Bottlenecks and Regional Economic Impact: Simulations with the CODE24 Transport Model

Hansjörg Drewello, Marcel Huschebeck, and Norbert Schick

Abstract Bottlenecks in transport infrastructure will change the behavior of logistics companies because of increasing costs of transportation. If a bottleneck in a railway network occurs, railway freight transport will be shifted to roadways. Railway congestion causes, for example, a decrease in reliability and a considerable increase in transport costs, and thus road transport becomes less expensive. The CODE24 Transport Model supports decision-making about choice of transport modes. All available information potentially affecting those decisions, such as regions, transport networks, terminals and logistic services, costs as well as transport or monetary flows, are integrated into the model. The model tries to find the shortest or most efficient route, e.g. with regard to transport costs.

In this article, economic effects along the railway corridor Rotterdam-Genoa were analyzed in a simulation of three different types of bottlenecks on railways by using the CODE24 Transport Model. The simulation shows a shift of freight transport from rail to road or from rail to barge, depending on different transport distances. The change of intermodal behavior increases transport costs, which can be calculated within the model. The simulation allows a better insight into the regional and overall costs generated by transport bottlenecks. The analysis indicates that an increase in transport costs for one transport mode, due to a bottleneck, has an impact on all the regions along the corridor and even more so on specific regions outside the corridor.

H. Drewello (✉)
University of Applied Sciences Kehl, Kinzigallee 1, 77694 Kehl am Rhein, Germany
e-mail: drewello@hs-kehl.de

M. Huschebeck • N. Schick
PTV Group, Haid-und-Neu-Straße 15, 76131 Karlsruhe, Germany
e-mail: marcel.huschebeck@ptvgroup.com; norbert.schick@ptvgroup.com

H. Drewello, B. Scholl (eds.), *Integrated Spatial and Transport Infrastructure Development*, Contributions to Economics, DOI 10.1007/978-3-319-15708-5_7

1 Introduction

Even if freight transport is still growing rapidly in Europe, building new rail infrastructure to further support modal shift is becoming more and more difficult due to public budget restrictions or opposition from civil society on environmental issues and route alignment. Frequently, transport associations or other economic stakeholders use the bottleneck argument to press for new tracks. From a local or national point of view, investments are first sought to expand infrastructure where bottlenecks are located. In the case of Germany, Deutsche Bahn denies the existence of bottlenecks along the German part of the corridor Rotterdam-Genoa. They maintain that the infrastructure manager DB Netz is able to satisfy all demands for new freight or passenger routes. This different view of reality probably results from a different concept of bottleneck.

Bottlenecks in transport infrastructure will change the behavior of logistics companies because of increasing costs of transportation. They will affect some regions more than others. If a bottleneck in a railway network occurs, railway freight transport will shift to road or barge because congestion causes, for example, a decrease in reliability and a considerable increase in transport costs, and transport by truck or by barge becomes less expensive. The CODE24 Transport Model supports decision-making about choice of transport modes. All available information potentially affecting those decisions, such as regions, transport networks, terminals and logistic services as well as transport-mode specific cost structures, are integrated into the model. The model tries to find the most cost-efficient route.

In this article, effects of bottlenecks along the railway corridor Rotterdam-Genoa are simulated in a shift of container freight transport from rail to road or from rail to barge. Three different simulations have been developed. The change of intermodal behavior increases transport costs, which can be calculated within the model. The simulation allows a better insight into the regional and overall costs generated by transport bottlenecks (costs of non-doing).

2 Bottlenecks in Transport Markets

2.1 What is a Bottleneck in Freight Transportation?

In public debate it is sometimes unclear what is meant by a bottleneck in transport infrastructure. In many of these political statements a lack of capacity is specified, usually combined with the projection of increasing freight transport.[1] Holzhey determined capacity bottlenecks by calculating the potential maximum of freight

[1] e.g. DB Schenker, Rail freight companies present their requirements for the most important European Corridor: Rotterdam-Genoa, Press release, 19 Dec. 2011; Port of Rotterdam, Newsflash 2012, February 2012, p. 4.

train runs per day for a corridor and comparing it with future needs (Holzhey 2010, p. 17, 2011, pp. 4–6).

As early as 1996 Rothengatter stated that technical capacity is not a sufficient measure to identify major deficiencies in railway networks. Accordingly, insufficient service levels of railway companies were more important than technical bottlenecks at that time (Rothengatter 1996, p. 1). Cipolina and Ghiara distinguish four different categories of bottlenecks in freight transportation: infrastructural, organisational, technical and bureaucratic (Cipolina and Ghiara 2011, p. 150).

One important aim of the CODE24 project was to better understand bottlenecks in logistics and their effects on the freight transport corridor Rotterdam-Genoa. In order to do so, an international and interdisciplinary expert group within the project (planners, architects, engineers, logisticians and economists) developed a common definition in 2011 in the course of a structured brainstorming process (metaplan):

> Bottlenecks always represent additional costs to logistic services by hindering them. They can be observed on a politico-legal, organisational or physical level. Such a bottleneck can be national or transborder. (Drewello and Günther 2012, p. 3)

On the politico-legal level, a bottleneck occurs if restrictions resulting from political decisions or legal frameworks hinder infrastructure planning and logistic processes. This can be e.g. regulation of competition, standards, regulation of noise protection, price and access regulation, taxes, nighttime bans and so on.

A bottleneck also emerges from inefficiencies of operation inside the logistics sector on the supply and/or on the demand side (organisational level). A common example of inefficiencies of operation is a lack of information e.g. concerning terminal services. The market structure can also lead to inefficiencies. Strong competition could hamper advantageous cooperation as well as a market-leader position of one supplier (Ahrens et al. 2007, p. 3).

On the physical level, bottlenecks emerge when demand for freight transport exceeds the available infrastructure capacity. Railway infrastructure includes tracks, junctions, signalling systems, terminals, tunnel heights, etc.

What are the consequences of emerging bottlenecks in transport infrastructure? Let us assume, for example, growing demand for freight transport runs on a railway corridor. If the price for train runs remains unchanged, this may lead to excess demand. A bottleneck appears where demand exceeds supply (capacity). Regulatory responses to the excess demand in the short run, which exclude new construction of infrastructure, could be to do nothing but accept the bottleneck or to increase the price for slots in order to create new market equilibrium. There are other possible substitutes for railway freight transport, specifically road or barge. Both regulatory options will therefore lead to a substitution effect. Freight which cannot be transported by rail will be transported especially on roads. This effect is contrary to the manifested transport policy of the European Union and Switzerland.

2.2 The “Rheintalbahn” as a Bottleneck

Bottlenecks with a physical characteristic emerge when demand for freight transport exceeds available infrastructure capacity. Many different kinds of information are necessary to compute the capacity of a railway line. Much of this data in Germany is only available to Deutsche Bahn, and that company has declared it to be a business secret. Nevertheless, transport capacity can be calculated for railway sections. But much effort is required.

One factor that is of major importance for determining the capacity of a railway line is the number of tracks available for travelling in a particular direction. Other key aspects influencing capacity are the distance between the block signals, buffer times, the speed difference between slow and fast trains, overtaking opportunities along the railway line and the sequence in which the various categories of trains follow one another (Drewello and Gütle 2013, 6 ff.).

In February 2013, the Universities of Kehl and Offenburg organised a train count on the Rheintalbahn near the town of Lahr. The analysis consisted of the calculation of a mean capacity for freight train runs per day for the two railway tracks near Lahr (Drewello and Gütle 2013, pp. 14–24) based on the blocking time model originally developed by Happel (1959). This information was then used as a baseline for the real use of capacity, observed and counted day and night for 2 weeks using a high-tech infrared camera.

The analysis shows that utilisation of the capacity of the Rheintalbahn on the section between Offenburg and Lahr is subject to fluctuations during the observation period. Capacity utilisation is at its highest on the weekdays of Tuesday to Friday. The data collected in February 2013 show that at this time of the year, at least at the weekend and more especially on Sunday, there is still capacity available for the transport of freight. On the weekdays of Thursday to Friday, this capacity reserve is, however, only marginal on the basis of the assumptions underlying the study (Fig. 1).

It is on Wednesday that the highest capacity utilisation is to be noted. The computed capacity limit is exceeded during the time segment between 8:00 a.m. and 4:00 p.m. in both directions (116 % from Offenburg southwards towards Freiburg). This can result in decreasing punctuality during this period. Capacity utilisation is slightly lower during the day’s other two time segments, but only in one direction the capacity limit is not exceeded (see Fig. 2). The explanation for that during the morning time segment from midnight to 8.00 a.m. is to be found especially in the lower number of passenger trains. During the evening time segment from 4:00 p.m. to midnight, the number of freight trains is lower southbound. In the other direction, the number of trains still exceeds the capacity limit.

The statements by DB Netz experts also indicate that the observation period occurred during a phase of below-average capacity utilisation. It follows from this that there is a further reduction in capacity reserves in the months May, June, October and November with above-average capacity utilisation (Drewello et al. 2013, p. 50).

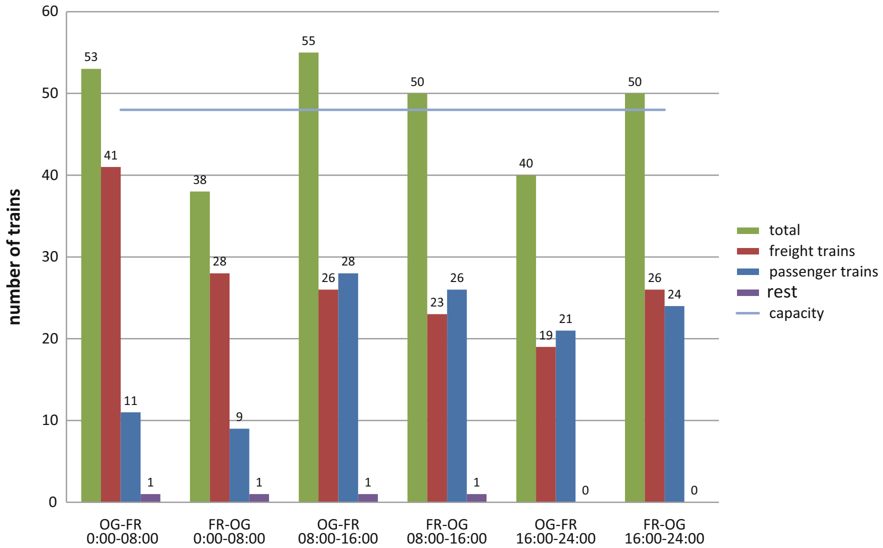

Fig. 1 Mean train numbers on Wednesday (Drewello et al. 2013, p. 51)

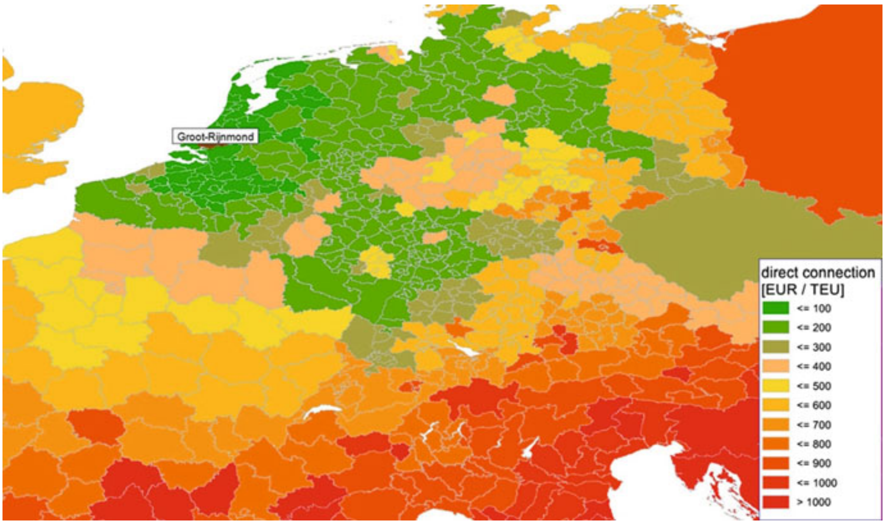

Fig. 2 Corridor and neighbouring regions in the CODE24 model. *Source*: Own illustration

A further effect to be expected is that most of the growth in freight traffic is therefore going to take place on the road. This effect can already be observed in the Upper Rhine Valley (Drewello and Gütle 2013, pp. 42–44).

3 The CODE24 Transport Model: Structure of a Traffic Model for the Calculation of Transport Costs and Accessibility

The CODE24 corridor is a central transport axis for freight transport in Europe. A major part of the imports and exports from and to European countries is transshipped at the seaports of Amsterdam, Rotterdam and Antwerp. The Ligurian ports, particularly Genoa, form the southern endpoint of the axis.

The seaports in this case do not frame the transport flows by forming their starting points and endpoints. They are the major transshipment points for global freight transport, especially container transport. The transport flows running through the CODE24 corridor can only be understood by looking at the underlying cost structure resulting from the combination of transport modes and transshipment possibilities.

A central issue in CODE24 is the location quality, i.e. the accessibility of regions by different means of transport. For the shipping and transportation industry, accessibility is expressed in terms of overall transport costs.

At the core of the CODE24 Transport Model is a cost modelling system derived from a bottom-up calculation approach based on generalized costs per transport mode. The specific transport model was conceptualized as a global model that—at least in rough simplification—additionally covers the transport route on the oceans and the worldwide origin and destination regions of the trade flows.

For the given task, it is a priority to correctly model the tenders of the transport operators and the underlying cost structures. This implies:

- For each means of transport (road, train, inland waterway, deep-sea shipping) vehicles/vessels of different size are used.
- The usability of the vehicles is limited by natural and technical conditions, such as the water depth in ports and waterways, the length and width of locks or the electrification and maximal train length on railway routes.
- Distance-related transport costs per unit decline with increasing vehicle/vessel size.
- General expenses increase along with vehicle size, because of loading and unloading costs as well as waiting times.

This shows that the use of larger-scale vehicles is only profitable for longer distances. This applies to different vehicle types within one transport means as well as to different vehicles from different transport means.

The cost structures illustrate that the operational transport costs play a less important role than in passenger transport. Of much more importance are the handling costs and time-related costs. Time costs originate from the deterioration of goods, the tie-up of capital and the resulting effects on subsequent production steps. These time costs require that a faster vehicle is used for higher-quality or perishable products. The transport costs for a faster vehicle are higher, but from the perspective of a goods owner, faster transport leads to decreased time costs and therefore, this is a reasonable action.

The relatively high proportion of time-dependent costs in the total cost structure means that on many shipping routes longer main-haul legs are chosen in order to avoid an additional transshipment process.

3.1 Development

The CODE24 Transport Model is an integrated intermodal transport network that in the first stage focusses on standard containers as transferable loading units across the transport modes. The networks for road, train track and waterway were created as three separate network models by using the transport planning software PTV VISUM. The road and train networks are limited to Europe. These networks were generated from existing network data and reduced to a reasonable network density. The waterway network contains the inland waterways and deep-sea routes connecting major ports overseas, such as those in Asia, Africa, North and South America and Australia. The inland waterways had to be updated with information on the maximum length of the vessels, the width of the vessels, maximum unloading depth and overhead clearance limitations.

The routes of the three networks are respectively opened or closed for the different vehicle types. This has also been done for deep-sea shipping. There, the biggest container ships are only accepted at a few ports. Eight vehicle types were identified for deep-sea shipping, 5 for inland waterway shipping, 12 for train and 4 for truck transport. Additionally, there are train- and truck-carrying ferries, which are part of the train or truck network. The network models calculate the vehicle-specific transport costs, which arise from distance-dependent costs (e.g. fuel costs) and time-dependent costs (e.g. driver costs, depreciation costs), taking into consideration the different velocities on the routes. For example, in the waterway network locks are depicted with a time supplement of 20–30 min. In road transport compulsory breaks for the drivers after 4 h are considered a time and cost supplement. For the total picture, the distance-speed-related calculation (instead of just a distance-related calculation) has advantages for regions with well-developed, dense and fast networks in all directions.

The zoning of the model is relatively accurate for the countries within the CODE24 corridor on a NUTS 3 level. In the neighboring European countries, a NUTS 2 level or a NUTS 1 level was realized. In total the model contains 963 transport districts.

A central part of the model is the terminal modelling. At these terminals the handling of different vehicles is possible. Handling can occur within one transport means and between different vehicle types, or between vehicle types which are assigned to different transport means. Tri-modal terminals are therefore included in all three networks and are connected to the terminals through the particular network. Railway yards are typical mono-modal terminals, at which a change between a short-distance freight train and a long-distance freight train can be depicted. In total, the model includes 1200 terminals which are depicted as additional and special terminal districts.

The cheapest route between all the transport districts is determined in terms of the assumption about the specific time costs (€/h) for the transported goods. For that, multiple sequential calculation steps are needed:

- For each vehicle/vessel type, the transport costs and the time needed between all transport districts (normal and terminal districts) without handling are determined.
- For each shipping route, the vehicle with the lowest total costs is determined.
- The time calculation assumes that different services are available with different frequencies for each transport system. Costs are considered as additional waiting time parameters relative to truck operations (truck frequency = 0)
- An assessment is made as to whether a handling connection makes cheaper transport possible. For that reason, all theoretically possible combinations with up to six route sections (five handling procedures, accordingly) are tested. In the case of the handling procedure, one must take into consideration the additional handling costs, handling times and waiting times.

3.2 Results

As a result of the calculations, a number is assigned to every shipping route (about 0.8 million shipping routes; theoretically 963×963 shipping routes; shipping routes that had neither origin nor destination in Europe where not considered) corresponding to the number of handling processes consisting of: transshipment terminals, the vehicles of each route section, the transport costs, the time required, the time costs and the total costs. Additionally, a main transport carrier (transport carrier whose vehicles manage the biggest route section) is determined (Fig. 3).

With this information, the transport districts within the research corridor can be rated in terms of their accessibility. A reasonable criterion is the spatial extent of the areas where the truck, the train or the ship is the respective cheapest main transport carrier. In general, good accessibility is given wherever cheap transport modes like inland navigation and rail are employed for the main haul.

After the assessment of some districts within the corridor, it becomes clear that the connection quality on the north-south axis of the corridor is significantly better than on the east-west axis. With regard to the Rhine waterway this is logical, but this fact also applies to the railway, whose network is better developed in the north-south direction between Scandinavia and Southern Italy than in the east-west direction. For that reason, in some of the transport districts in the east and west, though relatively far apart, truck transport is designated as the cheapest alternative by the model.

Fig. 3 Accessibility of Rotterdam: cost per TEU to/from Rotterdam. *Source*: Own illustration

An analysis with data from the CODE24 model shows very clearly the higher regional accessibility of the Rotterdam-Genoa corridor, especially to the north of the Swiss Alps, which one could also assume (Drewello 2014, p. 110). The results fit well with considerations of geographical economics, which explains the high regional GDP per capita in the corridor ("blue banana") with good transport infrastructure since Roman times (Brunet 1989).

It was also quite evident during the evaluation that the Rhine-Main-Danube Waterway, the Moselle, the Saar and the Neckar do not play a significant role in container transport from the perspective of the CODE24 corridor. This is because of the slow speed of transport, which is due to the multiple locks and loops in the waterways. On the other hand, this is not applicable to the Dutch and Northern German channel network, especially the Midland Canal.

On a final note, it should be taken into consideration that the shipping routes should not be regarded as equivalents, since the geographical units in the districts represent quite different population figures, economic performance and economic structures. Since these parameters cannot be included in one common average-costs scheme, more and in-depth structural indicators which determine regional accessibility are needed.

4 Simulation of the CODE24 Transport Model

The approach to modelling bottlenecks is to modify the cost structure on single links within the transport network. It is assumed that in the case of bottlenecks, substitution effects within the intermodal network structure will take place. Therefore, a bottleneck simulation is expected to provide the following adaptations:

- Shift to another mode, in the event that alternative access to inland waterways or road is possible. This might lead to additional transshipment processes which increase the overall transport costs;
- Shift to another railway route. The overall costs for making a detour are less than the increased costs resulting from the bottleneck;
- The initial transport route is retained while higher transport costs are accepted due to a lack of alternatives.

We defined three scenarios for bottleneck modelling based on an increase in transport costs for railway services. For the scenario set-up, one must take into account the fact that the cost structure in goods transport is characterized by high fixed costs resulting from the time-dependent costs. Therefore, in order to visualize the impact of bottlenecks on the overall transport operation cost variations as compared to the basis scenario, a significant increase in transport costs was chosen. A significant increase in distance and the time-dependent costs of railway operations are the basis for the three scenarios. At the same time, the value of the time parameter was increased, being equivalent to additional waiting times. Bottleneck impact is assessed by using a before-and-after comparison of the total transport costs from one district to all of the other 962 districts within the CODE24 Transport Model.

Within scenario 1, all rail corridors parallel to the Rhine valley between Cologne and Zurich were considered as bottlenecks. The distance and the time-related costs parameter were increased by a factor of 2

Within scenario 2, the corridor between Karlsruhe and Basel was considered as a bottleneck. Along this corridor, a significant increase, a factor of 5, was assumed for distance and time-related costs.

Scenario 3 again addressed the corridor Karlsruhe to Basel. However, a tenfold increase in time-and distance-related costs was modelled. As an additional effect, this scenario included an assumed bottleneck for the “Gäubahn” between Stuttgart and Konstanz as well as for the “Schwarzwaldbahn” between Offenburg and Konstanz, thereby increasing costs by a factor of 5.

The figures below show the impact on regional accessibility based on the different bottleneck scenarios (Figs. 4, 5 and 6):

By means of the variation of transport costs for selected links in the railway network along the CODE24 corridor, all shipping routes within the CODE24 Transport Model were recalculated. Although limited to specific parts of the corridor, this increase in transport costs for one transport mode has an impact on most regions, even on regions outside the corridor. Obviously, the impact for

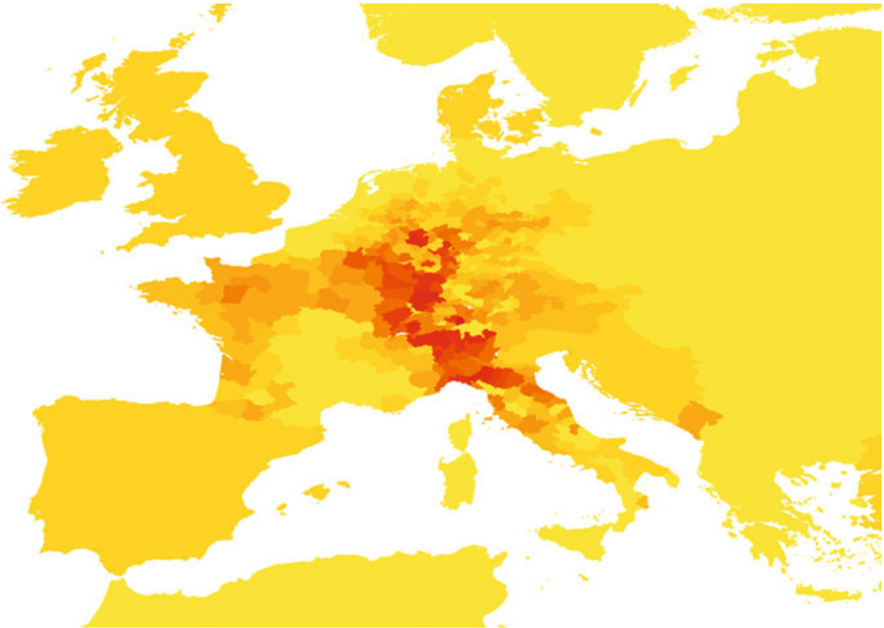

Fig. 4 Increased transport costs per region (*yellow*: 0 %, *red*: 10 %), Scenario 1: Cologne-Zurich, factor 2. *Source*: Own illustration

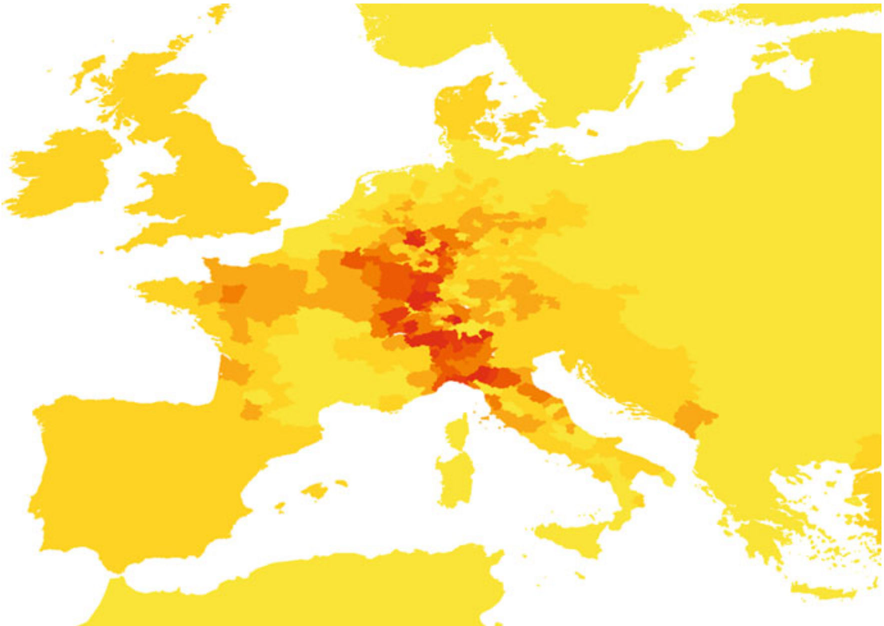

Fig. 5 Increased transport costs per region (*yellow*: 0 %, *red*: 10 %), Scenario 2: Karlsruhe-Basel, factor 10. *Source*: Own illustration

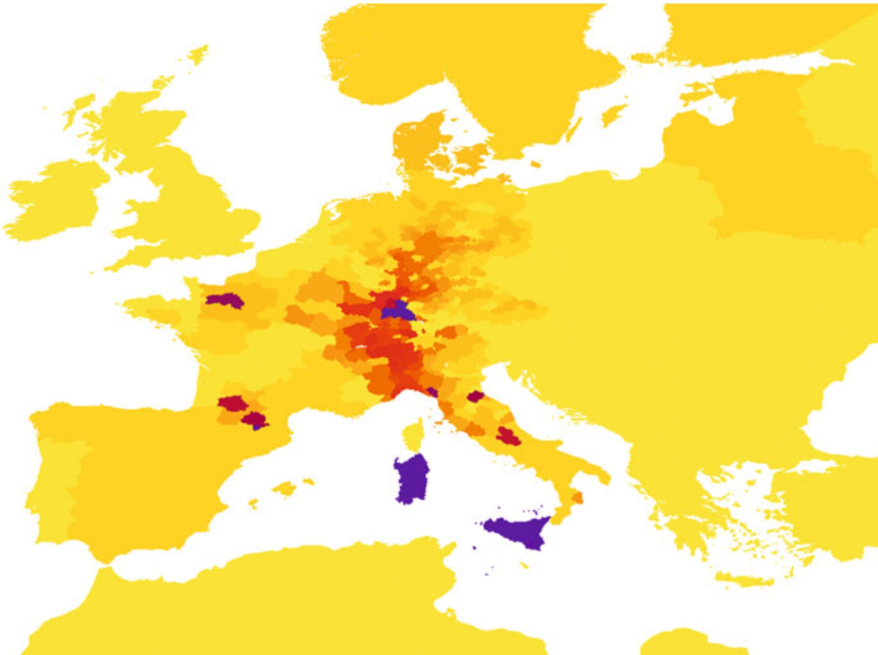

Fig. 6 Increased transport costs per region (*yellow*: 0 %, *red*: 10 %, *blue* 30 %). *Source*: Own illustration

regions located within the assumed bottleneck corridor is lower. This can be explained by the fact that other transport modes such as inland waterways or roads remain as transport alternatives, and that due to cost increases a shift in the main-haul leg from rail especially to inland waterways has taken place. The bottleneck has an especially negative impact on regions that can be considered as extensions of the bottleneck corridor, such as regions located to the east and to the west of the Rhine valley, and especially on regions with no inland waterway access such as the Southern Alps. These regions rely to a large extent on railways as the main long-distance transportation mode. In general, this can be stated for regions that have no direct access to inland waterways and to the northern seaports.

The differences in the scenarios are due to the significance of the chosen parameters, which increase transport costs for rail. The main observation of scenario 1 is that due to a moderate increase in transport costs, but over a longer corridor, the magnitude of impact is lower. More regions, however, are affected. In comparison, a significant increase in transport costs, but regionally focused, show higher impact values with fewer regions affected, as in scenario 2 and 3.

Scenario 1 and 2 show relatively similar results: The impact of a railway cost increase for a regionally focused bottleneck as in scenario 2 is comparable with a scenario of a moderate cost increase over a longer corridor as in scenario 1.

Scenario 3 addresses a scenario in which railway transport between Karlsruhe and Basel is practically blocked and all other regions are forced to accept additional transport costs, detours, additional transshipments and other transport modes on alternative routes, leading to higher costs for these regions.

A massive disruption, capacity limitations or cost increases for railway transport along the Rhine valley especially affect transport to and from Switzerland negatively. The necessity of additional transshipments in Basel to inland navigation or the use of alternative routes via France, Italy or Bavaria will lead to considerable extra costs.

5 Conclusions

Transport economics assumes that impediments on routes will increase with the number of users. In the case of alternatives, this leads to a split of transport flows. Within passenger and public transport modelling, this methodology provides realistic calculations of impediments and route assignments. Within the CODE24 Transport Model, this methodology has been applied to goods container transport, based on transport costs as the main impediment parameter. The calculated split of transport supply on the intermodal transport modes and routes is an impact of bottlenecks.

The modeled bottlenecks might not be considered as realistic in their magnitude. However, they show impressively the impact on regional accessibility and development. The analysis indicates that an increase in transport costs for one transport mode, due to a bottleneck, has a negative impact on most regions along the corridor and even more so on specific regions outside the corridor. Since we are analysing bottlenecks in the corridor, such negative impacts have to be considered and can be regarded as the "costs of non-doing."

A current example: The recent devaluation of the Swiss Franc is considered as a bottleneck on all Swiss railway routes, as it increases operational and infrastructure costs by 20 %. Since alternatives on inland waterways do not exist and road transport costs will also increase due to the HVC (Heavy Vehicle Charge), the conclusions from the CODE24 bottleneck modelling can be applied accordingly.

Within the CODE24 bottleneck analysis, two different analyses have been carried out: an empirical analysis on the capacity on a specific rail leg of the corridor Rotterdam-Genoa and an infrastructure-based modelling of regional transport costs (see Chapter "Comparative Analysis of Accessibility for Freight Transport in Corridor Regions: Results of Two Case Studies"). Transport demand issues suggesting interdependences with the supply side of the transport model have not been taken into account at this stage. In addition, the economies of scale that might provide an explanation for the concentration of transport flows on specific routes are not addressed in detail within the modelling approach. The empirical results as well as the modelling results suggest that an extension of the modelling approach into these research fields might complete the picture towards an optimal development and usage of CODE24 infrastructure.

References

Ahrens G-A, Baum H, Beckmann KJ, Brilon W, Eisenkopf A, Fricke H, Göpfert I, Hirschhausen C, Knieps G, Oeter S, Radermacher F-J, Rothengatter W, Schindler V, Schlag B, Siegmann J, Stölzle W (2007) Verkehrspolitische Handlungsfelder für eine effiziente Logistik, on behalf of Wissenschaftlicher Beirat beim Bundesministerium für Verkehr. Bau und Stadtentwicklung, Berlin

Brunet R (1989) Les Villes Européennes, Rapport pour la DATAR. Reclus, Montpellier

Cipolina S, Ghiara H (2011) Market situation and context analysis. Project report MoS24, Genoa

Drewello H (2014) Transport policy and regional development: the economic impact of regional accessibility on economic sectors. In: Lami IM (ed) Analytical decision making methods for evaluating sustainable transport in European Corridors. Springer International, Cham, pp 103–120

Drewello H, Günther H (2012) Bottlenecks in railway infrastructure—do they really exist? The Corridor Rotterdam-Genoa. Paper presented on the European transport conference, Crowne Plaza Hotel, Glasgow, October 2012

Drewello H, Gütle S (2013) The need for investment on the 'Rheintalbahn' in the Upper Rhine Valley. Results of a railway capacity analysis near the town of Lahr. 3rd Code24 report of action 9, August 2013, Kehl

Drewello H, Dittrich I, Gütle S (2013) Kapazitätsbelastung der Rheintalbahn—Zugzahlmessung mit Infrarottechnik. Internationales Verkehrswesen 4:48–51

Happel O (1959) Sperrzeitentreppe als Grundlage für die Fahrplankonstruktion. Eisenbahntechnische Rundschau 8(2):79–90

Holzhey W (2010) Schienennetz 2025/2030. Ausbaukonzeption für einen leistungsfähigen Schienengüterverkehr in Deutschland, ed. Umweltbundesamt, Dessau-Rosslau

Holzhey W (2011) Rail network 2025/2030. Expansion concept for an efficient rail freight service in Germany, Summary, Dessau-Rosslau

Rothengatter W (1996) Bottlenecks in European transport infrastructure. Paper presented on the European transport conference 1996, Brunel University, Uxbridge

Since 2009 **Hansjörg Drewello** has been a professor of economics, first at the University of Applied Sciences Göttingen and now at the University of Applied Sciences Kehl. He is the German director of the European Competence and Research Centre Cluster Management. His teaching and research deal with regional economics, in particular infrastructure development and the regional economic impact of cluster initiatives in a cross-border context. Until 2009 Hansjörg Drewello was the director of the Department of International Commerce, Transportation, Commerce and Tourism at the Chamber of Commerce and Industry Karlsruhe and a member of its management board. He was the lead partner of the study segment "Freight transport and logistics" of CODE24.

Marcel Huschebeck received his Diploma in National Economics at the University of Freiburg, Germany. He has gained more than 3 years' experience in the field transport, logistics and transport policy as officer for the German association Bundesverband Güterkraftverkehr Entsorgung und Logistik (BGL). Since 1999 he is involved in research and consultancy projects in the field of freight transport and logistics IT systems at PTV Planung Transport Verkehr AG. Today he has the position of a Manager responsible for the Logistics Systems group within the Research & Innovation unit at PTV. As project co-ordinator he has managed several EU research projects: IRIS, IDIOMA, AIMS, BESTUFS, BESTUFS II, PROMIT, BESTFACT, MODULUSHCA.

Norbert Schick received his master degree in civil engineering with emphasis on transportation planning at the University Karlsruhe, Germany. Since 1994 he is working with PTV as project manager and senior consultant in the fields of demand models (Prt, Put, Freight), network modelling, integrated transportation planning (PrT, PuT), urban and spatial planning as well as economic feasibility studies. He has been involved among others in the Interreg Project Corridor Development Rotterdam-Genoa (CODE24), the Transport Corridor Europe-Caucasus-Asia (TRACECA) and the Traffic Impact study Barwa city (Doha).