# Evaluation of the final report "ANALYSES OF PRECONDITIONS FOR THE IMPLEMENTATION AND HARMONISATION OF NOISE-DIFFERENTIATED TRACK ACCESS CHARGES", established by KCW, Steer Gavies Gleave and TU Berlin for EC DG TREN.

## Purpose of this paper

In October 2009 EC DG TREN published on its website the report "ANALYSES OF PRECONDITIONS FOR THE IMPLEMENTATION AND HARMONISATION OF NOISE-DIFFERENTIATED TRACK ACCESS CHARGES" (in this paper short named KCW study), established by a consultant's consortium of KCW, Steer Gavies Gleave and TU Berlin for EC DG TREN. As UIC in collaboration with CER and EIM had in summer 2009 as well analyzed this issue it seemed to be justified and useful to evaluate and summarize the KCW study in a critical overview from the railway sector. Therefore this paper intends to summarize the finding of the KCW study and to point on –if there are any- misinterpretations of data, diverging opinions or positions of the railway sector. It is structured in a synthesis with the main content of the KCW study and the main results of the evaluation which is followed by a detailed evaluation of the study.

### Synthesis of the evaluation

**An extensiv study correctly analysing rail freight complexity:** The KCW study has a volume of almost 100 pages and is arranged in 7 chapters plus a final chapter with recommendations. The study analyses the rail noise situation in Europe recognizing that the main rail noise source lies in noisy freight wagons and localizing retrofitting as an efficient way to reduce rail noise. The EC therefore recognizes retrofitting as the most efficient means in its current noise policy. The policy proposes noise differentiated track access charges (NDTAC) as the main incentive. Objective of the study is to propose NDTAC which should enable retrofitting within 5 – 7 years. The rail freight market is analysed and the risks of modal shifts by the impact of NDTAC on intermodal as well as intramodal competition. Further the complex contractual relationship between Infrastructure managers (IM), railway undertakings (RU) and Wagon keepers (WK) is analysed in detail as well as the existing track access charging and its compatibility with the upcoming NDTAC. The study developed proposals on the level of NDTAC based on investigations on the available technology for retrofitting, its costs a well as operational and administrative costs.

**NDTAC proposal based on bonus only:** The study proposes a NDTAC with the following main characteristically elements: NDTAC consists in a bonus with a fixed level to be applied over a defined period of either 6 or 12 years; the bonus is to be paid to all silent wagons (not only to the retrofitted ones). The bonus levels proposed for the 6 years model are for LL-blocks 0.012 €/km (4-axle wagons) or 0.005 €/km (2 axle wagons) resp. for K-blocks 0.032 or 0.016 €/km. Corresponding values for the 12 years model are 0.009/0.004€/km (LL) resp. 0.019/0.009€/km (K). The charging process is proposed to be fixed between IM and RU, RU is charged to allocate the bonus to the WK. As a short time solution self declaration is proposed, as a long term solution the use of TAF-TSI. No differentiation on time or routing of the NDTAC is recommended; member states are invited to consider the introduction of an additional bonus for trains consisting only in silent rolling stock.

**Deficits in the study result a NDTAC system with a questionable incentive for retrofitting:** The evaluation showed that the study analysed all processes and details carefully. However quite a few points of criticism have been found (see detailed evaluation). The 2 main fields of criticism are:

- In limiting the whole charging process to IM and RU, the study neglects the main influence of complexity to charge the NDTAC. The study did not investigate whether the proposed NDTAC process will really incentivise the WK to retrofit their wagon fleet.
- The study underestimates the additional operational cost (by about a factor of 2) as well as the administrative costs, this is in part related to the above point of criticism; in part also to the fact that no costs have been allocated to the new institutional Clearing body and the related processes, proposed by the study. The proposed levels of NDTAC are consequently too low; it is questionable whether they will actually form an incentive for WK to retrofit their fleet.

## Detailed evaluation of the study

For practical reasons this evaluation will follow the structure of the reviewed KCW study. It will summarize and evaluate the chapters in their succession in the KCW Study. To allow a better overview, critical remarks are underlined.

### 1. Executive summary:

This chapter summarizes the report on 3 pages. It will not be commented here, as our remarks will be done in the respective chapters of the study

### 2. Introduction:

The introduction describes the railway noise problem as well as the European Commission's approach to solve the railway noise problem. It is well outlined that the railway noise might be reduced in an effective way in retrofitting the existing freight fleet. The main factor hindering the retrofitting by the rail freight stakeholders is recognized in the commercial constraints. The authors estimate the fleet size to be retrofitted to some 370'000 wagons, this low estimate is explained later in chapter 7. In the correct estimate that 50 % of rail freight traffic is international, the authors see a risk in national abatement strategies as already practiced in the Netherlands and in Switzerland, as these might give some RU competitive advantages; however it is not explained in what this competitive advantage could consist. It is further stated and explained that the EC favors a European coordinated approach, as it also was stipulated in the former PWC impact assessment, delivered to the EC in 2007. The chapter finally stipulates that the study will analyze the challenges for the practical implementation of noise-differentiated track access charge, will develop appropriate solutions in cooperation with the stakeholders concerned and will explore other preconditions which must be fulfilled in order to secure a successful implementation of a noise-differentiated access charge. In practice it has to be noted, that the co-operation with stakeholders was limited to one meeting (mostly dedicated to the question of TAF-TSI) as far as it concerns the UIC/CER; further the UIC report the implementation of noise related track access charges (2009) was sent to the KCW consortium. In addition the consortium contacted some operators an IM, in the references of the report a list of these contacts would have been helpful, but is missing.

### 3. Scope and objective of the study

Chapter 3 has 3 subchapters: Subchapter 3.1 explains the (railway) noise and its sources. The main rail freight noise source is acknowledged to be the rolling noise and it is recognized that these noise levels might be reduced by up to 15 dB(A) using K or LL blocks instead of cast iron blocks. The authors of the report think that beyond retrofitting the rail freight noise could be additionally reduced in using noise absorbers or bogie suspension, without specifying these measures more in detail. However it is postulated that they should be supported by noise differentiated track access charges (NDTAC).

Subchapter 3.2 explains the structure of the report as well as its methodological approach. The objective of the study is explained to be the identification of an incentive system securing the retrofitting of the freight wagon fleet within a time horizon of 5-7 years. The level of complexity and administration costs should be kept to a minimum. Furthermore the incentive system should not weaken the overall market share of the (rail) freight sector. The results of analysis and researches were submitted to review to a large panel of experts on each issue; but in the report there is no record of these reviews or interviews.

Subchapter 3.3 clarifies the scope of the study. Emphasis of the study is correctly led on freight wagon, stating that for an efficient and real noise reduction a significant number of freight wagons with high mileage have to be retrofitted due to the logarithmic instead of linear decrease of noise. It is concluded that the existing fleet has to be retrofitted in chapter 7..3 'existing fleet' will be defined including all vehicles built after 1980 an excluding the older fleet of some 250'000 vehicles. Passenger coaches are further not considered, as these are already equipped mostly with silent disk brakes. Concerning the analysis of countries focus is set to those hosting the main European rail freight corridors with the highest freight traffic volume. Several point are declaimed to be out of scope for the study: Excluded is the analysis of constraints to apply externality charges to infrastructure user; but the authors of the study share the view that a rise of (rail) freight prices will have an

impact to the modal shift. Out of scope are also other noise abatement strategies (noise screens) as PWC already concluded the retrofitting to be the most cost efficient. Further out of scope is the question of direct funding the retrofitting; it is stated that PWC concluded NDTAC to be a better incentive. The authors also quote from the PCW study that direct subsidies would not incentivize the wagon keeper (WK) to keep costs for retrofitting low, but this argument could easily be met in limiting the sum paid for retrofitting.

**4. Academic approaches and development of design options.**

Chapter 4 includes 3 subchapters. The first subchapter gives an overview on the TSI Noise quoting the relevant noise pass-by limit values (the author speak of noise emission ceilings which is the wrong term in this context) and mentioning that wagons retrofitted with composite brake blocks are automatically homologated.

Subchapter 4.2 analyzes three possible approaches toward NDTAC: A first system based on rolling stock design criteria (split up in noisy/non-noisy design) is balanced against a second concept with noise emission ceilings, based comparison of real time noise measurement along the lines with preset noise emission ceilings; further a third solution is a Bonus/Malus system based on the TSI noise values; for this concept the idea is that wagons with a TSI certificate could receive a bonus and those having no certificate are submitted to a malus. The study concludes that the first and third approaches are similar and are in consequence linked to one design option.

Subchapter 4.3 analyzes the two possibilities to relay either on pass by noise or on TSI noise. For both possibilities the main characteristics are listed without coming to conclusion in this stage.

**5. State of the art of noise differentiated track access charges**

This chapter is structured in 3 subchapter plus conclusions. Subchapter 5.1 summarizes the Swiss NTDAC regime in force there since 2002. Specialty within Switzerland is that in addition to the noise bonus from NDTAC the retrofitting of the domestic rolling stock is fully funded by direct subsidies. All silent vehicles (freight and passenger) can claim the noise bonus fixed at 0.01 CHF/ axle-km (~.03€/wagon-km); there is no limitation of the bonus an operator could receive. The bonus is paid from IM to the RU; the RU's are responsible in forwarding the Bonus to other parties. The system is based on self declaration by the RU, general plausibility controls and punctual control actions have been announced. Some 12'000 wagons will be retrofitted in the program, their retrofitting is fully covered by direct funding. In evaluating the Swiss approach the study sees advantages in the relative low administrative costs due to the self declaration and the unlimited bonuses, in the axle based bonus being the more accurate measure with respect to the noise and its source and in the common IT systems used by RU an IM. Main disadvantages are seen in the risk of overcompensation due to absence of limitations of the bonus, in the administrative costs burdening the RU in passing on the bonus, in the fact that a trust based system might not be exportable in a wider European context, in the fact that 90 % of the bonus are received by passenger operators and in the level of bonus, apparently to low to stimulate to date any other party outside Switzerland to retrofit their rolling stock due to the NDTAC. The direct funding of the national rolling stock is seen to be discriminatory.

Subchapter 5.2 analyzes the Dutch situation where a NDTAC system came in force in 2008. In the Netherlands operators may claim a bonus of 0.04 €cts/wagon-km for retrofitted passenger and freight vehicles; this bonus is limited to a maximum mileage of 120'000 km or 4800 € per vehicle. The differentiation between passenger and freight vehicles, still mentioned in the study, is not anymore applied. IM has to keep record on the mileage of all vehicles in the program to control the existing funding limits. Financial flows are only fixed between IM and RU; for passing on the bonus to the WK/WO the market is supposed to solve the problem. Till autumn 2009 no freight operator applied for the bonus due to the low incentives. In addition noise ceilings on railway lines are planned to be introduced. The study contains too a prognosis on the development of the low noise Dutch freight fleet noting that data consists in the former NS fleet. This prognosis seems rather optimistic given the fact that currently no positive reaction to the NDTAC is known. Advantages of the Dutch system are seen in the bonus level, safeguarding overcompensation of the retrofitting cost, but the bonus level is also seen as disadvantage to encourage currently the retrofitting, especially using k-blocks. The self-declaration by the RU to IM is seen simple to implement, no comments are in the report regarding the control costs to check total bonus; however the authors raise the problem that

in a European context data on the distances travelled should be gained from each wagon in Europe; but is recognized that this would cause high administrative costs. A bonus limitation on time basis is seen to be easier to implement.

A subchapter 5.3 deals the other noise abatement programs in Europe, no other application of NDTAC could be localized. Planes on NDTAC have been discussed in Austria but are not ready for application currently. Pilot application of NDTAC are planned in Germany in the project 'Leiser Rhein', the study does not mention Germany's plan to introduce NDTAC in the next few years.

Subchapter 5.4 summarizes and concludes on existing NDTAC-systems in seeing the self-declaration as simplified approach and in using existing cash flows between RU and IM and leaving out payments to the WO/WK; but it has not been investigated how far in this case the bonus still remains an incentive to WO/WK. The bonus level should be high enough to incentivize RU to apply for; administrative costs to raise the bonus should be lower than the bonus itself.

**6. Framework condition for the implementation of noise differentiated track access charges**

This chapter is structured in13 subchapters; it forms one of the most important parts of the study. Subchapter 6.1 contains in an analysis of freight market. It recognizes that all non-bulk freight markets have to comply with a highly elastic demand as the road freight is a close substitute. It considers these fields as highly vulnerable to prize changes.

Subchapter 6.2 analyzes the substitution risks of modal shifts. It is recognized that the type of goods is one influencing factor and that price elasticity and modal shift risk are in parallel. The risk of modal shift is limited in some cases by long relationships with customers as well as by the reliability of a logistic chain including rail. The study also realizes that varying the NDTAC in function of products or wagon types would be too complex to implement. Concerning the impact of NDTAC on the modal shift the study concludes that the funding source (Member state or railway sector) will have a larger impact on the modal shift than choice of design options; the system should not become more expensive than it currently is or it would have an negative impact on the overall modal split.

Subchapter 6.3 is dedicated to the impact on the intra-modal competition. The analysis showed that the rail freight market is structured in four main groups (incumbent operators, newcomers, expanding RU and local suppliers) and that about half of the rail freight traffic affects 2 or more countries. The study concludes that NDTAC would have the same effect for all players and that the impact of the design options on intra-modal competition is considered as limited.

Subchapter 6.4 consists in a in depth analysis of European market for freight wagons and the resulting contractual relationships. In this chapter the complexity of the rail freight wagon market is correctly and in detail recorded. It is reported that 2/3 of the rolling stock are owned by former state-owned railways, that private RUs and shippers/clients own another 13% and that 21 % are owned by renting companies. In this chapter the study also concludes that any NDTAC necessarily has to take into consideration how incentives will influence the entities responsible for the retrofitting and not only the RU. Another conclusion is that the existing TAC relationship will be targeting the wrong entities as far as retrofitting goals concerned. It seems that these conclusions have been abandoned later in the study. In addition the study is not clear in the point whether the WO or the WK has to finance the retrofitting; both statements are to be found in this chapter. The structure of existing contractual relations is correctly illustrated in 5 examples including the observation, that in a freight train all models may occur in combination together. In their analysis of theses contractual relations the authors of the study realized the difficulty to pass on the bonus over several levels especially in the case of involved rental companies. They too conclude that, the more industry stakeholder are involved, the higher the incentive level will have to be set to compensate the involved transaction costs. As conclusion the study proposes either to transfer the bonus directly to the party financing the retrofitting –this model is according to the authors suitable for simple contractual relationships with few parties involved- or to factor the estimated revenue (bonus or malus) into the rental price – here the authors see as an advantage that the contractual complexity wouldn't been changed. The study does not propose any model as a solution. This seems to be a weak point of the study, as it is not analyzed how far especially the second model (inclusion of the incentive into the rental price) would form an incentive for the investing party to do the retrofitting.

Subchapter 6.5 lists the cost elements of the NDTAC. The study propose to base the incentive level

on the costs associated with the retrofitting, the wagon tracking and recording and the actual accounting, but not with the administrative costs for the IM, these costs are considered to be irrelevant for level of incentive but have to be taken in account for the economic costs of the whole incentive system. The types of costs for the retrofitting are in this chapter correctly recognized; the cost levels however are dealt with in a later chapter (and will be commented there). The analysis of costs for data recording and data exchange is incomplete, as the study fails to analyze the effect of changing current data exchange, based mainly on trains, to the needed data exchange for NDTAC with additional data, based on wagons and including recording and data storing the whole journey history for each wagon. Further, accounting costs are only localized at IM not including the RU and/or WK/WO expenditures.

Subchapter 6.6 analyses whether a differentiation by time or by route should be of applied and comes to the conclusion not o introduce any of these elements as it would raise the complexity of the system and would have negative impacts on the RU's and WK's ability to plan ahead.

Subchapter 6.7 deals with the general framework for a wagon specific accounting system and investigates in particular wagon tracking possibilities and in particular a possible TAF TSI use. It states that the wagon specific data (noise characteristics) has to be stored in the wagon register data. It is acknowledged that TAF-TSI is only a framework, but not a database or an application, ready to use for NDTAC. The study assumes correctly that a future additional TAF-TSI application could be NDTAC identification systems and corresponding charging software. It further analyses the elements usable for NDTAC in the WIMO-module, in this context it not clear how the authors think to allocate the mileage of a wagon on a given train path to the various networks; in the WIMO such information seems not to be included. The study concludes that TAF TSI will not be usable for NDTAC in time and that interim methods will have to be introduced for short term results concerning NDTAC. The study also investigated other TAF applications in use, among them the Dutch Gotcha system, the Dutch RFID application, Austria's Artis-System, GPS and Video-systems as well as the RAILDATA system. The study concludes that the use of the current TAF-Systems for automatic charging is technically possible but economically unfeasible. Concerning TAF-TSI the authors consider that it could be used for NDTAC and charging and that administrative costs could be lowered by its different usages, but the study gives no indication why and how these costs could be lowered, also no cost estimates to develop and implement the therefore needed modules are given.

Subchapter 6.8 gives an overview on the various European track access charging schemes and on the compatibility of NDTAC with national TAC and directive 2001/14. The study works out a set of indicators to assess whether existing TAC could be compatible with NDTAC; among these requirements are a charging based on kilometric performance, charging including environmental elements, charging on the basis of wagons or trains (or both), the possibility to charge or pay other parties than the RU and the level of targeted cost recovery in the existing TAC. The study investigates the TAC of Austria, Czech Republic, France, Germany, Italy, the Netherlands, Poland, Sweden, Switzerland and the UK. The presented TAC-System of Poland consists in the status of 2006 and not in the current one; the evaluation did not check whether also for other countries the presented results are outdated. The findings are that almost all investigated countries have train-km depending elements, in Italy and Poland even these elements are missing. Only the UK sets charges based on wagon kilometres. Only Sweden includes charges regarding external costs (for diesel traction). Only Switzerland differs between freight user groups (Incentives for piggyback trains). There is a large band of applied levels of targeted cost recovery between 5% (SE) and 92% (PL). The study concludes that a wagon based accounting system would have to introduced in almost all MS on top of existing TAC; the noise related component of TAC should not be a same EU-wide percentage of existing TAC, it should be set on a identical level in all member states to make it's effect calculable for the RU/WK.

The 6.9th subchapter analyses the possible technical solutions. The study excludes correctly the disk brake solution as not practicable for a general retrofitting. In sum the study advises to focus on LL-blocks as this technology increases due to lower costs the effectiveness of the incentive system. But as the homologation of LL-blocks might be further delayed, the consultants also consider the K-blocks in the study.

The chapter 6.10 investigates the methods of measuring noise. The study sees that real noise

measurement will have to be limited to few stations regarding the costs of such installations. This limitation has also consequences for its use for NDTAC purpose: the trains will have to be incentivized for the whole journey according to a single or few measurements or the application of the incentive is restricted to a limited area. The authors consider 'pass-by-measurements' only suitable for charging whole trains and consider the correlation and allocation of noise measurements to individual wagons as difficult. The authors think, that TSI-conformity measurement have to be executed at a test laboratory; these measurements are in reality done on TSI conform test tracks.

Subchapter 6.11 seeks to find out the usability of the system for other differentiated TAC. It seems questionable whether this chapter lies in the scope of the study. The authors conclude that other external effects such as CO2 emissions could be taken in account. It has to be pointed out, that currently there are no other external effects than noise known to be based on single wagons. Especially CO2-emissions are characteristically based on the traction of whole train. There seems to be neither need nor benefit of a wagon based NDTAC-system for any other purposes than noise.

Subchapter 6.12 summarizes in a table the various constraints for the implementation of NDTAC either as a TSI-based rolling stock NDTAC or as pass-by-noise based NDTAC. As result of this comparison, subchapter 6.13 concludes that a design option based on TSI noise will be the preferred option. Advantages are seen in the availability of the technical solutions as well as in the fact that no cost intensive installations as measurements stations are needed.

**7. Development of the preferred NDTAC**

This chapter and its 4 subchapters are dedicated to develop a model of NDTAC, the general characteristics of its charging and the related charging process as well as the level of an incentive.

Subchapter 7.1 defines the constraints of the NDTAC, which are said to be derived from the previous chapters. According to this subchapter the NDTAC should be based on the fix and additional variable costs caused by the retrofitting; as these costs correlate with the number of brake blocks and axles the calculations basis for the bonus is correctly based on the number of axles. To encourage the WK to retrofit the incentive must allow a secure planning. The procedures will be based on existing charging systems or on planned (TAF-TSI) processes, this statement is contradictory to the also stated need that wagons have to be recorded separately which is currently not the case and not planned. In a bonus & malus model self-declaration as method is excluded due to the not viable dataflow, as all wagons would have to be reported. It is also correctly recognized that a malus would weaken the sector. It is further stated that not all wagons on all rail corridors will have become silent and it is concluded that focus should be frequently used wagons and network parts with heavy traffic; therefore NDTAC needs only to be applied on major national networks only also to save administrative costs. However it has not been analyzed what would be the impact of these limitations on i.e. mixed trains; the proposal, small networks (what is small?) should NOT charge NDTAC seems also be in contradiction to the study's finding that the level of bonus should be the same everywhere in Europe.

Subchapter 7.2 analyzes the charging process and the bonus level. A first section of this subchapter clarifies in detail the charging process between IM and RU, the study recommends not implementing additional dataflow including WK/WO as this would cause more additional administrative costs. With this recommendation the study neglects the main problems to implement NDTAC. In the former chapter 6.4 the study correctly did analyze the market structure of the rail freight sector and especially the complexity of the wagon owner structure. As substitute the authors propose a 'clearing body' to which the WK/WO may address to receive information on bonus payments. No cost estimates on this new process have been included in the study. As alternative the authors think that the WK may factor the retrofitting cost in the rental price. No investigations have been done in the study whether this new factoring process still could form an incentive for the WK to invest in retrofitting. An "*option 1 charging process using TAF-TSI"* is sketched on the assumption that every party feeds the relevant data into the database, and that then the RU will be able to calculate the bonus in using all this information plus a supposed connection between the NDTAC database and the regular TAC schemes. No cost estimates on these additional TAF-TSI elements and processes are in the study. According to the study the RU 'may' pass the eligible share of bonus to the WK or the bonus may be factored generally into the renting price. No investigations have been done in the study whether either of these new factoring process still could form an incentive for the WK to invest in retrofitting. As

short term solution the implementation of an "*option 2 charging process using self declaration"* is recommended. The study sketches a feasible charging process between IM and RU; RU has to pass on the bonus to the WK on annual or semi-annual basis. The process is controlled by a control and enforcement body or alternatively the WK should be factored into the renting price. The study did not investigate the costs of this control and enforcement body. It therefore remains questionable whether the total administrative costs are really minimized as the study claims to do. Also no investigation have been done whether the new factoring process could still form an incentive for the WK to invest in retrofitting or whether it could hinder his business opportunities in the freight wagon rental market.

The second section of subchapter 7.2 analyses the level of bonus. As a basis for these investigations the costs of the retrofitting itself (initial upfront costs), the mileage related costs (operational costs) as well as administrative costs have been gathered or estimated and are listed in the study. The list gives no source of the used data or background. The costs of retrofitting are localized for K-blocks at an appropriate level of 6-10000 €/Wagon (4axled), resp. 3-6000 €/Wagon (2-axles). Concerning LL-blocks it is not clear what kind of block has been used for the estimates (sinter or organic); the estimated costs of i.e. 500-1600 €/s-Wagon (4 axles) are too low by at least a factor 2 even for the cheaper organic blocks according to existing practical experience in the rail sector. To estimate operational costs the study claims to be based on literature and stakeholder consultation; on this background the authors recommend to use for K-blocks the value of 4 €/1000 Wkm (4axled), citing the former PWC study, but without giving any detailed explanation or calculations for this result. To include the costs of the additional wheel wear the authors propose to increase this value by 1.3 €/1000 Wkm to a total of € 5.3/1000km. These costs are by far too low compared to the practical experience already gained in the sector in using synthetic brake shoes; the additional operational costs (brake shoes and wheel wear) are currently in a magnitude of above 10 €/1000km. Especially the influence of the wheel wear on the costs is completely underestimated in the study. For the cost estimation on LL-blocks the same remarks are valid; operational costs using LL-blocks have to be estimated at approximately the same level as for K-blocks. Concerning the administrative cost of the charging system the authors did find such a large a spread of estimates by the various stakeholders that they concluded these could not be considered for this study. The authors conclude that stakeholders opposing to NDTAC included cost elements not allocated to NDTAC into their respective cost elements, this should especially be valid for the IM. With this argument the authors also didn't consider the recent UIC study on implementation of NDTAC as the estimates had been executed by DB Netz. The authors neglect the fact, that these estimates have been endorsed by all but one of the entities involved in the UIC study; they also neglect that the estimates in the UIC study are based on analyses of the relevant processes. The authors recommend that the bonus should only consider the cost on RU and WK side; they then estimate these cost to 10-20 % of the actual bonus based on an earlier study of ETH (not mentioned in the references) and on stakeholders 'indifferent' to NDTAC. The general cost drivers of administrative costs (fleet size, ownership structure & amount of contractual parties & IM, accounting system) are localized, but no calculations are presented how and why these cost drivers should result in a 10-20% surcharge of the bonus. Any proof that this approach could cover the real costs is missing. To calculate the bonus level the study stipulates either an six year or an twelve years scenario as funding period; both scenarios are realistic, the second would cover with a higher probability the goal to use normal maintenance cycles for the retrofitting. In tables the incentive levels are calculated in adding up fixed costs, operational costs and administrative costs to a total. For 2-axle wagons half of the costs of 4-axle wagons are allocated. This is not correct for administrative costs, as these are a function of the vehicle only and not of the number of axles. The fixed costs for LL blocks as well as the operational costs for both K and LL blocks are heavily underestimated, as stated earlier in this paper; as consequence the total incentive is also too low. Interesting is also to compare the values given by the authors with the former PWC study: this study concluded (based on too low costs as well) that the bonus to cover the upfront costs of retrofitting should be 2-2.5 €cts/Wkm and the bonus needed to incentivize the WK should be in the range of 3 – 9 €cts/Wkm (PWC-Study, Pg 71/129).

The third subsection of subchapter 7.2 gives an interesting proposal to introduce an additional bonus for low noise trains using only low noise rolling stock

Subchapter 7.3 sets out key performance indicators of the proposed NDTAC model. In a first sub-

section the study gives some estimates on the fleet development, based on the assumption of a lifespan of 35 years for a freight wagon. With this assumption wagons built before 1979 have been excluded from retrofitting, downscaling the total fleet to be retrofitted from 623'000 units (PWC-study) to 370'000 wagons in the current study. 70 % of the fleet is assumed to be 4-axled, 30 % 2-axled; out of the 4-axled fleet 20 % are assumed to be enabled for ss-traffic (120 kmph), of the 2-axled there are 5 % ss-types. The study uses for its calculation the assumption of an average yearly mileage of 60'000 km. Given current average yearly mileage of less than 30'000 km, the study's assumption seems too optimistic and too high. The study proposes further equal treatment of new or retrofitted wagons regarding incentives from NDTAC as long as they are silent. They assume that annually 20'000 new and silent wagons will be come in operation. However, the conclusion in a graph, that therefore end 2009 some 75'000 silent Wagons should be in operation seems rather overestimated and cannot be confirmed. Concerning the retrofitting rate the study considers 3 scenarios, one with retrofitting some 60'000 wagons/year with a total retrofitting period of 6 years, a second (according the PCW Study) with 90'000 Wagons/year, considered as too optimistic by the authors and third scenario with 30'000 Wagons/year and a 12 years' timescale. This third scenario seems, as earlier mentioned, to be more realistic. The study further estimates the total economic costs of the system; but excluding the cost on IM side. Based on the cost and fleet data given in the study the total costs (including all LCC-costs) are estimated to € 2.11 billion using LL-blocks and € 4.11 billion using K-blocks. No detailed calculations for these costs are given in the report. The study sees a correlation between higher bonus level and higher retrofitting rate and illustrates this fact by a number of graphs.

Subchapter 7.4 analyzes the various options of funding the NDTAC in evaluating whether the bonus should be finances through the railway sector, the member states or in combined solutions. When financing should be done by the railway sector the approach to do so could be either a bonus/malus system or a general increase in TAC. According to the study both possibilities would increase the total costs of the railway sector and thus weaken the sector unless similar treatments would be introduced for other modes of transport. The financing through state authorities could be executed in compensating the IM for their losses caused by NDTAC, or even be directly paid to the RU; but this is not thought to be practical as it would mean to introduce new financial streams. The disadvantage of disregarding the polluter pay principle is considered to be acceptable as this principle is disregarded in many other cases of the transport sector. Further combined models of financing by the rail sector and the member states are briefly described. Also attention is drawn to the IM administrative costs for the NDTAC charging, but the study sees only for part of these costs the need to allocate them at NDTAC, as the authors suppose that the IM's will have to adopt their charging schemes anyway in near future. No estimates on these costs are included in this chapter.

**8. Recommendations**

This final chapter concludes all the results of the study and summarizes recommendations for the implementation of NDTAC.

*The general characteristic include:* Pure bonus system; bonus to be applied to all silent wagons (not only to retrofitted); Focus on LL-Blocks with option for k-blocks if homologation is further delayed; bonus level should during a fixed period cover retrofitting as well as additional operational and administrative costs of RU and WK; basis of bonus should be number of brake blocks/axle, this number depends according to the study on the authorized maximum speed level (this assumption is not correct, the number of brake blocks is a brake design question and not a question of speed levels). The recommended bonus levels/axle are for a 6 years funding period for K-blocks 0.0079 €/axle-km; for LL-blocks 0.0027 €/axle-km; for a 12 years funding period the corresponding levels are 0.0046 resp. 0.0021 €/axle-km. These levels are based on too low cost assumptions and therefore as well too low. The study proposes the same level of bonus and this to be implemented throughout Europe. Smaller networks might not charge NDTAC as the administrative costs could in these cases be higher than the noise effect; this forms a contraction to the goal of European implementation as proposed in the study. Financing could be at the member states, at the railway sector or shared by both, but no recommendation on one of these solutions is given.

*The proposals on the charging process* are based on the existing relations between IM and RU; it is mentioned that the bonus should be transferred to the party paying the retrofitting; here the pro-

posed solution is a mileage related transfer from RU to WK or a factoring into the renting price. The study bypasses in this proposal the crucial complexity of the rail wagon renting business as it was analyzed in its previous chapter 6.4. As interims method self declaration is recommended using a regulatory body with full access to data from IM, RU and, if needed WK. No cost estimate for this regulatory body and its allocated work are given in the study. For long term solution the use of TAF-TSI is recommended expecting to lower in this way administrative costs. No cost estimates for this expectation are in the study.

As length of the funding period either 6 or 12 years are recommended. A differentiation ob the bonus by time or route is not recommended.

*Additional aspects:* Both the use of cast iron blocks after a certain transition period as well a changing of retrofitted wagons back to cast iron brakes should be prohibited. Trains consisting in mostly silent rolling stock should get an additional bonus as additional incentive to form silent trains. In the TSI noise it should be clarified according to the authors that retrofitting with composite as well as with sintered blocks result in a self acting homologation according to TSI noise. Finally the study thinks that NDTAC environment could be used for other differentiated TAC in future. It is highly questionable whether other fields than noise really are wagon related.