

Timetabling and Capacity Redesign (TTR)

Call for External Support

Feasibility Study on the Framework for Allocation Principles
for Capacity Shortages

V0.6



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Purpose of the call

The European Commission (DG Move) published on 13.09.22 in the “CEF II Transport – TA – CINEA – General Envelope 2023-2024” the following text:

“WP3. Further development and implementation of new approaches for rail capacity management and allocation, in particular in the context of the ‘timetable redesign’ programme (TTR for Smart Capacity Management): Conducting a study on the feasibility of applying allocation principles based on socio-economic criteria”

Already prior to the above mentioned EU call, RailNetEurope (RNE) and Forum Train Europe (FTE) established a joint Railway Undertakings/Infrastructure Manager task force to actively tackle the issue of capacity shortages on the existing railway infrastructure. The task force has discussed and defined the business issues/needs in this regard (based on the already existing experience, such as the existing one in Nordic countries) and set up the direction. The usage of socio-economic criteria and evaluation should be thoroughly investigated and considered for a more comprehensive European application. Prior to this development, a study should be concluded to answer the open questions.

Therefore, RNE included into their Grant application for the above-mentioned CEF Call, the study on applying socio-economic criteria in case of capacity shortages. However, due to missing internal know-how, RNE and FTE are proposing to look for external support for conducting the study. This document contains a detailed introduction of the issue, the questions that should be addressed by the study, an overview of available sources, conducted research and ongoing developments.

Introduction to the topic

Currently, in most European countries, the capacity shortages are treated in the annual timetable constructing phase in cases when iterative conflict resolution rounds have not led to a satisfactory solution (according to art.46 of Directive 2012/34/EU about “Coordination process”). In several countries, there are priority rules based on the traffic type (described in each Network Statement), which gives a certain capacity need ultimate priority over other. This might not lead to an optimal usage of capacity¹, because:

- a) The traffic with a higher position in the priority list is not motivated to compromise – since it will win the case if the rule is applied.
- b) There might be a better solution for the whole sector, accommodating more capacity if the involved parties make certain bearable adjustments to the timetable (compared to one winner taking all the capacity).

In case that the coordination processes and the conflict resolution rounds were unsuccessful, the idea is to apply socio-economic scenario comparison, where different capacity usage scenarios are evaluated. This means that, the scenarios are objective², quantifiable and comparable to capacity usage. The socio-economic values of each scenario are compared, designating the best scenario: the one with the highest value for the Single European society. It is therefore not a question of determining a concrete winner and a loser of a conflict as today, but rather identifying the most optimal attribution of the diverse capacity needs on a line or on the part of the network from a socio-economic point of view.

¹ It has to be added that additional reason is the unharmonised priority list in European countries. One of the purposes, why the study should be conducted, is to define the potential basis for harmonisation.

² Scenarios are objective, but the result cannot be totally objective because it depends on the value attributed to each element (e.g., value of Volvo trains in transit countries DE/DK, when they run from SE to BE).

Scenario approach

As described before, in case of capacity shortage all previous steps (e.g., conflict resolution rounds) do not lead to an agreement between the involved parties, the relevant IM(s) should create different scenarios (based on market needs or own ideas). The developed scenarios need to have a comparable geographical scope and time window. In each scenario to be created, the capacity needs would be arranged (“placed”) differently. One scenario could for instance map the impact of priority given to one stakeholder without doing compromises/optimisation. In another scenario, the speeds of all affected capacities/paths would be adjusted (reduced for high-speed traffic, increase of average speed for regional traffic by abandoning intermediate stops). A third scenario could involve the diversion of some traffic via a parallel line. And so on...

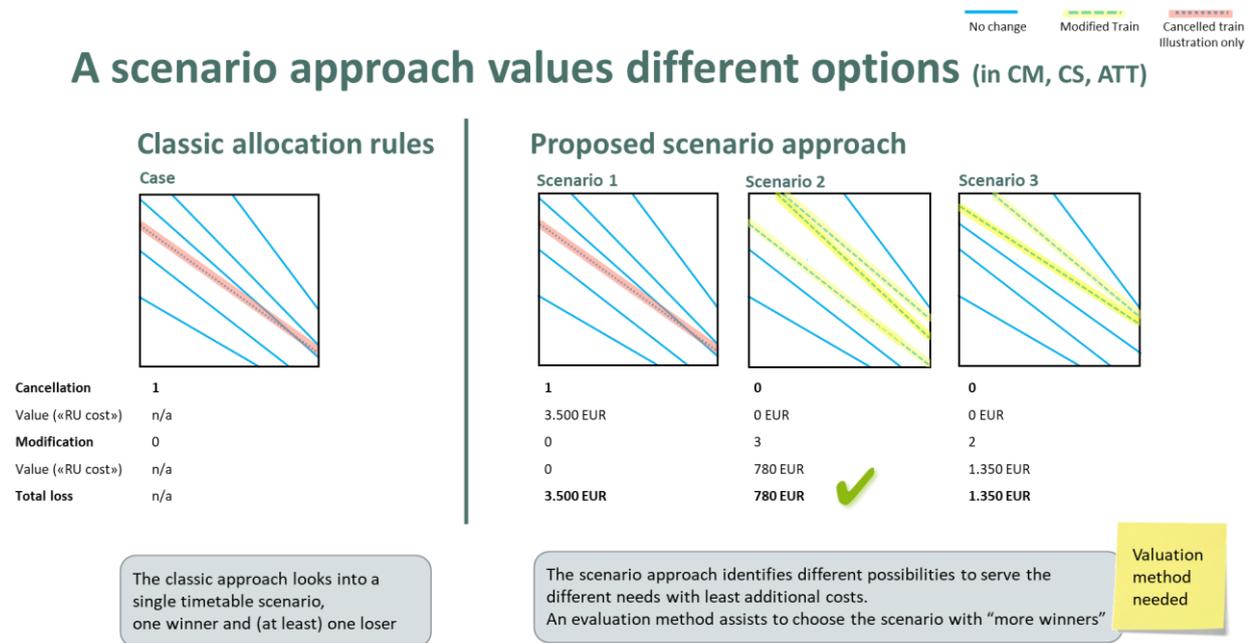


Figure 1: The picture shows a hypothetical example for annual timetable, where are 2 “wished paths” in conflict, instead of selecting one winner, in scenario 2 timetable of both paths and even another path are adjusted to accommodate all needs. Thanks to this, 3 paths can be planned or allocated instead of 2 in the classic allocation rules framework.³

Similar socio-economic evaluation can be used for planning of Temporary Capacity Restrictions (hereafter TCRs referring to works and possessions on the infrastructure). There might be cases on some lines where stakeholders may conduct the scenario comparison in order to find the best timing of a TCR to balance the impact on the market and financial consequences for the IM.

³ “In theory, all traffic everywhere should be included, but for practical reasons the time-space-area must be restricted. But the reason for defining an area and not just compare path-by-path conflict is that all traffic within the area are subject for adjustment, to maximize the benefit. This could lead to knock-on effects (as in ordinary timetable planning) and, in the worst case, someone may have to be removed leading to quite large costs in the calculus”.

This is illustrated by the very high “cost in scenario 1 where the red train will not receive any paths, whereas the 2 others shows scenarios enabling all requested paths to be allocated. The choice of scenario 2 shows that although 3 paths are effected (to a low degree) the benefit for the society are higher compared to scenario 3 where only two paths deviate from the requested times (but to a higher degree).

TCRs could be valued for RUs and IMs

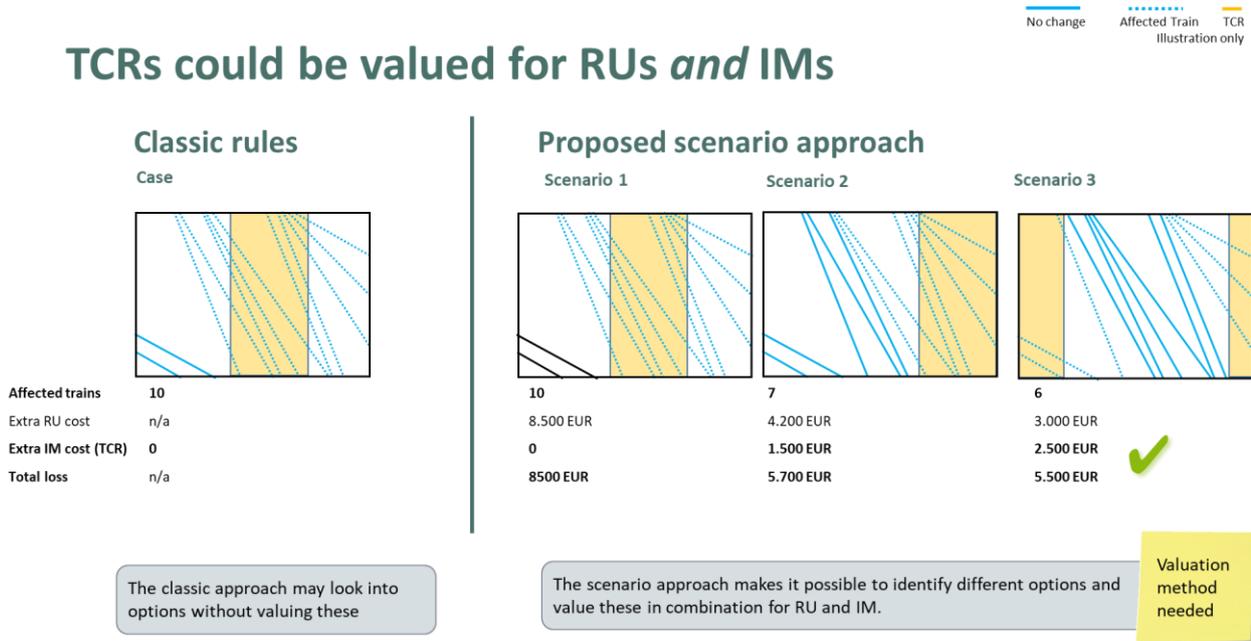


Figure 2: The picture shows the comparison of different hypothetical TCR timings. Scenario 1 (TCR during the day) generates lowest costs for the IM, while having high cost impact on the RUs. Scenario 2 (TCR in later evening) has lower extra costs for RUs, on the expense side, higher cost for the IM. The recommended scenario in this hypothetical example is Nr 3, where the overall socio-economic impact on RUs and IMs is the lowest. Note that the example is only hypothetical, the best scenario can be for instance the execution during the day, off-peak, in winter period etc.

There are four different situations when the socio-economic model should be applied:

- Advanced planning
 1. Capacity Model (CM) conflicts: traffic volume vs traffic volume, traffic volume vs TCR
 2. Capacity Planning/Supply (CS) conflicts: capacity product vs capacity product, capacity product vs TCR
- Annual timetable
 3. Annual timetable (ATT) conflicts: path request vs path request, path request vs TCR
 4. Path Alteration in the running TT period conflict: allocated path vs new TCR

The CM is a new early planning element to be introduced into the capacity planning under the TTR program within the next years. The CM is to be used as a visualisation and decision basis for partitioning the available railway capacity between different traffic types (especially on lines with high saturation). The final CM is published 1,5 years prior to the timetable change (X-18) and the capacity is set aside in the CM for dedicated purposes (volumes for Annual Timetable passenger & freight traffic, rolling planning, ad-hoc, TCRs). Note that compared to CS and the conflicting ATT requests, in this phase, no exact paths with exact times are defined. Moreover, in this situation, the real capacity requests were not placed yet, thus the comparison is based only on the historical data of the IMs, transport market study (hypotheses) and submitted Capacity Needs Announcements of applicants and other stakeholders.

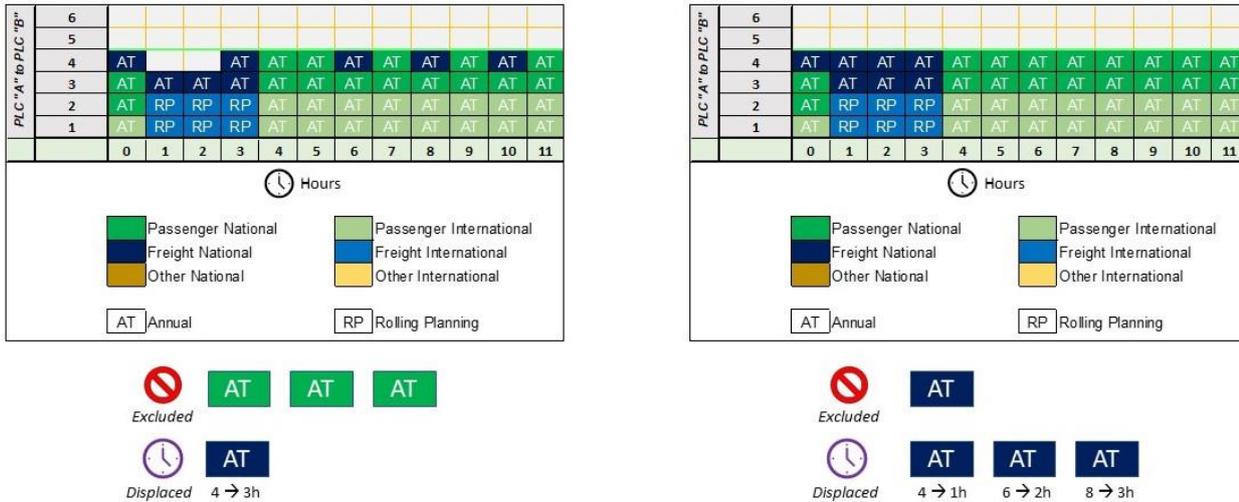


Figure 3: The picture shows a hypothetical comparison of two scenarios for single-track line in direction A to B, both scenarios solve the potential congestion in a different way. In scenario A, 3 national passenger slots are excluded, and one national freight slot will have to depart already before 4am, instead of between 4-5am. In scenario B all passenger slots are kept unchanged, but one freight slot is excluded from access, and 3 other freight slots have to be adjusted in time (shifted by 3 to 5 hours).

The final CM (defined 1,5 year prior to the annual timetable change) is the basis for the capacity partitioning for the particular periods of the upcoming annual timetable period. Nevertheless, the socio-economic evaluation might be needed again in the CS phase.

The CS is already a space diagram, where each capacity need has a form of a pre-planned path or a slot within a bandwidth. The exact position of the future used path is more precise (to minutes, compared to the CM where it was only per hour). The comparison is still based only on the historical data of the IMs and submitted Capacity Needs Announcements of applicants and other stakeholders. The final CS, including the resolution has to be published by the IMs 11 months prior to the timetable change.

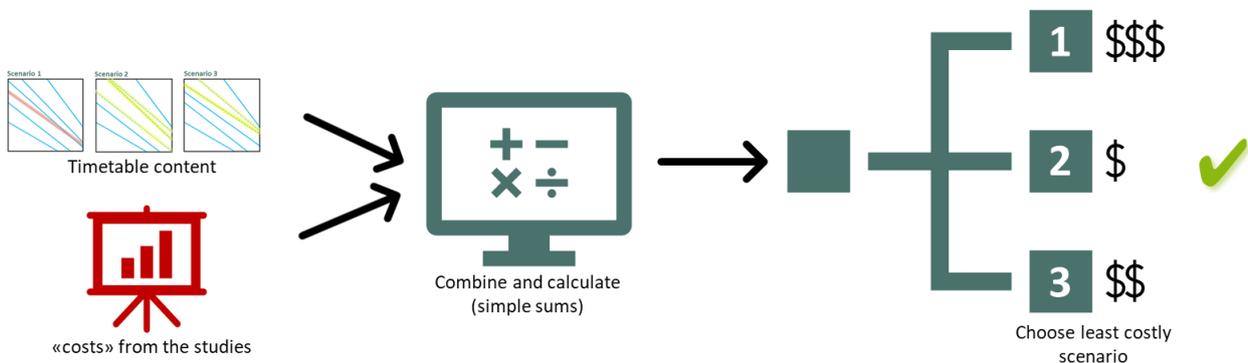
The next phase, where the socio-economic model can be used are unsolved conflicts in the ATT, after the path requests are placed by applicants. With the application of the socio-economic criteria in this phase, the railway sector has already some experience, namely in Sweden, Norway and Finland.

The last phase covers the use case, when a new TCR is intended to take place after the paths in the ATT (and Rolling Planning) are allocated to the capacity applicants (or after the provision of the draft path offers). In case, the needs for a new TCR occurs after the paths have been allocated, the socio-economic model should help to identify the optimal scenario, in case the stakeholders are unable to reach a consensus on the usage of the reduced available capacity. The railway sector already has some experience in the Netherlands with the application of socio-economic criteria in this phase.

More detailed information about the Capacity Model, Capacity Planning/Supply, Annual Timetable, Path Alteration and Ad-hoc traffic can be found in the TTR documentation (see the chapter on sources). Potential use cases for capacity shortage conflicts can be found in the paper A3b "Allocation guidelines for conflicting capacity announcements and requests".

Study assignment

The contractor is asked to perform the study, which will propose the socio-economic allocation model(s) including possible standardised or mean figures - see point 1) below - and tries to find answers to open questions. The contractor might consider for its work already available models, experiences and studies (see the list "Further sources and inspiration" at the end of the document).



1. **The contractor is asked to propose models (formulas)** which allow socio-economic evaluation for four situations: Capacity Model, Capacity Planning/Supply, Annual timetable request, Path Alteration in the running TT period.

The contractor shall:

- Ensure that the models are based on standardised or mean values for traffic types (as in the current Annual timetable model in Sweden) following for instance the HEATCO approach of the European Commission. The contractor is free to propose more different models for each phase.
- Provide with either prototype models and/or provide a sufficient basis for the demo models construction – so different scenarios can be compared using the models and the results of the study can be tested.
- Ensure (confirm or provide arguments) that the proposed models do not prevent competition and new market entry.
- Evaluate the usage of the criteria defined in the document “Allocation Principles for Capacity Shortages” (A3a). The contractor can exclude or not use any of the proposed criteria in their proposed models – but it has to provide reasoning why they are excluded. This can be for instance evidence that the criterium is already considered in another input to the model, and or the evidence that usage of the criteria is not practically manageable/relevant. The contractor can also include in the model other criteria – but has to prove their reasonable usefulness for the model.
- Evaluate if it make sense to apply all criteria identically for all phases, or are there some criteria that should not be applied in some of these phases?
- Define the standardised and/or customised (mean) values for the proposed standardised traffic categories, listed in the annexe of the “Allocation Principles for Capacity Shortages” (A3a). The contractor is allowed to include new or exclude a category, if this is supported by reasonable evidence. The contractor should investigate if a longer list of traffic categories is needed, taking into consideration that simplicity and transparency are the preferred direction.
- Ensure that the various elements of the path pricing can be correctly and fully reflected in the different criteria. The model should thus allow both IMs with very detailed prices to include them and IMs with generic prices to include them.

2. **The contractor is asked to define how the model can be applied on a European scale.**

- “Importance of a service to society” is primarily driven by national interests. How can such national considerations be brought together in the case of a cross-border perspective? What are the options and possibilities of weighting national consideration without making it a blocking point (or having contradicting model results for each country involved in the capacity shortage)?
- The socio-economic values (formula parameters) can have a different weighting in each country, but the contractor is asked to propose a European solution (e.g., set of standard values/parameters that are adjusted based on the purchasing power, GDP or similar).

- Interpretation of Art. 47, 2012/34/EC: For IMs with widely varying track access charges for the different train categories, there could be financial implications depending on the selection of the best scenario (service) to society. A scenario in which paths for train categories with low track access charges are disproportionately represented could lead to financial losses compared to the scenario which is inferior to the society but economically more interesting from an IM's perspective. Assuming that a Member State grants the IM compensation corresponding to any loss of revenue related to the need to allocate a given capacity to certain services pursuant to the second subparagraph. How would the next sentence in this paragraph of Art. 47 be applied ("Those measures and that compensation shall include taking account of the effect of this exclusion in other Member States")? By inventing an appropriate criterium in the other involved Member States with a fixed or flexible value? Any other proposal?

3. The contractor is asked to investigate the raised open questions:

- In the study "European railway deregulation: an overview of the market organisation and capacity allocation", A. Ait Ali & J. Eliasson (2021) conclude that it is essential that the most efficient operator, i.e., the one providing the most attractive services from the market's point of view, also gets priority in a capacity conflict. Is this finding confirmed, and if yes, for which parts of the planning process (CM, CS, Annual timetable)? Otherwise, another paper "Efficient capacity allocation on deregulated railway markets" by E. Broman, J. Eliasson & M. Aronson (2021) is addressing methods for resolving conflicting capacity requests in a deregulated railway market. To some extent it might be looked upon as a continuation to the previously mentioned study.
- In the phase of the CM development (X-24 until X-18), the information on market and TCRs needs will not yet be too detailed and may still change in the subsequent phases (e.g., factory closure, no resources). Does it therefore make sense to already solve capacity shortages, or would it make more sense to accept increased demand (similar to the overbooking philosophy in the airline sector) and apply the conflict-solving socio-economic principle only in later phases?
- In the CM phase, the volumes are distributed per hour, at this phase, it is not expected to define the volumes to the detail of minutes. How can criteria such as those stated below be used, when the value of minutes is not part of the CM:
 - i. Standardised cost of displaced traffic volumes (shift by one "hour block" in CM can mean in CS a shift of 2 minutes same as a shift of 119 minutes)
 - ii. Costs for lost association (even if two connected services are within the same "hour block", it is unclear if the association will be lost until the CS phase defines the consequence of the slots)
- The contractor should recognise the problem of unknown origin/destination and/or unknown traffic input – and to deal with this issue in the study, or argue how to overcome the problem (not all input are known, not announced by CNAs etc).
- Certain information, such as passenger and freight volumes, is often sensitive business information, and this might result in the situation when some applicants will decide not to notify the IMs about their plans by Capacity Needs Announcement (CNA). In the CM/CS phases, this is connected with a problem of unknown traffic input. The contractor is asked to analyse how to handle values of socio-economic criteria if not all details of the market needs are known:
 - iii. The exact origin and destination are unknown (e.g. if the traffic-volume-distance is part of the formula, but it is unknown)
 - iv. Other data such as exceeded maximum running time and rolling stock type are unknown.
 - v. A situation might appear when the historical data input (with missing data as stated in 3ei and 3eii) might be challenged by a new market input having these data.

Offer

The interested entities are asked to submit an offer in line with other tendering documentation, as listed in the paper "Invitation to tender for socio-economic criteria study".

The interesting entities shall incorporate into their bid calculation:

- Execution of the study
- Regular online presentation (every 4th month) of the state of the research, presentation of the preliminary findings to a body nominated by the contracting party – including consultation with this body.
- Presentation of the final study to a body nominated by the contracting party.

Further sources and inspiration

- Article 47(4) of DIRECTIVE 2012/34/EU: "The priority criteria shall take account of the **importance of a service to society** relative to any other service which will consequently be excluded."
- **Allocation Principles for Capacity Shortages (paper A3a)**: the document was prepared by the allocation principles task force and provides the draft process for solving shortage situations, including the potential business-driven factors to be evaluated by the contractor for the potential socio-economic model.
- **TTR process description**: the new TTR process to be implemented in Europe is described in the TTR process description, including the Capacity Model and Capacity Supply phases: <https://ttr.rne.eu/downloads/>
- **RNE Capacity Model Handbook**: the document provides more details about the phase Capacity Model. <https://ttr.rne.eu/downloads/>
- **Allocation rules for ATT in SE**: the network statement of IM SE Trafikverket describes the currently applicable model for the conflicting ATT requests, it is a good source of inspiration for understanding the scenario approach and standard value approach (both requested also by this study). [\[Link\]](#)
- **Trafikverket** is willing to share **practical use cases** in applying socio-economic criteria in case of capacity shortages in the annual timetable process
- **Allocation rules for ATT in NO**: the network statement of the IM NO, provides an explanation how the socio-economic model is used in Norway, note that the model does not represent scenario approach, neither standard value approach. [\[Link\]](#)
- **Socio-economic model for TCR planning in NL**: the model gives optimal socio-economic solution for TCR execution. It takes into account the costs for ProRail (IM NL)/constructor, the extra time for passengers (value for time), extra costs for freight, costs for alternative transport (passengers and freight), and missed income for passengers RUs. The costs are depending on the line (including number of trains, passengers, rerouting possibilities, ...) and the type of works, which both can be selected. <https://economisch-bureau.shinyapps.io/ProRail/>
- **Allocation rules for ATT FI**: the new criteria-based model to be implemented from timetable 2022, touches the topics of priority based on the line and train categories.
 - The unofficial English translation is accessible here: <https://www.doria.fi/handle/10024/183016>
 - There is also a report, on which the criteria are based on. It is in Finnish, but pages 95-97 provide an overview of used sources. <https://www.doria.fi/handle/10024/180162>
- **Allocation of train paths in the event of congestion the rail infrastructure**: study in German from 2004 by Ernst Basler + Partner (Zuweisung von Zugtrassen bei Überlastung der Schieneninfrastruktur). Accessible here: <https://gkb.at/images/infrastruktur-zugang/trassenzuweisung-ueberlast.pdf>
- **Dimensioning windows for railway infrastructure maintenance**: Cost efficiency versus traffic impact: another study focusing on cost efficiency when defining TCR timings and the impact on the traffic by Tomas Lidén and Martin Joborn from 2016. <https://www.diva-portal.org/smash/get/diva2:916954/FULLTEXT03.pdf>
- **Developing Harmonised European Approaches for Transport Costing and Project Assessment**: harmonised guidelines for project assessment for trans-national projects in Europe from HEATCO from 2004. <https://trimis.ec.europa.eu/project/developing-harmonised-european-approaches-transport-costing-and-project-assessment>

- **Ongoing study for Trafikverket:** Trafikverket (SE IM) contracted a consultant to perform similar study on the Capacity Model and Capacity Supply phases for Swedish market. This study is currently ongoing and the final results in English might be available in 4Q of 2023. Nevertheless, the contractor cannot rely on this study, but might use its output for benchmarking with own proposal, once the output is available.
- **Revision of allocation model by Bane NOR:** Bane NOR (NO IM) has recently revised its socio-economic model for ATT phase, it is published as part of the Network Statement including the demo file:
https://networkstatement.banenor.no/doku.php?id=vedlegg:method_for_economic_valuation_of_assigning_routes
- **Ongoing initiatives in Germany:** The German government plans to implement integrated railway timetables (project „Deutschlandtakt“) that are based on pre-constructed timetables. This is following the spirit of the redesign of the international timetabling process (TTR). In this context, the current German Railway Regulation Law (ERegG) foresees a new paragraph (§ 52a ERegG) that obliges the main infrastructure manager (IM) to start pilot studies on certain infrastructure segments chosen by the Ministry of Transport. In case of capacity constraints on these pilot project lines, the IM has to prioritise, adjust and optimise the planned/intended timetable taking into account the services' importance to society. According to the last information, there is a contracted consultant, which is investigating different socio-economic approaches in Europe. The contractor can investigate if any outputs of this initiative are available and benchmark them with own proposals.
- **Prioritising investments project in Germany:** Methodenhandbuch zum Bundesverkehrswegeplan 2030: https://bmdv.bund.de/SharedDocs/DE/Anlage/G/BVWP/bywp-methodenhandbuch.pdf?__blob=publicationFile
- **Evaluation of infrastructure Modules for long term planning by RUs and Regions in Switzerland:** To establish a Network usage concept for long term and to insure the best guarantee of capacity for market needs, the Swiss Ministry of Transport gather input for RUs and relevant authorities to measure the impact of infrastructure projects. Those inputs are used to help prioritise projects on a socio-economic basis. [Office fédéral des transports OFT Guide de données input requises pour l'évaluation des modules PRODES étape d'aménagement 2030 \(admin.ch\)](#)
- “European railway deregulation: an overview of the market organisation and capacity allocation”, A. Ait Ali & J. Eliasson (2021) in 3a of the Study assignment there is a relative new paper addressing methods for resolving conflicting capacity requests in a deregulated railway market.: <https://www.sciencedirect.com/science/article/abs/pii/S2210970621000597>