example for pilotage services, which covers the safe conduct of the vessel within the harbour, the charge has been designed to recover their costs in the long period (even along a time span of years).
**Main findings**

The following table summaries the findings arising from the review of pricing principles.

<table>
<thead>
<tr>
<th></th>
<th>Road</th>
<th>Rail</th>
<th>Air</th>
<th>Waterborne</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Social and</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Economic</strong></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Financial objectives** are common to all the transport modes. The emphasis is on the full cost recovery, including infrastructure investment and maintenance. To fulfil this goal, the revenues from charging the use of infrastructure are combined with other revenues streams, coming from State budget (in particular for rail, air and waterborne transport) and taxes and excise dues (for road). The principle of charging at the marginal short run costs (wear and tear costs) is supported in road and rail transport respectively by the amended Eurovignette Directive 2006/38 and the rail Directive 2001/14.

**Social and environmental objectives** are mainly addressed in road, rail and air transport. In such a contexts, charges may be differentiated to take account of vehicle environmental performances and social external costs, i.e. congestion and scarcity. Concerning waterborne, the only relevant exceptions are the differentiated fairway and port dues in Sweden and Finland.

**Economic efficiency objectives** correspond to charges applied in relation to the transport performance of the vehicles, i.e. considering the distance travelled. Charges responsive to the distance travelled are generally levied only in road (vehicle km) and rail (train km) transport mode.

### 1.2 Cost allocation methods in use

**Road**

The CATRIN road IMs shed lights on the cost allocation methods following the so called **Fully Allocated Costs approach** (cost recovery), that includes all infrastructure costs (maintenance, renewal and construction) in the charge.

In such a framework, the procedure for the calculation is the following, as described by the Austrian IM:

1. calculate the annual capital costs
2. calculate the yearly running costs
3. allocation of the costs to user groups (light/heavy vehicle), e.g. allocation to vehicle class (2,3,4+ axle) and pollutant
4. determination of the toll rates per vehicle class and kilometer
Step 1, the calculation of the annual capital costs, uses as input values for the calculation the capital value by road segment and the lifetime of the elements of road infrastructure, and leads to the estimation of the annual capital cost. The formula is the following:

\[
A = \frac{W W_{ij} \times Z \times (1+Z)^{n_i}}{(1+Z)^{n_j} - 1)
\]

The cost components entering in the calculation are indicated in the following picture:

Source: Friedrich Schwarz-Herda overview of Austrian tolls

The second step (the calculation of the yearly running cost) is determined through the integration of the annual running costs for the following cost categories:
- structural maintenance
- road operation costs
- administration costs
- operation of the toll system (incl. the toll operator's remuneration)

The third step, the allocation of infrastructure costs to the user groups (e.g. light/heavy vehicle) is based on the traffic performance, i.e. the number of vehicle-kilometers, which are supposed to be correlated with replacement expenditures, as in the figure below:
The key parameter for the cost allocation by type of vehicle is the number of axles for the vehicles above 3.5 tonnes.

The final step is the charge calculation as a combination of the weight/number of axles, and the distance travelled.

The Swiss cost allocation approach shares the same characteristics: a top-down procedure where total costs are split up into different categories which are allocated to vehicle types by using different allocation factors.

The difference is in using the maximum authorized weight among the cost allocation factors. In fact, using the continually changing operating weight of the vehicle would have been impracticable. Furthermore, the use of the maximum authorized weight provides an additional incentive to an efficient load factor policy, in order to reduce empty trips.

The following table shows the overview of cost allocation parameters from the CATRIN road IMs.

<table>
<thead>
<tr>
<th>Country</th>
<th>Implementation date</th>
<th>Cost allocation parameters</th>
<th>Network coverage</th>
<th>Vehicles charged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden 'The Eurovignette'</td>
<td>1st January 1995</td>
<td>Number of axles</td>
<td>Motorways only</td>
<td>HGVs &gt; 12 tonnes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emission class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>1st January 2001</td>
<td>Distance travelled</td>
<td>All public roads</td>
<td>HGVs &gt; 3.5 tonnes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max. permissible gross vehicle weight</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
An interesting and exhaustive overview of methods for infrastructure road cost allocation, assessing uncertainties and characteristics of the several approaches, has been provided by the French SETRA; the Ministry for Ecology, Energy, Sustainable Development and Spatial Planning (2008). The study stresses in the introduction that “a cost allocation method is a combination of a set of scenarios and rules to allocate the costs of these scenarios”, as explained in the picture below:

The study reviews four methods of cost allocation:

1. the incremental method;
2. the Shapley method;
3. the Federal Highway Administration method;
4. the method applied for the French case.

The **incremental method**, one of the most traditional and well-known procedures, allocates progressively the costs by each vehicle class through several scenarios, as follows:

- the scenario 0 with no HGV (only passenger cars),
- the scenario 1 with the less aggressive HGV class (LDH, up to 3.5),
- the scenario 2 considering the HGV class 1 and 2
- and the scenario 3 in which all vehicles are allowed.
The incremental method assumes the cost allocation to be proportional to the difference among the above scenarios, e.g.

- the difference of costs between scenarios 3 and 2 is allocated to HGV from class 3;
- the difference of costs between scenarios 2 and 1 is allocated to HGV from class 2;
- the difference of costs between scenarios 1 and 0 is allocated to HGV from class;
- Fixed costs that are measured in scenario 0 are allocated to light vehicles from class 0.

It has been stressed that the incremental method tends to overestimate the cost allocation to the lower classes, due to the fact that the fixed costs, e.g. the width of the lane (larger, to take account of the bigger HGV), are allocated to the classes 0 and 1, which benefits the HGV vehicles in class 2 and 3.

The Shapley method, based on the game theory, allocates the costs considering each vehicle class as a player and studying the different coalitions that can occur between classes. For each vehicle class the approach allocates certain infrastructure costs, in such a way there in no possibility to allocate to a certain vehicle class the costs of another (as may be the case for the incremental method).

The uncertainties of the procedure rely on the fact that light vehicles will pay less, due to the non consideration of their impacts on pavement design and the decision to build the infrastructure (light vehicles are in fact responsible by 88% of the vehicle-km in the French case.

The US Federal Highway Administration (FHWA) uses this approach for the Highway Costs Allocation Studies (HCAS) methods. The approach considers two scenarios:

The scenario 0, in which no HGV is considered
The scenario 1, in which all HGV are included

The cost allocation approaches in the two scenarios are the following:

- The difference of costs between scenarios 1 and 0 is allocated to HGV only through equivalency ratios equal to the relative Equivalent Single Axle Load (ESAL).
- The fixed costs in the scenario 0 are allocated to all users proportionally to their relative part in the global traffic.

The method applied for the French case is a combination between the incremental method and the FHWA approach. Four scenarios have been designed:

- The scenario 0 considers no HGV.
- The scenario 1 includes only HGV from the less aggressive class.
- The scenario 2 includes HGV from both class 1 and class 2.
The scenario 3, in which all HGV are included.

Scenarios 1, 2 and 3, assume a constant HGV traffic volume (equal to 2500 HGV per day and per sense of flow), in order to take only account of the impacts of the HGV vehicle type on pavement design, independently on the traffic volume.

The results obtained as similar to the FHWA.

It is interesting to consider that the application of the French approach to the assessment of the allocation of pavement costs by vehicle types leads to higher HGV ratios compared to those suggested by the revised Eurovignette.

The different results depend on different assumptions about how scenarios are set up, the type of software used, etc. However, the French approach has delivered acceptable results, in line with the philosophy of the Eurovignette Directive and possibly paving the way towards better assessment practices.

Concerning the influence of institutional factors on cost allocation practices, it is interesting to consider the situation where concession agreements between the public authority and a legal entity (the “concessionaire”) are established, according to which the concessionaire in return for undertaking obligations as may be specified in the agreement with respect to the design, construction, maintenance, operation or improvement of a special road, is appointed to enjoy the right to charge tolls in respect of the use of the road.

This is the case for the M6 Toll road, for which, as informed by the UK CATRIN road IMs, the charge is totally unregulated. In such case, the charge determination is part of the strategy under the condition of a private sector profit maximisation decision, subject to competition from the parallel untolled but congested route. The toll charge depends on the number of axles and the height at the first axle.

Similar conclusions can be drawn from the information collected from the private Italian IM Autostrade per l’Italia of the ATLANTIS Group. Ms Maria Pia Dall’Asta of the Autostrada per l’Italia released the following information. The determination of the toll is part of the concession contract subjected to private law (the concession contract is in fact not public). The concession contract, which regulates and disciplines the concession, establishes an average toll tariff for each stretch of motorway, which varies according to vehicle type, and is applied per kilometre travelled so as to ensure that the motorway company recovers investments to be made, those already made, those for modernisation and renewal and management costs.

The charge is modulated according to the different vehicle types, implying different uses of the infrastructure, on the basis of the space occupied, the potential usage of the services offered and increased consumption or degradation of the motorway.
The concession contract specifies the toll fare per kilometre that has to be applied to each class of vehicle is decided, subdivided into tariffs for flat stretches and mountainous stretches.

On all the Italian motorways, the classes of vehicles are identified on the basis of elements which can be physically measured:

- clearance, in other words the height of the vehicle perpendicular to the front axle for vehicles with 2 axles;
  - vehicles with two axles, class A: height at the level of the front axle up to 1.30 m;
  - vehicles with two axles, class B: height at the level of the front axle of more than 1.30 m;
- the number of axles for vehicles or lorries with more than two axles:
  - vehicles with three axles (class 3);
  - vehicles with four axles (class 4);
  - vehicles with five or more axles (class 5).

In 1986, the share between variable costs depending on traffic (wear and tear) and fixed costs (construction costs) on the Autostrada per l’Italia network were the following:

<table>
<thead>
<tr>
<th>Variable and fixed costs by vehicle type</th>
<th>€c/km 1986</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td></td>
</tr>
</tbody>
</table>

In conclusion, the CATRIN road IMs review allows to confirm that road infrastructure charges are determined through top down procedures, both in the case of publicly owned networks and in presence of private public partnerships and concessions. Marginal, bottom up procedures are not developed/adopted.

In the former case (public network), road tolls are part of the strategy to reach the financial equilibrium in developing and maintenance of the tolled network, responding to the objective of ensuring the correspondence between the use of road infrastructure (by vehicle type) and infrastructure damage, through the parameters of traffic
performance in vehicle kilometre and weight of the vehicle. In some cases (the Swiss case), environmental parameters may play a role as well.

In the latter case (PPP or similar), road tolls are part of the private business strategy (allowing shareholders to be adequately remunerated). In such case, the toll may reflect the different way in which the users contribute to the consumption or degradation of the road, through the parameters of vehicle type, weight, etc, but there is the possibility that the toll becomes part of a market strategy depending on users’ reaction, e.g. stimulating the demand for mobility in that segments for which there is spare capacity.

**Rail**

The CATRIN rail IMs have reviewed the rail charging structure, identifying three main components, which may differ according to specific national legislation:

1. variable usage charges – payable by all passenger and freight train operators and sub-divided into a track variable usage charge, a capacity charge, a traction electricity charge and an electrification asset usage charge;
2. fixed track access charges, differentiated in line with their projected vehicle km;
3. supplementary access charges – known as the performance regime and the possessions regime, and constituting a compensatory incentive framework potentially applicable to all train operators.

Incremental track maintenance and renewal costs are reflected in the track variable usage charge, though this probably equates more closely to average variable cost than to marginal cost. The estimation process is based on a top-down assessment of the total costs to the infrastructure manager of operating, maintaining and renewing the network, and the degree of variability of these costs across the network by different asset categories. Variable costs are then allocated to individual vehicles in line with a bottom-up analysis of how they cause damage to the infrastructure. It is said that this mechanism provides operators with incentives to use more ‘track-friendly’ equipment, though it is not always clear that this is actually occurring. It would be useful to explore this issue of incentivisation further.

Marginal wear and tear costs related to maintenance and renewal of electrification assets are reflected in the electrification asset usage charge, which is disaggregated by different geographical areas, season and time of day bands.

Marginal congestion costs – which arise from it becoming increasingly likely that, as capacity utilisation increases, an incident somewhere on the network causes knock-on delays to train services elsewhere on the network, - are reflected in the capacity charge. These costs are generally calculated via the estimation of a regression model, relating capacity utilisation to historic data on knock-on (or ‘reactionary’) delay.

The cost of electricity procurement and supply for electrified services is reflected in the traction electricity charge. There are discounts on this charge for trains operating with
regenerative braking to reflect the cost savings that result from their lower net consumption of electricity.

In such a context, the CATRIN rail IMs have reviewed the cost allocation practices and the relative key parameters taken into account. As summarised in the following table, the most important charging variables are a combination of train-km and gross ton-km (used by four IMs out of seven). The reference to train-km in isolation is used by three IMs (RFI, Italy and Deutsch Bahn).

<table>
<thead>
<tr>
<th>IM</th>
<th>Gross ton-km</th>
<th>Train-km</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBB (Switzerland)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RFF (France)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>ProRail (The Netherlands)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Deutsch Bahn (Germany)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>ORR (Uk)</td>
<td>Freight only</td>
<td>X</td>
</tr>
<tr>
<td>OBB (Austria)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RFI (Italy)</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

The CATRIN Italian rail IM has provided additional and detailed information about the cost allocation method based on train-km. Rail infrastructure wear and tear is calculated as follows:

\[ P_{\text{usura}} = \text{wear and tear. The wear and tear parameter is calculated with the formula:} \]

\[ U_i = \frac{\beta_i \left( v_{\text{elmj}} \cdot v_{\text{elmj}}^2 \cdot p_{\text{ebjl}} \right) + \beta_i \left( v_{\text{elmj}} \cdot p_{\text{anjt}} \right)}{\beta_i \left( v_{\text{elmj}} \cdot v_{\text{elmj}}^2 \cdot p_{\text{eblt}} \right) + \beta_i \left( v_{\text{elmj}} \cdot p_{\text{anlt}} \right)} \]

\[ \forall i = 1, \ldots, n \]

where:

- velmj: speed of the train on the line j, without taking on considering the time range;
- peblj: weight of the train on the line j, without tacking on considering the time range;
- pantj: number of pantographs used by the train- just for electric train
- velmt: standard train speed. The standard speed is at 80 km/h
- peblt: standard train weight. The standard weight is 500 tons
pant: standard number of pantographs used. The standard number of standard pantographs is 1.

$\beta_1, \beta_2$ assume the following values established for the tear and wear of the line:

$\beta_1 = 0.85$

$\beta_2 = 0.15$

The values of $U_i$ of the function $U$ and all the elements of the range $u$ are shown in the table below:

<table>
<thead>
<tr>
<th>Indicativo range $i$</th>
<th>Range limit $z_{i-1}$</th>
<th>$z_i$</th>
<th>$U_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>2</td>
<td>0.8</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>1.2</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>above</td>
<td>3.5</td>
</tr>
</tbody>
</table>

The approach shows that despite the reference to train-km, the application also includes the reference to the weight of the train.

As in fact stressed in the recent updating of the Railway Reform and Charges for the Use of Infrastructure, OECD-ECMT 2005 (ITF, 2008) the combination of gross-tonne and train-km charges should in principle address the marginal costs of both wear and tear (through the gross-ton km parameter) and congestion (through the train-km parameter), rather than using a single factor approach.

Concerning the assessment of marginal wear and tear costs, the CATRIN rail IMs agreed in considering the gross tonne-km parameter as one reasonable variable for charging for marginal wear and tear on the infrastructure, taking thus into account the relationship between wear and tear and traffic. It has also considered reasonable to adjust the gross tonne-km variable for line category (or line speed) and for types of rolling stock.

However, it was noted that the vast majority of studies have used gross tonne-km as the measure of output. This has allowed the marginal wear and tear cost for different vehicle weights to be established, but failed to allow for any other systematic variation in characteristics of vehicles. As such it would be desirable that econometric studies offer insights into the variation of marginal costs with characteristics other than gross weight. As a minimum, distinguishing between gross tonne-km which result from freight movements versus passenger movements would be desirable as these traffics tend to have different characteristics.

These requests have been addressed by the CATRIN rail research, to the extent that engineering research in CATRIN clearly demonstrated that there are large differences.
between the damage on the infrastructure for some vehicle types even per gross tonne-km.

Concerning the measures of scarcity (congestion), it is acknowledged that in theory, two-part charging regimes are appropriate where the system is congested and users should be forced to pay for the scarce capacity they demand.

The CATRIN discussion of the French approach, to be implemented in the 2010 charging reform, found the approach promising and in line with the CATRIN research development on allocation of capacity costs, advocating the use of two part tariffs, with the fixed charge based on avoidable costs in the long term. Following the French approach, in order to take account of scarcity for example in the most populated area (Ile de France/Paris region), charges are set to be close to full price recovery.

The approach is described in the Network Statement 2009 and 2010, in which the charge for reservation of capacity is structured as follows:

- the unit price varies according to the period of day when it is planned to use the path, with the day broken down as indicated below:

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Time period</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 : 01</td>
<td>00 : 30</td>
<td>Normal hours</td>
</tr>
<tr>
<td>00 : 31</td>
<td>04 : 30</td>
<td>Off peak hours</td>
</tr>
<tr>
<td>04 : 31</td>
<td>06 : 00</td>
<td>Normal hours</td>
</tr>
<tr>
<td>06 : 01</td>
<td>07 : 00</td>
<td>Intermediate hours</td>
</tr>
<tr>
<td>07 : 01</td>
<td>09 : 00</td>
<td>Peak hours</td>
</tr>
<tr>
<td>09 : 01</td>
<td>10 : 00</td>
<td>Intermediate hours</td>
</tr>
<tr>
<td>10 : 01</td>
<td>16 : 00</td>
<td>Normal hours</td>
</tr>
<tr>
<td>16 : 01</td>
<td>17 : 00</td>
<td>Intermediate hours</td>
</tr>
<tr>
<td>17 : 01</td>
<td>19 : 00</td>
<td>Peak hours</td>
</tr>
<tr>
<td>19 : 01</td>
<td>21 : 00</td>
<td>Intermediate hours</td>
</tr>
<tr>
<td>21 : 01</td>
<td>00 : 00</td>
<td>Normal hours</td>
</tr>
</tbody>
</table>

- a coefficient is applied to freight and light locomotive paths on the categories of elementary sections other than the category high speed lines. It is based on vehicle type (length, speed and carrying capacity): the higher the length, speed and capacity, the higher the coefficient raising the charge
- from the origin or from the destination of the paths reserved: a modulation coefficient is applied to paths for passenger trains on the categories of elementary sections, high speed lines. It is: 1.05 for "radial passenger trains" where the origin or the destination is one of the following stations: Paris-Austerlitz, Paris-Bercy, Paris-Bercy-Conflans, Paris-Est, Paris-Gare-de-Lyon, Paris-Landy, Paris-Montparnasse, Paris-Nord
and Paris-Vaugirard; 0.84 for « intersector passenger trains » where the origin and the destination are not in one of the stations mentioned above.

- The rolling stock planned for the path allocated (only on rate categories C* and D*) the PKR of the sub-category N3 applies to the paths of passenger trains:
- high-speed rolling stock (220 km/h and more).

The Reservation Charge as outlined is an approximation to a congestion/scarcity charge, though the differentiation of the charge by line-type may also be reflective of differing levels of congestion/scarcity on the different types of line.

**Air**

The CATRIN air IMs reviewed the cost allocation practices in the air transport, in particular at airport level. The review has identified the two main cost categories that are involved in cost allocation practices: capital and operating expenditures.

Capital expenditure represents the expenditure on major assets needed for the business top functions. The expenditures may be on investment in new facilities or major maintenance/refurbishment of existing assets. The day-to-day maintenance is assumed to be part of operating expenditures, although clearly there will be categories of investment that might be regarded as either capital or operating expenditures.

The analysis of the airport charges and the related services they are levied to cover, allows the identification of two main categories:

a) charges aiming to cover services and infrastructure which are generally related to the aircraft movement areas
b) charges related to the passenger processing areas which have to be differentiated from ground-handling and purely commercial areas.

The aircraft movement areas include aircraft parking areas, airfield lighting, airside roads lighting, airside safety and aviation supervision, fire brigade, grounds, runways, taxiways, aprons, nose-in guidance/visual navigation aids and signposting.

The passengers processing areas include departure and holding lounges, fire brigade, immigration and customs service areas, landside roads and lighting, public areas in terminals, lifts/moving walkways, security systems, signage and flight information systems.

It has been assumed that the cost allocation area of interest in CATRIN is the operating expenditures (opex), under which landing and passenger charges address infrastructure maintenance, as described in the following table summarising the situation for a sample of the most important European ports in terms of airport movements (ACI EUROPE, 2003).
<table>
<thead>
<tr>
<th>Airport</th>
<th>Landing/take off charge</th>
<th>Passenger charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vienna</td>
<td>Landing facilities and installations (lighting, a/c parking positions within the free parking time, marshalling, etc.)</td>
<td>Passenger service charge: use of terminal building infrastructure. &quot;Passenger&quot; charge : provision of check-in facilities and transfer facilities (communications weighing- and conveyer-technique for the check-in of passenger and services)</td>
</tr>
<tr>
<td>Brussels</td>
<td>Investment in and operating costs of runways, taxiways, taxi lanes, lighting &amp; airside signalisation, fire brigade, snow removal, marshalling, bird control and other infrastructure and services needed for landing and take-off of airplanes</td>
<td>Investment in and operating costs of surfaces used by and services for O&amp;D. passengers (airside &amp; landside terminals, piers, etc)</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>Landing and take-off charges cover the costs of runways, taxiways, apron and appropriate services</td>
<td>The security charge is included in the passenger charge</td>
</tr>
<tr>
<td>Helsinki</td>
<td>Landing charges cover the costs of building and maintaining the runways, lightning-systems etc.</td>
<td>Passenger charges cover the costs of building, maintaining and developing the terminal buildings and services</td>
</tr>
<tr>
<td>Paris Charles De Gaulle</td>
<td>Runways, taxiways, directional panels.</td>
<td>Areas of the terminals used by passengers and public</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>Landing and take-off charges cover the costs of runways, taxiways, apron and appropriate services</td>
<td>Passenger charges cover the costs of the terminals</td>
</tr>
<tr>
<td>Rome Fiumicino</td>
<td>They generally would cover all maintenance and operating costs related to: Taxiways, runways, airside lighting, surveillance, draining and water system, oil extractor, airside fencing, de-icing machinery, electric system, control tower, offices</td>
<td>Passenger terminals (elevators, toilets, passport control posts, cleaning and maintenance, etc.) shuttle bus, train services between terminals, information desks, etc</td>
</tr>
</tbody>
</table>
The table shows that landing and passenger charges could be differentiated in order to allow for the different costs they impose on the infrastructure to be taken into account (approximating in such a way a marginal approach to the infrastructure charging).

The current practices suggest that landing charges, whose overview is provided in the following table, based on the GRACE project (GRACE, 2006), are structured as to take account of the potential damage factors to the infrastructure (e.g. runway).

<table>
<thead>
<tr>
<th>Airport</th>
<th>Landing/take off charge</th>
<th>Passenger charges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dedicated to CAA, safety activities, etc.</td>
<td></td>
</tr>
</tbody>
</table>

### Summary of variables

1) Relative to the aircraft:
   - MTOW (metric tons)
   - Noise level (PNdB)
   - Emissions (Kg NOx)
   - Propeller or Jet Aircraft

2) Relative to the flight
   - Origin or Destination: (Domestic or International)
   - Type: Passenger or cargo
   - Scheduled / Out of hours

3) Relative to the time:
   - Peak/ off peak
   - Day/ night

### Summary of common schemes

1) “per ton or part thereof” or “per commenced” one. \[RC = R \times (MTOW)\]

2) “fixed rates” \[RC = R\]

3) “two part” (where V is a fixed amount) \[RC = F + [ V \times (MTOW) ]\]
   - Kölnere Variation: \[V = W \times (400-MTOW)\]
   - Sweden: “two part” \[RC \times E\] (emissions coef.)

4) “by steps” \[RC = A \times R + (B-A) \times S + (MTOW - B) \times T\]
   - Per ton under A \[R\]
   - above A up to B \[S\]
   - Per ton above B \[T\]

5) “weight factor” (Athens) \[RC = W \times R; \quad W = MTOW \times (120 / MTOW)^0.4\]

6) “multifactor” \[N= noise coefficient ; D = Day/night factor [1 or 2]\]
   - French Airports (also in Munich): \[LC = R \times (MTOW) \times N\]
   - Brussels: \[R \times MTOW \times N \times D\]
The table shows that normally a two-part tariff is used, in which the variable part depends on a metric ton or part thereof, or even is calculated according to weight categories.

Concerning passenger charges, the best practice would suggest to allow the main cost drivers reflecting the type of facilities that different passengers use at the airport. These should be differentiated to reflect whether passengers use security and passport control areas, check-in counters or baggage claim areas. For this reason, a lower passenger fee should be charged for transit passengers, because these passengers do not need any surface access requirements, any specific area for meeting or greeting people, and check-in, security or immigration facilities.

The Irish CATRIN IM suggests the steps that have been made towards this direction. The regulator of the Dublin Airport (DAA) has in fact questioned the relationship between operating costs and passenger growth. DAA pointed out that the majority of operating cost categories are not in fact strongly correlated with passenger growth, but are linked to other cost drivers determined by factors relating to regulation/economy, physical infrastructure, external factors (e.g. energy cost increases). Therefore, an in-depth analysis is necessary to identify only some categories of costs driven by passenger growth.

According to the regulator, it would be inappropriate to forecast operating expenditure based purely on a historically observed relationship between operating expenditure and passenger volumes. The analysis of the cost factor related to the marginal passenger has shown a good correlation between operating costs and passenger volumes for the sub-category of costs linked to passenger traffic (DAA, 2008).

The CATRIN air IMs have stressed that cost allocation methods in airports result to be characterised by a top-down approach, being subjected to planned investment, profit maximization strategies and (in case of regional airports) cross subsidization.

Concerning landing and take-off charges, the aircraft maximum take-off weight is the most important parameter, while as far passenger charges are concerned, current approaches (Dublin Airport) seem to be promising.

**Waterborne**

The CATRIN waterborne IMs have reviewed the cost allocation practices, stressing the complex characteristics of the charges (as far as maritime transport is concerned). The following picture summarises the main components of the port charges.
In general, the service category may be provided by private operators, under concessions of the port authorities, and do not include in itself port infrastructure damages.

In practice, port dues are the type of port charges through which users pay infrastructure damage. The prevailing parameters used are GT (Gross tonn), the net tonnage (NT) and length, breadth and summer draft of the ship (Lxbxdr), as shown in the table below for a sample of European ports (Wilsmsmeier, 2007).

<table>
<thead>
<tr>
<th>Port</th>
<th>Port dues Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aarhus</td>
<td>GT</td>
</tr>
<tr>
<td>Esbjerg</td>
<td>GT</td>
</tr>
<tr>
<td>Gothenburg</td>
<td>GT</td>
</tr>
<tr>
<td>Helsinki</td>
<td>NT</td>
</tr>
<tr>
<td>Hanko</td>
<td>NT</td>
</tr>
<tr>
<td>Kaliningrad</td>
<td>GT</td>
</tr>
<tr>
<td>Tallinn</td>
<td>GT</td>
</tr>
<tr>
<td>Ventspils</td>
<td>GT</td>
</tr>
<tr>
<td>Klaipeda</td>
<td>NT</td>
</tr>
<tr>
<td>Gdansk</td>
<td>GT</td>
</tr>
<tr>
<td>Gdynia</td>
<td>GT</td>
</tr>
<tr>
<td>Hamburg</td>
<td>GT</td>
</tr>
<tr>
<td>Emden</td>
<td>GT</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>GT</td>
</tr>
<tr>
<td>Rotterdam</td>
<td>GT</td>
</tr>
<tr>
<td>London</td>
<td>GT</td>
</tr>
<tr>
<td>Rouen 0</td>
<td>Lxbxdr</td>
</tr>
<tr>
<td>Le Havre</td>
<td>Lxbxdr</td>
</tr>
<tr>
<td>Saint-Malo</td>
<td>Lxbxdr</td>
</tr>
<tr>
<td>Bordeaux</td>
<td>Lxbxdr</td>
</tr>
<tr>
<td>Sete</td>
<td>Lxbxdr</td>
</tr>
<tr>
<td>Marseille</td>
<td>Lxbxdr</td>
</tr>
<tr>
<td>Lisbon</td>
<td>GT</td>
</tr>
<tr>
<td>Bilbao</td>
<td>GT</td>
</tr>
</tbody>
</table>
The CATRIN Port of Gdynia IM has provided additional information on the cost allocation approach, based on the GT (vessel tonnage).

The Port of Gdynia harbour dues are charged mainly on the basis of the vessel's tonnage. If the vessel's tonnage certificate indicates various tonnages or if the vessel holds 2 tonnage certificates, then the basis for calculation of the dues shall be the higher tonnage. In case when it is not possible to specify the gross tonnage (GT):

- For a seagoing vessel – the tonnage and wharfage shall be charged on to a vessel gross volume (V) calculated as a product of its total length (L), maximum width (B) and its draft according to the summer mark (D). The result shall be rounded up to a full cubic meter according to the formula: 1 GT = 1.00 m³ V
- For a harbour service and inland navigation vessels – the tonnage and wharfage shall be charged on the vessel's gross volume (V) calculated as a product of its total length (L), maximum width (B) and moulded depth (H). The result shall be rounded up to a full cubic meter according to the formula: 1 GT = 0.25 m³ V
- For vessels with tonnage certificate expressed in GRT it is assumed for the purpose of due calculation that 1 GRT = 1 GT.
- The maximum rate of the harbour dues shall be:
  a) For car carriers – 40,000 GT,
  b) For passenger vessels:
     - 50,000 GT (for vessels of tonnage 50,000 – 100,000 GT)
     - 65,000 GT (for vessels of tonnage over 100,000 GT).

The Finnish CATRIN IMs has informed about the cost allocation approach, which is determined on the basis of the following parameters:

The dues are calculated according to the vessels net tonnage (NT) and the Finnish - Swedish ice dues class. The unit price for vessels is based on the ice class of the vessel as follows (in €):

<table>
<thead>
<tr>
<th>Ice class</th>
<th>Cargo vessel</th>
<th>Passenger vessel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit price</td>
<td>Unit price</td>
</tr>
<tr>
<td>I A Super</td>
<td>1,185</td>
<td>0,798</td>
</tr>
<tr>
<td>I A</td>
<td>2,218</td>
<td>1,572</td>
</tr>
<tr>
<td>1 B, I C</td>
<td>4,475</td>
<td>2,710</td>
</tr>
<tr>
<td>II, III</td>
<td>6,421</td>
<td>4,528</td>
</tr>
</tbody>
</table>

In the Swedish case the criteria are the following:
- Fairway charges. Two parts.
1. Vessel related based on the size (GT), environmentally differentiated. This charge is 0 for the most environmentally friendly vessels.
2. Freight related charge, based on the number of tons loaded and unloaded (non for passengers)
   - Pilot charge: charged on users and is related to the vessels ship size (GT) and time.

Concerning inland waterways, the review of charging practices at country level in Austria, Germany, Netherlands, Czech Republic, Poland, Romania and Bulgaria, Switzerland (Rhine and Danube corridor) has shown the presence of large differences in port dues and canal fees charging.

The review has found that in general two main types of port dues exist:
1) Charge in euro/ton for transhipment;
2) Demurrage, i.e. a charge occurring when the vessel is prevented from the loading or discharging of cargo within the stipulated laytime, charged in euro per day or per hour if a vessel is anchoring.

It has been noted that both types of port dues in the Danube area are significantly higher than along the Rhine, while Austria and Germany have the highest port charges.

In general, the current system of charging is not transparent, because there is no direct relation between the level of charges imposed on a certain inland waterways market segment and the level of investments in infrastructure for these market segments. Furthermore, given that the rates are determined by the local port authorities the level of these rates differs a lot from port to port.

Summing up, in general the practices for setting charges for Port infrastructure use are based on vessel types (cost allocation main parameter: vessels’ gross tonnage). However, the cost coverage of charges is not clear (if they are fixed according to long or short marginal costs), in addition to the fact that port charges in most cases are subjected to negotiation, determining uncertainties on their actual levels.

**Main findings**

The review of cost allocation practices allows the identification of the following parameters:

<table>
<thead>
<tr>
<th>Road</th>
<th>Rail</th>
<th>Air</th>
<th>Waterborne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of axles</td>
<td>Gross ton-km</td>
<td>MTOW</td>
<td>Gross and Net Tonnage</td>
</tr>
<tr>
<td>Emission class</td>
<td>Train-km</td>
<td>Noise level</td>
<td>Emissions</td>
</tr>
<tr>
<td>Distance travelled</td>
<td>Vehicle length</td>
<td>Emissions</td>
<td></td>
</tr>
<tr>
<td>Height of the vehicle</td>
<td>Passenger charges:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In road transport, the axle weights and the gross vehicle weight represent the most important parameters for infrastructure wear and tear cost allocation. The French test on the aggressiveness of Heavy Goods Vehicles has proved to be in line with the Eurovignette approach, paving the way for further research.

In rail transport, infrastructure cost allocation results from a combination of gross ton-km and train-km parameters, using econometric and engineering models. It has been noted that the vast majority of studies have used gross tonne-km as the measure of output. This has allowed the marginal wear and tear cost for different vehicle weights to be established, but failed to allow for any other systematic variation in characteristics of vehicles. Addressing this gap, the engineering research in CATRIN has demonstrated that there are large differences between the damage on the infrastructure for some vehicle types even per gross tonne-km.

The air transport main parameter is the weight (metric ton) of the aircraft. However, the relationships with the marginal bottom-up damage caused to the infrastructure is weak, given that take-off charges are determined on a top-down basis, being subjected to planned investment, profit maximization strategies (market competition) and (in case of regional airports) cross subsidization. Concerning passenger charges, as the CATRIN discussion has shown, there are approaches trying to identify the cost drivers and operating expenditures, to be reflected in the charge, i.e. use of terminals and facilities.

Waterborne transport cost allocation practices are generally based on vessels’ gross tonnage, however, the cost coverage of charges is not clear (if they are fixed according to long or short marginal costs), in addition to the fact that port charges in most cases are subjected to negotiation, determining uncertainties on their actual levels.

1.3 The existence and availability of database

Road

The CATRIN road IMs have reported the existence of a regular activity in data collection, in particular concerning traffic data and road infrastructure costs. The corresponding data are in general available under request or published in aggregated form in official reports and statistics.

However, the CATRIN research activity has stressed the following issues:

- Marginal cost estimations may need complete, disaggregated, road section data in some case on several years basis. But data are often scarce, incomplete and even inaccessible.

- The trend towards privatization and outsourcing for large road sections to save maintenance costs may lead the IMs (regulators) to lose control over maintenance data on selected small road sections. On the other hand, data
collected by private operators may be regarded as confidential, and become de facto unavailable for public research.

- As for traffic data counting, the need to have frequent traffic counting for refining the analysis may impose additional data collection costs upon the IM. What can be suggested to overcome this? Can new technologies help in collecting traffic count data at lower costs?

The feedback received from the IM contributes to addressing the above challenges.

The issue of data collection in a form suitable to be usable within the marginal costs approach may be hampered by institutional settings. For example in Switzerland, it was noted that roads are built either by the confederation, the cantons or by the communities. This may be accompanied by different data collection formats, calling for time and resource consuming post processing.

Furthermore, and more importantly, data collection at all levels is not focussing on marginal costs, but on full costs. This implies that the marginal cost categories, e.g. a clear distinction between the variable and fixed costs components, may be missed.

The issue of privatization and its impacts on data collection deserves attention. It has been acknowledged that privatization, once implemented and permitted by national legislations, might make data collection more difficult.

Concerning the costs for data collection, e.g. traffic counting, it has been agreed that they are, at least in comparison to the other costs for building, maintaining and operating the roads, rather limited. However, the fact that ad hoc infrastructure is required is hindering the increase in the number of traffic counters that would be required/beneficial from the point of view of traffic and infrastructure managers. Things might be different when all vehicles are equipped with tags, but this will certainly not happen in the near future.

**Rail**

The research in CATRIN has underlined the problem of data availability. In particular, one of the main obstacles is how to face the lack of harmonization of the available rail data set for the purpose of marginal cost analysis. The research activity in CATRIN has in fact devoted significant efforts to carry out a robust data re-examination in order to achieve greater comparability between country case studies.

Among the main problems:

- Traffic data includes in some cases only average daily data on number of trains, axle load and gross-tons per track

- Data are not always available for passenger and freight traffic, separately.
• Different information on infrastructure data (e.g. length by track type, maximum line speed and axle load, signalling equipment, rail age and length of electrification, etc) are not always collected in the same unit of measure, etc.

• To date, econometric infrastructure wear and tear marginal cost studies have been conducted through analysis of cost, traffic and infrastructure data on a country-by-country basis. However, each study takes as reference data with subtly different definitions and in some case the datasets tend to contain a different mix of infrastructure variables. Furthermore, the statistical methods applied and specification used in each study may differ from case study to case study.

How can such barriers be overcome? The CATRIN rail IMs suggest that to move forward with a harmonization of definitions and data collection processes carried out through international bodies (e.g. UIC, EUROSTAT) may be a considerable step in the right direction. If the IMs can ensure that their Network Statements contain all of the information on infrastructure characteristics, published in at least one of the major common languages (English or French) as well as in the local language, the public information about e.g. access charges could be excellent and could make it possible to assess train operating costs and infrastructure provision more easily.

It has been already suggested (ITF, 2008) that RailNet Europe for example has successfully devised a common format for the Network Statements, and it would be highly valuable if they could move on to formulating a common format for the publication of Income Statements, Balance Sheets and statistical reports for the IMs and, equally important, for all operating companies.

All in all, the CATRIN research has confirmed that the quality and comparability of data across countries is critical for making valid comparisons and recommendations. Great effort has been produced to control for as many factors as possible in this research, given that datasets are still not totally consistent between countries. This is partly because datasets are generally collected for purposes other than for marginal costs analysis.

In terms of recommendations, it would be better if the EC could urge member states to be more forthcoming with respect to data collection for future research purposes. There is a need to understand the composition of costs better and in particular eliminate any arbiter allocation of costs to observations as this can distort estimated results. The way ahead to proceed is:

• To include enough information in the infrastructure accounts at detailed level, i.e. per track segment, type of service, etc
• To separate maintenance and renewal infrastructure costs
• To present all the information in order to be reasonably comparable among countries
• To publish such reports in a timely way
Air and waterborne

Air and waterborne transport sectors appear to be in similar situations for what concerns data availability. The only data publicly available are government or public accounting, financial accounting from Port Authority or Regulators or in some case operational and technical data, mainly used by IM for internal purposes.

In any case, detailed infrastructure data that would be needed for the assessment of marginal costs are not available for public analyses.

The international associations and organizations, such as EUROCONTROL for the air sector, or stakeholders association, e.g. ECSA for ship owners (maritime), generally publish data in which benchmarking performances at international level are provided, with however no detailed disaggregation.

Furthermore, it should be also noted that, differently from the rail sector and, at least from the environmental side and infrastructure costs, from the road sector, the assessment of short run marginal costs does not represent in general a priority for the IMs (a partial exception may be the landing and take-off charges in airport).

The government or other public accounting data, issued by regulators, are mainly oriented to the analysis of the financial equilibrium for the public budget, in which the main indicators are costs and revenues, highly aggregated.

Data available for financial accounting are used for the economic analysis and the monitoring of the economic performance of the Port or Airport. In such a case, it can be said that the need to have an efficient internal management, may release some data that could be used for the purpose of cost allocation analysis, e.g. cost allocation by line of business (passenger, freight), but, as for the government accounting data, data are in general insufficient for detailed cost allocation analysis.

**Main findings**

Concerning data availability for research and marginal costs assessment, the following table summarises the main issues emerged from the IMs:

<table>
<thead>
<tr>
<th>Road</th>
<th>Problems</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulties in collecting data disaggregated by road section along several years</td>
<td>To develop new technologies for making data collection less costly</td>
<td></td>
</tr>
<tr>
<td>Privatization may hamper data collection</td>
<td>To include provisions about data collection and</td>
<td></td>
</tr>
<tr>
<td>Problems</td>
<td>Recommendations</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>availability in the contract agreement with the private partner</td>
<td>To urge EC and member states for including harmonised rules for data collection and publication</td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td>Data availability and comparability may be a problem</td>
<td></td>
</tr>
<tr>
<td>Air and waterborne</td>
<td>Data are not collected for marginal costs research and assessment</td>
<td></td>
</tr>
</tbody>
</table>

### 1.4 Conclusions

The findings emerged from the CATRIN IMs activity allow to draw differentiated pictures by transport mode. The IMs of rail and road transport infrastructures, which can benefit from a significant tradition in dealing with pricing issues, have developed a stronger attitude towards the development of cost allocation practices in the direction of the assessment of marginal, differentiated infrastructure costs by vehicle type and characteristics.

The EU legislative framework supports this trend. The rail Directive 2001/14 on the allocation of railway infrastructure capacity costs has made relevant recommendations towards this direction, inviting the IMs:

- “To enable the establishment of appropriate and fair levels of infrastructure charges, [infrastructure managers] need to record and establish the valuation of their assets and develop a clear understanding of cost factors in the operation of the infrastructure” (art 36, preamble) and
- “infrastructure charging should be set at the cost that is directly incurred as a result of operating the train service” (art 38, preamble).
- “it is desirable for any infrastructure charging scheme to enable traffic to use the rail network which can at least pay for the additional cost which it imposes” (art 39, preamble)

The CATRIN rail IMs have indicated that the application of cost allocation approaches based on the combination of gross-tonne and train-km would be the optimal solution, allowing for the assessment of the specific contribution to rail wear and tear by type of train and indicators of scarcity.

Furthermore, the knowledge base of rail infrastructure charge as emerged from the CATRIN activity has benefited from the French revision of rail charges in 2010, which, on the one hand, seems to follow very much the approach to capacity charging advocated by the CATRIN research, i.e. adding a significant mark up on top of marginal costs to take account of scarcity, and, on the other, explicitly assumes the marginal cost (marginal components of maintenance, renewal, signalling) as the basis that must be covered through the running charge.
All the rail IMs currently use engineering and/or econometric models able to estimate the infrastructure cost allocation by type of train and service. However, the CATRIN research has also highlighted the discrepancies that still exist in methods and type of data used, which significantly hamper data usability for comparative assessments. Research would benefit from moving towards forceful harmonization through the intervention of rail IM associations and the EC initiatives.

Concerning road, the amended Eurovignette (Directive 2006/38), in the context of the full cost recovery charging framework, provides elements supporting the assessment of road marginal wear and tear infrastructure costs, in particular as far as structural repair costs are concerned, suggesting cost allocation ratios by type of vehicle.

The CATRIN road IMs knowledge base has allowed to test the cost ratios suggested by the Directive through several scenarios provided by the French IM SECTRA study. The study shows the consistency of the EC cost ratios with the French cost allocation approach, built upon the up-to-date methods of cost allocation. The study implicitly suggests that the assessments of the marginal wear and tear infrastructure costs can be based on reliable estimates and practices.

The CATRIN road IMs have also stressed that the institutional context, i.e. the growing importance of private public partnerships models (in particular in the South-European countries) can limit data availability at disaggregated level for cost allocation studies. In fact, detailed data on traffic flows, maintenance costs and cost allocation may be considered confidential by a private operator.

Air and waterborne transport modes lag behind. Full cost recovery is the key principle for charge determination and the rationale for the assessment of marginal short term infrastructure costs is in general weak.

The CATRIN air and waterborne IMs have indicated that Port dues and landing/take off charges cost allocation are in general determined on the basis of two key parameters, respectively the MTOW (metric tons of the aircraft) and the GT (gross ton of the ship), that are able in principle to allocate the infrastructure costs differentiating the charge by vehicle type.

However, the application of the charges is subjected to negotiation with operators (in Ports) and the relationships with wear and tear not clear, they are in fact determined on the basis of top-down objectives of financial sustainability.

From the legislative point of view, in the air sector the recent Directive 2009/12 on airport charges basically sets the basic criteria for non discrimination, transparency and consultation among the stakeholders, but does not provide a conceptual framework behind the structure or the level of the charges.

In maritime transportation, after the failure of the first and the second proposals directives on market access to port services, issued respectively in 2001 and 2004, the issue of a common framework for charging port services still has to be addressed.
Taking stock from the past experience, it is likely to conclude that to intervene directly in port charging structures through EU legislative initiatives would be difficult. Given the wide variety of systems existing in Europe, it is very much doubted whether harmonisation would be achieved or would even be possible. Intermediate and realistic steps could be undertaken towards the definition of a common framework for the interpretation of the State aid rules, which should clarify the extent to which public financing of port infrastructure would be compatible with the Treaty, together with ensuring more transparency in charge determination.
2. THE RESULT OF THE PROJECT; FEEDBACK FROM INFRASTRUCTURE MANAGERS

This section of the report summarises the additional feedback from the IMs on the CATRIN project results. The additional feedback basically consists of four interviews and other input collected and specified as follows:

- Concerning road: a) interview to Peo Nordio, of the Planning Data-/Documentation Section Office of the Swedish Road Administration; b) documents and research material on the French approach in assessing pavement building costs and cost allocation by vehicle type. The relevance of the input for CATRIN are twofold: a) to provide examples of cost allocation practices and further insights on methods and results; b) to provide contributions to the EURODEX approach outlined in the CATRIN Deliverable 7.
- Concerning rail: interview with the RFI (Italian Rail Infrastructure Manager) rail IM, Giampaolo La Paglia, in which the cost allocation approach has been analysed through an in-depth discussion.
- Concerning air transport, interview with the Deputy Managing Director of the Gothenburg Airport Brett Weihart, in which the charging practices have been analysed in terms of objectives and relevant parameters.
- Concerning waterborne, interview with the President Janusz Jarosinski and the vice-president Krystyna Szambelanczyk of the Port of Gdynia Board, in addition to information provided by Francesca Moglia of the Port of Genova.

The interviews and the documentation collected allow to shed further insights towards cost allocation practices for all the transport modes under examination in CATRIN, in addition to other consideration related to the EURODEX approach (only for road). The Chapter 3 draws the conclusions.

2.1 Marginal cost allocation recommendations

2.1.1 Road

a) Interview to the Swedish Road Administration (SNRA)

Brief Overview of the Swedish Road Administration (SNRA)

The SNRA is the national authority assigned the overall responsibility for the entire road transport system in Sweden. The SNRA is also responsible for drawing up and applying road transport regulations. In addition, the SNRA is responsible for the planning, construction, operation and maintenance of the state roads. Sweden has 138 000 km of public roads. The Swedish road network comprises approximately 138 000 km of public roads, 75 000 km of private roads receiving state subsidies, and a very large number of private roads without state subsidies, mostly forest motor roads.
Comments on result of project

The IM of Sweden believe the approach with a uniform elasticity and country and network specific average cost estimates as a decent approach to marginal cost estimation. However, they considered the estimated elasticity of 0.3 – 0.5 to be unexpectedly low.

The IM in Sweden will decide on a specific freight transport network in the near future. They expect the marginal cost to be lower on this network than on the remaining network. They have one in-house study that suggests road type differentiated marginal cost which is used to argue for lower charges on this dedicated network. The argument for a lower charge on this network follows thus the marginal cost approach recommendation. They demand more road type specific estimates.

Today they use the forth power rule to differentiate between vehicles. If EURODEX can start it would be a worthwhile project. The Swedish IM believes it is a question for the road administrations in Europe. The approach of cooperation would give cheaper and more efficient research if they join their research call on this issue. Preliminary the IM discuss ERA-NET Road and the cooperation of Director Generals of Road administrations (CEDR) as possible leading parties in this. However, they highlight that this cooperation seems to be a high-risk project.

Up to now, the Swedish IMs have not yet considered the possible need to collect specific cost data on the dedicated freight network to be able to argue for the price differentiation. The data that the IM has today is expenditures by expenditure type by procurement area annually. It is, according to the IM, not certain that the observed differences between areas and regions are due to actual differences but may be more a result of different accounting practices. This type of data is not used for any internal audit practice at the IM which probably reduces the interest to ensure a high quality dataset.

The Swedish IM has recently witness the problem of data-collection as part of the infrastructure operation is privatized (or semi-private) as the Oresund bridge. With more private toll bridge and road segments in Sweden they foresee this problem to increase. Also new technology will give rise to new data sources which is not thought of in the contracting phase with the private operators.

In the long run the IM expect that charges can be introduced for financing the wear and tear of roads. These charges should reflect the damage a specific vehicle does to the network and will make the maintenance of the network traffic dependent and not dependent on tax appropriation. To fulfill an equity objective they see the need for possible cross-subsidization between regions.


The present contribution has been collected under the suggestion of Pascaline Cousin, Director of Transport Economics at SETRA (Technical Department for Transport,
1. Introduction: HGV responsibility in pavement building costs

The French Highway Agency (Direction Générale des Routes) asked last year for a technical study on HGV responsibility in road building costs to help transposing the Eurovignette directive into French law. This paper tells about the part of this study devoted to pavement building.

In the past, several studies had already tackled this subject in order to assess the impact of HGV traffic on pavement costs. Here, it was decided to go further in details in order to assess the impact of each kind or silhouette of HGV on pavement costs using a specific criteria. This criteria was given by French pavement design methodology. In France, pavements are designed so that they can admit some "damage" due to HGV traffic (no matter the intensity of light vehicles traffic) during their lifetime. This damage can be quantified from each HGV "aggressiveness". This aggressiveness criteria can be then considered as a good criteria to characterize HGV according to the damage that they cause to pavements and to define classes gathering HGV of same aggressiveness (we decided to consider 3 classes of HGV).

Defining those 3 classes was the first step of the study. Then, 4 scenarios of HGV traffic were built. In scenario 0, it was considered that no HGV would be allowed on the pavement. In scenario 1, only HGV from the less aggressive class would be allowed. In scenario 2, HGV from both class 1 and class 2 would be allowed. In scenario 3, all HGV would be allowed. For all scenarios, appropriate pavement structures were designed and costs of these pavements were assessed in order to tell how responsible for pavement costs each class of HGV was.

Next section tells more about this methodology, explaining the theoretical background for this analysis and presenting the technical tools that were used to implement it. The third section is about results and the fourth analyses these results, regarding Eurovignette recommendations.

2. Methodology and tools

2.1 French methodology for pavement design

Pavement Structures (Sétra-LCPC, 1994) combines a rational approach about stress evaluation (stress and strain) and an experimental approach:

- Mechanical theory is used to define a model for the pavement structure and to assess stresses due to a reference axle;
- Fatigue tests in laboratories on materials used for pavements are then used to appreciate fatigue strength;
- Experience from observations on real roads are finally used to calibrate modelled results.

2.2 Aggressiveness assessment

Stresses that have to be assessed on the first step of pavement design are due to the transit of loaded axles. These stresses damage pavement structure. They are used to assess the axle aggressiveness (or the HGV aggressiveness in our case) that is considered. A special software is needed to assess these stresses and to value the exact impact of an HGV on pavement design. We decided to use the ALIZE software that was developed by the Laboratoire Central des Ponts et Chaussées (LCPC). It models stresses due to traffic in the different layers of the pavement structure. The model that was implemented in ALIZE is based on the theoretical model of Burmister that models the pavement structure as a semi-infinite material made of different layers with a constant thickness with a linear elastic isotropic behaviour (Figure 1 where E is for Young's modulus of elasticity and n is for Poisson's ratio). A full description of this software can be found on the web: [www.lcpc.fr/ext/pdf/prod/alize.pdf](http://www.lcpc.fr/ext/pdf/prod/alize.pdf) or [http://www.itechsoft.com/fr/alize/alizemeca.htm](http://www.itechsoft.com/fr/alize/alizemeca.htm).

Modelling an HGV in ALIZE requires modelling its pneumatic-tyres prints. Each print is characterized by:

- Its radius \( r \) (which is given here from the two next parameters),
- Its applied weight \( P \) (pneumatic weight),
- Its contact pressure between pavement and tyre \( Q \) (equal to 0.662 MPa for single and twinned tyres and 0.700 MPa for single tyres in a triple axle).
Then, for each HGV, the relative position of pneumatics has to be given. Finally, ALIZE requires as inputs pavement structure and HGV characteristics and returns stresses due to the considered HGV transiting on the considered pavement.

These stresses are used to assess each HGV aggressiveness from its axles aggressiveness. This is a relative value equal to the damage due to this axle divided by the damage due to a reference axle. In France, the reference axle is a single axle with twinned-tyres loaded with 130 kN (around 13 tons). The damage created in a layer from the transit of a loaded axle depends on only two parameters:

- The stress on the base of the layer;
- The layer material (bituminous or treated with hydraulic binders) that determines the stress type (respectively strain or stress) as well as the fatigue parameter to consider.

Axle aggressiveness is given by the following formula:

\[
A_i = \left( \frac{\varepsilon_i}{\varepsilon_0} \right)^\alpha \text{ for bituminous pavements,} \tag{1}
\]

\[
A_i = \left( \frac{\sigma_i}{\sigma_0} \right)^\alpha \text{ for semi-rigid pavements.} \tag{2}
\]

where:

- \(A_i\): single axle \(i\) aggressiveness;
- \(\varepsilon_i\): tensile strain on the basis of the sub-base due to the axle \(i\), taking into account whether the axle is included in a twinned or triple axle group;
- \(\varepsilon_0\): tensile strain on the basis of the sub-base due to the reference axle;
- \(\sigma_i\): tensile stress on the basis of one of the bedding courses due to the axle \(i\), taking into account whether the axle is included in a twinned or triple axle group;
- \(\sigma_0\): tensile stress on the basis of one of the bedding courses due to the reference axle;
- \(\alpha\): coefficient related to the fatigue slope of materials
  - \(= 5\) in France for bituminous mixtures;
  - \(= 12\) in France for hydraulically bound mixtures.

The HGV aggressiveness \((A_{PL})\) is given by:

\[
A_{PL} = \sum_{axle \_i} A_i \tag{3}
\]

When each HGV aggressiveness is given, it is possible to define a classification for HGV regarding the damage on pavements they are responsible for. The classification
for French roads that was calculated with this method is presented in paragraph 3.1. It leads to put in class 1 less than 12t 2-axle HGV, in class 2 refers more than 12t 2-axle HGV or 3-axle HGV and in class 3 all other HGV.

2.2 Pavement design

Pavement design is mainly based on different hypothesis about HGV traffic that will be supported by the pavement during its lifetime. This HGV traffic is characterised by its global volume and its aggressiveness through the "Equivalent Number of Reference Axles" NE that derives from the numbers NPl of each kind (or silhouette) i of HGV:

\[
NE = \sum_{pl} A_{pl} \times N_{pl}
\]  

(4)

As roads are usually designed for several years, a cumulated traffic TC on the pavement lifetime is derived from this NE with the following formula (for an arithmetic traffic growth of 5% and a 30 years lifetime) :

\[
TC = NE \times 365 \text{days} \times \left( 30 \text{years} + 5\% \times \frac{30 \text{years} \times (30 \text{years} - 1 \text{year})}{2} \right)
\]

(5)

NPl are the inputs to design different kinds of pavements for the different scenarios that have to be studied. Keeping a constant global volume of HGV and changing the authorized silhouettes i of HGV on the road, it is possible to measure the impact of each HGV kind on pavement design. The following paragraphs explain how these NPl change from one scenario to another.

In scenario 0, were HGV are not allowed on roads, we consider that only 2 12t and 2-axle HGV use the road every day (for road maintenance, safety measure…). This hypothesis was borrowed from a former study made by the Union des Sociétés d'Autoroutes à Péage (USAP) in June 1992. For this scenario 0, a flexible pavement is designed.

In scenarios 1, 2 and 3 where HGV are allowed on roads, the global volume of HGV traffic is equal to 2500 HGV per day and per sense of flow. This hypothesis of a constant global volume is made in order to measure only impacts of the HGV silhouettes on pavement design and to avoid volume impacts. The NPl depends on the proportion of HGV of kind i in the population of HGV on French roads but in scenario 3, all HGV are allowed, in scenario 2, HGV from class 3 are not allowed and in scenario 1, only HGV from class 1 are allowed. The proportions NPl are given by the Stations d'Analyse du Trafic Lourd (SATL) that are"counting hardware" all over the French National Road Network (RRN). For these 3 scenarios, two different pavement structures are studied : a bituminous pavement and a semirigid one with a structure designed after the former Design Manual for Pavement Structure (Sétra-LCPC, 1977 and 1988). Each of these two techniques represents about 40% of the French National Road Network.
The designed structures for each scenario are built using the ALIZE software directly. The French Design Manual for Pavement Structures (Sétra-LCPC, 1998) is not used because this manual is a tool that was developed to make pavement design more simple but that is not sensitive to the parameters we want to change in the different scenarios (it does not depend on the HGV traffic structure but on the global HGV traffic, considering a single average aggressiveness for all HGV). The outputs from ALIZE are presented in paragraph 3.2.

2.4 Cost assessment

The methodology to value designed structures lays on costs and volumes of materials that the structure requires. The costs are given by an Observatory of costs of pavement techniques. We consider costs from the year 2006, they are given in current euros. The differences of costs between two scenarios have then to be allocated to the different users (light vehicles, HGV from classes 1, 2 and 3). This problem does not have a single solution (Emile Quinet, 1998).

In this case, we used the following algorithm:

- Differences of costs between scenarios 3 and 2 are allocated to HGV from class 3;
- Differences of costs between scenarios 2 and 1 are allocated to HGV from class 3 and 2 proportionally to their relative part in the HGV global traffic;
- Differences of costs between scenarios 1 and 0 are allocated to HGV from all classes proportionally to their relative part in the HGV global traffic;
- Fixed costs that are measured in scenario 0 are allocated to all users proportionally to their relative part in the global traffic. An equivalence ratio of 2.5 between HGV and light vehicles is also used to take into account the fact that HGV are bigger than light vehicles and than make a more important use of the road. This coefficient is usually used in traffic modelling in France for volume-delay functions.

For HGV traffic, the hypothesis are consistent with the pavement design scenarios. For light traffic, we consider that HGV represents 12% of global traffic. This part is given by the traffic survey (Sondage de Circulation) of 2004-2005 on the National Road Network. This allocation method is derived from the Eurovignette directive recommendation that "the weighted average tolls shall be related to the construction costs and the costs of operating, maintaining and developing the infrastructure network concerned".

3. Results

In the first part of this chapter, results about HGV aggressiveness simulations are given and HGV classes are defined. In the second part, pavement structures that were
designed in each scenario are reported. Finally, in the third part, costs of these structures are assessed.

3.1 Modelled aggressiveness and designed pavement structures

Modelling HGV aggressiveness made us realize the different impacts of the different kinds of HGV on pavement design. One can notice the very high aggressiveness of 5 axles semitrailers with a triple axle behind. 50% of HGV traffic is done by these semitrailers in France.

The following table shows HGV aggressiveness and both bituminous and semi-rigid pavements and indicates for each kind of HGV its corresponding class.

**Table 1 – HGV aggressiveness.**

<table>
<thead>
<tr>
<th>Silhouette</th>
<th>weight (t)</th>
<th>Part in traffic</th>
<th>Aggressiveness (bituminous)</th>
<th>Aggressiveness (semi-rigid)</th>
<th>HGV class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.5</td>
<td>17%</td>
<td>0.01</td>
<td>1.08 e-5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>6%</td>
<td>0.10</td>
<td>0.32 e-2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>5.3%</td>
<td>0.74</td>
<td>0.36</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>2.7%</td>
<td>0.55</td>
<td>0.34</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>1.3%</td>
<td>0.49</td>
<td>0.05</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>11.2%</td>
<td>0.99</td>
<td>0.41</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>48.3%</td>
<td>1.80</td>
<td>0.66</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>1.2%</td>
<td>0.56</td>
<td>0.18</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>1.3%</td>
<td>0.93</td>
<td>0.17</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>1%</td>
<td>0.62</td>
<td>0.10</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>0.6%</td>
<td>0.49</td>
<td>0.09</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>3.1%</td>
<td>0.20</td>
<td>0.02</td>
<td>2</td>
</tr>
<tr>
<td>Other HGV</td>
<td>40</td>
<td>1%</td>
<td>0.8 (t)</td>
<td>1.3 (t)</td>
<td>3</td>
</tr>
</tbody>
</table>

(*) standard value from the design manual for pavement structures
### Table 2 – Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>NE</th>
<th>TC (x10^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.4</td>
<td>4.16 x10^{-3}</td>
</tr>
</tbody>
</table>

#### Bituminous pavement

<table>
<thead>
<tr>
<th>Scenario</th>
<th>NE</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>83.7</td>
<td>1.58</td>
</tr>
<tr>
<td>2</td>
<td>590.3</td>
<td>11.15</td>
</tr>
<tr>
<td>3</td>
<td>2731.4</td>
<td>51.50</td>
</tr>
</tbody>
</table>

#### Semi-rigid pavement

<table>
<thead>
<tr>
<th>Scenario</th>
<th>NE</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.1</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>218.7</td>
<td>4.13</td>
</tr>
<tr>
<td>3</td>
<td>1030.8</td>
<td>19.47</td>
</tr>
</tbody>
</table>

### 3.2 Structures

All hypothesis but traffic hypothesis that are required for pavement design are those that the French Design Manual for Pavement Structures recommends (risk assessment, choice for wearing course…). Abbreviations that are used in the following tables for each scenario are here summed up:

- **BB**: asphalt concrete (E = 5400 MPa, n = 0.35),
- **GNT2**: untreated graded aggregate (E = 400 MPa, n = 0.35),
- **PF2**: class 2 platform for the improved formation (E = 50 MPa, n = 0.35),
- **PF3**: class 3 platform for the improved formation (E = 120 MPa, n = 0.35),
- **GB3**: class 3 bituminous-bound graded aggregate (E = 9300 MPa, n = 0.35),
- **GC3**: class 3 cement-bound graded aggregate (E = 23000 MPa, n = 0.25).

### Table 3 – Structure for scenario 0.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Platform PF2</th>
<th>Platform PF3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acceptable stress (εo, in μdéf)</td>
<td>Material thickness (cm)</td>
</tr>
<tr>
<td>Scenario 0</td>
<td>2516</td>
<td>4 BB</td>
</tr>
</tbody>
</table>

(*) : simulated value

(**): technique minimum

μdéf is the unit for the acceptable stress
Table 4 - Structures for scenario 1, 2 and 3 for a bituminous pavement.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Platform PF2</th>
<th>Platform PF3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acceptable stress (ε₀, in μεdef)</td>
<td>Material thickness (cm)</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>94.6</td>
<td>6 BB, 20 GB3</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>56.2</td>
<td>8 BB, 28 GB3</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>36.6</td>
<td>8 BB, 37 GB3</td>
</tr>
</tbody>
</table>

Table 5 - Structures for scenario 1, 2 and 3 for a semi-rigid pavement.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Platform PF2</th>
<th>Platform PF3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acceptable stress (ε₀, in μεdef)</td>
<td>Material thickness (cm)</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>0.975</td>
<td>6 BB, 25 GC3</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>0.710, 0.645</td>
<td>6 BB, 21 GC3</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>0.575, 0.575</td>
<td>10 BB, 23 GC3</td>
</tr>
</tbody>
</table>

Tables 3 to 5 show the impact of HGV traffic and HGV silhouettes in the traffic on the thickness of the different structure layers, whatever the choice of technique is.

3.3 Pavement structures cost

We will focus on the bituminous structures for the cost analysis.

Table 6 – Pavement cost for scenario 0.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Platform PF2</th>
<th>Platform PF3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simulated</td>
<td>Minimum</td>
</tr>
<tr>
<td>Cost (k€HT/km)</td>
<td>133.54</td>
<td>139.75</td>
</tr>
</tbody>
</table>

Table 7 - Pavement costs for scenarios 1,2 and 3 on bituminous pavement.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cost of bituminous pavement (k€HT/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF2</td>
<td>PF3</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>602.34, 489.61</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>813.92, 687.85</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>1047.69, 893.54</td>
</tr>
</tbody>
</table>
4. Analysis

4.1 Designed pavement structures

Let’s compare designed structures from ALIZE with the structures that would be derived from the French Design Manual for Pavement Structures. For this exercise, we considered designed structures for scenario 3, since this is the only scenario with a HGV traffic that looks like the "real" HGV traffic on French roads for the National Road Network. We have to pick up in the manual a pavement structure designed for a HGV traffic of 2500 HGV per day and per sense of flow.

Table 8 - Comparison between a designed structure from ALIZE and a catalogue structure.

<table>
<thead>
<tr>
<th>Bituminous pavement on platform PF3</th>
<th>Designed structure</th>
<th>Manual structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 cm BB</td>
<td>8 cm BB</td>
<td></td>
</tr>
<tr>
<td>10 cm GB3</td>
<td>10 cm GB3</td>
<td></td>
</tr>
<tr>
<td>10 cm GB3</td>
<td>10 cm GB3</td>
<td></td>
</tr>
<tr>
<td>11 cm GB3</td>
<td>11 cm GB3</td>
<td></td>
</tr>
</tbody>
</table>

We could expect to find a thicker structure by using our hypothesis (because we consider full HGV in the study), but in fact we find the same structure. That’s because the traffic classes in the manual are "wide" : the structure designed in the manual allows from 2000 to 5000 HGV per day and per sense of flow.

4.2 Allocation of pavement costs

To allocate pavement costs, we considered pavement costs on class PF3 platforms because in most cases, PF3 platforms lead to cheaper road (taking into account the improved formation plus the pavement costs). We also consider the technique minimum for scenario 0. Costs that are finally considered are in the following table.

Table 9 – Pavement costs for a class 3 platform.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cost (k€HT/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 0</td>
<td>143.56</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>489.61</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>687.85</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>893.54</td>
</tr>
</tbody>
</table>
Applying the costs allocation method to pavement building costs proportionally to each user traffic (light vehicles and HGV from classes 1, 2 and 3), the following equivalence ratios are found.

Table 10 – Equivalence factors for pavement allocation.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 0</td>
<td>1</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>25</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>41</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>62</td>
</tr>
</tbody>
</table>

5. Conclusion

As a conclusion, this study shows that it is possible to assess the responsibility on pavement building costs of each kind of HGV according to their aggressiveness.

To abide by the Eurovignette directive recommendations that any HGV charging system should be proportional to the infrastructure use, the ratios that were finally calculated should be used to allocate pavement costs. This would lead to equivalence factors for investment costs differentiated by HGV class with ratios between HGV and light vehicles bigger than 3 in all cases.

To calculate these ratios, we consider that pavement costs represent 15% of investment costs on roads (other expenses refer to excavation, cleansing, bridges, fixed common costs...) and that all other expenses are allocated using the 2.5 ratio between HGV and light vehicles that was previously used for scenario 0. Equivalence factors for investment would then vary from 3.1 for class 1 HGV to 3.5 for class 2 HGV and 4.2 for class 3 HGV.

These ratios have to be considered as minimums because HGV do have an impact on other expenses that has to be calculated in an other study.

Finally, it would lead to different ratios for each HGV class contrary to ratios reported in the annex III directive and globally higher ratios than those presented in the preparatory documents for the directive proposition.
2.1.2 Rail

Introduction

This document reports the interview with the RFI infrastructure manager. The interview focussed on the following five questions, of particular relevance for the CATRIN project:

1. Describe the methodological assumptions behind the infrastructure cost estimation
2. The RFI approach for infrastructure cost allocation; parameters and methods
3. Infrastructure maintenance and renewal costs: cost coverage through the rail charge
4. The role of State funding in the overall infrastructure cost coverage
5. Barriers to the charge implementation

The five questions have been developed and accompanied by documents and papers, excerpts of which have been included in this report, when necessary. The report does not follows the chronological order of the discussion, which can be referred to as follows:

- Questions 1, 3 and 4 in the section 2 of this report
- Question 4 in the section 3 of this report
- Question 5 in the section 4

The final section draws the conclusion, with reference to the CATRIN outcomes.

1. Brief overview of RFI

Rete Ferroviaria Italiana (RFI) is the company of the Ferrovie dello Stato Group with the public role of Infrastructure Manager. As the body responsible for the track, the stations and the installations, RFI ensures to Italian railway undertakings (RU) the access to the railway network, performs the maintenance and the safe circulation on the whole network, manages the investments for the upgrading and improvement of railway lines and installations and it develops the technology of systems and materials.

On the international front, RFI promotes the integration of the Italian infrastructure in the European railway network, by co-ordinating with the EU Member States the quality standards, the activities and the marketing strategies of the services.

Presently, operational lines are over 16,300 km long; more than 11,500 Kms of it are electrified and over 7,000 Kms are double track. Stations and stops for customer service are approximately 2.300. Under the Bluvia trademark, RFI ensures the ferry link with Sicily and Sardinia.
2. The scope of the rail charge

The Italian rail charge is cost-based, i.e. the main objective is the costs coverage and no user’s willingness to pay or other market based components (bidding procedures) are allowed in the determination of the charge level and composition.

The charge has been designed to cover the circulation costs, direct and indirect, which are incurred by the infrastructure manager in providing the services to allow the movement of the train on the rail network. The circulation costs basically concern of traffic management costs (including the salary costs). The charge does not intend to cover maintenance and investment costs, that are funded by State budget.

More specifically, the regular activity of maintenance and the related maintenance costs are regulated under the framework Contract Service between State and RFI, while extraordinary activities, corresponding to the infrastructure renewal and investment costs, are regulated under specific framework Contract Programme. From the point of view of the accounting principles, the former activity does not increase the patrimonial value of the infrastructure, while the latter (renewal and investment) corresponds to the RFI valorisation of the infrastructural assets.

The assessment of the maintenance costs are monitored through regular activities by the Infrastructure Manager, through diagnostic tests (inspections) and taking into account the average life cycle of the asset. In such a way the Infrastructure Manager can control the quality of the asset, planning the interventions and the relative maintenance infrastructure costs, to meet the State funding resource allocation.

The following picture summarises the scope of the rail charge:

The rail charge depends on two main factors:
1. Spatial, i.e. the portion of the rail network used (main or secondary) and the presence of nodes (the rail network developed around the main urban metropolitan rail stations, corresponding to the 8 bigger Italian metropolitan areas)

2. Temporal, the day time for which the use of the rail network is requested; in three classes: night (22.00 – 6.00), day (9.00 – 22.00), commuting (6.00 – 9.00)

The combination of the two factors determines the slot for which the user requests the use of the rail infrastructure and in relation to which the charge is paid. In other words, the charge calculation starts from the slot requested, which is analytically determined for each train circulating on the network. The rail charge allows the users the right to use the rail infrastructure for that slot, i.e. for the scheduled time. It is important to stress that in case of non utilization of the slot, the RU has to pay the same the reservation fee, which is a part of the charge that should have been paid for using the slot as requested.

The rail charge does not include the energy consumption charge (on the basis of electric consumption), which is calculated separately.

3. The cost allocation parameters

In order to describe the cost allocation approach, it may be useful to consider the picture below.

It can be observed that the rail charge is divided two parts: ) the fixed part, corresponding to the access to the rail infrastructure and that is independent by the use
of the node or the portion of the rail network (secondary or main truck network), and b) the variable part, depending on the minutes spent in the node (for the node) and the usage of the rail network (in kilometre) in the case of the rail network.

In terms of cost allocation parameters, the use of the node, other than the minutes (time) spent in the node area, includes the day time and the importance of the station (to access the central station of the urban area implies a coefficient $\mu$ equal to 4, to access to the secondary stations the coefficient is 1). The day time classes correspond to the following coefficients:

<table>
<thead>
<tr>
<th>Day time class</th>
<th>Coefficient $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Night (22-6)</td>
<td>0.8</td>
</tr>
<tr>
<td>2. Day (9-22)</td>
<td>1</td>
</tr>
<tr>
<td>3. Commuting (6-9)</td>
<td>1.3</td>
</tr>
</tbody>
</table>

The use of the coefficients $\mu$ and $\alpha$ aims at considering scarcity and congestion factors, to the extent that the users pay more for the use of congested infrastructure: during peak hour and for using the nodes (minutes).

The formula is the following:

$$\text{Charge (node)} = \text{Fixed Access charge (€)} + \text{Variable part (Charge/minute * minutes * } \mu \text{ * } \alpha)$$

Concerning the rail charge for the portion of the rail network, the parameters are more complicated. In fact, if the RU has requested the slot on the main network, other than the parameter of the km, corresponding to the use of the infrastructure, there are the following three parameters to consider:

- **Speed (S),** as the ratio between the commercial speed (including the stops) and the average commercial speed existing on that section due to the technical characteristics of the line (e.g. number of tracks).

- **Density (D),** corresponding to the circulating trains in that portion. There are three categories: low density (circulating trains lower than 50% of the capacity), medium (circulating trans corresponding to 50 and 75% of the capacity, and high, with the circulating trains higher than 75% of the capacity).

- **Wear and Tear (WT),** as the ratio of the average wear and tear (for a typical train of 500 gross weight ton, 80 km/h speed and one pantograph) and the actual wear and tear of the train requesting the slot. This is calculated including a) the gross weight ton, b) the operating speed (due to the fact that the damage is intended to vary with the square of the speed) and the number of pantographs. The first two parameters relate to the track damage, the last one to the catenary. The weight of the parameters to the truck and catenary wear and tear is respectively 0.85 and 0.15.

The coefficients corresponding to the three parameters are the following:
Parameter speed = \( \frac{\text{Commercial speed} - \text{Averagespeed}}{\text{Averagespeed}} \)

<table>
<thead>
<tr>
<th>Range of P speed</th>
<th>Coefficient ( \tau )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 0.2</td>
<td>1</td>
</tr>
<tr>
<td>0.2 – 0.5</td>
<td>1.3</td>
</tr>
<tr>
<td>0.5 – 1</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 1</td>
<td>5</td>
</tr>
</tbody>
</table>

Parameter density Coefficient \( \phi \)

<table>
<thead>
<tr>
<th>Range of density</th>
<th>Coefficient ( \phi )</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50%</td>
<td>0.3</td>
</tr>
<tr>
<td>50% - 75%</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 75%</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Parameter wear and tear = \( \frac{0.85(\text{Speed}^2 \times \text{Weight}) + 0.15(\text{Speed} \times \text{NrPantograph})}{\text{Averagewearandtear}} \)

<table>
<thead>
<tr>
<th>Range of P swear and tear</th>
<th>Coefficient ( \psi )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>0.8 - 1.2</td>
<td>1</td>
</tr>
<tr>
<td>1.2 – 2</td>
<td>1.8</td>
</tr>
<tr>
<td>&gt; 2</td>
<td>3.5</td>
</tr>
</tbody>
</table>

The three coefficients corresponding to the three parameters are then included in the formula as the average mean. \( M = (\tau + \phi + \psi)/3 \)

The formula is the following:

Charge (portion of the network) = \( \text{Fixed Access charge (€)} + \text{Variable part (Charge/km} \times \text{km} \times (\tau + \phi + \psi)/3) \)

In case the RU requests a portion of the network corresponding to the secondary line, the formula does not include the coefficient \( \tau, \phi \) and \( \psi \), being the rail charge determined by the fixed access charge and the charge per km.

The cost allocation parameters assign an important role to the speed: both the commercial speed including the stops (the parameter speed) and the operating speed, influencing the wear and tear parameter (the square of the speed multiplied the weight).
Considering an average rail charge paid by the RU for using the main network, the proportion between the fixed and the variable component is about 20% for the fixed part and 80% for the variable part.

4. Implementation barriers

The rail charge has been designed to be tailored as far as is possible on the specific characteristics of the train requesting the slot. In principle, this would allow the application of the fairness of the charge, due to the fact that the payments correspond to the relevant conditions for the use of the infrastructure, e.g. weight, speed, contribution to the congestion, quality of the track, etc.

However, it has been stressed the existence of the trade off between complexity of the charge and its applicability. The more the charge is complex in order to take account of the cost drivers, the more it became difficult to apply, raising relevant transaction costs and misunderstanding with the users.

5. Conclusions

The cost allocation process is basically a top down exercise based on average costs, in which the circulation and traffic management RFI costs are allocated in a fixed and a variable component of the rail charge, depending on a series of cost drivers: speed, network density, damage, time of usage, kilometre travelled, etc.

The coefficients of the drivers of speed and wear and tear are calculated in order to take account of the proportional contribution of the individual train compared to the average conditions for a typical train on that segment.

Particular relevant in the context of CATRIN project is:

- The use of the square root of the speed multiplied the weight of the train as measure of the track damage
- The method to estimate the analytical contribution of specific trains by comparison with the average conditions on the rail segment, similar to the generalization formula proposed by the CATRIN research
- To consider the trade off between high charge differentiation and difficulty in implementation
- Independently from the marginal or average approach in charge determination, it is important to reach the financial equilibrium considering the State funding in view of the full cost coverage.
2.1.3 Air

Introduction

This document reports the interview with the Goteborg Airport manager and the LFV Group analyst. The interview focussed on the following four questions, of particular relevance for the CATRIN project:

6. Cost allocation practices: structure and type of the airport charge, with a focus on the infrastructure costs (passengers and aircraft activity: runaway, terminal, facilities, etc)
7. Review the charging policy of the airport: objectives and methods of implementation
8. Regional airport and cross subsidization; pros and cons
9. The EC charging policy; the Directive of Airport charge

The above questions have been developed and accompanied by documents and papers, excerpts of which have been included in this report, when necessary. The report does not follows the chronological order of the discussion, which can be referred to as follows:

- Questions 1, in the section 2 of this report
- Question 2 in the section 3 of this report
- Question 3 in the section 4
- Question 4 in the section 5

The final section draws the conclusions, with reference to the CATRIN outcomes.

1. Brief overview of the Goteborg Airport and the LFV group

The Göteborg Landvetter Airport is west Sweden's international airport with more than 4.3 million passengers per year. There are approximately 40 non-stop scheduled destinations and 50 charter destinations to choose between and the airport has a vital role in west Sweden's infrastructure providing both air transport for passengers and cargo. Among the relevant activities of the Airport there are 30 scheduled airlines, 65,000 RPT movements per year, 3300m runway ILS CAT II, 24/7 operations, daily wide body freighter services to Asia/Middle East.

The LFV Group consists of the State enterprise and its subsidiaries and associated companies. The Group operates 16 airports and is responsible for air navigation services in Sweden. The LFV Group’s reported sales amounted to SEK 6.0 billion and its profit was SEK M 447 in 2006. There are 4054 employees. A large proportion of the revenue (65%) arises from charges relating to aviation traffic at airports and also from over-flight traffic within Swedish airspace. Other revenues (35%) relate to the Airports’ commercial stores, parking areas, conference facilities, restaurants and much more.
Stores and restaurants are managed by tenants and associated partners whilst parking areas are generally provided under LFV’s own auspices.

2. Cost allocation practices: structure and type of the airport charge

The charges of the Goteborg Airport, consistent with the LFV group, are the following:

<table>
<thead>
<tr>
<th>Charge</th>
<th>Parameters</th>
<th>Values (SEK per unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Passenger</td>
<td>Freight</td>
</tr>
<tr>
<td>Take off</td>
<td>Weight MTOW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-25 tonnes</td>
<td>19 21</td>
</tr>
<tr>
<td></td>
<td>Over 25 tonnes</td>
<td>45 50</td>
</tr>
<tr>
<td></td>
<td>Over 100 tonnes</td>
<td>30</td>
</tr>
<tr>
<td>Emission</td>
<td>Aircraft engine emissions for all aircraft with MTOW over 5.7 tonnes: kg NOx emitted, multiplied with a factor a higher than 1 if HC Dp/Foo &gt; 19.6 g/kN</td>
<td>50</td>
</tr>
<tr>
<td>Noise</td>
<td>According to the ICAO regulation, per Unit Noise Charge</td>
<td>20</td>
</tr>
<tr>
<td>Terminal Navigation Charge</td>
<td>Paid for each take-off on the basis of MTOW</td>
<td>Fixed charge</td>
</tr>
<tr>
<td></td>
<td>9-15 tonnes</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>16-50 tonnes</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>51-100 tonnes</td>
<td>1020</td>
</tr>
<tr>
<td></td>
<td>Over 100 tonnes</td>
<td>2020</td>
</tr>
<tr>
<td>Ramp Infrastructure charge</td>
<td>MTOW</td>
<td></td>
</tr>
<tr>
<td>Passenger charge</td>
<td>Number of departing Passengers</td>
<td>9</td>
</tr>
<tr>
<td>Parking charge</td>
<td>MTOW</td>
<td></td>
</tr>
<tr>
<td>Passenger charge</td>
<td>Per departing passenger</td>
<td>Domestic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>International</td>
</tr>
</tbody>
</table>

The take-off charges are paid in accordance with the maximum start weight of an aircraft (MTOW). In general, the heavier the aircraft the higher the charge. These charges cover costs relating to the runway system, ramps and fire and rescue services. The difference between passenger and freight aircrafts is small.

The emission charges are levied at all aircraft whose take-off charge exceeds 5.7 tons coupled with the aircraft’s’ actual emission levels of nitrogen dioxide (NOx) and hydrocarbon (HC) during the LTO cycle (landing, taxiing and take-off up to 900 metres). The principal source for these emission levels is the ICAO Engine Standards and Emission Database. According to the polluter pay principle, the “dirtier” the
emission the higher the charge. These charges are intended to cover the costs incurred by the community (external costs for environmental damages) of NOx emissions up to 900 metres by all aircraft.

The noise charges are levied according to each aircraft’s certified noise level (ICAO Annex 16 Volume 1 Chapter 3 or 5 or in accordance with FAR Part 36 stage 3). These charges should cover the cost of measuring the level of noise as well as noise insulation actions (abatement costs). LFV airport’s noise classification is based on proximity to densely populated areas, the more sensitive the airport the higher the charge. In principle this means the higher the noise level the higher the cost.

The TNC charges (terminal navigation charge) are the same at all airports and payable by aircraft with a maximum take-off weight over 9 tonnes. The charge covers the cost of local air traffic control services which direct air traffic to and from the airport and also impart important information.

Infrastructure charges are determined following a consultation procedure between the stakeholders; Ramp agents, airlines, etc. The charge are set by the Airport manager, showing the relative costs, and discussed with the stakeholders and then levied. They are intended to cover the infrastructure costs related activities of the Ramp area (unloading, loading, refuelling, boarding) and the terminal infrastructure costs related to the passengers transit.

Parking fee - There is a monetary charge for aircraft standing at Swedish airports. The cost differs depending on the airport. More details can be found at the local airport.

Passenger charges are paid by every passenger. These charges should cover the cost of terminals, passenger access bridge and docking system connecting aircraft with terminal. These charges should go someway to covering the cost of airport security incurred by air travel. This charge is differentiated, passengers travelling on international flights pay more than those on domestic flights. The differentiation is explained on the basis of the costs for providing the services; for example passenger charges for international trips are higher than the passenger charges for domestic flights, due to the higher security costs.

Furthermore, in addition to the above charges, there are the route charges that are levied against all aircraft whose maximum take-off weight charge exceeds 2000 kg as specified within the Swedish Flight Information Region. This charge is imposed regardless of whether the flight is carried out using IFR (Instrument Flight Regulations) or conducted visually VFR (Visual Flight Regulations).

The route charges should cover the costs incurred by Air Navigation Services, telecommunications services, rescue services, weather information services and briefing.

Summing up, the main criteria behind the charge determination is cost-relatedness, aiming at covering infrastructure maintenance and investment costs. The application of the cost relatedness principle is confirmed by the cost allocation parameters, e.g. the
weight of the aircraft (MTOW), aiming at charging more the most costly vehicles in terms of damage.

However, it should be stressed that cost-relatedness is accompanied by market-driven principles, i.e. to determine charges that the market can bear, in view of the competitive conditions and marketing strategies. This could ultimately lead to determine charges for particular services at levels that do not fully cover the costs.

3. Review the charging policy of the airport

The charging policy of the airport is driven by the following goals and principles:

- charges should be in line with international practice, i.e. being defined according to the indications of international bodies, e.g. ICAO, The International Civil Aviation Organization
- charges should not have a discriminatory nature and not exceed the actual costs involved
- they should include a reasonable profit for the owner.

An important issue to consider is to take into account of the charging policy of the competing airports. For example, the Malmoe Airport (internal to the LFV group), due to its direct competition with the Copenhagen Airport, offers for the new intercontinental destinations the following discounts.

<table>
<thead>
<tr>
<th>New Intercontinental/European Destination (citycode)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malmö Airport (MMX)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Year 1-5</strong></td>
</tr>
<tr>
<td>Take-off:</td>
</tr>
<tr>
<td>100% discount*</td>
</tr>
<tr>
<td>Passenger charge:</td>
</tr>
<tr>
<td>50% discount</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Year 6</strong></td>
</tr>
<tr>
<td>Take-off:</td>
</tr>
<tr>
<td>Bonus for passenger increase (50/20 SEK for each new Intercontinental/European passenger)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>*Excl. environmental charges and TNC</td>
</tr>
</tbody>
</table>

The incentives programmes are part of the airport charging strategy. In 2003, LFV introduced a marketing incentive programme with the intention of encouraging airlines into increasing passenger volumes and developing services to new destinations.
This programme is limited to new traffic services. Applicable for a maximum period of 5 years to all airline companies who establish services to a new destination in accordance with the conditions stated as follows:

The Marketing Incentive Programme should be:

- Transparent
- Non-discriminatory, that is to say, accessible by all airline companies
- Published

Through the introduction of discounted, new destination, traffic charges, the intention is to facilitate the decision-making process and reduce risk levels by the airlines. It would normally take an airline about 2 years to establish a new route and for that route to become profitable or at least reach break-even. With the introduction of this Programme, the intention is to provide an effective contribution during the start-up phase and at the same time create long-term increased volume levels.

Traffic charges are designed to gradually increase and the discount decrease over a period of time. When the introduction period is over the new route should have reached a sustainable level of passenger volumes and able bear normal traffic charges.

In order to be classed as new destination traffic, the following criteria must be met:

- The definition of a new destination is the city designator. Traffic to a new airport with the same city designator that already has a service on this route is not judged to be new traffic.
- Traffic services available on a new route offering at least one flight per week on an annual basis.
- These new services (to the same city designator) have not been provided by another airline during the past 12 months.

4.3 Regional airport and cross subsidization; pros and cons

LFV is an example of network airport (like the ANA Portuguese airports and Aena Spanish airports). An Airport network can in principle allow the existence of smaller regional and peripheral airports. There is some case in which the airport networks are supported by large metropolitan areas and international airport network-members. Through the airport networks internal economies and relationships, the level of traffic and the versatility areas of the business of large airports allow for the generation of economies of scale and hence the funding of the smaller airports in the network.

In general, although criticised for harming competition, cross-subsidisation between different services is a principle largely applied by multi-products businesses. In some case, in the airport industry it is sometimes necessary in order for a country to implement its social strategy in isolated peripheral areas. A cross-funding network
policy should be a strategic option available to airport network operators and Member States.

On the other hand, the principle of cost-relatedness also requires that each airport should be regarded as a financially separate entity. Passengers and airlines using one airport should not have to pay for the development of another airport. If, however, Member States allow for airport networks, any cross subsidization should at least to be transparent.

5. The EC charging policy and the Directive on Airport charge

Concerning the EC charging policy, the most recent and important example is the Directive 2009/12 on airport charges. Two main remarks have been moved to the Directive:

1. The Directive implicitly assumes that there are very little competition among airports. The goal of the Directive to define clear principles for the definition of airport charges acts as if the airport industry was characterised by a world dominated by monopolistic flag-carriers and related airports. The reality is that there is a wide-European competition among airports, with most airports not free to impose whatever charges they want.

2. The Directive requires major transparency on the procedure for determining the airport charges, in particular to the airport managers, which should provide a lot of information. However, not the same level of transparency is requested to the airport users; in particular to the airlines, which in some case, own the airport.

Furthermore, it has been stressed that airport charges in themselves do not adequately enable the financing of future capacity projects, especially when related to large infrastructure investments (e.g. construction of new terminals etc.).

The ICAO principles on airport charges, acknowledged by the Directive 2009/12, are considered appropriate.

6. Conclusions

The cost allocation process is a complex activity driven by cost-relatedness and market-driven principles. Cost-relatedness implies that infrastructure costs are allocated according to parameters reflecting the costs generated by the infrastructure user, e.g. the weight (MTOW) of the aircraft. Market driven principles may imply that the cost of the service is not fully covered by the corresponding charge, due to cross- subsidization with other revenues from non aeronautical sources or other aeronautical services, or due to market competition.

Particular relevant in the context of CATRIN project is:
• Full cost recovery is the main objective for setting charges
• Cost allocation of infrastructure costs reflects on the one hand the cost causation of specific drivers, e.g. the weight of the vehicle, additional costs for security, facilities, etc, and, on the other, may be influenced by market driven opportunities, e.g. to incentivize a specific service, which can lead to subsidiizations
• The EC framework for charging airport services correctly assumes the ICAO principles and recommendations on airport and air navigation services charges as starting point, however, the articles of the Directive on transparency are not fairly balanced among the stakeholders, committing the airport to deliver too much information

2.1.4 Waterborne transport

The interview with the President Janusz Jarosinski and the vice-president Krystyna Szambelanczyk of the Port of Gdynia Board focused on the following issues:

1. Cost allocation by type of vessels: which is the method behind the differentiated charges?
2. Which type of data are collected for charging purposes (cost accounting from balance sheet, engineering data, transport data (e.g. flows by type of vessels, etc)
3. How much the competition with other ports influence charging policy?
4. The EU policy on Port charges: which is the right approach?

Brief overview of the Port of Gdynia

The port of Gdynia is located on the coasts of the South Baltic Sea. Construction of the Port started in the 1920's of the 20th century and from its early beginnings, it distinguished itself as a strong and dynamic port in the Baltic Sea region. The development of the Port of Gdynia is inseparably linked to the fortunes and development of the City of Gdynia. In 1901 the state owned enterprise was transformed into a shareholding company 100% owned by the state. The privatisation of the port has commenced from that date. From 25 - 09 - 1996 the Port of Gdynia finalised its restructuring programme. A new economic structure – the Port Gdynia Holding S.A. was established.

In 2008 the Port activity in the container segment lifted about 700 thousand of TEUs.

1. Cost allocation by type of vessels

The Tariff Plan of harbour duties states rates for using port’s facilities. There are three kinds of harbour dues: tonnage dues, wharfage dues and passenger dues. Dues paid by vessels depend on the type and size of the vessel. The additional factor which has an
impact on the height of the rate is the frequency of arrivals at Port of Gdynia. The last factor is applied for seagoing liners and ferries.

Each of vessels pays two (sometimes three) dues. All these dues are considered in the Port balance account as revenues from port dues. On the other hand the company occurs in costs for delivering the services on the basis of which port dues are levied, which include i.e. costs of maintenance of port’s infrastructure, deepening of port’s canals and water regions, fire service, etc.

Costs are allocated on each kind of port’s infrastructure despite the fact that they aren’t strict sources of income. Then, the costs of infrastructure are allocated on different activity: port’s dues, media like energy, water, IT. Costs of port’s dues are not allocated according to the type of vessel or type of port’s dues.

Port’s yearly investment in infrastructure exceeded over 100mln zl. Most of them are related to berth and canals. If we would like to calculate the height of port’s dues as full costs related to them their level would excess the level which is permissible by law.

Summarizing, the port balance accounts record the revenues according to the type of port’s dues (not according to the type of vessels) and allocate the revenues according to the type of port’s infrastructure cost.

2. Which type of data are collected for charging purposes

Port balance accounts provide income statement according to a standard classification. This implies that there is no possibility to assess the cost coverage of port’s dues (as a specific kind of port activity) from the income statement. However, the detailed port accounting system allows to observe and analyse the effects on this kind of port’s activity.

To summarize, keeping costs accounting in company is used for pinpointing the profitability of specific port’s activity, not for charging purposes. In setting charges, the basic question is how to assure enough sources for the development and to be competitive.

3. How much the competition with other ports influence charging policy

All Polish ports could establish their charges within the framework which is settled in Sea Harbour Law (consolidated text: Journal of Law dated 20th of December 1996, No 110, item 967 with subsequent amendments). The law assigns the highest level of port’s dues. So we could say that it is a kind of constraint of the competition. Of course, each of ports reflects its own specific and technical conditions’ in settling the charges.
4. The EU policy on Port charges

Ports are autonomous bodies in creating their Policy on port’s charges so it is difficult to ensure harmonized framework. ESPO has collected data from its members in order to recognize that issue.

Port of Genova

The following information has been collected under request to Francesca Moglia, of the Port Authority of the Port of Genova. The focus of the information is the charging system in the Port.

Brief overview of the Port of Genova

The Port of Genoa, with a trade volume of about 57 million tonnes it is the first port of Italy, and the second in terms of twenty-foot equivalent units after the port of transshipment of Gioia Tauro, with a trade volume of 1.86 million TEUs. Several cruise and ferry lines serve the passenger terminals in the old port, with a traffic of 3.2 million passengers in 2007. The quays of the passenger terminals extend over an area of 250 thousand square metres, with 5 equipped berths for cruise vessels and 13 for ferries, for an annual capacity of 4 million ferry passengers, 1.5 million cars and 250,000 trucks.

Port main charges and taxes

The harbour taxes of the Port of Genova are the following:

- tax anchorage and the surtax of anchorage, of which the fundamental parameter of calculation is represented from the tons of net tonnage as registered to the Italian ships and foreign;
- State taxes on goods disembarked loaded, based on ton of disembarked and boarded cargo;
- Port charges on the goods disembarked and boarded determined on the base of the type of goods and operation (boarding, unloading, etc).

Pilotage

The pilotage rates are approved by the Navigation and Ministry of Transportation, in accordance with the trade-union associations, according to dell'art. 91 of the navigation code, and disciplined from the artt. 130, 132, 133 and 134 of the executive regulations. The rate base (for the service in entrance, escape or all inside of the port) is calculated on the gross tonnage (T.S.L.) of the piloted ship.
Towing

The rates of the towing service are determined from the Port Authority, in accordance with the positions expressed from the trade-union associations of category. The calculation bases are constituted from the towed tonnage of the vessel and from the zone in which the service is lend.

Mooring

The rates (maximum) for the mooring service are fixed from the Port Authority and are calculated based on gross tonnage of the ship.

**Port dues and investments**

It has been observed that the activities of the Port of Genova provide about 2 billions € of revenues to the State budget (on annual basis), of which the 0.5% (about 50 million €) remains for financing the Port activities. The European Ports in competition with Genova may benefit up to 30% of internal revenues available for investments.

Considering the need to increase the resources available for funding investment, the Port Authority, in agreement with the national legislation allowed in 2003 to levy an additional charge on goods loaded and unloaded, differentiated by type of goods (from 0.02 €/ton for phosphates and assimilated nitrates to 0,28 €/ton to textiles, tobacco, coffee, cacao, etc
3. CONCLUSIONS AND FUTURE RESEARCH NEEDS

The feedback with the IMs has shed further lights on the cost allocation practices and the potential for marginal cost allocation approaches in transport infrastructures.

The French studies on road infrastructure cost allocation show that the assessment of the damage on pavement structure by vehicle type, i.e. the degree of aggressiveness, is one of the most important and decisive factors for a proper charging. The evaluation of the equivalence factors for allocating pavements costs by vehicle type conducted through a dedicated software taking into account HGV weight, axles configurations, types of tyres, etc, has led to higher ratios compared to the indicative reference values published in the Directive 2006/38.

The sensitiveness of the infrastructure road charging to the proper evaluation of pavement damage, in the first place, confirms the relevance of the EURODEEX (EUropean ROad Damage EXperiment) objectives as stressed by the CATRIN research, to the extent that they aim at consolidating a reliable and improved basis for a sustainable and fair transport pricing on European roads.

In particular, the Swedish Road Infrastructure manager has stressed the importance for the road administrations in Europe to benefit from cooperation, which would provide cheaper and more efficient research insights if they could join research efforts through a dedicated call on this issue.

In the second place, it also suggests future research needs, in the direction of improving the modelling tools for pavement performance and deterioration either by means of laboratory and full-scale pavement testing, or by means simulations.

Furthermore, the French approach provide insights on the other key parameter for the road infrastructure cost allocation: the allocation of global, fixed, costs by vehicle type. They refer to investment costs for pavement building, that are common to the transport users and that have to be allocated through equivalency ratio (the Equivalent Single Axle Load) to the different users (vehicle types). The review of the approaches has shown the consistency of using the relative share on global traffic (in vehicle kilometre) with the practices reviewed by the CATRIN road IMs.

The feedback with the rail IM allows the identification of two issues:

- To test the remit of the CATRIN research, i.e. the relevance of the marginal cost measurement, against the rail infrastructure cost allocation practices
- To discuss the implications in terms of cost coverage

The relevance of the marginal cost measurements has been confirmed by the IMs approaches in rail infrastructure cost allocation. In particular, the research carried out in CATRIN concerning the application of engineering models to analyse the relationships between infrastructure wear and tear and the average speed by type of rolling stock,
addresses an important cost allocation driver, as shown by the Italian rail infrastructure manager approach, adding new insights and paving the way for future research needs.

The implication of the marginal cost measurements in relation to the cost coverage issue has been repeatedly raised by the rail IMs. It has been stressed that infrastructure costs are covered jointly by track access charges and government funding and therefore the level of track access charges depends on the level of funding, as charges cover the difference between full cost and funding. This implies that Infrastructure Managers are not free to set up the level of access charges and that charges can be low only in countries where government funding is high. Therefore, to determine track access charges, not only marginal costs estimates but also full costs coverage and funding should be taken into account.

Despite the remit of CATRIN research is not to analyse how to implement marginal costs based pricing in the context of cost recovery, it has been shown, for example in the French revision of rail charges in 2010, that marginal cost estimates are important inputs into constructing track access charges. Mark ups plus scarcity/reservation charges may be high enough to cover fixed maintenance costs and contribute to renewals costs as well, but in presence of moderately used routes with low usage elasticity and possibly scarce opportunity for reservation, mark-up and scarcity charging, the application of marginal costs for charging may be difficult to apply.

Air and waterborne transport infrastructure cost allocation practices have proven to be scarcely responsive to marginal costs measurements. Parameters like the metric tons of the aircrafts (MTOW) and the gross tonnage of the ships, widely used by the IMs in the determination of airport take-off charges and Port dues, could in principle represent the basis for a marginal cost allocation approach, corresponding to the damage caused by the additional vehicle to the infrastructure.

However, in practice there are several barriers, economic, institutional, cultural, acting against the use of the above parameters in the direction of marginal costs assessment. Namely:

- Airports and Ports economics, characterised by the presence of significant fixed and capital costs, base their charging policy according to the full cost coverage, including investments. The short term horizon is not relevant
- Airports and Ports market condition, characterised by a high level of competition at wide-European scale (this is how the IMs perceive the business), making charging policy part of a complex strategy, subjected to the pursuing of objectives that may lead to high divergence between charge (price) and costs for the infrastructure use
- Airports and Ports historical tradition of diversity and legislative autonomy (in particular for Ports), deeply rooted in different legal and cultural local traditions, makes the adoption of common rules for charging determination difficult to be implemented. As a consequence, the existence of wide differences of charging levels across Europe and a general lack of transparency in charge determination can be observed; even if the recent EC Directive 2009/12 on airport charges set out the definition of common principles.
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ANNEX I: IMS SURVEY

The objective of the CATRIN Work Package 8 (Infrastructure Manager) task 1 is to carry out a survey among transport Infrastructure Managers in order to review the pricing principles underlying the charging practices in the respective sectors: road, rail, air and waterborne transport.

The discussion held in the CATRIN consortium about the most efficient and less time-consuming approach for carrying out the survey has compared pros and cons of the following two options:

1. To launch a comprehensive survey among the transport Infrastructure Managers involving the respective associations and aiming at collecting at least 80/100 questionnaires duly filled
2. To design a more flexible and targeted survey (max 30-40 contacts), based on the existing mailing lists

The first option has been considered not realistic. In fact, to carry out a comprehensive survey at such very big scale would have been made necessary a) to involve the Infrastructure Manager associations for conveying the questionnaires among the associates b) to have official EC presentations letter supporting the initiative. Furthermore, as suggested by the Institute of Transport Studies, similar surveys among the rail infrastructure managers had been recently carried out (the RAILCAL study), with the risk to duplicate the information and to hamper data collection.

On the other hand, the second option resulted as the most viable. Firstly, such an option would have benefited from the IMPRINT-NET Coordination Action contact list, which set up a network of transport researchers, transport infrastructure managers and stakeholders discussing over a four year time span the implementation of pricing reforms in the transport sector. Secondly, such an approach allowed in principle major flexibility in the definition of the questionnaires. The discussion in the CATRIN consortium stressed the fact that instead of one single questionnaire fitting all the transport modes, it would have been better to design differentiated approaches for each transport mode. This would have implied the need of last minute changes in the structure of the questionnaire, a procedure not compatible with a centralized big and “one time for all” sending of questionnaires.

According to this option, the IMPRINT-NET contact list has allowed the set up of a mailing list of about 50 contacts as starting point for the carrying out the survey. The IMPRINT-NET contact list is shown in the following table.

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1 IMPRINT-NET (Implementing Pricing Reforms in Transport Networking). Project Deliverables, Conferences programme and papers can be downloaded at http://www.imprint-net.org/
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<th>Institution</th>
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The next graphs show the composition of the contact list by category and transport mode.

The composition of the contact list is for 75% characterised by the presence of Infrastructure managers, for 17% by members of Infrastructure Managers associations with a limited participation of researchers (9%).

The composition by transport mode is balanced:

- 23% related to the road transport
- 19% related to rail
- 25% related to waterborne transport
- 33% related to the air transport
50% of the infrastructure managers responded to the survey (18 out 36), with rail infrastructure managers accounting for the higher share.

Despite the differentiation introduced in the structure of the questionnaires in order to take account of the specific characteristics of the transport mode, e.g. the section “revenues” has been included in particular for the road sector, given its importance in the context of road transport, in general the questionnaires have been focussed on the following topics:

a) The cost allocation method in use (e.g. Can you describe rules and criteria behind the cost allocation method in use?)

b) The institutional context (e.g. In your country, who is responsible for setting and administrating the charges?)

c) Shortcomings to overcome (e.g. Can you suggest areas of improvement in the current cost allocation method?)
Road

Questions to Infrastructure Managers – Road (Austria)

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in road charges - for example Ministry of Finance. We are here looking for the division of responsibility.

1. A - Is pricing of infrastructure use (toll, km charges, vehicle tax, fuel excise duty etc) something that is substantial considered when you develop your business or road plan?

The Austrian federal road network - motorways and expressroads of 2100 km – is in the responsibility of the state owned company ASFINAG (motorway and expressroad financing company) since 1997. The company has to plan, built, maintain, operate and finance this network. The company does not get financial support from the state budget but has to finance its duties from the revenue of a time based user fee (vignette) for light vehicles and a distance based toll for heavy vehicles.

In that context pricing of infrastructure as a very important element in the development of a road plan.

B - Can you roughly estimate the proportion of resources used for;

- investment planning? 65%
- maintenance planning? 25%
- pricing development? 10%

2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

At the beginning in 1997 the objective of charges was nearly exclusively the financing of road infrastructure. In the meantime also environmental aspects become more of interest.

3. Although you may consider pricing in your day to day activity;
A - who is actual responsible for setting the charges (toll, km charges, vehicle tax, fuel excise duty etc)?

Deciding the level of vehicle tax and fuel excise duty is in the responsibility of the Minister of Finance based on legal decisions of the parliament.
Setting the level of the user fee and the toll rates is in the responsibility of the Minister of Transport based on legal acts concerned and taking into account proposals of the company ASFINAG.

B - can you give references to the relevant law regulating the charges and the responsibility

The main legal act regulating the basic conditions for road charges is the “Bundesstraßen-Mautgesetz” (legal act on charging the use of federal roads). It consists the definition of the road network and the type of vehicles due to charges, the general structure of toll and user fee and the exemptions from paying toll as well as the responsibility for setting the level of toll and user fee.

C - do you have influence over the level of charges.

The level of road charges (vignette and toll) has to be fixed in a decree of the Minister of Transport.

4. What is the objective when charges (toll, km charges, vehicle tax, fuel excise duty etc) are actually decided (financing, economic efficiency etc).

The objective in actual deciding of road charges in Austria is primarily financing, not exceeding the limits of the European decision on road charges for heavy goods vehicles.

5. Can you describe the actual road user charges paid by a HGV and a passenger car driving an interurban road and an urban road?

There is no differentiation between urban and interurban roads
The toll rates per km for heavy vehicles (more than 3,5 t permissible gross weight) on motorways and express roads are:
- 0,158 Euro for a 2-axle vehicle
- 0,2212 Euro for a 3-axle vehicle
- 0,3318 Euro for a vehicle with 4 or more axles
These rates do not include 20% VAT
On certain road sections with high costs in the mountainous areas (Alps) there are higher rates.

Light vehicles (not more than 3,5 t) have to buy a vignette and can choose between:
- a yearly sticker for Euro 73,80
- a sticker for 2 months for Euro 22,20
- a sticker for 10 days for Euro 7,70 (including VAT)

Motorbikes pay a reduced rate
On those sections where heavy vehicles pay higher rates light vehicles do not need a vignette but have to pay a toll per section.

6. Can you give reference to the background material explaining the level of charges?
The frame conditions (tolling regulations) for toll and user fee are published on the website of ASFINAG (www.asfinag.at/Maut/Mautordnung) – also in English. The toll rates for heavy vehicles are based on the infrastructure costs of the tolled network.

7. Do you develop charging technology? What is the purpose?

Austria has in operation for heavy vehicles (more than 3,5 t) a fully electronic multilane freeflow toll collection system since 2004. The system is based on a DSRC 5,8 GHz microwave communication and is well accepted by the users. Find additional information on the tolling system on www.go-maut.at.

As a country in central Europe with therefore a higher percentage of international traffic Austria primarily concentrates on the development of interoperability with other electronic systems; on bilateral level (e.g. Germany, Czech Republik, Italy) and on EU level within the committee concerning the decision on an “European electronic toll service” (EETS).

III – Revenues

These questions are simply related to the use of the revenues from road user charges.

1. Do you have influence or even responsibility for the use of the revenues from the charges (toll, km charges, vehicle tax, fuel excise duty etc)? Who is responsible?

The use of revenues from the user fee and the heavy vehicle toll is fixed in a law and a contract between ASFINAG and the state. The responsibility is at the Minister of Transport together with the Minister of Finance. The revenue from vehicle tax and fuel excise charge goes to the common budget.

2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?

The revenue from user fee and the heavy vehicle toll is earmarked to cover the costs created by the motorway and express road network.

3. What is the principle guiding the use of the revenues?

The user pays principle

II – Available information for calculating charges

The third set of questions is related to available information for calculating (marginal) infrastructure cost.

1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure (especially road damage)?

ASFINAG as road and toll operator permanently collects data concerning road infrastructure and traffic.
2. What kind of data is collected and is the data available?

All data relevant to roads and traffic. Traffic data is partly available to the public.

3. If you had the responsibility to set the charges would you change the principle of collecting information/data?

At the moment there would be no reason for substantial changes.

III – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:
   A - a recommended cost per vkm?
   If charges allocated to the users shall reflect the real costs of a charged road infrastructure a common (average ?) level of costs per km will not be very helpful.
   B - a common methodology to estimate infrastructure cost?
   The infrastructure costs in Austria are calculated on the basis of a methodology accepted by the European commission. In addition the current eurovignette-directive gives in the annex a methodology for cost estimation that has to be used for new tolling systems.
   C - a decided price level per km?
   The answer can be similar to “A”; an average price level per km can never reflect the real individual cost situation of a dedicated road network.

2. Are you concerned with the pricing policy of neighboring road networks? Why?

In configurations where roads or road networks stand in competition to each other (even cross border), the pricing policy can be of great influence on the split of traffic to these roads. Such a situation exists e.g. between the main alpine transit routes in Austria and Switzerland. High Suisse charges impose a traffic diversion of heavy goods vehicles to parallel routes in Austria with all the problematic impacts.

3. Do you think a European legislation is necessary to control the price level?

In the sense of a successful common European market that depends also very much on acceptable conditions for the use of the international transport infrastructure it is useful to have an independent instrument for controlling the price level.

3. If you had the opportunity to write legislation what would you put in the regulation?
The possibility to take into consideration not only the real costs of infrastructure but in a given case also the competitive situation in traffic and price between roads of states in neighborhood (especially if not both are an EU memberstate)

IV - The future.

Finally, a question about the future.

1. What are the future plans for charges?

Austria intends to introduce a differentiation of toll rates by Euro emission classes of heavy vehicles in 2010 as it is recommended in the Eurovignette-directive (1999/62/EC and 2006/38/EC).

In addition there are suggestions to allocate to heavy vehicles also external cost charges as far as the discussed amendment of the directive concerned will be available.

2. Is it any discussion or plans for changed responsibility within the road sector?

No changes are intended.

3. Anything else we should have asked you?

Don´t think so.
Questions to Infrastructure Managers – Road (UK)

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in road charges - for example Ministry of Finance. We are here looking for the division of responsibility.

1.A - Is pricing of infrastructure use (toll, kmcharges, vehicle tax, fuel excise duty etc) something that is substantial considered when you develop your business or road plan?

UK has no national tolling schemes. On the national scale the main income is through fuel duty excise and vehicle tax, with the levels set by Central Government.

There are a number of toll bridges and tunnels throughout England were the toll is either set by Central Government or though legislation. Central London has a charging area with charging levels set by the elected Mayor of London.

The UK also has a privately own motorway (M6 toll road) with charge levels set by the private company who owns the road.

B - Can you roughly estimate the proportion of resources used for;
- investment planning?
- maintenance planning?
- pricing development?

2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

   All discussion to date has been to tackle congestion.

3. Although you may consider pricing in your day to day activity;
A - who is actual responsible for setting the charges (toll, kmcharges, vehicle tax, fuel excise duty etc)?

   • Tax - Central Government
   • Local Charges – Local Authorities
• National network e.g. Dartford – Department For Transport
• Individual Bridges and Tunnels and M6 toll road – Operator sets

B - can you give references to the relevant law regulating the charges and the responsibility

• Transport Act 2000 – Local tolling schemes
• Greater London Act 1999 – Central London Congestion Charge
• 1991 New roads and Streets Works Act – M6 Toll road
• Bespoke for other tolls

C - do you have influence over the level of charges.

4. What is the objective when charges (toll, kmcharges, vehicle tax, fuel excise duty etc) are actual decided (financing, economic efficiency etc).

See question 2.

5. Can you describe the actual road user charges paid by a HGV and a passenger car driving an interurban road and an urban road?

Central London


Low emissions zone


M6 toll road

http://www.m6toll.co.uk/pricing/default.asp?mainmenuid=4

6. Can you give reference to the background material explaining the level of charges?

See links above.

7. Do you develop charging technology? What is the purpose?

• We are involved in this at two levels: we are preparing to provide substantial financial support to local authorities to implement local road charging schemes, using the most innovative solution for the congestion challenge they face. That support means that the authorities will then be able to procure the right equipment and
work with their suppliers to adapt it to their particular needs. We also now have a programme in place to develop industry’s capability on more sophisticated charging, the ability to charge by time, distance and place driven. Through a series of progressively more challenging Demonstration Projects over the next two years we will aim to develop answers to the key challenges around the longer-term evolution of charging, such as how to achieve accuracy and fairness and how to protect privacy.

II – Revenues

These questions are simply related to the use of the revenues from road user charges.

1. Do you have influence or even responsibility for the use of the revenues from the charges (toll, kmcharges, vehicle tax, fuel excise duty etc)? Who is responsible?
   - All local schemes are set by the local authorities with revenue collected being used to fund local transport schemes.

2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?
   - See above

3. What is the principle guiding the use of the revenues?

III – Available information for calculating charges

The third set of questions is related to available information for calculating (marginal) infrastructure cost.

1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure (especially road damage)?
   - We collect and use data for use in theoretical models.

2. What kind of data is collected and is the data available?
   - Traffic counts
   - Traffic surveys

3. If you had the responsibility to set the charges would you change the principle of collecting information/data?
IV – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:
   A - a recommended cost per vkm?
   B - a common methodology to estimate infrastructure cost?
   C. – a decided price level per km?

   • We believe that we have the data required for setting the appropriate charge.

2. Are you concerned with the pricing policy of neighboring road networks? Why?

   • Not that much due to being an island. However some concern with regards to HGV if British hauliers have to pay a charge to use other roads in the EU both EU hauliers do not have to the in the UK.

3. Do you think a European legislation is necessary to control the price level?

   • Not for the UK but we recognise it may do for other countries.

3. If you had the opportunity to write legislation what would you put in the regulation?

V - The future.

Finally, a question about the future.

1. What are the future plans for charges?

   • No plans for wide spread distance or vignette scheme for trucks. Some Local Authorities are considering local charges.

2. Is it any discussion or plans for changed responsibility within the road sector?

3. Anything else we should have asked you?
Questions to Infrastructure Managers – Road (Sweden)

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in road charges - for example Ministry of Finance. We are here looking for the division of responsibility.

1.A - Is pricing of infrastructure use (toll, km-charges, vehicle tax, fuel excise duty etc) something that is substantial considered when you develop your business or road plan?

Yes, it will be important in our next national transport plan 2010-2021. During that period a km-fare may become reality in Sweden. The road charging scheme of Stockholm may be followed by new scheme in Göteborg. The system with toll roads on Öresund bridge and Svinesunds bridge may be followed by some more bridges that not pass country borders.

B - Can you roughly estimate the proportion of resources used for;

- investment planning? Strategic level index 100
- maintenance planning? Strategic level index 70
- pricing development? Strategic level index 10


2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

- Marginal cost for external effects including wear and tear – km-charging (now Eurovignette)
- Marginal cost for congestion and environment - road price charging in Stockholm, Göteborg mostly
- Alternative ways of financing infrastructure:
- regional benefits (public or firms) – regional willingness to pay.
- In the long run maybe user charge – wear and tear – like paying water and drain
- New toll roads like in Norway – mostly bridges and tunnels

VTI comment: It seems that the Swedish IM has three objectives when discussing charging principles; efficiency on a principle level (km-charges), congestion and environmental objectives in urban areas (congestion charging in Stockholm) and
financial objectives. The latter contains both co-financing from regions and more user charges and toll roads with the aim to finance roads.

3. Although you may consider pricing in your day to day activity;
A - who is actual responsible for setting the charges (toll, km charges, vehicle tax, fuel excise duty etc)?

**The Government**

VTI comment: The Swedish IM has very limited responsibility over the charging policy. Most of the responsibility for policy and the level of charges are at the hands of the Government. The IM is more involved in technical development of charging systems as well as the management of charging scheme (Stockholm).

B - can you give references to the relevant law regulating the charges and the responsibility

- **Heavy vehicle:** [http://www.notisum.se/rnp/sls/lag/19971137.htm](http://www.notisum.se/rnp/sls/lag/19971137.htm)

C - do you have influence over the level of charges.

**No – the government**

4. What is the objective when charges (toll, km charges, vehicle tax, fuel excise duty etc) are actual decided (financing, economic efficiency etc).

**Stockholm price-effect economic efficiency**

**Bridges – financing**

**Km-charges marginal cost – external costs**

VTI comment: The IM has the same objective for discussing charging schemes as their impression of the objectives of the Government. This includes thus internalization of external cost for km-charges, economic efficiency for the urban pricing schemes and financing for the toll solutions for bridges.

5. Can you describe the actual road user charges paid by a HGV and a passenger car driving an interurban road and an urban road?

### Price per single trip

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Price (EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorcycle</td>
<td>20</td>
</tr>
<tr>
<td>Car up to 6 m</td>
<td>36</td>
</tr>
<tr>
<td>Van and minibus 6-9 m</td>
<td>71</td>
</tr>
<tr>
<td>Car up to 6 m with trailer/caravan, mobile home over 6 m *</td>
<td>71</td>
</tr>
<tr>
<td>Coach over 9 m</td>
<td>151</td>
</tr>
<tr>
<td>Lorry over 9 m</td>
<td>106</td>
</tr>
</tbody>
</table>

b) **Svinesundbroarman** (Norwegian krona (NOK)):  
[http://www.svinesundsforbindelsen.no/english/](http://www.svinesundsforbindelsen.no/english/)

Light vehicles with a maximum total weight of 3.5 tonnes or less pay a fee of NOK 20 each time they pass a toll station. Heavier vehicles weighing more than 3.5 tonnes pay NOK 100 each time they pass a toll station. Motorcycles and mopeds are exempt from charges. The charges are the same at all toll stations.

c) **Stockholm:**

Times and amounts

<table>
<thead>
<tr>
<th>Congestion Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>6.30 a.m.–6.59 a.m.</td>
</tr>
<tr>
<td>7.00 a.m.–7.29 a.m.</td>
</tr>
<tr>
<td>7.30 a.m.–8.29 a.m.</td>
</tr>
<tr>
<td>8.30 a.m.–8.59 a.m.</td>
</tr>
<tr>
<td>9.00 a.m.–3.29 p.m.</td>
</tr>
<tr>
<td>3.30 p.m.–3.59 p.m.</td>
</tr>
<tr>
<td>4.00 p.m.–5.29 p.m.</td>
</tr>
<tr>
<td>5.30 p.m.–5.59 p.m.</td>
</tr>
<tr>
<td>6.00 p.m.–6.29 p.m.</td>
</tr>
</tbody>
</table>

No tax is charged on Saturdays, Sundays, public holidays, the day before a public holiday or during the month of July.  
[http://www.vv.se/templates/page3____17154.aspx](http://www.vv.se/templates/page3____17154.aspx)
d) Road user charges heavy vehicles 12 ton: 
http://www.vv.se/templates/page3_3379.aspx

How much is the tax?
The amount of tax is based on

- the type of vehicle
- the tax class (weight) of the vehicle
- the number of axles on the vehicle
- coupling devices
- fuel
- municipality of residence
- type of use.

Följande belopp gäller för år 2008.

<table>
<thead>
<tr>
<th>Antal axlar</th>
<th>Avgasklass</th>
<th>Vägavgift per år</th>
</tr>
</thead>
<tbody>
<tr>
<td>Två eller tre</td>
<td>Euro 0</td>
<td>8 743 kr</td>
</tr>
<tr>
<td>Två eller tre</td>
<td>Euro 1</td>
<td>7 741 kr</td>
</tr>
<tr>
<td>Två eller tre</td>
<td>Euro 2</td>
<td>6 831 kr</td>
</tr>
<tr>
<td>Fyra eller fler</td>
<td>Euro 0</td>
<td>14 117 kr</td>
</tr>
<tr>
<td>Fyra eller fler</td>
<td>Euro 1</td>
<td>12 751 kr</td>
</tr>
<tr>
<td>Fyra eller fler</td>
<td>Euro 2</td>
<td>11 385 kr</td>
</tr>
</tbody>
</table>

http://www.skatteverket.se/skatter/vagavgifter/vagavgifter.4.18e1b10334ebe8bc8000899.html

VTI comment: Specific charges exist for Sweden in the form of tolls at a) the Öresunds and b) the Svinesunds bridge; in the form of congestion charging in c) Stockholm and d) kilometer charges for Heavy vehicles (Eurovignette)

6. Can you give reference to the background material explaining the level of charges?

Yes on internet (se above)

7. Do you develop charging technology? What is the purpose?

SRA is giving some research grants. Goal is to have small system costs.

III – Revenues

These questions are simply related to the use of the revenues from road user charges.

1. Do you have influence or even responsibility for the use of the revenues from the charges (toll, kmcharges, vehicle tax, fuel excise duty etc)? Who is responsible?

The Government. SRA are administrating the collection.
2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?

The bridges are financing. The Stockholm toll charge is juridical a tax and the payment goes to the government.

3. What is the principle guiding the use of the revenues?

In Stockholm government are giving back the money to the region for special use. There is a political discussion where all parties agree that the money goes back to the region. Government want it to build a new road and the opposition want it to public transport.

Road user charges heavy vehicle goes to the Finance department.

II – Available information for calculating charges

The third set of questions is related to available information for calculating (marginal) infrastructure cost.

1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure (especially road damage)?

Yes

2. What kind of data is collected and is the data available?

What money goes to road damage. Available from VTI. Some years ago a special study – see the marginal cost report. Vägverket 2003.

3. If you had the responsibility to set the charges would you change the principle of collecting information/data?

Not really – but improving and secure the data.

III – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:

A - a recommended cost per vkm?
Yes, for comparison. Important to have it differentiated on different types of road (road damage) and rural and cities.

B - a common methodology to estimate infrastructure cost?

Yes.

C. – a decided price level per km?

No, some adjustments must be done according to different parts of Europe. One important question is about countries place in the middle or at the outer edge of Europe and how long the transport are inside the countries.

2. Are you concerned with the pricing policy of neighboring road networks? Why?

Yes because of the competition in industry. They must have equal opportunities.

3. Do you think a European legislation is necessary to control the price level?

Don’t know – maybe not.

3. If you had the opportunity to write legislation what would you put in the regulation?

Marginal costs of externalities and marginal damage. Consideration about countries place in the middle or at the outer edge of Europe and how long the transport are inside the countries. Differentiated km-fees. First generation heavy vehicles. Second generation all cars.

IV - The future.

Finally, a question about the future.

1. What are the future plans for charges?

Two bridges inside Sweden. Maybe Göteborg.

2. Is it any discussion or plans for changed responsibility within the road sector?

SRA have said it want predestinated charges – but no response (yet?) from government.

3. Anything else we should have asked you?

Don’t think so.
Questions to Infrastructure Managers – Road (Switzerland)

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in road charges - for example Ministry of Finance. We are here looking for the division of responsibility.

1. A - Is pricing of infrastructure use (toll, kmcharges, vehicle tax, fuel excise duty etc) something that is substantial considered when you develop your business or road plan?

It depends on the level of responsibility. On the national level (motorways), the main income is generated by the fuel excise duty. It’s level is fixed legally, Parliament decides periodically how much of the income shall be set free for road purposes.
On the cantonal level, the main source is the vehicle tax. Due to lack of money, cantonal governments and parliaments occasionally try to increase the vehicle tax, but usually fail when the proposal is brought to public vote. So it happens occasionally that money from the general budget is used for Road purposes. As communities do not participate in the income of the fees mentioned above, they have to finance their road expenses mainly from the general budget.

B - Can you roughly estimate the proportion of resources used for;

The costs mentioned below are unknown to me

- investment planning?

- maintenance planning?

- pricing development?

2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

The main object is financing, but the other aims can play a role. This was specifically true in the case of the Swiss HVF:
3. Although you may consider pricing in your day to day activity;
A - who is actual responsible for setting the charges (toll, km charges, vehicle tax, fuel excise duty etc)?

The Charges are set by law. Changes of the level of the charges need therefore changes of the corresponding law. This change can be put into question (what’s normally the case) in a public referendum, as it was mentioned above in the case of the cantonal vehicle taxes. In the case of the HVF, the rate can be set up to a maximum value fixed in the law by the Swiss government.

B - can you give references to the relevant law regulating the charges and the responsibility

**HVF:**
Federal law on the Heavy Vehicle fee
Federal directive on the Heavy Vehicle Fee

**Motorway User Fee**
Federal Constitution Art. 86
Federal Directive on Motorway User Permit
(It is planned to introduce a law as legal bases for the Motorway user fee, this law does however not yet exist)

C - do you have influence over the level of charges.

As mentioned above, the Swiss government can set the level of the HVF up to a maximum rate fixed in the law. The level of the motorway user fee and the level of the fuel excise duty are both set by federal law.
The level of the vehicle tax is set by the cantons, usually by their parliaments (with the possibility of popular referendums).

4. What is the objective when charges (toll, km charges, vehicle tax, fuel excise duty etc) are actual decided (financing, economic efficiency etc).

Mainly financing (see question 2)

5. Can you describe the actual road user charges paid by a HGV and a passenger car driving an interurban road and an urban road?

A HGV has to pay for the use of all roads the same fee. The level of the fee depends of the km driven, the admissible weight and the emissions. From the 1.1.2009 the rates according to the emissions will be the following:
2.26 Swiss Cents per tonne-kilometer for clean vehicles (Euro 4 and cleaner)
2.66 Swiss Cents per tonne-kilometer for Euro 3
3.07 Swiss Cents per tonne-kilometer for Euro 2 and worse
A Euro 5 truck with an admissible weight of 40 tonnes therefore has to pay a total amount of 90.4 Swiss Cents (about 55€Cts) per km.
Light Vehicles with an admissible weight up to 3.5 tonnes have to pay an annual flat fee of 40 CHF for the use of motorways. The use of all other roads is free of charge (see introduction).

6. Can you give reference to the background material explaining the level of charges?

For HGV’s see the brochure Fair and efficient – The Distance-related heavy Vehicle Fee in Switzerland:

7. Do you develop charging technology? What is the purpose?

Charging technology has been developed for the introduction of the HVF. The federal state fixed the formal requirements (with the help of consultants) and then made a call for tender. More information can be found in the brochure “Fair and efficient” mentioned above. At the moment, the second generation of on board units is in production.

II – Revenues

These questions are simply related to the use of the revenues from road user charges.

1. Do you have influence or even responsibility for the use of the revenues from the charges (toll, kmcharges, vehicle tax, fuel excise duty etc)? Who is responsible?

On the federal level, the use of the revenue is strictly regulated by different laws.
On the level of the cantons, it depends on their legislations.

2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?

About 70% of the revenue of the fuel excise duty and 100% of the revenue of the motorway user fee are earmarked, mainly for construction, maintenance and operation of motorways. The remaining ca 30% of the fuel excise duty are not earmarked.
Two third of the revenue of the HVF are earmarked for big investments in public transport (mainly infrastructure). The remaining third is given to the cantons, the way they use the money is mainly up to them. The same is true for the revenue from the vehicle taxes.
3. What is the principle guiding the use of the revenues?

The idea is that road transport should cover its costs. In the case of HGV’s, external costs are included in the calculations, in the case of private cars, external costs are not included.

III – Available information for calculating charges

The third set of questions is related to available information for calculating (marginal) infrastructure cost.

1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure (especially road damage)?

The Swiss federal office for statistics collects such data and publishes the results periodically. They are summarized in the federal Road Account.

2. What kind of data is collected and is the data available?

All kind of data are collected. Unfortunately, the results are published in German and French only. They can be found in detail under the following link:

http://www.bfs.admin.ch/bfs/portal/de/index/themen/11/02/blank/key/strassenrechnung/globalrechnung.html

Although the question is limited to costs of infrastructure, we would like to mention that we although do dispose of scientific calculations of the external costs of transport. Here is the link:


3. If you had the responsibility to set the charges would you change the principle of collecting information/data?

No, but we would seriously check the distribution of costs between the different categories of vehicles

IV – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:

As Switzerland is not a member of the EU, we are, in the limits set by the transport agreements with the EU, free in how we do calculate our fees. It would
(or will) of course be interesting for us to learn about the results figured out on EU level.

A - a recommended cost per vkm?

B - a common methodology to estimate infrastructure cost?

C. – a decided price level per km?

2. Are you concerned with the pricing policy of neighboring road networks? Why?

Yes we are, mainly due to possible detour traffic of HGV’s in transit across the Alps.
We are also concerned by the level of the fuel excise duties in the neighboring countries, as differences in fuel prices lead to tank tourism.

3. Do you think a European legislation is necessary to control the price level?

No. As it can be learned from experience, it is not possible to raise extravagant fees on the national level. The only thing the EU ought to do is to control that the principle of non discrimination of foreign vehicles is respected.

3. If you had the opportunity to write legislation what would you put in the regulation?

I would certainly put in the principle of full cost coverage, including external costs.

V - The future.

Finally, a question about the future.

1. What are the future plans for charges?

Government plans to allow urban areas to make trials with road pricing (due to legal restrictions, such trials are not possible today). If these trials will be successful, urban areas can implement Road Pricing Schemes definitely.

2. Is it any discussion or plans for changed responsibility within the road sector?

The only change envisaged is the one mentioned above (enable urban areas to introduce Road Pricing)

3. Anything else we should have asked you?
**General Remark regarding the Situation of Road Financing in Switzerland**

The situation in Switzerland is somewhat different from the one in other European countries: Except from some small private roads, the Swiss Road network is planned, built, maintained and operated by a public authority, either on federal, cantonal or communal level. The answers given to the questions below reflect therefore the view of a transport expert employed by the Swiss ministry for Environment, Transport, Energy and Communication(DETEC).

It has to be mentioned that the question of Pricing is special insofar, as according to our federal constitution the use of the road network is free of charge. To this principle there are, however, three exceptions:

- For the use of motorways, light vehicles up to 3.5 tonnes have to be equipped with a sticker which costs 40CHF (about 25€) per year. The income from this sticker, about 300 Mio CHF/year has to be used for the road.
- Vehicles with an admissible weight of more than 3.5tonnes have to pay a distance related fee, the so called heavy vehicle fee (HVF), which depends on the distance driven, the admissible weight and the emissions. Two thirds of the net income of this fee are used for the financing of projects for public transport, one third is given to the Cantons which are supposed to use it for projects in context with road transport.
- Parliament can agree to charges for specific infrastructure projects like bridges or tunnels. Up till now, this happened only once when Parliament agreed to finance the St. Bernhard Street Tunnel (which connects Switzerland with Italy) with user fees.
Rail

Questionnaire (Switzerland)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastructure cost). It intends to steer the discussion internal to the Rail Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (members of association may provide an overview of the prevailing existing practices) ?

Short run marginal cost pricing  ☒

Full cost recovery  ☐

Full cost recovery less State subsidy  ☐

Others (specify)  ☐

2. Can you describe the methods used for estimating the infrastructure charge ?

Econometric approach  ☒

Engineering approach  ☐

Cost allocation approach  ☐

Others (specify)  ☐

3. Are in place hypothesis for future modifications ? If yes, where and why ?

Some relevant ideas to give good incentives with respect to tear and wear, environment, life cycle costs, productivity/efficiency and quality:
• minor adjustments planned from Dec 2009: mark-up for freight trains time differentiated and based on train path (today: weight);

• “Railway reform 2.3” planned from 2013: differentiated charges according to time, track categories and train path quality

The institutional context

4. In your country, who is responsible for setting and administrate the charges?

<table>
<thead>
<tr>
<th>Name of the institution</th>
<th>Role and responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOT (Federal Office of Transport)</td>
<td>defining charges</td>
</tr>
<tr>
<td>Railway undertakings (SBB, BLS…)</td>
<td>Operation; setting mark-ups (within legal framework)</td>
</tr>
</tbody>
</table>

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

- procedures for charging: yes

- procedures for changing the system: no

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply?

- yes, the system is quite simple

If no, please describe why.

7. Can you suggest fields of improvement in the existing cost allocation method?

- see question 3. We are aware namely of the fact that heavy freight trains pay a rather high access charge compared to passenger trains

8. In your country, could you give some examples of best practices and case studies in cost allocation methods?

- Heavy vehicle fee on roads
9. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?

**Vertically integrated railway companies**

**Political interests do not correspond to the economically reasonable solutions**

Please note down a reference person:

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Capacity: Adviser  
Address: Bundesamt für Verkehr, 3003 Bern, Switzerland  
Telephone: +41 31 322 57 72  
Email: kjell.kolden@bav.admin.ch

May we contact you again for further information?

☒ Yes ☐ No

**Thank you for your participation and the support of our project!**

Please returns this questionnaire in digital or paper format to the following address:

ISIS  
Istituto di studi per l’Integrazione dei Sistemi  
Via Flaminia 21, 00196, Roma  
Fax: 06-3213049  
e-mail: renei@isis-it.com
Questionnaire (France)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastructure cost). It intends to steer the discussion internal to the Rail Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (members of association may provide an overview of the prevailing existing practices) ?

   - Short run marginal cost pricing
   - Full cost recovery
   - Full cost recovery less State subsidy
   - Others (specify)

The principle according to the recent “contrat de performance” between RFF and the French state is full price recovery minus subsidies, on a national basis. Since the reform of the infrastructure charges, in 2010, the charges are calculated in such a way as not to be under marginal costs (marginal components of maintenance, renewal, signalling...). This is the case for instance for freight.

The charge increases above the MC as much as the market can bear it. This is the case for example for High speed trains, where the infrastructure charge is close to full cost recovery.

Also in urban areas a significant mark up on top of marginal cost is added, in order to take into account scarcity. Charges are close to full price recovery for the most densely populated area (Ile de France / Paris region).

2. Can you describe the methods used for estimating the infrastructure charge ?

   - Econometric approach
   - Engineering approach
   - Cost allocation approach
So far, our provisional model includes an engineering approach for most elements, with an econometric approach “on top” for those elements which have not been estimated by the engineering approach. Also, for cross checking, a fully econometric approach has been implemented.

3. Are in place hypothesis for future modifications? If yes, where and why?

**RFF plans a full review of its marginal cost model in 2009/10.**

---

### The institutional context

4. In your country, who is responsible for setting and administrate the charges?

<table>
<thead>
<tr>
<th>Name of the institution</th>
<th>Role and responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFF</td>
<td>Proposal of charges</td>
</tr>
<tr>
<td>From late 2009 onwards</td>
<td>“Avis conforme” of the forthcoming regulator (i.e. the regulator can say yes or no, but not pick items).</td>
</tr>
<tr>
<td>French State</td>
<td>Final approval</td>
</tr>
</tbody>
</table>

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

The institutional procedure is generally smooth.

---

### Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

Yes.
7. Can you suggest fields of improvement in the existing cost allocation method?

**During our 2009/10 review, we would like to consolidate various methods, and further understand why different methods can lead to different results.**

8. In your country, could you give some examples of best practices and case studies in cost allocation methods?

**Internal studies of RFF (econometric approach; non complete engineering approach). Also there are interesting academic studies in France, notably that of Quinet and Gaudry. (econometric)**

9. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?

**RFF has implemented a through charging reform, applicable in 2010. Negotiations with relevant authorities have lasted 3 years (2005-2008), and one can only praise the French State for its listening capacity in the matter.**

Please note down a reference person:

Name: __SAUVANT Alain_________________________
Capacity: _Chief economist_________________________
Address: _RFF__________________________
____92 avenue de France, 75648 Paris Cedex 13, France
Department: ______________________
Telephone: _+331 53943450________________________
Email: _alain.sauvant@rff.fr_________________________

May we contact you again for further information?

☑ Yes □ No

**Thank you for your participation and the support of our project!**

Please returns this questionnaire in digital or paper format to the following address:

ISIS
Istituto di studi per l’Integrazione dei Sistemi
Via Flaminia 21, 00196, Roma
Fax: 06-3213049
e-mail: renei@isis-it.com
Questionnaire (The Netherlands)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastructure cost). It intends to steer the discussion internal to the Rail Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (members of association may provide an overview of the prevailing existing practices)?

- Short run marginal cost pricing  
- Full cost recovery  
- Full cost recovery less State subsidy  
- Others (specify)  

ProRail uses a combination of the short run marginal cost pricing and full cost recovery less state subsidy. The principle ProRail uses is: the marginal cost of the complete train service in one year. They say: fixed costs are the costs they make today to run a complete train service tomorrow. All the extra costs you make tomorrow are the marginal costs of the complete train service. In practise this is more then the short run marginal costs, more of less the variable costs. All the costs above it, are subsidised by the state.

2. Can you describe the methods used for estimating the infrastructure charge?

- Econometric approach  
- Engineering approach  
- Cost allocation approach  
- Others (specify)  

3. Are in place hypothesis for future modifications? If yes, where and why?

The Dutch Railway Act and within that also the charging principles, are now been evaluated by the Ministry of Transport. Dependent to the conclusions in the
evaluation, the law could be adjusted and hereby also the charging principles. The evaluation is ready in the first half of 2009.

The institutional context

4. In your country, who is responsible for setting and administrate the charges?

<table>
<thead>
<tr>
<th>Name of the institution</th>
<th>Role and responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM - ProRail</td>
<td>Set charging principles (=proposal to negotiate) and administrate them.</td>
</tr>
<tr>
<td>IM and RU’s</td>
<td>Negotiation about and agree upon the charges.</td>
</tr>
<tr>
<td>Regulator</td>
<td>Test principles and charges to the law (Ex post)</td>
</tr>
</tbody>
</table>

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

The negotiation process is not working quite well. The results of the negotiations are seen as a ‘what the market can bear’ test. But the RU’s don't have enough information about the costs of the IM to know were the can negotiate about. There is not enough transparency. It is not clear what the minimum charge is (marginal costs), and what is the mark up above it. The last is were they can really negotiate about.

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

<table>
<thead>
<tr>
<th>Rule and/or criteria</th>
<th>Shortcomings</th>
</tr>
</thead>
<tbody>
<tr>
<td>See above</td>
<td></td>
</tr>
</tbody>
</table>

7. Can you suggest fields of improvement in the existing cost allocation method?

More transparency and more usage of performance regimes.

8. In your country, could you give some examples of best practices and case studies in cost allocation methods?

The office of transport regulation has also supervision on the airport Schiphol and on the pilots in the harbours. With both organizations we use cost
allocation methods. But they don’t say anything about marginal costs, only about which costs must be allocated to which activity.

9. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?

Please note down a reference person:

Name: Hilbert Klok
Capacity: Economist
Address: Postbus16326, 2500 BH Den Haag, Netherlands
Department: Office of Transport Regulation/ Dutch Competition Authority
Telephone: 0031 070 330 3311
Email: w.h.klok@nmanet.nl

May we contact you again for further information?

☑ Yes  ☐ No

Thank you for your participation and the support of our project!

Please returns this questionnaire in digital or paper format to the following address:

ISIS
Istituto di studi per l’Integrazione dei Sistemi
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e-mail: renei@isis-it.com
Questionnaire (Germany)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastructure cost). It intends to steer the discussion internal to the Rail Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (members of association may provide an overview of the prevailing existing practices) ?

- Short run marginal cost pricing
- Full cost recovery
- Full cost recovery less State subsidy
- Others (specify)

The institutional context

4. In your country, who is responsible for setting and administrate the charges ?
5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

Long-Range time limits for the publication of tariffs are causing risks for IM; process for setting charges actually is fine

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

<table>
<thead>
<tr>
<th>Rule and/or criteria</th>
<th>Shortcomings</th>
<th>Used Rules and Criteria are easy to apply, Growing number of RU and market demand is a proof of effectiveness of principles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7. Can you suggest fields of improvement in the existing cost allocation method?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Actually we do prefer a market based pricing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. In your country, could you give some examples of best practices and case studies in cost allocation methods?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>YES, there is a case study on DB Netz AG within the CER-broschure on “Rail Charging and Accounting Schemes in Europe”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?</td>
</tr>
</tbody>
</table>
Any change of pricing can cause market adjustments and additional burdens for the RU.

Please note down a reference person:

Name: ____________________________
Capacity: __________________________
Address: ___________________________

Department: ________________________

Telephone: _________________________
Email: ____________________________

May we contact you again for further information?

☐ Yes  ☐ No

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Questionnaire (UK)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastructure cost). It intends to steer the discussion internal to the Rail Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (members of association may provide an overview of the prevailing existing practices) ?

   Short run marginal cost pricing

   Full cost recovery

   Full cost recovery less State subsidy

   Others (specify)

The charging principle in Great Britain is a combination of the above, depending on the type of user. The charging principle for open access passenger and freight operators is broadly based on short run marginal cost pricing. For franchised passenger operators the principle is closest to full cost recovery less state subsidy: the “variable usage charge” is based on the short run marginal cost principle but there is full cost recovery through the “fixed charge”, though – to support government accounting aims – some of the fixed charge is converted into “network grant”, paid directly by government to the infrastructure manager Network Rail. Whilst this network grant can be conceived of as subsidy, government is legally required to pay it in lieu of fixed track access charges, as approved by the Office of Rail Regulation. If it were not allowed by the ORR then (besides affecting the balance of government accounts) it would mean that franchise passenger operators would be liable for the whole amount of the fixed charge – which would then mean that their premia payments of support requirements in their franchise bids would reflect this.

2. Can you describe the methods used for estimating the infrastructure charge ?

   Econometric approach

   Engineering approach

   Cost allocation approach

   Others (specify)
* Note that the charges that will take effect on 1 April 2009 the basis for calculating the variable usage charge has changed from a largely cost allocation basis to an engineering approach. The other charges (e.g. the fixed track access charge) to ensure full cost recovery, are based on projections by Network Rail, the infrastructure manager, of its expected costs over the next five years, which are then reviewed and, as necessary, adjusted by the ORR.

3. Are in place hypothesis for future modifications? If yes, where and why?

The charges that will take effect on 1 April 2009 will remain in place for five years, until 31 March 2014. The only change will be annual rebasing to adjust for general inflation. (The traction electricity charges are based on a cost pass through basis.) During the next five years the ORR expects to undertake a comprehensive review of the basis for access charging. This will include examining the charging principles, the basis for the calculation of the variable usage charge, station charging, and further consideration for route based/geographical, reservation/scarcity and environmental charges.

The institutional context

4. In your country, who is responsible for setting and administrate the charges?

<table>
<thead>
<tr>
<th>Name of the institution</th>
<th>Role and responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of Rail Regulation</td>
<td>The ORR has a legal duty to approve or where parties disagree, to direct, the track and station access agreements between Network Rail and train operators. Track and station access charges are determined by ORR at the five yearly periodic reviews of Network Rail’s access charges, which are set for the following five years. At the end of a periodic review “price lists” and “charge schedules” are published which are then reflected in existing and new access agreements.</td>
</tr>
</tbody>
</table>
Network Rail’s role, as infrastructure manager, has the role of (a) making proposals to ORR for its access charges (for existing charges, with the ORR doing the analysis for possible new charges) and (b) administering the charges through its billing system and collecting the income from train operators.

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

In my view the overall institutional procedure is relatively smooth. It has largely been in place since privatisation of the GB railway in 1996. The procedures have involved since then, including the definition of the structure of charges, the calculation methodology for the various charges and the arrangements for doing the calculations.

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

<table>
<thead>
<tr>
<th>Rule and/or criteria</th>
<th>Shortcomings</th>
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<tbody>
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</table>

7. Can you suggest fields of improvement in the existing cost allocation method?

The ORR expects Network Rail to make further improvements in its understanding and forecasting of its costs (including marginal costs) in time for the next periodic review of access charges, expected in 2013. The key issue in relation to marginal costs is to continue to improve asset degradation – including on different categories of track (e.g. rural versus primary routes).

The ORR also intends to make further comparisons to methods/calculations in other countries/infrastructure managers and compare to Network Rail.

8. In your country, could you give some examples of best practices and case studies in cost allocation methods?
Numerous work undertaken by Network Rail and ORR as part of the 2008 periodic review of Network Rail’s access charges. See ORR and Network Rail websites. (Further specific details can be provided on request.)

Institute for Transport Studies, University of Leeds has also carried out various assessments in the field of access charges.

9. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?

There are no fundamental barriers. Pricing reform must take place in the context of the relevant European Directives, as transposed into UK law. In addition, in approving or making determinations of access charges (including introducing new charges) the ORR must have regard to its public interest duties (established through the 1993 Railways Act), though these do not present any fundamental obstacles. Within this context pricing reform comes either through (a) Network Rail proposing changes to charges, new charges, etc which ORR will review, consult on and reject or approve (with or without modifications), or (b) ORR proposing new charges, through public consultation, which can then be implemented in track access charges.

Please note down a reference person:

Name: Paul McMahon
Capacity: Deputy Director of Competition and Regulatory Economics
Address: Office of Rail Regulation, 1 Kemble Street, London WC2B 4AN, United Kingdom
Department: --
Telephone: +44 (0)20 7282 2095
Email: paul.mcmahon@orr.gsi.gov.uk

May we contact you again for further information?

☐ Yes  ☐ No

Thank you for your participation and the support of our project!

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e-mail: renei@isis-it.com
Questionnaire (Austria)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of Transport Infrastructure cost). It intends to steer the discussion internal to the Rail Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (members of association may provide an overview of the prevailing existing practices)?

- Short run marginal cost pricing
- Full cost recovery
- Full cost recovery less State subsidy
- Others (specify)

The product range of Railnet Austria consists of 4 product-groups:
1. train-movement
2. stop in stations
3. shunting,
4. stabling and use of other facilities.

The minimum access package refers only to the train-movement according to EURL 2001/14. There we practice a separation between the minimum access package and other services, we offer. For this reason the following remarks refer only to the minimum access package.

Goal is to cover all costs by subsidies (§42 - over several years continuously) and charges (so-called IBE and charges for other services).

With regard to the price-formation, the charge increases as much as the market can bear, on the one hand.
On the other hand we try to reach a certain degree of cost recovery.

We pass to account
- different charges for several line-categories: transit-axis are more expensive, secondary lines and narrow-gauge lines are the cheapest ones
- The weight of the train is further an important factor, according to marginal cost pricing. Thus a very important issue is, to consider the infrastructure wear based on marginal costs
- Furthermore we give a bonus for soft traction unit categories and take mark-ups for incriminating ones.
- Mark-ups are added for time and local capacity bottlenecks.
2. Can you describe the methods used for estimating the infrastructure charge?

Econometric approach □
Engineering approach □
Cost allocation approach □
Others (specify) □

3. Are in place hypothesis for future modifications? If yes, where and why?

The institutional context

4. In your country, who is responsible for setting and administrate the charges?

<table>
<thead>
<tr>
<th>Name of the institution</th>
<th>Role and responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railnet Austria Inc. Network Access/Marketing and Sales</td>
<td>Setting and administrate the charges</td>
</tr>
<tr>
<td>Federal Ministry for Transport, Innovation and Technology (BMVIT)</td>
<td>Final approval</td>
</tr>
</tbody>
</table>

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

The institutional procedure is generally smooth.

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

I am sorry, but I did not understand this question.

7. Can you suggest fields of improvement in the existing cost allocation method?
We try to organize the cost calculation in a more detailed differentiation (spatial and on basis several facilities).

8. In your country, could you give some examples of best practices and case studies in cost allocation methods?

Our cost allocation is based on more than 200 track sections. So we can separate the costs of several line characteristics.

9. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?

Railnet Austria has implemented a new station-price-model 2009. Now each station has its price. There we have now no more station without a price. Passenger-frequency per day, importance of the station, facilities and operating costs are the main criteria. Furthermore we established an equalizing factor for traffic mode. The price-model is transparent and modular in structure and development. Therefore we want to aim a target cost coverage.

Up to 2010 we simplified the train path charges (no more market-segmentation). Each train independent of traffic mode and freight settles the same price.

Please note down a reference person:

Name: Dr. Katja Skodacsek  
Capacity: Productmanager  
Address: Elisabethstraße 9, 1010 Vienna  
Department: Railnet Austria Inc./Network Access/Marketing & Sales  
Telephone: 0043-1-93000-33107  
Email: katja.skodacsek@oebb.at

May we contact you again for further information?

☐ Yes  ☐ No

Thank you for your participation and the support of our project!

Please return this questionnaire in digital or paper format to the following address:

ISIS  
Istituto di studi per l’Integrazione dei Sistemi  
Via Flaminia 21, 00196, Roma  
Fax: 06-3213049  
e-mail: renei@isis-it.com
Air

Questionnaire (Ireland)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastructure cost). It intends to steer the discussion internal to the Air Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (airport, regulatory body)?

   - Short run marginal cost pricing
   - Full cost recovery
   - Full cost recovery less State subsidy
   - Others (specify)

2. Can you describe the methods used for estimating the infrastructure charge?

   - Price Cap formula
   - Rate of Return formula
   - Others (specify)

When setting a price cap in respect of airport charges at Dublin Airport, the CAR follows the principle of economic efficiency seeking, where possible, to incentivise the Dublin Airport Authority to achieve operational efficiencies and to provide capital investment in an efficient manner.

In formulating a price cap, the CAR applies a ‘building blocks’ approach. This process involves calculating the following ‘building blocks’: which are used to determine the price cap.

- The level of return that the airport can earn on its regulated assets;
- The depreciation to be remunerated in respect of the regulated assets;
- The level of allowable operating expenditure;
- The levels of commercial revenues that the airport is expected to earn; and forecast passengers
The cap is currently set using a “single till” (i.e. where non-regulated commercial revenues are taken into account in setting the price cap) but a dual till is also possible under Irish law. The total required revenues (the sum of the return on regulated assets, depreciation and operating expenditure) less commercial revenues is referred to as the total allowable revenues. The allowable revenues are spread over forecasted passengers to give an annual revenue yield per passenger or ‘price cap’.

Also, the Commission sets a price cap limiting the total revenues that the Irish Aviation Authority (IAA) can collect from air terminal services charges at Cork, Dublin and Shannon airports; and has to approve any changes to the fees charged by the airport authorities at Cork, Dublin and Shannon airports for access to installations needed to provide ground handling services.

The Commission has no power to regulate other charges, including:

- car park charges at airports, and more generally non-aeronautical charges (except those levied for access to installations needed for ground handling services at Cork, Dublin and Shannon airports);
- en route air traffic charges the IAA sets; and charges at Knock, Kerry, Galway, Waterford, Donegal and Sligo airports.

3. Are in place hypothesis for future modifications? If yes, where and why?

The institutional context

4. How the airport charges are approved?

<table>
<thead>
<tr>
<th>No approvals required</th>
<th>☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic approval of charges submitted</td>
<td>☐</td>
</tr>
<tr>
<td>Approval following scrutiny and negotiation</td>
<td>☐</td>
</tr>
<tr>
<td>Set by formula, with limited consideration of future finances</td>
<td>☐</td>
</tr>
<tr>
<td>Set by formula, after detailed consideration of future finances and airport traffic</td>
<td>☒</td>
</tr>
</tbody>
</table>

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

It takes approximately 12 months for legislative changes to be implemented, such as after the introduction of the State Airports Act, 2004. There is a high
frequency of appeals of the CAR’s decisions. A number of determinations of the CAR have been challenged in either the Courts through a judicial review or a specialised appeal panel which can be established by the Minister for Transport under the 2001 Act.

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

<table>
<thead>
<tr>
<th>Rule and/or criteria</th>
<th>Shortcomings</th>
</tr>
</thead>
<tbody>
<tr>
<td>To take account of new planned investment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

7. Can you suggest fields of improvement in the existing cost allocation method?

8. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Please note down a reference person:

Name: Bridin O’Leary
Capacity: Economist
Address: Commission for Aviation Regulation, 3rd Floor, Alexandra House, Earlsfort Terrace, Dublin

Department: ____________________________
Telephone: +353 1 6346858
Email: boleary@aviationreg.ie

May we contact you again for further information?

☑ Yes  ■ No

Thank you for your participation and the support of our project!

Please returns this questionnaire in digital or paper format to the following address:
Questionnaire (Sweden)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastucture cost). It intends to steer the discussion internal to the Air Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

**The cost allocation method in use**

1. Can you indicate the charging principle operating in your organization (airport, regulatory body) ?

   - Short run marginal cost pricing
   - Full cost recovery
   - Full cost recovery less State subsidy
   - Others (specify)

   Changes set to cover direct costs, short term investment needs and to contribute to LFV Group profit margin needs. To cover total costs, commercial revenues is necessary. Smaller airports are subsided by larger airports

2. Can you describe the methods used for estimating the infrastructure charge ?

   - Price Cap formula
   - Rate of Return formula
   - Others (specify)

3. Are in place hypothesis for future modifications ? If yes, where and why ?

   Yes, perhaps with more environmental focus with some CO2 component

**The institutional context**

4. How the airport charges are approved ?
No approvals required | ✗
---|---
Automatic approval of charges submitted | □
Approval following scrutiny and negotiation | □
Set by formula, with limited consideration of future finances | □
Set by formula, after detailed consideration of future finances and airport traffic | □

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

**Yes, still different operators have different opinions regarding the mix of set and variable costs**

**Shortcomings to overcome**

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

<table>
<thead>
<tr>
<th>Rule and/or criteria</th>
<th>Shortcomings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigidity of the approach</td>
<td>Hard to move towards more variable costs without decreasing the overall revenue level. This is due to differences in load factors</td>
</tr>
</tbody>
</table>

7. Can you suggest fields of improvement in the existing cost allocation method?
8. Can you mention the main barriers to the implementation of pricing reform in the
determination of charge?

**Discrimination of main carriers and regional air traffic with small aircraft**

Please note down a reference person:

Name: Henrik Littorin_____________________
Capacity: Senior Analyst_____________________
Address: Vinkoplan 11 601 79 Norkopping_____________________
Sweden_____________________
Department: LFV headquarters_____________________

Telephone: +46 11 19 23 63____________
Email: henrik.littorin@lvf.se____________

May we contact you again for further information?

☑ Yes ☐ No

**Thank you for your participation and the support of our project!**

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Fax: 06-3213049
e-mail: renei@isis-it.com
This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of Transport Infrastructure cost). It intends to steer the discussion internal to the Air Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (airport, regulatory body)?

   Short run marginal cost pricing  
   Full cost recovery  
   Full cost recovery less State subsidy  
   Others (specify)  

   According to the Regulation of Transport Ministry the basis for airport charges is full cost recovery, but costs are based on historic costs of last full year of operations. We use a model based on Activity Based Costing.

2. Can you describe the methods used for estimating the infrastructure charge?

   Price Cap formula  
   Rate of Return formula  
   Others (specify)  

3. Are in place hypothesis for future modifications? If yes, where and why?
The institutional context

4. How the airport charges are approved?

<table>
<thead>
<tr>
<th>Approval Type</th>
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<tbody>
<tr>
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<tr>
<td>Automatic approval of charges submitted</td>
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<td>Approval following scrutiny and negotiation</td>
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<tr>
<td>Set by formula, after detailed consideration of future finances and airport traffic</td>
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</table>

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

Civil Aviation Office can ask for detailed complementary information, can force to change charges according to their own assessment. Intervention is too detailed.

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.
7. Can you suggest fields of improvement in the existing cost allocation method?

<table>
<thead>
<tr>
<th>Rule and/or criteria</th>
<th>Shortcomings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historic costs</td>
<td>Unables to include in the cost base new investments</td>
</tr>
<tr>
<td>Financial Model</td>
<td>Late information (after auditing financial statements)</td>
</tr>
<tr>
<td>Procedure of Approval</td>
<td>Long time No flexibility</td>
</tr>
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</table>

Charges should be based on planned costs. Maximum level of charges should be approved, not every change downwards.
Discounts should be assessed after implementation, under the criteria of non-discrimination and not on account of users not benefiting from them.

8. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?

1. Different interests of low-cost airlines, established airlines and airports/ANS providers.
2. Lack of financial knowledge of civil aviation administrations.
3. Lack of cost databases enabling proper cost allocation.

Please note down a reference person:

Name: Dariusz Kalinski
Capacity: 
Address: Polish Airports / Warsaw School of Economics

Department: 
Telephone: +48609710444
Email: dkalin@acn.waw.pl

May we contact you again for further information?

☐ Yes ☐ No

Thank you for your participation and the support of our project!

Please returns this questionnaire in digital or paper format to the following address:
Questionnaire (Spain)

This questionnaire is part of the European Union funded research project CATRIN (Cost Allocation of TRansport INfrastructure cost). It intends to steer the discussion internal to the Air Committee, in order to identify the key issues under examination. In particular, we call your attention on the following topics: a) description of the cost allocation method currently in use; b) the institutional context; c) shortcomings and problems to overcome in the near future.

The cost allocation method in use

1. Can you indicate the charging principle operating in your organization (airport, regulatory body)?

   Short run marginal cost pricing

   Full cost recovery

   --- X

   Full cost recovery less State subsidy

   Others (specify)

   Being private companies that is the principal to apply, however market rules and hard competition dictates many times reconsideration of the rules.

2. Can you describe the methods used for estimating the infrastructure charge?

   Price Cap formula

   Rate of Return formula

   --- X

   Others (specify)

   Rate of return is the principal and we try to get 12% ror, however in the competitive market we are some times we have to keep lowers rates, since the last principal applying is to avoid the ebitda dilution.

3. Are in place hypothesis for future modifications? If yes, where and why?

   NO
The institutional context

4. How the airport charges are approved?

<table>
<thead>
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</table>

5. Is the overall institutional procedure smooth? If not, what kind of bottlenecks may be identified?

__________________________________________________________________________

Shortcomings to overcome

6. Are the rules and criteria described in the above section clear and easy to apply? If no, please describe why.

<table>
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7. Can you suggest fields of improvement in the existing cost allocation method?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

8. Can you mention the main barriers to the implementation of pricing reform in the determination of charge?
Please note down a reference person:

Name: Miguel Alvarez Amador
Capacity: __________________________
Address: Montserrat, 18, 28015 Madrid
Department: ________________________

Telephone: +34600970695
Email: mialvarez@mialvarez.jaztel.es

May we contact you again for further information?

X Yes  ☐ No

Thank you for your participation and the support of our project!

Please return this questionnaire in digital or paper format to the following address:

ISIS
Istituto di studi per l’Integrazione dei Sistemi
Via Flaminia 21, 00196, Roma
Fax: 06-3213049
e-mail: renei@isis-it.com
Waterborne

Questions to Infrastructure Managers – Waterborne (Belgium) -

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in waterborne charges - for example Port Authority. We are here looking for the division of responsibility.

1.- Is pricing of infrastructure use something that is substantial considered when you develop your business plan?

Yes

2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

All costs, including the external costs, have to be charged to each modus.

3. Can you describe the actual charges

Taxes to use the waterways.

II – Revenues

These questions are simply related to the use of the revenues from charges.

1. Do you have influence or even responsibility for the use of the revenues from the charges? Who is responsible?

Yes. The waterway management.

2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?

Yes, for environmental use.

3. What is the principle guiding the use of the revenues?

They have to be used for the exploitation of the waterway network.

III – Available information for calculating charges

The third set of questions is related to available information for calculating infrastructure cost.
1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure?

Yes

2. What kind of data is collected and is the data available?

Financial data/Data of the use of the waterway network. The data are available for our company. A part is available for general use.

3. If you had the responsibility to set the charges would you change the principle of collecting information/data?

No

III – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:

A - a recommended cost? **No**

B - a common methodology to estimate infrastructure cost? **No**

2. Do you think a European legislation is necessary to control the price level?

**No. It's only an interesting idea in case full cost incl. external cost, is charged to the customer of road, rail and pipeline.**

IV - The future.

Finally, a question about the future.

1. What are the future plans for charges?

**Trying tot charge full cost, incl. external costs, for all transportmodus and abolishing all subsidies.**

2. Is it any discussion or plans for changed responsibility within the sector?

**No**

3. Anything else we should have asked you? **No**
Questions to Infrastructure Managers – Waterborne (Finland) -

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in waterborne charges - for example Port Authority. We are here looking for the division of responsibility.

1.- Is pricing of infrastructure use something that is substantial considered when you develop your business plan?

Yes

2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

Primarily financing the costs of fairway maintenance, icebreaking, hydrographic surveys and VTS for merchant shipping along the Finnish coast. These costs are covered by fairway fees. The fairway fee system includes a vessel ice class element, with the aim of promoting the availability of ice strengthened vessels during winter in traffic to/from Finland. Plans have also been made for creating environmentally differentiated fairway fees based on the vessels air emissions (in line with the system applied in Sweden).

3. Can you describe the actual charges

The system of fairway dues is somewhat complicated, but as a general rule fairway dues have to be paid for all merchant vessels sailing in Finnish territorial water and calling at any Finnish sea port. The dues are calculated according to the vessels net tonnage (NT) and the Finnish - Swedish ice dues class. The unit price for vessels is based on the ice class of the vessel as follows (in €):

<table>
<thead>
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<th>Ice class</th>
<th>Cargo vessel</th>
<th>Passenger vessel</th>
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<tr>
<td></td>
<td>Unit price</td>
<td>Unit price</td>
</tr>
<tr>
<td>I A Super</td>
<td>1,185</td>
<td>0,798</td>
</tr>
<tr>
<td>I A</td>
<td>2,218</td>
<td>1,572</td>
</tr>
<tr>
<td>I B, I C</td>
<td>4,475</td>
<td>2,710</td>
</tr>
<tr>
<td>II, III</td>
<td>6,421</td>
<td>4,528</td>
</tr>
</tbody>
</table>

Vessels in the ice classes IA Super, IA, IB and IC are strengthened for navigation in ice. IA Super is the highest class which means that the vessel is capable of operating in severe ice conditions. A vessel in class II fulfils the requirements for
winter traffic, but has no ice strengthening. A vessel in class III, on the other hand, does not fulfil the requirements for winter traffic.

The fairway fee for each vessel is calculated by multiplying the net tonnage of the vessel with the unit prices presented in the table above.

There is also a maximum fee regardless of the size of the vessel. The upper limit for fairway dues for any vessel is € 100 000. The maximum amount for passenger vessels is 30 100 € and for cruise vessels 41 300 €.

Although there are several additional rules and exceptions to this general picture, the major additional rule is that cargo vessels that have paid fairway dues 10 times during one calendar year are exempt from these dues during the rest of that year. However, passenger vessels are exempt from further fairway dues, as above, only after having paid these dues 30 times during one calendar year.

II – Revenues

These questions are simply related to the use of the revenues from charges.

1. Do you have influence or even responsibility for the use of the revenues from the charges? Who is responsible?

The fairway fees are collected by the Finnish Customs. Although the fairway fee is currently considered as a tax (and not as a service charge) imposed on the traffic, the yearly budget of the Finnish Maritime Administration (FMA) is connected to the collected yearly fees. The cost equivalence between the collected fees and the costs mentioned in question I2 above are continuously calculated. The cost equivalence in recent years has exceeded 100% (i.e. full cost coverage).

2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?

No.

3. What is the principle guiding the use of the revenues?

See question I2. Ministry of Transport and Communications in Finland sets yearly operational goals for the activities and responsibilities of the FMA (economic efficiency, safety and security etc.)

III – Available information for calculating charges

The third set of questions is related to available information for calculating infrastructure cost.

1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure?
Yes

2. What kind of data is collected and is the data available?

Financial data of different operations / Data of the use of the waterway network. Normal bookkeeping.

3. If you had the responsibility to set the charges would you change the principle of collecting information/data?

No. There are certain needs to develop further in more detail the knowledge of cost buildup, e.g. the costs for certain waterways or areas of waterway network.

III – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:

A - a recommended cost? No

B - a common methodology to estimate infrastructure cost? No

2. Do you think a European legislation is necessary to control the price level?

Not necessarily any immediate need for detailed legislation. However, steps to move towards general transport infrastructure pricing principles for all transport modes could be taken on a European level.

IV - The future.

Finally, a question about the future.

1. What are the future plans for charges?

See I2. Developing environmentally differentiated fairway fees based on the vessels air emissions (in line with the system applied in Sweden).

2. Is it any discussion or plans for changed responsibility within the sector?

From beginning of 2010 FMA will be merged with the Finnish Road Administration and Finnish Rail Administration. The new authority will continue being responsible for the tasks of FMA.

3. Anything else we should have asked you?

No
Questions to Infrastructure Managers – Waterborne – (Sweden)

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in road charges - for example Ministry of Finance. We are here looking for the division of responsibility.

1.- Is pricing of infrastructure use something that is substantial considered when you develop your business plan?

Yes, the board has defined a charging strategy involving the balance between pilot charges and fairway charges.

2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

* Environmental adaptation – fairway charges environmental differentiation is basic.
* Cost recovery: businesses that can recover their costs should do it, thus, we develop the charges in order to reach cost recover for pilotage (but it may take some years).
* Charges should not be distortive. Ramsey style charges are applied.

3. Can you describe the actual charges

Fairway charges. Two parts.
1 Vessel related based on the size (GT), environmentally differentiated. This charge is 0 for the most environmentally friendly vessels.
2 Freight related charge, based on the number of tons loaded and unloaded (non for passengers)
Pilot charge. Charged on users and is related to the vessels ship size (GT) and time.

II – Revenues

These questions are simply related to the use of the revenues from charges.

1. Do you have influence or even responsibility for the use f the revenues from the charges? Who is responsible?
Yes, we keep the charges to fund our own services. On top of that we have some, but limited budget funding, to cover costs not related to commercial shipping.

2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?

Thus, it is all earmark for our expenses, but not to specific services, there are cross subsidies

3. What is the principle guiding the use of the revenues?

The government cap the charges, then we shall use them in the best possible way to reach the targets stated by the government.

III – Available information for calculating charges

The third set of questions is related to available information for calculating infrastructure cost.

1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure?

Yes, but the direct links are limited. Fairly close when it comes to pilotage, but less when it relates to fairways.

2. What kind of data is collected and is the data available?

Time, and route for pilot jobs. It is available to us, internally, but published at an aggregate level.

All vessel traffic, and data according to the AIS-system (Automatic Identification System). Similar data are collected by large consultancies (independently of us).

3. If you had the responsibility to set the charges would you change the principle of collecting information/data?

No, we are already there I guess.

III – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:
A - a recommended cost?

No. it would not be proper. Costs vary - so should the charges. We have extensive archipelagos and ice!

B - a common methodology to estimate infrastructure cost?

A cost method could be good, but not necessarily desirable. Of course we see a risk: Would Europe allow us to continue charging according to our top priority: Environment?

2. Do you think a European legislation is necessary to control the price level?

We have international law that prevents charging of “innocent traffic”, traffic that does not call a port in your country. I see limited risk for overcharging traffic to your own country: It would harm the port businesses and it would be paid by consumers and industry in your country. However, there is a need for common charging practices related to externalities, basically emissions.

IV - The future.

Finally, a question about the future.

1. What are the future plans for charges?

Further developed environmental differentiation. Improved cost recovery for pilot services, balanced by reduced fairway charges (the freight related part)

2. Is it any discussion or plans for changed responsibility within the sector? There is a governmental commission looking into it. Unlikely that it will trigger any change to this end.

3. Anything else we should have asked you?

Not really, but an aspect of importance and interest from our perspective is possible future relations to climate change policy
Questions to Infrastructure Managers – Waterborne – (Poland)

I. Division of responsibility

The first set of questions start with the picture that it is more organizations than IM involved in road charges - for example Ministry of Finance. We are here looking for the division of responsibility.

1.- Is pricing of infrastructure use something that is substantial considered when you develop your business plan?

No. The company is an owner of infrastructure.

2. What is your objective when discussing (or deciding) the principle of charges (financing, environment, economic efficiency etc).

All of them.

3. Can you describe the actual charges

There are a source of revenue for Port of Gdynia Authority.

II – Revenues

These questions are simply related to the use of the revenues from charges.

1. Do you have influence or even responsibility for the use of the revenues from the charges? Who is responsible?

The company has an influence and responsibility for using port’s charges.

2. Is any of the revenues earmarked for use on your network or any other type of transport infrastructure?

There are not earmarked revenues which are purposed for finite purpose.

3. What is the principle guiding the use of the revenues?

The general rule is to use port’s charges for i.e. forecasting, planning and programming of port development and construction, development, maintenance and upgrading of port infrastructure, rendering of services connected with the use...
of port infrastructure, assurance of access to port reception facilities for wastes from vessels with the purpose of their recycling or neutralization

III – Available information for calculating charges

The third set of questions is related to available information for calculating infrastructure cost.

1. Do you collect and save data for the purpose of estimating cost relating to the use of the infrastructure?

Yes.

2. What kind of data is collected and is the data available?

The company collects financial data including all capital and revenue expenditure related to infrastructure. The data are available in our company.

3. If you had the responsibility to set the charges would you change the principle of collecting information/data?

No. The collecting of data are required by accounting principles.

IV – European Union task

The next sets of questions are related to the interaction at the European level and the possible need for European legislation etc.

1. Would you be helped by:

A - a recommended cost?

No.

B - a common methodology to estimate infrastructure cost?

No.

2. Do you think a European legislation is necessary to control the price level?

No. There is now comparative terms of building and reconstruction of infrastructure in different countries so the price level has to be different.

V - The future.

Finally, a question about the future.

1. What are the future plans for charges?
The kind and level of charges in Port of Gdynia are established according to act of parliament concerning Polish ports. Port of Gdynia Authority couldn't change them at the discretion of itself. Regardless of the regulations Port of Gdynia has to maintain the market level charges.

2. Is it any discussion or plans for changed responsibility within the sector?
There is no any discussion or plans for changing responsibility within sector

3. Anything else we should have asked you?
No
ANNEX II: IMS MEETINGS

Rail Committee

Rail Infrastructure Managers’ Group
Meeting to be held on Friday 26 September 2008 at UIC, 16 Rue Jean Rey, Paris

Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>Arrival</td>
<td></td>
</tr>
<tr>
<td>09:30</td>
<td>Introduction and Overview of CATRIN</td>
<td>Prof Chris Nash</td>
</tr>
<tr>
<td>09:45</td>
<td>Rail Infrastructure Costs and Charges – current situation and future research</td>
<td>Bryan Matthews</td>
</tr>
<tr>
<td>10:15</td>
<td>Discussion – Experience from particular countries</td>
<td>All</td>
</tr>
<tr>
<td>10:45</td>
<td>Tea/coffee</td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td>Discussion – experience from particular countries (continued)</td>
<td>All</td>
</tr>
<tr>
<td>11:30</td>
<td>Discussion – Future research needs</td>
<td>All</td>
</tr>
<tr>
<td>12:30</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td>CATRIN rail infrastructure cost research</td>
<td>Phill Wheat</td>
</tr>
<tr>
<td>14:30</td>
<td>Comments and discussion</td>
<td>All</td>
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<tr>
<td>15:30</td>
<td>Concluding summary</td>
<td>Chris Nash</td>
</tr>
<tr>
<td>16:00</td>
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</table>

Project Coordinator: Gunnar Linberg (VTI), gunnar.lindberg@vti.se
Rail Committee Leader: Chris Nash (ITS), C.A.Nash@its.leeds.ac.uk, Rapporteur: Bryan Matthews (ITS), B.Matthews@its.leeds.ac.uk
**CATRIN RAIL INFRASTRUCTURE MANAGER’S COMMITTEE**  
**FIRST MEETING**  
**26TH SEPTEMBER 2008**

**PARTICIPANTS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>AFFILIATION</th>
<th>E-MAIL ADDRESS</th>
</tr>
</thead>
<tbody>
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<tr>
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<tr>
<td>Mario Theis</td>
<td>Deutsch Bahn</td>
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<tr>
<td>Paul McMahon</td>
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</tr>
<tr>
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<td>Latvian Rail</td>
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</tr>
<tr>
<td>Riccardo Enei</td>
<td>ISIS</td>
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<td><a href="mailto:s.d.iwnicki@mmu.ac.uk">s.d.iwnicki@mmu.ac.uk</a></td>
</tr>
</tbody>
</table>

**Introduction**

The meeting commenced with the presentation of a background paper, setting out the current situation with regard to research on the marginal costs of rail infrastructure use and to policy on charging for the use of rail infrastructure. It was highlighted that there is a growing body of evidence on the marginal costs of infrastructure wear and tear and a degree of consensus emerging. However, particular outstanding issues remain in relation to understanding differing results from different studies of the marginal costs of maintenance and improving evidence and understanding of the marginal costs of renewals. Furthermore, with a network increasingly subject to bottlenecks and capacity constraints, further evidence is required on the cost of these capacity constraints and the potential role for charging as a means of alleviating them. In relation to policy, it was noted that whilst there is a common framework for charging throughout the EU, there remains a variety of interpretations of this framework and, hence, a range of different charging systems; differing in both structure and level.
Furthermore, it was briefly explained that the CATRIN project is undertaking research particularly on the cost categories:

- ‘wear and tear’ (to improve understanding of the marginal cost of renewals, and of how this and maintenance costs vary with the type and volume of traffic and with the type of track); and
- ‘scarcity’ (to understand the merits of charges per path km or per node and to seek to provide some basis for generalisation).

The remainder of the meeting comprised:

- A discussion of the usefulness of the marginal cost principle;
- A discussion of charging practices in different countries; and
- A discussion of research needs.

Marginal Cost and Infrastructure Charging

The Background Paper had identified a range of charging practices clustered around those based on Marginal Cost plus a mark-up (MC+) and those based on fully-allocated costs minus government grants (FC-). However, it was suggested that, in fact, FC- is the approach throughout the EU, in so far as every railway is working on the basis of how it can cover its costs minus what it receives from the state. The difference in charging practices arises because whilst in Scandinavia and the Netherlands, for example, the state is receptive to providing funds for their railways so the infrastructure manager can start from the bottom up, whereas for other countries, eg some of those in eastern Europe, the state is not in a position to provide the level of funding that a system closely based on marginal cost would require. The main obstacle has always been the appropriate level of state funding.

Whilst there is an attraction to harmonizing charges, in reality infrastructure managers have to find funds from somewhere, and some national contexts are more amenable than others. Hence, two countries may adopt the same economic charging principles but if one is in receipt of a state contribution and the other is not then the result will be two very different sets of charges. It seems that more information on costs is continually being sought so as to get toward more harmonised charges, when we actually know that the main barrier to more harmonized charges is the contribution from the state.

It was further argued that the rail industry has moved on from where it was when the idea of basing infrastructure charges on marginal cost was first introduced. The purpose of focusing attention on marginal costs was to stimulate incumbents to be more transparent in time for the opening up of the freight market. Given that this is occurring, it was questioned as to whether marginal cost based charging is still relevant and necessary?
Hence, it was suggested that rather than perpetually drilling down further into a concept that has acknowledged practical problems, effort should focus on whether the total costs of the system are appropriate and whether and how they can be reduced.

In response, one of the infrastructure managers stated that marginal cost serves as a useful minimum, before you apply mark-ups. Their new tariff structure will be based on marginal cost, with the permitted mark-ups. Once you look at what the mark up is to be, then you come back to FC-, though even in this case, marginal scarcity costs, along with ability to pay, can give you guidelines on what the mark up should be. Marginal cost is a floor beneath which one should not go, and in this way MC+ and FC- can be compatible.

It was acknowledged that the application of mark-ups can be problematic. if an infrastructure manager says that the marginal cost is x, but we need - for financial reasons - to apply a 300% mark-up, then this risks undermining the usefulness of estimating the marginal cost. However, this process then makes the question of mark-up an explicit negotiation amongst the stakeholders at the national level. Furthermore, where mark-ups have potentially distortionary impacts at the international level, eg where they lead to high charges in transit countries, the EU may also seek to exercise its influence. It was suggested that there is a kind of bargaining between the infrastructure manager, operators and the state and that this process may be interesting to analyse further, eg via game theory or political economic analysis.

It was highlighted that the European Commission is still very much committed to applying the concept of marginal cost. Their recent consultancy project, RAILCALC, concluded that Directive 2001/14 is still appropriate. Indeed, they have issued a request to several member states asking why they are not applying marginal cost in relation to their rail infrastructure charges. Ultimately, a number of cases may end up being taken to the European Court.

Another recent study concluded that there are huge varieties in charging systems but that this should be accepted. The variations in subsidy levels, traffic profiles and network cost characteristics between different railways makes it impossible to have an entirely harmonious system. Therefore, the aim should be less about achieving a harmonious system and more about why different systems differ so much. For example, it should be of widespread interest - to incumbents and new entrants alike - as to what extent marginal cost differences are as a result of efficiency differences or due to other factors.

Charging Practices

Germany

It was noted that the German system has incorporated considerable use of mark-ups, with a high degree of differentiation according to market conditions. There is a wide range of operations, from frequent passenger trains (hourly or more) to passenger trains that run once a day and express freight through to local, small load freight.
However, it was acknowledged that sometimes it is more expensive to have the systems than the money they bring in, so some mark-ups have been abandoned. Remaining differentiation includes by: line categories; speed; equipment; kind of users; local areas. There is also a charge for stopping, in the form of a surcharge where operators stop for more than an hour.

Ability to pay is an important charging criterion. It was, for example, highlighted that for high quality lines the marginal costs are low and the traffic volumes are high, and that to charge purely according to marginal cost would seem to make no sense as the result could be relatively high charges and, consequently, no traffic on the lower quality tracks. Hence, ability to pay considerations lead to a raising of charges on high quality lines in relation to charges on the lower quality lines.

A bonus malus performance regime was introduced a few years ago. However, this had to be withdrawn after a legal challenge.

There are particular aspects under observation; eg, what is the right charge for cancelling an allocated path and what is the right charge for switching a path. The path cancellation fee was highlighted as an interesting aspect of the charging system. Presently, the cancellation fee is a proportion of the overall fee for the route; the fee is more on a busy line so the cancellation fee is greater for that busy line, and it increases the closer you get to the time slot. This is an explicit representation of scarcity costs - where there is scarce capacity then there is a real opportunity cost.

A question was raised as to the impact of charges on operators. It was stated that no operator asks what the marginal cost of infrastructure use is; rather, they ask why is it so high and could it not be lowered? On the other hand, it was noted that if an operator is offered two options, one cheaper and the other more expensive, they will take whichever is the fastest or higher quality. Hence, the charge is important, but not necessarily the most important factor in the decision.

France

RFF, the infrastructure manager, was created in 1997 at which time a marginal cost based charging structure was put in place. Since then, the revenues of high speed services have increased considerably and the situation of the main railway undertaking’s finances has substantially improved.

The infrastructure charging tariff has included a mark-up on high speed lines. This mark-up has been increasing over time, based on ability to pay and in consultation with the operator.

For freight, the current tariff structure is probably not compliant with the Directive as it is below marginal cost. However, the tariff is going to increase, with an accompanying subsidy from the state, that is itself set to decrease over time.
Regional lines charges are to be introduced in 2010, whereby operators pay marginal cost, with the regional authorities paying the fixed costs. At present, the region pays in IDF, but for other regions the central state pays.

The infrastructure manager is interested in using charges to arrive at win-win situations, for example:

- To incentivise less damaging rolling stock;
- To incentivize more efficient use of the network (if operators are using a high speed line at less than the recommended speed, they are using more train paths than they need);
- To incentivise use of electricity if the line is electrified, via an environmental bonus malus scheme.

The infrastructure manager will be undertaking a major review of how they arrive at their marginal costs. This is so they have a credible justification of their charges in terms of marginal cost, should there be any legal challenges.

An interesting difference was noted between France’s Reservation Fee and Germany’s Cancelation Fee. Both appear to be means of charging for scarcity, but the German approach involves the infrastructure manager bearing part of the risk of paths not being used, whilst the French approach involves the operator bearing this risk. In fact, a relatively high proportion of the French infrastructure manager’s revenues come from the reservation charges, which are widely differentiated.

In terms of impacts, one case was highlighted of an operator changing their route in response to the charge. The case related to a high speed, high charge, line and an existing, lower charge, line, where it has been observed that the operator sometimes chooses to take the existing line to get the lower charge. Furthermore, when the Reservation Fee was introduced a significant reduction in the demand for paths was observed.

Britain

It was noted that Britain has one of the longest traditions of charging for infrastructure use as the railway was privatised and opened to competition in the mid-1990s. There are 3 drivers underpinning the charges:

- compliance with Directive 2001/14;
- promoting efficiency; and
- optimising the use of the network.

The regime is transparent, with the set of charges being openly published on the internet (either the ORR or Network Rail website) since 2001. The view is that marginal cost is important, not just for legal reasons but it promotes competition. Prior to 2001, much of the pricing was down to negotiation, giving a lot of market power to incumbents.
More recently, there has been a lot of concern about charging for freight services. The UK government stated that it no longer wished to pay for the costs of freight only lines, requiring the consideration of mark-ups on infrastructure charges for those lines. Work was undertaken to examine ability to pay amongst the users of freight only lines, taking into account Directive 2001/14. This work concluded that only coal and nuclear waste traffic can afford to pay mark-ups to pay for these lines.

There have also been concerns about the efficiency of the infrastructure manager. Work has been undertaken to examine potential efficiency improvements, and to reflect these projected improvements in charging levels into the future.

The Netherlands

It was explained that there is one main passenger operator, NS, who operate the franchise for the central part of the country. In addition, there are a number of smaller passenger operators in other parts of the network and there is on track competition amongst freight services.

The charging regime consists of a variable charge only, based on the marginal cost of all train services in the year (as opposed to the marginal cost of one train). This definition of marginal cost, set out by the infrastructure manager Prorail, is acknowledged not to be the generally accepted definition. However, as the Directive does not explicitly refer to marginal cost but, instead, to direct cost, it is difficult to say that the Prorail definition does not comply with the Directive.

The charge comprises:

• a maintenance component, levied by tonne km;
• a planning component, levied by train km; and
• station charges according to large and small stations.

Charges are subject to annual negotiations between the infrastructure manager and the operators. However, these negotiations can only relate to the mark-ups and to quality of service, not to the core structure of charges or to the level of marginal cost.

Furthermore, there is a new-build dedicated freight-only line on which the charges are different to elsewhere on the network. For one thing, there are no historic costs to use as a judge, as to whether maintenance costs on this new line are reasonable or not – this will emerge in time. Also, for this freight-only line, a reservation charge has been incorporated, whereby it is cheaper if operators book early and more if they book late.

Switzerland

It was explained that the Swiss network comprises a lot of different operators, many of which are integrated railways. The infrastructure charging regime, which is already
based on marginal cost concepts, is currently at the beginning of a review process with a view to establishing a new, revised set of charges in 2010; a more major revision may come later, eg 2013 or so.

A number of aspects of the current system were highlighted:

- There are mark-ups for freight and passenger trains;
- There is a simple fixed tariff for entering and passing nodes;
- There is a simple differentiation in relation to noise (whereby a price reduction is granted for rolling stock with defined standard noise reducing measures at the wheels).

A sizeable proportion of the charges relate to gross tonne km and the system has, hence, been criticised for being very weight-based. A key element of the revision will be to change the mark-up for freight trains from a gtkm based charge to a train km based charge. It was noted that this change will shift the charge-burden from bulk to intermodal freight, and a question was raised as to whether this is in line with what the market will bear?

The node charge currently means that if a train starts from a node and makes a stop at a node it will be charged 5 Swiss Francs for every halt and start. The plan is to revise this component of the charge so as to introduce more differentiation in terms of congestion, scarcity, quality of service, etc.

Performance regimes are already permitted by the law - infrastructure operators can include a performance regime into their contracts with operators. However, very few have actually been introduced. Therefore, another part of the proposed revision will be to provide infrastructure managers with greater incentives to adopt performance regimes.

Italy

The structure of the Italian rail market was explained, including the fact that the market has been gradually opened since 2001. The infrastructure manager is tasked to recover only a part of their costs; that proportion which equate to the traffic management and path allocation costs. Consequently, it was stated that more effort is put into understanding whether the infrastructure manager’s cost structure is efficient or not, considering that IM has not control on the price tool which is an algorithm determined by decree.

An algorithm has been devised which results in a fixed charge and a usage tariff based on train km. This is then adjusted taking into account certain parameters in an effort to give the right signals to the market. For example:

- charges per train km are differentiated according to the density of the line and how busy it is at different times of the day;
- there are charges at nodes and these are similarly differentiated, such that trains which use a main station pay 4 times more than if a minor station is used;
- trains that diverge from the ideal speed for a line pay more than those which operate at that ideal speed, so as to promote efficient use of capacity;

So even though the costs allocated are only those relating to train operations, the way it is achieved is linked to scarcity in the hope of providing incentives for efficient use of the network. It is, however, not known whether the operators perceive the charge variations sufficiently well.

Research Needs

Previous research has found that for each country there is a range of marginal costs, and this now raises a crucial research question as to whether this is because researchers have been modelling these things differently or because there are legitimate differences from country to country?

Focusing on marginal maintenance costs, some convergence of the scaled cost elasticities is observable, and this leads to a reasonable ‘rule of thumb’ that approximately 20 percent of maintenance cost is marginal. However, variation around the average seems rather difficult to explain. It is possible to offer a number of possible, plausible explanations for such variation, but it is difficult to verify any such explanations. It is clear that cost may be different to damage, depending on the maintenance and renewal policy of the infrastructure manager, but this difference is hard to uncover using historic data sources. This variation amongst results engenders a wariness amongst infrastructure managers in relation to the use of econometric methods for establishing marginal cost. For marginal renewals costs there is little actual evidence as yet and, consequently, much less convergence.

Therefore, CATRIN is attempting to harmonise the econometric method. That is, it is seeking to understand more about the different cost categories and to iron out definitional issues. For example, the definition of maintenance differs across different railways. On the statistical side there are several competing functional forms, and so CATRIN is aiming to re-estimate models using a variety of functional forms. There is also concern about the different nature of passenger and freight traffic being properly reflected, and so there will be an attempt to separate out passenger and freight traffic. There is also a recognition that the influence of other variables, such as infrastructure condition and capability and, more generally, the characteristics of the network, needs to be better understood. CATRIN has, so far, had some success in harmonising functional form and it is hoped that it will be able to make further progress in these areas.

Furthermore, there is a need to try to integrate engineering and econometric studies. Econometrics is theoretically attractive but is backward looking and dependent on infrastructure manager policy towards maintenance and renewal. It is thought that marrying the two approaches may have substantial benefits. Indeed, infrastructure managers have started to attempt this for themselves, with some degree of success. One infrastructure manager noted that they have undertaken econometric and engineering approaches and, at an aggregate level, they generate a similar result. Nevertheless, they
also report that when you drill down and examine different types of costs and traffic, the
different approaches appear to give very different results. CATRIN has undertaken
engineering-based analysis of costs using Swedish and Swiss data.

It was suggested that there is potentially a significant amount of research still needed to
examine how we can match the econometric with engineering approaches. As a means
of prioritizing this further research, it was suggested that we should look at where
marginal cost is most relevant for charging. This would lead to a focus on freight,
where there is potential for charges to be closest to marginal cost, and lower priority to
be given to research focusing on high speed lines, where the charge is so much higher
than marginal cost – such that it actually matters less if marginal cost estimates are less
accurate.

More research is also needed on the allocation of costs between passenger and freight
and different types of freight. If, for example, it is agreed what the costs are on a
particular line, but there is disagreement on what the allocation is between passenger
and freight, then this poses difficulties for charging policy.

There is also scope to look further at the area of the cost of infrastructure operations.
One of the group highlighted that they have looked, though not particularly extensively,
at this, and arrived at the view that there may be some interesting findings to be
uncovered, but the scale of costs is dwarfed by the costs of maintenance and renewal.
Indeed, one of the infrastructure managers has reported that their costs of operations has
increased notably since increases in traffic levels, suggesting a marginal component to
the cost category. However, the relevance of operations costs for charging purposes
was questioned.

In addition, there is more work to be undertaken to better understand scarcity costs.
CATRIN includes three scarcity case studies:

1. A review of the British regulator’s proposal to use avoidable cost - the cost
   saving from removing a train operator from the network (and the knock-on
   impact of reduced capacity requirement) – as a means of disaggregating the
   British fixed charge;
2. Modelling using the PRAISE model;
3. A review of the node charges and the charges for deviating from optimal
   track speeds that exist in Italy.

It was highlighted that the mark-ups in the central Paris region are set in relation to
capital costs over a 30 year period, and it was suggested that this might form an
interesting case study for the future. Another area for further research concerns whether
and how operators respond to these very different charges. There is both scepticism and
enthusiasm about the likely impacts of charges on operators. For example, there is the
view that price plays only a subsidiary role when it comes to operating decisions (as
expressed above), but there is also the observable fierce negotiations that take place
between operators and those responsible for setting charges. Further evidence in this
area is needed.
It was suggested that it could also be interesting to undertake political science-based research to examine the varying study results in this area taking into account the study stakeholders. For example, do studies by rail infrastructure managers get higher or lower findings than those commissioned by operators? In relation to this, it was noted that while the British infrastructure manager was Railtrack, a private company, they were risk taking and in favour of greater variability in charges, whilst since Network Rail has taken over, they are much more risk averse and argue that so much more of their costs are not variable with traffic.

The meeting was drawn to a close, and it was proposed that another meeting be organized, towards the end of the CATRIN project, to feed back the CATRIN research findings.
CATRIN 2nd Rail Infrastructure Managers Meeting

Meeting held on Wednesday 18 March 2009 at UIC, 16 Rue Jean Rey, Paris

Agenda

0930  Arrival

1000  Introduction  Chris Nash

1015  CATRIN Results – Wear and Tear Marginal Costs

   Econometric Results  Phill Wheat
   Engineering Results  Simon Iwnicki
   Generalisation  Phill Wheat

1115  Coffee

1130  Discussion

   Specific questions for discussion
   - Do you accept the recommendations of CATRIN?
   - If not why not?
   - What are the barriers to implementing these recommendations?
   - How can such barriers be overcome?

1230  Lunch

1400  CATRIN Results – Allocation of Capacity Cost

   and Wider Policy issues  Chris Nash

1430  Discussion

   Specific questions for discussion
   - Do you accept the recommendations of CATRIN?
   - If not why not?
   - What are the barriers to implementing these recommendations?
   - How can such barriers be overcome?

1530  Close
Participants

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Summary

Introduction

Chris Nash of ITS introduced the meeting, specifying what we have done in the first meeting and stressing the fact that we are in the final stage of the project, asking the IM to consider whether they agree with the conclusions of the project and to report on the main barriers to the recommendations provided in the CATRIN study.

A brief introduction on the CATRIN project followed, focussing on the measurement of the marginal costs for rail (following the stream of previous EU research project: UNITE, GRACE, etc).

We have three main research area in CATRIN:

1. We have had different results for different countries from the econometric exercises in previous studies (UNITE, GRACE), and we have focussed on trying to understand whether these are caused by the application of different methods or whether they arise from different circumstances (e.g. volume of traffic, quality of the track)
2. We need to be able to disaggregate results in more detail according to type of train; for this a combination of econometric and engineering models has been used.
3. The issue of how best to charge for scarce capacity remains an important area, and several different approaches have been examined

The econometric model

In his presentation Phill Wheat of the ITS introduced the work done, illustrating the story of the WP 5 (econometric). The rationale is to continue the econometric studies after GRACE/UNITE and to harmonize the conclusions (one of the problem in GRACE).

The recommendations of the Deliverable for the work package are to give advice to the IM on how they can calculate marginal costs in a very simple way?

The top down econometric approach uses regression analysis to determine how actual costs change in relation to cost drivers.

The evidence from the case studies show that there are wide differences in MC costs

In the work package we examined what costs were considered in each of the CATRIN case studies. We made adjustments where (non variable) elements in cost were included in some but not all studies.

Plotting the MC and elasticities holding track quality (and other characteristics) constant at different traffic densities provides an appropriate way to understand the outcomes of the models, as this shows MC/elasticity against traffic density holding all other things constant. It then lets us consider how the MC and elasticity curves shift with changes in track quality.

The elasticity for maintenance only cost is found to be between 0.2 and 0.35 for and is increasing with traffic density: Concerning the track quality, it does not seem to affect the elasticity in any systematic way.

Plotting the MC in relation to quality of infrastructure shows that the poorer the quality, the higher maintenance MC costs are estimated.

Paul McMahon (ORR) asks how quality has been defined. Phill Wheat answers that a sample of indicators has been used in order to find an “average meaning” of quality.

Passenger seems to cause more damage than freight traffic per gross tonne-km. However, more research is needed to confirm this.
The engineering model

Simon Iwnicki of Manchester Metropolitan University (MMU) presented the background to the engineering case study. This included track settlement and rail wear and rolling contact fatigue (RCF). A summary of the main costs analysed, data input and results was shown.

Daniele Ongaro of MMU presented the results for a case study using Swedish data and using the Vampire software. The highest rail damage was due to the high speed locomotive. The highest track settlement damage was due to the freight wagon. Track damage is mainly influenced by axle load and rail damage is seen to be more influenced by vehicle speed

Generalization

Phill Wheat of ITS showed the formula suggested for generalising the results. The formula, \( MC=AC*\text{elasticity} \), where the CATRIN case studies provide a default measure of the elasticity (between 0.2 and 0.35 for maintenance cost, 0.28 and 0.35 for maintenance and renewal costs)

A preliminary discussion about what elements of cost should (and should not) be part of “Maintenance” and “Renewal” costs is anyway necessary.

Capacity Charges

Chris Nash of the ITS reviewed the CATRIN contribution to charging for scarcity (estimating the opportunity cost of slots, examining the Italian approach to charging for inefficient use of capacity, and charging long run avoidable capacity costs as part of a 2-part tariff). He showed the values of the opportunity costs of slots on the Leeds-London rail route, where slots have a high value in the peak, but some existing off peak trains show a negative social value, i.e. even if attractive for an operator, the social costs of the current use of the slot would outstrip the benefits.

Trains which run at a different speed from the optimal for a particular route consume more capacity than trains that run at that speed, and a case study of the current Italian access charging system showed how this is currently taken into account. Long run avoidable costs should in principle be charged as a fixed cost wherever a long run track access agreement involves a commitment to making this capacity available long term, but this poses problems in terms of ensuring non discrimination when open access competition is present. No such problem arises with monopoly franchises where it is important that the franchising body is aware of the long run costs of their decisions.
Discussion

The discussion focussed on 5 issues:

1. Relevance of marginal cost measurement
It was agreed that the measurement of short run marginal cost provided important information for the infrastructure manager. Short run marginal cost provided the floor below which infrastructure charges should not be set, although they may have to be considerably higher on average unless the government provides sufficient funding to cover all fixed costs. It was therefore more important to obtain accurate measures of marginal cost in those locations and sectors where prices were close to marginal cost than where they were well above them. From the point of view of future planning, long run marginal cost was also very important.

2. Accuracy of CATRIN results
It was commented that, although the best information available, the CATRIN results remained subject to considerable uncertainty. This was particularly true of renewals costs, where there was little evidence available. Whilst it was not possible to provide formal confidence intervals, the uncertainty surrounding the relevant elasticities should always be emphasised.

3. Use of CATRIN recommendations
The CATRIN recommendations gave a suitable methodology for estimating short run marginal costs where data was not available for an in depth study, and being based on good data and state of the art methodology, were to be preferred to a superficial study. However, where a good study had been undertaken its results are likely to be more accurate than transferring those of CATRIN.

4. Differentiation by type of rolling stock
The engineering approach provided the possibility of differentiating charges in great detail by type of rolling stock. Only Britain currently does this. It was seen to be important to give train operators appropriate incentives regarding the type of rolling stock they used, although the franchising system in Britain actually gave passenger operators limited choice so the existing charges may be unnecessarily complex. Some countries do not even differentiate charges between trains according to gross tonne kilometres, which is the obvious first step.

5. Capacity charges
Most countries do not currently charges for capacity; for instance in the Netherlands allocation of capacity is according to relative social benefits of alternative uses and pricing plays no part in this process. However, the high reservation charges on congested routes in France, both in the Isle de France and on high speed routes such as Paris – Lyons, may be seen as a sort of capacity charge somewhat in line with the CATRIN recommendations.
6. Access to and charges for other facilities

The point was made that opening up of the market requires not just non-discriminatory access to track, but also to other facilities such as freight terminals, marshalling yards and maintenance depots. Charges for such services also need examination.

As a result of the discussion, it was agreed that the conclusions of the rail infrastructure costs deliverable would be revised to emphasise the remaining degree of uncertainty about the results, particularly in the case of renewals costs, and to provide guidance on the relative role of the CATRIN generalisation and of specific studies for different countries.
**AGENDA**

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<tr>
<th>Time</th>
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<tr>
<td>09:30</td>
<td>Welcome and introduction</td>
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<tr>
<td></td>
<td><em>Juan Carlos Martin (Chair)</em></td>
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<td>9:45</td>
<td>The cost allocation method in use</td>
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<td>Objective: review of the methods, discussion on the questionnaire</td>
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<td>results, literature review, etc</td>
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<td>The institutional context</td>
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<td>Objective: To discuss the prevailing institutional context</td>
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<td>11:00</td>
<td>Coffee Break</td>
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<td>11:20</td>
<td>Shortcomings to overcome</td>
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<td>Objective: Identify imperfections, if any, and discuss alternative</td>
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<td>options.</td>
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<td>12:30</td>
<td>Next meeting and other issues</td>
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<td>Lunch</td>
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**Rapporteur:** Riccardo Enei (ISIS), renei@isis-it.com
CATRIN AIR INFRASTRUCTURE MANAGER’S COMMITTEE
FIRST MEETING
5TH JUNE 2008

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</tr>
</tbody>
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MINUTES

The attendance of the meeting is composed of representatives of research institutes and administrators. The discussion during the meeting was based on the following topics derived from the presentation given by Juan Carlos Martin of the University of Las Palma, chair of the meeting:

a) The Cost Allocation Method in use
b) The Institutional Context
c) Shortcoming to overcome
d) Presentation of the results of the questionnaire
e) Next meeting and other issues

The discussion which followed is summarised below around this main topics

The Cost Allocation Method in use

Juan Carlos Martin’s presentation stressed the fact that full cost recovery is the basic charging principle in the sector, due to the fact that airports are profitable units. Rafael Echevarne stressed the key distinction between small airports and big airports. The former are heavily subsidized and the role of revenues may be ancillary to other political objectives. Furthermore, we should also consider the network of airports
managed by a single administration (as in Sweden), in which cross subsidization is the current practice. Juan Carlos asks if the current charging practices may be considered efficient from a theoretical point of view. He doubts that. the ICAO guidelines, stressing the principle of non-discrimination, transparency and non-overcharging approach, do not enhance the principle of efficient charging. Also the proposed new EC Directive on airport charging does not add anything new to address efficiency issues. Riccardo Enei stressed the importance of the new Directive at least under the profile of ensuring a level playing field for airlines against excessive market power of airports. The possibility of maintaining airport market power has been criticized by Juan Carlos. The analysis of the current practices in charge determination takes into consideration the main categories of charges: landing, passenger, parking, non-aeronautical. Landing charges, based on MTOW are considered efficient by the participants. As far as passenger charges are concerned, the participants agreed with the principle of differentiating the charging according to the quality of the terminal. An important source of conflict between airlines and airports has been identified in the myriads of rebates and incentives discriminating specific airlines. For example, the Manchester airport gives 25% of discount parking charges for airlines operating at least 362 days a year. Another issue of potential conflict is the pre-financing of infrastructure investments in airport charge.

The institutional context

Juan Carlos illustrates the different type of airport under the institutional point of view: fully State owned, partially or fully privatized, with minor participation of local authorities or State bodies, etc. Concerning the pricing formula, the basic classification is between charges under price regulation, either single till or dual till, and public prices. The former are in general characterised by RPI-X., where RPI represents the change in the retail price index, and X is generally considered to be a productivity factor, which could be positive if the industry is expected to operate more efficiently in the future, or negative if the opposite case. The participants stressed that environmental costs are not generally considered in the regulated prices and that the single-till approach may be dangerous in the presence of congestion.

Concerning the public prices, i.e. fixed by local authorities or State owned bodies, they are determined to address several policy objectives.

Shortcoming to overcome

They concern the following issues:

- Best practices in charging determination (first best prices) do exist, but their implementation is difficult. Juan Carlos complained that in some cases the academic papers are distant from the reality.
- The current practices in charging determinations cannot solely pursue efficiency, but consider other issues, such as safety, security, etc. Bridin OLeary stressed that the micromanagement of airport activities is not a policy that any regulator
would like to follow as this would result in mismanagement. The management of the airport activities should be related to the policies on quality of service.

- To have collaboration between airlines and airport managers is a challenging task.

Presentation of the results of the questionnaire

Riccardo Enei illustrates the results of the questionnaire sent to the members of the Air Committee. There have been four questionnaire filled by Henrik Littorin and Brett Weihart (LFV), Bridin OLeary (Commission for Aviation Regulation), Darek Kalinski (Polish Airport company) and Miguel Alvarez (AENA). The answers have addressed the following topics:

- Charging principle, from which it emerges that the full cost recovery is the reference charging principle
- The cost allocation in use, from which it emerges that the Price Cap formula and rate of return formula are the main methods
- The procedure of charge approbation is considered efficient in the case in which there is no need to have intermediate or bargaining procedures involving several institutional levels
- Shortcomings to overcome are the lack of a detailed database to support robust cost allocation and a lack of financial knowledge of civil administrators (in the case of the Polish case)

Conclusions

Riccardo Enei stresses that the CATRIN consortium will inform the participants about the project results and that the second and final meeting will take place towards the end of the project, probably early 2009.
**Waterborne Committee**

**CATRIN MARITIME (WATERBORNE) INFRASTRUCTURE MANAGER’S COMMITTEE**

**FIRST MEETING**

19th May 2008

**NH Grand Place Arenberg**

15 Rue d'Assaut - B-1000 Brussels

Tel: +32 2 501 16 16; Fax: +32 2 501 18 18

**AGENDA**

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<td>09:30</td>
<td>Welcome and introduction</td>
<td>Gunnar Eriksson (Chair)</td>
</tr>
<tr>
<td>9:45</td>
<td>Categorization of infrastructure for waterborne transports</td>
<td>Objective: Develop a categorization to enhance discussions on infrastructure costs and pricing policy issues.</td>
</tr>
<tr>
<td>10:15</td>
<td>Cost structures</td>
<td>Objective: Identify the most relevant cost items for the different infrastructure categories.</td>
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<td>11:00</td>
<td>Coffee Break</td>
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<tr>
<td>11:20</td>
<td>Scope for national or European charging policies bearing on the different infrastructure categories.</td>
<td>Objective: Identify market imperfections, if any, and discuss policy options.</td>
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<tr>
<td>12:00</td>
<td>Next meeting and other issues</td>
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<tr>
<td>13:00</td>
<td>Buffet Lunch</td>
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CATRIN MARITIME (WATERBORNE) INFRASTRUCTURE
MANAGER’S COMMITTEE
FIRST MEETING
19TH MAY 2008

PARTICIPANTS

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MINUTES

The attendance of the meeting is composed of representatives of research institutes and administrators. The discussion during the meeting has been based on the following topics derived from the introductory note delivered to the participants by Gunnar Eriksson of the Swedish Maritime Association, chair of the meeting:

f) Categorisation of infrastructure, aiming at identifying the main difference in the waterborne context, notably between inland waterways and maritime transport

g) Definition of the main infrastructure costs

h) The EU basis for adopting pricing policies

The discussion which followed is summarised below around the main topics
Categorisation of infrastructure

Gunnar Eriksson introduces the categorization of infrastructure, in which fairways from the open sea to the port areas are mentioned for maritime ports as well as for inland waterways. This approach is questioned by Leo Clinckers, who suggests to consider the inland waterways channels similar to road and rail routes, with no need to consider other type of access (i.e. the fairways). Leo Clinckers also points out that to consider separately inland waterways infrastructure and inland waterways infrastructure ports (proposed by Gunnar Eriksson) could be not so relevant. On the other hand, Janus Jarosinski stresses that there are examples of direct accesses to inland ports, so that the concept of fairways could be useful from a methodological point of view. The discussion anyway stresses the fact the boundaries between seaport (or inland ports) and the open sea or river is not always clear. This leads the Committee to delete the reference to fairways to the inland ports and to consider inland ports infrastructure as part of the inland waterways infrastructure. Arnaud Burgess raises the issue of the mixed traffic (inland and maritime) using the same access (channels) to ports: in terms of investment allocation it could be useful to estimate the specific damage to the infrastructure. Difference in charging principle between inland ports and maritime ports (port dues) have been also stressed by Michael Lloyd and Gunnar Eriksson.

Definition of the main infrastructure costs

Gunnar Eriksson introduces the matter, specifying that the objective of the introductory note is to identify the main cost component in the waterborne transport. Jolco Brolsma stresses the need to consider also the costs for traffic information services, approximately equal to 10% of the total costs. Concerning the cost allocation Leo Clinckers stresses that an allocation based on historical costs by type of vessel do exists, but no estimations of the actual damage by type of vessels has been carried out. Operational costs are mainly considered for infrastructure inland locks, e.g. the extra-costs for opening up the locks on Saturday. Jolco Brolsma stresses that for inland waterways, diversely in that from port (port dues) the cost for the infrastructure use (canal dues) is not established. Gunnar Eriksson stresses as possible basis for charging, the dredging costs, considered negligible for the inland waterways by the Committee. Concerning ports, Janus Jarosinski stresses that the Port Authority in Gdynia is in charge for financing the dredging costs. Michael Lloyd suggests to distinguish between maintenance infrastructure costs and investment (for new infrastructure). Icebreaking may be present and are in general under the government funding (Jolco Brolsma says it for Germany). Different national contexts manage the pilotage costs (private companies, state owned companies, etc). Concerning docks, quays and jetties, Michael Lloyd stresses the distinction between superstructure and infrastructure. Land rent costs is mainly seen as a revenues instead of costs. Leo Clinckers suggests that environmental costs due to specific regulation, e.g. to avoid harming species (fishes), may be a relevant infrastructure costs, e.g. docks design.
The EU basis for adopting pricing policies

The discussion relates to the principle of national and European charging policies in waterborne transport. Gunnar Eriksson stresses that it is important to distinguish between type of waterborne transport. In open waters (maritime) financial infrastructure costs are limited and near to zero. As far as external costs (air pollution) is concerned, there are hypothesis to levy fuel charges. Concerning ports, the legislation aims at avoiding distortion in competition and increase efficiency. Taneli Antikainen stresses that fix costs are important in port economics. Concerning inland waterways, Arnaud Burgess, summarising the conclusions of the transport waterborne Expert Groups in the IMPRINT-NET project, stresses that marginal costs are generally low and that pricing is seen as a strategy potentially detrimental to the already bad competitive position of inland waterways market compared to road or rail.

Conclusions

Riccardo Enei stresses that the CATRIN consortium will inform the participants about the project results and that the second and final meeting will take place towards the end of the project, probably early 2009. Gunnar Eriksson thanks all the participants for the fruitful discussion.
ANNEX III: BACKGROUND MATERIAL

Rail

Rail Access Charges – current situation and research needs
Chris Nash, Bryan Matthews, Pedro Abrantes, Phill Wheat and Andrew Smith
Institute for Transport Studies, University of Leeds

Executive Summary

This note aims to review briefly the principles and practice of the setting of rail track access charges in Europe and the evidence on which they may be based. From this it considers research needs, and the contribution to satisfying them that CATRIN is seeking to make.

The current situation in Europe may be summarised as follows:

1. Directive 2001/14 requires that charges should be based on the direct cost of operating the train service. This is generally interpreted as what economists know as short run marginal social costs, although Germany and a number of new member state still rely more on a system of fully allocated costs.

2. There is a widely differing range of cost categories taken into account in the charges, with most countries charging for track maintenance and train planning an operations, but only some countries charging for renewals and congestion and scarcity. A few countries charge for external accident and/or environmental costs.

3. The actual parameters on which charges are based vary widely, with some countries charging per train km, others per gross tonne km, some charging for both and some having fixed charges and/or reservation fees.

4. Levels of charge vary widely both in terms of absolute level and relative to total cost, leading to widely differing levels of cost recovery.

In terms of existing evidence, the situation is as follows:

Wear and tear costs
Best practice requires a charge per gross tonne km according to marginal wear and tear costs, differentiated according to type of vehicle and type of track, including traffic density. However, whilst existing evidence implies that for maintenance costs, around 20% are typically variable with use, there is much less evidence on renewals costs and on how this proportion varies with the characteristics of both trains and track.

Train planning and real time infrastructure operating costs
There is little objective evidence on how these vary with use, and widely differing practices in terms of charging; there is only a small amount of econometric evidence that they are
mainly fixed. Train planning and operating costs will presumably vary with the number of paths planned and their length in path km.

**Accidents**

Given the low accident rates and the fact that most costs are covered by insurance, it is generally assumed that the external costs of accidents are small. The only real evidence of external costs relates to level crossings in Sweden, where additional trains may raise the risk for road users, so a charge related to the number of level crossings passed and their characteristics may be justified.

**Congestion**

The direct impact of a late running train on others is best handled by a bonus/malus performance regime which may attribute delays to the party responsible for them. The external cost of congestion relates to the fact that an additional train, even if not directly causing delay, reduces the capacity of the network to recover from delays, leading to knock-on effects on other services. The best evidence of this relates to Britain, but the parameters of the resulting relationship between secondary delays and capacity utilisation vary between routes in an unexplained way, so the results cannot be generalised. They do, however, lead to a charge per train km varying in time and space (a charge for passing congested nodes might be an alternative).

**Scarcity**

Scarcity represents the inability of some operators to get the slots they want because of inadequate capacity. Some studies have tried to quantify this, particularly in the case of Britain, but again the cost varies so much with the characteristics of the traffic in question that generalisation is difficult. Scarcity charges would ideally be reservation charges per path or path km varying by time and location; again there may be justification for a charge relating to particular nodes.

**Environmental charges**

There is considerable evidence on how climate change, noise and local air pollution costs vary with type of vehicle and traction, electricity generation mix in the case of electric trains and population density. For noise and local air pollution, ideally charges would vary with the type of train, location (esp population density, so an urban/rural split might suffice) and time of day.

For global warming a tax on diesel fuel is the most appropriate approach (electricity generation is already part of the European emissions trading scheme).

**Mark ups**

Under the legislation mark ups are permitted for financial reasons.

Mark ups should vary with willingness to pay, which again means type of train (e.g. intercity, commuter, bulk freight, intermodal) location and – for passenger trains at least – time of day.

The CATRIN project is undertaking research particularly on the cost categories ‘wear and tear’ (to improve understanding of the marginal cost of renewals, and of how this and maintenance costs vary with the type and volume of traffic and with the type of track) and
'scarcity' (to understand the merits of charges per path km or per node and to seek to provide some basis for generalisation).
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Appendix A – Work Areas for CATRIN .............................................................................................
Introduction

The CATRIN project is undertaking original research designed to improve cost allocation methods used in infrastructure charging in Europe. The aim of this paper is to outline the background to rail access charges in Europe, to consider the existing evidence on which they might be based, to describe existing practice in general as well as to consider in detail the charging systems of some contrasting major European countries, and to consider research needs and the way in which CATRIN is seeking to contribute to meeting them.

Background

The need for explicit methods of charging for the use of rail infrastructure has arisen as a result of the policy of the European Commission of separating infrastructure from operations and opening up operations to new entry. The European Commission sees this as an important way of improving the efficiency and marketing of rail transport and, hence, of increasing the role of the railways in the European ‘Common Transport Policy’.

The Commission is keen to see comparable approaches to infrastructure charging being used in all member states, to avoid the distortions that exist when neighbouring countries charge for the use of infrastructure on a totally different basis, and to base these charges on marginal social cost as the most efficient approach to transport pricing. Directive 2001/14, on allocation of railway infrastructure capacity and levying of charges (CEC, 2001), determines that charges must be based on “costs directly incurred as a result of operating the train service” (CEC, 2001). However, deriving and implementing an appropriate pricing system has been found to pose extreme difficulties.

Short run marginal cost pricing advocates charging the incremental, or marginal, cost of use of the existing, i.e. fixed in the short run, infrastructure by the train concerned, given the assumption that all other trains on the network are running. That is, the infrastructure charge for operating a particular service should be the additional costs imposed by that service, given that all other services are operating and are paying for the additional costs which they each impose.

The costs generated when an additional train uses the infrastructure are comprised of five main elements:

- Use-related wear and tear costs – the costs associated with maintenance and renewal activities that are required as a direct consequence of damage to the infrastructure resulting from the passage of trains;
- Congestion costs – the costs associated with ‘knock-on’ or ‘reactionary’ delays on the network, whereby a delay to one train has a ‘knock-on’ effect that causes subsequent trains to be delayed, which increases as capacity is utilized ever more intensively;
- Scarcity costs – the opportunity cost of network capacity, which again intensifies as capacity is utilized ever more intensively;
- External accident costs – the external costs associated with fatalities, injuries and damage to property resulting from rail accidents; and
- Environmental costs – the costs associated with rail-related noise, local air pollution and CO2 emissions.

The concept of short run marginal cost is often contrasted with that of long run marginal cost, which represents the additional cost of an extra train when the infrastructure is optimally adapted to the demand in question. It is well known that if the infrastructure were optimally configured, the two concepts would give the same resulting value, since the infrastructure would be improved to the point at which the cost of the extra capacity exactly matched its value in terms of relieving congestion and permitting additional trains to run. The general perception that short run marginal cost is below long run is only true in the presence of excess capacity; the reverse is true when capacity is scarce.

In practice, indivisibilities and the time lags involved in adapting infrastructure to volume mean that differences between short and long run marginal cost are likely. This has resulted in a vigorous debate regarding the relative merits of short and long run marginal cost pricing (Nash et al, 1999).

Where short and long run marginal costs diverge, the text book solution is to price at short run marginal cost, whilst adapting the infrastructure in accordance with the outcome of social cost-benefit analysis of alternative schemes. In this way, the optimal use of existing infrastructure can be guaranteed, whilst over time, the quantity and quality of infrastructure would be optimised, and the price adapted accordingly. It is also arguably easier to measure short run marginal cost than long run, which - in the presence of indivisibilities - may only be approximated as the average incremental cost of specific capacity enhancing measures which may vary greatly in cost from place to place. However, arguments do exist in favour of the long run marginal cost pricing approach. Specifically it may give a value which is more stable over time, not fluctuating with changes in the level of congestion, and thus aid planning by the train operating company. Linked to this is the fact that many operators, both freight and passenger, seek contracts running for a number of years in order to justify specific investments in rolling stock or fixed equipment such as terminals. One solution might be to charge long term contracts on the basis of long run marginal cost (or two part tariffs, with a fixed charge covering the cost of providing the capacity and a variable charge for its use), but to sell paths on the ‘spot’ market at short run marginal cost.

Given that rail infrastructure is usually in the hands of a national monopoly provider, another problem of short run marginal cost pricing is that it makes it more profitable for a commercial rail infrastructure manager to constrain capacity to force the price up than to invest in expansion. At least if it is regulated to charge long run marginal cost this incentive is removed, although it is still not clear that the appropriate incentive to invest will exist. It may be far more appropriate therefore if long run marginal cost pricing is seen as part of a long run contract which also specifies the infrastructure investment to take place, although such contracts may be difficult to negotiate if several operators are involved.
It may also be doubted whether it really is the case that short run marginal cost is easier to measure than long, particularly in the context of capacity constraints, where scarcity charges based on alternative operators’ valuations of the slots concerned must be appraised. Alternative ways of doing this have been put forward, such as an auctioning system, or permitting individual negotiations over the rate to be charged on the basis of ‘willingness to pay’ (ECMT, 1998).

Evidence on Costs and cost Structures

A number of recent empirical studies have been undertaken to estimate the value of different components of marginal cost of rail infrastructure use. The most extensive work has concerned wear and tear costs, and Table 1 summarises results from recent studies. It can be seen that charges based on marginal maintenance cost would cover somewhere between 13-38% of maintenance costs and that charges based on marginal maintenance and renewal costs would cover somewhere between 19 – 30% of total maintenance and renewal costs.

These results are generally interpreted as implying that, for maintenance costs, around 20% are typically variable with use, though the smaller number of studies on renewal costs make it more difficult to agree on an approximate percentage of them that vary with use. In addition, it is known that wear and tear costs vary with the characteristics of both trains and track but there is, as yet, insufficient evidence on precisely how. Further research in these areas will improve understanding of these issues.

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<tr>
<td>Booz Allen and Hamilton (2005)</td>
<td>Cost Allocation</td>
<td>Great Britain</td>
<td>0.28 for track maintenance</td>
<td>Not tested</td>
</tr>
<tr>
<td>Maintenance and renewals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andersson (2006a)</td>
<td>Econometric</td>
<td>Sweden</td>
<td>0.302*</td>
<td>Falling</td>
</tr>
<tr>
<td>Marti and Neuenschwander (2006)</td>
<td>Econometric</td>
<td>Switzerland</td>
<td>0.265</td>
<td>Not tested</td>
</tr>
<tr>
<td>Tervonen and Idstrom (2004)</td>
<td>Econometric</td>
<td>Finland</td>
<td>0.267-0.291</td>
<td>Not tested</td>
</tr>
<tr>
<td>Booz Allen and Hamilton (2005)</td>
<td>Cost Allocation</td>
<td>Great Britain</td>
<td>0.19</td>
<td>Not tested</td>
</tr>
<tr>
<td>Renewals only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andersson (2006b)</td>
<td>Duration</td>
<td>Sweden</td>
<td>Not reported</td>
<td>Not tested</td>
</tr>
<tr>
<td>Booz Allen and Hamilton (2005)</td>
<td>Cost Allocation</td>
<td>Great Britain</td>
<td>0.19 (renewals as a whole); 0.45 for track renewals</td>
<td>Not tested</td>
</tr>
<tr>
<td>Operations only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andersson (2006a)</td>
<td>Econometric</td>
<td>Sweden</td>
<td>0.324</td>
<td>Falling</td>
</tr>
</tbody>
</table>

(* average elasticity.  
(**) 2005/06 prices

Sources: Wheat (2007) based on Tables 6 and 7 in Lindberg (2006), and updated from Wheat and Smith (2008). The studies highlighted are the latest econometric studies for maintenance and maintenance and renewal costs for each country.

These studies only took account of infrastructure wear and tear costs and there is much less evidence relating to the other components of marginal cost. There is, for example, only a small amount of econometric evidence on how train planning and real time infrastructure operating costs vary with use, and that which does exist suggests that they are mainly fixed. The UNITE project found evidence of external accident costs at level crossings in Sweden, where additional trains may add to the risk for road users; otherwise it is generally assumed that, given the small number of accidents and the fact that most costs are covered by insurance, for railways external accident costs are small.
In terms of congestion costs, only Britain seems to have published evidence on the degree to which delays to other services differ by capacity utilization, time and location. Similarly, there is a lack of empirical evidence in relation to scarcity costs, though there are proposed methods for doing so and a number of case studies. Neither for congestion nor scarcity does the published evidence seem to be sufficient for generalisation to other circumstances. Estimates of the air pollution, noise and global warming costs of rail operations broken down by type of vehicle and location do exist, but again they are relatively limited in number.

Cost Recovery and mark-ups

Making reasonable assumptions based on the available evidence on these other cost components, indications are that, even once these components are included, revenues from charges equal to marginal cost are likely to fall short of infrastructure manager’s costs. This raises a serious question of how to fund the resulting deficits?

One solution to this is a contribution from the state. However, some see this as dangerous in terms of the incentives to efficiency; others fear that it might prove inadequate to fund an appropriate level of investment. In any event it is generally accepted that government funds have a shadow price above one, so that it is appropriate to seek to recover more than simply the marginal cost of infrastructure use from rail operators.

Alternative means of recovering more than simply the marginal cost of infrastructure use from rail operators, with the least possible damage to efficiency, have been proposed. The standard Ramsey pricing argument would justify raising price above marginal cost in inverse proportion to the elasticity of demand for the service in question. However, it would be difficult to do this in a fixed tariff for more than a limited number of categories of train. Much finer differentiation would be possible if individual negotiations between infrastructure provider and train operator were permitted. It should also be pointed out that the application of Ramsey pricing to an intermediate good is not straightforward; it is the effect on the prices and service patterns in the end-user market that matter, and that is difficult to predict and appropriately allow for. It is generally accepted as desirable that the prices of individual slots remain as close as possible to marginal cost - second best theory suggests that any divergences from marginal cost pricing, including Ramsey pricing, are better applied in the end-user product market than on the intermediate good of transport infrastructure (Diamond and Mirrlees, 1971).

The generally advocated alternative to Ramsey pricing is two part tariffs (of course, the two may be combined as well). The attraction of two part tariffs is that the fixed part may be related to ability to pay, but still leave the operator free to raise the necessary cash in the way that loses them the least traffic, without the distorting effect on service levels that a surcharge on the charge per train kilometre has. The difficulty is that if the fixed part is the result of a tariff, it almost inevitably favours large operators against small (even if there is a fixed charge per route kilometre, it favours the operators who
have a lot of traffic on the particular route, although it is not as damaging to the prospects of entrants as a large fixed charge for an entire network.

The accepted theoretical solution to the problem, for an integrated infrastructure owner and operator, is the efficient component pricing rule of Baumol (1983). The entrant who comes in on a small scale should be charged marginal social cost plus whatever contribution to the fixed charge the existing operator loses as a result of the new entry. That however is very difficult to estimate.

**Overview of European Practice**

**Directive 2001/14**

The legislation governing railway infrastructure charging is enshrined in Directive 2001/14, on allocation of railway infrastructure capacity and levying of charges (CEC, 2001). In summary, the directive determines that charges must be based on ‘costs directly incurred as a result of operating the train service” (CEC, 2001). They may include:

- Scarcity, although where a section of track is defined as having a scarcity problem, the infrastructure manager must examine proposals to relieve that scarcity, and undertake them unless they are shown, on the basis of cost benefit analysis, not to be worthwhile;
- Environmental costs, but these may only add to the revenue raised from train operators in total where these are levied on other modes;
- Recovery of the costs of specific investments where these are worthwhile and could not otherwise be funded;
- Discounts but only where justified by costs; large operators may not use their market power to get discounts;
- Reservation charges for scarce capacity, which must be paid whether the capacity is used or not;
- Non discriminatory mark ups but these must not exclude segments of traffic which could cover direct cost.
- Compensation may be paid for uncovered costs on other modes through a specific time-dated compensation scheme.

It seems clear from the list of elements that may be included in the charges that ‘the direct cost of operating the service’ is to be interpreted as short run marginal social cost. However, the arguments that this form of pricing may lead infrastructure managers to artificially restrict capacity or to be unable to fund its activities in total or particular investments are all addressed by special provisions. Moreover, there is allowance for second best pricing in the face of distorted prices on other modes. However, the effect of these provisions, all sensible in themselves, is to considerably water down the likely effect of the Directive by giving infrastructure managers various loopholes under which they can argue for the maintenance of previous forms of infrastructure charging. In particular, the degree to which competitive charges for paths involving several
countries, based on comparable pricing regimes, will be achieved will inevitably be limited.

**Fel! Hittar inte referenskälla.** summarises the charging structure for rail infrastructure in the EU, highlighting the principles adopted and the mix of fixed and variable charges in place. This categorisation draws on the European Conference of Ministers of Transport’s paper “Railway Reform and Charges for the use of Infrastructure” (ECMT, 2005) (currently being updated).

Charging regimes can be distinguished by the following characteristics, and each is discussed in more detail below:

- pricing principles adopted (marginal cost pricing, marginal cost pricing with mark-ups, full cost recovery and full cost recovery less state subsidy);
- type of mark-up (if any) (either two-part tariffs or mark-ups on the variable component);
- type of variable charging (e.g. by train-km or gross t-km);
- charges for different elements of cost (e.g. maintenance, renewal and environmental).

<table>
<thead>
<tr>
<th>Pricing Principle</th>
<th>Fixed Charges</th>
<th>Charges per Gross t-km</th>
<th>Train-km</th>
<th>Path-km</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>MC+</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>FC-</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td>MC+</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>MC+</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>MC+</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Charges per train for bottlenecks and bridges</td>
</tr>
<tr>
<td>Estonia</td>
<td>FC</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>MC+</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>MC+</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Charges for stop at “congested” stations</td>
</tr>
<tr>
<td>Germany</td>
<td>FC-</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>FC</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>FC- (Traffic management only)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Also charge per node</td>
</tr>
<tr>
<td>Latvia</td>
<td>FC</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>MC</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>FC</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pricing Principle</td>
<td>Fixed Charges</td>
<td>Charges per Gross t-km</td>
<td>Train-km</td>
<td>Path-km</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------</td>
<td>---------------</td>
<td>------------------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>Portugal</td>
<td>MC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Romania</td>
<td>FC</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slovenia</td>
<td>FC</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Sweden</td>
<td>MC+</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>MC+</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>MC+</td>
<td>Franchisees only</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ECMT (2005)

Underlying Principles Adopted

As stated earlier, marginal cost pricing is usually advocated in order to encourage efficient use of the railway network. However railways tend to exhibit economies of density and so the marginal cost of extra network utilisation is below the average cost. Thus full cost recovery is not achieved through (simple) marginal cost pricing. Therefore, two broad pricing principles can be distinguished; pricing by marginal cost (MC) and pricing to recover full cost (FC) (usually through some average cost pricing scheme). There are two further pricing principles reported in the table, marginal cost plus pricing (MC+) and pricing to recover full cost less government grants (FC-). Both MC+ and FC- are aimed at full cost recovery less government grants; however the MC+ approach, being based on marginal cost pricing, is viewed as less distorting in terms of incentives; those countries using FC- do not usually calculate marginal cost as the starting point for setting charges.

Type of Variable Charge

A mixture of number of train-km, gross tonne km and train path km is used by for variable charges by systems in Europe. In terms of charging marginal cost, the unit of usage should reflect the driver of the marginal damage caused to the network. Therefore to reflect different cost drivers (and, as is likely, to reflect distributional concerns) a mixture of charging measures have been implemented.

Elements of Costs Charged

Across Europe elements of maintenance, renewals, train planning and operations, congestion and scarcity, accidents and environmental costs are used as the cost base to determine both marginal cost (in the MC and MC+ approaches) and average cost (in the FC and FC- approaches). No country charges for all of these categories and only Switzerland, Germany and France charge for 4 of these categories. All except Italy charge for maintenance expenditure and 13 out of 18 countries charge for train planning...
and operations. Charges for congestion and scarcity, accidents and environment are only undertaken by a minority of countries.

**Overall cost recovery**

Fig 1 illustrates the range of cost recovery levels achieved by European rail infrastructure managers, varying from less than 10% in some countries adopting pure marginal cost pricing (or even charges below marginal cost) to 100% in some new member states. This range of levels of cost recovery is reflected in enormous variation in the levels of charge.

![Graph showing cost recovery levels](image)

Source: ECMT (2005)

**Some National Cases**

The ECMT review in 2005 (currently being updated), the RAILCALC project in 2007 (RAILCALC, 2007) and, most recently, a joint CER/EIM booklet (CER/EIM, 2008) each give quite a lot of detail about infrastructure charging practices in different countries. The following draws on those documents to consider the pricing structures in the contrasting cases of Britain, France and Germany, trying to pick out key issues which might form the basis for discussion rather than simply re-presenting their content.

**Britain**

The ECMT review (ECMT, 2005) characterised the British system of rail infrastructure charges for franchised passenger services as being based on marginal cost, with mark-ups to increase cost recovery (MC+), whilst the system for freight and ‘open access’ passenger services as being based on Marginal cost (MC). The stated intention is that revenue from infrastructure charges, together with the Infrastructure Manager’s surpluses from other commercial activities and any public funds, shall at least balance with their expenditure.
The charging structure comprises 3 main components:

4. variable usage charges – payable by all passenger and freight train operators and sub-divided into a track variable usage charge, a capacity charge, a traction electricity charge and an electrification asset usage charge;
5. fixed track access charges – payable by franchised passenger train operators, differentiated in line with their projected vehicle km;
6. supplementary access charges – known as the performance regime and the possessions regime, and constituting a compensatory incentive framework potentially applicable to all train operators.

Incremental track maintenance and renewal costs are reflected in the track variable usage charge, though this probably equates more closely to average variable cost than to marginal cost. The estimation process is based on a top-down assessment of the total costs to the infrastructure manager of operating, maintaining and renewing the network, and the degree of variability of these costs across the network by different asset categories. Variable costs are then allocated to individual vehicles in line with a bottom-up analysis of how they cause damage to the infrastructure. It is said that this mechanism provides operators with incentives to use more ‘track-friendly’ equipment, though it is not always clear that this is actually occurring. It would be useful to explore this issue of incentivisation further.

Marginal wear and tear costs related to maintenance and renewal of electrification assets are reflected in the electrification asset usage charge, which is disaggregated by different geographical areas, season and time of day bands. It would be interesting to learn more of how these second set of wear and tear costs are estimated.

Marginal congestion costs – which arise from it becoming increasingly likely that, as capacity utilisation increases, an incident somewhere on the network causes knock-on delays to train services elsewhere on the network, - are reflected in the capacity charge. These costs were calculated via the estimation of a regression model, relating capacity utilisation to historic data on knock-on (or ‘reactionary’) delay. The charge is differentiated by different service-type, but it was not possible to differentiate it by time period so the costs represent an average across the network. Furthermore, the charge was set to half of the estimated cost, for fear that it might otherwise suppress growth. Finally, freight operators receive a further 10% discount on the capacity charge, to reflect their greater flexibility in pathing their services. This charging component has been particularly innovative but has also been somewhat controversial, so a discussion of its advantages and disadvantages would be very interesting.

The cost of electricity procurement and supply for electrified services is reflected in the traction electricity charge. There are discounts on this charge for trains operating with regenerative braking to reflect the cost savings that result from their lower net consumption of electricity.
The fixed track access charges applied to franchised passenger operators constitute a mark-up to ensure the Infrastructure Manager, Network Rail, recovers all its costs. They are substantial in scale, comprising approximately 80% of the total paid by franchisees to Network Rail, and cover the gap between the Regulator’s determination of Network Rail’s total revenue requirement and all other sources of Network Rail revenue: variable track charges to franchised passenger train operators, station charges, freight and open access charges, property income and government grant. The ORR calculates the total amount that Network Rail should recover for a five-year period following a standard “building block” methodology, and then calculates the charges by allocating this total to routes and then dividing it among franchised passenger train operators on the basis of vehicle miles operated. As this fixed element of the charge only applies to passenger franchisees, it is thought that it ends up being passed through to government by, in effect, suppressing the size of franchise bids at the time of franchising. It would be interesting to discuss the role, the effect and the efficacy of this fixed charge further.

An additional mark-up, this time affecting particular types of freight services, is to be introduced in 2009. Following the Government’s aspiration that freight services meet their full avoidable cost (the cost that could be avoided if freight services were withdrawn) a surcharge will be imposed on coal and on nuclear traffic. These were found to be the only market segments that could bear such a charge.

It is estimated that, on average, passenger charges currently comprise approximately 30% of total train operating costs; I.E. £1.9 b out of a total of £5.9 b. However, if the fixed component of charges (estimated to be approximately £1.5 b) is removed from the equation (on the basis that it is accounted for as an element in the size of the bid at the time of franchising and, there-after, beyond the control of the train operator), then it is estimated that variable charges comprise approximately 10% of total train operating costs; I.E. £0.4 b out of a total of £4.4 b. These estimates are based on figures from Train Operating Company accounts, for the year 2003/04.

The detail of the various charging components is subject to revision as part of the current Periodic Review of Track Access Charges. This has included consideration of revisions to the track variable usage charge, the capacity charge and to fixed charges, as well as consideration of the cases for introducing reservation/scarcity charges and/or environmental charges. It would be useful to understand current thinking on these issues.

France

The ECMT review characterised French infrastructure charges as being based on marginal cost, with mark-ups to increase cost recovery (MC+). However, it was also noted in the RAILCALC review that “tariffs are mainly determined on the basis of financial considerations and are not based on a detailed methodology to determine the
marginal cost of the infrastructure” (RAILCALC, 2007). It would be interesting to clarify this issue further.

The charging structure comprises 4 main components:

- An Access Charge – differentiated by four different types of line and by up to 12 sets of different traffic characteristics, accounting for approximately 4% of charging revenue;
- A reservation charge – differentiated by time of day, accounting for approximately 55% of charging revenue;
- A running charge – differentiated by different train-types and applied per km, accounting for approximately 14% of charging revenue; and
- A charge for reserving stops at the main passenger stations (per stop reserved) – applied to passenger trains and focused on peak-hours, accounting for approximately 16% of charging revenue;

In addition, where relevant there are charges for electric traction and for use of marshalling yards and intermodal terminals, accounting for approximately 11% of charging revenue.

It appears that the system of charges seeks to take account of maintenance and renewal costs through some combination of the Access Charge and the Running Charge. However, the differentiation of the Running Charge such that freight trains pay a lower per km charge than do passenger trains would appear to be counter-intuitive in relation to the expected wear and tear associated with freight versus passenger trains. Indeed, it has been suggested that these freight charges may fall below the level of marginal cost. It would be interesting to gain a better understanding of the differentiation applied.

It is said that the Reservation Charge is an approximation to a congestion/scarcity charge, though the differentiation of the Access Charge by line-type may also be reflective of differing levels of congestion/scarcity on the different types of line. There is, however, no reference to how these congestion/scarcity components are estimated, though they are clearly substantial; in 2005 it was estimated that the Reservation Charge comprised 61% of the value of all charges. It would be interesting to better understand how the Reservation Charge is calculated and how the differentiation of the Access Charge is arrived at.

It is thought that the identification of sub-categories of line, according to traffic characteristics, is done – in part at least – for the purposes of applying mark-ups on particular traffic groups, in line with their willingness to pay. Further discussion of the use of mark-ups on different traffic categories would be very interesting.

Revenue from infrastructure charges are thought to equate to 63% of RFF’s total costs, whilst charge payments are said to comprise 33% of SNCF’s expenditure (2005 figures). It would be useful to confirm these figures and to discuss how they have changed and might change further in the future.
The charges can vary annually but are generally known at least one year ahead. It would be interesting to discuss the advantages and disadvantages of allowing for this degree of flexibility, as compared with the British case for example, where charges are confirmed for a 5 year period.

Germany

The ECMT review characterised German infrastructure charges as being based on full cost recovery, minus government grants and loans (FC-). It is structured into 3 main components, as follows:

- Pricing for train paths;
- Pricing for facilities (stations, terminals etc) and
- Pricing for additional services.

The system is said to be a ‘product-oriented’ system whereby all operators pay the same price for the use of identical train path products. The charge calculation formula can be seen in Fel! Hittar inte referenskälla.

<table>
<thead>
<tr>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base charge</td>
</tr>
<tr>
<td>x</td>
</tr>
<tr>
<td>+/-</td>
</tr>
<tr>
<td>x</td>
</tr>
<tr>
<td>+</td>
</tr>
<tr>
<td>=</td>
</tr>
</tbody>
</table>

*Source: DB Netz (2006)*

The level of the base charge is said to be cost based and depends on the track category. The whole network is divided into eleven categories. Additionally there is a 20 percent demand-based surcharge for high utilized tracks. It is not clear what the nature of the methodology used to estimate costs is, so it would be interesting to understand the cost-basis further.

It is suggested that there is “strong evidence that high speed trains do not cover their true (incremental) infrastructure costs when operating on dedicated lines with maximum speeds higher than 250 km/h” (Railimplement, cited in RAILCALC, 2007). It would be interesting to explore this argument further.

Table 4 shows the base charges for 2003 and 2006. The surcharges for higher quality track products are said to be an attempt to capture operators’ willingness to pay for higher quality. Again, it would be interesting to understand the methodology underpinning the estimation of willingness to pay here. For the purpose of these surcharges, track products are divided into the classes shown in Table 5.
<table>
<thead>
<tr>
<th>Track category</th>
<th>Base charge (€/train km)</th>
<th>Base charge for highly utilised tracks (€/train km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
<td>2006</td>
</tr>
<tr>
<td><strong>Long-distance tracks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fplus Tracks with maximum speed over 280 km/h</td>
<td>8.30</td>
<td>7.90</td>
</tr>
<tr>
<td>$F_1$ Tracks with maximum speed 200-280 km/h</td>
<td>3.51</td>
<td>4.02</td>
</tr>
<tr>
<td>F2 Tracks with maximum speed 161-200 km/h</td>
<td>2.53</td>
<td>2.78</td>
</tr>
<tr>
<td>F3 Tracks with maximum speed 101-160 km/h (mixed traffic)</td>
<td>2.28</td>
<td>2.47</td>
</tr>
<tr>
<td>F4 Tracks with maximum speed 101-160 km/h (inter-regional, fast traffic)</td>
<td>2.20</td>
<td>2.36</td>
</tr>
<tr>
<td>F5 Tracks with maximum speed &lt;120 km/h (slow traffic)</td>
<td>2.03</td>
<td>1.82</td>
</tr>
<tr>
<td>F6 Tracks with maximum speed 101-160 km/h (mainly short-distance passenger services)</td>
<td>2.00</td>
<td>2.13</td>
</tr>
<tr>
<td><strong>Feeder tracks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z1 Tracks with a maximum speed up to 100 km/h</td>
<td>2.13</td>
<td>2.21</td>
</tr>
<tr>
<td>Z2 Tracks without or with low-standard signalling equipment and a maximum speed up to 50 km/h</td>
<td>2.20</td>
<td>2.29</td>
</tr>
<tr>
<td><strong>Rapid transit tracks (S-Bahn)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1 Tracks with mainly or exclusively S-Bahn operations</td>
<td>1.46</td>
<td>1.55</td>
</tr>
<tr>
<td>S2 S-Bahn network Hamburg</td>
<td>2.09</td>
<td>2.09</td>
</tr>
<tr>
<td>S3 S-Bahn network Berlin</td>
<td>2.09</td>
<td>2.51</td>
</tr>
</tbody>
</table>

*Source: Nash et al, (2005), ; DB Netz AG cited Link 2006.*

<table>
<thead>
<tr>
<th>Track product factor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger services</strong></td>
</tr>
<tr>
<td>Express track</td>
</tr>
<tr>
<td>Track for synchronised timetable long distance services</td>
</tr>
<tr>
<td>Track for synchronised timetable short distance services</td>
</tr>
<tr>
<td>Economy track</td>
</tr>
</tbody>
</table>

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The regional factors are multiplicative surcharges for the use of certain regional infrastructure facilities. It is argued that the reasons for these surcharges are first higher costs, which combined with low demand, would not allow these parts of the network to remain in operation. In actuality, the impact of these regional factors is felt by the respective regional authorities, which purchase the transport service within the regions.

Traction energy is excluded from the train path price, but there is a charge for ‘service installations’, calculated according to the length of track, the length of catenary, the number of switches, and the number of peripheral facilities, performance-based constituents and ancillary and consumption costs.

Whilst reservation charges are not explicitly mentioned, the 2007 charging scheme does consider a specific charge for making an offer, which is levied when an ordered path is not taken up by the requesting operator. This would appear to be analogous to a reservation charge.

In addition to the willingness to pay component of the train path charge, the regional factors and the surcharges referred to above, mark-ups are permitted, subject to the approval of the regulator, for new investments and to allocate specific risks. It would be interesting to understand the process of establishing these mark-ups, and how it is ensured that they are non-discriminatory and do not deter traffic that would be willing to pay the marginal cost in the absence of the mark-up.

The ECMT review estimated that revenue from infrastructure charges equates to 60% of DB Netz’s total costs. However, RAILCALC highlighted that regional government pay a major contribution towards infrastructure charges in the regions, and estimated that government’s contribution to total rail infrastructure cost is approximately 65-70%.

**Relevant Research in Catrin**

This section sets out how the work in CATRIN is seeking to build on previous work in this area notably work undertaken in the FP6 Project GRACE. In particular our focus is how the work in CATRIN can help resolve some of the outstanding issues found in studies or found when studies are reviewed and compared (e.g. GRACE Deliverable 6 (2007)). We see the key issues as:

Differences in the absolute value cost elasticities (the ratio of marginal to average costs) and of marginal costs

The table above showed the (average) elasticity of cost with respect to usage (usage elasticity) for a selection of countries. The elasticities differ considerably between...
studies. We constructed a further elasticity, called the scaled elasticity, by multiplying the average usage elasticity by the proportion of total maintenance (or maintenance and renewal) cost considered in the study. This gives a more comparable figure because, provided the elements of cost excluded from each analysis do not vary with usage, the scaled elasticities give the elasticity of total maintenance cost with respect to usage. However the range of scaled elasticities is still very high. It must be noted that this computation was based on a limited amount of data from partners and further information would be welcomed to compute a more robust scaled elasticity.

In addition, the table above shows that the range of marginal cost estimates is even wider than the range of usage elasticities. For example the marginal cost in Britain are over three times greater than those in Austria and between 6-10 times greater than those in Finland.

Only comparing the mean elasticity and/or marginal cost may be too simplistic given the wide distribution of elasticities and marginal costs across the samples. Thus very small changes to the sample at the extremes, may have a large effect on the averages computed.

**Falling cost elasticity with respect to usage**

One of the most consistent findings from studies is that marginal costs are found to fall with usage. Not only this, for several studies they are initially very high with low usage levels but then fall very sharply, such that for medium and high tonnage levels marginal costs are very small. This counters an engineering expectation that there is no strong reason to suspect such a dramatic pattern.

It should be noted that in the case of a Cobb-Douglas model with a constant elasticity less than unity, it must be the case that marginal cost is falling (since marginal cost is less than average cost and so average cost must fall as usage increases, implying that marginal cost has to fall as well to maintain the constant elasticity). When a Translog cost function is estimated, again the elasticity is found to be less than unity and falling with usage. This implies that marginal costs fall even faster with usage than in the constant elasticity formulation.

This seems to be a robust finding across studies which have used a double log specification. Two exceptions are firstly Gaudry and Quinet (2002) which used a generalised Box-Cox model form and found a rising elasticity. The second are from two studies, Wheat and Smith (2006) and Andersson (2006a) which included a third order term for usage. They observed that while the elasticity did initially fall, eventually it began to rise.

**Distinguishing between passenger and freight vehicles**

The vast majority of studies have used gross tonne-km as the measure of output. This allows the MC cost for different vehicle weights to be established, but fails to allow for any other systematic variation in characteristics of vehicles. Evidence from engineering
studies would suggest that there are characteristics such as unsprung mass and the speed of the vehicle that effect track wear. As such it would be desirable if econometric studies could offer insight into variation of marginal costs with characteristics other than gross weight. As a minimum, distinguishing between gross tonne-km which result from freight movements versus passenger movements would be desirable as these traffic tend to have different characteristics.

Only Gaudry and Quinet (2003, 2007) have managed to distinguish between these traffic types. In both studies they find that per gross tonne-km freight trains are much less damaging than high speed passenger but regional passenger much more so. This slightly puzzling result may reflect the fact that regional passenger trains spend a lot of their time on relatively poor quality track.

Wheat and Smith (2006) tried to incorporate both passenger and freight gross tonne-km variables but find these do not yield robust parameter estimates. Data also exists in Sweden to analyse this distinction, however work to date has failed to produce robust estimates.

As with the issue of the falling elasticity of usage, results from other studies seem to conflict with those from Gaudry and Quinet’s studies. As mentioned in the previous section, there are two distinctive features of this study. The first is the rich cross sectional data set that they possess (1500 track sections). The second is the use of a generalised Box-Cox functional form as opposed to the double log used in other studies (either Cobb-Douglas, Translog or some intermediate case including some interactions terms). So it would seem useful to re-estimate models using the Box-Cox functional form and trying to include passenger/freight gross tonne-km distinction.

Accounting for infrastructure characteristics, capability and condition in the analysis

All studies have sought to control to some extent for these variables. Infrastructure characteristics are variables which describe the environment for which the physical infrastructure runs. These include the length, number, gradient and radii of tracks and the number of switches, tunnels and bridges on the track section. Capability or quality measures refer to variables which characterise the performance capability and inherent capital investment in the infrastructure. This includes variables such as the type and grade of the rail (continuously welded rail versus jointed track and rail weight for example) and the maximum line speed and axle load capability of the track.

Condition measures are more difficult to collect and apart from ages of rail (UK, Sweden and Switzerland), sleeper (Sweden and Switzerland) and ballast (Sweden) there are no other variables which are available for the studies. Examples of variables that could conceivably become available are horizontal and vertical displacement measures and number of broken rails and other failures.

Infrastructure characteristics, capability and condition variables are seen as important as they clearly are strong drivers of cost. It has been observed that marginal cost estimates between countries tend to differ substantially. However the average usage elasticities do
not differ by the same scale and thus there must be strong differences between average costs by countries. Accounting for infrastructure characteristics, capability and condition should hopefully give insight into why average costs differ so much between studies.

The table below shows the variables used in each study. While there are a lot of variables used, the balance of variables between each category differs from study to study. As noted earlier of particular, the lack of variables regarding the condition of assets is concerning.
We are also aware that the processes adopted by the infrastructure manager will impact on cost. For example, a determinant of the cost of doing maintenance and renewal is the possessions regime adopted e.g. closing a line versus working with a (reduced) timetable. This is difficult to examine since possession policies tend to be country wide,
however there maybe differences depending on the number of running lines for each track section (e.g. single versus double track).

Finally, in the Austrian case study, interaction terms between usage and infrastructure characteristics and condition measure were tested. Some of the interactions between the characteristics and output were found to be statistically significant and remained in the final specification. This approach is very interesting, as this allows the usage elasticity to be a function of infrastructure characteristics, as opposed to the approach in the other studies where the elasticity is independent of infrastructure characteristics, capability and condition.

Renewals

Renewals have proved more difficult to analyse than maintenance. This is due to two factors:
At the individual track section level, renewals tend to be lumpy. That is there tends to be periods with little or no renewal activity on a track section and then a very large amount of renewal activity as a large section of assets become due for renewal;
Track renewal is a function of cumulative traffic as opposed to current traffic. This presents onerous data requirements for direct specification of the relationship.

To date there have been two approaches used in the econometric literature. The first is to use a similar approach to that which is used to analyse maintenance expenditure. Renewal cost for one year is regressed against traffic for the same year and various infrastructure characteristics, capability and condition measures. Of the studies in 1 Andersson (2006a) examined renewals in Sweden and Marti and Neuenschwander (2006) examined “Contracting B” expenditure which includes some small scale renewals in Switzerland. Current traffic is likely to be correlated with past traffic and the inclusion of condition measures may proxy for the state of the assets in terms of life expired. However it is far from clear whether this is sufficient to yield an unbiased estimate of marginal cost.

The second approach is to use survival analysis. This requires data on traffic over the life time of the assets however does explicitly allow for the lumpiness of renewals activity. Essentially the approach models the probability that an asset will survive past a certain age conditional on a set of exogenous factors, here traffic. A deterioration elasticity can be derived which examines the reduction in expected life of an asset given a change in traffic. This allows a marginal cost of traffic to be calculated. Andersson (2006b) is the only study to apply this analysis to rail infrastructure. He reports marginal costs inline with his analysis using the year-by-year regression approach. It should be noted that the data requirements are onerous and where traffic data has not been available in the Andersson (2006b) study, assumptions regarding growth had to be applied to back cast traffic.
Scarcity

As commented above, the principle problem with the measurement of scarcity values is that there are only a small number of case studies, all relating to one line in Britain, giving no possibility of generalisation. A few countries do levy scarcity charges on particular parts of the network or for particular nodes; one such country is Italy, which has a relatively sophisticated way of taking account of the capacity requirements of different speeds of train. Therefore as well as seeking to develop a model which can be used as the basis of generalising scarcity charges, we will undertake a specific case study of the approach taken in Italy.

Conclusion and Summary of outstanding research issues

Currently rail access charges in Europe take a wide variety of structures and levels. Whilst this is partly because of different approaches to the principles in different countries, it is also the case that there is inadequate evidence on the measurement of marginal costs. In undertaking the work in CATRIN, we are aiming to develop understanding on a number of issues as outlined above. In summary these are:

- Understand why estimates of the ratio of marginal wear and tear costs to average differ so much between countries;
- Understand why estimates of marginal wear and tear costs differ so much between countries;
- Investigate the evidence for and explanations of falling marginal wear and tear cost with usage;
- Try to distinguish between the impact of different vehicle types;
- Account for infrastructure characteristics, capability and condition measures in a more systematic way;
- Improve understanding of how to measure marginal renewals costs.
- Develop a model which may form a basis for generalising scarcity charges, in the light of British and evidence.

A more detailed description of proposed work in CATRIN is given in Appendix A.

It would be useful to get the views of the group on these issues and on the work proposed or already undertaken on them.
References


Appendix A – Work Areas for CATRIN

Examine in more detail the definition of maintenance and renewal costs across countries

a) Further information on the proportion of costs considered in each study would be useful to understand better how each of elasticities reported in each study compare to each other. We would use this information to improve the calculation of the scaled elasticity.

b) Information on the constituent activities of operations, maintenance, renewal and enhancements – In addition, a more qualitative exercise of reviewing what activities constitute operations, maintenance, renewal and enhancements would be useful to better understand any differences in the results of studies.

Examine Box-Cox Functional Forms

c) Rerun models with a Box-Cox functional form – The Gaudry and Quinet studies do not suffer from the falling usage elasticity observed in other studies and are able to distinguish between passenger and freight traffic types. These studies depart from others in that they adopt the Box-Cox functional form rather than a double log variant. As such it seems beneficial to re-estimate models using the Box-Cox functional form.

Accounting for infrastructure characteristics, capability and condition

d) Partners to investigate the availability of condition measures – It was noted the limited number of condition measures available for analysis. The existing condition of the infrastructure is potentially a strong driver of maintenance and renewal cost. Thus it would be desirable if partners could re-examine whether there are any other suitable condition measures available for their case study.

e) Agree an a priori best set of variables to include in the model – In consultation with engineers, determine an a priori justification and ideally an expected sign for each variable. Obviously such justification and expected sign will be conditional on the other variables included in the model as each variable will, at least to some extent, proxy for each of the other characteristic, capability and condition variables. Ideally all partners would aim to use the same or similar variables in their analyses in order to aid comparability between studies. This set of ideal variables may contain interactions between infrastructure characteristics, capability and condition variables and usage variables to capture effects of these variables directly on the
usage elasticity. It may also contain variables to characterise the possessions regime such as whether the line is single or double track.

Renewals

f) Partners to continue to research renewal costs empirically where data permits – This may involve using the year-on-year approach or the survival analysis approach. It would be interesting to look at aggregation/averaging over time or over track sections in order to reduce the lumpiness problem in the year-on-year regression approach. Finally partners could continue work on dynamic modelling of renewal costs where appropriate.

g) Consider the theoretical assumptions required for the year-on-year approach to yield an unbiased estimate of marginal cost

Engineering approach

In conjunction with the econometric analysis, the project will undertake engineering analysis with a view of answering some of the above research questions. The work will apply engineering analysis to a set of case studies (either hypothetical or real) comprising different track and vehicle characteristics.

Literature review

h) For CATRIN as a whole, there needs to be a literature review on the various methods - econometric, engineering models (and use of engineering judgement), and the cost allocation approach (this approach may be combined with engineering and econometric methods) – and how these are combined to produce variable access charges. The review will also identify the key research gaps.
Air

Agenda

CATRIN Air IM Committee

1. Welcome and Introduction
2. The Cost Allocation Method in use
3. The Institutional Context
4. Shortcoming to overcome
5. Next meeting and other issues

Rome - ISIS
05 June 2008

Welcome and Introduction

• Juan Carlos Martin
  – Economics and Infrastructure Transport Research
    Unit of the University of Las Palmas
  – Air Committee Leader
  – WP Leader of CATRIN in Air transport

• CATRIN
  – Cost Allocation in Transport Infrastructure Cost
  – Implementing efficient pricing policies
  – Based on social marginal costs
  – Maintenance, Renewals and Operations.
  – Congestion and Scarcity would also be contemplated.
Cost Allocation Methods

- Full Cost Recovery
  - It means that airports are profitable units.
- Do we really know that prices are efficient?
  - I don’t think so.

Airport Charges, ICAO Guidelines

1. Non-discrimination in the application of charges.
2. No overcharging or other anti-competitive practice or abuse of dominant position.
3. Ensure transparency to determine the basis for charges.
Airport Charges. ICAO Guidelines

1. The cost to be shared is the full cost of providing the airport, including cost of capital and depreciation of assets, maintenance, operation, management and administration.
2. Airport users should not be charged for facilities and services they do not use.
3. The cost of facilities exclusively leased or occupied and charged for separately should be excluded.
4. The proportion of costs allocable to various categories of users should be determined on an equitable basis.

So what?
Is new EU Directive adding anything new?

Airport Charges. Real Practice.

1. landing charges.
2. passenger charges.
3. parking charges.
4. other aeronautical charges.
5. handling charges.
6. rebates and incentives.
7. non-aeronautical charges.
Landing Charges.

- Charges and fees collected for the use of runways, taxiways and apron areas, including associated lighting, as well as for the provision of approach and aerodrome control.
- Basic schemes
  - \( f(MTOW, OC) \)
    - \( MTOW \): Maximum Take-Off Weight
    - \( OC \): Other characteristics such as, Origin-Destination, Point-to-point vs. Local, Connected vs. Disconnected, Pax vs. Cargo, Peak vs. Off-Peak, Night Surcharges, Noise Surcharges, Emissions, Category of airport.
    - Normally two-part tariffs in which variable part depend on a metric ton or part thereof, or even is calculated according to weight categories.

Passenger Charges

- Passenger charges are related to the infrastructure and the services provided at terminals either as facilitation or as security charges. (ACI Europe, 2003). They are also cost based charges, intended for recovery purposes.
- Basic schemes
  - \( f(pax, OC) \)
    - \( Pax \): Passengers
    - \( OC \): Other characteristic such as, O/D (Schengen area), Transit, Departure-Arrival, Flight Type (regular-charter), (summer-winter)
  - Normally unitary rate per passenger
Rebates and Incentives

- Myriad of examples
- The Runway Charge is reduced for crew training or test flights (for ensuring that the Aircraft and the Aircraft instruments are serviceable).
- Positioning
- O/D like Short Distance or Double stop flights (Scotland and Islands in some EU countries).
- In BAA airports exist an automatic rebate in passenger charges for all aircraft using remote stands.
- Manchester gives 25% parking charges for those airlines scheduled to operate at least 364 days a year.
- They are a source of important conflict between airports and airlines.

The Institutional Context

- ICAO Guidelines and EU Directive
- Different type of airports
  - Airports fully State owned/managed: (Spain, Portugal, Ireland, Finland, Sweden, France, Greece, Amsterdam)
  - Airports involved actively in privatization plans, with State maintaining minority shares in capital, often controlled by local authorities: (Germany, rest of Belgium, Manchester, Milan, Venice, Athens)
  - Fully or partially privatized: (UK, Brussels, Rome, Naples, Vienna, Copenhagen, Frankfurt)
The Institutional Context

- Price Regulation
  - Single Till
    - BAA and ADP
  - Dual Till
    - Fraport and Schiphol
- RPI-X. Where RPI represents the change in the retail price index, and X is generally considered to be a productivity factor, which could be positive if the industry is expected to operate more efficiently in the future, or negative if other case.
- Public Prices
  - France, Spain and Portugal
  - Its evolution used to obey, in many cases, to the different transport policies.
  - Airport have been traditionally considered as public services

Shortcomings to overcome

- The application of guidelines are not clear.
- What happens if first best prices produce more or less revenues.
  - Different stakeholders would react very differently depending on this result.
- Airlines would take different positions based on their own effects.
  - LCC vs. Incumbent airlines
- Are airlines price-elastic to change their behaviour?
  - Can load factors and airlines strategies with respect to overbooking practices be also affected?
Shortcomings to overcome

- Lack of good studies to see whether some practices are discriminatory or not.
- Too much noise for every change in airports charges.
  - Lack of flexibility
  - Cumbersome activity which is usually based on winners and losers and not in terms of economic efficiency.
- Airport managers are more interested in safety and security than in economic efficiency.
  - This follows a trend in history.
- The academic papers seem to be science fiction and not real case studies.
  - They are really far from real practice.
  - Their interests are based on publication and not in resolving real problems.
Waterborne

Committee meeting 19 May 2008

Categorisation of infrastructure

The characteristics, in terms of costs as well as in terms of policy contexts, differ considerably between different parts of the waterborne infrastructure. Thus, a categorisation of infrastructure may be fruitful. A possible approach is as follows.

Open water

Outside coastal areas and archipelagos, where natural preconditions offer sufficient water and room for maritime navigation, without specific measures to improve the infrastructure.

Charges are regulated by UNCLOS and its obligation for states to provide “innocent passage”.3

Maritime access

Fairways from the open sea to port areas and to inland waterways, where specific measures, like dredging and aids to navigation, are needed.

With reference to port state jurisdiction states may apply charges for vessels that pass a fairway to call a port in the state or enter inland waters. However, charges must not be discriminatory. National legislation does exist.

(Maritime) Port areas

The area directly linked to port operations. It involves docks and quays, but also waters needed for manoeuvring and, when relevant, for anchoring.

European legislation with relevance for the area has been proposed, but no EU rules have been passed.

Inland waterways

The inland waterway involves channels, locks, etc.

National and regional legislation do exist. The Manheim Treaty, prohibiting navigational charges on the Rhine river, probably is the most prominent piece of legislation in the field.

3 Coastal state jurisdiction. For vessels who claim the right to innocent passage the coastal state can only assume rules regarding construction, design, equipment or manning if these constitute an expression of an internationally accepted standard i.e. in principle the rules that are laid down in various international conventions3.
Inland ports

Tentatively, it is suggested that inland ports are defined as a separate infrastructure category. An alternative could be to merge ports into one group.

Definition of Infrastructure cost – cost components of relevance

Aids to navigation (AtoN)

Aids to navigation, in terms of lights, buoys, beacons, etc. are an obvious part of the infrastructure for waterborne traffic. First and foremost costs related to AtoN have importance when it comes to port related fairways and to inland navigation.

In many cases an issue, however, is how to allocate cost between commercial shipping and leisure-boating. For some fairway the allocation may be obvious: On the one hand side fairways dedicated for leisure boat traffic and on the other hand fairways to major ports where commercial shipping totally dominates.

Hydrographic survey

Hydrographic survey is an important element of the provision of maritime infrastructure. The depths set the stage!

For open waters hydrographic survey typically is a one time investment. When the bottom topography once has been described, and areas with sufficient depths have been defined, there is rarely reason to redo the exercise. Typically, survey at larger depths is less expensive than survey in shallow waters.

For channels to ports and for inland waterways the situation is different. Often, regular control measurements are called for. Sediment transported by rivers, or by water movements caused by vessels, builds up and influences the fairways capacity. Control programmes may call for more or less frequent controls, some fairways may demand monthly controls for others every ten years or less may be sufficient.

Dredging

Dredging is an issue for port related fairways, but the situation differs considerably. In some cases the natural geography offers proper conditions and no or very limited dredging is needed. More often dredging operations has to be undertaken, often regularly. For inland waterways, the need for dredging most often is considerable.

Navigational charts

According to the International Convention for the Safety of Life at Sea (SOLAS), all ships shall carry adequate up-to-date nautical charts and other nautical publications necessary for the intended voyage. Furthermore, SOLAS concludes that the coastal states have to publish the nautical publications in question.
The production involves fixed costs for the collection of information concerning topography, hydrography and aids and services as well as for editorial work. Variable costs are related to printing and/or distribution of the information.

**Icebreaking (when relevant)**

Icebreaking involves considerable investments in icebreakers. During off-season some icebreakers can be used for other purposes, such as off shore activities, while others are dedicated icebreakers with no alternative use. Icebreaking involves considerable marginal costs in terms of fuel and emissions of air pollutions.

Within the European Union the need for icebreaking, related to Maritime shipping, is focused to the Baltic Sea, with particular needs in the Finnish Bay and in the Bottnian Bay. Ice may also be an issue in some European inland waterways.

**Emergency planning**

Emergency planning aims to reduce the consequences of accidents and crisis. The objective is to achieve preparedness to adjust to unexpected situations. It may include alternative routing if a fairway temporarily is closed. Alternatives are analyzed beforehand and measure may be taken to increase flexibility.

It could be argued that actions in this area are part of a sound infrastructure management, aiming at maximizing the benefit of the infrastructure, also during exceptional circumstances. On the other hand, it may be difficult to define the costs for emergency planning that reasonably should be allocated to waterborne transport.

A tentative conclusion based on Scandinavian data is that the issue rather is of an academic interest. The overall budget for Swedish maritime emergency planning in 2008 is € 100 000. It corresponds to less that 1 per mille of the Swedish Maritime Administrations budget. Thus, the cost category is limited and hardly effects cost structures or overall conclusions on charging. It may well be left aside.

**Search and rescue**

National organisations for search and rescue involve important investments in information systems, rescue boats and helicopters. On the one hand it can be claimed that maritime search and rescue services are closely related to corresponding services in other sectors, like aviation and pleasure boating, etc. A major part of the costs are fixed. For the SMA, the fixed share is about 90 percent of the total costs for search and rescue.

**Pilotage**

Pilotage is generally rather seen as a service than as infrastructure in the European transport policy discussion. Shipowners most often have the choice to hire and educate officers with the technical and nautical skills to qualify for pilot exemption.
Nevertheless, pilotage can also be viewed as infrastructure or at least as an alternative to the provision of traditional fairway infrastructure. Additional investments in fairway capacity and quality would reduce the need for pilots for ships at “the margin” – ships near the limit for mandatory pilotage.

Pilotage is generally financed by pilot fees. In some countries the full cost is charged to users, in others part of the costs are funded by a general tax/charge on maritime shipping.

*Quays, docks and jetties*

When it comes to ports, a distinction is normally done between infrastructure and suprastructure. Quays and docks are seen as infrastructure but warehouses and elevating equipment such as cranes, pumps, etc are defined as suprastructure.

Costs related to modern quays and docks are basically fixed. Normal use give rise to limited were and tear. However, careless manoeuvring of ships may considerably influence the costs to keep the quays in shape.

*Land rent*

Land rent may be an important part of the costs to provide port infrastructure. The cost category is looked upon most differently from one port to another.

*Locks*

Locks are characterised by large investment costs and long (technical) life span. Marginal costs for operation are non neglectible. Apart from financial costs for manning and wear, it is fairly common that the operation of locks have side effects/costs on other modes of transports.

*Justifications for European or international legislation on charging*

The justifications for European or international law may differ between kinds of waterborne transport.

*Open waters*

Analytically, “open waters” is probably best seen as a common good. When used by someone, it does not prevent someone else to use it and it does not add costs for the “infrastructure manager”. The financial cost to provide the infrastructure is close to zero. Charges on foreign traffic could be tempting, but would hamper the global economy.

Traffic causes externalities in terms of air pollution though. Economic incentives could trigger emissions reductions. An international framework for emission charging or emission trading could reduce administrative costs, reduce risks for market distortions as well as for discriminating charging schemes.
**Maritime access to ports**

Maritime accesses are used by the ports customers. Excessive charging would then first and foremost hamper the port business, but not the global economy. Local regional or national infrastructure managers may have incentives to recover their costs for providing the infrastructure, but to do it in a way that does not harm the port business.

Arguments may be raised for environmental charges to make up for air pollution. In long access fairways, such as fairways through extensive archipelagos, cost for air pollution are considerable. On the other hand it can be argued that emissions are better handled within a general charging scheme (for open waters).

**Sea ports**

The main justifications for European policy related to Sea port infrastructure is to:
- Prevent distortive state aid. It has been argued that aid to one port can harm to competitiveness of a neighbouring port active in the same market segment.
- Trigger efficiency by eliminating monopolistic charging (and reduce barriers for market entry).

**Inland waterways**

There may be reasons to look upon inland waterways in close parallel to road and rail. The justifications for European charging policy may be similar. Rail charging as well as the charging of HGVs are regulated in European law.

The infrastructure has a character of a common good, but the use gives rise to (social) costs.