Findings Report
August 2015

Action WP6A29

Integrated corridor appraisals and master plans for regional cases:
Developing the Arnhem-Nijmegen electrical rail network, and territorial benefits (working draft)
Sustainable transport for North-West Europe’s periphery

Sintropher is a five-year €23m transnational cooperation project with the aim of enhancing local and regional transport provision to, from and withing five peripheral regions in North-West Europe.

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Findings report: elektrification Arnhem – Doetinchem - Winterswijk

1. Background and objectives
The line Arnhem – Doetinchem – Winterswijk is situated in the eastern part of the Netherlands and has about 18,000 travellers a day. This makes it one of the busier regional lines in the Netherlands. From Arnhem to Zevenaar there is a double and electrified track, which is shared with international trains from Amsterdam to Germany. From Zevenaar to Winterswijk there is mostly single track without a overhead line. This section is only used by trains from Arnhem to Doetinchem / Winterswijk. The provincie of Gelderland grants two concessions for the operation on this line, which is diesel operated.

- **Breng**: 2 trains an hour between Arnhem and Doetinchem (December 2012 – December 2022);
- **Arriva**: 2 trains an hour between Arnhem, Doetinchem and Winterswijk (December 2012 - December 2020).

![Map of Arnhem Winterswijk railway line](image)

Between Arnhem and Doetinchem there are 4 regional trains an hour, of which 2 two trains (Arriva) continue to Winterswijk. This can be explained by the number of passengers, which is also the result of the fact that this area is less populated. Around 80% of the journeys takes place between Arnhem and Doetinchem. Arnhem is a mayor attraction for travellers on this line. About 25% of travellers change trains from Arnhem to Utrecht.

There are issues with the reliability of this this line and the transfer on other trainers offered in Arnhem. The score of customer satisfaction has been low for years, the line is usually among the lowest in the Netherlands. However, due to the introduction of the new trains with more capacity the score has increased in the last two years.

Also, feasibility studies were performed for two new railway stations, Arnhem Pley and Zevenaar East. Conclusion: both stations will not be realised in the next years, because of the low numbers of (new) travellers and the problems with regard to the capacity on the track. The province of Gelderland decided that it is better to invest in improving the reliability of the trains service, rather than the opening new railway stations. This is why the decision was made to build a second track between Zevenaar and Didam, and to improve the speed on the track.
Finally, the province of Gelderland decided to study the electrification of Arnhem – Doetinchem – Winterswijk. There are also other initiatives to make rail lines more sustainable, like the battery-powered train initiative of Network Rail and the discussion on bio LNG. These are all very new initiatives and are not a proven technology. That is why this study focuses only on electrification.

2. Feasibility study electrification

The workpackages included a number of work packages which are shown in the figure below.
The study initially started as an infrastructure study. However, as anticipated, the rolling stock became a major point of focus. The life span of the regional trains is about 25 – 30 years. The trains of both operators are relatively new (December 2012). In the current concessions there are obligations with regard to the use of the diesel trains in a new concession. For example, in the concession of operator BRENG (ends in December 2022), it’s stated that the rolling stock will also be used in the new concession (until 2032).

Therefore, two options for electrification were studied:
- Transforming the diesel unit in electric ones in 2025.
- New electric rolling stock in 2032

In the end, a social cost benefit analysis was performed, in which the Dutch OEI-guideline was used in the process. However, it was less detailed than the social cost-benefit analyses that are done for large national projects.

3. Conclusions
   - The investment costs of electrification of Zevenaar – Winterswijk (67 km) are estimated at € 77,5 million;
   - According to figures from the two operators, the operation costs are now € 17,4 million a years. The annual saving of the operational costs are extmated at €1,7 million a year (operators) and €2,8 million a year (consultats);
   - The annual benefits would grow from €13,4 to €14,1 milion;
   - The cost coverage degree of the line would grom from 77% to 83% (operations) or 88% (opinion consultants);

4. Lessons learned
   1. **It is possible to realise a reduction in the investment costs by realising a lighter version than in traditional heavy rail**

   The expectation value of the investment costs were € 94,5 million. The costs went down when the future claim for electric freight trains between Zevenaar and Winterswijk was dropped. The extimated costs were then calculated at € 77,5 million. The recent tendering of another regional line, Zwolle – Kampen, learned that the prices of the market are much lower than expected.

   2. **Electrification leads to a reduction in operational costs and a higher cost coverage degree.**

   There is consensus on the positive effects of electrification on the businesscase of operators. However, there is discussion on the exact expected impact. In this study, consultants were more positive on the benefits of electrificaton than the two operators.

   3. **The social cost benefit analysis can deliver a useful contribution in the decision making process.**

   In the businesscase, the operational costs and benefits of electrification are determined. This is interesting for both the operator and the provinice, who subsidises the line. There are also important external benefits, like the effects on noise and emissions, which are not part of a businesscase but generate benefits which should be taken in account. The social cost benefit analysis proved to be a useful method in the decision making process.

   4. **Electrification has a positive effect on the reduction of the operational costs and the rise of the cost coverage degree.**
The most important benefit from electrification is the reduction of the operational costs (in this case 45%). However, there is debate on the amount of reduction it delivers.

5. It is possible to quantify external effects in an early stage.
Usually the external effects are dealt with in a qualitative manner in the early planning stages. In this study, the choice was made to quantify the effects on external effects like CO2 and noise reduction. Of course, this is open to debate.

The life span of a modern diesel train is 25 – 30 years. Electrification is more interesting in situations the rolling stock is relatively old.
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