The strategic impacts of upgrading the E22 from Malmö to Kalmar

An analysis of the changes in travel time and mobility

Table of contents

1 Introduction

The analyses in this report illustrates some of the more general – or strategic – consequences of upgrading the E22 to motorway standard between Malmö and Kalmar.

The analyse has been undertaken by PRODEC Planning Consultants for the Chamber of Commerce and Industry of Southern Sweden.

The methodological approach has been to use a strategic mobility model to illustrate the potential for interaction both before and after the upgrade of E22 as well as the difference. In this case interaction has been defined as the possibility to participate in a normal working day.

The result of the analyse is presented in a number of thematic maps. These maps can be interpreted individually – but can also be interpreted in connection and thereby form a broader basis for evaluating the strategic impacts of the upgrade. Two different types of maps has been used in the analysis:

- Isocrones
- Interactionbands

The isocrones shows the distance in time to a certain city and thereby how accessible the city is. In this analysis the distance in time to Malmö and Kalmar is shown with isocrones.

The Interactionbands differs from the isocrones and shows the potential for participating in a specific kind of activity. In this analysis the activity has been defined as the possibility for participation in a workday with 1 hour of transport to and from the workplace. The interpretation of the interactionbands is a bit more complex than the interpretation of the isocrones.

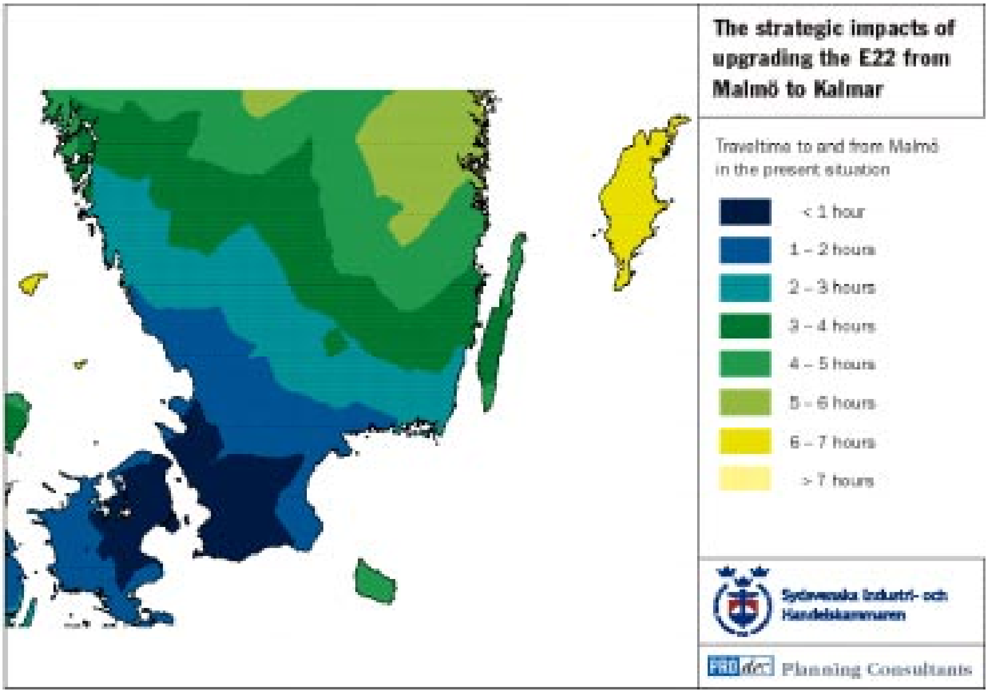
2 The strategic impacts of upgrading the E22 between Malmö and Kalmar

2.1 Isocrones

As the name implies the isocrones shows the distance in time relative to a location. The isocrone is the same whether one travels to or from the location. The present situation includes the fixed link over Öresund as it can be seen on the isocrone maps.

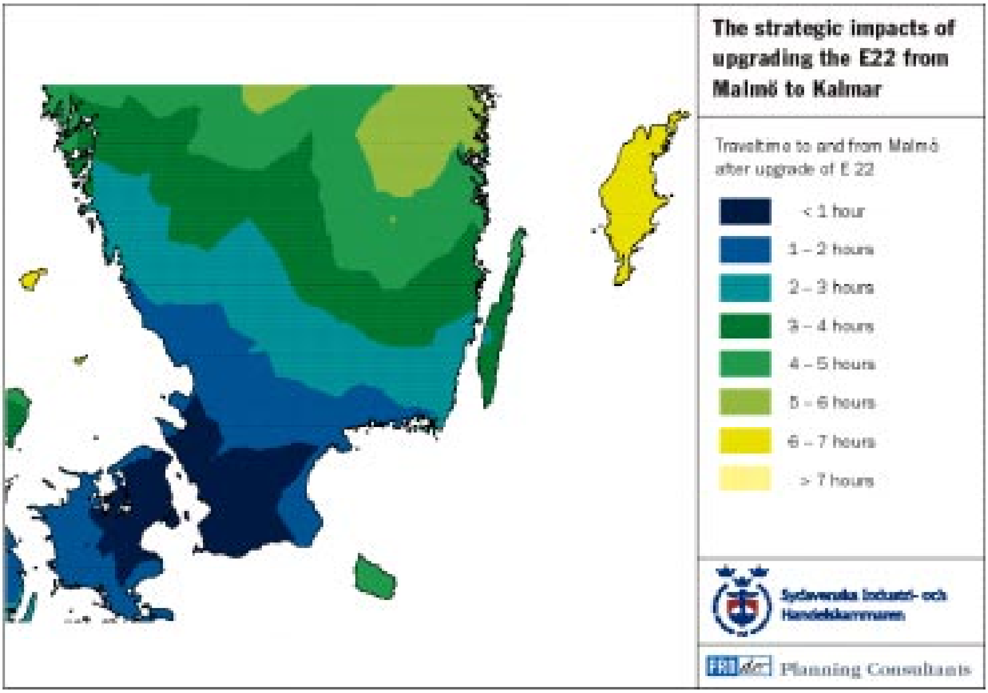
The first sets of isocrones shows the travel time to and from Malmö before and after an upgrade of the E22 between Malmö and Kalmar to motorway standard as well as the geographical distribution of the travel time changes.

Isocrones for car travel time to and from Malmö in the present situation.



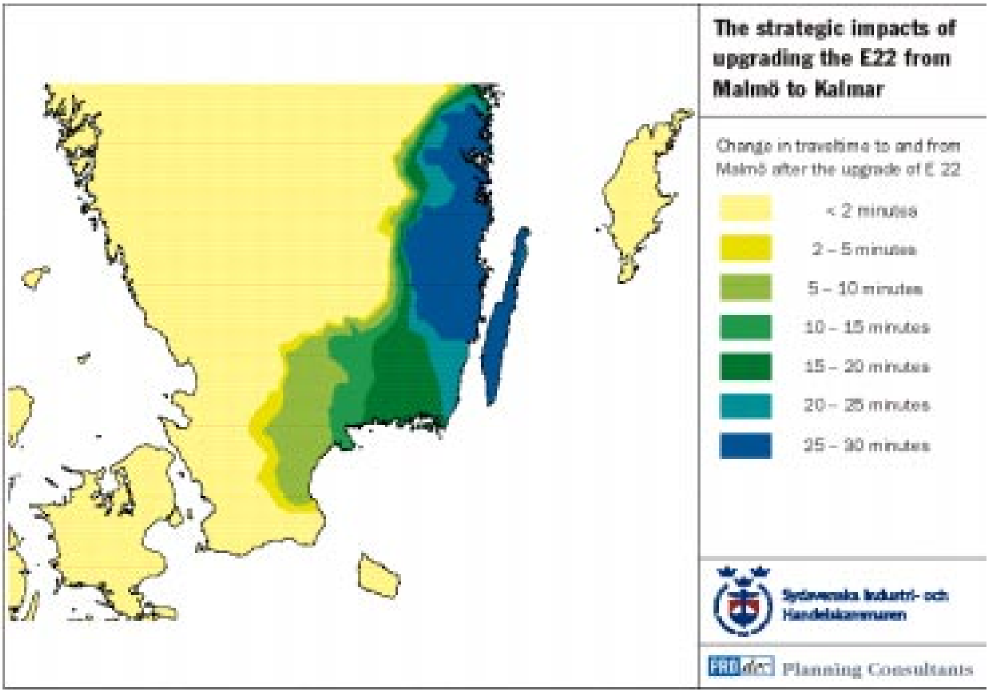
The general structure of the Swedish road network can easily be seen on the isocrone map where the E6 are stretching the isocrones towards Göteborg, the E4 are stretching the isocrones towards Jönköping (and Stocholm) and the E22 are stretching the isocrones towards Kristianstad and Kalmar.

Isocrones for travel to and from Malmö after the E22 has been upgraded to motorway standard between Malmö and Kalmar.



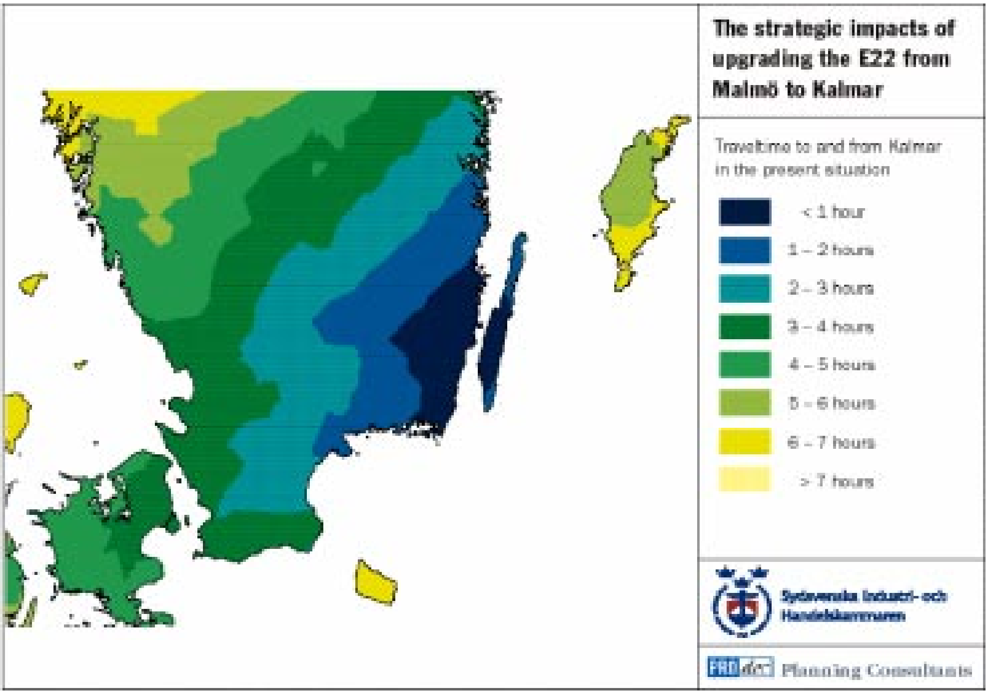
The consequences of the upgrade of the E22 to motorway standard can be seen as a stretching of the time-bands along this road. The following figure shows the exact amount and the geographical distribution of the change in travel time.

The decrease in travel time to and from Malmö as a consequence of the upgrade of E22 to motorway standard between Malmö and Kalmar.



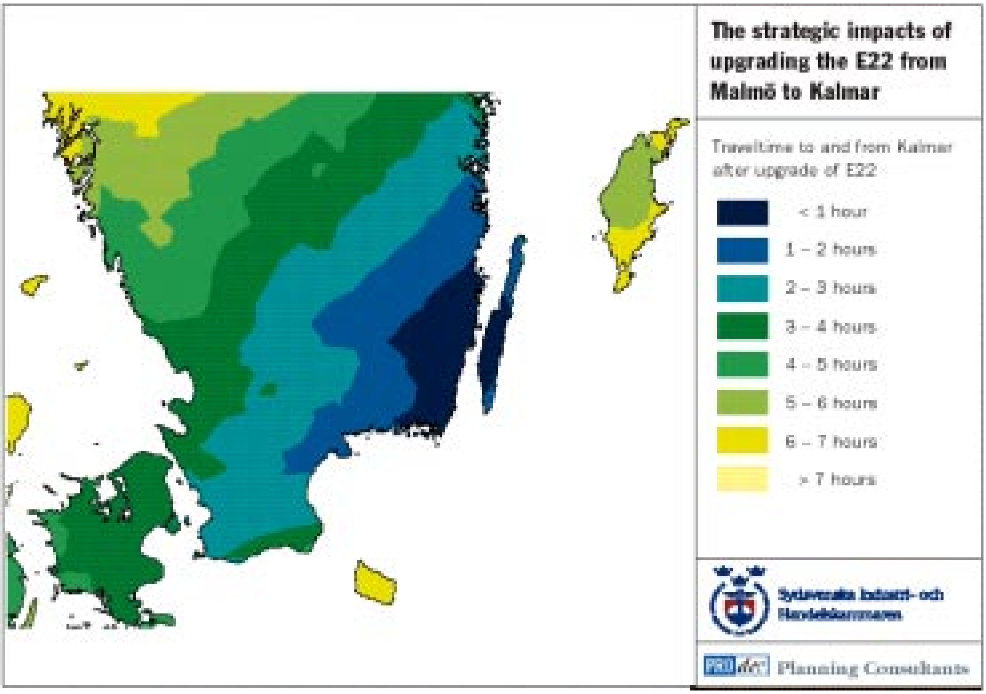
The largest decrease in travel time can be found in the vicinity of Kalmar where the travellers will have the full benefit of the upgrade. But the upgrade of the E22 will also offer travel time benefits for travel to and from areas north of Kalmar. The yellow 2–5 minutes band also marks the area that the E22 influences for journeys to and from Malmö. The influenced area is limited mainly by road 23 to Växjö in the southern part and by E4 to Stockholm in the northern part.

Isocrones for travel to and from Kalmar in the present situation.



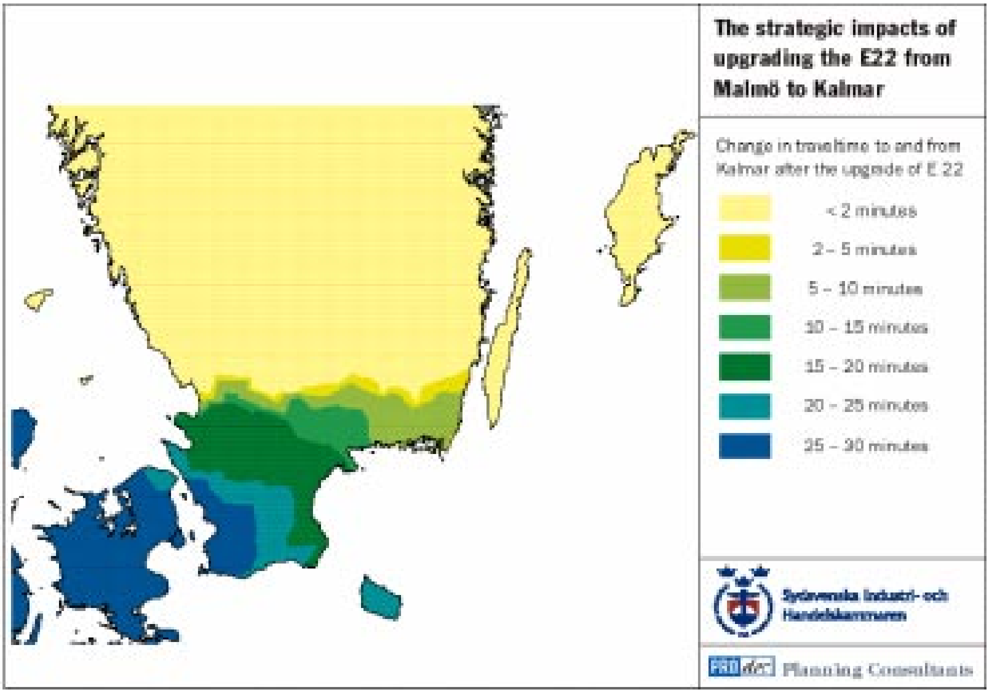
The structure of the general Swedish road network can also be found in the maps showing the travel time to and from Kalmar. The E22 is stretching the time bands in direction towards Stockholm and Kristianstad/Malmö while road 25 is stretching the time bands towards Växjö and Halmstad and further up north towards Göteborg.

Isocrones for travel to and from Kalmar after the E22 has been upgraded to motorway standard between Malmö and Kalmar.



As the travel time to and from Malmö the upgrade to motorway standard stretch the time-bands along the E22 even over the Öresund fixed link into Denmark. The decrease in travel time to and from Kalmar can be seen on the following figure.

The decrease in travel time to and from Kalmar as a consequence of the upgrade of E22 to motorway standard between Malmö and Kalmar.



In this case the area of influence (as marked by the yellow 2–5 minute band) is limited northward by road 25 between Kalmar and Halmstad. An interesting effect is that the travel time savings extend across the Öresund fixed link and thereby implies that the 25–30 minutes travel time saving will be available also to travellers from north-west Europe.

2.2 The potential for interaction

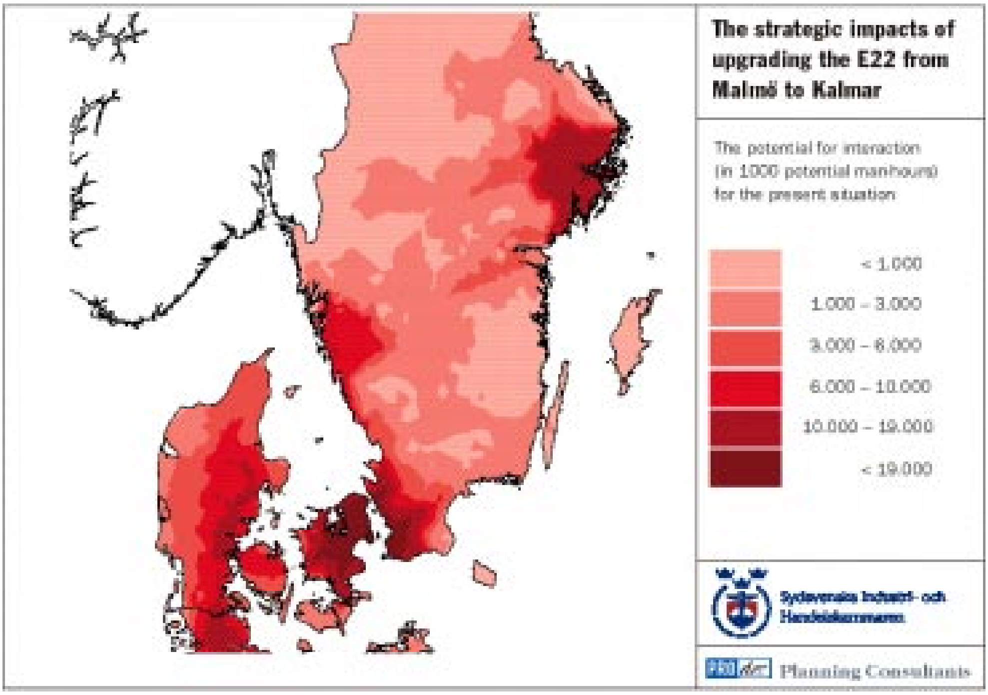
Changes in the character of the infrastructure also changes the potential (or opportunity) for people to interact.

An upgrade of a road like E22 to motorway standard will result in an increase in the potential for interaction for the people living in the vicinity of the road. This does not imply that people are going to make use of this potential, but the fact that the potential increases also increases the possibility of people utilising the potential.

In this analysis the potential for interaction has been defined as the potential for participating in a normal working day. It is assumed that people are willing to travel a maximum of one hour to and from their work.

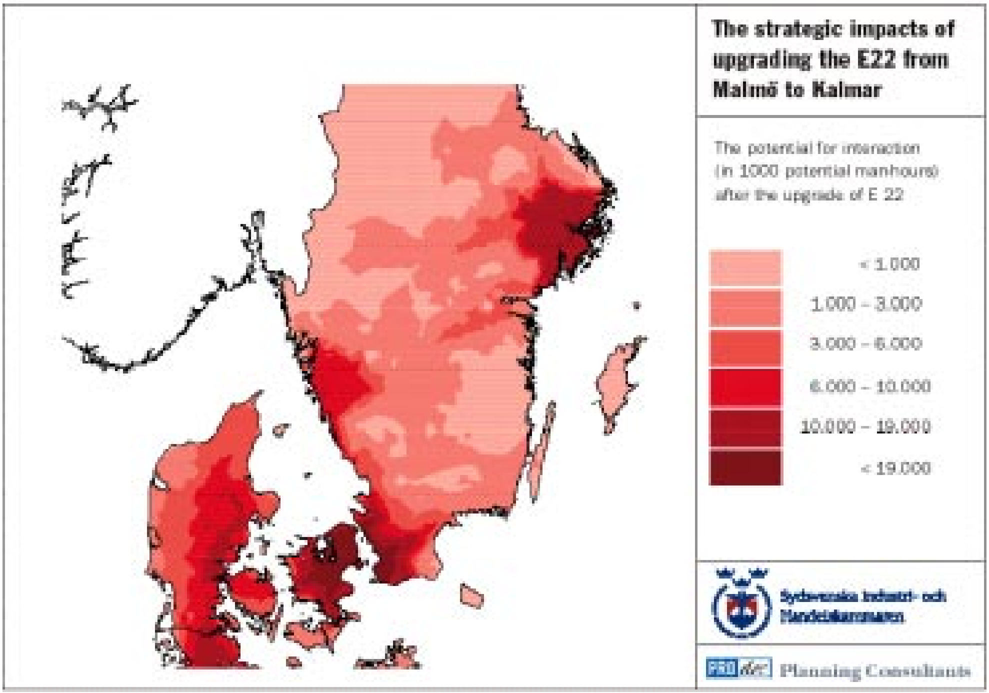
The potential is found by multiplying the number of people with the number of hours that one can interact with these people. This means that the potential for participating in a workday, all things being equal, is bigger in and around the bigger cities where the population is larger. In this analysis the distribution of workplaces are assumed to follow the distribution of the population. The maps that are the results of this analysis shows the combined effect of the transport system (in this case the road network) and the spatial distribution of the population. As a result of this, areas with good transport infrastructure and high population density will have a larger potential for interaction than areas with either low population density or poor transport infrastructure.

The geographical distribution of the potential for interaction for a trip type that corresponds to a normal workday (8 hours of interaction – 1 hour of travelling each way), in the present situation.



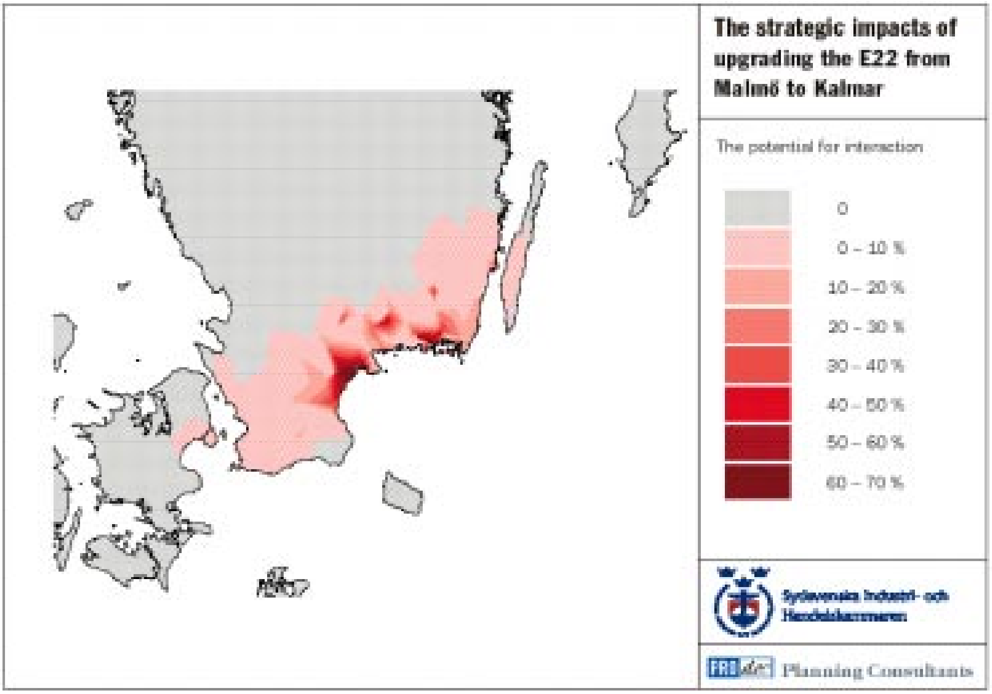
The potential for interaction in the southern and central parts of Sweden is highest in the areas with the largest agglomerations of population; Stockholm, Göteborg and Malmö. The same can be seen in Denmark where the total level of potential is slightly higher due to the higher population density.

The geographical distribution of the potential for interaction for a trip type that corresponds to a normal workday (8 hours of interaction – 1 hour of travelling each way), after an upgrade of the E22 to motorway standard between Malmö and Klamar.



As for the timebands the initial result of upgrading to motorway standard seems to be a stretching of the iso-potential along the E22. The geographical distribution of the increase in potential for interaction (in %) can be seen in the following figure.

The geographical distribution of the change in the potential for interaction for a trip type that corresponds to a normal workday (8 hours of interaction – 1 hour of travelling each way), as a consequence of an upgrade of the E22 to motorway standard between Malmö and Kalmar.



The change in potential as the result of upgrading the E22 is shown in percent of the increase in potential. This means that if the increase is 100%, the potential for this kind of interaction is doubled as a consequence of the upgrade of the E22 to motorway standard. One has to bear in mind that the map only shows the increase in potential and not directly anything about the utilisation of this potential.

The area of influence is limited by the maximum travelling time of one hour. This means that with this measurement of potential there is no impact on areas more than one hour from the E22.

The figure shows that the largest increase in potential can be found in and around Kristianstad and Karlskrona but also in an area north of Karlshamn. One of the main reasons for the increase in and around Kristianstad is that the upgrade of E22 makes it possibly to reach both the Malmö and Karlskrona area within one hour. Hence, the increase in potential in the Karlskrona area is due mainly to the possibility of reaching and spending more time in Kristianstad and Kalmar.

The increase in the area north of Karlshamn is mainly due to the combined effect of spending more time on interaction in both Kristianstad and Karlskrona.

3 Analysis background

This section gives a short description of the analysis background and the used models.

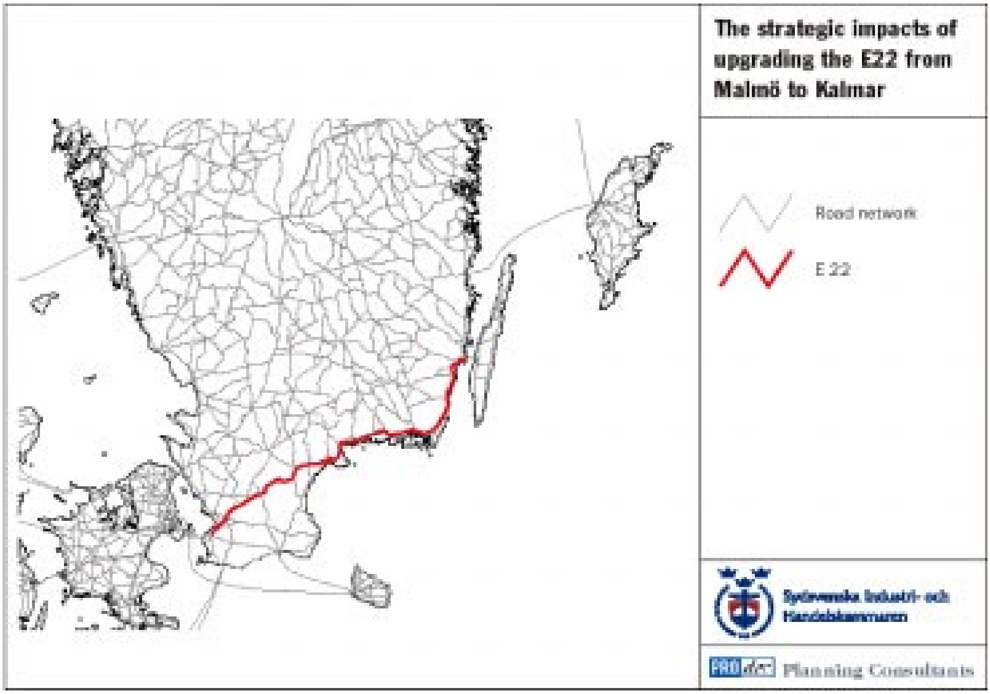
The analyses presented in this report are all calculated and visualised by implementing the models in the geographical information system ARC/INFO. The calculation of both the Isocrones and the interaction-bands have been based on a common digital network.

For each of the isocrones and interactionbands 3 maps have been calculated: Two maps showing the situation before and after an upgrade of the E22 respectively and one map that illustrates the difference between the two situations.

3.1 The transport system

The geographical area covered in the analysis includes all of Sweden and Denmark and has not been limited to the region around the E22 between Malmö and Kalmar.

The traffic network used in the analysis.



The transport system used, is a multi-modal transport system such that different modes are included and changes between these modes is possible. This analysis only incorporates a road network and the ferry connections that link up the road network.

All links in the road network is classified into 8 different road types. A functional classification is used in order to take national differences into consideration. For each of the 8 classes an average travelling speed is estimated based on the speed limits in Denmark, Sweden and Germany.

All travelling times are free flow and there is on capacity constrains in the model.

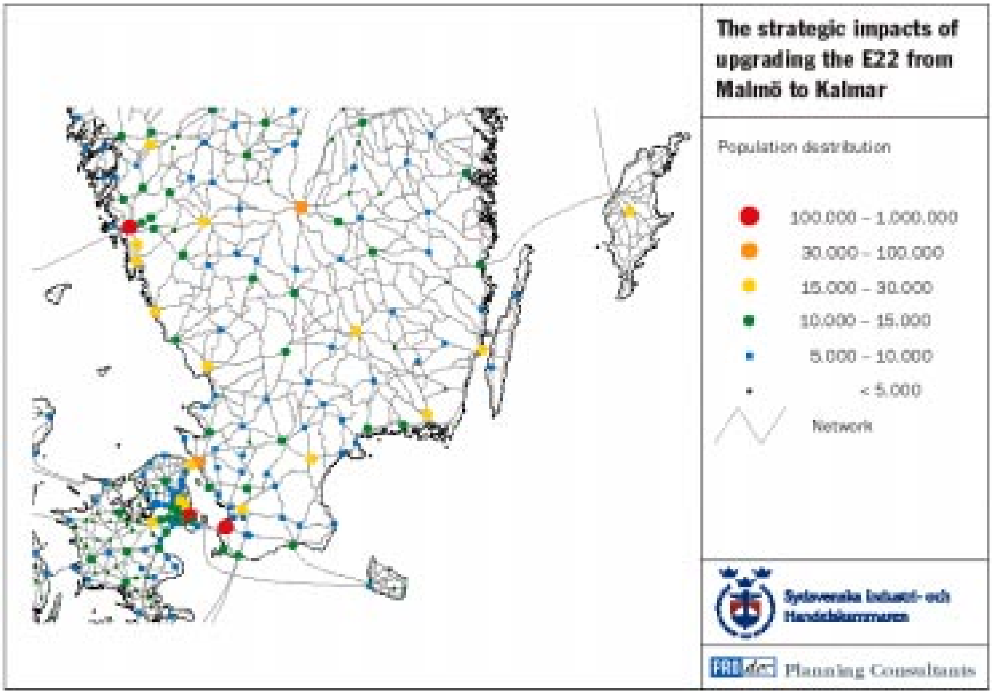
However, it should be noted that the travelling speed on the E22 has been set according to the speed limit provided by Vägverket specifically for this project.

Average travelling speed for passenger cars in the used network.

	Average travelling speed for passenger cars in km/time		
Road type	**Denmark**	**Sweden**	**Germany**
Motorway	110	110	130
Motor-traffic roads	90	90	100
Major rural roads	80	70	80
Rural roads	60	50	70
Other rural roads	50	50	50
Traffic roads	50	50	50
Secundary traffic roads	40	40	40
Local roads	30	30	30

The spatial distribution of the population is used to represent activity when calculating the potential for interaction. The population is distributed by municipality in Sweden and Denmark.

The spatial distribution of the population.



3.2 The POINTER interaction model

In this analysis the POINTER1 model has been used as interaction model. Besides information about the travel time in the transport system the POINTER model uses socio-economic data such as the population. In this analysis the population has been distributed according to the municipalities in the different countries (Denmark – 278 and Sweden – 288). The population figures used are from 1998.

The main purpose of the POINTER model is to give an indication of the potential (or opportunities) for human interaction that arises as a consequence of changes in the infrastructure.

The POINTER model aims at describing the correlation between the activity system and the transport system, and hereby quantifying the individuals potential for participating in activities.

The activity is an indicator for how attractive a location is. A location where there is plenty of activity will, all things being equal, be more attractive than a location with less activity regardless of measure of activity. In this analysis the activity used is the population, but it could just as well had been the number of cultural offerings or the economic activity.

The transport system is normally represented by the resistance of using the system for travelling. This resistance can be in terms of time, financial cost or some kind of generalised cost. In this analysis time has been used as transport resistance.

In the POINTER model the time is split into two components. This due to the fact that an activity in a location has no value if there is not enough time left to participate in the activity. The first time-component is thus the minimum time required in order to participate in a specific activity (TI).

The second time-component is the limitation in the available time (TA). Within the available time the individual has to be able to travel to another location, participate in some kind of activity and return to the origin afterwards. In this analysis, the potential of participating in a work-day has been limited by a travel time of less that 1 hour each way (which corresponds to a TA of 10 hours) and a necessary interaction time TI of 8 hours (one full working day).

The POINTER model is constructed in such a way that a reduction in travel-time will correspond to an increase in time for interaction. This means that the potential for interaction will raise with a decrease in travel-time.

The mathematical formulation of the POINTER model is:

$$POINTER_i(T_A, T_I) = \sum_{j=1}^{N} P_j(T_A - 2 \cdot t_{ij}); \quad for\ t_{ij} \leq \frac{T_A - T_I}{2}$$

Where T_A is the available time
T_I is the minimum required interaction time
P_j is the population in the location j
t_{ij} is the travelling time between the location i and j

The potential value for a location *i* is defined as the product between the total population P_j in the location *j* and that time span that are available for interaction (or contact) in this location. Those locations (j=1... N) that can be reached are determined by fixing a minimum time span T_I, that are necessary in order to participate in an interaction within the available time span T_A. T_A can be set to any time span in order to evaluate trips with a minimum required interaction time T_I. The shortest possible travelling time provided by the transport system t_{ij} covers the travelling time between the location *i* and *j*.