

Improvement of the  
Eindhoven - Düsseldorf Rail Corridor

- Overview -

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Version 1-00

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### Version control

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## 1. Introduction

### 1.1 Initial situation

Since December 2002, the second stage of the integral fixed-interval timetable (*integraler Taktfahrplan*) has been running in the German state of North Rhine-Westphalia (NRW). One benefit of this new timetable was direct Regional Express (RE) trains from all parts of NRW to the economic centres of Cologne, Düsseldorf and the Ruhr region. This put the quality of local public transport services on a high level. The Netherlands also offers an integral fixed-interval timetable. Based on regional and intercity services running on half-hour intervals, it provides very good service.

Cross-border services, however, are inferior to the domestic Dutch and NRW services. The lack of technical interoperability between the networks of DB Netz and ProRail is a major obstacle to better rail services between the two countries. Differences in the power supply and signalling systems hamper cross-border services. One of the few links between NRW and the Netherlands is the RE line 13 on the (Hamm –) Düsseldorf – Mönchengladbach – Venlo route. This is part of the route between Düsseldorf and Eindhoven, but requires a transfer in Venlo to the Dutch Venlo – Eindhoven – Rotterdam – Den Haag Intercity service with an unattractive transfer time of about 20 minutes. The result is a travel time of 2:12 on the 108 km route (in the opposite direction 2:06). In Eindhoven, the Venlo – Den Haag / Rotterdam IC service connects to the Maastricht / Heerlen – Amsterdam IC services. Düsseldorf offers a connection to the European high-speed network, with links towards Hamburg, Berlin, Frankfurt, Munich and Basel, among others. The following line schematic shows Eindhoven – Düsseldorf services in 2011:

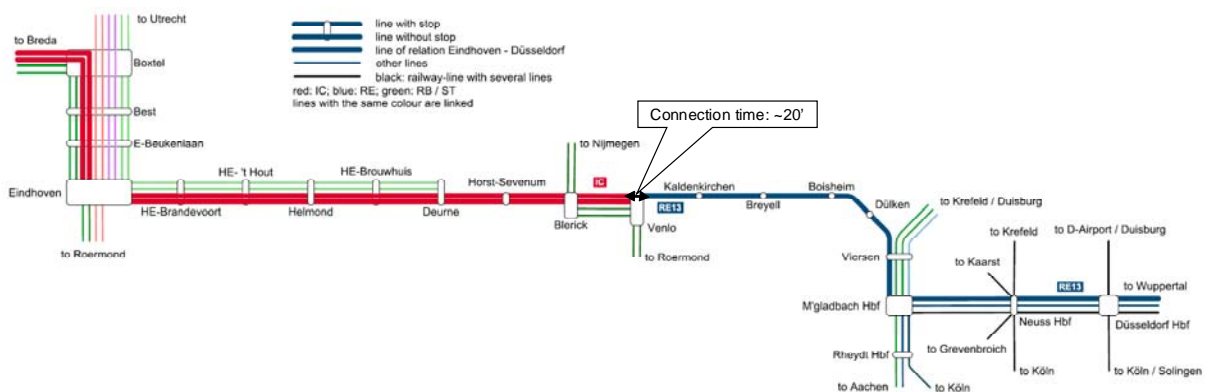


Figure 1 Eindhoven – Düsseldorf services in 2011



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## 1.2 Objective of the study

The objective of this study is to identify appropriate possibilities for the improvement of Eindhoven – Düsseldorf rail services. In this context, inter-regional travel between Randstad (Den Haag, Rotterdam) and NRW (Düsseldorf, Cologne, Ruhr region) and the accessibility of Düsseldorf airport will also be considered. The following groups of variants are considered as possible service concepts:

- Optimisation and extension of the RE 13 into the Netherlands
- Extension of Dutch IC trains into Germany
- Additional long-distance trains that complement existing services

The variants require differing timescales for implementation; it may be possible for some variants to build on others. Thus, for example, in a first step the connection in Venlo can be improved and in a second step a direct service can be developed.

Given the importance of the Eindhoven – Venlo – Mönchengladbach route for rail freight, for each variant we determine the maximum number of freight paths per hour.



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## 2. Constraints

The Eindhoven – Düsseldorf route connects two closely knit rail networks in the Netherlands and NRW. In addition to connections in Eindhoven and Düsseldorf, other major connections exist today in Venlo for travel towards Nijmegen and Roermond, in Viersen towards Duisburg and Essen (RE11 starting in 2011) and in Mönchengladbach towards Cologne and Koblenz (RE8). These routings should be maintained in the variants to be studied.

In addition to dense passenger traffic, the route between Eindhoven and Mönchengladbach is also important for freight moving between Rotterdam, Cologne and southern Germany. When developing the timetable, several sets of constraints must be taken into account:

- Track assignments in Eindhoven and Venlo
- Single track between Kaldenkirchen and Dülken
- Heavy train traffic between Eindhoven and Deurne and between Mönchen-gladbach and Düsseldorf
- Numerous potential conflicts at flat junctions
- Reversal of RE13 trains at Mönchengladbach

Currently, plans are being developed for regional train service on shorter fixed intervals between Eindhoven and Deurne; on this basis, our study assumed a 15-minute interval for regional trains. IC trains are assumed to run per the 2010 timetable. In NRW, the basis for the study is the 2011 timetable.

For trip-time calculation, the variants whose trains run through Venlo assume use of dual-system FLIRT rolling stock from Stadler. Such vehicles provide cross-border services between Switzerland and Italy today. The electrification systems of these two countries are different, just as they are in Germany and the Netherlands. For cross-border services via and beyond Venlo, however, no dual-system vehicles are available today. The following figure presents an overview of the Düsseldorf – Eindhoven corridor:



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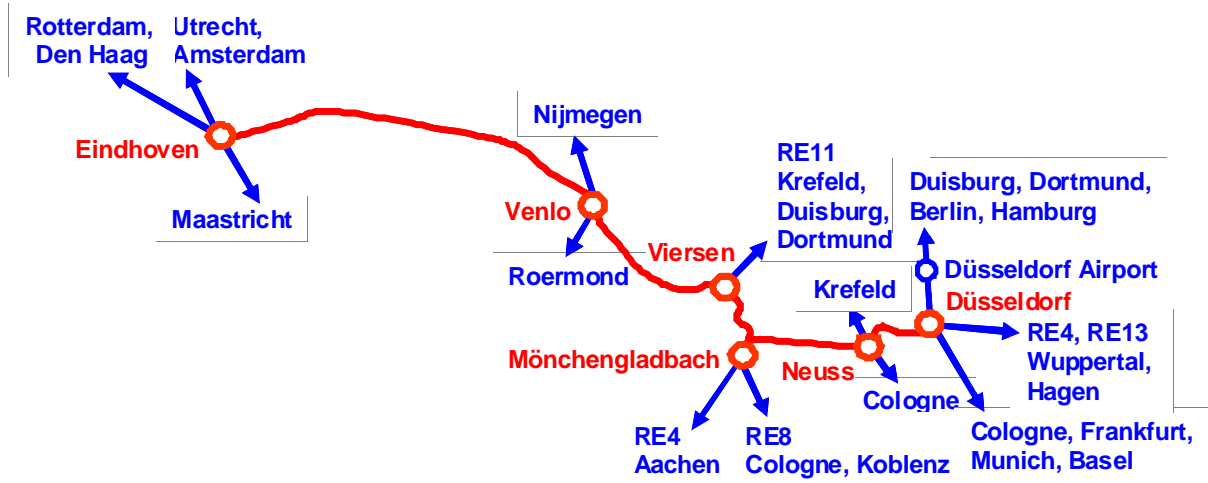


Figure 2 Overview of the Düsseldorf – Eindhoven corridor

The following figure shows the lines that operate on the corridor between Eindhoven and Düsseldorf in the 2011 timetable:

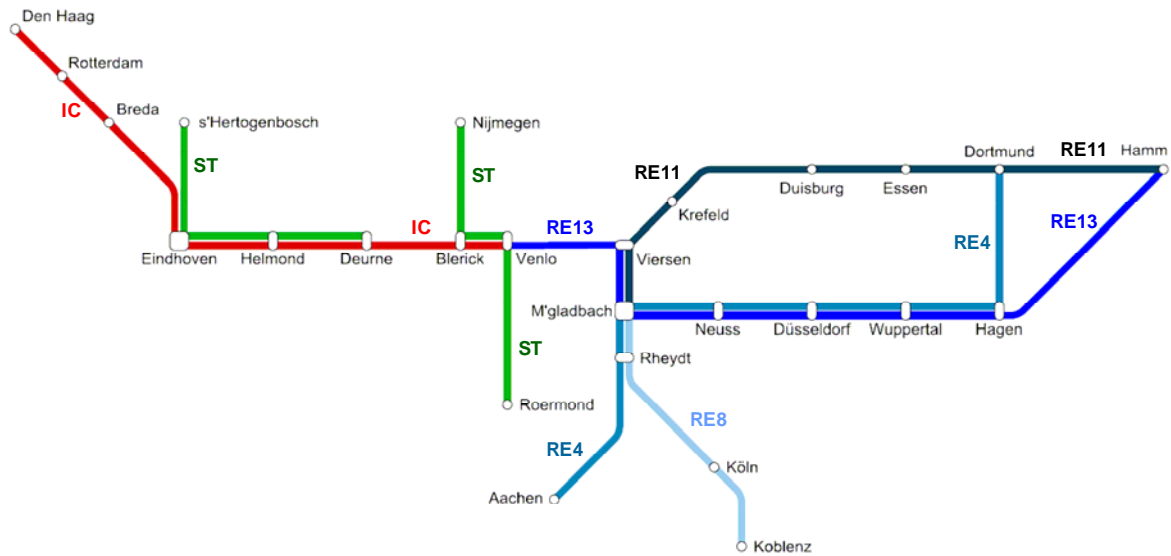


Figure 3 Eindhoven – Düsseldorf line network, 2011 timetable



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### 3. Overview of the variants developed

Each of the variants we developed fulfils the following conditions:

- Additional train services: The additional train services presented here are obtained by splitting/joining trains in Mönchengladbach or by extending existing lines.
- Intermediate stops: All variants retain all existing stops. Variants A3a and A3s-RE8 require an additional transfer in Mönchengladbach to reach Düsseldorf. This applies to passengers at all stops between Venlo and Viersen.
- Capacity for freight trains: All variants retain four paths per hour for freight trains on the Dutch side. On the German side, depending on the variant, two to three freight trains can run per hour.

The variant group A was developed on the basis of the 2011 integral fixed-interval timetable in NRW. Variants A1 to A4 and A6 to A8 foresee the extension of RE13 to Eindhoven. In variant A5, the RE4 takes over the Düsseldorf – Eindhoven route as a train that splits/joins in Mönchengladbach Hbf.

The following table presents an overview of the variants developed:

Main variants	Sub-variants
<b>Short term</b> Optimised connection in Venlo	A3s-RE8: Better connection in Venlo / Add RE8 to Venlo
	A3s-RE13: Better connection in Venlo / Split-join in M'gladbach
<b>Variants A</b> based on extension of existing German regional trains to Eindhoven	A1: RE13 per 2011 timetable, extended to Eindhoven with node in Venlo
	A2: RE13 per 2011 timetable, faster to Eindhoven
	A3: RE13 splits/ joins in M'Gladbach; faster train part to Eindhoven
	A3a: RE13 faster to Eindhoven; RE8 slow to Venlo
	A4: RE13 as faster IC in NL; add Eindhoven – Venlo stoptrein
	A5: RE4 splits/ joins in M'Gladbach
	A6: Fastest Düsseldorf – Eindhoven (RE13) service
	A7: S28 to Venlo; RE13 faster to Eindhoven (long term)
A8: RE4 to Venlo, RE13 faster to Eindhoven	
<b>Variants B</b> based on extension of the Dutch IC to Germany	B1: IC Den Haag – Düsseldorf; it is additional in NRW
	B2: IC Den Haag – Düsseldorf; it replaces RE13 in NRW
	B3: IC Den Haag – Düsseldorf; fastest service
<b>Variants C</b> based on additional long-distance services	C1: EC Eindhoven – Düsseldorf; additional train running every two hours
	C2: EC Eindhoven – Düsseldorf; fastest service
	C3: RRX-international: Eindhoven – Düsseldorf – Arnhem (long term)

Figure 4 Overview of the variants

The variant group B includes an extension of the Dutch IC to Düsseldorf.

The variant group C foresees a long-distance line between Eindhoven and Düsseldorf that operates in addition to existing services. Variant C3 builds on the RRX concept planned in NRW and foresees an RRX line from Eindhoven via Düsseldorf to Arnhem. This line would cross the German-Dutch border twice and thus doubly justify the use of dual-system vehicles.



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The variants A7 and C3 are possibilities only in the long term, as they require significant infrastructure improvements. All variants are compared according to the following criteria (in order of descending priority):

- travel time (Düsseldorf – Eindhoven today: 2:12)
- available connections
- infrastructure requirements
- additional train kilometers
- number of required dual-system vehicles
- possible freight paths on the Eindhoven – Mönchengladbach section (today: four freight paths in the Netherlands and three in Germany per hour).

The following table shows the criteria for comparison of the variants:

Variants	Travel time Düsseldorf - Eindhoven	Connection to Den Haag	Connection to RE11 in Viersen	Connection to RE8 in MG	Freight trains (NLD)	Infrastructure	Needed additional train-km / train (NLD)	Dual-system trains	Comments
A1 RE13 per 2011, Venlo node	1:57	17'	5'	5'	3/3	none	18,800/ 0	8	
A2 RE13 per 2011, fast in NL	1:47	27'	5'	5'	3/3	none	18,800/ 0	8	
A3 RE13 splits/joins in MG	1:39	6'	none *	none *	4/2	signals	1,200/ 10,700	7	
→ A3s short term	1:42	5' ****	none *	none *	4/2	signals	1,200/ 10,700	0	Transfer in Venlo
A3a RE13 fast; add RE8 slow	1:39	6'	none *	none **	4/2	none	1,200/ 10,700	7	
→ A3s-RE8 short term	1:42	5' ****	none *	none **	4/2	none	1,200/ 10,700	0	Transfer in Venlo
A4 RE13 as IC in NL	1:39	6'	none	none	4/3	none	10,700/ 0	7	
A5 RE4 splits/joins in MG	1:35	6'	none *	none **	4/2	signals	11,900/ 10,700	6	
A6 RE13, fastest service	1:30	14'	none *	none **	4/2	signals	20,000/ 10,700	7	
A7 S28 to Venlo	1:39	6'	5'	6'	4/2	many	11,900/ 12,900	7	Long term only
A8 RE4 to Venlo	1:39	6'	5'	6'	4/2	stations	11,900/ 10,700	7	
B1 IC added to Düsseldorf	1:45	dir.	23'	24'	4/2	none	1'200/ 19'500	8	
B2 IC replaces RE13	1:40	dir.	4'	5'	4/3	none	10'700/ 0	8	Düsseldf. Airport
B3 IC, fastest service	1:30	dir.	none *	none **	4/2	none	11,900/ 19,500	8	Düsseldf. Airport
C1 EC added every 2 hours	1:30	16'	none *	none **	3.5/2.5	none	20,000/ 19,500	3	Every 2 hours
C2 EC, fastest service	1:28	18'	none *	none **	3.5/2.5	none	20,000/ 19,500	3	Every 2 hours
C3 RRX to Eindhoven	1:34	6'	none *	none **	4/2	RRX	11,900/ 10,700	7***	Long term only

Figure 5 Comparison of variants (the connections shown are available in 2011)  
Green: favourable criterion; red: unfavourable criterion

On the basis of the evaluation, the variants that only slightly reduce travel time, eliminate connections or greatly increase costs can be eliminated (red marking). In line with the timescales of their feasibility, the variants selected are put in sequence and in some cases modified.

## 4. Variants selected

A concept for improvement of rail service between Düsseldorf and Eindhoven should permit upgrades in the longer term. From this viewpoint, variant A3 is particularly well-suited. Even in its early phases and without direct service, it reduces the current travel time of 2:12 between Düsseldorf and Eindhoven by 30 minutes. The following table shows the preferred variants and the timescales for their implementation:

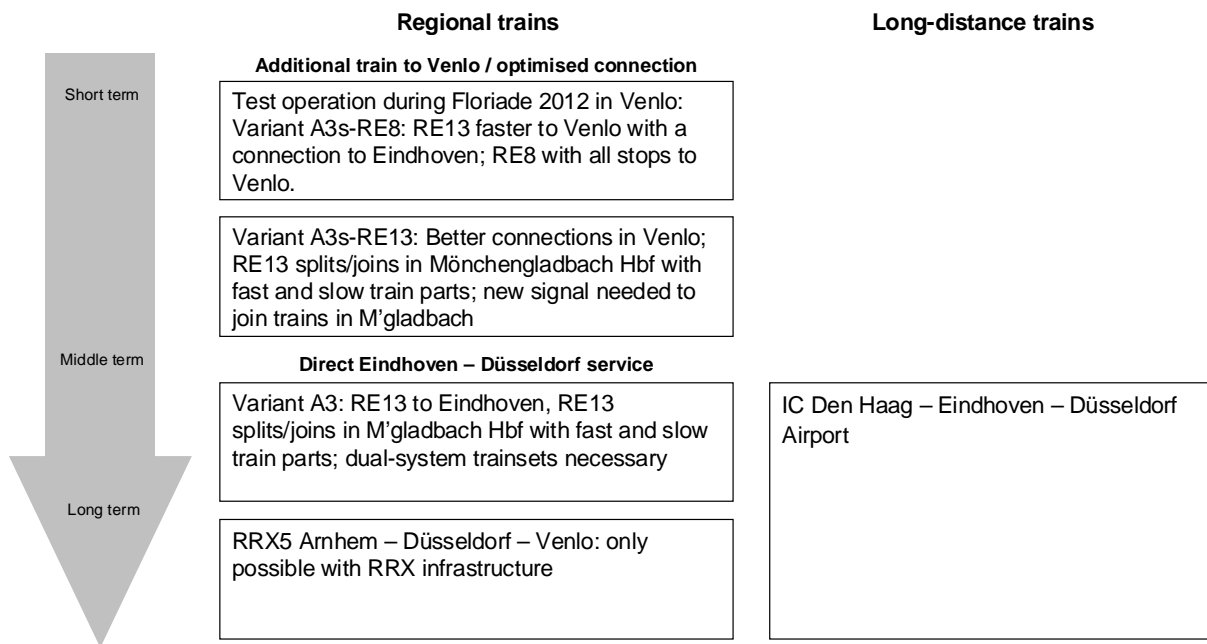


Figure 6 Variants selected – Overview

## 4.1 Possibilities for regional train service in the short term

In the short term, the RE13 can be accelerated between Mönchengladbach and Venlo so as to optimise the connection to the Dutch IC towards Eindhoven – Den Haag. This concept achieves this in part by giving the RE13 a shorter turning time in Mönchengladbach and a slightly faster path between Neuss and Mönchengladbach. Between Viersen and Venlo, the RE13 runs non-stop. The current RE13 path contains additional stops at intermediate stations. In the concept, a new, additional service will make these stops. This shortens the trip between Düsseldorf and Eindhoven by 30 minutes by allowing a transfer in Venlo to the IC that runs one interval earlier. In the concept, the RE13 does not



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reach connections to the RE11 towards the Ruhr region and to the RE8 towards Cologne, but the new, additional service does.

In a first phase (variant A3s-RE8), the RE8 can serve the intermediate stops and thus also create a direct Venlo – Cologne – Koblenz service. A test of operations during Floriade 2012 in Venlo is an option for the integration of this operating concept.

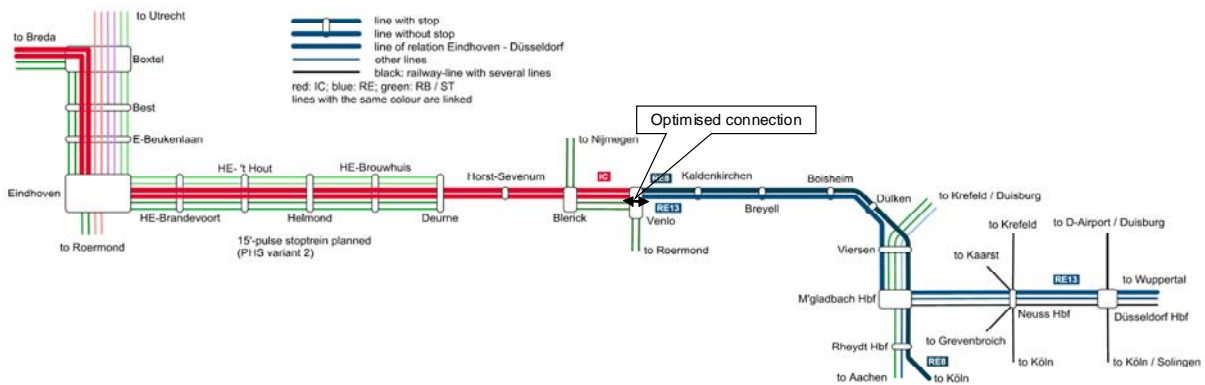


Figure 7 Variant A3s-RE8: Optimised connection in Venlo; RE8 to Venlo

In a second phase, for the creation of a direct service from the stops served by the new train between Venlo and Viersen to Düsseldorf, the new train can be made part of a RE13 train that joins/splits in Mönchengladbach (variant A3s-RE13). In Mönchengladbach, this requires a new mid-platform signal to allow unification of the train's two parts.

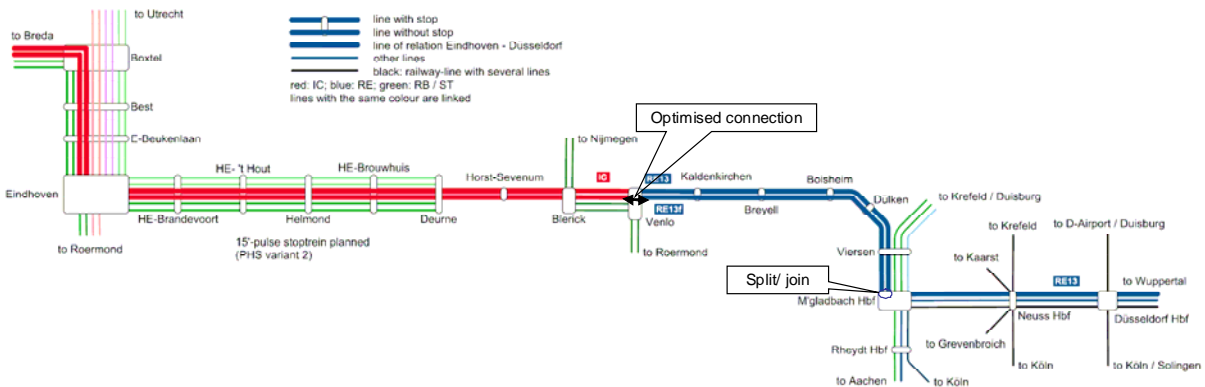


Figure 8 Variant A3s-R13: Optimised connection in Venlo; RE13 splits/joins in M'gladbach

These two development phases of the improved operational concept entail more train traffic on the Mönchengladbach – Venlo segment. To minimise



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this additional traffic, it would also be possible to implement the concept described for the accelerated RE13 on a two-hour interval. Dual-system vehicles are not required. However, certification of the vehicles foreseen (ET 425 in the case of variant A3s-RE8) for the Dutch Kaldenkirchen – Venlo segment needs to be obtained.

#### 4.2 Mid- to long-term options for regional services

In the middle term, and on the basis of the preliminary phases described above, a direct Düsseldorf – Eindhoven service can be developed. For this purpose, the faster part of the RE13 train (RE13f) is extended along the path used until now by the IC to Eindhoven. There, a connection to the IC to Den Haag is created. In this way, in Eindhoven the RE13f optimally serves the connection node for the IC routes to Amsterdam<sup>1</sup>, Maastricht / Heerlen and Rotterdam / Den Haag. To go to Eindhoven, the RE13f requires dual-system vehicles.

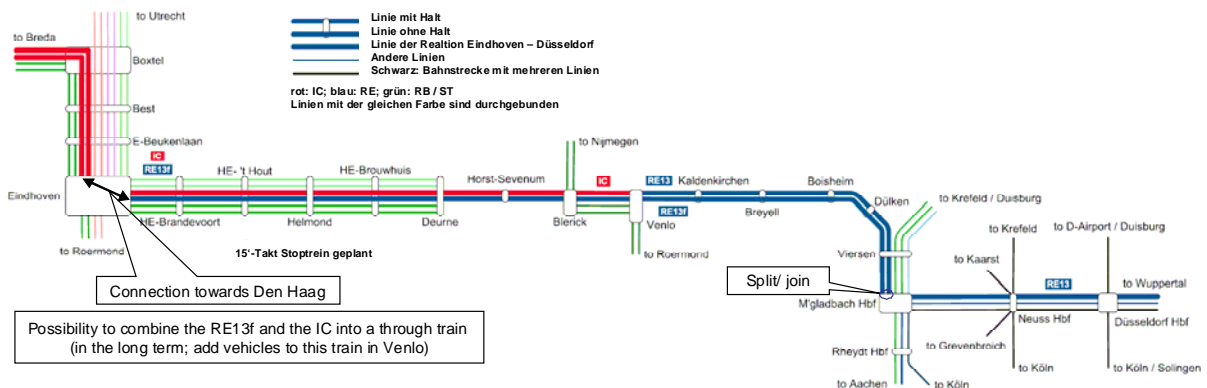


Figure 9 Variant A3: Direct Eindhoven – Düsseldorf service that splits/joins in Mönchengladbach

Combining the RE13f with the IC for Den Haag into a single train is conceivable. This would, however, require a large number of dual-system vehicles. In order to meet the greater demand between Eindhoven and Den Haag, the stop in Eindhoven or Venlo can be used to add vehicles to the trains for Den Haag and remove some from the trains for Germany. The additional vehicles can be cheaper single-system ones.

As a variant for the long term, the routing of the RE13f to Eindhoven can later be replaced by a line of the Rhine-Ruhr-Express (RRX). One possibility would be an extension of line RRX5, which in this case would

<sup>1</sup> Starting in about 2020, trains towards Amsterdam will run on a 10-minute interval.



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serve an Eindhoven – Düsseldorf – Arnhem route. The double crossing of the German-Dutch border would permit optimal use of dual-system vehicles. The RRX concept in NRW presupposes significant infrastructure work between Dortmund and Cologne. This solution must therefore wait until the RRX infrastructure enters service.

#### 4.3 Possibilities for long-distance services in the middle to long term

The basis in NRW for the development of the variants described above is local service. From an operational viewpoint, a long-distance service on the Den Haag – Eindhoven – Düsseldorf Airport route would also be possible. Between Den Haag and Eindhoven, a current IC path is to be used. In order to be conflict-free along the entire route, the service must be fast. Between Eindhoven and Düsseldorf, trains will therefore stop at Venlo, Mönchengladbach and Neuss only. As an alternative to reversal in Düsseldorf main station, the IC can be extended to Düsseldorf Airport with no need for additional vehicles. To reduce the traffic and cost impact of an additional long-distance line, this concept can also be implemented either on a two-hour interval or for isolated trains with no fixed interval.



Figure 10 Variant B3: IC Den Haag – Düsseldorf Airport Terminal

The increasing number of passenger trains on the Venlo – Mönchengladbach route leaves fewer paths available for freight trains. Currently, a transfer of freight trains onto the Betuwe route is occurring that will presumably continue with the rising passenger train traffic via the Venlo border crossing.

However, given the expected increase of traffic – particularly freight – in coming years, upgrading the Kaldenkirchen – Düren section to two tracks, as foreseen in the German federal transport route plan (*Bundesverkehrswegeplan*), may be necessary.



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## 5. Summary

This study describes a multi-phase approach for sustainable qualitative improvement of the international Düsseldorf – Eindhoven (– Den Haag) rail corridor. It shows the way towards a solution that can be unanimously supported by all the towns and cities participating in this sub-project within the INTERREG IV-B project „RoCK“. This phased approach allows significant qualitative improvements and 30-minute reductions in travel time for cross-border travellers. Implementing the proposals requires the following next steps:

- broad-based agreement within the governing bodies of the participating towns and cities and of the Rhine-Ruhr transport authority (VRR);
- participation of the Dutch provinces and German administrative districts (*Regierungsbezirke*);
- conduct of possibly simultaneous planning efforts (for example, extension of line S28) with the goal of a regionally agreed concept for regional and long-distance rail service in Niederrhein, Limburg and Brabant;
- introduction of the concepts within the responsible units of the state of North Rhine-Westphalia and at national level in the Netherlands; and
- parallel accompanying marketing and lobbying.

A possible short-term goal for implementing a better service concept on the Düsseldorf – Eindhoven route is a pilot operational test during Floriade 2012 in Venlo. The following are the biggest issues to be clarified:

- customer-friendly, through ticketing (eliminating the VRR supplementary ticket in favour of a “Floriade Combined Ticket”);
- agreement of all participants on a service concept;
- co-financing of tickets and, as required, financing of additional train services;
- enablement of a cross-platform transfer in Venlo station; and
- determination of path availability and reservation of paths.

Resolution of these issues requires rapid agreement among the following parties:

- responsible managers for regional transport, including VRR and others, regions, provinces, the *gemeente* Venlo and the Floriade 2012 project managers;
- the involved train operating companies (eurobahn, DB Regio, NS); and



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- the infrastructure operators (ProRail and DB Netz).

A successful pilot operation during Floriade 2012 will then deliver the best possible initial conditions for the phased implementation of the operating concepts developed as part of our expert appraisal.

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