

EVALUATION PROGRAM FOR THE LUND INTELLIGENT SPEED ADAPTATION (LISA) PROJECT, 1999-2001

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INTRODUCTION

The Swedish National Road Administration (SNRA) will perform a large-scale trial with Intelligent Speed Adaptation (ISA) in Sweden during the years 1999 to 2001. The trial will take place in four cities, Borlänge, Lidköping, Lund and Umeå, and there will be different systems evaluated in the different cities.

The system which will be evaluated in Lund is the active throttle which means that the car works like a normal car in speeds up to the speed limit. If the driver tries to exceed the speed limit, he will have to push the throttle with a greater force to accelerate. This system does not make it impossible to speed but it helps the driver to adapt his speed to the prevailing speed-limit.

Test area

The test area includes the entire city of Lund which consists of all legislated speed-limits in Sweden, 30, 50, 70, 90 and 110 km/h. However, the speed-limiter (SL.) will only interfere if the driver tries to exceed the speed limit on 30, 50 and 70 streets. On streets with other speed-limits the speed will only be logged. The system will be turned on every time the vehicle enters or starts in Lund and it can not be turned off inside the test area. Outside Lund the SL. can be used voluntarily.

Control

Some of the studies described later in this document will be carried out in Helsingborg as well as in Lund. Helsingborg is a city 60 kilometres north-west of Lund and has about 115 000 inhabitants, compared with 100 000 for Lund. Helsingborg will be used as a control city to be able to detect eventual general changes in traffic behaviour. National data from the SNRA will also be used as a control.

Test driver selection

There will be a total of 300 vehicles equipped with the SL. Some of the vehicles will be driven by more than one person, so the number of test-drivers will be approximately 350.

The drivers will be divided into groups with regard to sex, age and initial attitude towards the SL. There will be four age-groups; 18-24, 25-44, 45-64 and 65+. Together

with sex and positive/negative attitude to the SL, this makes 16 cells with 15-20 drivers in each.

Of the selected drivers 50% will be from different companies / organisations and 50% will be private drivers. From the company car selection there will be some vehicles driven by professional drivers. These will consist of approximately 30-50 taxis, 20-40 buses and 20-30 delivery cars. The rest of the company cars (up to 150 vehicles) will be recruited from local companies and organisations such as the hospital and the city council. The rest of the 150 vehicles will be recruited amongst private drivers who will be contacted when they leave their car for its annual motor vehicle inspection.

STUDIES

Questionnaire- / interview- studies

There will be three different questionnaire studies carried out throughout the project.

Baseline questionnaire

The object of the baseline-questionnaire is to find out what attitude different traffic groups have towards speed and safety. The result from the survey shall then be used as a guideline for the recruitment as well as a norm to compare with the interviews made with the test-drivers. It will also be used as a comparison between the different cities within the project.

The baseline study will be carried out twice, once before the LISA-trial starts and once in the end of the trial. The before study is already completed.

The questionnaire was sent by mail to 750 randomly selected inhabitants of Lund in the ages of 18-74 years. It consisted of six different parts. The first part dealt with what the respondent thought was important regarding his/hers personal travels and travels in general, the second part dealt with speeds and speed-limits followed by a part about compliance with traffic-regulations. The fourth part considers accidents, the respondents own experience as well as their opinion about what causes accidents and where the risk of having one is the greatest. In part five the respondents are asked to give their opinion about the effectiveness of some safety increasing measures and in the final part they are asked about background-information about themselves and their household.

Recruitment-interview

The recruitment procedure will be somewhat different between company drivers and private drivers. The private drivers will be asked about their opinion of the different systems used in the Swedish ISA-trial as well as a few questions from the base-line questionnaire. These questions will be same for all the four cities. Further the drivers will be asked about themselves and their vehicle, if they are planning on exchanging it during the forthcoming year and how many kilometres they drive the vehicle in Lund annually. They will then be asked if they are willing to participate in the trial, and if they don't want to participate they will be asked to give a short explanation why not. This interview will be carried out as a questionnaire but with an interviewer on sight helping the respondent. The interview will take place at the Swedish Motor Vehicle Inspection Company in Lund.

For the company car drivers there will not be any question about if they want to participate or not since this has already been decided by their employees. The rest of the questions however are similar.

The object of this study is to categorise the test-drivers into the 16 cells as well as to categorise the persons who are not willing to participate.

Interview with all test subjects

All LISA test-drivers will be interviewed four times; before their vehicle is equipped with the SL., after driving with the SL. for one month, at half time and finally at the end of the project. Most of the questions from the base-line questionnaire will be in there, but there will also be more specific questions about the SL.

The object of the questionnaire is to study the drivers attitudes and experiences of the SL. and possible changes after using the equipment for a year.

The first interview will be carried out with some help from the interviewer whereas the following three will be sent to the test-persons by mail. In the first interview the questions regarding the SL. will be focused on the expected effects that the system will have on their driving, experienced stress, interaction with other road-users, time-consumption etc. The following interviews will focus on the test-drivers experience with regard to the same variables.

Parts of the questionnaire will be designed together with the other test-sites to make a comparison possible.

In depth interviews

In depth interviews will be carried out on a smaller sample of the test drivers. The interviews will be regarding their experiences with the SL., how the system has changed their driving and their attitudes and what they think the future possibilities are for a system like this.

Field studies

Field studies will be carried out in Lund as well as in the control city Helsingborg. The object of the studies are mainly to make sure that the traffic-situation is comparable throughout the project, but there will also be a possibility to study changes in speed.

Traffic counts

The traffic flow will be measured at 45 different sites in Lund with a data-log. It will be measured during weekdays for 24 hours at each site, before and after the equipment of the vehicles. The flow data will be presented as AADT. Control-measurements will be carried out at 8 sites in Helsingborg. The traffic flows will be used as a control of the traffic situation, but also as a base for the emission calculations.

Speed-measurements

Speeds will be measured with two different methods, data-logging and radar-measurements. The speeds will be measured before and after the vehicles are equipped.

The data-log measurements will be carried out at 17 sites representing the speed-limits 30, 50 and 70 km/h. The speeds will be measured for 48 hours at each site. Control measurements will be made at 6 sites. The speeds will be used as a control of the traffic situation

At specific spots, such as intersections and pedestrian crossings, speeds will be measured with radar. In Lund, spot-speeds will be measured at 12 sites, 8 intersections and 4 pedestrian crossings. 100 free vehicles will be measured at each site (a free vehicle is defined as a vehicle which has at least 100 meters to the

proceeding vehicle and can choose its speed freely). Control-speeds will be measured at 5 spots.

The SL.-equipped cars will be marked in order to make comparisons between equipped and non-equipped cars. However, the amount of equipped cars is expected to be too low to trace any significant differences in speed.

Driving against red

There is a hypothesis that SL. cars will change their driving in a compensatory way, for instance by an increase in driving against red.

Cars will be observed at signalised intersections and the percentage of drivers passing at amber and red will be calculated. Due to the signal-change in traffic-lights that took place on September the first 1999 the observations will not start until spring 2000. This is estimated as a reasonable time for the drivers to adjust to the new situation and since the equipped vehicles will be compared with the non-equipped vehicles there is no need for before / after studies. Five intersections will be observed in two directions at each.

Interaction studies

The aim of the interaction studies is to analyse the difference (if any) between equipped and non-equipped cars as far as their interactions with other road users are concerned.

The hypotheses are:

- Lower speed for the equipped cars will make the drivers more willing to yield
- Drivers of other cars and unprotected road users – knowing that SL. cars can not accelerate over the speed limit – will more often demand priority
- Delay caused by the SL. causes the drivers of the equipped cars to try to avoid speed-reduction
- Cars following an SL. car will become impatient and try to get priority in every situation

Interaction studies will be conducted at two sites in Lund where the amount of SL.-equipped cars is expected to be high. Interactions between car-pedestrian, car-bicycle and car-car will be analysed from video recordings.

The interaction studies will be carried out two times, after driving with the SL. for a short time and in the end of the project when the drivers are used to the system and has developed their driving style in accordance with it.

Driver behaviour studies

With in-car studies it will be possible to conduct studies that are more focused on the driving pattern of a specific driver or vehicle.

In car observations

A selection of 80 drivers, 5 in each of the 16 cells, will be observed using the "Wiener Fahrprobe" method. In short two observers are studying the driver on a standardised test-route, one of the observers are looking at standardised variables such as speed and distance to vehicles in front etc., the other observer is doing free observations looking at driver behaviour and interaction with other road-users. The drivers will be observed twice, once before installation and once one year after installation.

Workload study

A selection of 20-25 drivers will be studied while they are driving an instrumented vehicle. The variables studied will be similar to the ones in the "Wiener Fahrprobe" with the difference that the driver will be alone in the car. The study is aimed at observing the eventual change in workload that the driver experience. A secondary task will be developed to increase the workload imposed on the driver.

Diary

A number of test drivers, approximately 24-40 persons, will be asked to fill in a diary regarding their experience of the SL. The purpose of the diary is to collect low probability events and other experiences which are difficult to trace in other studies. Examples of variables is social press and "pub-talk", experience of accidents and conflicts, mechanical problems etc.

There will be two kinds of diaries, one which will be filled in and sent by e-mail and one booklet for those who do not have access to e-mail.

The subjects will be asked to fill in the diary during three periods of one week at each period. The first time shortly after their vehicle has been equipped with the SL., secondly in the middle of the test-period and finally at the end of the test-period

Data-logging

All 300 vehicles within the project will be equipped with data-logging facilities and a flash-memory. This makes it possible to register and save data about speed, speed-limit, position, time and date. These data will be saved 5 times per second.

The cars will be logged for two months before the SL. is installed, for two months after driving with the SL. a short while and for two months after driving with the SL. for one year.

The logged data will be used to analyse how speeds differ with and without the SL. and how speeds changes over time. They will also be used to calculate emissions, fuel-consumption and travel-time.

Others

Emissions

The data from the data-logging will be used to calculate how the SL. cars emissions differ from ordinary cars (SL. cars in the before studies).

Travel time

The data from the data-logging will be used to calculate if travel time changes after the SL. has been initialised. Certain routes and times will be chosen from the logged positions and average travel-time will be calculated.

Accidents

Statistics from police, hospital and insurance companies will be analysed and the SL. cars will be compared with their previous history / average cars.

Weather data

Throughout the project weather and road condition will be monitored. These data will be used to determine how different results can be compared with each other.