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5.1 Case Study Repository

TRANSFORMATION IS POSSIBLE!

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Introduction

This repository of case studies forms the deliverable 5.1 of the TRANSFORuM project. The production of the deliverable has been carried out in accordance with the 5 tasks outlined in the project description of work. A full explanation of the methodology, selection process and analysis of the case studies can be found in deliverable 5.2 "Transformation is Possible! Good practice in the context of the EU White Paper".

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1 Executive Summary

This repository of case studies forms deliverable 5.1 of the TRANSFORuM project. The production of the deliverable has been carried out in accordance with the 5 tasks outlined in the project description of work. A full explanation of the methodology, selection process and analysis of the case studies can be found in deliverable 5.2 "Transformation is Possible! Good practice in the context of the EU White Paper". This summary, however, will briefly outline how each of the tasks was completed and give some overview information about the case studies contained in the repository.

1.1 Task 5.1 – Case selection

In collaboration with the thematic group leaders and the consortium partners involved in WP5 a set of principles was defined for case study selection. The criteria relating to identifying good practice, as a general concept were established, before identifying criteria that were relevant for each specific thematic group. The work of Bardach (2005; 2012)[1] was used as a starting point to frame discussions about good practice in the context of TRANSFORuM. This work suggests that a practice is a tangible and visible behaviour, for our work, this definition was broadened to include not just behaviours, but other entities and measures (such as technologies, train routes and payment systems) that demonstrate contributions towards achieving the White Paper goals. Good practice was identified as a process, which could be situated in a context. Based on these discussions a case study template was prepared to be used as a guide for preparing all the studies. Where possible, it was ensured that case studies reflect different geographical locations and scales – some large infrastructure projects are included as well as some technological innovations, decision making processes and soft measures to give a diversity of elements which are all in some way good practice and contributing towards the delivery of the White Paper goals.

1.2 Task 5.2 – Knowledge acquisition

Throughout the first 6 months of the project, UOXF conducted research into each of the thematic groups and also took nominations from consortium members and stakeholders on successful initiatives that may be a candidate for a case study. Long lists were drawn up for each thematic group and by applying the good practice criteria; a short list of 10 cases was established relevant to each White Paper goal. It was decided that it was important to gain stakeholder perspectives on the short lists at the autumn workshops. This proved to be a useful exercise as some case studies were removed and others included as a result of these discussions.

UOXF allocated some of the case studies to TOI, UG and CDV according to the contribution each organisation had in the WP description. UG and CDV were primarily researching New Member State cases and those areas in which they were most familiar or had requisite expertise. UOXF conducted 8 semi-structured interviews with relevant stakeholders. Existing tools such as the Eltis portal and the Polis network were utilised as TRANSFORuM was intended to draw and build on existing resources as well as creating new ones. Barriers and

[1] Bardach, Eugene (2005). A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving, 2nd Edition, (Thousand Oaks, CA: Sage); Bardach, Eugene (2012). A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving, 4th Edition, (Thousand Oaks, CA: Sage)

challenges to each case study were reflected upon, as well as the achievements so that important lessons learned and transferability insights could be gained from the cases individually and as a whole. All cases studies have undergone peer-review by the thematic group leaders.

1.3 Task 5.3 – Four Thematic Workshops on good practice – "Transformation is possible!"

UOXF selected workshop locations for the 4 autumn workshops to discuss issues of good practice, knowledge transfer and current practices of sharing information about policy successes. The stakeholders were asked to consider the following questions:

- What are the conditions and considerations necessary for policy/idea transfer?
- Which mechanisms are currently used to promote knowledge exchange and information sharing?
- What other means could encourage replication/uptake of successful ideas?
- What is the role of the EU in facilitating the exchange of good practice experience?

UOXF prepared a briefing document together with the thematic group leaders for each of the workshops to develop specific, focused tasks and to ensure that the stakeholders were informed of the work to date, and the areas where insights were needed. UOXF also worked with KIT to ensure that the good practice insights were useful and relevant to the initiation of the roadmapping process.

Four location specific site visits were organised as a part of these workshops to demonstrate sites of international 'good practice'. Further information about these site visits can be found in deliverable 5.2 – which forms task 5.4 of this work package. It will outline in more detail, the approach followed, the lessons learned from the case studies, the evaluation of their transferability and most importantly the elements to be integrated into roadmaps, recommendations and the strategic outlook.

The case studies contained in this repository have in common that they have been identified as good practice, but they also all follow the same format. Whilst this means that for some cases some elements are more important than others, taking the opportunity to reflect not just on substance and information about the 'what' was done, this format allows us also to examine 'why', 'how' and 'who' questions, which are often as, if not more, important than information the substance of a particular policy or measure. The cases however, are also very diverse to enable us to determine if and where there are any cross-cutting characteristics of good practice that can be learned from.

The case studies, whether as a primary focus, or as part of a multi-national project, cover 22 member states, as well as Norway and Switzerland. Of these countries, 10 are new member states (since 2004).

The urban mobility case studies feature 2 multi-national projects, 1 national project and 7 city-based projects. Of these 2 concern CO_2-free logistics, 4 are about electric vehicles, 2 feature public transport and 2 are about transport/sustainable urban mobility planning. It was intended to focus not just on alternatively-fuelled vehicles, as the White Paper goal states, but also on approaches that would reduce the number of vehicles in the city more generally.

The freight case studies focus on 3 different technological solutions that would shift freight from the road to rail, 2 exemplary routes (one rail, one water-based) are discussed as well as 1 policy framework, 2 port cases and 2 other solutions. The first of these looks at a project promoting optimising and improving the efficiency of transnational logistics and the second discusses a project aimed at improving the movement of oversized cargo with a view to contributing efficiency improvements the freight network as a whole. Whilst the last two are not directly related to modal shift, they demonstrate that by addressing associated or peripheral issues concerning the freight sector, modal shift might be easier to achieve.

Five of the high speed rail case studies focus on routes that have been successful either in terms of construction, modal share or profitability. There is 1 company case, 1 case related to ticketing and 2 cases related to infrastructure development are also discussed. A final case relates to information provision for high speed routes across Europe.

The case studies that relate to the integrated ticketing, information, payment and management goal have primarily to do with ticketing – 6 of the cases are concerned with this. One is focused on payment and 3 on information provision. It is important to emphasise however, that the objective of this goal is to integrate all of these areas and thus this separation of focus is deliberately simplistic – these cases have in fact been chosen because of the level of integration that the technologies and policies they cover have been able to achieve.

2 Urban Mobility Case Studies

2.1 beÁgueda, Águeda, Portugal

Thematic group: Urban
Specific area of focus: Contributes to the White Paper goal of reducing the use of 'conventionally-fuelled' cars in urban transport
Why good practice? Demonstrates that electric bikes can provide low carbon mobility in cities with very diverse terrain
Time period: 2011 – on-going
Budget: €22,000

Overview: In 2010, a trial was carried out to explore the feasibility of installing electric bikes in the topographically-challenged city of Águeda in Portugal. Following a positive reception, 10 electric bikes were installed in the city for the people to test. As a living labs initiative, the comments and feedback of the users throughout the pilot went directly to the bike manufacturers who would work to improve the bikes for the city in the longer term. The bikes were charged via a micro-generation photovoltaic installation on the street. The pilot was successful and plans are now underway to increase the number of electric bikes helping residents and tourists alike through the hilly streets of the city. A system is also being developed to help with the maintenance of the bikes and to inform people about the availability of bikes and parking in the city. Long term, it is hoped that cycling will become a culturally embedded activity and synonymous with the city.

Background: Águeda is a city in central Portugal (pop. 49.456) which is characterised by some steep terrain, with various public services being located at different levels between the river and the hills. This topography has limited the extent to which active forms of mobility could be employed by residents of and visitors to the area travelling between the historical centre and the higher inclines of the city. The city has a local cultural background in the two-wheeler and metallurgy industries.

Process: In 2010, the need for better mobility and less traffic was identified as a priority in the city's State of Sustainability Águeda report. The use of bicycles and the investment in cleaner vehicles were seen as two of the key actions to be undertaken to make progress on achieving this priority objective.

The beÁgueda brand

The city authorities subsequently issued a challenge to companies inside the Municipality of Águeda to develop a pilot project for electric bikes. In July 2010 bikes were tested and were viewed positively in terms of their ability to cope with the hills, easy to use and environmentally friendly. In June 2011, the beÁgueda commenced in the city, it ran for a year and delivered clear results.

Given its success, Águeda purchased more electric bicycles in 2012 and is working to upgrade the monitoring system and the security of the bike locks. The project team is also currently developing an innovative parking and sharing system for smart bikes, an Open-Bike system,

which allows detection of the exact location of the bicycle, number of available e-bicycles and their use conditions (e.g. battery capacity). This technology will help to facilitate the user friendliness of the bikes as people can see where/when bikes are available. The surveillance that the BikeEmotion technology provides also ensures that bikes can be sufficiently maintained and that any issues can be addressed in a timely manner.

Details: The bikes were all aluminium with a 24v lithium ion battery and a velocity of 25 km/h. As well as the 10 free rental electric bikes, the Municipality of Águeda invested in 10 parking ranks, a central station with a micro-generation photovoltaic panel to recharge the bikes and a management and monitoring system (WiMAX) to track the hire of the bikes. Each of the parking bays enabled bike charging so that the issues with battery cycles could be minimised. Some 29km of cycle paths were also constructed.

Bikes were free and available for all to use during the pilot, although a fee may be introduced in the future. The pilot was intended to be part of a longer term shift towards embedding cycling and sustainable modes of travel into a cultural identity for the city. As well as reducing costs for travellers commuting, reducing noise and pollution levels and to create new avenues of opportunity for the two-wheeled industry already located in the region. The installation of the bikes and their infrastructure in the beÁgueda project was developed alongside initiatives with schools to promote cycling and road safety education.

Stakeholders: The initiative has support from the Mayor from the outset and he remains an advocate for the promotion of cycling in the city. An important element of the beÁgueda pilot project was that it adopted a Living Lab methodology, meaning that the population of Águeda tested the bikes for themselves. Their feedback was given to the bike companies in order for them to improve bikes that will subsequently be introduced to Águeda. Other stakeholders involved include the Orbita and Miralago, SA (bike companies) and the IMTT (Instituto da Mobilidade e dos Transportes Terrestres).

Further partnerships may be established in the future around electric bikes in the city between local technology-based companies and the municipal authority, with stakeholders like driving schools to raise awareness of cyclists on the road with other road users and organisations that can offer adult cycling lessons, to open up access to the bikes to a broader range of users.

Success: Six months into the pilot year, about 150 registered users travelled over 20,000km in the city in more than 4,000 trips. There were 137 regular users (35% female; 65% male). This total delivered emissions reductions (from conventional vehicles) of almost 3 tonnes CO_2. The renewable charger produced around 1 MWh of electricity. 100% of users surveyed (representing 20% of those that had tried the bikes) liked the beÁgueda travelling experience and 23% said that taking the strain out of the hills out was the best thing about the bikes. In 2013, beÁgueda was recognised by the Covenant of Mayors and Energy-Cities as an exemplary initiative promoting local sustainability and emission reduction.

Challenges/barriers faced: The users of the pilot scheme bikes were asked if there were any problems with the system 67% said no, but of those problems highlighted the bike battery and the limited number of bikes and parking bays were most common. Additionally it has been suggested that parking without battery charging would be a useful facility. These issues are being addressed with BeÁgueda phase two. The OpenBike system will also improve users' experiences through providing them with information such as bike/parking space availability.

There is a danger that charging for the system may discourage people from using the bikes, but in order to ramp up the provision of bikes and infrastructure, the scheme will need to be self-financing in the longer term.

More systemic barriers include the need for further and improved planning for cycling in the city – especially around preferential routing for cars and with lack of awareness of drivers about cyclists on the roads. 18% of survey participants said the driving safety of the bike was the element they liked the most, which is encouraging and through the planned introduction of education around these issues, for cyclists and drivers alike, the roads of Águeda should become safer over time.

Transferability/learning/scaling up: For the city of Águeda, this small scale project started the momentum towards bigger and more ambitious sustainable transport initiatives. The Mayor and staff from the Municipality have actively shared their experiences at several conferences and workshops in Europe following the pilot project. On the European scale, whilst a modest pilot, Águeda has nonetheless helped to demonstrate that specific issues can be accounted for and overcome. For the city, the electric bike is a clever solution to address social, environmental and economic objectives. Such a scheme is easy, fairly low cost initiative to replicate in other towns whose hilly slopes can be discouraging for cyclists.

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2.2 CNG and biofuel buses, Toulouse, France

Thematic group: Urban Mobility
Specific area of focus: Contributes to the White Paper goal of reducing the use of 'conventionally-fuelled' cars in urban transport
Why good practice? Emissions of pollutants from the bus fleet have decreased by 84.4%
Time period: 2004 – 2008
Budget: Almost €10 million in capital costs. Over €7.7 million initially invested on 28 compressed natural gas (CNG) buses (€275,000 each). €2 million on natural gas filling station

Overview: Toulouse has been successful in switching 100% of its diesel bus fleet to run on CNG. This was achieved during the CIVITAS Mobilis (Mobility Initiatives for Local Sustainability) 4-year project supported by the European Commission. One of the aims of this project was to foster a transition process towards the broad use of alternative fuels and clean, energy-efficient vehicles. Clear political commitment enabled the implementation of CNG buses, biodiesel and soot filters. Toulouse also developed an implementation plan for biogas use.

Background: Toulouse is a city of about 700,000 inhabitants, characterized by an annual population growth rate of 1.6% - one of the largest in France. Due to the high growth of the conurbation transport and traffic management needed to be re-organised to prevent complete congestion of the city centre and address air quality issues.. In 2004, the public transport bus fleet in Toulouse was composed of 100 CNG buses (one of the biggest fleets in Europe at the time) and 414 diesel buses, but none of them were using biodiesel or a soot filter. The capacity of the only existing CNG filling station was limited to 125 buses. Through the Mobilis project, a CIVITAS Initiative supported by the European Commission, which started in 2004, the city of Toulouse together with the public transport operator Tisséo aimed at improving air quality at conurbation level by developing clean buses.

Process: At the beginning of 2005, Tisséo purchased 28 new CNG buses. As a part of the Mobilis project, additionally 40 buses were ordered, but due to manufacturing problems they were not delivered until summer 2009. Tisséo also opened a second CNG filling station, permitting an increase in the CNG fleet. In order to achieve a 100% alternatively-fuelled fleet, Tisséo initiated studies on complementary measures such as biodiesel and biogas.

	2004	2008
Euro 0	159	27
Euro 1	133	88
Euro 2	90	72
Euro 3	17	77
Euro 4	0	41
CNG	100	128
Biodiesel	0	81
Total	499	514

Composition of the Toulouse bus fleet, 2004 and 2008 (CIVITAS, 2009)

In 2008, Tisséo tested the use of biodiesel with 81 of its oldest buses. The blend of 30% first generation bio diesel used in these buses was a real test of the fuel which had had limited practical use at the time.

In 2007 Tisséo started to plan the implementation of biogas use in the bus fleet, lobbying to lift the legal barriers blocking the use of biogas.

In 2006 and 2007 soot filters were implemented: 65 diesel buses fitted with particle filters were bought and in 2007 40 particle filters were installed on diesel buses already in use.

Details: The Mobilis project was an opportunity for Toulouse to improve the attractiveness of public transport and develop its modal share by making it a less environmentally impactful form of transport. The city aimed at reducing pollutant emissions and confirming its leading role in the field of clean vehicles. An additional objective for CNG deployment was to develop CNG solutions for homes through installing compressors in a selection of homes in the Toulouse area. This objective of the project was not met.

Operational costs for CNG buses are 23% higher than for diesel buses, although these higher investment costs are almost compensated for by the difference in fuel costs. The final extra cost for operating 28 Euro 3 CNG buses instead of 28 Euro 3 diesel buses in 2008, was about €150,000. The extra cost for biodiesel and soot filter operations was about €1,400,000.

Stakeholders: The public transport authority of Toulouse, Tisséo, was leading the working group established for the purpose of this project. The working group created a central mobility agency that offered mobility services under the management of Tisséo. Another local partner was the management of the local mobility agency of Labège. Toulouse had partner cities through the Mobilis project in Hungary, Slovenia, Italy and Denmark.

Success: After the Mobilis project, NO_X, CO, HC and particle emissions from Tisséo's bus fleet decreased by 84.4%, an important outcome to help improve the air quality of the city. In addition, the project developed an implementation plan for biogas use and overcame legal barriers. The project received positive feedback from the inhabitants in Toulouse, who participated in satisfaction studies. A clear political commitment to environmental goals and improving the city's public image, associated with strong and open management, has been important for the continuation of the CNG solution.

For the implementation of biodiesel, Tisséo's commitment to present the Toulouse public transport as a clean and environmentally friendly network has been important. Since 2008, Tisséo has included soot filters as a necessary criterion in call for tender specifications. Moreover, the Mobilis project including experiences from Toulouse contributed research findings on second-generation biofuels, providing insights to better understand the effects of the gas composition on engine combustion and gas quality for the bus fleet.

Challenges/barriers faced: The CNG option was strongly opposed when it was introduced, due to the lack of clarity around lifecycle costs and no clear comparison with other options in terms of environmental performance. A barrier to the implementation of biodiesel was the maintenance departments' doubts about the viability, cost effectiveness and environmental performance. For implementation of biogas, the legislation, which does not allow biogas producers to inject it in the natural gas network, was a barrier.

Transferability/learning/scaling up: Political commitment is one of the key factors that enabled success in reducing emissions from the bus fleet in Toulouse. As well as the reduction in pollutants, the project was seen to shift perspectives in the city towards a sustainable mobility culture more broadly.

Concretely, it was determined through the project that a multi-criteria analysis is a fundamental requirement before political and investment decisions can be made around biofuels. Furthermore, where political or legislative barriers exist to promote the use of alternative fuels, policy makers need to join forces to push for change, as was seen in the Mobilis project. It was also discovered that bus routing for CNG buses is more challenging due to the limitations the technology imposes, which are not a constraint for diesel buses.

The Mobilis project has been a major motivational factor to enable research on biofuels and helped with additional funding to develop on the successes achieved by 2008. Indeed, the thorough studies conducted in Toulouse on the possibilities to run on biogas in the near future highlight that if local production of biogas (such as that in Lille) is possible, or if the biogas can be injected in the main gas network then renewable fuels can replace fossil-fuel derived CNG.

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2.3 CycleLogistics, Multi-national

Thematic group: Urban Mobility
Specific area of focus: 3-year EU project focusing on reducing city-based motorized logistics through cycling
Why good practice: Promotes learning and sharing on switching to non-motorised (cycle-based) urban freight transport across 11 European countries.
Time period: 2011-2014
Budget: €1,363,985 (EU contribution: 75%)

Overview: CycleLogistics is a 3 year project working in partner cities across Europe and bringing together local authorities and businesses to understand the potential for non-motorized vehicles to play a role in intra-urban goods transport. There are 9 partners with clear roles in the project – some independent and some in collaboration – and the project aims not only to work with leading cities or businesses with relevant experience in these areas, but to bring together expertise with willingness to try and learn new ideas and concepts throughout the duration of the project. The European CycleLogistics Federation has been established since the beginning of the project and continuation of the project is expected following 2014 with a follow-up project which seeks to build on the learning that has occurred since 2011.

Background: CycleLogistics is an EU-funded (Intelligent Energy Europe) 3 year project in which 9 partner organisations in 11 countries are collaborating on efforts to reduce energy use in urban freight transport. It does so by promoting the replacement of motorised vehicles with cargo bikes for intra-urban delivery and goods transport. The driving force behind the project was to gain insight into the potential benefits of shifting away from heavy vehicles to address issues including congestion, high maintenance costs on urban roads, streets ill-equipped for large goods vehicles, noise and air pollution. The project's activities include convening focus groups, consumer tests and the establishment of the European Cycle Logistics Federation. Moreover, 'living laboratories' are being operated by project partners to extend the use of cargo bikes for lightweight delivery and to investigate new applications in the field.

Process: The project serves to inform individuals about using bicycles to transport goods (private logistics) and uses shops to promote this activity with customers, to encourage businesses to use bikes and cargo bikes for their own intra-urban logistics needs and by the goods delivery sector to increase their use of bikes. The project is testing and reporting on various bicycle transport products (cargo bikes, trailers and bags & baskets) and will share the results of the project through the European Cycle Logistics Federation, which was established to broaden the range of stakeholders engaged with and informed about the work of the project. Although CycleLogistics is set to finish in April 2014, a follow-on project has been confirmed which will commence following the end of the current project.

Details: CycleLogistics carried out a baseline study in 2011 in which the potential to reduce all motorised urban trips by 25% through cycle travel was identified.

CycleLogistics has 3 implementation strands, the first is concerned with product delivery, the other 2 focuses on the potential to offer municipal services (for example, using cargo bikes for waste collection) and the final strand encourages people to shop-by-bike. Outspoken Delivery, based in Cambridge, UK, for example, is heavily involved in the first strand of the project, as a bike-courier company investing in the use of larger cargo bikes as part of the project.

Outspoken Delivery's living laboratory was Cambridge, a city with limited access for traffic, including deliveries for part of the day. Cargo bikes offer an effective solution as they can operate all day and have access to routes through town that conventional vehicles do not

CycleLogistics Partner Outspoken Delivery (Cambridge, UK)

have. Outspoken Delivery has a business model picks up goods from other distributors outside the city and brings them in, as well as capitalising on working for clients in the city and that need goods to be transported to other locations in the city.

As a part of the project, the company is also sharing their experiences at conferences and through training and case studies and has been offering advice to start-up companies hoping to using cargo bikes. The project highlights include multiple focus groups that have engaged diverse stakeholders; a presentation light goods delivery bicycle was given to 56 transport ministers from across Europe at the International Transport Forum in Leipzig in 2012.

Stakeholders: There are 9 partners in the CycleLogistics consortium, a mixture of cycle-based businesses, civil society, local authorities and consultants with a wide geographical spread across Europe. The chosen approach whereby partners in the project are not made up entirely of 'leading' actors with experience in similar projects; but of a mixture of Masters, Climbers and Beginners, is an innovative one.

Partner	Master	Climber	Beginner
Alba Iulia			x
Brussels		x	
Cambridge		x	
Copenhagen	x		
Ferrara		X	
Graz		x	
London		x	
Plovdiv			x
Utrecht	x		

This mechanism offers cities/partners with less experience, but enthusiasm to engage the opportunity to be involved in constructive progress and facilitates knowledge sharing and learning in a proactive process.

Success: Whilst the final outcomes of the project have yet to be published, there are some areas where the project has already impacted. The establishment of the European Cycle Logistics Federation is highlighted as a significant development that was facilitated by the project and the living laboratory campaigns

used to trial the use of cargo bikes in partner cities and organisations have been well-received on the ground, promoting awareness of cargo bikes. The project has been successful in engaging some of the large distribution firms including TNT, to trial the switch to cargo bike for the city-based trips across a number of the case study cities.

Challenges/barriers faced: Developing the CycleLogistics concept and working on a viable and credible implementation plan was one of the first challenges that the project faced. Some of the other main challenges the project faces relate to perception that cargo bikes are not a realistic option for the transfer of light goods in urban areas.

One particular challenge which relates to the switch to bike is that a lot of delivery into city centres is carried out by multi-national companies and operating at this large scale denotes that the companies cannot change practice from city to city. Whilst some distributors have engaged in the project and worked on pilot initiatives using cargo bikes, this is still at a relatively small scale. Without buy-in from the companies at large, it is difficult to achieve a shift towards CO_2-free city logistics at scale.

Transferability/learning/scaling up: The mixture of expertise, the use of cities and businesses alike as test beds for new ideas, as well as the methodology devised by CycleLogistics are elements of the project that could be replicated and scaled up across businesses and entire cities across Europe alike.

Project partner Outspoken Delivery have had 80 enquiries from start-up companies over the last 3 years interested in setting up similar businesses in different locations, 5 of which have subsequently been successfully established, demonstrating the potential for replication of such a successful business model as theirs.

The continuation of the project is encouraging as further insight can be derived from the initial project partners whilst also offering an opportunity for new relationships and connections to be made across Europe.

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2.4 E-mobility, Madrid, Spain

Thematic group: Urban Mobility
Specific area of focus: Reducing the use of conventionally-fuelled vehicles and achieving CO_2-free city logistics in major urban centres
Why good practice? Efforts promoting uptake of electric vehicles have been comprehensive
Time period: 2009 – on-going
Budget: Municipal investment in electric infrastructure and vehicles: €14 million (2011-2013)

Overview: Madrid's road transport contributes significantly to the city's carbon footprint and air pollution levels. Since 2009 the city has embarked on a series of initiatives and collaborative projects to promote electro-mobility. These measures have led to a fairly comprehensive set of strategies and measures to move the city's own fleet and the private vehicles – both passenger and freight – away from the internal combustion engine. Public private partnerships and international knowledge exchange have been important to this objective and the number of charging points and electric vehicles in the city continues to rise.

Background: In the municipality of Madrid road transport accounts for 34% of greenhouse gases and 56% of NOx. The need to address these areas provided some of the impetus for the city government to invest in cleaner vehicles.

In the 2008 City Energy and Climate Change Plan, the city outlined a need to reduce the fast-growing private car fleet and as well as encouraging the use of public transport, a goal was set to see cleaner vehicles making up 10% of the new purchases in 2012 and 50% of the municipal fleet should be low-emitting by 2012.

In 2009 Madrid City Council set a CO_2 reduction target of 20% on 2004 levels by 2020. Promotion of electric vehicles was seen as a key measure to help achieve this target and to improve the city's air quality. The city's Air Quality Plan 2011-2015 outlined an electric mobility strategy that included joint procurement of vehicles between the city and business, tax incentives for electric vehicles, charging infrastructure development and knowledge exchange.

Process: Efforts to deliver these targets started in 2009. Madrid was chosen by the Spanish Industry Ministry, alongside other municipalities to participate in the MOVELE project, piloting electric vehicle infrastructure including 24 on-street charging points and 67 car park-based chargers. This project invested over €1 million and was developed in partnership between Madrid City Council and the Institute for Diversification and Energy Saving (IDAE). In 2011, the city carried out MADrid Electric Vehicle (MADEV), a 2-year project funded by the European Investment Bank to foster e-mobility through focusing on energy efficiency. Madrid has also participated in European city initiatives including EVUE (electric vehicles in urban Europe); FR-EVUE (Freight electric vehicles in urban Europe); Urbact II and the Green eMotion initiative. The city plans a 2020 Low Emission Zone and an Ecotaxi Ordinance to build on effort to date.

Details: The EVUE project was focused on information exchange and learning with 9 cities across Europe sharing their experiences in developing electric vehicle strategies – considering mobility concerns as well as air quality. Measures committed to in EVUE were aligned with the city's own Air Quality Plan. A project output was an electric vehicle roadmap developing a longer-term strategy (to 2016) for e-mobility in the city. The Urbact II project was concerned with dynamic leadership techniques to promote electric vehicle use and Green eMotion was concerned with establishing a demonstration city. Currently the Proyecto Clima 2013-2016 and the Plan Azul+ 2013-2020 both have particular policy goals and objectives to promote the

growth in the number of electric vehicles being sold in the Madrid community. There are also medium term plans to integrate electric vehicles into a flexible distributed smart power system, bringing the energy and transport policy areas together.

These projects have also enabled the city to develop a comprehensive strategy and a package of policies to encourage uptake of electric vehicles in the city. Such measures include the unrestricted free parking for electric and plug-in electric hybrid vehicles (via a zero emission vehicle label), free on-street charging, a 75% reduction in municipal motor vehicle tax (for the first 6 years for hybrids and permanently for electric and plug-in hybrid vehicles). Cars, lorries, delivery vans, buses, coaches, motorcycles and mopeds without an internal combustion engine are eligible for the discount. Fast charging infrastructure will be introduced in 2014.

For freight vehicles specifically, a discount on the annual operations fee was given for hybrids and removed entirely for electric and plug-in electric hybrid vehicles. There was also a voluntary agreement in place with freight companies to get 6% of vehicles operating with alternative fuel technology by 2012. Madrid will also establish a consolidation centre, which will be used by 3 different logistic operators to use electric vehicles for last mile delivery. In 2011-12, subsidies were also made available to replace existing taxis to vehicles emitting less than 160g CO_2/km. By 2020, the entire fleet in Madrid will meet this standard.

The municipal fleet is also a focal point. The council gives preference in the tendering process to rental companies/municipal contractors (such as waste management) offering low emission vehicles and prioritises low emission models when purchasing vehicles (buses). The city has a website and organises and contributes to events sharing information about electric vehicles.

Stakeholders: Public private partnerships have been important to the development Madrid's electric vehicle infrastructure. The national government has played a role in investing in Madrid's infrastructure. A mobility forum (Foro de Movilidad eléctrica) was established in 2011, which brings stakeholders involved with electric vehicle development (including vehicle and charge point manufacturers, electricity companies, companies engaged in car leasing and rental, companies with large fleets, logistics companies) together. The group meets periodically and holds workshops. Engaging with the public has been The Energy Agency of Madrid is a key public partner as is Madrid Movilidad S.A. – the car park owner responsible for the city's off-road charging.

In 2013, an agreement was signed between the Environment and Spatial Planning Ministry and IBIL to promote the use of electric vehicles in the public and private fleet in Madrid. In collaboration with SEAT, the municipality piloted the Altea XL Ecomotive, an all-electric vehicle, which will be built entirely in Spain. The city also has a ongoing dialogue with other car manufacturers including Toyota and Renault-Nissan.

Success: According to Madrid Energy Agency, there are currently 173 public charging points, with an additional 120 for the municipal fleet. This fleet is made up of 181 electric vehicles (including 20 buses and 24 motorcycles). A total of 2,500 taxis in the city's fleet are hybrids. Madrid experienced a 124% rise on 2012 levels in terms of the total number of electric vehicles sold – 352 new vehicles were bought in the city in 2013, but whether rapid growth in acquisition can be transformed into a sustainable, viable market remains to be seen. It does however, make Madrid the national leader in the sale of electric vehicles and of the 18 vehicles sold in the first 2 months of 2014 in Spain, 15 were purchased in Madrid.

The activities undertaken by Madrid Movilidad S.A. have been recognized through being given the Garrigues Award for Environmental Policy, for the best initiative for Sustainable Management in the Public Administration category.

Challenges/barriers faced: The rate of adoption of electric vehicles is still being constrained in the city despite the efforts that have been undertaken to promote them. High purchase price and limited availability are enduring challenges. Despite impressive growth, total vehicle numbers remain low. The deployment of quick charging infrastructure will be a challenge. As a start, locations with surveillance (e.g. underground parking, service stations) have been strategically selected for the initial roll out.

Nonetheless through its early activities, the municipality has learned some important lessons. Cooperation between different administrations has been identified as a crucial factor in creating stable policy frameworks. Locating charging points in high occupancy areas, encouraging suppliers to introduce cleaner vehicles to the fleet by introducing clauses relating to emissions, and the use of incentives to change to electric are all found to be important measures. Working with grid operators and energy companies is also important to manage load and develop renewable energy capacity and a smart grid. Experimentation, collaboration and partnership with established and new private sector actors are key elements to success.

Transferability/learning/scaling up: By engaging in knowledge transfer projects as well as pilots early on, Madrid has already provided a wealth of insight and experience to other cities keen to promote the use of electric vehicles. Madrid has learned a lot from its own early efforts and continues to combine long-term strategic planning for electrification with on-the-ground initiatives. Madrid has been an important test bed across freight and passenger transport and has linked its internal municipal efforts with initiatives promoting public use of electric vehicles. Finally, by involving a broad range of stakeholders in the mobility forum, learning from others has been built into the developments from the outset, which is a strong model for other cities to follow.

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2.5 Electromobility Model Regions, Germany

Thematic group: Urban Mobility
Specific area of focus: National programme to roll out electric vehicles in Germany
Why good practice? The comprehensive, competition-based initiative from the German government is promoting widespread introduction of electric vehicles and infrastructure
Time period: 2009-2020
Budget: €1.5 billion

Overview: In 2009, the German government announced a €500 million programme to support the development and introduction of electric vehicles. The "Electromobility Model Regions" funding scheme, headed by the Federal Transport, Building and Urban Development Ministry (BMVBS) was established to develop a widespread cross-cutting cooperation between industry, science and the public sector. Eight regions are involved in the programme with the aim of getting 1 million electric vehicles on the road by 2020 and integrating electromobility into everyday life. An additional €1 billion was invested in 2011.

Background: Against the backdrop of EU legislation for tailpipe emission reductions, the challenge to deliver long term clean and affordable mobility is increasingly important. Recent efforts in Germany have been initiated to understand and develop appropriate future technologies that can move away from fossil fuel power. Much of this effort has been in investigating the potential of electric vehicles (both battery and fuel cell).

In 2009, as a part of the government's 2nd fiscal policy stimulus package, €500 million was allocated to support the commercialisation of electric vehicles in Germany. The programme was formulated in the "National Electromobility Development Plan" (NEDP) to provide incentives for the development vehicles and also for charging infrastructure and energy storage technology. An additional €1 billion was added to the total government funding for electromobility in 2011, bringing total investment in electric vehicles to €1.5 billion, of which €130 million has been allocated to the delivery of the pilot projects in the 8 model regions.

Process: The NEDP was drawn up by the Federal Ministry of Economics and Technology (BMWI); the Federal Ministry of Transport, Building and Urban Affairs (BMVBS); the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU); and the Federal Ministry for Education and Research (BMBF), further to the prescriptions laid out in the Integrated Energy and Climate Programme which was introduced by the German Government in 2007. Promoting information exchange was identified as a priority.

From the 130 applications that were received from partnerships between industry, research associations, academic institutions, cities, municipalities, and regions, 8 model region partnerships were selected to test the application of battery-driven mobility within Germany. Thirteen additional locations are focusing on the smart grid infrastructure as well as the ICT applications that are necessary for widespread electromobility. BMVBS has also launched a battery test centre and is promoting the construction of hydrogen filling stations. In 2010, the Government and the car industry signed a joint statement as part of the NEDP that the objective of delivering electric mobility will be consistently pursued and that the government will help expand the sector and create conditions for rapid market penetration.

The 8 Model Regions (BMVBS)

Details: The "Electromobility Model Regions" is a federal government-led initiative that provides funding for cross-sectoral partnerships to establish pilot projects in 8 German regions. The model regions are Hamburg, Bremen/Oldenburg, Rhine-Ruhr (Aachen and Münster), Rhine-Main, Saxony (Dresden and Leipzig), Stuttgart, Munich and Berlin-Potsdam. Each region will adopt a different approach and focus which will help to develop knowledge around electric vehicle use and the integration of electromobility into the existing transport network. For example, in the Berlin-Potsdam region, one of the priority activities is the integration of electromobility with public transport, tourism, mobility, housing services and city logistics. In Saxony, efforts include battery storage and the implementation of an ICT-enabled charging infrastructure.

The project considers the wider implications of electric vehicles in terms of future energy supply, research, regional planning and urban development. Pilots are designed to gain insight on user expectations, charging infrastructure and the relationship between electric vehicles and urban public transport.

The model regions are a comprehensive effort to link research, transport, environmental and economic considerations together in order to deliver a long term strategy to maintain the economic competitiveness of the German car industry whilst at the same time meeting environmental and energy needs for the coming decades. It links national government, with regional and municipal level efforts and works to deliver strong links with industry.

Stakeholders: Each of the chosen model regions has a different approach and focus as well as distinct stakeholder partnership. Carmakers such as BMW, Daimler and Volkswagen are all engaged in the programme. The National Organisation for Hydrogen and Fuel Cell Technology (NOW GmbH) is coordinating all activities on behalf of the federal Government.

Each of the involved federal ministries has a distinct area of focus in delivering the national plan. BMWi is responsible for areas including ICT for electromobility and drive systems and battery compatibility. It is also responsible, along with BMVBS for user acceptance and charging infrastructure, with the latter also working on areas including battery and vehicle safety. BMBF is working on the development of batteries, novel materials and education and training as well as other areas. Finally BMU is responsible for linking electromobility with renewable energy systems, determining the environmental and climate factors of electric vehicles and research and development in recycling batteries and other relevant materials**.**

Success: Progress in the model regions to date has seen the roll-out of charging infrastructure and efforts are underway to address issues including battery capacity through the scheme. The comprehensive nature of the programme, the level of investment and the R&D measures already underway are currently not matched anywhere in Europe. The cross-sectoral, large scale and competitive nature of the project's partnership approach allows demonstration of a variety of approaches and technologies with a view to determining which hold the most promise and allows for an examination of contextual elements to also take place. In terms of demonstrating ambition and scope the model regions are a comprehensive effort to alter the shape of the car industry to deliver non-conventionally fuelled vehicles.

Challenges/barriers faced: From a practical perspective, whilst the project is progressing well, the uptake of electric vehicles remains low and the ambitious target of 1 million on Germany's roads by 2020 is becoming increasingly difficult to achieve.

The delay of agreement upon an EU-level 95g CO_2/km tailpipe emission target for 2020 was a direct result of German government and industry opposition, which sends mixed signals to the public and calls into question the motives behind the NEDP. Such contestation highlights that significant changes are needed across the industry, not just in the model regions, to deliver the ultimate vision of sustainable mobility for all in Germany.

Transferability/learning/scaling up: There is significant potential to roll out the lessons learned by the model regions to other areas in Germany, the competitive approach allows the market to determine which electric vehicle models are the most acceptable and the efforts to standardise charging infrastructure and storage devices allow scaling up from the region to national level.

In terms of transferability, not all EU states have a significant auto-manufacturing presence, but the model regions method developed in Germany would still be a potential approach for other member states, and could be relevant for addressing other policy areas too. Promoting and facilitating partnerships between urban and regional governments, business and research to deliver non-conventionally fuelled vehicles is an approach could be replicated elsewhere.

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2.6 Electric vehicles, Oslo, Norway

Thematic group: Urban Mobility
Specific area of focus: Contributes to the 2011 White Paper goal of reducing the use of conventionally-fuelled cars
Why good practice? Norway has a comprehensive programme to promote electric vehicles and Oslo is central to this
Time period: 1990s – on-going
Budget: 20 million NOK in government investment since 2007; 4 million NOK per annum.

Overview: Electrification of vehicles was introduced in order to contribute to reducing environmental impacts and greenhouse gas emissions from transport. A combination of incentives has made electric vehicles a success in Norway. The national tax system opens up unique opportunities for supporting the electric vehicle market, including low and zero taxes to vehicles with low emissions. In the first half of 2013, the share of electric vehicle sales was about 3% of the total vehicle market. A majority of the customers are ordinary people, who buy a new car for personal use. Strong governmental incentives support the sale. The incentives are so extensive that removing them would disturb the market.

Background: Pollution is particularly a problem in the winter in Oslo, when there is no wind to clear the air in the valley the city is situated in. Whilst firewood for heating was a significant contributor to the problem, cars were also a factor. Also important is the Norwegian automotive market, which has certain characteristics that deviate from other markets. Vehicles are heavily taxed in Norway. A typical compact conventional car is taxed with a registration fee of 5,000-10,000 € the first time the vehicle is registered. The tax is progressive, resulting in extremely high taxes on conventional vehicles.

In 1989, the Bellona Foundation and several electric vehicle producers and importers organised an event to promote awareness of the need to reduce emissions. It involved Norwegian celebrities driving around Oslo's ring road. At the time electric vehicles were not allowed on the road in Norway.

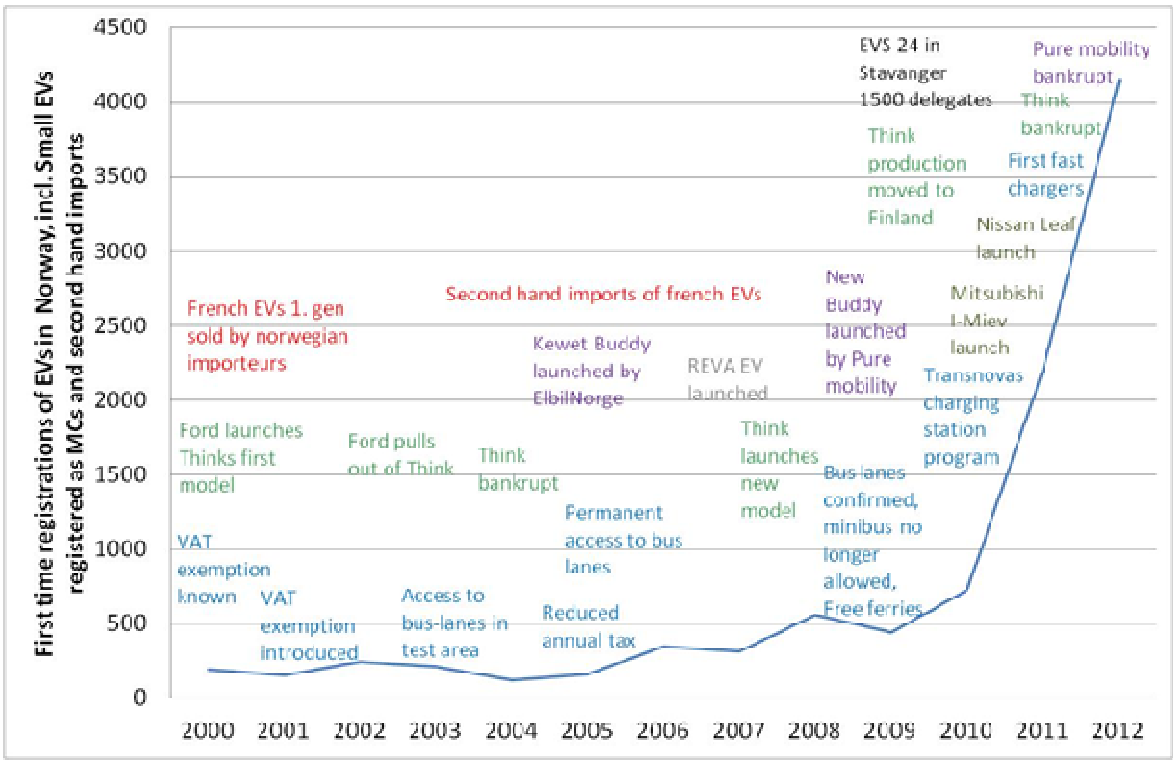
Then in the mid 90s there was a Norwegian initiative (THINK) to develop electric vehicles. This spurred media attention and great enthusiasm publicly. The Norwegian electric vehicle association (Elbil), an NGO, was also established in 1995, working to introduce electric vehicles to the market that run fully or partially on renewable energy. The first charging station in the city was established 20 years ago. Despite this early development, market growth in the sector did not take off until a decade later.

Process: Despite low numbers until recently, electric vehicles have been high on the political agenda since the mid-1990s. The government has introduced a range of incentives that have been necessary to meet market challenges and encourage early adopters to test new technology. Reductions in the annual vehicle fee and exemptions from toll road charges reduce the costs of having an electric vehicle compared to those of a conventional vehicle and this has been a particular driver for change.

In 2007 the Norwegian Parliament introduced a climate policy target, aiming for Norway to become carbon-neutral by 2050. An interim target for new passenger vehicles is that they should not emit more than an average of 85gCO_2/km by 2020. The 2020 target entails a high share of electrified vehicles.

It was also in 2007 that Oslo city council committed to installing 1,000 charging stations, which were installed in 2008. This was seen as a controversial measure as conventional parking spaces made way for electric vehicle spaces. Plans made at this point included 200 more stations in 2011, 100 more in 2012 and 200 more in 2013.

Details: Public investments in charging infrastructure and free access to bus lanes are important advantages to the electric vehicle owners. The combined effects of these and other incentives have made electric vehicles popular, increasing the share of electric vehicle owners in Norway. Modern design electric vehicle models became available on the market from 2010 onwards, resulting in an attractive image and increased interest.



Electric vehicle sales in Norway 2000-2012 and timeline of incentives and important events (Figenbaum and Kolbenstvedt, 2013)

Stakeholders: When the 2007 investments were made Olav Elvestuen, a liberal politician, was very active and spoke in favour of such developments. A long-lasting broad interaction between private enterprises, public authorities and non-government organizations has been established in the city.

The city is in regular contact with the drivers, to provide support for using their new vehicle. The drivers communicate issues with the infrastructure and recommend to the council where new chargers should be introduced. Each new driver receives a starter pack with a key for charging infrastructure. This pack also gives membership to Elbil for the first year. There is on-going political engagement and funding in vehicles and infrastructure.

Success: These efforts combined have resulted in Norway being the largest per capita electric vehicle market in the world. As of February 2014, the electric vehicle share of the total Norwegian car fleet reached 23,566, with electric vehicles accounting for 12% of new car sales nationwide. Only one complaint about the removal of conventional parking spaces in the city has been filed in the 5 years since the electric vehicle charging stations were introduced, which demonstrates public acceptability of the changes.

Challenges/barriers faced: The temperature in winter has been an issue as the range of the vehicles is reduced due to the cold. Similarly, in 2008 and 2009 it was difficult to find the equipment to install on street for charging. Switching from slow to quick charge infrastructure is also an issue the city will need to confront as more technology enters the market.

The main marketing challenges are related to range and purchase price. Moreover, the incentives for buying an electric vehicle have been in place for a long time and phasing these out will be a challenge. The incentives are so extensive that removing such incentives will cause considerable disturbances to the market, raising the cost of owning purchasing an electric vehicle. The incentive that will be the most difficult to remove is the exemption from the VAT, which for a car costing € 25,000 will add another €6,250 to the price tag. The most attractive user incentive, access to the bus lanes, will probably be phased out in the next few years as capacity in the bus lanes reaches its limit.

Transferability/learning/scaling up: High taxation of conventional cars combined with exceptions of taxes and fees for electric vehicles make them an attractive proposition. The future of the market for the vehicles is dependent on incentives, market and technology developments and the competitiveness of electric vehicles as compared to other technologies and fuels. The Norwegian market is expected to continue to grow as more models enter the market. Several car manufacturers are coming to Oslo, using it as a test park for issues such as range, so Norway is already seen as a destination where things can be learned.

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2.7 Fossil free Växjö and TRAILBLAZER, Växjö, Sweden

Thematic group: Urban Mobility
Specific area of focus: Contributes to achieving CO_2-free city logistics in major urban centres
Why good practice? As a result of coordinating urban freight deliveries and increasing use of biofuels, annual CO_2 emissions from delivered freight have decreased by 95% 2010-2013
Time period: 2010 – 2013
Budget: €520,000 per year

Overview: The Swedish municipality Växjö has set itself the goal of being fossil fuel free by 2030. The city was part of the European project TRAILBLAZER, which was co-funded by the European Commission. TRAILBLAZER's aim was to contribute to reduce emissions, noise and delivery costs, while improving security, reliability and time savings. As part of this project Växjö has coordinated the distribution of goods to the various municipal units. Among other outcomes, this has resulted in decreased CO_2 emissions, reduced traffic volumes, increased safety and improved competition among vendors.

Background: Växjö is a Swedish municipality of about 85,000 inhabitants located between Stockholm and Malmö It is a regional centre of trade and education. About 8000 companies are situated here. In the 1990s Växjö was already a frontrunner among Swedish municipalities, with a goal of becoming a fossil fuel free municipality within 2030. Joining the EU-project TRAILBLAZER, gave the town an opportunity to explore the possibilities of coordinating urban freight distribution between municipal institutions. The local politicians initiated an investigation of such possibilities. The report showed that total deliveries to municipal units (e.g. administration, nursing homes etc.) could be halved, whilst maintaining the number of delivery days per week.

Process: A base line study was conducted in the city as part of the project which demonstrated that the municipality had 185 suppliers that use 73 distributors and also that the municipality had 390 supply units which took around 1,900 deliveries every week.

The main objective of the TRAILBLAZER project was to achieve a 10% reduction in the energy used emissions relating to urban freight transport. Växjö targeted increasing the coordination of freight transport between the units to make the flow of goods more efficient. Throughout the project an increased number of biogas vehicles were used for distribution.

The municipality's current goal is that all future transport will be based on biogas as an energy source. The municipality is currently carrying out a situation analysis to determin how surrounding municipalities in the whole county could contribute to the vision of coordinated, CO_2-free logistics.

Details: Växjö decided to establish an Urban freight Consolidation Centre (UCC) to coordinate freight deliveries. In 2010 the company Alwex won the competitive tendering to operate this centre. Distribution started small-scale with office supplies towards the end of the year, but was soon up-scaled to including food supplies. The Centre established an e-purchasing system and, together with the municipality, introduced an optimised delivery plan.

The new system with predetermined routes informs the units in advance when to expect deliveries, which makes it easier to plan work and resources and contributes to time saving. Depending on size and specific requirements, municipal units receive deliveries once to five

times a week (most commonly twice a week). Delivery of dry goods happens only once a week, fresh foods more often.

Stakeholders: The project was a political exercise initiated by a centre and right-wing alliance in the city. This coalition encouraged the administration to look into the viability of coordinated goods distribution before the UCC was established. The strategic planning office wanted Växjö to participate in the TRAILBLAZER project and worked out a delivery and service plan. The project group has been able to push the project forwards. The involvement and training of the stakeholders in the municipal organization has been important to understanding and implementing the new freight distribution regime.

Within the project, the grouping and information sharing between project participants and the broader urban freight community allowed insight into the city's activities and progress to be shared with a broad range of interested stakeholders.

Success: From 2010 to 2013, the urban logistics trips decreased from 1,900 to 350 per week. At the same time, the emissions from transport running on diesel decreased by 74%: from 61 kg CO_2/delivered tonne to 16kg CO_2/delivered tonne. The increased use of biodiesel from 5% in 2009 to 81% in 2013, has contributed to a reduction in annual CO_2 emissions from delivered freight of 95%. Other achieved objectives include increased road safety, as there are fewer vehicles on the road.

	Before UCC	After UCC	% change
Delivered goods/day (tons)	15.6	15.6	0
weeks/year	45	45	0
Total goods per year (tons)	**3,500**	**3,500**	**0**
office supplies	*875*	*875*	*0*
food supplies	*2,625*	*2,625*	*0*
Amount of fuel per ton goods (litres)	23.96	6.28	-74%
Amount of CO_2 per ton goods (kg) with diesel.	61	16	-74%
Number of stops per week	1,900	350	-82%
Fuel consumption per year	84 m3	22 m3	-74%
Amount of fossil fuel (%)	95%	19%	-80%
Amount of renewable fuel (%)	5%	81%	+94%
CO_2-emission per year including 85% of delivered ton with RME	214 ton	11 ton	-95%
Time spent loading/unloading per week (7 min/stop)	222 hrs	41 hrs	-81% (-181 hours = 4,5 full time employees)

UCC= urban consolidation centre

Växjö municipal freight distribution before and after UCC (CPAS, 2013)

Political commitment and adequate resources to train the municipal organization in new ways of thinking and working has contributed to make the project successful. The significant reduction in emissions and km travelled demonstrates that virtually CO_2 free city logistics for certain parts of urban deliveries can be achieved.

Challenges/barriers faced: The different suppliers' various systems of handling transports with regard to purchasing and labelling proposed a potential challenge to the coordination. As Alwex provided the logistical services of storing, picking, packing, labelling and packaging goods, this did not become an issue. This is particularly favourable for small companies and suppliers of local products, and may even improve their ability to compete. Another challenge was the capability to keep the municipal organization up-dated as to the reception of goods. The municipality therefore had 'ambassadors' and certified purchasers in every part of the organization.

Transferability/learning/scaling up: The TRAILBLAZER partners were separated into TRAILBLAZERS – experienced organisations and PATHFINDERS – less experienced authorities and the knowledge and experience of the first group was shared with the second to enable the implementation of similar initiatives across the whole project and beyond. There was also a User Group – 18 actors in the field of urban freight keen to learn from the lessons of the project. Finally, ASSIMILATORS was a self-identified group receiving updates on the project activities. Such an approach is comprehensive in sharing knowledge and information to

interested stakeholders and Växjö's case can certainly be useful for cities with many delivery locations and a variety of vendors.

In terms of the city's own learning from the project, plans to extending the approach to all freight distribution in the county demonstrates that Växjö intends to scale up and transfer its experiences to the wider community.

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2.8 Multi-modal transport planning, Freiburg, Germany

Thematic group: Urban Mobility
Specific area of focus: Contributes to the White Paper goal of reducing the use of 'conventionally-fuelled' cars in urban transport
Why good practice? Freiburg has received numerous awards for its leadership in sustainable transport planning, promotion of walking and biking, traffic calming mechanisms, human scale mixed-use development, renewable energy, protection of nature, and sustainability.
Time period: 1970s – on-going
Budget: €28 million (transport investments 2006-2012)

Overview: Freiburg has been successful in multi-modal urban planning, including both incentives and disincentives to limit car traffic. Citizen groups have been important to promoting the agenda, working with the city administration and politicians to develop and implement policies. Freiburg's approach is characterised by using both carrot and stick measures and taking a long term perspective. The city does not consider car restrictive measures as punitive, as car users can take advantage of safe, convenient and affordable alternatives.

Background: Freiburg is a University town with about 230 000 inhabitants, and has been recognised worldwide as one of the most liveable, sustainable and child-friendly cities. Freiburg's old town was almost completely destroyed after the Second World War, and the city administration decided to rebuild the city centre in its historic compact form. Freiburg's first land use plan of 1955 resulted in a rapid increase in the number of cars per inhabitant. In the 1960s Freiburg decided not to scrap its tram system as was happening elsewhere, but invest in it. Then the 1970s brought more awareness of environmental issues, in part because of heavily increasing car traffic. The citizens mobilised in order to make their city a more environmentally friendly place to live. Public discourse, citizen participation and cooperation paved the way for gradual change towards sustainability in Freiburg.

Process: In 1973 the city centre was closed to car traffic. A compromise was made between the city administration, citizen groups and local businesses in exchange for automobile parking garages along the ring road at the fringes of the car free zone. The General Transport Plan from 1979 promoted alternative transport modes above the car. When the first light rail line opened in 1983 and proved successful, more lines followed (an extension of about 36.4km). Successful implementation encouraged other areas to follow, and in 1989 limiting private cars and increasing use of green modes became an explicit goal in Freiburg's transport plan.

Over the last 40 years, Freiburg has adjusted its policies and goals gradually. The policies have been implemented in stages, often choosing projects everybody agreed upon first. Successful implementation has encouraged further measures to be taken. The city administration has been largely responsive to citizen groups, as demonstrated by the restriction of downtown car access following citizen lobbies. Active monitoring takes place to ensure that city is on track to meet sustainability commitments, including the targets set for modal share. The city is currently working to make cycling the primary transport mode in the city by 2020, with the goal that a quarter of all trips will be made by bike. It is expected that only 24% of journeys will be made in single occupancy vehicles. The city is committed to reduce greenhouse gas emissions by 40% on 1992 levels by 2030.

Details: Coordinated urban development and transport policy has enabled much of the change in Freiburg. Traffic calming measures such as implementing a 30km/h speed limit in

neighbourhoods were originally initiated by residents who complained about car travel. The mutual communication between citizen groups and the city administration made it possible to create a liveable city for all population groups. Simultaneously with creating viable alternatives to the private car, the costs of driving have been increased through parking management schemes, and in many residential neighbourhoods parking is reserved for residents and requires a special permit.

Transport plans have prioritised measures to promote public transport, walking and cycling over the automobile and called for integration of transport and land use planning. Freiburg has been able to create financially viable public transport, indeed only 10% of the operating costs are subsidised, compared to 30% in the rest of Germany. An extensive network of bicycle paths (around 450km) has been created over 40 years. The city's RegioCard allows passengers unlimited access to all urban transport in the city – and the region – for less than €50 per month. New tramlines are still in development and the city continues to invest in new and improved infrastructure.

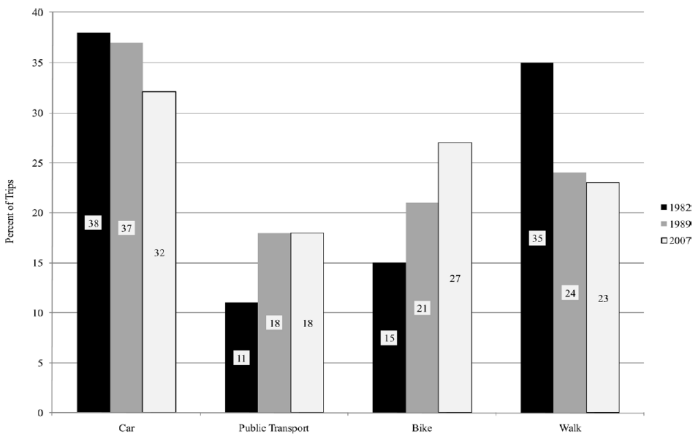
From 1993-2009, two inner suburban neighbourhoods (Rieselfeld and Vauban) were developed around newly extended rail lines with limited car access and parking (each resident parking space costs €18,000). Vauban was designed as an environmentally friendly neighbourhood, developed in partnership with citizen groups. Life without a car is just one measure promoted in the broader mandate of delivering sustainable urban neighbourhoods.

As part of a state initiative and to improve the city's air quality, since 2010, an environmental zone has been in place. All vehicles driven and parked in the city need to display a sticker to demonstrate their emissions levels. Heavily polluting vehicles are not permitted a sticker. Non-compliance will result in a €40 fine.

Stakeholders: Citizen participation in land use planning has been a key aspect of the Freiburg green urban development. The city administration has ensured through planning processes that their plans include citizen input and in some cases have worked together with citizen groups to develop environmentally friendly residential areas. Support from the higher levels of government has also been important through more flexible funding, which has made improvements in local public transport and infrastructure possible.

Success: Freiburg has been successful in multi-modal urban planning, including both incentives and disincentives to limit car traffic. Only 32% of journeys were made in the car in 2007, down from 38% in 1982. Public transport use has risen from 11 to 18% over the same time period. Cycling has seen the largest increase from 15 to 27% over the time frame. There are over 400km of cycle paths and 9,000 bicycle parking spaces in the city.

From 1992 to 2005, transport CO_2 emissions per capita in Freiburg fell by 13.4%. 70% of the population now lives within 500 metres of a tram stop. In Vauban there are 250 cars per 1,000 residents, in Freiburg as a whole, there are 423. This compares to 500 in Germany.



Freiburg Modal Split, 1982 - 2007 (Buehler and Pucher, 2011)

Freiburg has received many accolades for its environmental performance, including the 2009 European Green Capital Award and more recently Germany's most sustainable city in 2012.

Challenges/barriers faced: Local business leaders have been opposed to restricting car use in the city centre. However a compromise was reached when the city administration agreed to build parking garages along the ring road. Many residents were initially sceptical about traffic calming for neighbourhoods. However, successful implementation encouraged others to follow. The railway line is also 50 years old and is beginning to require renovation, but this has not been flagged as a priority for investment.

Transferability/learning/scaling up: Freiburg is not a typical city. It is viewed as one of the most sustainable cities in Germany and has developed sustainable transport and land use systems for decades already. However, every city can learn from elements of Freiburg's experience. There are seven lessons to be learnt from Freiburg. The case suggests to: (1) implement controversial policies in stages, (2) make flexible and adaptable plans over time, (3) include both incentives and disincentives in policies, (4) fully integrate land use planning and transport, (5) involve citizens in planning processes, (6) get support from higher political levels and (7) make long term policies and reflect on/update these periodically.

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2.9 Sustainable Urban Transport Plan, Maribor, Slovenia

Thematic group: Urban Mobility
Specific area of focus: Contributes to the White Paper goal of reducing the use of conventionally-fuelled' cars in urban transport
Why good practice? Addresses the core urban challenges concerning mobility patterns, congestion, urban sprawl, greenhouse gas (GHG) emissions energy efficiency,fossil fuel dependency, air quality, road safety and exposure to ambient noise
Time period: 2011 – on-going
Budget: No available data

Overview: During the 1990's, the massive increase of car ownership and car usage by commuters brought congestion problems to the roads in the city and region of Maribor. The city's Sustainable Urban Transport Plan (SUTP) goes some way to minimising these negative impacts. The plan's purpose is to support local authorities in addressing the current and future problems related to the urban transport system. Actions in the plan relate to local transport planning, communication and streamlining and coordinating transport policy in the city.

Background: Slovenia faces a number of transport problems, such as decreasing use of public transport and freight traffic and overly car-centric focus within recent planning practices. Maribor is the second largest town in Slovenia, with its population, including the suburbs, amounting to 180,000 people The geographical position of the city on the junction of roads connecting Central Europe with Southern Europe and Western Europe has determined Maribor's development plans. Due to its favourable position – close to the Austrian border – the city has become a cultural and economic centre of northern Slovenia, which has however contributed to the city's environmental pollution caused by traffic.

Maribor also has serious mobility-related problems, including an old city bus fleet. People use mainly private cars. The City council realised that improving the situation would call for more sustainable patterns of travel and improvement of the quality of alternative transport options.
In 1999, the Municipality of Maribor signed the Aalborg Charter of European Cities and Towns Towards Sustainability and in 2002 the city prepared a Local Agenda 21 framework for a gradual transition to sustainable development at the local level.

Any discussion of the future urban mobility and urban transportation system in the city is also required to take account of policies aimed at reaching the EU's ambitious CO_2 reduction targets of '20-20-20' and of the 2011 Transport White Paper goals.

Process: Development of the SUTP was a long process, started in 2000. It was important to embrace core urban challenges, so Maribor adopted a spatial development concept aimed at sustainable urban development, environment protection, improving quality of life in the city and better connecting the urban and rural parts of the city.

In subsequent years the city activities continued to address and link relevant areas of policy. Following the development of indicators and environmental challenges in 2006, a detailed action plan was produced in 2008. This was included in the municipal environment plan. In 2009 a sustainable energy and climate change plan incorporated an action plan for energy use reduction in transport and a local energy strategy was adopted. The city consolidated all of these documents into the SUTP.

From 2011, progress against the objectives laid out in the SUTP is reported to the city council annually. Along with the action plan, in following years Maribor has also developed separate strategies and implemented activities related to:

- Better mobility for disabled persons (2010)
- Investment programme for sustainable mobility in Maribor – establishment of cycling centre for the region (2010)
- Council for the sustainable development of public bus services (2011).

The city has since undertaken the process of developing a sustainable urban mobility plan (SUMP). Maribor's SUMP was launched in 2013 lays to foundation for a strategic action plan until 2018. It was sent to the City Council in November 2013 and is currently being reworked into a final version to be agreed upon by the Municipality.

Details: The main goals of the SUTP focused on improvement of the quality of urban life with sustainable mobility development. The basic goals embraced such issues as improvement of the air quality, low noise levels, better quality of public spaces – less traffic in pedestrian zones, less parking places – more green areas, more safety for bikers and pedestrians. Other very important issue was energy efficient transport. In 2010, 75% of trips to work were made by car in the city. Public transport accounted for less that 10% and ridership was decreasing before the SUTP was introduced. The City council has established the following operational objectives to be achieved by 2020:

- increasing the share of public transport to 25%,
- increasing the share of cycling to 25%,
- increasing the share of walking to 25%,
- reducing the share of cars to 25%.

The bus fleet consists of 38 buses running on 19 lines. All buses are equipped with GPS receivers, which allow vehicle tracking and voice announcement inside buses about the next station. A contactless electronic ticket is used as a payment allowing shorter boarding times. Passengers can choose between monthly passes and value tickets. Value tickets are transferable and allow multi-run trips charged as one in case of interchanging inside an hour period. Maribor is also working on the development of cycling and walking routes.

Stakeholders: Traditional transport planning in Slovenia has been criticised for limiting citizen engagement to viewing and commenting on previously developed projects just before their implementation. With the environmental plan and energy concept, citizens were involved in deliberations, leading tot he establishment of the SUTP. The importance of the SUTP is not limited to transport, but it allows for involvement in the planning process other administration departments of (at urban or regional level), such as spatial planning, environmental protection, economic development, social policy, health care, public safety. Slovenian public transport services in Maribor have been handled by public utility Marprom since August 2011 when they took over the management from Veolia.

Success: The results of reformulating transport policy in Maribor to support improvement of city public transport and enlarging pedestrian and payable parking zones – are already visible. Since 2009 over 1,400 payable parking places in the city centre have been introduced and Svetozarevska Street has been closed for motorized transport to build a pedestrian area (Leon Štukelj square).

Challenges/barriers faced: Upgrading the public transport in the city and encouraging use of the network is a significant challenge and is likely to be a long-term and expensive

exercise. Challenges like road traffic congestion, road safety, environmental impacts (and urban sprawl are all connected to the same planning framework which is a start, but Maribor needs to ensure that measures are implemented that are capable of addressing more than one concern at a time. Annual reporting on progress will help, but with through-traffic in the city being a major concern, Maribor will also need to think about how to address the non-local traffic too.

Transferability/learning/scaling up: Before introducing the SUTP all available knowledge and good practices were studied to find an approach that was apprppriate for Maribor. Through the SUTP project the city expects and is interested in exchanging know-how and experiences with other cities. Maribor is the leading best practice region in Slovenia regarding energy use and renewable energy sources in the public sector and they would like to be also leading in the field of transport. Maribor was the European Capital of Culture in 2012 and this allowed a platform to start making the connections between cultural, social, environmental and economic development.

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2.10 Trolleybuses, Gdynia, Poland

Thematic group: Urban Mobility
Specific area of focus: Contributes to the White Paper goal of reducing the use of 'conventionally-fuelled' cars in urban transport
Why good practice? Gdynia committed to retrofitting its trolleybuses from diesel to electric power and encouraged passengers back onto the network
Time period: 1943 – on-going
Budget: Over €30 million in projects investing in trolleybuses

Overview: Gdynia has over 70 years' experience of running a trolleybus network. Yet 10 years ago the system was in need of an overhaul; it was perceived as an old and slow means of transport. Instead of investing in new vehicles, the trolleybus operator retrofitted the fleet from diesel to electric power, saving significant amounts of money that could be invested in an expanded network and to encourage people back to the trolleybus. And the results have been successful with the trolleybus accounting for 30% of all trips made in the city in 2012.

Background: Gdynia, a harbour city on the Baltic Sea, has a population of 250,000 inhabitants and the largest trolleybus network in Poland. The trolleybuses are operated by Przedsiębiorstwo Komunikacji Trolejbusowej (PKT), which is owned by the Gdynia municipality. PKT has a fleet of 85 trolleybuses, with up to 73 of these operating at any one time. There are 12 routes amounting to 43.5km, 2 of these running in Sopot in the Gdynia municipal area.

After joining the EU, Polish public transport system in all cities entered a new era of improved service quality. In 2004, PKT decided to upgrade the trolleybus system on technical and organizational grounds. This involved upgrading the fleets with cleaner, more efficient vehicles, building a new depot and improvement customer perceptions. In Gdynia this included electrifying the trolleybus system and converting some of the conventional diesel buses to trolleybuses. But effort was also placed on marketing the new system. Converting the vehicles cost 25% of the cost of purchasing a new electric bus

Process: City Council of Gdynia issued a city development strategy in 2000 which stated that electric transport was to be a key factor in public transport. As a next step, the city underwent a complete, multilevel and complex strategic development plan concerning infrastructure, rolling-stock, organization of services and marketing, especially in relation to improving access to information about the importance of and details regarding the planned investments. To facilitate the system upgrade, PKT has successfully secured both regional and European funding over the last 10 years for projects.

This funding came from the Pomeranian Marshall Office in 2 project periods, between 2004 and 2006 and again 2006-2013. Gdynia has participated in 2 European projects relating to the Trolleybuses. TROLLEY (2010-2013) was concerned with improving the public image of and marketing the Trolleybuses. The current CIVITAS DYN@MO project - "DYNamic citizens @ctive for sustainable Mobility", sees Gdynia working in partnership with 3 other European cities on sustainable mobility planning. Within this project a there are plans to develop systems and services to integrate electric mobility solutions with digital technology to optimise travel – especially of the younger generation – within the city. There are also plans to use battery-powered trolleybuses in areas of the city currently not connected to the wired infrastructure.

Details: In 2005 PKT was a beneficiary of funding from the Pomeranian region to construct a new trolleybus depot and a new line, as well as 10 new low floor buses. A second fund covering Gdynia and surrounding areas saw the construction of new substations for the network, purchase of additional low floor buses and an initial awareness raising campaign to promote public transport. Initiatives within the awareness raising campaign included Trolleybus days, photo competitions and visits to the trolleybus depot.

The overhaul the system through specific improvements to make it operationally, economically and environmentally more efficient and to reduce its energy consumption was also prioritised. As a result of this project, the PKT fleet has 86 vehicles, half of which will be fitted with battery propulsion. The fleet will also consist solely of low-floor vehicles, except 3 historical vehicles for special events.

The objectives of the Citivas Dyn@mo project are to reduce the electricity power demand of the trolleybus system, to enhance its energy efficiency further and make it a showcase for innovative technologies in public transport across Poland and Europe. The installation of a super-capacitor in Gdynia and regenerative braking systems on the buses themselves will contribute to achieving these objectives.

Stakeholders: PKT Gdynia and the Gdynia Public Transport Authority are joint stakeholder in the projects working to upgrade and improve the network and therefore strong relationships between the two are required, as well as significant support from City Hall and Council. The success of the upgrades depends on public use of the network, so investing in the engagement of the population has been prioritised in the city to encourage people to use the trolleybuses, the public patrons are therefore important stakeholders in this city.

Success: By 2012 trips made by trolleybus accounted for 30% of all journeys – a very high modal split compared to other cities. This equates to more than 25 million passengers per year, and over 5 million vehicle kilometres each year. This shift (a 10% increase in mode share) in 8 years demonstrates that the efforts in increasing the efficiency of the network and in marketing the services have been effective. Another success factor is the stability of the trolleybus system in Gdynia which celebrated 70 years of service in 2013. Citizens are used to the catenary and the buses and in many surveys; increasing trust in trolleybuses is evident.

Challenges/barriers faced: Each of the projects that Gdynia undertook to revitalise its trolleybus network was confronted with the reality that the public perceive it as slow and old fashioned. By investing in the image as well as the technology, this perception could be altered. There are also certain barriers to future developments. Primarily, financing future plans is going to be a challenge. In Poland, the average self-financing share in co-funded projects amounts up to 50 -75% which means that the city and PKT must secure funds to allocate to further developments.

With the plans for off-infrastructure batteries to power the trolleybuses to enable the network to widen, the weight of the batteries is an issue that needs to be resolved in order for this technology to be rolled out at scale.

Transferability/learning/scaling up: PKT is a leading operator in Europe that has experience in retrofitting vehicles instead of buying just electric vehicles and because these lessons could be important for other cities with vehicles that also be retrofitted, a guide book on converting trolleybuses from diesel was prepared.

Currently PKT Gdynia is developing cooperation to foster knowledge exchange in:

- Sofia, Bourgas, Varna (Bulgaria): modernization of rolling stock and organizing services,
- Kaunas (Lithuania): energy control, substation modernization and energy use,
- Koprivnica (Croatia): bus conversion from diesel to electric propulsion,
- Aachen (Germany): establishing trolleybuses in favour of trams,
- Lublin (Poland): substation modernization, propulsion and fleet purchase with EU funds,
- Tychy (Poland): battery use on board of trolleys.

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3 Freight Case Studies

3.1 Bosch and Siemens Hausgeräte GmbH, Germany

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport.
Why good practice? A shift to multi-modal distribution transport contributed to a 65% reduction of diesel consumption and CO_2 emissions.
Time period: 2004 – on-going
Budget: Investments of approximately €300,000 on containers and €175,000 on vehicles and other equipment.

Overview: The cookers made by Bosch and Siemens Hausgeräte GmbH (BSH) used to be sent by trucks from the southwest of Germany to Rotterdam, where they was loaded on to ships to be sold in the UK. However, increasing road congestion prompted BSH to look to the river Rhine as a more efficient way to transport their goods in the long-term. In order to move to waterway transportation, BSH and other transport partners invested in special containers and trucks, co-funded by the EU'[s Marco Polo project. The shift has proven to be more efficient, reliable and to reduce environmental impact compared to the road alternative. BSH has therefore extended their maritime freight transport to include dishwashers and refrigerators from production sites in Bavaria through also incorporating rail transport in their intermodal transport chain.

Background: BSH is the largest manufacturer of home appliances in Europe and the UK is the second largest market for Bosch goods in Europe. The company experienced increasing problems due to traffic en-route from southwest Germany to the main UK warehouse in Milton Keynes. With driving regulations becoming increasingly stringent and fuel and toll costs rising, the company looked to waterway vessels. They are more economically efficient and can avoid these challenges transporting the cookers on the 900-km route.

Process: In 2004 BSH adopted a new freight transport strategy, incorporating the waterways to increase efficiency, but also to transport the goods in an environmentally friendly way. It engaged the hauler Robert Kukla Company (GmbH) to find an intermodal chain to transport the goods. As a result special heavy goods vehicles now transport the cookers from BSH's factories in the southwest of Germany to Bretten, where the home appliances are consolidated, and from Bretten to the tri-modal terminal at Gernsheim. At the port the operator transfers the containers to inland waterway vessels to travel to Rotterdam. In Rotterdam, the port transfers the goods to short-sea ships and sends the cargo to Purfleet in the UK. From Purfleet trucks transport the goods to the main warehouse in Milton Keynes.

BSH's multi-modal route for transporting

Details: Although there are just a few kilometres between the factory and the Gernsheim port on the Rhine, to be able to operate on a large scale, it was necessary to invest in containers and special equipment to make the switch. This equipment included specifically modified trucks that could fit the containers to be shipped on for the short journey to the port, whilst also staying within road high restrictions. The partners applied for funding through the EU-project Marco Polo and were granted €280,000 by European Commission. The volume of the modal shift that has occurred is around 12.24 million tkm per annum.

Stakeholders: BSH initiated the shift of modes. The haulier Robert Kukla Company, the Belgian company ACB and Gernsheimer port terminal operator GUT were also involved in the process. When the project got EU funding, these partners signed a long-term contract, with the Robert Kukla Company as the responsible partner for acquiring the necessary equipment.

Success: BSH's achieved its goals to create an intermodal solution that was more efficient than the existing transportation, while also reducing CO_2 emissions by 64%. The waterway vessels contribute a saving of 65% on diesel consumption (from 448 to 157 litres of diesel equivalent per shipment). In addition, waterway vessels are more reliable and their costs more constant and therefore easier to calculate. The special oversized containers reduce the need for inventories, as they are essentially "floating warehouses", which also makes the safety and security of goods higher. The success of the cookers' move away road transport from Bretten has encouraged BSH to look at shifting transport modes for products from other production sites. For example, refrigerators and dishwashers produced in Bayern are sent by train to Rotterdam and from there by maritime transport to England.

Challenges/barriers faced: There were two main challenges. First, the conventional containers the ships use were smaller than the containers used in truck transport, which meant a 30% loss of loading space. The solution was to buy specially constructed 45-feet containers. However, as the containers had a short journey to make by truck, a challenge was that the special constructed containers exceeded the maximum of four metres height for truck transport. With a long-term contract, the partners were able to convince a truck operator to construct a low-lying trailer so that this height limit was not exceeded.

Transferability/learning/scaling up: BSH have demonstrated that congestion on the roads is a contributor to looking for alternative modes. The company has also expanded the practice from shifting to nearby waterways to also looking to the rails instead of the road. Other companies that are located with viable alternative transportation routes could look to the BSH example and its success.

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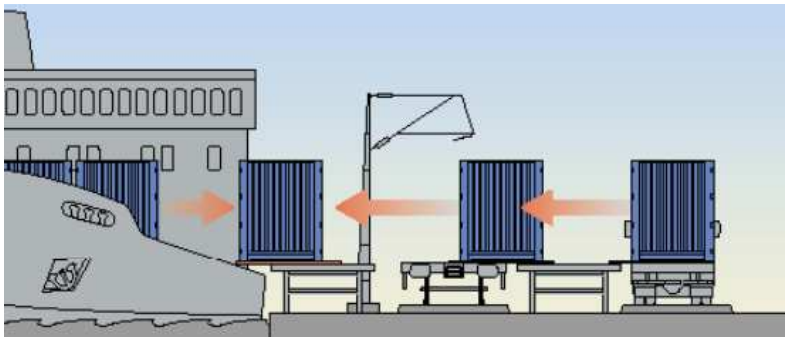
3.2 CarConTrain, Sweden

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? CarConTrain technology facilitates flexible freight loading between modes
Time period: 1970s – on-going
Budget: SEK28.5 million

Overview: CarConTrain (CCT) is a horizontal transfer technology that places containers onto hydraulic poles during the trans-shipment process. First conceived in Sweden in the 1970s, the CCT technology has been evolving over the past 40 years with successful pilots being established in the early 2010s. Collaboration between established and new freight sector actors has been required to realise the initial vision of providing a flexible, inter-modal trans-shipment process. By using CCT there are opportunities to choose the mode of transport which is most effective for a given transport route, which enables a more integrated freight system.

Background: CCT is a technical innovation, known as a horizontal transfer system, which is able to remove some of the barriers associated with loading and unloading freight containers between trucks and trains and thus makes inter-modal cargo transfer easier and less energy intensive.



CCT concept

Process: CCT is a Swedish innovation, which began life at KTH, Sweden's Royal Institute of Technology. In the mid-1970s engineering student Sten Lövgren conceived the idea and developed the concept through a thesis. Making CCT a reality took some time and only in the recent years has the technology gained traction. The initial proposed technology has evolved over time and various iterations or aspects of the technology have been trialled in Sweden and further afield, in Norway, Poland and the United Kingdom. Some pilot projects were recently completed, others are underway, but to date the prototype is not being commercially produced.

Details: "Ant" – the transfer unit which handles the containers between modes – operates on a parallel track to the incoming/outgoing train and at a height underneath the overhead cables of the railway track, allowing containers can be accessed direct from the tracks. This shortens the time in which loading and unloading can take place and therefore allows for shortens train stops.

Hydraulic poles lift the container and a conveyer slides underneath, which then rolls the container across to the temporary storage platform. It can then be moved from the stand onto the final transport mode. The train can be bought into terminal, unloaded onto the Ant(s) and the train can leave the other end of the terminal returning to the main track in as little as 20 minutes. This also means that no shunting occurs because the train can stay connected.

The Ant has the potential to operate in full automation. This means that not only can the height be vertically adjusted for any given container, but the Ant will also correct itself to the appropriate height throughout the reloading process. It can also determine where the load needs to be removed from or placed onto. These elements remove the need for marshalling and therefore save time and money. Managing this automation effectively relies on sophisticated information systems to control the system across the terminal and across the local network (and ultimately the national and international level).

Ant puts unit loads into temporary storage or retrieves loads to be transferred to the train. The base units can be joined together to form a single unit, which scales up the amount that can be shifted. Ant takes loads from the train and leaves them in a temporary rack. This allows the two transport modes to operate independently of each other and transfer need not be simultaneous.

Estimates based in the sale of 15,000 units per year (50 per day – or 25 incoming and 25 outgoing devices) costs would be about SEK100/unit. The cost of the CCT equipment to deal with 40-foot containers has been estimated at SEK3.6 million.

CCT is a part of a new logistic system for containers and swap-bodies that means:

- Loading and unloading under the contact wire during a quick stop at a siding
- Linear traffic with stops underway instead of endpoint traffic is possible
- No diesel shunting engine is needed and no tracks for storing wagons
- Compact terminals with lower cost for transfer of containers permit more terminals and make inter modal profitable on shorter distances
- Automated terminals possible and independence between train and truck
- Low energy consumption and even less GHG by electrification of terminal handling

Stakeholders: Partnership has been crucial to the development of CCT. CCT Intermodal Sweden AB has developed and launched CCT through interaction and co-working with Volvo trucks, IKEA and the NSB amongst other partners. These partnerships have developed the technology and run pilot tests using various elements of the CCT system. The demonstration project carried out in 2011 was financed by VINNOVA.

Success: Despite CCT's long history of development, tangible success has been limited, although great potential still exists. The first phase of CCT's distribution project was completed in 2012 and full-scale equipment has been installed. The pilot was evaluated by KTH. It was deemed to have worked well and it was calculated that the system could be profitable if it were operating at the rate of distributing three or more trailers per day..

A new pilot project with a complete terminal is planned to start in 2014 together with stakeholders, if it secures finance.

Challenges/barriers faced: With over 35 years' experience and insight into the concept of CCT, several challenges have been faced and many lessons learned. Securing funding and buy-in from the existing freight operators and logistics companies has been one challenge to operationalising the concept.

A reticence about changing the current system is cited by CCT AB as the reason that certain previous activities have not come to fruition. Bad management of projects (such as INHOTRA in the mid-1990s) is also flagged as a problem experienced. Based on successful pilot testing in Norway, some important barriers were identified that could be taken forward to the future

specification of the system. These included the necessity to manage the system under the overhead cables of the rail track, immediate access to each unit on any part of the train was required, that wagons should be kept as simple as possible and that equipping wagons and trucks with electricity and information was fundamental. The current pilot developments have worked to integrate these considerations into the latest offering.

Transferability/learning/scaling up: CCT is a case, which highlights that evolutionary change takes time and can fail before they succeed. CCT was initially an idea before its time, but with the pilot rollout gaining momentum, CCT holds real promise in the near to medium-term future. CCT is an example of how organisations can continue to learn from themselves, from their own mistakes and lessons and take these forward and improve a system. The ultimate success of CCT is still unknown, but with ever more emphasis being placed on intermodal freight, CCT has a wealth of knowledge about what does and what doesn't work and could offer a very viable solution in the years to come.

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3.3 Duisport, Duisburg, Germany

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? Largest inland port in Europe; working to improve its rail links and promote rail and inland waterway freight transportation
Timeframe: 1998 – on-going
Budget: €160 million (2012 revenue)

Overview: An historically important site linking the Rhine and Ruhr rivers, Duisburg has experienced periods of decline and growth over the past century. In 1998 following the decline of the steel and coalmining industries in the area, Duisburger Hafen AG acquired land to expand the port and over the past 15 years the vicinity has been transformed into a globally competitive trimodal hub. Rail and inland waterway based transport has been promoted and is now offering a competitive alternative to truck based freight transport. By 2015, the port is aiming to move 5 million twenty-foot equivalent units (TEU).

Background: Duisberg in currently the world's largest inland port. It is situated at the confluence of the Rhine and Ruhr rivers, lying some 40km from the Netherlands and despite being almost 200km from the North Sea, it is considered a seaport due to the vessels that it serves heading to or coming from destinations across Europe, Africa and the Middle East.

Connected to destinations across Germany through a series of canals, evidence of trading in the area can be dated back to the 5th century and became an it first became an industrial centre in the 18th century. Duisburger Hafen AG was founded in 1926 and since 2001, the port has been trading under the name Duisport. Emphasis has been placed on improving the rail hubs at the port over the past decade; it has over 25 miles of platforms, 22 docks and is a truly multi-modal hub with links to river, rail and road transport.

Process: The city of Duisburg was levelled during the Second World War, but in the 1960s became a hub for steel and coalmining. Following a steady decline for these industries recent decades, Duisburger Hafen AG began to invest in the area. In 1984 the first roll-on/roll-off container terminal system was established in the port to promote Rhine-sea shipping. In 1998 the company bought up 655 acres on the Western Rhine shore to transform into a logistics centre – Logport. The first Logport trimodal centre opened in 2002Some of the uninhabited real estate from the mining and steel production sites has also been transformed, turning the port from a bulk cargo harbour for these local industries into a fast-growing container and multi-modal logistics hub.

Following the establishment of Duisport rail in 2001 and in the following decade much of the emphasis on the port's plans for expansion was around promoting the use of rail. Elements of the developments have been delivered ahead of schedule and under budget, with on-going stakeholder consultation throughout the planning and development phases. The Duisport Group is now aiming to handle 5 million TEU from January 2015.

Details: Duisport is home to 9 intermodal container terminals the port handles some 110 million tonnes of cargo and 2.6 million TEU every year; this includes 20,000 trains and 20,000 ships annually. The company owns some 200km of its own rail infrastructure, in addition to linking with 25 national and international railway service providers offer connections to some 80 destinations in Europe, with the most frequent connections being to the Zeebrugge,

Antwerp, Rotterdam, and Amsterdam (ZARA) port network. 25 departures by barge are made to Rotterdam each week, 15 to Antwerp and 10 to the UK. The Logport

Stakeholders: Duisburger Hafen AG is the holding and management company of the Port of Duisburg. The federal government, the state of North Rhine Westphalia and the city of Duisburg are all 1/3 equal shareholders in Duisport. There are over 300 companies operating at the port. Global companies that have invested in Duisburg include Kuehne and Nagel, DHL and DB Schenker with entities including IKEA, Danone, ABB, Siemens and HP all making use of Duisport services.

In 1999 a memorandum of understanding was signed by Duisburg and Antwerp port authorities to work together and in 2013, Duisport and the Port of Antwerp committed to working closely to intensify rail and barge transport between the 2 regions. The agreement will set to reduce transit times between the two areas and improve the rail connection between the ports.

Success: Container throughput has grown from 890 thousand TEU in 2003 to 2,600 thousand TEU in 2012 and traffic through the port continued to grow, even through the recession of the last 5 years. Whilst road-based transport is still the primary means of passage from the port, over the past decade the ship-based freight has increased by more than 2 million tonnes and rail freight has more than doubled. Whilst still accounting for a smaller share, rail freight growth in the port is happening faster than road-based growth.

Growth in the amount of freight handled by the port over the past 10 years, particularly in the rail transport moving through the area demonstrates that rail and inland waterway modes can be competitive with road transport. Duisport is now among the largest 50 container ports worldwide. The rail improvements made at the port have made it possible for some 50,000 trucks to be avoided in the Ruhr region alone, with the Glückauf-Express along taking 16,000 off the road each year between Duisburg, Dortmund and Gelsenkirchen.

The surrounding areas of the city of Duisburg have also been redeveloped, increasing visits from residents and tourists who come to frequent the shops, restaurants and museums that have been introduced to the disused inner harbour.

Challenges/barriers faced: The growth experienced by Duisport in recent years demonstrates it is fulfilling its potential, even in a time when global industry has been stagnant. However not being a seaport is perceived as being an immovable, permanent barrier for the port; both in terms of future growth and further development and expansion plans. Therefore there is a need for the port to continue to innovate, to give a competitive edge over other, perhaps more convenient terminals for global transportation.

Because Duisport has moved from mining and steel production to a more diversified stock of goods and services being shipped through the port, it is perhaps more resilient to economic change and able to withstand shocks better. However, the city itself continues to be financially stretched and the economic conditions in the area of course have an impact on the productivity and throughput of the port.

Transferability/learning/scaling up: Duisburg finds itself with a strategically important location in Europe, both geographically and economically. It has a vantage point at the junction of two major rivers and a well-connected rail and road infrastructure, which makes it

a prime location to manage the movement of freight and these advantageous elements cannot be transferred.

However, it is clear that the strategic investment made by Duisport over the past 10 years and the deliberate attempts to improve the rail infrastructure around the port demonstrates that inland and sea-based ports alike can learn it from, and not just in Europe. Indeed, the port company has been advising the Brazilian government on its expansion plans for Santos a significant development on the country's coast. The scale at which the port operates means that large scale modal shift can be achieved, but this should not deter smaller ports to also look to Duisburg as a model for promoting change.

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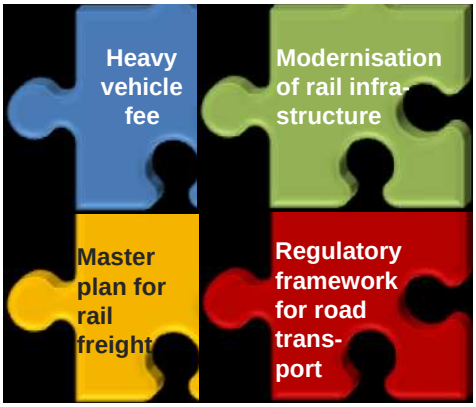
3.4 Freight transport policy, Switzerland

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? Switzerland has introduced a series of comprehensive measures since the 1990s to promote rail freight and limit the extent to which trucks travel through the Alps.
Timeframe: 1992 – on-going
Budget: Heavy vehicle fee and other revenues totalled €2,060 million in 2009

Overview: Switzerland has introduced a comprehensive framework of regulatory measures in recent years to enable a competitive rail freight transport sector to thrive in the country. A heavy vehicle fee has been introduced alongside investments in modernising the rail infrastructure, enacting a master plan for rail freight as well as a regulatory framework for road transport. Implementing these policies as a package has been fundamental – none of the component measures can be successful without the others. Various referenda have been conducted around the proposed strategic direction of Swiss freight transport policy and the measures in place have been agreed upon by public vote, which has been an important driver in the success of the programme.

Background: In 1992, a new railway link through the Alps was approved and shortly after a referendum was conducted to ensure that the Alps were protected from the negative effects of road freight transport. 'Alpeninitiative' as it was known, was approved in 1994. In 1999, the Land Transport Agreement (LTA) was introduced which legislated the shift from road to rail and a Heavy Vehicle Fee (HVF) was introduced in 2001 to support this law. Phase 2 of the HVF was brought in subsequently in 2005 and this mechanism also increased the weight limit for trucks from 28 to 40 tonnes. In 2010, Switzerland introduced a new law on modal shift. Infrastructure developments have also been taking place over this timeframe with the Lötschberg base tunnel opening in 2007 and the Gotthard base tunnel will be operational from 2016 and the Ceneri tunnel from 2019.



Swiss Government approach to addressing road freight (Berndt and Schreyer, 2013)

Process: The primary drivers around the current Swiss freight transport policy are two-fold; not only do the measures aim to protect the Alps from heavy road transport and the Swiss environment more generally, but they also serve to provide a stronger connection between Switzerland and the rest of Europe. Given that Switzerland is an important north-south transit route, measures implemented within its borders are significant for Alpine crossing freight transport, promoting the shift to both domestic and international rail was seen as an important means to manage increasing traffic volumes through and in the country. Upgrading the rail infrastructure and installing modern terminals before 2020 is providing additional capacity to encourage road freight carriers to switch to using the rail network.

In 2013 a consultation was set up for a Master plan for rail freight in Switzerland, which is being developed through 2014. It will be a regulatory framework to manage the rail infrastructure in line with the needs of the market. It will ensure that passenger transport is no longer given priority in a move to improve the capacity of the network for freight and

intercity and regional passenger trains. It aims to make the planning processes iterative, more transparent and coordinated. It will also improve the supporting non-track infrastructure that the sector requires such as sidings and terminals. Technical innovations will also be piloted and tested under the master plan to improve technologies and employ new and better standards across the sector. In February 2014, 62% if voters backed the FABI bill which has ring-fenced CHF6.4 billion between 2014 and 2025 to increase network capacity and finance network maintenance and upgrades.

Details: The 1999 LTA between Switzerland and the EU laid enshrined the polluter pays principle into law with regard to transport, particularly road through enabling a phased-in charge for use of Swiss roads and a maximum weight limit. In 2001 this was a maximum charge of 1.34€cent/tkm and an increase in the weight limit from 28 to 34 tonnes. The fee increased to a maximum of 2.2€cent/tkm and the weight limit set at 40 tonnes (in line with EU standards) in 2005. HVF charge rates are now differentiated into 3 payment brackets based on EURO categories, with the oldest trucks (EURO 0-II) charge a maximum of 3.1€cent/tkm (or 272 CHF for a 300km journey).

The cost of the charge was calculated based on what costs there are to manage the Swiss infrastructure (noise, congestion, climate and nature costs are factored in here), thus there is a true internalisation of external costs. The fee does make it much more expensive to drive through Switzerland, but the HVF and other revenue from fuel taxes and vehicle taxes generally cover the costs, with a slight shortfall.

The regulatory framework for road transport supporting the LTA has been fundamental in ensuring the measures are effective. These include a ban on weekend (Sat 10pm – Mon 5am) and night (10pm – 5am) driving, a ban on cabotage and a HGV control centres which check truck criteria and monitor the distance between trucks. These measures have been supported by the modernisation of the rail infrastructure, as well as harmonisation of operational rules in bordering countries and a new train control system. Pre-arranged train paths and long term funding through the Rail Infrastructure Fund are some of the other supporting measures that make with approach more comprehensive.

Stakeholders: The developments in Switzerland can be lauded for being consistently participatory and consultative. Throughout the public have been able to vote for particular measures. The new masterplan has been developed in broad consultation with the public, industry representatives from both passenger and freight rail, cantons and the Swiss government to ensure that this broad-reaching and cross-cutting vision considered the needs and perspectives of all in working together for collaborative improvement of the system.

Success: Modal splits generally through the country have been fairly constant since 1990. At the current time the rail market share for freight (tkm 2011) is 46%, the highest in Europe, road makes up the remainder. But in terms of freight travelling through Switzerland in transit the picture is much different with 70% of all transit freight going by train in 2010. Also rail passenger transport in Switzerland is highest in Europe at 18% of total passenger kilometres.

Challenges/barriers faced: Whilst the mode shift for transit trips on the rails is promising, in absolute terms road still dominates as the mode of choice. Roads are still largely faster than rail routes and in 2013 1.4 million truck trips were carried out on Swiss roads. The law set the target for a maximum of 650,000 trucks trips per year to be achieved by 2009, this target wasn't met and there is still has some way to go.

Transferability/learning/scaling up: Whilst Switzerland is not a part of the EU, there is a certain freedom in terms of the policy mechanisms available within the country that is perhaps not available to member states. However, the context and issues that are experienced in the Swiss context are likely to be similar to those experienced in member states and the harmonization of standards and approaches between Switzerland and the EU make these issues less relevant. Other countries could certainly learn a lot from Switzerland's experiences of implementing policy measures as part of a package as opposed to standalone initiatives.

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3.5 InnovaTrain AG, Switzerland

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? Horizontal transhipment technology that facilitates short distance truck-to-rail freight shifts to enable rail transport even on shorter distances than 300km
Timeframe: 2010 – on-going
Budget: €5 million (revenue 2013)

Overview: InnovaTrain AG was set up in 2010 as a competence centre to manage intermodality between trains and road-based freight transport and to make the connections between modes more efficient and even seamless where possible. The company has a focus the improving the connections for time sensitive cargo on short routes. The company's technology works with conventional swap-bodies and containers.

Background: With a background in the rail freight industry, InnovaTrain founder identified a need to use a horizontal transhipment technology, which could transfer containers and swap-bodies in small scale terminals under the catenary without heavy lifting equipment as reach-stackers or container cranes. In order to switch cargo from road to rail, only the transfer equipment on the truck is required which means that more terminals can be established and the train can make intermediate stops with profitable service also on shorter distances. The company was formed in 2010.

Process: Railcare, is a small, private company running its own small, freight trains on the Swiss rail network by taking available slots in the schedule between freight and passenger services to take containers from the centre of Geneva. Railcare was also considering horizontal transhipment, so the technology being developed by InnovaTrain was of interest for their operations. The Coop announced a future logistics strategy stating that they wanted the system to be developed. InnovaTrain therefore had a year to develop the new horizontal system; it needed to be working by the end of 2011. The prototype was built by May/June 2011; lots of experimentation and testing ensued and the product eventually became successful. The trains are being implemented through a 5-year plan (2011-16).


InnovaTrain ContainerMover

Details: Railcare offers rail freight transport on a 5-10 wagon push-pull train less than 300 metres long and operating like a passenger train. Services can travel up to 120km/h running on electric and diesel power. Classical intermodal transport is long distance, with trains loaded approximately 5 times a week and travelling 800km over 2 days. However, given the size of Switzerland, freight distances (and trains) can be much shorter and therefore much quicker – operating more like passenger trains - and can be loaded up to 4 times a day. Unloading and loading usually takes a lot of time and a lot of trucks to pick up a full trainload of containers. Long distance trains would go to hubs to have loads transferred to trucks, with Railcare, now some of this domestic freight can be transported on the short distance trains.

InnovaTrain's ContainerMover facilitates quick unloading and loading, systems are optimised and congestion at the depot can be managed. It only requires 3 metres of asphalt parallel to

the railway track to transfer containers, which can be done in 3 minutes. The technology can shift up to 22 tonnes, which is a normal maximum weight for a 20ft (6,06m) container.

ContainerStation is a further innovation from InnovaTrain, which enables containers that do not have their own stands to be left in the depot and unloaded with no time constraints – there is no need for trucks carrying containers to wait hours to be unloaded or to wait for the train. They can drop off the container and leave, which further optimises general distribution.

Stakeholders: The linking of Railcare and InnovaTrain highlights how partnership can be the key to a successful business innovation. Linking to established market players, such as Coop in this case, has been a key driver for the success of the technology. And the relationship required with the existing train operators, in this case SBB and the regional transport authorities in urban areas have also been important to managing the train schedules enabling Railcare to add value to the network without straining capacity.

Success: By the end of 2013; there were 38 ContainerMovers in operation, 380 stand/slots and 80 wagons installed and the arrangement has been successful to date. In 2014, the company plans to consolidate its operations, with substantial expansion to new clients planned for 2015. 50,000 containers can now be conveyed as far as possible by rail.

Railcare lists its success factors as the ability to use standard transport equipment without customers having to change, reliability, relatively short (about 1 hour) standing time at terminals, the horizontal transhipment technique that InnovaTrain has developed and their train fleets being fully scheduled on the network.

Research into the most appropriate means to transport LDHV goods, suggested that InnovaTrain's multi-purpose, with no semi-trailer approach, is optimal in the European context.

Challenges/barriers faced: There has been some resistance to short distance rail freight, those working in the sector perceive that short trains as ineffective. There is some way to go before the industry accepts initiatives like InnovaTrain as a mainstream approach. Big players with investment, strategy and a long-term future vision are required to overcome this barrier. Industries that have a lot of traffic between privately-owned sites, and their own infrastructure – or both, may be a good place to start.

ContainerStation was actually developed following identification of a difficulty. Time was an important consideration during the initial tests and was seen as a necessary requirement after 6 months to improve the logistics of the hubs themselves. Similar, new problems are likely to continue to arise as fast logistics becomes more prominent within the sector.

Transferability/learning/scaling up: InnovaTrain have been very active over the past 4 years working with peers, sharing insight in their experiences, the problems that they have encountered and contributing knowledge to the field of modal shift in the freight sector. The company also sees that there is potential for their technology to be replicated in other cities with similar problems.

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3.6 KASSETTS project, Multi-national

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? Freight optimization to deliver overall energy and CO_2 emissions reduction
Time period: 2008 – 2012
Budget: €2.5 million

Overview: The Knowledge-enabled Access of Central Europe SMEs to Efficient Transnational Transport Solutions (KASSETTS) project developed a "Logistic Broker Solution" service to enable manufacturing companies to collaborate with logistics service providers. The Broker is not a new logistic operator (neither 3rd Party Logistics Provider (3PL) nor consulting firm (4PL)) but an integral part of the logistic offices of the manufacturing companies. The project serves to open up the possibility of optimised transport solutions for SMEs and to boost the ICT solutions available for companies with limited resources.

Background: SMEs often lack access to optimized transport solutions due to the small volumes and low frequency of their operations and shipments but also because of the limited influence over and unequal relationship with carriers and logistic operators and a lack of ICT capacity. Optimisation opens up the opportunity for SMEs to have access to multi-modal logistical chains.

If a modal shift toward rail and waterway transport is going to be achieved, it is important to first optimise operations and to include SMEs. This is particularly critical in Central Europe where small companies make up a large share of a market that trades frequently with partners in other countries.

In order to overcome the present scattered demands of transport services and maximise the efficiency of the current situation, two main conditions must be met:

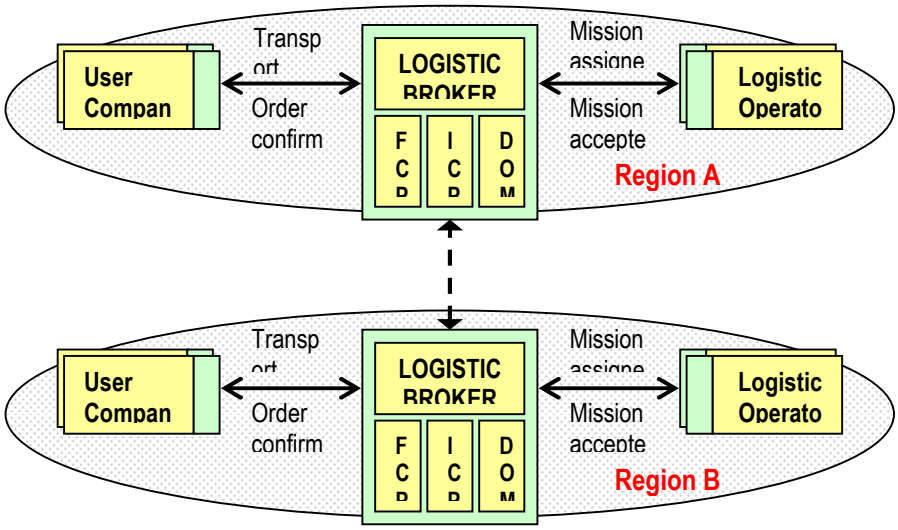
- Finding a sufficiently large number of collaborating companies located in the same territory to aggregate their payloads
- Combining these with the payloads of companies in other territories to complete routes and avoid empty trucks

Process: Eight Central European partners launched the KASSETTS project in 2008 with the aim of establishing a European ICT network for optimizing and improving regional and transnational freight and logistics. The project was implemented within the CENTRAL EUROPE Territorial Cooperation Programme, co-financed by the European Regional Development Fund.

KASSETTS aimed at enabling manufacturing SMEs based or located in Central Europe to jointly participate in the dynamic construction of efficient transnational transport solutions by means of knowledge and intelligent information and communication technology (ICT) services provided by an EU-wide network of intermediary organizations (logistic coordinators/brokers).

Details: The main objective was to create a stable EU-wide operative ICT network for logistics brokers. Each broker represented a joint logistic office among SMEs that: collected manufacturing SMEs transport orders daily through IT interfaces; aggregated SME transport demand in terms of routes and load factors at regional and transnational levels in order to achieve a critical mass. In working with and matching the demands of companies working

with other brokers in the KASSETTS operational network; logistics of regional and transnational chains based on destinations/quantity and timing of shipping for different local groups of manufacturing SMEs could be optimized for logistics operators. The following figure depicts the devised reference situation.



Regional scenario: Demand aggregation and planning

Stakeholders: There were 9 Consortium members from academia and industry working on KASSETTS from across 7 Central European countries including the Czech Republic, Germany, Italy and Poland. The project engaged with a wide variety of relevant stakeholders in each of the project regions, including various sectors of industry, education, policy makers, cluster and region representatives.

Success: The sustainability and effectiveness of the KASSETTS broker solution was proven through the project. Cost savings were delivered through the broker model and other observed benefits included over an 18% reduction in the trips needed to fulfil orders and a reduction in trip length of over 11%. An 11% reduction in fuel consumption and a 9% reduction in CO_2 emissions were also witnessed. These benefits delivered an overall cost reduction of 13.6% for involved manufacturing companies.

Challenges faced: The fundamental challenge for both the KASSETTS project and the potential for future up-scaling and continued use relate to capturing and managing the logistical interoperability of SMEs.

Optimising road freight operations may encourage the continued use of trucks over and above rail and waterway options. It is important that the increased efficiency be taken a step further and incorporate modal shift opportunities too.

Transferability/learning/scaling up: The project results and future prospects have been presented at several conferences demonstrating the potential for further innovative trends in logistics and networking approaches for policy making in the European business ecosystem. Although the project has finished, the KASSETTS broker solution continues. It has been proven to be a powerful tool that can offer beneficial and competitive solutions for its users. The KASSETTS broker solution is realized in each project region through real life implementation and also for educational purposes.

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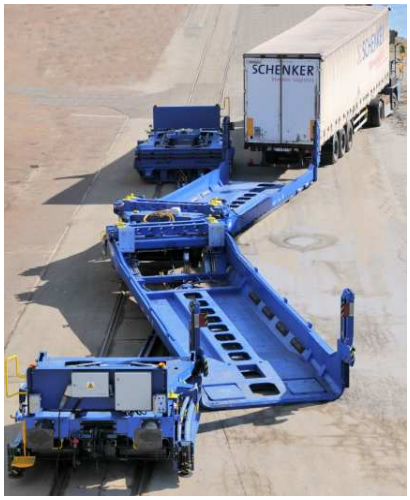
3.7 MegaSwing trailer wagon, Sweden

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport.
Why good practice? The new MegaSwing intermodal wagon is an innovation that facilitates the shift from road to rail-based freight transportation.
Time period: 2011 – on-going
Budget: No available data

Overview: MegaSwing is a Swedish innovation which builds on the current road and rail freight systems and offers a means to take freight off of the roads without the need to build new dedicated infrastructure such as dedicated terminals and storage facilities. It was piloted in 2011 and has since proven itself to be a viable system to help achieve the White Paper goal relating to long distance freight modal shift.

Background: MegaSwing is a new type of freight wagon, designed by the Swedish railway logistics company Kockums Industrier. The system focuses on semi-trailers. Only 5%-15% of semi-trailers can be moved on and off trains at the current time, as cranes or reach-stackers cannot lift them. MegaSwing combats this problem by allowing trailers to enter and leave the train on their own wheels. A prototype of the system was launched in 2011 and now two models – Single (4-axled) and DUO (6-axled) – are available. MegaSwing's function opens up the potential for all road-based freight to be shifted to rail.



MegaSwing trailer wagon

Process: In 2004, the European project RoRoRail finalised a study of the technical, operational and economic feasibility of horizontal transhipment technologies. This project was initiated to foster knowledge on innovations that could be designed to remove the barriers to multi-modal freight transportation. MegaSwing was one of the systems that emerged following the outcomes of the project.

Details: The MegaSwing consists of a wagon with two swinging load beds for trailers in which all power, hydraulics and operating systems are self-contained on the wagon. The 'pocket section' swings out and using a hydraulic system it is lowered to the ground. A semi-trailer can then be reversed into the pocket. After releasing the trailer from its truck, the pocket and the trailer are then pivoted back. The wagon can be accessed from either side and there are power sources on each corner of the wagon.

MegaSwing is a part of a new logistic system for trailers that means:
- All trailers can use the system not only those 5-15% with lifting equipment as today will widen the market
- Loading and unloading under the contact wire during a stop at a siding
- No diesel shunting engine is needed
- Linear traffic with stops underway instead of endpoint traffic is possible
- Compact terminals with lower cost for transfer of trailers make inter modal profitable on shorter distances

Stakeholders: Because MegaSwing is capable of working with currently-operational rolling stock, the partnership required to realise its potential is perhaps less important than for the other solutions which require changes to the system. Lübeck Hafen Gesellschaft introduced the 2011 pilot of MegaSwing in partnership with Kockums Industrier.

Success: MegaSwing can move any semi-trailer and separating the wagon into the 'pocket section' and the semi-trailer takes less than three minutes, with the possibility to load an entire train within 30 minutes – making it a very viable option to deliver freight modal shift.

The MegaSwing service between Malmö – Eskilstuna has been running since January 2011 and available information suggests that the wagons have successfully run over more than 80,000km. This is on the basis of a 4 day a week return service. Independent analysis suggests that over a 500km (one way trip) MegaSwing has the potential to reduce operating costs by as up to as much as €100,000 per year.

Challenges/barriers faced: MegaSwing enables transhipment under overhead lines as it does not require lifting. However it does require flat ground alongside the rail track, so whilst locations for the system are limited, there are many possible loading and unloading places in addition to the conventional intermodal terminals. The market introduction of MegaSwing may be a lengthy process when the current economic situation in Europe, combined with the traditionally slow modernisation pace in the rail freight sector is considered.

Transferability/learning/scaling up: Because the MegaSwing wagon is able to withstand a comparable weight as fully loaded trucks, no additional equipment is required in the switch from road to rail. It is also possible to use MegaSwing without building a dedicated terminal or storage, loading and unloading can take place wherever the trackside area is suitable for trailer management.

These elements combined mean that operators can continue to load trucks in the conventional way and use their own containers and warehouses for this purpose, significantly reducing costs of switching modes and reducing the congestion at dedicated terminals. Therefore, there is significant potential for adoption of the MegaSwing system; it is a solution that works in the confines of the current system and by using conventional semi-trailers and rolling stock, therefore making the switch from road to rail much easier.

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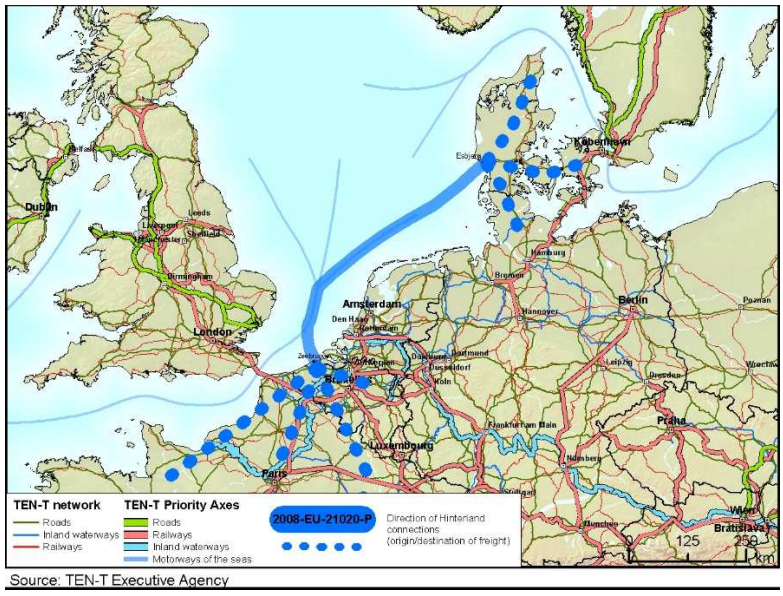
3.8 Motorways of the Sea: Esbjerg – Zeebrugge, Multi-national

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? The shift of mode from road to waterborne transport has contributed to about 40% cost savings and reduced CO_2 emissions by 58%
Time period: January 2008 – December 2012
Budget: €26,540,000, of which €5,308,000 is EU contribution

Overview: As a part of the EU-supported project Motorways of the Sea (MoS), upgrading the roll on, roll off (RoRo) link between the port of Esbjerg in Denmark and the port of Zeebrugge in Belgium, was selected to receive funding. RoRo ships are designed to carry wheeled cargo, such as automobiles, trucks, trailers, that can be driven on and off the ship on their own wheels. To improve the link between the ports, investments have been made to double capacity, reduce bottlenecks in the intermodal chain and to assure faster transit times and reliability. This has made maritime transport more attractive. As a result, compared to freight transport on roads between the countries, the maritime route contributes to 58% less CO_2 emissions and cost savings of about 40%.

Background: The maritime link between Esbjerg in Denmark and Zeebrugge in Belgium has been in service since 2005. The link provides an alternative to trucks when transporting goods between Denmark and the Benelux countries. The European Commission supports the project through the MoS commitment, but this project is a part of a broader global action. The aim of the project is to improve the handling of goods by doubling capacity through investments in a floating RoRo ramp, a RoRo jetty, cranes to load containers on and off the rail, to improve the Esbjerg port access way and improve ICT-systems to foster integration to other parts of the intermodal chain.



Esbjerg-Zeebrugge Motorway of the Sea (TEN-T Executive Agency, 2009)

Process: In 2004 the original MoS concept was introduced in the TEN-T guidelines, as a potential means to reduce road congestion and to concentrate flows of freight on standard maritime-based links between member states. But was at this time no more than a concept. It wasn't until 2008 that the first MoS began to be implemented. Esbjerg-Zeebrugge was one of only three routes to be co-financed. The funding allocated to this MoS was intended to create a coordinated increase of the frequency on the Zeebrugge-Esbjerg route, investment in infrastructure and facilities and the adoption of accompanying measures to foster integration of various parts of the intermodal chain. Future plans include developing the ports of Esbjerg and Zeebrugge by adding more connections to the ports.

Details: The main objectives of the project was to increase capacity in the ports, remove bottlenecks for freight transport between the port of Esbjerg and the hinterland and to improve ICT-systems to assure faster transit times, lower costs and increased reliability. The capacity in the port of Esbjerg has been increased by building a floating RoRo ramp to increase the RoRo handling capacity. In addition, an extension of the access way to the port of Esbjerg has been built to ease traffic around the port area.

In the port of Zeebrugge, an additional RoRo jetty has been constructed to increase capacity and reduce waiting time for the ships. In addition, two rubber-tyred cranes have been purchased so that containers can be loaded onto rail in Zeebrugge. To promote efficient cooperation between all the actors in the intermodal chain, ICT investments have made it possible to simplify the handling procedures for cargo at the terminal and keep electronic data, so that delays from missing documentation are avoided.

Stakeholders: There have been several actors involved, and over half of the budget costs are covered through state funding. Implementing bodies include the Port of Zeebrugge, Sea-Ro terminal NV, Port of Esbjerg and the Danish Road Directorate. The European Commission has covered about 20% of the costs.

Success: Compared to other routes supported by the Commission, improving the link between Esbjerg and Zeebrugge has been successful in saving costs and reducing CO_2 emissions. The project reports cost savings up to 40% compared to the alternative road connection. CO_2 emissions have been reduced by 58%. A key to climate benefit is the low service speed of the ships, around 18 knots. Another benefit from the project is that congestion has been reduced on the busy road network from Denmark to the Benelux countries, and that it provides an opportunity for further expansion by adding more connections to the ports.

Challenges/barriers faced: Some issues were encountered in the initial contract regarding the assurances around the service level upgrades which meant that the co-financing for the upgrades of the ports depended on the performance of the private sector partners, which meant that the project's concept was not ideally appropriate to the reality of the commercial sea-based transport. The project and all of the upgrade components were nonetheless completed. The floating RoRo ramp was finalised in 2009, the RoRo jetty in 2011 and the access road to Esbjerg port was finished in 2012.

Transferability/learning/scaling up: The Esbjerg-Zeebrugge case has been successful in upgrading services so that more freight can be transported inter-modally. It has demonstrated that on particular routes significant savings of cost, energy and CO_2 emissions can be achieved. The potential for generalising such solutions is somewhat uncertain, since a limited share of freight flows in Europe may be channelled from port-to-port this way with such gains.

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3.9 Oversize Baltic, Multi-national

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? Oversize transportation is very differently organized in separate countries of EU and concept of Oversize Corridors simplifies procedures to enable an increase in rail and inland shipping's share of freight transportation
Time period: 2009-2011
Budget: The overall project budget for Oversize Baltic was €769,610,000

Overview: The transport of oversize cargo is growing in Europe and there is therefore a need for specific oversize corridors to be developed to handle this growth. "Oversize Baltic" was an international project, part of the EU South Baltic Cross-border cooperation programme 2007-2013, involving partners from Lithuania, Poland, Sweden and Germany working together to improve the quality of oversize cargo transportation services. The project ran for 24 months and finished in June 2011. One of the primary outcomes of the project was the development of an electronic platform to submit applications for the issue of standard oversize transport permits.

Background: Oversize cargo is predominantly transported by road due to a lack of infrastructure to move large items (such as wind turbine or tunnel components) and the possibility for mode switching is minimal. Appropriate routes and suitable vehicles to deliver these items are fundamental, and special permits and arrangements need to be made with transport infrastructure providers. International transport of such items can be difficult due to the different procedures and requirements in each country/region.

In 2006, the EU issued guidelines on good practices for oversized vehicle transit in Europe. It aimed to increasing effectiveness of the transport of oversize cargo and increase transparency in the operation of the sector.

Routes examined by Oversize Baltic

Process: Oversize Baltic was region-wide initiative designed to increase the effectiveness and safety of the oversized and overweight cargo transportation and to understand where potential to remove some of these barriers in transporting large items lay.

The project's main objective was to improve and harmonise transportation of oversized cargo in the South Baltic region, attract transit traffic, expand industrial zones, and optimise conditions for implementation of South Baltic Oversize Transport Corridors infrastructure projects. It was perceived that the development of a joint strategy for the South Baltic would facilitate the process of harmonising oversize transportation procedures in the region. The platform Transport Oversize is an important legacy of the project which provides information about permit requirements and is a useful resource for information relevant to transporting oversize objects.

Details: The Oversize Baltic project had three main components – to develop an oversize cargo strategy for the South Baltic region, to develop an Oversize Transport Information Network – an online platform for information provision – including a database on available routes for oversize cargo, maps of routes across various modes (not just road), existing infrastructure and obstacles, and the promotion of business-to-business communication with a view that improved cooperation and education for business actors would strengthen links and lead to an increase in the competitiveness of the region.

The Oversize Transport Information Network (OTIN) that the Oversize Baltic project developed combined the VEMAGs system – which was the German permission system for oversize transport – with the Swedish Permission system TRIX and the Polish permission system. The application form through OTIN is available in Polish, English and German. After its completion, the program automatically guides the application to the appropriate office issuing the permit. It also include the option to automatically check and inform the applicant whether it is possible to obtain a permit for the proposed journey, and how much will it cost.

Stakeholders: The project was carried out by nine partners spanning the region from Lithuania, Germany, Sweden and Poland. Klaipeda Science and Technology Park was the lead partner, Klaipeda State Seaport Authority, Klaipeda Shipping Research Center, the Federal Association of SME, Wismar Technology, Business and Design University, Blekinge Institute of Technology, Port of Karlshamn, Maritime University of Szczecin and the Swedish Road Administration. In addition, some 16 other partner associations were also involved in the project.

Success: The involvement of companies engaged in oversize transport in the South Baltic region was a key factor in the successful implementation of the new strategy. By clearly delineating routes and consolidating application processes, oversize cargo transportation is becoming more straightforward. By clarifying particular routes throughout the region, trips can be planned more efficiently, which can reduce time and cost. And in addressing some of the inherent challenges that oversize cargo presents to the broader transport network, traffic flows and conventional freight can also be better managed and planned for through improving communication channels across stakeholders working in freight in the South Baltic Region.

Challenges/barriers faced: Safety issues and time losses due to the transport of oversized cargo are still problematic and there is no easy way to remove the barriers to transporting large items or to the impact this activity has on the broader network.

A significant problem is that although obliged to report oversize cargo transport, some operators omit to file applications. This challenge is perpetuated by the penalties which should follow such an omission not being imposed. In effect, it can be profitable for companies to break the rules and removing this barrier is fundamentally difficult.

Transferability/learning/scaling up: The oversize corridors concept could be implemented on the existing corridors of the TEN-T network (Trans-European Transport Network). Map and procedures of European Oversize Corridors will enable continental origin-destination oversize transport services based on usage of two or more modes of transport.

Improving the efficiency and transparency of the oversize cargo sector may yield important insights that could be applied to the conventional freight sector. Looking at the sector as a whole, including niche elements such as oversize freight may facilitate a shift from road to

water and rail. As conventional freight moves from the road, there is more potential to transport oversize cargo on the network, which may be an economic driver.

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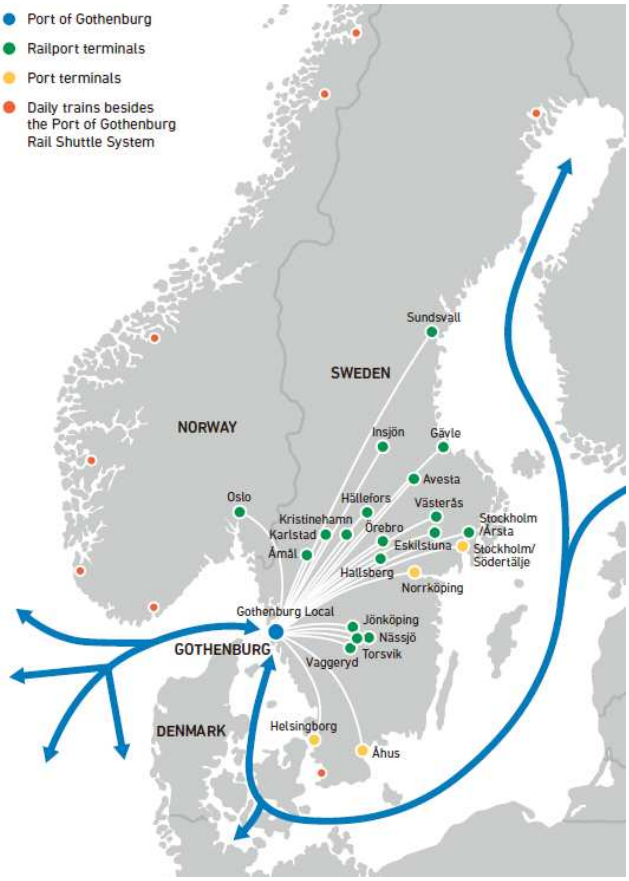
3.10 Railport Scandinavia, Gothenburg, Sweden

Thematic group: Freight
Specific area of focus: Contributes to the White Paper goal of shifting road freight (over 300 km) to rail or waterborne transport
Why good practice? The Port of Gothenburg set ambitious targets to shift road freight to rail and has been successful in delivering this transition to rail. About half of the container transport now enters and leaves the Port of Gothenburg by rail
Time period: 2000- ongoing
Budget: Not known. Funding of infrastructure investments in rail links and port terminals

Overview: The Port of Gothenburg (PoG) in Sweden has been successful in developing a network of rail shuttles in its hinterland. The project, known as Railport Scandinavia now transports approximately half of the containers to and from the port. It saves the industry 5-10% in transport costs annually. This growth of rail shuttle transport has been achieved during a time of extraordinary growth in container liner shipping.

Background: Gothenburg is Sweden's second largest city with a population of half a million. It is located only 1.5 hours from open sea and with 70% of the Nordic industry and population within a radius of six hours. PoG is the biggest port in the Nordic countries. It represents the largest container terminal in Scandinavia with a cargo capacity of 900,000 twenty-foot equivalent units (TEUs). Due to its location, it is an appropriate site as a freight hub and for an efficient "on-dock rail terminal".

Process: The city of Gothenburg aims to reduce CO_2 emissions by 30% on 1990 levels by 2020. In 2000, the PoG management decided that half of the growth in the container segment should enter or leave the port by rail by 2020. Over the last decade, the network that has been established involves a number of freight terminals in Sweden and Norway. Future plans include building double tracks on the 10km long rail link connecting PoG to the Swedish rail network. The Swedish Transport Authority plans to finish the construction work in 2021.



Railport Routes (Railport Scandinavia)

Details: Railport Scandinavia services terminals stretching from Sundsvall in the north to Helsingborg in the south, and there are also shuttles to Oslo, Norway. There are several supporting facilities, such as loading containers, in the vicinity of the PoG to prepare cargo for efficient onward transport.
With an average distance of 300 km, the rail shuttles are now transporting about half of the containers to and from the port. A few shuttles operate once or twice a week in each direction, but the majority operate five to seven times a week, and the most frequent operate

14 times a week in each direction. The rail shuttle system has grown by about 15% annually, but this has occurred during a period of extraordinary growth in container liner shipping and general trade outlooks remain generally positive. The PoG has 22 terminals and 24 shuttles and will continue to place emphasis on terminal development to further improve logistics flow.

Stakeholders: The key actors participating in the shift to rail include the City of Gothenburg, the railport terminals, several rail operators, goods owners, supplementary service providers, and the national Swedish Transport Administration. The funding includes investments and 'payment in kind' from the city, the Swedish Transport Administration, local terminal companies, forwarding agents, shipping, import and export companies and haulage companies. The PoG is the project coordinator.

Success: Since 2002, the rail transport to and from the PoG has increased from six to 28 daily shuttles and has now surpassed its original goal of transporting half of the growth in the container segment by rail. Each year, the rail shuttle system contributes to a decrease of 60,000 tonnes of CO_2 emissions by taking vehicles off the road. In addition, the system relieves Gothenburg's traffic congestion, reduces air pollution from trucks and the industry saves transport costs of about €5 million annually.

Challenges/barriers faced: In near future, expansion challenges are expected due to the limited capacity of port infrastructure and the difficulty of rail to compete on short distances.

Transferability/learning/scaling up: In general, the Railport concept is replicable where it is possible to establish applicable terminals at both ends and at intermediate points of the service system.

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4 High Speed Rail Case Studies

4.1 City-Ticket, Deutsche Bahn, Germany

Thematic group: High Speed Rail
Specific area of focus: European high-speed trains
Why good practice? The City-Ticket assists the integration of travel on long-distance and local trains
Time period: 2003 – on-going
Budget: Regulated division of revenue between Deutsche Bahn and local transport companies

Overview: In Germany, Deutsche Bahn together with local transport authorities has launched the City-Ticket, which allows use of local public transport services when travelling on a long-distance ticket (over 100 kilometres).

Background: Towards the end of 2002, Deutsche Bahn significantly reformed its pricing strategy. The company replaced its century-old linear pricing model (where ticket prices were fixed and proportional to distance travelled) with a new, diversified tariff model. The old fare system for standard tickets remained as a basis, but Deutsche Bahn introduced some yield management for discounted tickets.

City-Ticket

At the same time, the railway operator reduced the discount offered to BahnCard holders from 50 to 25%. This was justified with the argument that the BahnCard discount was valid on top of the new saving fares ("Plan-und-Spar") that included discounts of up to 40% on standard fares. However, such discounts were only available under certain conditions: they were non-exchangeable, had to be booked more than three days prior to the journey, a return journey was required, there was a "weekend rule" and there were only a limited number of seats. The changes were unpopular among BahnCard customers.

As a result, passenger protests and declining passenger numbers occurred. In August 2003, Deutsche Bahn modified its pricing model. It reintroduced the original BahnCard, which gave 50% discount (although with a price increase from €120 to €200), whilst also keeping the 25% Bahncard.

In December 2003, Deutsche Bahn, the Association of German Transport Companies (Verband Deutscher Verkehrsunternehmen) and relevant local transport companies launched the City-Ticket in 44 German cities. Since then further cities have joined the scheme: another 13 in December 2004, 19 further cities one year later (coinciding with Deutsche Bahn's introduction of a new timetable), 16 in April 2007 and seven in December 2007. Today there are more than 100 participating cities across Germany.

Process: The change of habits and the need to create easy mobility solutions were the key driving forces behind setting up the City-Ticket, which among others can be booked online or

via the smartphone application 'Touch&Travel'. Integration of ticketing solutions was a response to the fact that people do not want to go from station to station, but door-to-door. Deutsche Bahn decided to have a smart phone application with the increasing use of smart phones in the population.

The integrated ticket solutions are in line with Deutsche Bahn's increasing focus on offering mobility packages and viewing itself as an integrated system provider and system integrator - rather than offering only rail services as in the past. In competition with other transport modes it has been important for the company to be 'seen to lead' by developing new transport services. Ticketing is one important contribution, aiming to integrate all services.

Details: BahnCard holders (i.e. subscribers to Deutsche Bahn's discount programme) can travel for free by bus, suburban train, and tram or underground at their destination in more than 100 German cities.

The offer is differentiated according to which BahnCard a customer holds. While the City-Ticket is already included in the BahnCard 100, BahnCard 25 holders pay €1 and BahnCard 50 holders €2 for the city-based travel. The City-Ticket is valid in more than 100 German cities and enables door-to-door travel by entitling passengers to travel to the departure station and from the arrival station to the final destination with their BahnCard.

For customers that do not have a BahnCard, whilst not discounted, the "City mobil" rail ticket is available which enables travellers to book local public transport at the same time as booking their long distance rail ticket.

Stakeholders: Deutsche Bahn AG, local authorities and the Association of German Transport Companies jointly developed the City-Ticket to enable rail passengers to use both intercity and local transport using only one ticket. Cooperation with authorities has been necessary to facilitate solutions. There are more than 100 participating cities located all over Germany. The revenue generated is split between the local authorities and Deutsche Bahn according to the contracts that have been put in place to manage the City-Ticket.

Success: By the beginning of 2008, over 100 million tickets had been sold which included the "City-Ticket" element. The key success factor has been the usability of the ticket; it takes away the challenge of navigating ticket payment and integrates long and short distance travel and high speed and regional trains. It is easily accessible – and serves customer needs. It is of great benefit that travellers can go by public transport at their destination without having to go to the ticket booth or having to understand the different regional ticketing schemes. It is also of great benefit that they can book their tickets with applications on smart phones.

Challenges/barriers faced: Working across very different local or regional transport authorities to secure the introduction of the City-Ticket was challenging for implementation due to the different payment systems in place at the local level. The manifold contracts that have been put in place were difficult to achieve but help to navigate some of these differences in the longer term.

Transferability/learning/scaling up: The cooperation between the local authorities and Deutsche Bahn that has enabled the success of the City-Ticket is an important model that could be learned from across other nations in Europe.

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4.2 Frecciarossa, Trenitalia, Italy

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of Europe's High Speed Rail Network
Why good practice? Frecciarossa already leads the modal split between road and air on its route and Frecciarossa1000 is set to become the fastest high speed train in Europe.
Time period: 2010-2015
Budget: €1.54 billion (€30.8million per train)

Overview: In the past 20 years, the Frecciarossa has achieved an impressive modal share over road and air on its route between Turin and Salerno. In August 2010, 50 Frecciarossa1000 – a new generation of high speed trains – were ordered by Trenitalia. Made by Bombardier Transportation and AnsoldoBreda, the trains are designed for speeds up to 250 mph (400km/h), making it the fastest train in Europe.

Frecciarossa1000 (Railway Technology)

Background: The Frecciarossa (or red arrow), an ElettroTrenoRapido 500 train has been one of the main high speed carriers on the Italian rail network since its introduction in 1993. It covers the route between Turin and Salerno.

Process: The second generation train, conceived by design company Pininfarina, was first seen on Italian routes in 2000 and had a maximum speed of 211 mph (340 km/h).

The new Frecciarossa1000, also known as the V300 Zefiro (by Bombardier Transportation) and ETR 400 (Trenitalia) is expected to be fully operational on the route by early 2015. The first new train was introduced in March 2013 and testing of the train began in August.

Details: Frecciarossa currently travels to 300km/h on its North-South route, with convenient, frequent connections and a non-stop train between Rome and Milan in each direction every hour. The current fleet of 60 trains carries approximately one million passengers a month. The train offers 4 levels of service: Executive, Business, Premium and Standard, to provide a wide selection of choice to its customers, as well as free on-board wifi and power supplies at all seats. The new Frecciarossa1000 will even have a meeting room in the Executive compartment.

When these offers are combined with the new higher speeds offered by Frecciarossa1000, the choice to go by train is likely to be even more compelling. The 'silent' train is 200m long with 8 cars in fixed formation to distribute traction along the train. It will be able to hold 485 passengers and have a high commercial top speed of 360 km/h.

Due to its flexible electrification and signalling set-up and compliance with all European TSIs, the train is capable of running on all major European high speed tracks. And because of this potential to run on other domestic high speed tracks in Europe, the drivers' cabin is modular so it can be decoupled from the other cars depending on domestic set-up.

The train has strong sustainability credentials – it is constructed with 95% renewable materials and 85% of it can be recycled at end of life. The trains are also mobility-need friendly and wheelchair compatible which opens up the service to formerly marginalised parts of the community.

Stakeholders: The Frecciarossa1000 order is being fulfilled in partnership between AnsoldoBreda and Bombardier Transportation following a tender from FerroviedelloStato – the Italian government-owned holding company responsible for the Italian rail infrastructure and services. Once operational, Trenitalia will run the trains.

Success: The current Freccia services in Italy have been very successful in gaining a market lead over cars and air over its routes. But they have not only been competing with the other transport modes in Italy, but also in competing with competitors in the high speed rail market in Italy. In 2012, Frecciarossa achieved a customer satisfaction of higher than 96%.

Frecciarossa1000 is set to run on the Italian high speed network; however a significant share of its potential for success is likely to come from the important step the new train's technology is taking towards integration. Unlike any current high speed train in operation, it is capable of running on the networks of the following European countries: Austria, Belgium, France, Germany, Netherlands, Spain and also Switzerland. This is because it has been built with multi-voltage technology and fulfils all of the European Railway Agency's technical specifications for interoperability (TSI).

Challenges/barriers faced: The Italian high speed rail network is the only European system that operates competitively. Trenitalia face the possibility that their private competitor Italo will increase its market share and that the significant investment made on the new fleet of trains will not be recouped. However, the speed of the new trains and the built-in capacity of the trains to operate beyond Italy may in fact benefit the company and open up new markets beyond the domestic.

Transferability/learning/scaling up: Because the train can move between national systems it offers a compelling solution to some of the challenges of standardisation currently being faced in the achievement of the White Paper goal. If other countries chose to invest in similar track compatible technology, or opened up the market to Trenitalia to compete, then integrated HSR across Europe comes one step closer.

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4.3 HS1 and Eurostar, Multi-national

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of the HSR network in Europe
Why good practice? Successfully constructed and well-performing high-speed line linking the UK with mainland Europe
Time period: 1994 – 2009 (service on-going)
Budget: £6,163 million (construction of the line)

Overview: High Speed 1 (HS1) is the 109 km railway between London and the Channel Tunnel that connects with the international high-speed routes to Paris and Brussels. The route serves 4 principal UK stations, St Pancras International in London, Stratford International, Ebbsfleet International and Ashford International.

Background: Although the original idea for a route to the continent was conceived of in 1970s, in 1991, the government selected the route that the Eurostar would take through Kent through Ebbsfleet and Ashford before reaching the coast. When the Channel Tunnel opened in 1994 Eurostar trains shared domestic rail lines into and out of London Waterloo. The trains were restricted to 100mph and due to their size took up space on the line, causing congestion.

It wasn't until the Channel Tunnel Rail Link (CTRL) 1996 Act was passed that the construction of a high-speed line would become a reality. CTRL became known as HS1 – a 109km high speed rail line connecting linking London with Paris and Brussels.

Process: Whilst the development was envisaged as a single project, financial difficulty resulted in a 2-phase project from 1998. The first section of the HS1 line was completed in 2003 and the line opened in 2007 for 186mph Eurostar trains between London, Paris and Brussels. The full HS1 service commenced in December 2009, ensuring that the British service was of a comparable standard as the Belgian and French high-speed tracks. Journey times Paris between London are now 2 hours 15mins away and London to Brussels takes 1 hour 51mins. In 2013 it was announced that Eurostar would be providing direct trains to Rotterdam, Antwerp, Schiphol Airport and Amsterdam by 2016.

Details: The first section of track carries trains 72 km between the Channel Tunnel and Fawkham Junction in Kent and the second is 38km long connecting Ebbsfleet Station with St Pancras – the station that replaced Waterloo as the terminus in the UK.

HS1 is the first railway to be built in the UK for 100 years, and also the first high-speed line linking London to the European HSR network. The route serves 4 principal UK stations, St Pancras International in London, Stratford International, Ebbsfleet International and Ashford International. High-speed commuter trains are also able to travel on the track.

The project development cost included the expansive redevelopment of St Pancras station, doubling the length of existing platforms to be used for Eurostar and domestic trains. The Eurostar trains using the track are GEC-Alsthom @Three Capitals@ Class 373 Units that are 400 metres in length with a capacity of 750 passengers over 18 carriages. Eurostar trains have 3 different braking systems (as well as regenerative braking capacity) and work with 4 different signalling systems.

Stakeholders: The line was originally run by London & Continental Railways (LCR), but was purchased in 2010 by a consortium for almost £2.05bn. The current owner, HS1 Ltd manages the stations on the route between St Pancras and the Channel Tunnel as well as the railway. Network Rail operates the route.

Success: 2013 saw over 10 million passengers on the Eurostar, the most passengers carried in a single year in the route's 19 year history. In total 140 million passengers have travelled on the Eurostar since 1994. In the 3 years 2009-2012 following the launch of HS1, 25 million journeys have been made on the line. HS1 was delivered on time and on budget and sold in 2010 for a figure higher than expected. The delays that the route occurs can be counted in seconds and the punctuality of the service since the high-speed track opened has been very good.

Challenges/barriers faced: Passenger numbers are up to 2/3 fewer than was projected when the UK government guaranteed the debt of the investment. However, this may be a flaw in the original business case development, which overestimated passenger numbers, not in the performance of the line.

The original business case for sale of the line in 1995 was based on the benefits that passengers would derive from faster journey times, increased rail capacity and regeneration benefits. But it has subsequently been difficult to calculate the actual value of these benefits. This left the taxpayer exposed to the debt risk of £4.8 billion as passenger income is not as high as was projected. Whilst the government targets haven't been met, the service is nonetheless well frequented and managed.

Transferability/learning/scaling up: The potential for a High Speed 2 rail link is currently under review in the UK and it is clear that a lot can be learned from HS1 if the project goes ahead. Many of the problems facing HS2 are the same that HS1 faced and the measures that HS1 put in place terms of ensuring environmental quality and protecting of the natural and un-built environment can be replicated. It would be useful to learn from the issues now being faced with HS1 in terms of the overestimation of the passenger demand. But this will remain to be seen.

It is also clear that HS1 learned a lot from its European peers in terms of delivering a network that could be comparable to its mainland Europe connections and built to be compliant with the same standards.

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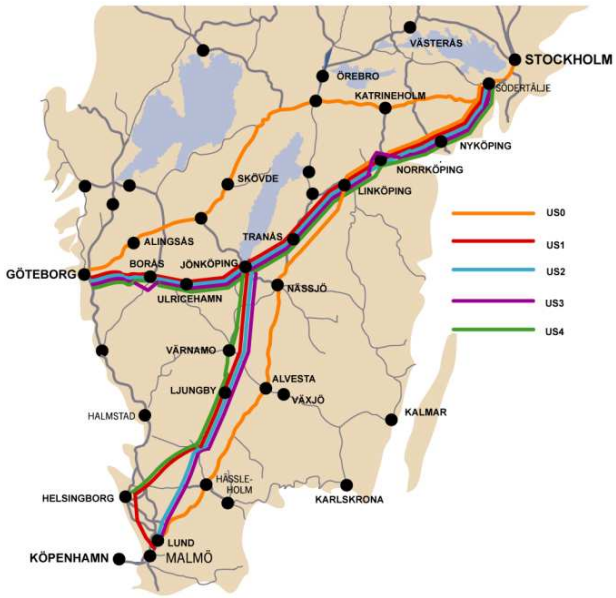
4.4 HSR investment, Sweden

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of the HSR network in Europe
Why good practice? Demonstrates the broader framing through which policy and investment choices can be made.
Time period: 2009 – on-going
Budget: No available data

Overview: The decision to invest in high speed rail in Sweden is worthy of note, because it was considered and transparent.

Background: The population of Sweden at around 9 million (20 inhabitants/km^2) is much lower and less dense than in the European countries with extensive dedicated HSR lines and ambitious HSR plans. This population and therefore economic activity is rather concentrated to three urban areas, Stockholm, Göteborg and Malmö. Train travel increased by 96% between 1992 and 2012. This change was largely unexpected and when combined with delays for reinvestment that the network has experienced, means that the existing tracks and the whole network is severely constrained.



Scenarios for HSR investigated in Sweden (Trafikverket)

In addressing these challenges Sweden was confronted with a choice; upgrading the existing network, or installing new, dedicated HSR routes. Whilst it is possible to upgrade many of the newer rail lines in Sweden to run at 250km/h, it would require new signalling systems and trains and could be costly. The older lines would not be suitable for high speed upgrading.

Process: Before committing to new high speed lines, an international external analysis study was conducted in 2009 to see how other countries have dealt with various issues concerning high speed rail at a general level. The international study looked at France, Spain, Germany, Italy and Japan and explored such issues as choice of lines, stations, traffic operations and capacity. It examined the approaches that had been taken by these other countries in the development of their high speed rail networks.

In addition, the Swedish Government commissioned a study to investigate in broad terms how provide increased capacity to deliver efficiency in the transport system up until 2050 and as a part of this scenarios for High Speed rail in Sweden were studied.

Details: A four step principle was advocated which suggested that firstly measures to increase the competitiveness of public transport should be implemented. These should be followed by better use of existing transport systems. Improving those elements of the railway infrastructure that make sense to upgrade should be the next step and finally new

investments should be made. Five scenarios were developed and assessed in the Swedish context, and these scenarios were informed by this principle and by the international study. The scenarios ranged from building new tracks for HSR and upgrading existing tracks, to integrating HSR into existing regional network to an entirely separated system. Different speeds were also examined – 250km/h/320 km/h in the different scenarios. As well as travel times, long term costs, punctuality and socioeconomic considerations were factored into the study. The environmental effect of constructing HSR lines has been seen as a key issue in debating the 'social worthiness' of any planned developments.

The findings were reported in April 2012 and based on the results, investment plans have been outlined. The first high speed track in Sweden will run between Stockholm and Göteborg, the line will run at 320lm/h and will offer a 2hr 30 min service between the two cities, making it competitive with road and air travel. Construction of this new route will allow separation from at least part of the existing tracks, which will also be of benefit to rail freight and will contribute to a reduction on the cost of managing the infrastructure.

Stakeholders: The partners involved in project include Swedish Transport Administration, municipalities through which the high speed railway will pass, such as: Stockholm, Nyköping, Göteborg, Borås, Malmö, as well as rail supply industry, operators, infrastructure managers, urban operators and research centres and clusters. Many experts were asked to review the scenarios and much academic support was enlisted for the analysis of the report.

Success: The approach of opting for broader factors in decision making than just economic cost is something that is often discussed in infrastructure development policy and projects. The Swedish approach factored in a broad base of considerations into the decision before deciding which scenario made most sense for the context and the country in the short and long term. Whilst the outcome of the investment will not be realised for some time as construction is on-going, this demonstrates good practice for looking to experiences elsewhere and acknowledging social and environmental considerations before investment decisions were made.

Challenges/barriers faced: The complexity related to the interconnectivity of the issues under consideration was a likely barrier to examining the scenarios. Each approach would yield both positive and negative outcomes. The long term nature of the project and the regional differences further complicate the picture as scenarios can only go part of the way to reflecting on realities, as well as issues that may arise in the future.

Transferability/learning/scaling up: Paying more attention to societal and environmental considerations is important in decision making in order to deliver upon the White Paper objectives. Sweden informed its policy making by learning about the experiences from elsewhere in Europe and further afield. It used this information to develop a plan which was understood to make sense for the national context and to address the challenges the current system faces. Whilst the outcomes of the decision remain unknown, the process is encouraging and in terms of deciding where and how HSR infrastructure should be built to deliver on the White Paper goal, the Swedish experience of decision making may be useful to consider.

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4.5 Javelin, Southeastern, UK

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of the HSR network in Europe
Why good practice? Well-functioning high-speed line that provided connection to the 2012 London Olympics
Time period: 2009-2012
Budget: £258 million

Overview: The 29 Hitachi Rail Systems 'Class 395' six-car high-speed electric trains that serve the 67 miles between London and Kent were built in Japan and introduced to the line in 2009. Over the course of the 2012 Olympic and Paralympic games the Olympic Javelin Shuttle – or the 'Javelin' service as it became known, twelve trains an hour ran between St Pancras and Stratford International, the journey allowed athletes and spectators alike to reach the main Olympic park from central London in just 7 minutes.

Background: The approval to run domestic train services on HS1 was originally granted at the end of 2003, with Hitachi signing the £250 million contract to build 28 trains in 2005. Construction of the HS1 line was completed in 2007 and a 29th train was added into the order by Southeastern – the owner of the line franchise – to increase capacity. A preview service was initiated in June 2009, with the service Southeastern Highspeed fully operational by December 2009.

Process: From 2009, the domestic high-speed service was predominantly carrying commuters between north and east Kent and central London. The trains cut journey times by up to 50 minutes for London commuters from Kent. Journey times to St Pancras International are 17 minutes from Ebbsfleet International and 38 minutes from Ashford International.

The Olympic services were solely intended to decrease the journey time between central London and the Olympic park and greatly increase capacity of the existing links between central and east London. The Javelin services began on 28 July 2012 and ran until 12th August. The service was reintroduced on 29th August for the Paralympics and ran until September 9th. As well as serving London St Pancras and Stratford International, the Javelin continued to Ebbsfleet International station in North Kent on the outskirts of London to enable motorway park-and-ride access.

After the Games, the Javelin trains were reintegrated back into Southeastern's conventional high-speed fleet and it was confirmed in November 2013 that Southeastern would continue to manage the franchise.

Details: The trains have a maximum speed of 140 mph (225 km/h), which can be achieved under 25kV AC overhead electrification on High Speed 1 (Ashford to London), and 100 mph (161 km/h) on 750V DC third rail supply on conventional lines (London to Dover). On average the trains have been running at 114mph. There is no first class carriage on the trains; all cars are standard and seating operates in a '2+2' configuration, with an overall capacity for 354 passengers in total.

For the duration of the Olympic games, an additional 3,354 trains were operated – more than double the conventional service level of 1,037 weekly trains. The service was capable of carrying 25,000 people in either direction every hour. Between 11pm and 1.59am there were

12 trains an hour serving the city and the venue, with half-hourly shuttles between 2 and 5am. Tickets for events at the games came with free travelcards inclusive.

The Javelin trains are fully compliant with disability regulations and the latest CCTV and Passenger Information Systems were installed. Javelin is safer and quieter, compared to conventional trains.

Stakeholders: The Class 395's belong to HSBC Rail, and are leased to Southeastern. During the 2012 Olympic and Paralympic Games, HS1 Ltd worked with London & South Eastern Railway Limited (LSER) and Network Rail (High Speed) to provide the Javelin service. The standard domestic HS1 services are operated by (LSER) under a franchise let by the Department for Transport.

Success: The Class 395's were originally delivered 6 months ahead of the passenger service introduction, which enabled trialling of the trains before entering operation. The time savings that the trains have delivered are clear. The trip from Ashford in Kent to London St Pancras takes 30 minutes at an average speed of 114mph, whereas conventional commuter trains take almost 3 times longer at 80 minutes. Moreover, the additional services that were provided by the Olympics had no impact on performance on the broader network. During the Olympics, over 2.4 million passengers took the seven-minute journey from St Pancras to Stratford International. And in 2012 in total, 9 million passengers journeys were made using the trains.

Challenges/barriers faced: The price hikes that the network has experienced to cover the cost of the new trains have been prohibitive. Prices across the Southeastern network have gone up, regardless of the fact that the trains will not benefit or visit all of the trains on the network. And at the same time, the introduction of the service saw some existing services into London Bridge, Charing Cross, Cannon Street and Victoria greatly reduced, some by up to 60%.

The location of St Pancras is also problematic for some regular commuters. Is it toward the North of central London and many people coming to London to work are located in the city to the East and in the West En. This has meant that despite high-speed trains reducing journey time into the city, additional travelling across London may be required, which actually makes total journey time longer than before the service was established.

Transferability/learning/scaling up: The experience of significantly altering a service for a short period of increased demand was most successfully executed in London and is an approach that is being consulted by other cities/countries, such as Brazil, with major sporting events coming up. The delineation between short term increased service and conventional service was well-made and could also be learned from elsewhere in Europe.

The UK has had success in its first experience with domestic high-speed trains and there is valuable insight that can be derived from introducing the Javelin trains that could be applied to future services and lines.

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4.6 LGV Sud-Est, SNCF, France

Thematic group: High Speed Rail
Specific area of focus: Contributes to the White Paper goal of tripling the length of Europe's High Speed Rail Network
Why good practice? The train was innovative, it was the first over 250km/h and increased rail market share significantly.
Time period: 1976 – on-going
Budget: FF13.8 billion (initial investment) equivalent to €3.5 billion.

Overview: Of the now over 1,850 km of HSR track laid in France, Paris to Lyon was the first route. The development of the "Train a Grande Vitesse" (TGV), literally translated as High Speed Train was financed by The French Government in 1976 and "Ligne à Grande Vitesse" (LGV, high speed line) Sud-Est between Paris and Lyon opened in 1981. It was the first HSR train to achieve speeds of over 250km/h. Today, the subsequent network that has been built on the back of the first line's success enjoys a ridership of 115 million passengers a year (2010) and generated profits of over €950 million in 2012.

Background: TGV was the world's 4th HSR system and the 3rd using standard gauge. It was initially conceived as an idea for France in the 1960s following the success of the Shinkansen in Japan.

TGV Sud-Est (SNCF)

Process: Funded with an initial investment from the French government in 1976, the first 390km of track – known as LGV Sud Est opened to the public in 1981. The Sud-Est fleet was developed over a decade between 1978 and 1988.

Details: The Sud-Est line, as all other TGV routes, is electrified. Using the same technology as the conventional rail system allows existing infrastructure in city centres to be used alongside the dedicated high speed lines built across the country. There are over 100 passenger sets made for the line, each consists of 2 power cars and 8 carriages. This offers a passenger capacity of almost 350 (trains built for subsequent routes have a higher capacity). Each train weighs almost 400 tonnes and are 200m long. The initial sets were built to run up to 270km/h although many have been subsequently upgraded to run at 300km/h. Dedicated postal trains have also been introduced to the route.

Stakeholders: The initial train development was conducted in the 1970s between SNCF and GEC-Alsthom (now Alstom). When the Sud-Est line opened, SNCF owned both the trains operating on all routes, all the stations and the track itself. However in 1997, due to EU Directive 91/440, a separate government institution – Réseau Ferré de France – became responsible for the track and signalling equipment across all SNCF routes. This step was initially undertaken to open up the French market to other train operating companies, though this was largely unsuccessful and SNCF continues to dominate the market. The French government funded the first line; although latterly more public private partnerships have emerged between SNCF and other commercial entities to finance new stretches of track.

Success: Introducing a high speed line between Paris and Lyon reduced the travel time between the cities from 4 to 2 hours. The market share of the train rose from 49 to 72% following the introduction of the route.

Part of the success of the TGV network is the mix between conventional rail infrastructure and dedicated high speed tracks. TGVs are able to run on existing lines, which has made it relatively cheap and simple to connect city centres with high speed services as stations built for conventional trains can still be accessed. However, because there is also dedicated track allocated for TGVs between cities, they are able to maximise the time spent at high speed, making journey times shorter.

TGV also has an exemplary safety record, in the 30 years of operation; no fatalities have been recorded on the trains whilst operating at high speed.

Challenges/barriers faced: In terms of infrastructure, SNCF faces continued opposition to and complaints about the noise generated by the TGV from residents in 'pass-through' areas. As a measure to reduce this noise, SNCF have built fences to reduce the disturbance caused.

Transferability/learning/scaling up: The TGV concept was first considered in France in the 1960s following the success of the Shinkansen (bullet train) in Japan. The market share shift achieved by LGV Sud-Est and its continuing commercial success led to the comprehensive network expansion that has been witnessed over the past 30 years. Subsequent routes on the LGV network include LGV Rhône-Alpes, LGV Méditerranée, LGV Atlantique, LGV Nord, LGV Est.

Neighbouring European countries (Spain, Italy, and Germany) all subsequently developed high speed lines following the success of TGV. And the UK, Belgium and the Netherlands have all built lines using TGV technology. France's experience in high speed rail demonstrates key lessons that could continue to be useful as more parts of Europe look to introduce high speed lines. The TGV has also extended its network outside France, for example with Thalys in Belgium, the Netherlands and Germany, and with Lyria in Switzerland.

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4.7 Madrid-Seville route, AVE, Spain

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of the HSR network in Europe
Why good practice: Improved the connection between two main cities in Spain. Achieved and retains and high modal share over air and road.
Timeframe: 1986-1992
Budget: 448,000 million pesetas (€270 million)

Overview: The Seville-Madrid line was initially discussed as part of a move to introduce a high speed rail network in Spain in the 1980s. The line, the first on the network was opened in 1992 to coincide with EXPO 92 in Seville and was built on a standard gauge with a view that the line(s) could eventually be connected with the rest of Europe's high speed network. Over the last 20 years, the line has been very competitive with road and air routes and maintains a modal share of around 60% of trips. Despite some of the negative experiences that the rest of the network has faced in terms of providing over-capacity and a low ridership, Madrid-Seville has been successful and offers insight into the importance of route choice and distance between destinations to make for a workable high speed network.

Background: The high speed rail line – or Alta Velocidad Española (AVE) – linking Madrid to Seville was first conceived of in the 1980s. Because the traditional Spanish rail gauge is different to that adopted across most of mainland Europe, and because the country was experiencing a dramatic decline in demand, a decision was made to invest in high speed rail at the national level to boost the system.

The system was built to be completely separate from the conventional Spanish rail network and for passenger rail only. This decision was made due to the existing line being seen as unacceptable for both the citizens and the decision makers, so a different track and alignment (standard gauge) was chosen with the long term view that Spain could eventually be connected to the rest of Europe by rail.

Madrid-Seville HSR route

Process: A discussion was initiated about which routes to invest in. There was an initial choice between Madrid and Barcelona (an East – West corridor) or between Madrid and Seville (a North – South corridor). Whilst it was almost certain that in a long term rail plan, the East-West link would be built, and due to the quality of service in place at the time, it was the track to Seville that was introduced first. In part because Expo 92 was to be a universally important event held in Seville, and because Andalucia was the poorest region in Spain, it was seen as strategically important to invest in the region and to link it with the rest of Spain. The initial line was 550km long and was opened in 1992 in time for the EXPO.

Details: The route travels through 5 principal stations Madrid Puerta de Atocha, Ciudad Real, Puertollano, Cordoba and Sevilla Santa Justa. The Madrid to Seville line was designed for trains to travel at speeds of around 300km/h, and after tests conducted saw the speed exceed this figure in 1993 without train modification, trains were permitted to operate at 300km/h as

standard in commercial operation which saw the travel time between the two cities cut by a further 40 minutes, so the total trip at this speed takes 2 and a half hours.

At the time of construction, pioneering technologies were used on the line, such as the LZB, which continuously monitors speed and allows two-way communication between the train and the track to enable automated driving.

Stakeholders: The development and management of the line involved a host of public and private partnerships and collaboration between the European Union, the national and regional authorities as well as with private landowners and the public. Initially, the work on the line was co-financed by the European Regional Development Fund. RENFE- the state-owned national rail passenger operator, which is controlled by the Ministry of Public Works is responsible for the route and the entire AVE network. Siemens was responsible for the electrification of the high speed line, Alsthom Iberia built the trains and ACS, Ferrovial, FCC, Sacyr Vallehermoso and OHL built the track.

Success: From 1992 to 2011, 56 million people travelled on the AVE between Seville and Madrid and double this figure 118 million have travelled on non-AVE trains that now also run on this line. The network that was initially envisioned has been delivered through the upgrade of other regional tracks to the standard gauge, which opens up more routes and offers access to AVE trains to more users, particularly commuters.

In terms of the whole Spanish AVE network, Madrid-Seville laid some important groundwork that has been developed upon in the last 20 years. The AVE won the European Quality Award in 1998 and the European Seal of Excellence, certifying an evolution of continuous improvement in management in 2000. Finally, since 1992, the cost of maintenance per kilometre of track on the high speed network has been reduced by half, despite an increase in traffic of some 300%.

Challenges/barriers faced: The construction of the initial line was a major challenge, but continuing to maintain and improve the infrastructure remains a challenge for RENFE. The economic downturn in Spain has presented another set of challenges because the extensive investment made in the high speed rail network across the country means that supply outstrips demand severely and it is extremely expensive to operate and maintain such a comprehensive network.

Transferability/learning/scaling up: The Spanish network is frequently cited as one in which the capacity outweighs the demand and this is identified as an important lesson to learn from AVE. Spain demonstrates that there is a need for careful consideration about which routes to invest in. Specific routes, like Madrid – Seville are logical, of a certain distance to make the train favourable over other modes and are therefore highly frequented. Another important lesson we can learn from the success of AVE on its optimal routes is that incremental change will not be enough to achieve a strong modal shift – the quality of the infrastructure and the train are important and the wholesale upgrade to a new network is the reason for the shift. It is not enough to only improve the infrastructure a little, where major issues exist, significant solutions are needed.

The location of stations is something that can be learned from Spain's experience. All stations on the route are central stations in the cities. These offer a high competitiveness to the railways, especially for commuters as the link that the high speed network has to the regional

network is important. Inter-modality and the central location of the stations are key to the success of the system.

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4.8 Rail Baltica, Multi-national

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of Europe's High Speed Rail Network
Why good practice? Complex project creating a vertical rail corridor in the Baltic Sea Region
T*ime period*: 2006 – on-going
Budget: €1.5-2.4 billion (initial investment)

Overview: Rail Baltica is an international railway development intended to connect the Baltic countries. Together with the Via Baltica road network, it forms a trans-European transport corridor to link Warsaw, Riga, Tallinn and Helsinki. The project is currently underway and expected to be completed by 2020. The integrated rail network will also improve connections to the Nordic countries and eventually to Central Asia.

Rail Baltica route

Background: The Baltic countries' transport was built and has traditionally operated on an east-west axis and this is reflected in current rail traffic flows. This infrastructure prescribes that to date the dominant rail traffic and trade flows have been to-and-from Russia. Similarly, these tracks are wide-gauge and not compatible with much of European infrastructure – it is therefore difficult and expensive to transport rail freight and passengers to the West.

This problem became more pressing when Estonia, Latvia and Lithuania joined the European Union and subsequently agreed with concept of full integration with EU rail transport system. The idea was formalized in September 2001, when it was added to the priority project list of spatial planning of the Wismar Declaration by Baltic Sea States Ministers.

In 2001 the European Commission revised the TEN-T guidelines and in 2004 it was decided to amend the community guidelines for the development of the TEN-T, with a particular focus on the development of the transnational infrastructure projects. Priority project 27 with this decision was the Rail Baltica axis Warsaw – Kaunas – Riga – Tallinn. In 2006 all four transport ministers signed an agreement for Rail Baltica, along with the Finnish government.

Process: Initially, there was a plan in place to upgrade the wide gauge railways in the Baltic States, but in learning about the co-funding available through the EU, it was decided that linking Poland to the Baltic states with a new line would be a more robust option. EU Member state integration and economic growth within the region were the main driving forces for the Rail Baltica project. The project is/will be financed by member states, the European Regional Development Fund (ERDF) through the Interreg IIIB project as well as the Cohesion Fund.

Details: Since 2004 several studies have been undertaken and will continue until 2015 on different elements of the line in terms of feasibility and optimal routing. In 2006, the planning of the route from Lithuania to the Polish border was started but was cancelled. The upgrade and reconstruction of sections of the line between the Latvian and Lithuanian and the Latvian and Estonian borders respectively were started in 2008 and are expected to be finished by the end of 2015. The cross border section of the Tartu-Valga line was upgraded between 2007

and 2010. In 2010, the reconstruction and upgrade of the cross border sections between Poland and Lithuanian was started, and these are also due for completion by late 2015.

Rail Baltica is partially finished and increasingly exploited as more and more parts are put into operation, the project however is not expected to be completed until 2020 and the construction to date has experienced some delays. Despite these delays, the project does have clear timeframes and is built into each member states' transport development plan.

Stakeholders: The nature of the construction and operation of Rail Baltica mean that there are two sets of stakeholders. The first are those that construct and maintain the rail line and supporting infrastructure. The second are the operators – both passenger and freight – responsible for maintaining the train fleets and paying to access to the new tracks. In addition there is a wealth of other stakeholders involved in or concerned in some way with the project. These include the public administrations in each member state, regulatory bodies, other transport modes, users /customers, and land owners, amongst others.

The role of the seaports in the project is particularly interesting. All the seaports see potential for increased capacity and demand upgraded access to both the rail and road networks in the region. However, the maritime operators will also be in direct competition with the Rail Baltica corridor, so the improvements may in fact cost maritime operators, which is an interesting dynamic when considering the White Paper goal.

Success: Rail Baltica has experienced significant problems in the last 10 years, but nonetheless there are some positive lessons that can be derived from its experience. Some of the routing choices have been changed to take account of environmental protection considerations, which a significant step forward in infrastructure development away from conventional cost benefit analysis approaches. The modernisation of local tracks that has been able to take place in parallel with the Rail Baltica project has also been successful and will likely add value to the finished Rail Baltica route through offering workable feeder services on to the network. The forecasted rail passenger transport volumes on the Rail Baltica corridor are expected to be high on some sections, such as Warszawa – Bialystok – Kaunas – Siauliai or Tartu – Paide – Tallinn.

The key to the success of Rail Baltica will be its ability to capture a significant percentage of the international trade, particular in north-south flows, between the Baltic States that is currently moved on the road.

Challenges/barriers faced: Some of the line construction has been delayed, which poses problems for keeping the project on track. For example, the Polish National Railways (PKP) has encountered many problems with some route development not yet started. The legal agreements in place mean that these problems need to be resolved by the end of 2016, after which time EU funding for the route will be removed.

There has also been some delay in signing contracts that identify the scope of duty for each participating member state. This agreement is needed to establish a joint venture enterprise, which would manage the further development of the route, financing and construction in the long term. The delay results from disputes between the Latvian and Lithuanian governments.
Some more underlying problems have less to do with construction, but of the legacy of the east-west axis in the region. As Russia still provides core business for the operators in the Baltic region and because the national railways are in direct competition with each other on this route, there is some reticence to focusing on the new route. There are notions that Rail

Baltica will interfere with their flexibility to develop freight transport capabilities and that rail operators from outside the Baltic region within Europe have a bigger interest in developing the line than the Baltic states themselves. Whilst this is true, the fast international rail capacity that is being built would not be possible were it not for EU funding, so building stronger to each other and to Europe is perhaps inevitable in the long run.

Transferability/learning/scaling up: The progress made on the Rail Baltica project to date demonstrates that a transnational large scale project to build large scale infrastructure in Europe is possible. Some of the problems to be overcome in terms of the gauge difference and the national reticence to the project offer important insight into how such obstacles can be managed to deliver a project that will benefit the region and Europe as a whole. More evidence is needed about how the lines will be promoted to ensure that they are highly occupied by both passengers and freight. And there are importance lessons that the project can learn from elsewhere in Europe about how to deliver this successfully, which should be utilised. Rail Baltica has not been the perfectly managed or undertaken project, but the scale of change it will deliver, despite delays and changes to the proposed plans is still laudable.

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4.9 Rail Europe Ltd., Multi-national

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of Europe's High Speed Rail Network
Why good practice? Website facilitating integrated information and ticket payment across rail services in Europe
Time period: 1995 – on-going
Budget: No available data

Overview: The Rail Europe Network is a group of companies created by the French National Railways (SNCF) dedicated to foreign distribution. It is the largest international distributor for European rail travel.

Background: The Chemin de Fer du Nord became the first French private railway to be introduced into the UK over a hundred years ago by establishing an office in London's Victoria station. It has since acted as the main gateway for passengers wishing to travel on the continent.

Process: In 1995 French Railways Ltd opened a public call centre in London to manage European rail ticket sales, in 1997 it acquired British Rail International. It was when SNCF merged French Railways with British Rail International that Rail Europe Ltd. was established.

In December 2013, Rail Europe Ltd. was rebranded and became Voyages-sncf.com. Aside from the name, there have been no other significant changes to the services that the website offers; it continues to sell the same tickets and passes for rail travel throughout Europe, with the North American, Australian and World websites maintaining the original Rail Europe brand.

Rail Europe website

Details: Rail Europe 4A is a joint venture between the French national rail company (SNCF) and the Swiss national railway company (SBB). This arm is the leading distributor of rail passes and point-to-point tickets. Rail Europe Inc. is distributor of European rail products in North America; Rail Europe Continentale is responsible for the marketing and distribution of French domestic and international rail products in continental Europe.

Finally, Rail Europe Ltd. is based in London and is the specialist in European Rail Travel for the United Kingdom in terms of rail information and ticketing. The Rail Europe website is dedicated to selling tickets and passes, such as InterRail and the Swiss Pass, to the UK market. It is commercially linked to European rail operators including SNCF, Eurostar, Deutsche Bahn, Elipsos, Artésia and Thalys.

As well as the Rail Europe Ltd. website which provides services in English, French and Spanish there is also a dedicated call centre and travel office on Regents Street in London.

The website provides timetables, fares and journey information on thousands of routes as well as an online booking facility. Customers can either print their tickets out or collect them at

central railways stations across Europe's main cities. As of the end of 2013, Rail Europe will become known as Voyages-SNCF, reflecting better its close links with the French rail company.

The offerings available from Rail Europe Ltd. can be broadly grouped as:

- Rail passes, allowing travel on European trains for specific zones and number of days
- Rail tickets (one way or roundtrip)
- Seat reservations
- Sleeping berths for overnight trains
- High speed train services
- City sightseeing tours
- Group travel

Stakeholders: Rail Europe Network is a group of companies each with a specific focus on a particular geographic area or service-based offering. Rail Europe is commercially linked to European rail operators including SNCF, Eurostar, Deutsche Bahn, Elipsos, Artésia and Thalys. These are associated arrangements, which facilitate Rail Europe's ability to maximise the integration of information and payment systems for major rail journeys across Europe.

Success: Rail Europe Ltd. is the largest distributor of European rail products in North America and the leading stockist in the UK. It currently serves over 1 million customers every year.

Challenges/barriers faced: Integrating all of the information across all available routes and providers is a complex undertaking and the Rail Europe website at the current time cannot cater for all connections across the continent, which may discourage potential customers from using the service in favour of booking individual train services.

Interoperability and integration between the domestic rail companies across Europe would certainly facilitate the removal of this barrier.

Transferability/learning/scaling up: Rail Europe integrates national offers to make travel easier across Europe, removing some of the national and language barriers that are often prohibitive. Such a site is useful for UK customers and could be useful for other European countries to follow suit. However, this may lead to additional fragmentation of rail offerings at a time when standardisation would benefit all. If Rail Europe's website could be used across Europe as the main point for ticketing and information, this would be beneficial to encouraging train use across the continent.

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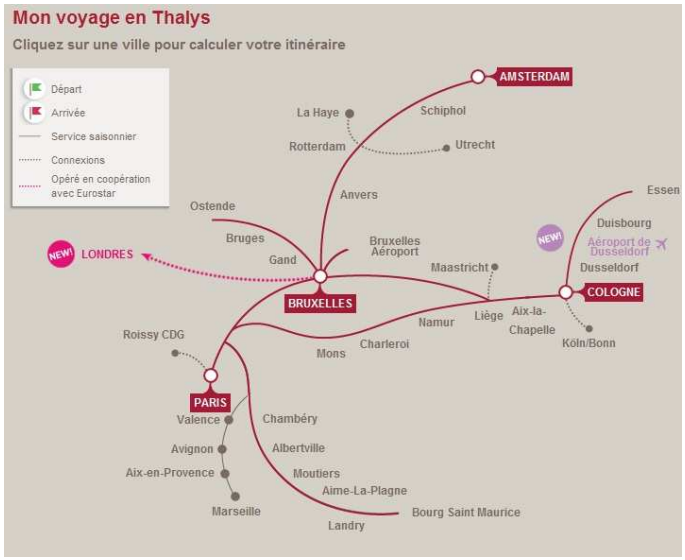
4.10 Thalys, Multi-national

Thematic group: HSR
Specific area of focus: Contributes to the White Paper goal of tripling the length of the HSR network in Europe
Why good practice? Thalys was a successful example of cross-border collaboration in HSR management and has evolved into a competitive service
Time period: 1995 – on-going
Budget: €487 million (turnover 2013)

Overview: Thalys was the original European HSR operator. In 1995 an agreement was signed by the French, Belgian, German and Dutch rail authorities to link Paris, Brussels, Cologne and Amsterdam by train. In the past 20 years Thalys has led the shift from road and air to rail across these routes. Recent developments since 2012 have seen Deutsche Bahn step away from the joint venture and enter competition with the company on the routes into Germany. This makes Thalys a fascinating testbed in European HSR, not only was it successful in bringing operators together, but it is now set to determine whether a competitive HSR network will flourish in Europe.



Thalys website

Background: The decision to link Paris, Brussels, Cologne and Amsterdam by rail was initially made in 1987 and was followed in 1993 by an agreement between the French (SNCF), Belgian (SNCB), German (DB) and Dutch (NS) railways to work together to provide the service. In 1995 Thalys was set up following this agreement. It was a collaborative effort, and essentially the first European high speed train operator, and its first services were launched in 1996.Thalys is currently a cooperative company with limited liability under Belgian law.

Process: The first services offered under the Thalys umbrella were on the Brussels to Paris line at the end of 1997, using the LGV Nord high speed line. This was joined by the Brussels to Cologne (via Aachen) route. Whereas on the Brussels to Paris route, regional services continued to also serve the principal and connecting stations, the high speed service between Brussels and Cologne spelled the end of the local train service in 2005. Both of these international services have undergone periodic improvement in the last 17 years and upgrades to both trains and tracks have resulted in resulting decreased trip times.

In 1999 Thalys also began to serve Charles de Gaulle airport. This was also the year the company changed its name to Thalys International. In 2003, the service was extended to serve Brussels International Airport and in 2009, services from Brussels to Antwerp and Amsterdam were introduced.

Details: At the current time Thalys has a fleet of 26 trains, each with 377 seats. Over half (58%) of Thalys customers travel between Paris and Brussels. Over a quarter (27.4%) take

the route Paris – Belgium – Netherlands and trip purposes are fairly even; with 48% of people travelling for business and 52% for leisure purposes. In 2011, 38% of tickets were paperless.

The Paris and Brussels track is shared with domestic TGV trains in France and with Eurostar trains that go from either city to London via Lille. The route is effectively managed by SNCF and SNCB alone as NS is an inactive partner in the company and this is reflected in the proposed restructuring of the company scheduled for completion by 2015.

Following Deutsche Bahn's 2012 decision to compete on the route into Germany, a new phase in Northern European HSR has been ushered in. Thalys is no longer a symbol that collaboration between operators is possible, but more of 'real' competition on the network for the first time. Whilst Eurostar and Thalys compete for Brussels-Lille traffic, SNCF has a share in both companies, so this isn't competition in its true sense. But with Deutsche Bahn no longer selling Thalys tickets and with the company selling their share, we may begin to see the market decide which operator the public favours. Although at the current time the prices offered by each operator remain very similar, it is not easy to see a leader emerging just yet, though Thalys continues to grow year-on-year in terms of revenue and passenger kilometres travelled.

Stakeholders: Since its inception, Thalys has been built upon a cooperative business model which has brought together domestic rail provides to offer international high speed services. Thalys employs over 2,500 people and it is the national operators are responsible for seconding staff from domestic operations to work for Thalys.

In 2009 Deutsche Bahn acquired a 10% stake in Thalys, but subsequently decided to sell it in 2013, to stop selling Thalys tickets and to operate its own trains on the routes to and from Germany. Following this development, in 2013, the boards of SNCB and SNCF approved a restructuring of Thalys by 2015 to create a single corporate entity, which is subject to approval by the European Commission. SNCF will hold the majority share (60%) of the restructured company.

The Train+plane tickets that have been offered for the past decade between Brussels and Paris (Brussels Airlines and Jet Airways) and Antwerp and Schiphol (with KLM) demonstrate that collaboration between modes in competition can also be achieved.

Success: In its first year of operation, the share of rail trips between the cities served by Thalys almost doubled (from 24 to 43%). Thalys continues to dominate the service and mode choice made for each of its routes.

By 1998, Thalys had carried 5 million passengers; by 2013 this figure had reached 100 million. In 2012, Thalys had 6.7 million passengers and turned over €487 million. In 2012, 88% of all customers were satisfied with the service that Thalys provided and the punctuality of the services reached 90%.

Challenges/barriers faced: Thalys is confronted by a number of issues that are problematic for all (high speed) rail providers. But the international character of the company highlights many of the barriers to true interoperability in Europe. Because of the speed that high speed trains travel at, systems need to be installed on trains to inform drivers of speed limits for safety purposes. Each national system is currently different and in France, Germany and Belgium the services travel on both high speed and conventional lines. Therefore Thalys trains need to be fitted with 7 different systems to enable the frequent crossing of borders

and switching between lines, which is clearly not an optimal set-up and requires significant investment on the part of the company. Similarly, national performance target and engineering schedules, regional and domestic traffic are all issues that an international service provider like Thalys must navigate.

Thalys operating on a competitive basis goes against the objectives of the Railteam alliance, the trade body set up in 2007 to promote HSR in Europe. Yet instead of encouraging cohesion, the selling of operator-specific tickets is a step backwards for HSR integration in Europe. It may also contribute to increased difficulty in integrated multi-modal journeys and also opens up the threat of fare hikes, which may jeopardise progress already made on affordable fares.

Transferability/learning/scaling up: The operators involved in Thalys have first-hand experience now of how to collaborate to deliver HSR across borders in Europe. There is much insight that the company could offer other clusters or regions in the Union that are considering linking efforts for international routes. Yet with recent developments shifting the area from collaboration to competition, there are likely to be many new lessons that Thalys and competitors will learn and be able to share in the coming months and years.

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5 Integrated Ticketing, Information and Payment System (ITS) Case Studies

5.1 ACTIV Card, Bucharest, Romania

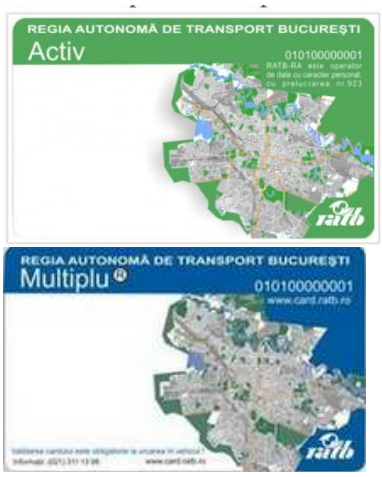
Thematic group: ITS
Specific area of focus: Contributes to the 2011 White Paper goal concerning integrated iticketing and payment systems
Why good practice? RFID smart card integrating public transport ticketing and fares
Time period: 2006 – on-going
Budget: €12 million

Overview: In 2006, as part of the automatic taxation system (SAT), ACTIV, was implemented at Bucharest's smart ticketing system. It was intended to increase the attractiveness of public transport by integrating all modes across the city and introducing a flexible fare policy. In the first stage, ACTIV brought together the two biggest public transport operators: METROREX (underground) and RATB (trams, buses and trolleybuses) and passengers can use the card to travel on both networks. The cards could be integrated with 6 additional operators in future.

Background: Romania's capital Bucharest, with over 2 million inhabitants, is facing issues of increased traffic congestion and also rising passenger numbers on the public transport networks. The ground transport network, which is operated by RATB, consists of over 100 bus lines, 20 trolleybus lines and 25 tram lines. METROREX operates the 4-line subway network.

In 2000, the "Comprehensive Urban Transport Study" of Bucharest city and metropolitan area highlighted that the paper-based ticketing system and the diversity of fares between modes and operators were inconvenient and this was seen as one of the biggest challenges for public transport. Subsequently, Bucharest City Council decided to invest in the modernization and improvement of public transport facilities.

Among the action undertaken was a project on ticketing and payment by smart cards as part of the CIVITAS - TELLUS initiative. The project's main goals were to improve the public transport attractiveness by introducing integrated fares and flexible fare policy, to protect revenues; and improve the public transport offer. The public transport operators engaged in the project also aimed at fraud reduction from 25% to a maximum of 15%.



ACTIV and Multiplu cards

Process: In November 2004, a public international open tender for a system integrator was organized. RATB and METROREX signed an agreement on the technical integration of their ticketing systems and fares. As a result of this agreement, the passengers can use the same card for all urban public transport modes, while at the commercial level the two operators agreed to share all income generated. At the beginning of the project, 2000 vehicles operated by RATB were equipped with the new devices for contact-less ticketing and payment and 65 points of sale were established. RATB has also developed a marketing campaign in order to promote the new ticketing system.

The tariff integration and modernisation of ticketing system was part of the larger strategy of fare system improvement written in the Bucharest Transport Master Plan.

Details: The new RFID-based technology system introduced in 2006 offered smart cards for regular users. Readers have been placed on buses and on the metro to read new smart cards. These cards could also be used to pay fees for other services such as bike sharing and parking. Initially RATB offered the smart cards alongside paper tickets, but as of 2011, only smart cards were accepted. The ACTIV card is customised and designated to permanent customers.

Nominal cards are initially free of charge (with a fee for replacing lost or stolen cards) and can only be used by the registered individual. Non-nominal cards cost 3.7 RON (€0.80) and can be used by members of groups (families or employees for example). It can be topped up with up to 50 RON (€11) and each full trip costs 2 RON (€0.47).

A second card, the Multiplu is also available for infrequent customers (primarily non-residents of Bucharest). This type of card can be used only for RATB and it cannot be recharged.

Stakeholders: A public consultation was carried out before the project was implemented, ensuring that users' perspectives were heard. The roll-out required the involvement of many parties, including the City Council of Bucharest, RATB and METROREX.

Success: The ticketing system became operational at the end of 2006 and is now functioning throughout the RATB fleet and in 49 underground stations. The ACTIV smart card can be topped up at 95 RATB sales points, via the Internet (https://online.ratb.ro/), or at ATMs of the Romanian Commercial Bank. By January 2012, 1,877,019 ACTIV smart cards and 984,072 Multiplu cards had been sold. The success of the project can be attributed in part to the piloting phase and supporting marketing of the case, through which customers became familiar with the technology and to making the system easy to maintain with clear roles and responsibilities laid out for the operators involved.

Challenges/barriers faced: Because the political landscape was changing during the implementation phase of the project, smart ticketing was introduced after the TELLUS project. A key finding of the project was that public awareness and marketing were critically important.

The complete switch away from paper tickets, even for non-residents has been criticized by some, as tourists or those unfamiliar with the system may experience difficulties in using the system, which could act as a barrier. Others have lauded Bucharest for taking this affirmative step towards integrated ticketing and payment.

Transferability/learning/scaling up: Introducing the ACTIV card was part of RATB's modernization plan. The integrated ticketing system and smart ticketing have been met with a positive reception and there is potential for the technology to be extended to national rail (CFR) and private operators.

Following the success of ACTIV, Bucharest's residents have been offered another smart ticketing option. Banca Comerciala Romana (BCR) launched a debit card (the ZAMBET BCR card) in 2011, which can be also used to pay for public transport journeys. The ZAMBET card is a contactless debit card with an embedded transport application. Card users are given 10

RON (€2.25) credit when the card is issued and 5% bonus from all public transport transactions using the card.

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5.2 Autolib', Paris, France

Thematic group: ITS
Name of case study: Autolib'
Specific area of focus: Contributes to the 2011 White Paper goal concerning integrated information, management and payment systems
Why good practice? The system that oversees the payment, information and management of the Autolib' car-sharing scheme is well integrated.
Timeframe: 2011 – on-going
Budget: Initial contract €14 million; €804 million (Bolloré Group 2012 profit)

Overview: Autolib' is an electric car-sharing service, operating in Paris since 2011. The Bolloré Group runs the scheme and its success is in part due to the integration between the customer interface and back-end technology used for battery charging, payment and management.

Background: Autolib' was introduced following the success of the Velib bike-sharing concept in Paris, which was launched in 2007. Paris, like many other major cities struggles with issues of congestion, air pollution and the high cost of car ownership. Autolib', as an all-electric vehicle, is a relatively low cost and cleaner alternative means of getting around Paris. The historical role of the French government supporting innovation and technological development in the country's prominent car industry was also a likely key driver behind the developments.

Process: Autolib' customers can subscribe online, at a subscription kiosk, or in the Paris showroom using their driving licence, ID and a credit card. Once registered, customers receive an RFID badge, which can be used to unlock the car door and also to access the unit to recharge the vehicle's battery. Of all the means available to use the service, nearly 80% of Autolib' bookings are made via smartphone apps.

Autolib"s system has been devised in a way that means that the batteries, cars, information, security, communication, operations, payment and location tracking are all fully integrated into one package, which makes the hiring experience for the user better and the system management easier. The technology consists of three types of kiosks for registration, rental and vehicle charging; an internal driver system in the vehicle and handheld devices to monitor location, charge and maintenance.

Details: Autolib" Bluecar® vehicles have a range of 250 km. They are 100% electric vehicles powered with a 30 KWh lithium metal polymer battery. Each vehicle is equipped with a GPS system, which enables communication between the car and control centre.

IER, which is part of the Bolloré Group manages the charging infrastructure (all Autolib' rental kiosks are linked), on-board solutions and back office car sharing fleet management technology. The company's software suite manages the real-time monitoring of the fleet availability, remote diagnosis of the state of the vehicle and the customer interaction with the vehicle. The self-service rental kiosks have touchscreens, readers for ID cards and payment modules. The charging stations are also self-service.

The on-board technology consists of a digital screen that displays necessary data about the car (range, battery level, etc.) and welcomes the driver by name, and a button that allows contact with the call centre (via videoconference) in case of an emergency. The integration of

these payment and use considerations through one customer interface was identified as important priority for the service.

This technology called Bluecore, which runs on Windows Embedded, offers the operations centre vehicle positions in a real-time map and is integrated into a central module which also allows subscriptions, payment and customer relations to be managed.

Stakeholders: Autolib' was initially a public private partnership that was commissioned by the then-Mayor Bertrand Delanoe in 2009. Bolloré developed the vehicles and the system together. IER with expertise in self-service, access control and tracking in other sectors has brought these technologies together to offer an integrated car-sharing package. The île de France regional government, the city government and the surrounding 46 municipalities have all been actively involved in establishing the scheme.

Success: As of September 2013, there were 2,000 vehicles in the Paris fleet, up from 250 cars that the service launched with in 2011. The company has over 50,000 subscribers and in January 2013 the service saw its total rentals surpass the 1 million mark.

Challenges/barriers faced: Due to the nature of the infrastructure it is not possible to use non-Autolib' charging points for the vehicles, so if public charging infrastructure takes off following the increase in availability of electric vehicles, private ownership may grow. Also any non-French national without an international driving licence cannot use the service, so a significant proportion of the potential market – tourists – may not be captured here.

Developing its own smart technology and management system may make it difficult to include Autolib' as one mode of a package of an integrated transport system in the future. But with IER's technology being as comprehensive as it is, the company may have the edge over the public transport authorities of île de France and the city and municipalities and be seen as a model for how to integrate ticketing and payment systems together.

Transferability/learning/scaling up: The decision to make an integrated payment and management system for the Autolib' scheme was one of the key factors behind its success. Customers have a complete service that is fully automated and makes use of the scheme easy. Other initiatives could learn a lot from this approach.

Following the success of Autolib' in Paris, Bolloré has established similar schemes trading under different names in Lyon and Bordeaux and recently announced plans to take over the running of the Source London scheme in London to offer a car-sharing service integrated into the charging infrastructure there.

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5.3 Co-Cities – European Cooperative Mobility Services, Multi-national

Thematic group: ITS
Specific area of focus: Contributes to the 2011 White Paper goal concerning integrated ticketing and payment systems
Why good practice? Co-Cities was a project that took lessons learned on previous projects and the cities involved developed ideas and technology further in collaboration with stakeholders and each other
Time period: 2011-2013
Budget: €3.9 million

Overview: Co-Cities was a 2-year European project, which aimed to develop a 'dynamic feedback loop' between mobile users and travellers in order to foster a collaborative relationship between transport users and the traffic information services. It was funded by the EU's Information and Communication Technologies Policy Support Programme under the Energy efficient co-operative transport management systems area and ran from the beginning of 2011 to the end of 2013.

Background: Integrated traffic information systems began to appear in European cities in the early 2000s in an attempted to improve movement on congested networks and encourage more user-friendly interfaces for information delivery to drivers and public transport alike. Today real monitoring and feedback manage traffic flows in many urban areas. European projects seeking to advance the quality and usefulness of this information in the recent past have demonstrated that more cooperative systems, which are capable of bringing together users and providers, are not only technically feasible but also likely to be accepted more than systems that rely on a one-way flow of information.

Process: The software extension used in Co-Cities is based on the commonly agreed interface (CAI) that was developed in a previous project called In-Time. The Co-Cities project was designed to further the work of this and other preceding activities by offering cooperative mobility services that include dynamic navigation and intermodal routing and advice in real time. Additionally, and perhaps most importantly, it provides the possibility for the traveller to deliver relevant information to the traffic management and give feedback on the quality of the information given. Six cities were involved in the development and piloting of the new technology interfaces (Bilbao, Prague, Reading, Treviso, the Tuscany region and Vienna) and despite the project coming to an end, the cities are still actively developing the platforms and continue to engage residents to feed into the information system.

Details: Co-Cities provides one standard interface, the Commonly Agreed Interface (CAI), between city traffic management information and the Transport Information Service Providers (TISPs). The latter element of the project is where Co-Cities adds value to the work that has gone before. The cooperation between user and provider that this feature permits enables the public travelling across modes to feedback to traffic management centres via the standardised Interface. This allows the information on traffic conditions to be as dynamic as the changes that occur to the network in real time and by interacting with travellers, their engagement with the network becomes more active than passive. It also speeds up the time in which they can receive information about changes to the network to alter their journeys (both in terms of travel times and connections where relevant) accordingly.

It is expected that with the increase in information sharing and capturing these experiences within the Co-Cities pilots, faster uptake of such successful arrangements in other cities across Europe can be fostered.

The Co-Cities registry was based on the Open Source GeoNetwork platform, a free, standard-based catalogue application for managing spatially referenced resources through the web. It was developed to be used across different information domains including public transport, road traffic, parking and multimodal journey planning. The registry provided advanced metadata editing and search functions to be used by TiSPs and local organizations – it was run at a centralized as well as local level. The interface uses different hardware and software platforms such as personal navigation devices, smart phones and web services.

The consortium set up a reference platform for the testing and validation of cooperative traffic information services and combined this with a service evaluation framework for the mobility services. Business-to-business services also enabled Europe-wide TISPs to work alongside regional and urban authorities in fields such as strategy-based routing and adaptive mobility services.

Stakeholders: The project relied on the buy-in of transport network users in order to be successfully piloted in each of the six test cities – therefore there was a strong participation and engagement emphasis throughout the project. Softeco Sismat developed the end user app and there were a number of local technology partners in each of the test cities. Coordination between the partner cities and the TISPs was fundamental to ensure that approaches in each had differentiated, but interoperable and common elements.

Success: All the components of the Co-Cities platform that was envisioned at the beginning of the project were delivered according to the technical specification in its lifetime and the project built on the success of its predecessor In Time. This enabled all interface elements to be tested during the Co-Cities project and means that it is now technically mature enough to be made available for other entities to use and input to system. The full interoperability of the platform between the TISPs and the local systems was showcased at the ITS World Congress in Vienna.

Challenges/barriers faced: The environment for info-mobility services has changed during the course of the project. Depending on the local framework conditions the pilots have been partially successful. In Vienna, a site with a sophisticated and high competition in the offer of mobility information, hardly any usage of the Co-Cities app has been seen, but in the meanwhile the official mobile application of the transport operator has integrated a feedback loop. Compared to that in Bilbao, where no integrated mobility information has been available before, the pilot was rather successful with quite a lot of users.

The overall experience is that the feedback tends to be highest when the quality of the information is low or the data is even wrong, as soon as the data was correct this could not be seen in the feedback stream as an increase in perceived quality but in a low number of feedbacks. As in any other Real-Time-Traveller Information (RTTI) project the technical work was not an issue but the cooperation and exchange between the local actors and stakeholders was a challenge, there have been a lot of issues regarding data access which caused a pilot site (Munich) to leave the project.

Transferability/learning/scaling up: A significant characteristic of the Co-Cities project is to support cities and regions in developing and installing tools to become cooperative despite

having limited budgets and time frames. The project relied on learning from previous projects and the pilots undertaken in the project are also intended to form the basis of future work.

Cities looking to introduce similar RTTI initiatives with end users could learn from the challenges Co-Cities faced in terms of organisational issues and stakeholder cooperation.

Co-Cities PRIME (Provide Improved Mobility Services) is an initiative that commenced during the project to invite other cities to share insight and experiences in using cooperative mobility services. This was with a view to actively engage a wide range of urban areas in Europe, encouraging them to begin to use the service.

The consortium members were actively participating in conferences and dissemination activities to promote awareness of and encourage use of the service developed through Co-Cities. This on-going activity has continued following the completion of the project. A Co-Cities Forum, a core group of cities and technical providers, has been established to manage the further extension, development and release of the CAI to adopt to future trends and developments.

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5.4 GA Travel Card, Switzerland

Thematic group: ITS
Specific area of focus: Contributes to the 2011 White Paper goal concerning integrated ticketing and payment systems
Why good practice? The GA travel card enables travel across the network in Switzerland, across modes and national and regional providers with seamless ticketing and payment.
Time period: 1990 – on-going
Budget: Unknown

GA Travel Card

Overview: The GA ('General abonnement') travel card offers discounts for frequent travellers at monthly and annual rates. It is flexible, of economic benefit and environmentally friendly as compared to travelling by car. It gives the customers unlimited travel on the entire network of the Swiss Federal Railways (SBB) as well as most private railways all over Switzerland. It is also valid on postbuses, boats and municipal public transport services such as trams and buses in most cities.

Background: General subscriptions such as the GA travel card have a long tradition in Switzerland, where the first general subscription was introduced in 1898 on the initiative of the Association of the Working Travellers and the Northeastern Railway. At the time, there were 15 Swiss railways with a total length of total 3195 km. Since the end of the 1920s, the scope has gradually expanded as the network has lengthened.

While general subscriptions have long tradition in Switzerland, a key objective of the current GA travel card has been to offer high quality services to the passengers. The GA travel card is a flexible pass that is easy to use and includes positive economic incentives that are intended to discouraging the use of cars. It is therefore considered environmentally friendly and contributes to decreasing congestion on roads. However, there is an increasing problem with congested public transport systems. In the future (c. 2018), it is hoped that the vision of "GA for everybody", can be realised.

Process: In 1990, the local transport companies of the 24 largest cities joined the general ticket system. Today the postal bus network creates the largest part of the network. Since 1996 the card has been sold in the format of a credit card. The subscription is different from network cards in other states, such as the 'rail card 100' in Germany or 'Austria Card' in Austria, which are mainly only valid at the respective railway companies.

Details: Some 52 companies in Switzerland share a common fare scheme, which covers nearly 13,000 stops. The GA travel card contributes about 40% of total revenues from public transport fares. Based on a distribution formula this income is shared between the different companies that are involved in the service provision. For the customers, there are different travel cards to choose between: GA travel card for adults, young adults, trainees, people with disabilities, pensioners, families, kids and even dogs. A customer that has a 2nd class GA travel card for adults (CHF 3550) and travels 25,000 km/year pays 14.2 centimes per km as compared to 65 centimes per km by car. Companies may underwrite the full or partial costs of a GA travel card. SBB also offer additional services, including a 'pause' as customers, who do not need their travel card for at least seven consecutive days, may deposit it at a ticket counter for up to 30 days during its period of validity. SSB replaces lost or damaged travel

cards (CHF 30) and if it is left somewhere, there is a possibility to issue a temporary one-day travel card (CHF 5).

Stakeholders: The Swiss 'Verband Öffentlicher Verkehr', which is a national interest organisation, representing 127 transport operators and 180 other industrial operators, plays an important role.

Success: The GA travel card is very popular among the travellers due to its ease of use and flexibility. Some 430,000 GA travel cars are in operation. On it's web site, the SBB advertises: "You simply hop on board the next train." The price is fixed with no additional costs (e.g. insurance, repairs). The company highlights the fact that the travellers can take advantage of their travel time to work or relax and that it is environmentally friendly (i.e. low-emission rail travel).

Challenges/barriers faced: In Switzerland most citizens have a local public transport card subscription. Today a lot more people are commuting than a decade ago. As a result, the trains are overcrowded – the public transport system is congested. Currently there are ongoing discussions as to how to solve this issue; increasing capacity of the system would be one such approach. Doubling the price of the GA travel card is politically unfeasible. An alternative option may be to abolish the GA travel card and instead include a limited number of countrywide trips as part of regional travel cards, but this doesn't seem to fit with the "GA for everybody" approach.

Transferability/learning/scaling up: Transferability is dependent on the possibility to increase the capacity of the public transport system, in case of congested public transport services. Lessons from Switzerland also suggest that in order to be sustainable, such travel cards should not be too cheap.

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5.5 ID Tickets and Free Public Transport, Tallinn, Estonia

Thematic group: ITS
Specific area of focus: Contributes to the 2011 White Paper goal concerning integrated ticketing and payment systems
Why good practice? The ID ticketing system in Tallinn integrated travel tickets with identification documentation and the city has subsequently offered free public transport to all registered citizens.
Time period: 2005 – on-going
Budget: €53 million (Public transport budget – 2012)

Overview: The Estonian city of Tallinn implemented a payment system for public transport (ID tickets) whereby electronic tickets for both public transport and certain local attractions were carried on a personal ID card. The tickets were obtained through mobile devices and on a specific website. In January 2013, the Tallinn City Administration took the unprecedented step and made the use of public transport free for registered users. The 'green card' was introduced as an alternative to the ID card and is available to all registered citizens of the city. Non-residents can load the required amount of money on to the so-called 'green card' to get about the city too.

Background: Mobile-based services began to be tested in Estonia in 2000 when parking and vending machine pilots were carried out. After these positive experiences, the first mobile ticketing system was piloted in 2002. From 2002 all residents were been required to have an ID card, so it made sense to combine the two systems and have the ticketing and payment for public transport in Tallinn incorporated into the technology already being used with the ID card. As there was no way to monitor use of the public transport services using the ID ticket, the green card was introduced to enable a more responsive system.

Process: Improving the quality of public transport was seen as important to the city of Tallinn and adjacent urban areas given the rising use of cars within the area. Implementation of Inter-municipal electronic ID ticket system in Estonia was consistent with several national policy areas and local plans and strategies that facilitate the development of public transport. The basic ID-ticketing system was launched in Tallinn in 2004 and in 2005 it was extended to an inter-municipal ticket.

Details: The system was based on the personal ID card, which is a mandatory document for all Estonian residents, including Estonian citizens and resident aliens. The Estonian ID card has two functions, firstly to serve as a standard identification mechanism and secondly to enable access to a number of services online conveniently and securely. Tickets were activated by making a phone call or on the internet – the customer did not to buy a ticket, it was added to the ID-card.

Before 2012, Tallinn's standardised ticket system accepted either paper-based (for non-registered people) or ID card-based tickets. By 2011 the ID ticket was the most common public transport ticket in Tallinn and in the 2009-2013 Innovation Strategy the use of ID tickets for people who do not have Estonian ID was prioritised. It was under the auspices of the CIVITAS Mimosa project; that preparations were made for the withdrawal of paper tickets from sale towards moving the whole system towards contactless chip cards.

Now it is possible for tourists and non-residents to purchase non-personalised Public Transport Cards which do not store any data and are not registered to the user, but can buy

tickets for up to 6 passengers for each journey. In January 2013, the City Administration stopped using the ID card and at the same time made the use of public transport in Tallinn free for those passengers that registered their new contactless green card. Although the service is free, users are still required to touch card to reader when using public transport in order that the public transport authority can have a better idea about patronage of particular services and the network as a whole.

Stakeholders: The ticketing service is the result of the cooperation between many stakeholders: the Tallinn City Administration and surrounding municipalities, Certification Centre (Sertifitseerimiskeskus), banks, phone and mobile companies, Post office and R-Kiosk newspaper stands.

Contactless green card, Tallinn

A public referendum took place to determine public appetite for free public transport with over 75% of the population in favour of the measure. And the Mayor Edgar Savisaar has been an advocate for the free public transport system since it was initiated, with the city hosting conferences advocating it's approach to free services in an array of public fora.

Success: Introduction of intermunicipal electronic ID ticket system in Tallinn has brought several benefits for the municipality, including optimization of distribution costs (less need for printing and delivering paper tickets). Before the removal of paper tickets in 2011, up to 95% of all tickets sold were via the ID card and since the introduction of free travel using the green card, a significant increase in the number of registered residents has been observed.

There is limited evidence to date about the success of the measure, though according to a Mayoral statement from August 2013, 68% of people state that public transport is their mode of choice, with the number of cars in the city centre down by 15%.

Challenges/barriers faced: Whilst the increase in registered population has been a boost to the system, long term capacity may be a concern for the network if the revenue for growth and improvements is not generated by ticket income. But removing the cost implications for registered residents, issues of fare avoidance have been removed for citizens and the increase in municipal revenues from income tax covers the €12 million cost of free public transport in the city. Ensuring that non-residents use public transport by charging their cards is perhaps another current challenge for the city.

Transferability/learning/scaling up: Scaling up beyond the metropolitan area would be a first step. A further step would be to integrate the system other local governments (primarily Harjumaa and Helsinki region) and private sector (primarily organisers of mass events). Linking road user charging with free public transport is an aspiration that is discussed in the city, but no plans are in place to move forward with this idea at the current time. The step of making public transport free is exemplary and the success experienced by and model utilised in Tallinn should be noted by other European cities. Tallinn is a candidate for the 2018 European Green Capital which would certainly boost awareness of the initiative if the city was successful.

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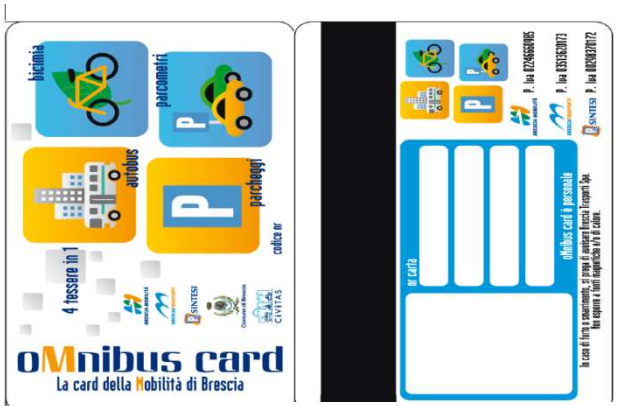
5.6 Omnibus Card, Brescia, Italy

Thematic group: ITS
Specific area of focus: Contributes to the White Paper goal of establishing a European multimodal transport information, management and payment system
Why good practice? Successful implementation of an integrated electronic ticketing system for bus, metro, bike sharing and parking
Time period: 2009 – on-going
Budget: €143 million

Overview: The Municipality of Brescia started in 2009 to upgrade and develop the existing public transport electronic ticketing system. The goal was to include other services such as parking and bike sharing. The seasonal Omnibus card, which is a MIFARE contactless card, was launched in 2012. In addition, a single ticket has been developed, that can be used both for parking and public transport. The crucial success factor for the project was the constructive partnership among the key actors, and the funding through the CIVITAS Modern project, co-funded by the European Union.

Background: The Italian city of Brescia is the second largest city in the Lombardia region with 190,000 inhabitants. The municipality of Brescia decided to develop and upgrade the existing ticketing system, in order to strengthen intermodality and improve sustainable mobility. For the city administration, it was important to improve the existing ticketing system *before* the opening of the new metro line in March 2013. In 2012, the Omnibus card was introduced, allowing the travellers to use one single card for different modes, such as public transport, parking and bike sharing systems.

Process: The main goal of introducing an integrated e-ticketing system was to increase the use of public transport. The new Omnibus card is a MIFARE contactless card. This technology replaced the previous GTML cards, and made it possible to extend the ticketing system to other services such as parking and bike sharing. The municipality of Brescia's participation in CIVITAS Modern, a project co-funded by the European Union, facilitated the research, demonstration and testing activities that were required to develop the technology and find viable solutions. The Omnibus card was successfully launched in 2012.



Omnibus Card

Promotional campaigns to spread information about the new integrated card and increase the awareness of the available integrated mobility systems was also undertaken. Future plans include upgrading all of the parking machines in the city to be able to read the tickets.

Details: The electronic ticketing system consists of two kinds of tickets: Contactless cards for frequent users and magnetic tickets for occasional users. The technology for *contactless cards* is innovative, and demanded substantial modifications in the existing software in order to facilitate communication between the ticket machines and the new cards.

In addition, ticket devices had to be modernized with contactless interfaces to assess the range of additional services managed by the new card. The challenge related to the *magnetic occasional tickets* was the different kinds of ticket readers in public transport and for parking. To install chips on occasional paper tickets (as is the technology used for contactless cards) would be too expensive (about €0.40cents each).

The solution was a double face ticket with thermal paper on the one side to collect information about parking use and a magnetic strip on the other side, which stores information about the public transport trips made by the user. The automatic payment machines read both sides of the ticket, if it detects that both public transport and parking have been used on the same trip, it will apply a discounted park and ride fare.

Stakeholders: The municipality of Brescia, Brescia Mobility (the local public transport company), the parking sector and the bike sharing sector were responsible for the project. Other important stakeholders were the Brescia citizens, who have been involved through a satisfaction survey, and current users of the different modes who have been directly involved during the operational phase.

Success: The new smartcard made it possible to integrate the different transport systems both technologically and for fares. Potential and actual users were surveyed in May 2011 about the system and only 22% of potential users were aware and accepting of a €5 charge for the scheme. By November 2011, this figure had increased to 89%, an increase of 67% demonstrates high acceptance and willingness to pay for the card.

A constructive partnership between the municipality, local public transport company and the parking sector has been important. Furthermore, the funding through the CIVITAS Modern project was fundamental for developing the electronic ticketing system upgrade.

Challenges/barriers faced: For the near-field communication (NFC) technology experimentation, the time required to arrange technical and economic elements with different partners were undervalued. Furthermore, the distribution of the new cards has been insufficient, due to organizational barriers.

Transferability/learning/scaling up: The importance of collaborative partnerships between key actors for multimodal ticketing has been highlighted in Brescia. Direct engagement through campaigns and meetings is as important as open but strict collaboration with technology providers. Solving technological issues quickly is another important lesson.

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5.7 Oyster Card, London, UK

Thematic group: ITS
Specific area of focus: Electronic integrated ticketing and payment for public transport
Why good practice? Successful roll out and high uptake
Time period: 2003 - On-going
Budget: £1.1 billion cost (1998-2015) initial contract £100 million

Overview: The Oyster card was introduced in 2003 following a four year development phase after a decision to invest in integrated ticketing technology was made in 1998. Oyster is supported by Transport for London and can be used across most modes of transport on the Greater London network. As contactless smart cards, they can hold various ticket types and money can be added to the card via ticket machines, on line or at some credit card terminals. Passengers must 'touch in' at the beginning of their journey and 'touch out' when they reach a final destination.

Background: Outdated technology and a lack of integration between the transport modes in the London public transport network led to a decision to invest in smartcard technology in 1998.

Process: Following a Transport for London decision in 1998 to invest in technology to update the network with integrated ticketing, it took 4 years to introduce the system. In 2002 ticket barriers, bus ticket machines and DLR (Docklands Light Railway) and tram ticket validators were installed with staff being issued tickets to trial the system.

The first public Oyster card was issued in July 2003. Since 2004 pay-as-you-go Oyster cards have been introduced, the rail network (within Greater London) has begun to accept Oyster cards and other modes of transport – including the river service and the recently opened Emirates AirLine – have also become part of the Oyster network.

Oyster Card

Details: The card operates through an RFID system and the card has a proximity range of around 3 inches. Oyster uses a distributed settlement framework that allows interaction for movement to take place solely between the card and the reader; this allows transmission of the record of transactions to be done in batches and eliminates the need for real time monitoring of activity.

The Oyster system is a closed architecture developed by Cubic Transportation Systems. No personal data is stored on the card. Oyster readers are capable of reading other types of cards and since 2010 all Oyster card chips have been MIFARE DESFire EV1 chips – which are becoming increasingly commonplace as smartcards for travel. These chips are more robust than the predecessor used at the time of the Oyster card introduction as they have on-board CPUs and are more secure.

Stakeholders: Oyster was set up through a Private Finance Initiative (PFI) contract. Transport for London and the TranSys consortium of suppliers offering day-to-day management, as well as other stakeholders with passive engagement (including Fujitsu). In

2008, the contract with TranSys was set to terminate in 2010 – five years early. A new contract between Transport for London, Cubic and EDS (original consortium members) was negotiated between 2010 and 2013.

Success: In the decade following the launch of the Oyster card 60 million cards have been issued and over 85% of all rail and bus travel in London is paid for using an Oyster card. The number of cash fares taken on buses and station ticket offices within the Greater London area has been dramatically reduced.

Challenges/barriers faced: Non-payment or failure to 'touch out' at the end of a journey is difficult to police in such a large system. Such incomplete journeys are managed by Transport for London at the current time through issuing a maximum £8.60 standard fare for the journey.

Whilst customer data is secure, there is a residual concern relating to the privacy of Oyster card users. One of the biggest challenges remains the lack of integration with the National network, which prevents a fully integrated ticketing and payment experience for those commuters coming into London from across the country.

Transferability/learning/scaling up: The system continues to evolve and payment by contactless debit and credit cards was introduced in December 2012. As the technology utilised by Oyster is commonly employed in other transport systems, lessons around tackling issues experienced by London and other cities can be shared. London now has a wealth of experience of delivering a successful system – which was second only to the Octopus in Hong Kong so there is much that Transport for London could share with cities looking to introduce or improve their own smartcard payment systems in Europe and further afield.

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5.8 Real time traffic information, Budapest, Hungary

Thematic group: ITS
Specific area of focus: Contributes to the 2011 White Paper goal concerning integrated ticketing and payment systems
Why good practice? Hungarian project harmonizing transport services and enhancing mobility through ITS deployment using inputs from motorists
Time period: 2013-2014
Budget: €22.3 million

Overview: Since 2010, a series of developments have been made in integrating real time traffic information in Budapest, with the aim of reducing congestion across the city. A real time information system has been put in place, with cameras installed across the city, at motorway entry points and other identified traffic bottlenecks – including the bridges over the Danube.

Background: The Municipality of Budapest is the local transport authority in the city, but until 2010 there was no real cooperation between urban and transport development, from an institutional and a procedural point of view – the responsibilities between operators and owners were unclear.

Process: The establishment of the Budapest Mobility Centre (BKK) was intended to integrate the management of all transport and services across modes including public transport, cycling, road infrastructure, parking, taxi services and transport development projects. BKK, being aware of huge congestion problems facing the city, aimed at improving this situation by developing an integrated solution for mobility management – a real-time traffic information system, which was implemented as part of the EasyWay project. A number of options were considered in advance of the introduction of the system, it was decided that leaving route selection to drivers whilst offering travel times. This was seen as the simplest and most impactful solution.

Details: These cameras are connected to licence plate recognition systems and works to calculate journey times between these identified points. The city has also implemented new GPS-based traffic management and passenger information system (FUTÁR) for surface transport services (all trams, buses and trolley buses). It provides on-board visual and acoustical passenger information and real-time travel data in SMS text messages and online journey planner.

The traffic cameras that have been installed are connected to an intelligent licence plate recognition system, which calculates travel time through an automated algorithm. This is then relayed to drivers through electronic boards, which suggest in real time the quickest routes over the Danube based on the traffic levels. The system is also capable to provide data on lane occupancy and overall road capacity and offer customised warnings.

Stakeholders: The system is operated by BKK and the National Motorway Agency in collaboration. It is necessary for all relevant traffic data to be shared between these two organisations and during the pilot phase the relationship between these two entities was strengthened.

Success: The system proved to be reliable during its pilot phase, which ended in June 2013. Feedback from users has also been positive and one of the key successes has been the collaboration between the authorities responsible for managing the traffic management.

Challenges/barriers faced: The system is still very new and more time and research is required to see the long term effect that real time information provision will have on congestion and traffic levels in the city.

Competing initiatives could be beneficial, or present challenges to the BKK system. For example, Jitti – or just in time traffic information – is a traffic information system that has also been in operation in the city since 2010. Jitti is distinct from the BKK-managed service and relies on users providing information. It measures speeds and traffic levels using GPS and information appears in real time on the internet and signed-up users smartphones. Such services could be combined with the BKK network over time, or could stand in competition to it, but as it relies on individual users, has a narrower public base to engage with. It has also been in place longer than the BKK system, which suggests it has had a limited impact in terms of reducing congestion at a large scale. It is at the current time too early to tell what the impact of competing initiatives will be over time.

Transferability/learning/scaling up: The background of this project is based on good practice learning – starting from its origin, which can be seen in establishment of BKK to fully integrate transport in Budapest. The concept of a new institutional system for Budapest was developed after the assessment of the practical experiences of major transport organizations around European cities (e.g. Transport for London, AB Stockholms Lokaltrafik, Berliner Verkehrsbetriebe). After examining a number of different models, it has been decided to select Transport for London as the most appropriate model of BKK.

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5.9 Rejseplanen, Denmark

Thematic group: ITS
Specific area of focus: Contributes to the 2011 White Paper goal concerning integrated information, ticketing and payment systems
Why good practice? Rejseplanen and the Danish Road Directorate (DRD) have developed a national online co-modal journey planner which covers public transport, cars (park and ride)
Time period: 1998 – on-going
Budget: €1 million – €5 million

Overview: Rejseplanen is the biggest public transport journey planning service in Denmark. It delivers 10 million online travel plans each month making it the largest public internet service in the country. The prime objective of the service is to provide travellers with complete up-to-date travel information across all public transport modes and walking and cycling. The site is owned and operated by Rejseplanen A/S, but relies on a close working relationship with DSB, the Danish bus and train operator to function.

Background: Denmark is a relatively small country (43.000 km^2) located on Jutland peninsula and is made up of more than 400 islands in the Baltic Sea; the two largest are Sjælland, the site of Copenhagen, and Fyn. A well-connected transport system in Denmark is therefore dependent on several infrastructure solutions capable of integrating all regions

Having this complexity in mind, an advanced tool was needed to provide up-to-date information on trip options, a user-friendly journey planner covering all transport modes, including walking and cycling, without passengers requiring any knowledge of local transport companies. The inclusion of Park and Ride offers is a more recent development to the plan.

The project is implemented through partnerships between the national and regional administrations, the private and non-profit sectors. On the administrative side, such a partnership between so many local and national public transport companies is unique. The system is connected to the EU-Spirit system, but has its own interface.

Process: From the mid-1970s, Danish transport and land use policies shifted dramatically to favour walking, cycling and public transport over the private car. The policy reform was a reaction to the increasingly harmful environmental, energy and safety impacts of rising car use. In 2010, 2.1 million passenger cars were registered in Denmark and 60 % of all commuting-related journeys are made by private car.

The Danish approach to deliver sustainable urban transport is multifaceted, relying on a combination of efficient and integrated public transport and the deployment of new technologies. The state policy assumes that public transport should be an easy everyday alternative to the car. As a consequence, large investments have been made to increase the availability and attractiveness of public transport in cities.

Rejseplanen is one project supporting these policy goals. By improving access to the necessary information by making bus and train times across Denmark readily available, some of the barriers to choosing public transport are removed.

Furthermore, the site was launched to encourage a shift away from car to public transport and cycling, to enhance the number of car-pooling and multimodal trips and to improve mobility by allowing for departure time/route flexibility.

Details: Rejseplanen is a digital multi-channel service providing user-centric information from all public transport companies and some private entrepreneurs. The stated mission of the travel planner was simply to make it easier to travel by public transport. This was achieved by making traffic information easily accessible, accurate, simple and understandable. The system is automatically updated and is therefore able to provide real-time information about possible delays.

Rejseplanen.dk contains data from all Danish train and bus companies as well as information about most ferry services. As well as the website, Rejseplanen is also available as an iPhone/smartphone and Java application.

The journey planner was officially launched on October 1, 1998, with the multi-modal version (including park and ride options) available since 2007. This followed a pilot project to ascertain if such integration was possible. The park and ride element works through using GPs information, linking it with information about park and ride options and using a proven route mixing tool (PTV) the data could be assembled. It is now also possible to purchase train tickets through the site and on-going development continues.

Stakeholders: There are several stakeholders engaged in Rejseplanen. A consortium of Danish national and regional public transportation transport companies, including DSB, BAT, Fynbus, Sydtrafik, Midttrafik, NordjyllandsTrafikselskab, Moviatrafik, Metroselskabet own Rejseplanen collectively. The planner is managed by a board consisting of representatives from the owners.

Additional stakeholders involved in delivering the planner include the data suppliers, the national road administration, the Danish municipal governments, the police and all actors concerned with public transport. Rejseplanen is designed not only to be used by Danish commuters. In fact the system embraces all users of public transport in Denmark, resident and visitor alike. The service is available in 3 languages: Danish, English and German, so both national and international users are encouraged to make use of it.

Widespread use of the site would not be possible without the cooperation and partnership from the diverse public transport operators across Denmark working together to achieve the common goal of an integrated, easy-to-use, multi-modal transport system.

Success: By 2007, the service had already reached over 6 million journey plan queries and more than 1.8 million unique users per month. The users are widely distributed across different groups including young and old, male and female public transport users. Rejseplanen currently receives more than 20 million views per month across both web and mobile applications (to compare to the Danish population of 5.3 million people) and is also one of the Top Apps in Denmark with more than 400,000 downloads.

The service also helps the public transport authorities reduce resources spent on providing information to their users. The service is nation-wide and provides door-to-door travel information for the entire journey independent of which public or private transport authorities are involved.

Challenges/barriers faced: Rejseplanen faced two overall challenges. The first is connected with the changes of customers' expectations and needs, as well as the technology these customers are using. Rapid changes in technology make the prioritization of a particular product and service roadmap increasingly difficult. The second challenge refers to the

complexity of the Rejseplanen ownership structure and organization. Bringing together disparate actors from diverse sectors and ensuring integration of data and service information was a huge challenge, but it has been overcome to deliver a successful product.

The enduring challenge is that such a complicated structure demands a high level of involvement to make discussions and decisions on strategically important issues fruitful. Additionally, ensuring that the real time data available on services is reliable across the network remains an everyday challenge which Rejseplanen appears to deal with very well.

Transferability/learning/scaling up: The successful implementation of Rejseplanen has demonstrated that user-centric services can be delivered, but that such a project requires collaboration, both vertical and horizontal, between both public and private partners (on different levels) and sometimes even between partners who in other situations could be viewed as competitors.

Rejseplanen has also proved that it is necessary to engage all potential users in the planning process – and continues to receive a broad range of input (including user surveys, end user groups, professional user input, and continuous feedback via mail/phone) which can be used to keep the service operational. Rejseplanen continues to be one of the best and most successful examples of an online public information service.

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5.10 Touch & Travel, Deutsche Bahn, Germany

Thematic group: ITS
Specific area of focus: Contributes to White Paper 2011 goal of establishing the framework for a European multimodal transport information, management and payment system
Why good practice? Smart phone app using near field communication for ticketing and payment
Timeframe: 2008 – on-going
Budget: No available data

Overview: Deutsche Bahn introduced 'Touchpoints' to 320 of its long distance stations in 2011, following a 3 year pilot to trial integrated ticketing and payment through smartphones. The pilot and initial roll out of the technology was successful and the system has been expanded to more stations with regional connections. The system is now app-based and relies on GPS tracking to identify where customers begin and end their journeys.

Background: With the advent of smart phone technology, many transport service providers, Deutsche Bahn included, have developed ticketing and payment systems which are directly connected to the devices. Deutsche Bahn has moved away from being just a train company towards becoming an integrated system provider and integrator and ticketing is just one part of this integration across all services.

Process: The Ring and Ride project which was funded by the German Ministry for Education and Research (BMBF) from 2001 to 2005 investigated the feasibility of utilising multi-functional mobile-based ticketing. A consortium of technology partners including Deutsche Bahn began a technology demo in 2007 and by 2008 a 3 year pilot project trialling Touch & Travel was rolled out. Following this successful pilot, Touch & Travel was launched across 320 long distance railway stations in Germany. Since its initial launch, Touch & Travel has been rolled out across more of the network, to include more regional connections and has kept speed with technology improvements in changing how the customer interface with the system works.

Touch and Travel brand

Details: The 'Touchpoints' that were installed in long distance railway stations in Germany use near field communication (NFC) and 2D barcodes to allow customers to start and finish their journey. The customer's mobile phone stores ticket information and payment data and the Touchpoint terminal then transmits billing data to the company and on to the customer. The Touch & Travel app is now aided by the GPS module in the smartphone. This enables the location of the equipment and the passenger throughout the journey. The advent of app-software located in the smartphones revolutionised the Touch & Travel offering. An important point is that the journey is dynamic and by commencing the journey at the start station, the passenger has a valid ticket regardless of where the destination of the trip is, even if this changes.

Customers must download the Touch & Travel app onto their smartphone and register to use the service. Before each journey, customers must log on and at this point the customer has a valid ticket and should simply show their phone to the inspection staff on board the train. At the end of the trip the customer should log out of the system and a cost for the trip is then calculated and sent to the passenger. Deutsche Bahn keeps track of all of the journey

information and will calculate the cheapest fare for each journey and for multiple trips in one day, a day rate if this is ultimately cheaper. Monthly bills are issued for all trips by direct debit.

Stakeholders: The initial pilot project and roll out involved the following technology partners, Vodafone, Giesecke and Devrient, NXP, Motorola and Atron. There was a need for really in-depth cooperation with the mobile network providers to move to the GPS system – this started with the T-Mobile network and has subsequently extended to all the networks. The initial roll out and subsequent expansion of the scheme has involved strong collaboration and partnership between the regional and central transport authorities. The Association of German Transport Companies (VDV) was also involved in the early developmental activities.

Success: In 2011, Deutsche Bahn experienced growth of 17% and saw the number of passengers travelling rise by 18.4 million. In 2013, 43 billion passenger kilometres travelled on Deutsche Bahn's rail network. Part of the success of Touch & Travel has been the usability of the system. It is a very accessible technology which takes the hassle of ticket purchasing out of the journey and calculates the cheapest fare for a trip and is therefore perceived to be user-friendly.

Touch & Travel has been nominated for the Travel and Mobility Award at the 2014 MobileTech Award. The winner will be voted for by the users, so if the system wins, this is indicative of public support for the technology and demonstrates that it has been successful.

Challenges/barriers faced: An initial challenge was getting technology into the smartphones to enable the NFC to work. This challenge was overcome when the GPS technology became available and improved access to the system for all.

However, with this development another key concern has emerged around the issue of data protection. Deutsche Bahn needs to ensure the protection of people's private data, not just in terms of the payment for the service, but in terms of having access to mobility and movement profiles through the use of GPS technology. There is a fine balance to keep to in terms of not collecting too much data and ensuring that it is protected and disposed of in the right way.

Finally, a user-based concern is that with the current system the onus is on the user to 'log out' to end the journey. With NFC the passenger would pass the device that detects the end of the journey. With GPS however, if the customer does not log out, then there is no other way to determine the trip is over and customers may be charged for travel despite having ended the journey because the system is still tracking location.

Transferability/learning/scaling up: The expansion of the network to other stations in Germany demonstrated that this business model could be scaled. It is a product that could clearly be applied elsewhere and it is in the interest of Deutsche Bahn to share it. Representatives of the company are active at hearings and events in the EU and at business conferences where in-depth information about the development and deployment of the technology can be shared. Deutsche Bahn remains active in promoting knowledge about their experiences in this area.

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