Measure title: **Traffic speed reduction zones in Aalborg**

City: **Aalborg** *Project:* **ARCHIMEDES** *Measure number:* **43**

0 Summary

This measure focused in the experimental comparison between methods to implement new speed limits in the city of Aalborg, increasing the compliance with safe speed limits. The implementation of the speed limits are related to fullfilment of the goals of the Traffic Safety Plan 2008.

Objectives are related to the reduction of roadside accidents, the increase of pedestrian's and cyclist's safety and also the safety perception of security both for families with children, other residents, cyclists and also drivers. Results previewed are the reduction of 3 to 4km/h till 10 km/h in the CIVITAS corridor, and the decreasing of speeding.

The city has in 5 contiguous residential areas within the city implemented different strategies, through a colaborative work team (police, municipal technicians, and CIVITAS team). The initiatives in the different zones consist of:

- Zone 1 (30km/h): Signs, narrowing streets, bumps and bollards including some pre-existing speed reduction measures (30 km/h bumps and signage).
- Zone 2 (40km/h): Appropriate bumps, narrowing streets, signage and bollards.
- Zone 3 (30 and 40km/h): In both areas narrowing streets and appropriate bumps, two pillow bumps, signage and bollards were installed, inluding few pre-existing bumps.
- Zone 4 (40km/h): An entire speed reduction zone using only signage with a 40km/h limit.
- Zone 5 (40km/h): Besides a few pre-existing bumps, this zone relied only on new signs.

A total of 43 flexible bumps have been installed, 23 of 40 km/h speed reduction bumps and 18 of 30 km/h, plus two pillow bumps. Implementation has been completed in July 2010.

Evaluation has been focused in the measurement of speed levels with continued spools and mechanical car counts during a week in autumn 2009, spring 2010 and May 2011 within the experimental area. Society indicators have been compiled via the answers of two online surveys (Jul-Sept 2010 and Sept. 2011) about acceptance, awareness and perception of safety by area residents, anounced by a postal letter. The accidents have also been measured through police records, but the the time scope is too short to get proper conclusions.

Some results: people feeling unconfortable with letting their children walk alone in the street have decreased from 56% to 43% as an average in the 5 calming traffic areas. The share of people who were comfortable with letting their children travel in the traffic increased by 13% from 2010 to 2011. Accordingly, the share of people who felt discomfort with letting their children travel in the local area decreased by 16%. The 'only signage' zone has got the better rates in this issue.

Analysing the difference between zone 1, 2, 3 and 5 in combination (the zones where bumps and/or road narrowing were implemented) and zone 4 (the zone where only signs were implemented), shows a difference. The experienced speed reduction is more explicit in the zones, 1, 2, 3 and 5 combined.

Speed levels have been lowered in the main part of the measured roads within the five zones. The measurement shows that after the implementation of the speed reduction zones, speed level has increased only in minimal % on 3 roads. In the only signage zone, the speed has increased, indeed not surpassing the legal limits.An explanation could be the effect of the signage speed level. After the implementation of the speed reduction zone signs with 40 km/h were placed when entering the zone. Before this project there were no signs and people drove with the speed they felt was justifiable.

A Introduction

A1.1 Objectives

The objectives of the measure are:

High level / longer term:

- To reduce the number of casualties as a result of roadside accidents.
- To ensure pedestrian and cyclists safety.
- To increase compliance with safe speed limits.

Strategic level:

- To reduce the average speed in certain zones in the ARCHIMEDES corridor.

Measure level:

- To establish five speed reduction zones within the ARCHIMEDES corridor.
- To reduced the average speed by 3-4 km/h pr 10 km/h speed reduction.
- To reduce speeding to a minimum.

A1.2 Target groups

- Car drivers
- Cyclists
- Pedestrians
- People living in the areas

A2 Description

Aalborg has established five speed reduction zones in Vejgaard and Aalborg Øst with 30 km/h and 40 km/h speed limits - see Figure 1. Speed reduction zones are established as part of the Traffic Safety Plan and the Speed Action Plan from 2005. The overall goal of the Traffic Safety Plan 2008 is to reduce the number people killed and injured in the traffic by 40% in 2012 compared to 2005.

The five speed reduction zones have been established in residential neighbourhoods in the ARCHIMEDES corridor. The effect of various speed reducing measures such as signs, bumps and road narrowing is being tested.

The reduced speed level is expected to contribute positively to the general traffic safety as well as the safety for particularly vulnerable citizens such as elderly, disabled people and children.

Furthermore, the speed reduction zones will be tested as instruments to address problems of safety and perceived safety in relation to speed. The ARCHIMEDES project has contributed to the design of the zones.

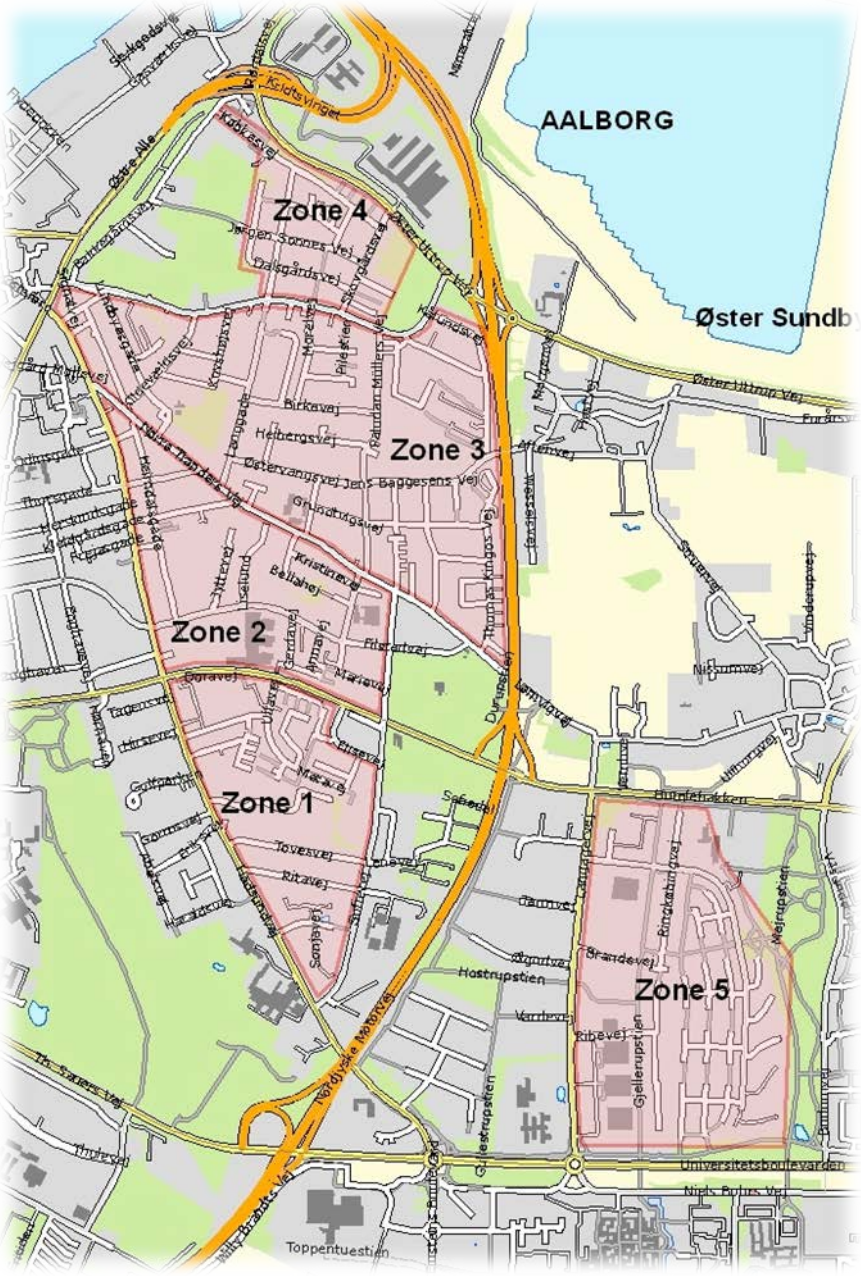

Figure 1. Map of the five speed reduction zones. The zones cover an area with approximately 1.500 households.

The planning and pre-data collection period started in autumn 2009. Several stakeholders such as technicians from the municipality, the police and the ARCHIMEDES secretariat were involved. It was decided to employ several new and innovative speed reduction measures such as flexible bollards, 'pillow bumps' (soft bumps, which are constructed to allow buses to pass with up to the signed speed while they are slowing down regular car traffic, see figure 2) and an entire speed reduction zone using only signage.

Figure 2. 'Pillow bump'.

The construction of the speed reduction measures took place in August and September 2010. At the same time, the residents were kept informed through different communication channels and their comments and concerns were addressed. The speed reduction zones were implemented by the middle of September 2010. Thereafter, the after-data collection and evaluation began.

The speed reduction zones included the following measures:

- Zone 1: this zone was implemented as a 30 km/h speed reduction zone. Signs, bumps and bollards at road narrowings were installed. The pre-existing speed reduction measures (30 km/h bumps and signage) on certain roads were included.

- Zone 2: this zone was implemented as a 40 km/h speed reduction zone with appropriate bumps, signage and bollards at road narrowing's. One pre-existing bump was included.

- Zone 3: this zone was established as a 30 km/h speed reduction zone in the western part and as a 40 km/h zone in the eastern part. In both parts appropriate bumps, two pillow bumps, signage and bollards at road narrowing's were installed. A few pre-existing bumps were included.

- Zone 4: this zone is established as an entire speed reduction zone using only signage with a speed reduction of 40 km/h.

- Zone 5: zone 5 was established as a 40 km/h speed reduction zone. Besides a few pre-existing bumps, which were included, this zone relied only on new signs.

Altogether, 43 bumps were installed, consisting of 23 40 km/h speed reduction bumps, 18 30 km/h speed reduction bumps and two pillow bumps.

A3 Person in charge for evaluation of this measure

Name of person Anne Marie Lautrup Nielsen

Name of organisation	City of Aalborg
Direct telephone	+45 99312307
e-mail	aml-teknik@aalborg.dk

B Measure implementation

B1 Innovative aspects

Innovative Aspects:

- **New conceptual approach.** The idea is that one of the zones (zone 4) is implemented using only signage while the zones 1, 2, 3 and 5 will be implemented with bumps. The speed counts might show if there is a difference between the two types of speed reduction zones.

- **New physical infrastructure solutions**. Firstly, two ´pillow bumps´ were established. Secondly, flexible bollards were established in order to test whether they can replace the existing metal bollards. The advantages of the flexible bollards are that they will damage the car less in an accident and that replacement of the bollard after a car hit can be avoided. Thus, the flexible bollards imply decreased expenses during daily operation.

B2 Planning of Research and Technology Development Tasks

Not relevant.

B3 Situation before CIVITAS

Speed reduction zones are established as part of the Traffic Safety Plan and the Speed Action Plan from 2005. The fact that cyclists' accident rate is higher within the ARCHIMEDES corridor compared to the city's average indicates a need for making use of all measures that can improve cyclists´ safety.

B4 Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: Planning phase. *(15. September 2008 – 14. July 2009) – The planning and pre-data collection phase started in autumn 2008 by a working group consisting of the measure leader, the head of the traffic planning department, and the technical designer.*

Stage 2: Develop tender document *(15. July 2009 – 14. March 2010) – Approval of the five zones by the North Jutland Police. Detailed tender documents, based on the original Description of Work were written and detailed plans were drawn.*

Stage 3: Construction *(15. August – 14. September 2010) - Establishment of the traffic speed reduction zones and the set up of the signage took place.*

Stage 4: Demonstrating and evaluating the zones *(15. September 2010 – 14. September 2011). The after-data collection phase started in autumn 2010 and consisted of accident data, speed levels, and user perception and acceptance. The data collection was repeated in spring/summer 2011.*

B5 Inter-relationships with other measures

The measure is linked to the other ARCHIMEDES measures aiming at increasing cycling and walking - e.g. the 'Cycling Motorway' scheme measure 51, the 'City Bike' scheme measure 52, 'Cycling to School campaign' measure 29 and measure 42 to cater for cyclists and pedestrians at the waterfront.

C Planning of Impact evaluation

C1 Measurement methodology

C1.1 Impacts and indicators

C1.1.0 Scope of the impact

Traffic speed reduction zones are established as part of the Traffic Safety Plan and the Speed Action Plan from 2005. The traffic speed reduction zones are expected to have an impact on the areas where they are implemented. The zones are expected to contribute to lower speed level and increase the safety for soft modes.

C1.1.1 Selection of indicators

NO.	EVALUATION CATEGORY	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
	SOCIETY					
13		**Acceptance**	Awareness	Awareness level	Awareness of the policies/measures	Index (%), qualitative, collected, survey
14			Acceptance	Acceptance level	Attitude survey of current acceptance of the measure	Index (%), qualitative, collected, survey
		Safety	Safety	Perception of safety	Perception of safety when moving in the speed reduction zones.	Index, qualitative, collected, survey
	TRANSPORT					
20		**Safety**	Transport safety	Injuries and deaths caused by transport accidents	Number of accidents, fatalities and casualties caused by transport accidents	No, Quantitative, measurement
23			Traffic Levels	Average vehicle speed - peak	Average vehicle speed over total network	Km/h, quantitative, derived
24				Average vehicle speed - off peak	Average vehicle speed over total network	Km/h, quantitative, derived

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C1.1.2 Methods for evaluation of indicators

No.	INDICATOR	TARGET VALUE	Source of data and methods	Frequency of Data Collection
13	Awareness level	To ensure a safe environment for pedestrians and cyclist. Some of the soft modes may also be car drivers in the speed reduction zones.	Questionnaires. The City of Aalborg has sent out an information letter to more than 3,000 residents in the areas where the speed reduction zones were implemented in July 2010. Along with this letter there was a link to an online questionnaire. The questionnaire was open from July to September 2010 and the response percentage was 4 % . In June 2011 a letter/ flyer was distributed to all household in the five zones along with Post Denmark's regular commercials. The letter/flyer links to an online questionnaire, and the response percentage was 12 %. Both surveys included more than 3000 households.	2 times
14	Acceptance level	To ensure a safe environment for pedestrians and cyclist. Some of the soft modes may also be car drivers in the speed reduction zones.	Questionnaires. The City of Aalborg has sent out an information letter to the residents in the areas where the speed reduction zones have to be implemented in July 2010. Along with this letter there was a link to the online questionnaire. The questionnaire was open from July to September 2010 and the response percentage was 4 % In June 2011 a letter/flyer was distributed to all household in the five zones along with Post Denmark's regular commercials. The letter/flyer links to an online questionnaire and the response percentage was 12 %. Both surveys included more than 3000 households.	2 times
	Perception of safety	To ensure a safe environment for soft modes in the speed reduction zones.	Questionnaires. The City of Aalborg has sent out an information letter to the residents in the areas where the speed reduction zones have to be implemented in July 2010. Along with this letter there was a link to the online questionnaire. The questionnaire was open from July to September 2010 and the response percentage was 4 % In June 2011 a letter/flyer was distributed to all household in the five zones along with Post Denmark's regular commercials. The letter/flyer links to an online questionnaire, and the response percentage was 12 %.	2 times
20	Injuries and deaths caused by transport accidents	To reduce the number of casualties as a result of roadside accidents.	Accidents analysis. The police register traffic accidents in their own system and when the accident is finally registered the data is sent to The City of Aalborg where the data is transferred to VIS (the National Road Directorate information	2 times

No.	INDICATOR	TARGET VALUE	Source of data and methods	Frequency of Data Collection
			system). Thereafter accidents can be withdrawn and used in analyses.	
23	Average vehicle speed - peak	To increase compliance with safe speed limits.	Speed measurements. Automatic speed measurements through spools and car counts were conducted in autumn 2009 and spring 2010 for some of the measure points as pre-data for the evaluation and for qualifying the selection of zones. Similar measurements were conducted in May 2011. The registration lasted each time a whole week. In each zone 1-3 measure points have been chosen. The measure points were chosen in relation to the following criteria: - The measure points should represent both overall roads in the zones and some of the smaller roads in the zones in order to get the full picture of the effect of the initiatives. - The measure points should be related to the new bumps, signage or bollards – not the pre-existing ones.	2 times at all measure points.
24	Average vehicle speed - off peak	To increase compliance with safe speed limits.	Speed measurements. Automatic speed measurements through spools and car counts were conducted in autumn 2009 and spring 2010 for some of the measure points as pre-data for the evaluation and for qualifying the selection of zones. Similar measurements were conducted in May 2011. The registration lasted each time a whole week. In each zone 1-3 measure points have been chosen. The measure points were chosen in relation to the following criteria: - The measure points should represent both overall roads in the zones and some of the smaller roads in the zones in order to get the full picture of the effect of the initiatives. The measure points should be related to the new bumps, signage or bollards – not the pre-existing ones.	2 times at all measure points.

C1.1.3 Planning pre- and after-data collection

EVALUATION TASK	INDICATORS INVOLVED	COMPLETED BY (DATE)	RESPONSIBLE ORGANISATION AND PERSON
Baseline data collection	13, 14, 20, 23, 24	Month 23	City of Aalborg, Mette Mandrup Sørensen and Anna Alice Wust
Collection of after data	13, 14, 20, 23, 24	Month 42	City of Aalborg, Mette Mandrup Sørensen and Anna Alice Wust
D12.2 Baseline and first results from data collection	All indicators	Month 34	
D12.3 Draft results template available	All indicators	Month 45	
D12.4 Final version of results template available	All indicators	Month 48	

C1.2 Establishment of a baseline

Pre-studies of accidents and measurements of speed levels were used to select and delimit the five traffic speed reduction zones. Speed measurements and car counts were conducted in autumn 2009 and spring 2010, both as pre-data for the evaluation and to qualify the selection of zones.

In spring 2010 a questionnaire addressing the perceived traffic safety was conducted with a special focus on the residents of the five coming speed reduction zones. The purpose of the questionnaire was to get a picture of the residents´ opinion of the five speed reduction zones, of their perceived traffic safety and of the speed reduction measures.

The questionnaire included questions on how comfortable the residents were in letting their children travel alone in the local traffic and how they experienced the general traffic safety when walking, driving or riding a bike in the selected areas. Other questions were related to the residents´ opinion on speed limits and bumps ability to increase traffic safety in residential areas, and their opinion on speed reduction zones in residential areas in general.

C1.3 Methods for Business as Usual scenario

The business as usual scenario will imply no changes for speed levels in the smaller roads. Business as usual would imply that the speed limit is maintained at 50 km/h.

In the period 2005-2009 the speed level in the Municipality of Aalborg has decreased on 25 main roads. In the period from 2009-2010 the speed level increases by 2-5 % on the main roads. However, the tendencies from the main roads are not regarded to be transferable to the smaller and minor roads in the speed reduction zones, since the traffic on the main roads servers other purposes than on the smaller roads (e.g. transport of goods etc.) and therefore are affect by factors that will not affect the smaller roads. Hence, the assumption is that the speed on the smaller road in the business as usual scenario has not changed during the project period.

C2 Measure results

The measure has focused on lowering speed levels and increasing traffic safety. The results are divided into speed level (measured and perceived) changes and safety trends.

C2.1: Society

The perceived speed level, before and after implementation of the five speed level zones, has been revealed through questionnaires.

Pre-data were collected in spring 2010, and after-data were collected in summer 2011.

The response percentage in the before-collection was 4% and in the after-collection it was 12% among the more than 3000 households included in both surveys.

Before the speed reduction zones were implemented, 56 % of the respondents were uncomfortable with letting their children travel in the local area. After the implementation, this number has decreased to 43 %. Whether or not respondents were comfortable with letting children travel in the local area after the implementation of the five zones - split up by year and the difference between zone 4 (only signages) and the other zones combined - is shown in figure 3 and figure 4.

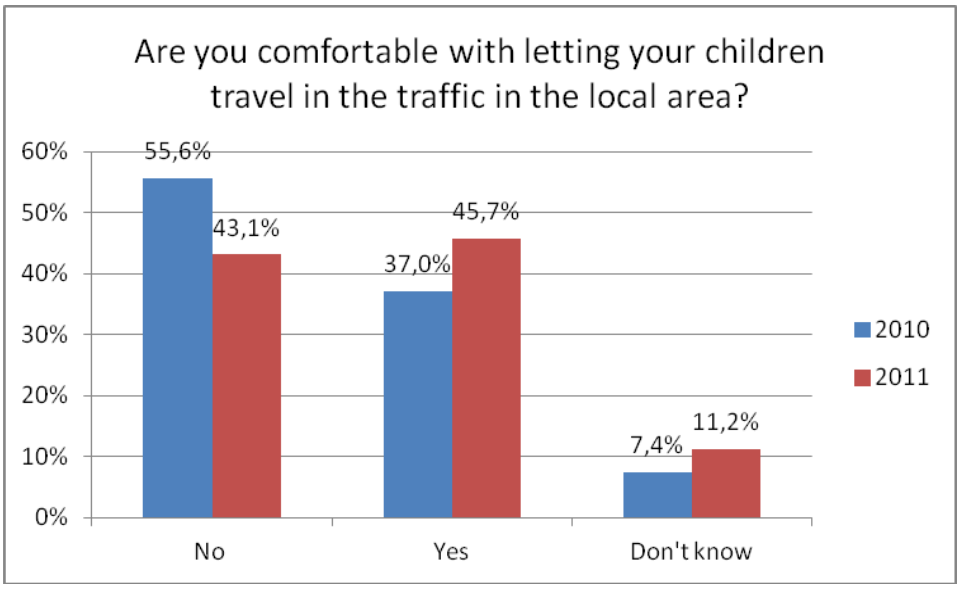

Figure 3.

Comfortable with letting your children travel in the local area 2010-2011.

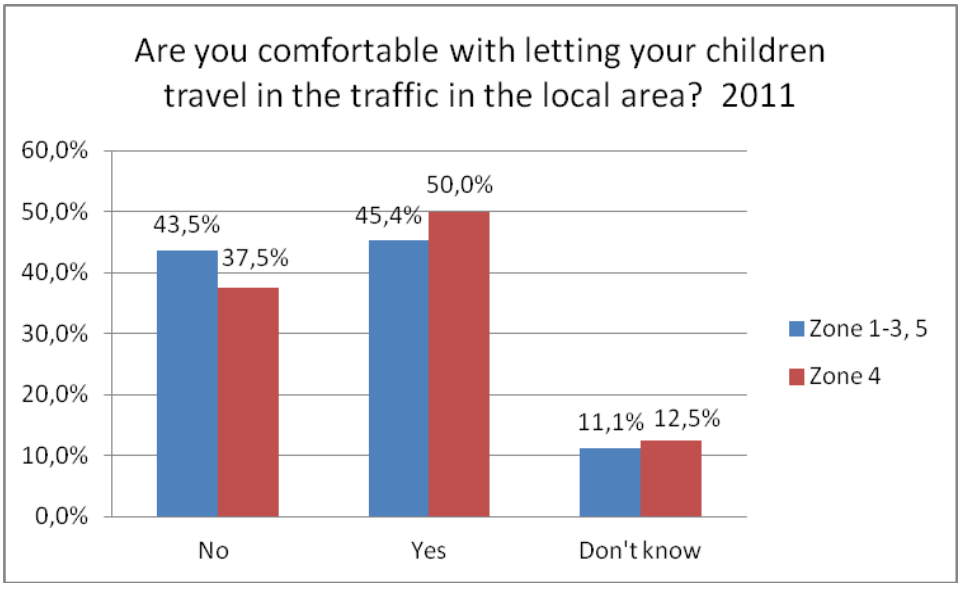

Figure 4. Comfortable with letting your children travel in the local area 2011.

Figure 3 shows that the share of people who were comfortable with letting their children travels in the traffic in the local area increased by 13% from 2010 to 2011. Accordingly, the share of people who felt discomfort with letting their children travels in the local area decreased by 16 percentage point.

Figure 3 and figure 4 shows that more respondents in zone 4 are comfortable with letting their children travel in the local area than respondents in the other zones.

In general there is a positive attitude towards the traffic safety after implementing the speed reduction zones.

Respondents, who bicycled in the local area felt more unsafe before the implementation of the speed reduction zones than after the implementation, see figure 5 and figure 6.

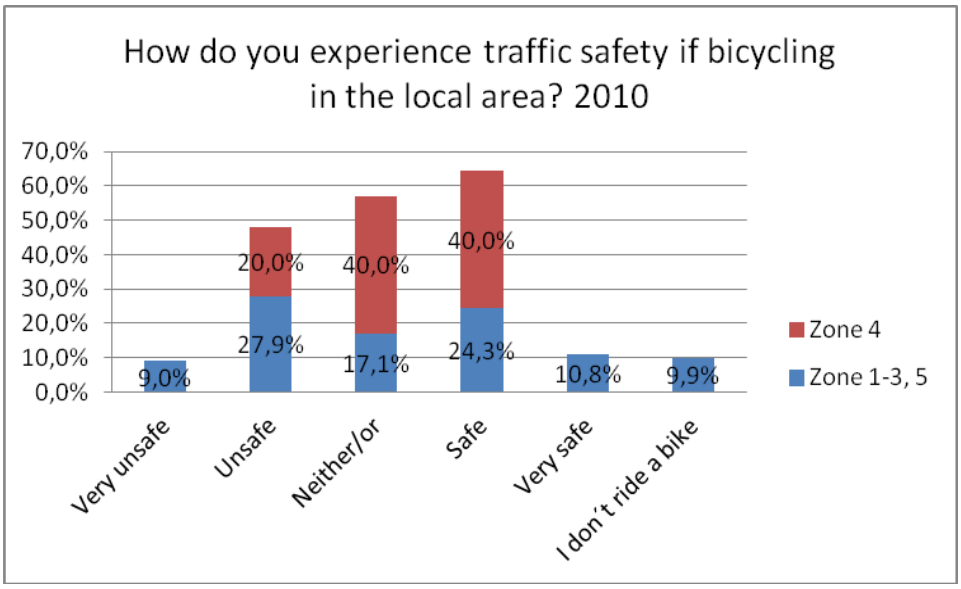

Figure 5. Traffic safety in local area when bicycling. 2010

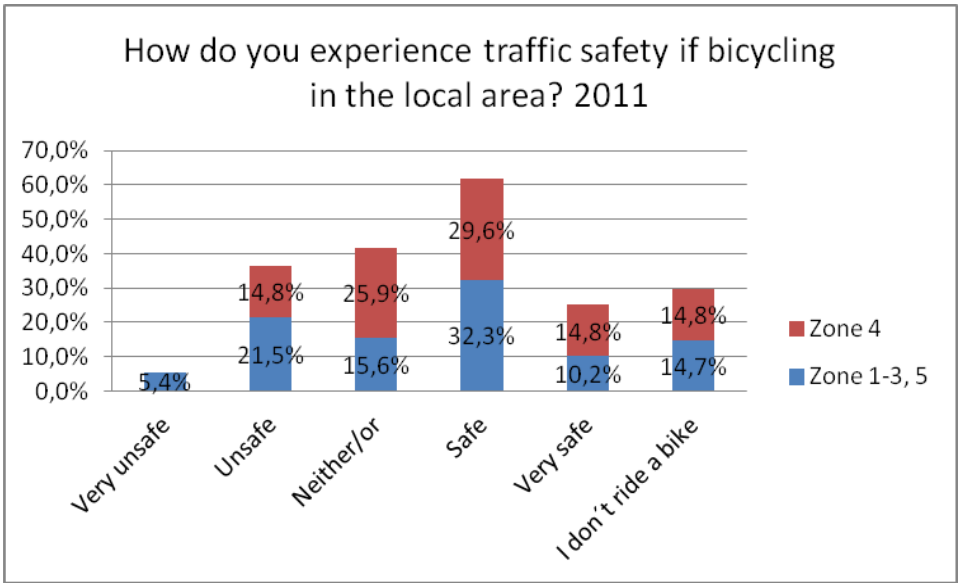

Figure 6. Traffic safety in local area when bicycling. 2011

Figure 5 shows that in 2010, 20 % in zone 4 experienced to be very unsafe or unsafe if bicycling in the local area and 40 % experienced to be safe or very safe. The experienced safety was lower in all other zones combined as 37 % felt very unsafe or unsafe and 35 % felt safe or very safe.

Figure 6 shows that the share of respondents in zone 4 who feel very unsafe or unsafe has decreased by 5 percentage point compared to 2010. On the other hand the share of respondents feeling safe or very safe has increased by 3 percentage points compared to 2010.

In all other zones combined the share of respondents who feel very unsafe or unsafe fell by 10 percentage points and the respondents who feel safe or very safe increased by 8 percentage points compared to 2010. In general, the increase in the experienced traffic safety when bicycling from 2010-2011 is more explicit in the zones, where physical changes of the infrastructure occurred.

In general, pedestrians and cyclists experience increased safety after the implementation of the speed reduction zones, see Figure 7.

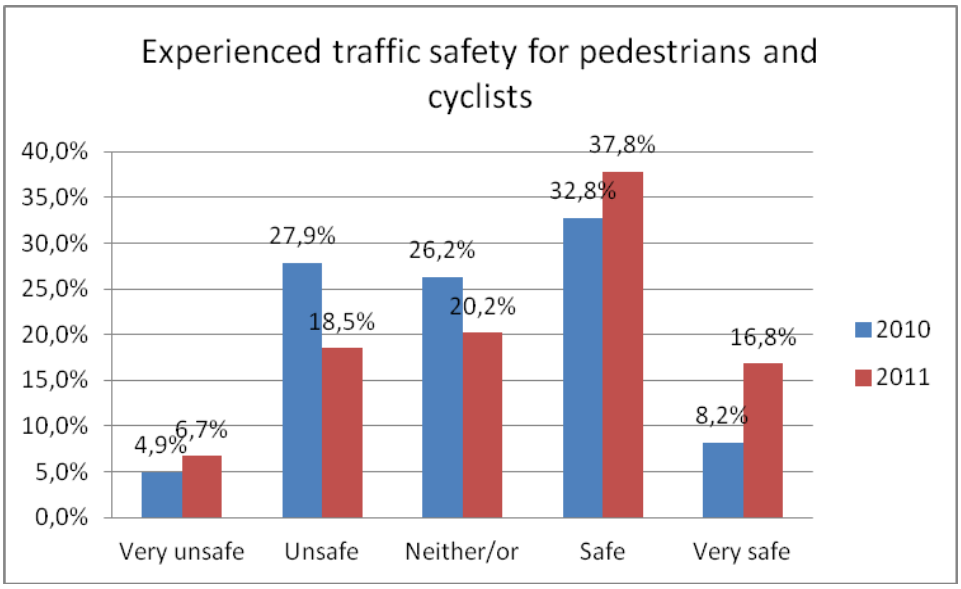

Figure 7. Experienced traffic safety for pedestrians and cyclists.

Figure 7 shows a general increase in the experienced safety for pedestrians and cyclists from 2010 to 2011. 33 % felt very unsafe or unsafe in 2010 compared to 25% in 2011. 41 % felt safe or very safe in 2010 compared to 54 % in 2011. The experienced traffic safety for pedestrians and cyclist has thus increased after implementing the speed reduction zones.

When analysing the answers from respondents who drive a car in the local area the picture is even more explicit than for respondents who are bicycling. The experienced safety in zone 4 has increased from 60 % in 2010 to 82 % in 2011. In the other zones combined the experienced safety increased from 44 % in 2010 to 64 % in 2011. The large increase in experienced safety is a result of change from "neither/nor" to a perception of that the local area is safe, see Figure 8 and Figure 9.

In general, people experience a safer environment in zone 4 than in the rest of the zones combined, which can be related to the actual speed levels. However, the zones have in general improved the experienced safety.

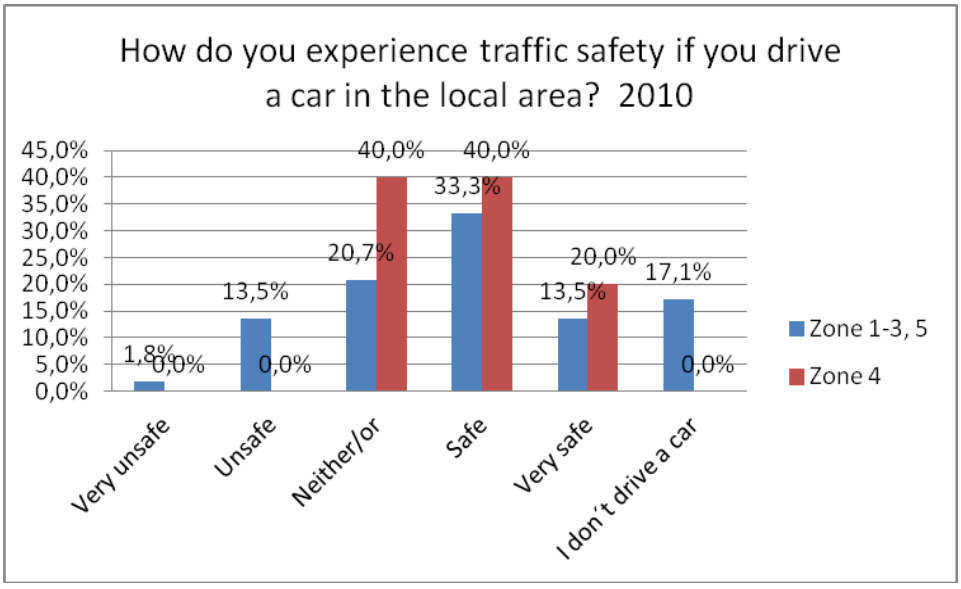

Figure 8. Experienced traffic safety in the local area when driving a car. 2010

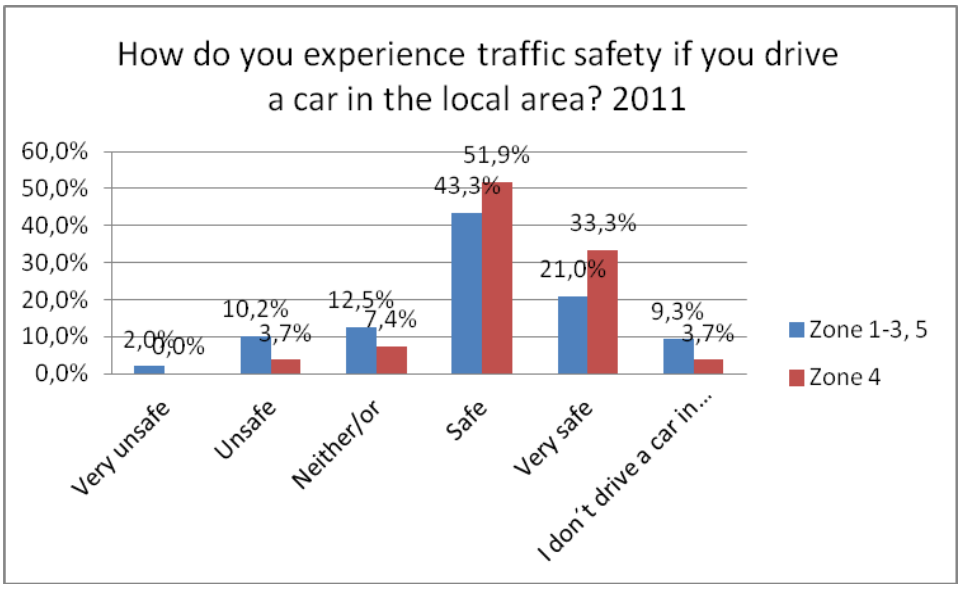

Figure 9. Traffic safety in local area when driving a car. 2011

In the questionnaire in 2011 people were asked if they think the speed reduction zones have increased road safety in the local areas. 34 % of the respondents in zone 1, 2, 3 and 5 combined answered that they think the zones have increased road safety in the local areas greatly or to some extent, see Figure 10. In zone 4 this number is 26 %.

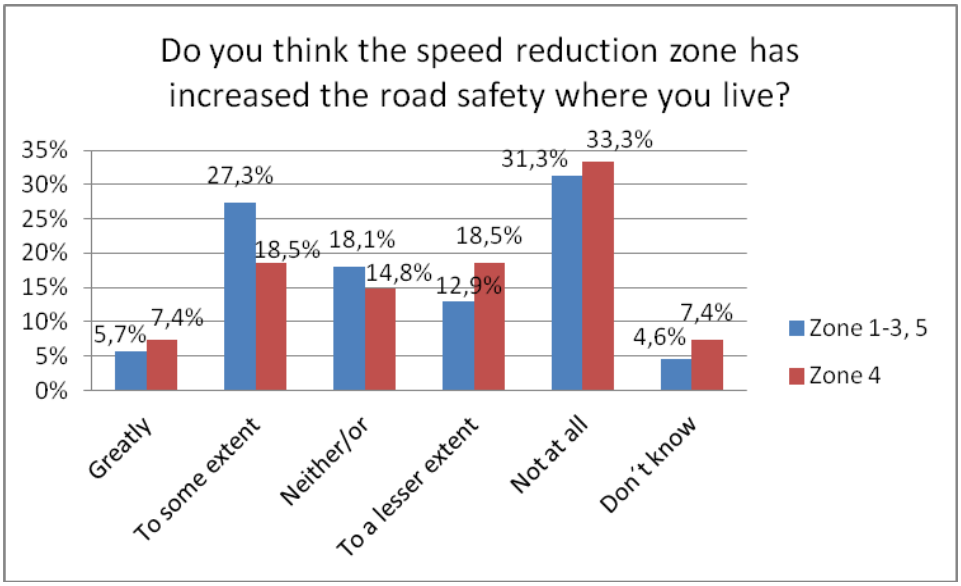

Figure 10. Has the speed reduction zone increased the road safety in local area?

In zone 4, 37 % do not think that the speed reduction zone has lowered the speed level in the local area, while 33 % think the speed reduction zone has lowered the speed level in the local area, see Figure 11. In zone 1, 2, 3 and 5 combined 41 % thinks the speed level has been lowered. Generally, the speed reduction zones are experienced as more efficient in zone 1, 2, 3 and 5 combined.

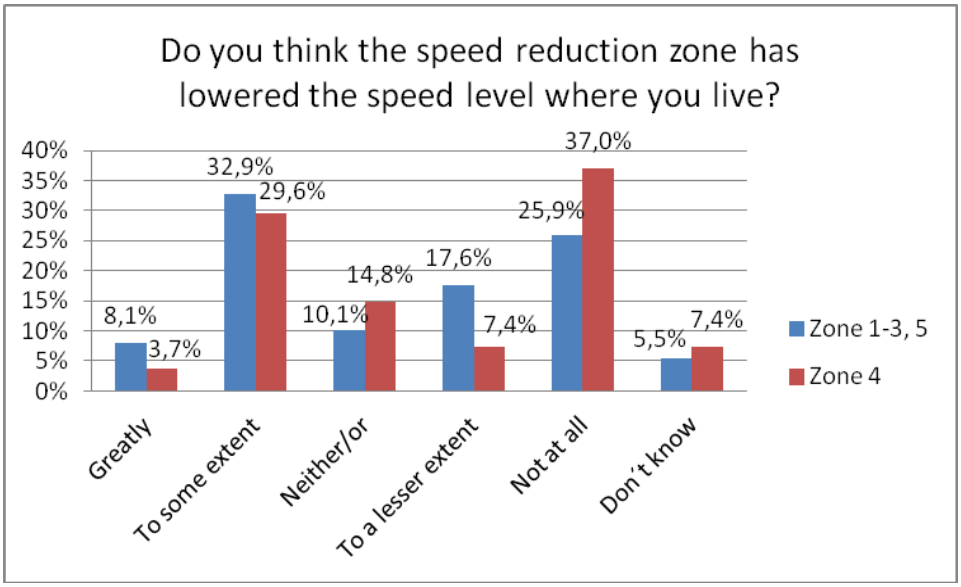

Figure 11. Has the speed reduction zone lowered the speed level where you live?

The five speed reduction zones have undergone different kind of changes.

- Zone 1: some roads already had a lower speed level before the implementation, and afterwards the whole zone have a speed limit on 30 km/h. Signs, bumps and bollards were installed.
- Zone 2: some roads had a speed limit on 40 km/h, and after the implementation the entire zones was a 40 km/h speed limit. Signs, bumps and bollards were installed.
- Zone 3: is a big zone and in the western part the speed limit was lowered to 30 km/h and in the eastern parts it was lowered to 40 km/h. Some roads had a lower speed level than 50 km/h before the implementation. Signs, bumps, pillow bumps and bollards were installed.
- Zone 4: the speed level was 50 km/h before the implementation, and after establishing a speed reduction zones with a speed limit on 40 km/h, using only signage. Signs were installed.
- Zone 5: in this area pre-existing bumps had already lowered the speed level to 40 km/h and the only implementation consisted of new signs. Signs were changed.

As expected the speed level has fallen the most where bumps and road narrowing were implemented, but the perceived traffic safety has increased in all zones. This increase is probably caused by the visibility of the new legal speed level. There is no clear evident that people in zone 4 feels more insecure than respondents in the other zones.

Table C2.1 Society Indicator	Before Spring 2010	B-a-U Spring 2010	After Summer 2011	Difference: After –Before	Difference: After – B-a-U

No.13 Awareness	87% of the respondents supported the idea to lower the speed levels in residential areas.	The same	84% of the respondents supported the idea to slow down in residential areas.	-3 % percentage point	
No.14 Acceptance	71% thought that speed limits and road bumps could increase the road safety in residential areas.	The same	65% think that speed limits and road bumps could increase the road safety in residential areas.	-6 % percentage point	
No. 14 Safety	27% of the respondents experienced the general road safety in the local area as unsafe. More than 56% were uncomfortable about letting their children travel alone, either on foot or by bicycle in the local traffic.	The same	20% of the respondents experienced the general road safety in the local area as unsafe. More than 43% were uncomfortable about letting their children travel alone, either on foot or by bicycle in the local traffic.	-7 % percentage point -13 percentage point	

The indicator for transport safety is the number of traffic accidents. It is the North Jutland Police who takes report about accidents and afterward the City of Aalborg reports all reported accident to a national system from where statistic can been drawn.

The speed reduction zones are implemented in a relative small area that encompass relatively few traffic accidents. Combined with the relative small time period that the zones have been in operation (1½ year) it is not possible to make any sound analysis of this data.

2.2 Transport

Speed level measurements were conducted in 2009 and 2010 and then again in 2011.

The measurement points were selected on basis of reviews of roads in the chosen areas. It is important that there is no road crossing near the point to avoid the effects of acceleration/deceleration as this will

disturb the picture of the actual speed level. The measuring system is a tube counting, see Figure 12. Mechanical car counts are more precise than manual counts due to the longer time period.

Figure 12. Mounting of measuring machinery.

The measurement period is a week and it is important to conduct measurement in weekdays outside holiday periods. Measurements cannot be made during winter because of the possibility of snow. Measuring traffic speed level is not 100 % accurate; there is an error of approx. +/-5 % when using tube counting.

Speed levels have been lowered in the five zones, see Figure 13. In zone 3 there are two different legal speed levels, 30 km/h in the western part and 40 km/h in the Eastern part.

Speed level [km/h]	Before	After
Zone 1: Tovevej	30	30
Zone 1: Doravej	40	30
Zone 2: Heimdalsgade	40	40
Zone 2: Filstedvej	50	40
Zone 3: Lundbyesgade	50	30
Zone 3: Paludan Müllers Vej	50	40
Zone 3: Jens Baggesens Vej	50	40
Zone 4: Martinus Rørbyes Vej	50	40
Zone 5: Herningvej	40	40
Zone 5: Ribevej	50	40

Figure 13. Legal speed level before and after implementing speed reduction zones.

The 10 different places where speed levels have been measured are allocated in the 5 zones, see Figure 14.

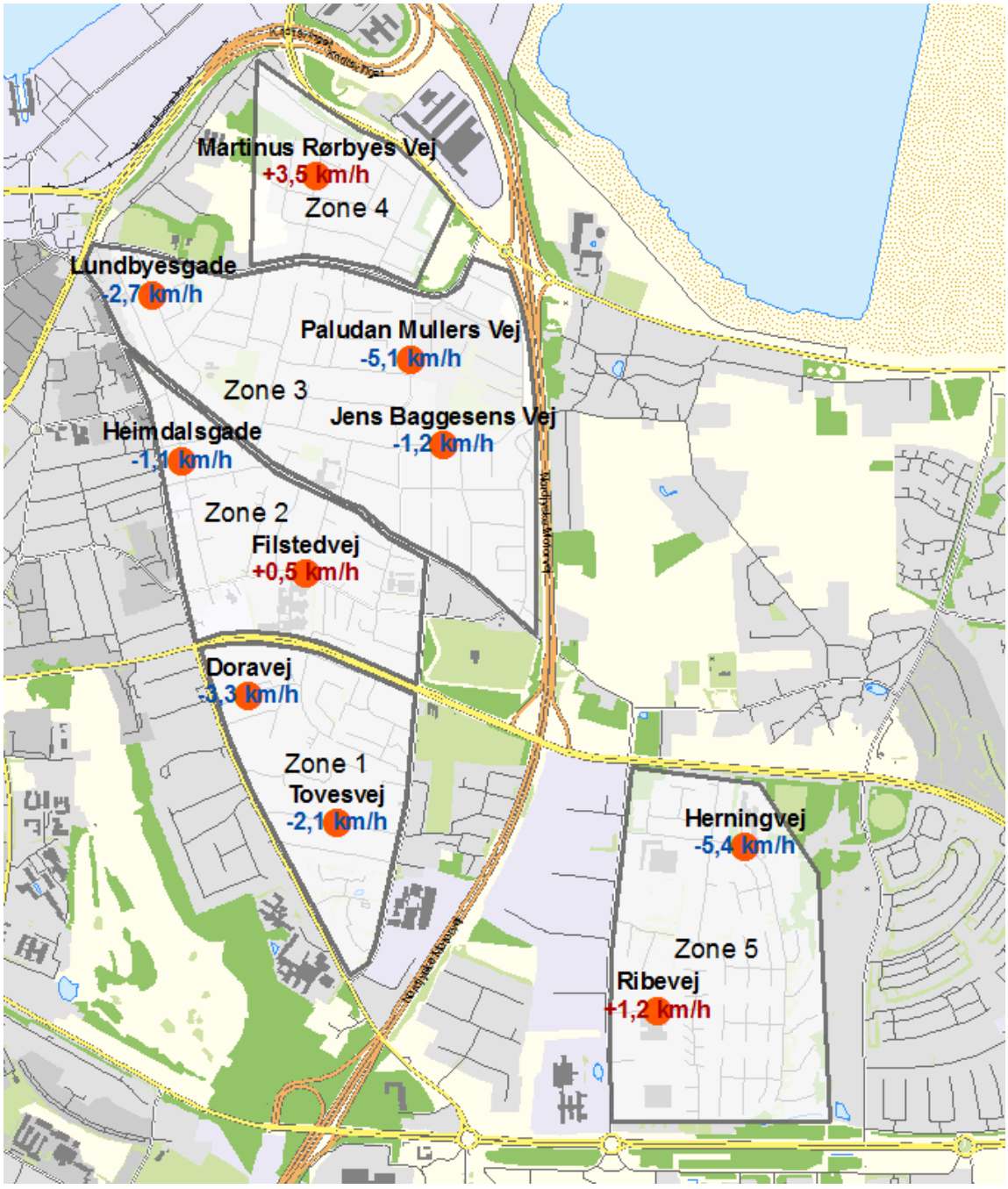

Figure 14. The five speed reduction zones with different between before and after average speed level. Red numbers indicate an increase while blue numbers indicate a decrease.

The average speed level on 10 selected roads in the speed reduction zones has fallen by 1,42 km/h from 2009 till 2011, see Figure 15.

On Filstedvej the first after-measurement of speed level seemed very high compared to previous measurement. It could be caused by errors in the measurement equipment; hence, a new measurement was conducted.

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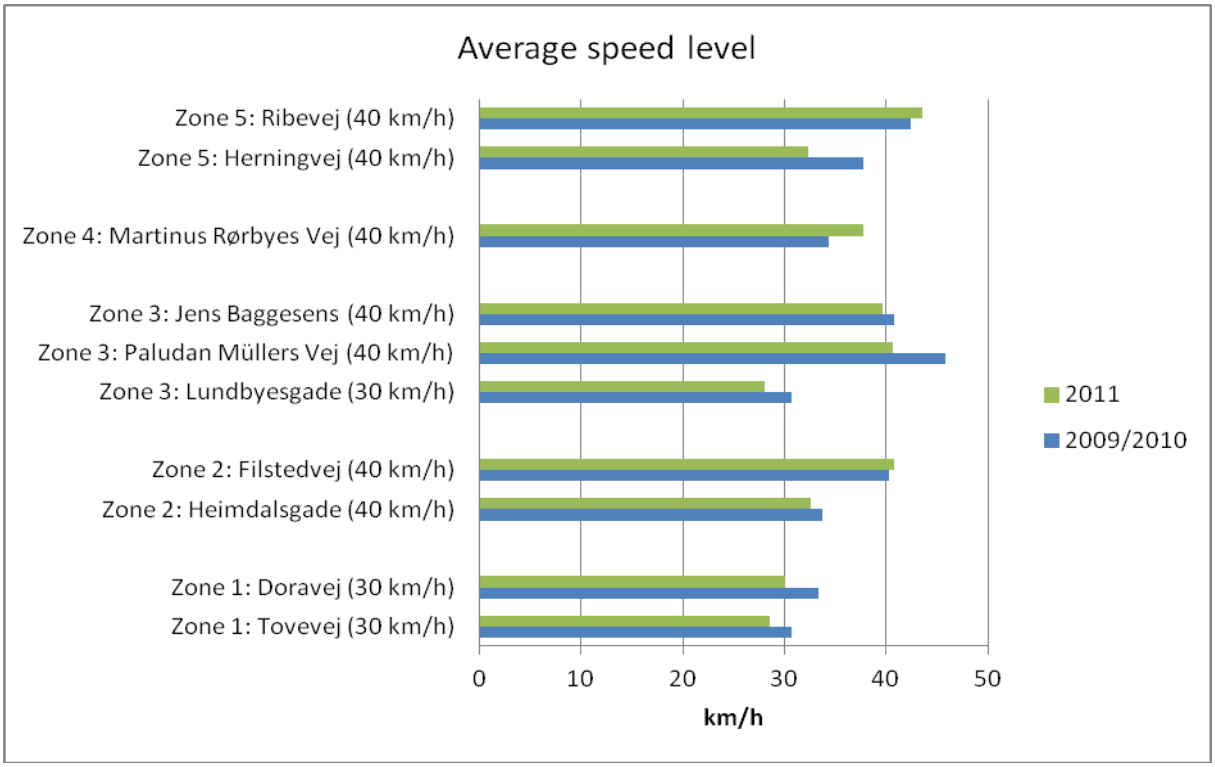


Figure 15. Speed level on selected roads in the speed reduction zones.

The 85 % quantile is interesting when analysing speed level. The 85 % quantile km/h, is the speed at which 85 % drives less than. When analysing the 85% quantile, the speed level is higher than the legal level, which means that 15 % drives faster than the stated speed levels in Figure 16.

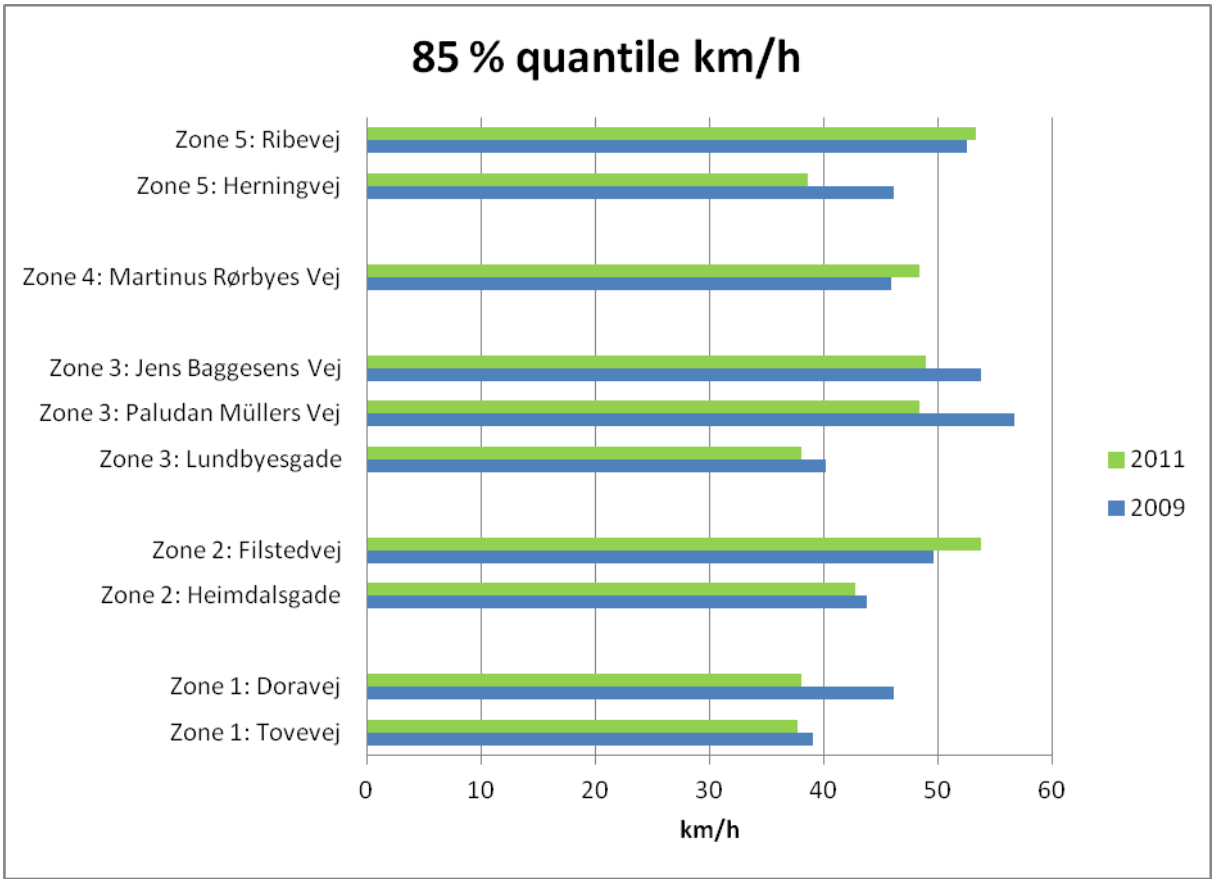


Figure 16. 85 % quantile km/h.

The speed level allocation, average for all 10 roads, shows that speed levels in general have fallen after the implementation of the speed reduction zones, see Figure 17.

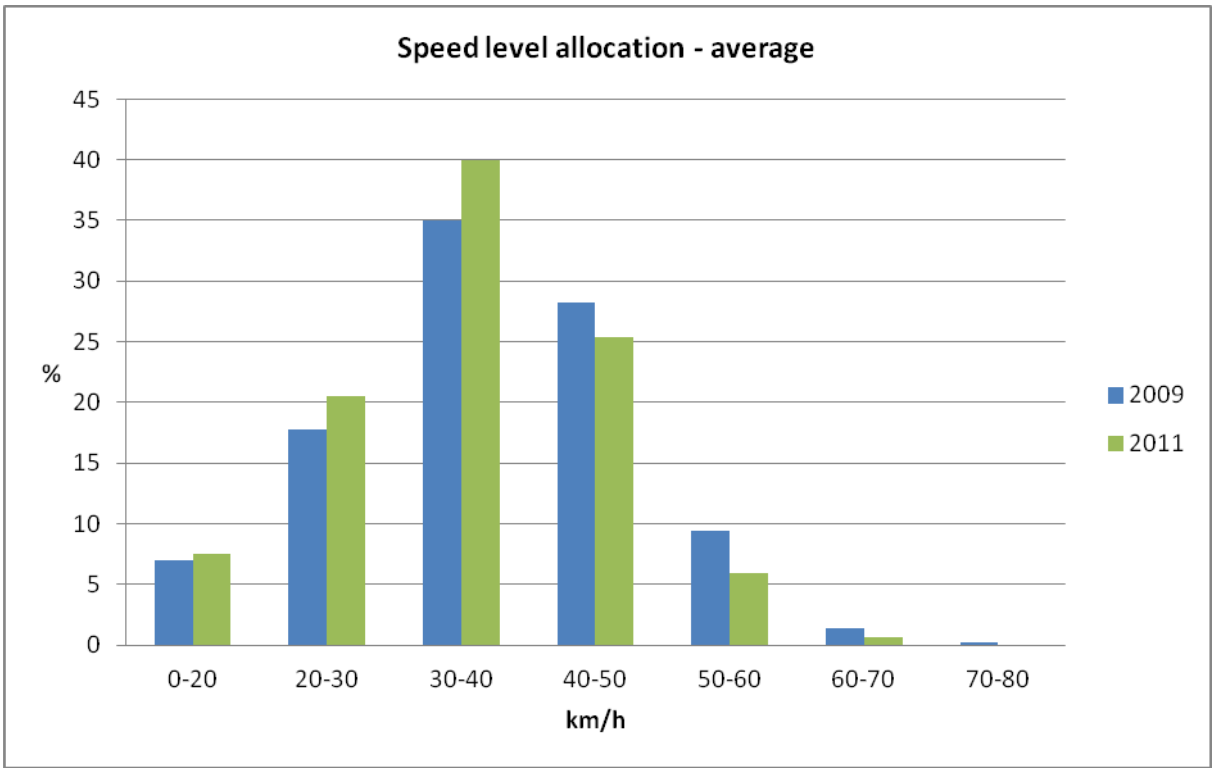


Figure 17. Speed level allocation – average for all 10 roads.

The measurement shows that after the implementation of the speed reduction zones speed level has increased on 3 roads: Filstedvej, Martinus Rørbyes Vej and Ribevej.

On Filstedvej the allowed speed level was 50 km/h before, except for at short distance nearby the school where the allowed speed level was 30 km/h. After the implementation of the speed reduction zone the speed limit was lowered to 40 km/h, except for the short distance nearby the school where the speed limit remains on 30 km/h. The average speed level has increased from 40,1 km/h to 40,5 km/h. The speed level allocation from 2009 is almost similar to the one in 2011, see Figure 18.

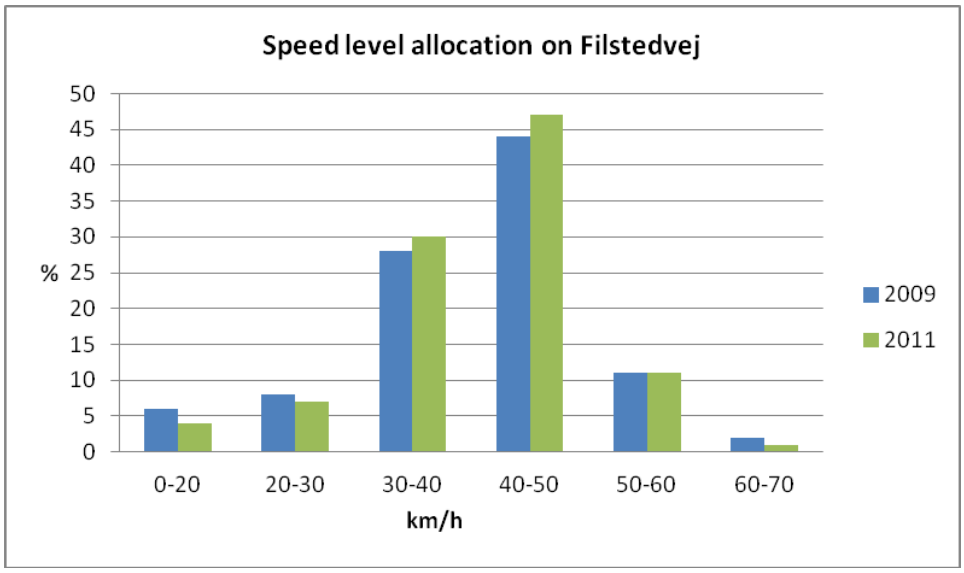


Figure 18. Speed level allocation on Filstedvej.

In zone 4, where the speed reduction zone has been established only by using signs, the speed level has increased, although the speed level is still below the legal limit. In zone 4 a single speed level measurement was conducted, hence, it is possible that the speed level may not have increased on all roads. The reason for the higher speed level on Martinus Rørbyes Vej is that the percentages of people driving more than 30 km/h is higher in 2011 than in 2009. Another explanation could be the effect of the signage speed level. Signs with 40 km/h were implemented as part of the speed reduction zone. The signs were placed at the entrances to the zone. No signs were established before entering the speed reduction zone and it is assumed that people drove with the speed they felt justifiable.

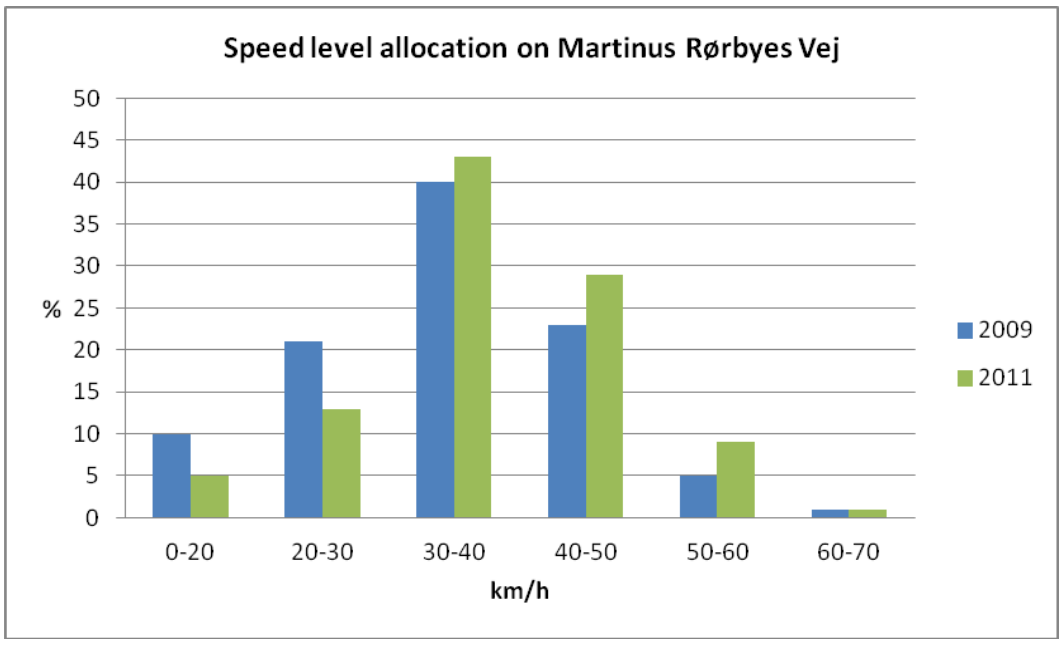


Figure 19. Speed level allocation on Martinus Rørbyes Vej.

The last road that experienced an increase in speed level was Ribevej. Here, the average speed level has increased from 42,0 km/h in 2009 to 43,3 km/h in 2011. See speed level allocation on Figure 20.

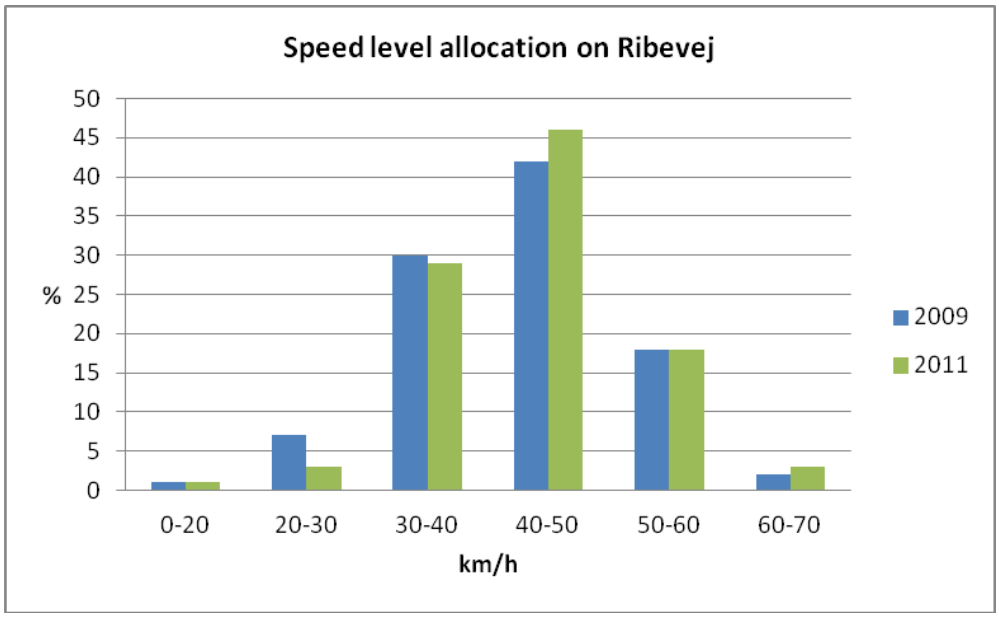


Figure 20. Speed level allocation on Ribevej.

The speed level has fallen the most where bumps and road narrowing were implemented, but the perceived traffic safety has increased in all zones. This increase is probably caused by the visibility of the new speed limits.

During the speed level measurements the number of cars were also counted, and there has been an average fall in annual day traffic on 7,3 %, see figure1. Due to the financial crisis the yearly traffic attribution is not very high - in some areas it is even negative - like on most of the roads in the speed reduction zones.

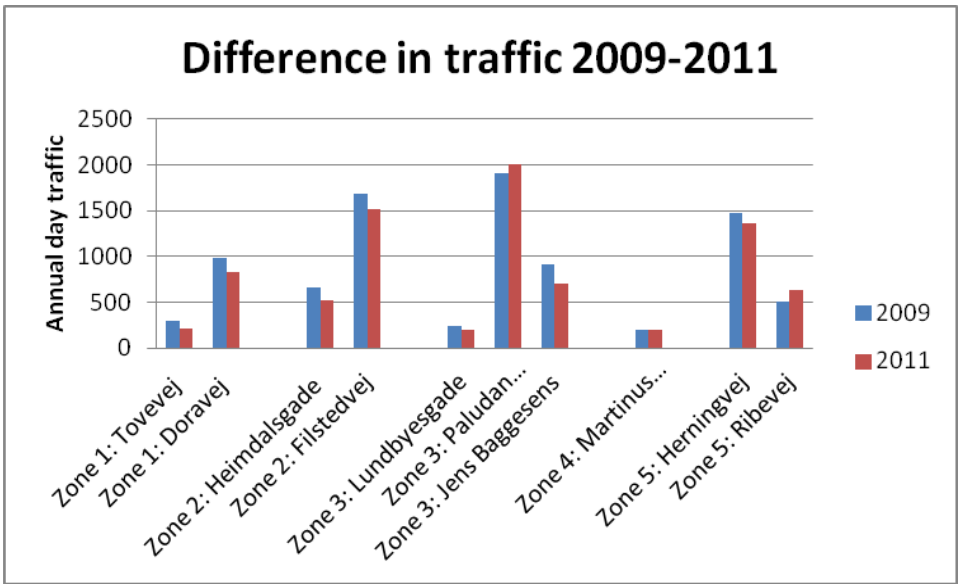


Figure 21. Annual day traffic before and after.

Measure title: **Traffic speed reduction zones in Aalborg**

City: **Aalborg** *Project:* **ARCHIMEDES** *Measure number:* **43**

Table C2.2 Transport

Indicator	Before Transport safety – 2007-2008 Traffic level – 2008-2009	B-a-U	After Transport safety – 2011-2012 Traffic level – 2012	Difference: After –Before	Difference: After – B-a-U
No.20 Transport safety	In a two year period (2007-2008) there has been 6 traffic accidents, two of them with personal damage.	The same	Data from 2011 has not been registered yet. Data will not be available this year. In 2010 there has been 1 material damage accident.	Data not available before 2012.	
No. 23 Traffic level Weekly work average – speed level See graph below	Zone 1: Tovesvej 30,8 km/h Doravej 32,2 km/h Zone 2: Heimdalsgade 33,6 km/h Filstedvej 40,1 km/h Zone 3: Lundbyesgade 31,2 km/h Paludan Müllers Vej 45,8 km/h Jens Baggesens Vej 40,9 km/h Zone 4: Martinus Rørbyes Vej 34,0 km/h Zone 5: Herningvej 37,7 km/h 1 Ribevej 42,0 km/h	The same	Zone 1: Tovesvej 28,8 km/h Doravej 30,0 km/h Zone 2: Heimdalsgade 32,6 km/h Filstedvej 40,5 km/h Zone 3: Lundbyesgade 28,4 km/h Paludan Müllers Vej 40,6 km/h Jens Baggesens Vej 39,7 km/h Zone 4: Martinus Rørbyes Vej37,9 km/h Zone 5: Herningvej 32,3 km/h 2 Ribevej 43,3 km/h	Zone 1: Tovesvej -2,0 km/h Doravej -2,2 km/h Zone 2: Heimdalsgade +1,0 km/h Filstedvej +0,4 km/h Zone 3: Lundbyesgade -1,8 km/h Paludan Müllers Vej -5,2 km/h Jens Baggesens Vej -1,2 km/h Zone 4: Martinus Rørbyes Vej - +3,9 km/h Zone 5: Herningvej -5,4 km/h Ribevej -1,3 km/h	
No. 24 Traffic level	Zone 1: Tovesvej 30,7	The same	Zone 1: Tovesvej 28,6	Zone 1: Tovesvej- 2,1	

Weekly average – speed level	km/h Doravej 33,4 km/h Zone 2: Heimdalsgade 33,7 km/h Filstedvej 40,3 km/h Zone 3: Lundbyesgade 30,7 km/h Paludan Müllers Vej 45,8 km/h Jens Baggesens Vej 40,8 km/h Zone 4: Martinus Rørbyes Vej 34,3 km/h Zone 5: Herningvej 37,7 km/h Ribevej 42,4 km/h		km/t Doravej 30,6 km/h Zone 2: Heimdalsgade 32,6 km/h Filstedvej 40,8 km/h Zone 3: Lundbyesgade 28,0 km/h Paludan Müllers Vej 40,7 km/h Jens Baggesens Vej 39,6 km/h Zone 4: Martinus Rørbyes Vej 37,8 km/h Zone 5: Herningvej 32,3 km/h Ribevej 43,6 km/h	km/h Doravej -2,8 km/h Zone 2: Heimdalsgade -1,1 km/h Filstedvej -0,5 km/h Zone 3: Lundbyesgade -2,7 km/h Paludan Müllers Vej -5,1 km/h Jens Baggesens Vej -1,2 km/h Zone 4: Martinus Rørbyes Vej - 3,5 km/h Zone 5: Herningvej - 5,4 km/h Ribevej +1,2 km/h	

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	To reduce the number of casualties as a result of roadside accidents.	**NA** Data not available before.
2	To ensure a safe environment for pedestrians and cyclists.	**
3	To increase compliance with safe speed limits.	**
4	To reduce the average speed in certain zones in the ARCHIMEDES corridor.	**
5	To establish 5 speed reduction zones within the ARCHIMEDES corridor.	**
6	To reduced the average speed by 3-4 km/h pr 10 km/h speed reduction.	* The average speed reduction pr. 10 km/h speed reduction is 2,1 km/h.
7	To reduce speeding to a minimum.	**O** 85 % quantile level is high.
NA = Not Assessed O = Not Achieved * = Substantially achieved (at least 50%) ** = Achieved in full * = Exceeded**		

C4 Upscaling of results

Upscaling this measure would imply a speed limit at 30 or 40 km/h for the entire city. Speed reduction zones are established as part of the Traffic Safety Plan and the Speed Action Plan from 2005. The overall plan for Aalborg is to have a lower speed limit on smaller roads (the exact speed level depending on the local conditions) and to have 50 km/h on main roads.

C5 Appraisal of evaluation approach

It is always difficult to reach a high response percentage when conducting a questionnaire. In this measure the target groups is pretty small, because people have to have residency within one of the five zones. Previous to collecting the before-data, all residents within the five zones received an information letter about the new speed reduction zones, and about the construction period. The letter also contained information about ARCHIMEDES and clarified the importance of answering the questionnaire for evaluation purposes. Previous to collecting the after-data, the residents also received

a letter explaining the zones and the importance of participation in the questionnaire. The response percentage was 4 % when collecting before-data and 12 % when collecting after-data among the more than 3000 households included in both surveys. This implies an increased interest in the speed reduction zones after the actually implementation. The participants could win gifts certificates from both questionnaires.

The questionnaires could be accompanied by telephone interviews in order to increase the response percentage.

C6 Summary of evaluation results

There are two ways to evaluate the new speed reduction zones; through the experienced road safety and speed level and by the actually road safety and speed level.

Experienced road safety and speed level

Two questionnaires were carried out, one previous too and one subsequent to the implementation of the five speed reduction zones.

Overall, people are more comfortable with letting their children move around in the local neighbourhood after the implementation of the speed reduction zones.

For cyclist and car drivers the experienced traffic safety has improved due to the new speed reduction zones.

Analysing the difference between zone 1, 2, 3 and 5 in combination (the zones where bumps and/or road narrowing were implemented) and zone 4 (the zone where only signs were implemented), shows a difference. The experienced speed reduction is more explicit in the zones, 1, 2, 3 and 5 combined.

In zone 4 people are a little bit more comfortable with letting their children travel in the area than people in the other zones. People in zone 4 felt slightly safer in the before-investigations than in the other zones combined. A note to these findings is that the average speed level in zone 4 before the implementation was rather low.

For cyclists and car drivers the experienced road safety is a bit bigger in zone 4 than in the other zones combined.

On the question whether the new speed reduction zone has increased road safety in the local area the attitude is almost the same, though people in zone 4 are slightly more sceptical.

Whether or not the speed reduction zone has lowered speed level more than 50 % do not think so in zone 4, and in the other zones the attitude is more positive.

Altogether people experience a bigger road safety after the implementation of the five speed reduction zones. People do to a lesser extent think that the new speed reduction zones have increased road safety and lowered the speed level. The experienced safety is increasing the most in zones where bumps and speed narrowing have been implemented.

Actually speed level

Speed level measurements shows that the speed level has fallen on 7 out of the 10 roads that has been measured on. On two of the roads that have experienced a rise in speed level the rise is very little and there is no clear reason for that.

In zone 4 the speed level has increased, but is still below the maximum allowed limit. An explanation could be the effect of the signage speed level. After the implementation of the speed reduction zone signs with 40 km/h were placed when entering the zone. Before this project there were no signs and people drove with the speed they felt was justifiable.

Regarding the accident level the speed reduction zones are implemented in a relative small area that encompass relatively few traffic accidents. Combined with the relative small time period that the zones have been in operation (1½ year) it is not possible to make any sound analysis of this data.

C7 Future activities relating to the measure

The five speed reduction zones were established in line with the Municipality's Traffic Safety Plan from 2008. The long term plan is to lower the speed level on all small/local roads and maintain the current speed level on all main roads.

The speed reduction zones will continue to exist in the municipality.

D Process Evaluation Findings

D.0 Focused measure

X	0	No focussed measure
	1	Most important reason
	2	Second most important reason
	3	Third most important reason

D.1 Deviations from the original plan

There has not been any deviation.

Overall, the planning, implementation and operation of this measure has been as planned and no major barriers or drivers were experienced. This can be explained by the fact that planning and implementing speed reduction zones have been done before in Aalborg and therefore know-how and cooperation with the police on these issues exist.

D.2 Barriers and drivers

D.2.1 Barriers

Preparation phase

- **Approval of speed reduction zones –** In principle this could have been a hindrance to implement the measure. However, there is a well established cooperation with the police on traffic safety matters and a common view on the importance of this. Therefore, the police´s approval of measures did not constitute a real risk.

Implementation phase

- No barriers experienced.

Operation phase

- No barriers experienced.

D.2.2 Drivers

Preparation phase

- **Know-how –** Planning and implementing speed reduction zones has been done before in Aalborg.
- **Part of overall traffic safety planning policies –** This measure is related to the overall traffic safety policies in Aalborg and has therefore a strong basis.
- **Public involvement –** Having the public to accept the zones is an important part of the measure in order to obtain the purpose of the measure. Therefore, part of the planning was to secure sufficient information to the public, as it will be described in section D 2.3.

Implementation phase

- **Know-how –** Planning and implementing speed reduction zones has been done before in Aalborg.

Operation phase

- No drivers experienced.

D.2.3 Activities

Preparation phase

- **Public involvement through information letters** –A letter was sent to the residents of the five speed reduction zones prior to the implementation of zones in summer 2010. The letter aimed to reach all the residents of the five zones to inform them about the speed reduction zones and making them aware of the benefits from the zones. Furthermore, the purpose was to inform them about the upcoming road work. The letter urged the citizens to utilise the possibility for receiving more detailed information from the municipality's website.

Implementation phase

- No actions undertaken.

Operation phase

- No actions undertaken.

D.3 Participation

D.3.1. Measure Partners

- **City of Aalborg –** Responsible for the planning and implementation.
- **The North Jutland Police** – Approval of the speed reduction zones and enforcement.

D.3.2 Stakeholders

- **Citizens –** Car drivers, cyclists and pedestrians moving in the area and in addition people living in the area. The acceptance from these groups is as described important for the success of the measure.

D.4 Recommendations

D.4.1 Recommendations: measure replication

This measure has been successful and can easily be adopted by other cities.

- **Recommendation 1 –** Implementations of speed bumps, road narrowing with flexible bollards and pillow bumps increase the experienced traffic safety to a larger extent than implementation of signage only. Evidently, the speed has been reduced the most in zones where speed bumps and road narrowing have been implemented.
- **Recommendation 2** - As people become aware of the speed reduction zones they might express increased experience of speed reductions and traffic safety.

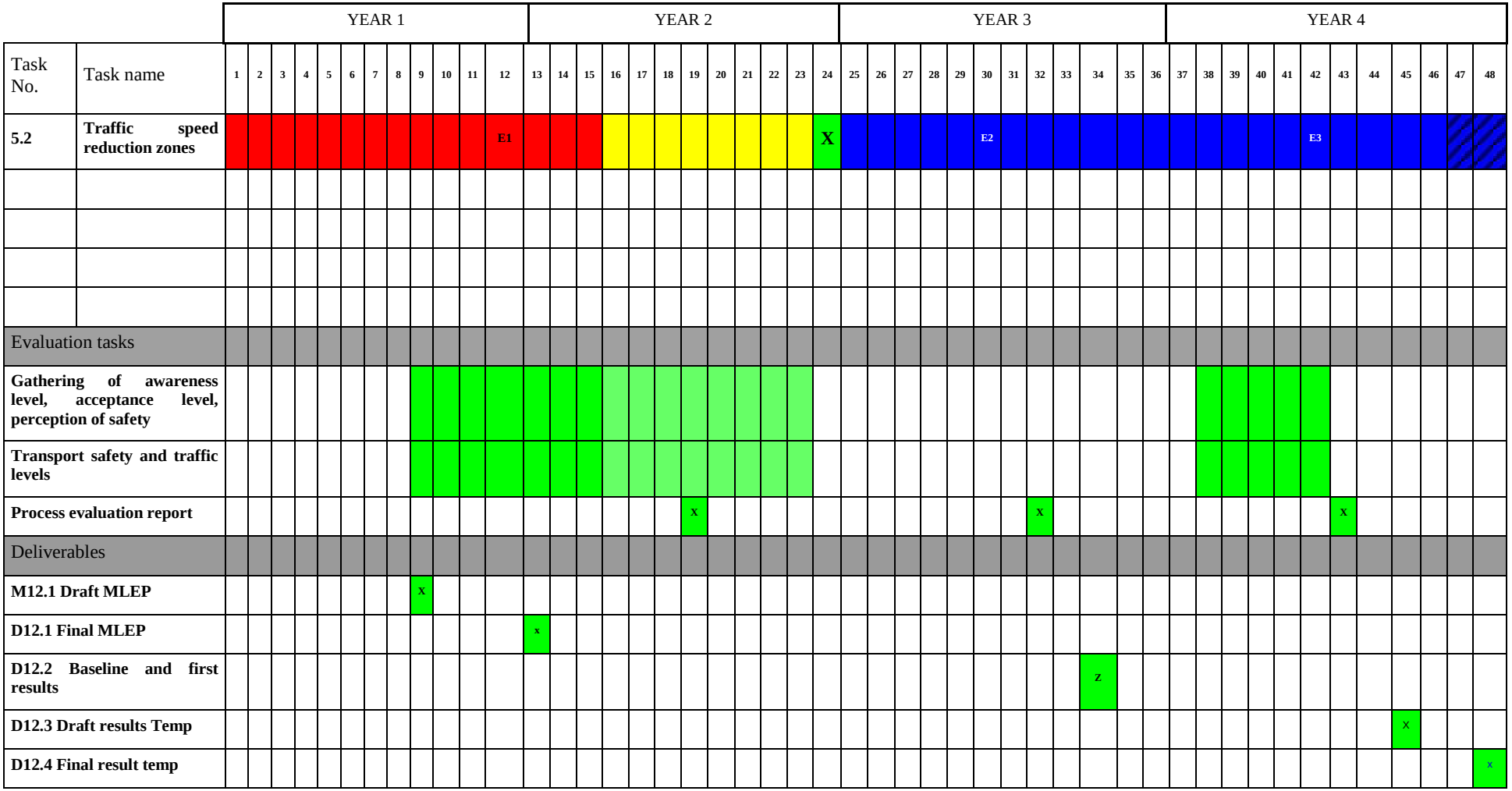
D.4.2 Recommendations: process

- **Recommendation 1 -** The implementation of speed reduction zones requires a good cooperation with the police and it facilitates the process if the city has experience with bumps and narrowing roads. Methodologically, it is, therefore, recommended that the police is actively involved.
- **Recommendation 2 –** In the evaluation of the measure questionnaires could be accompanied by telephone interviews in order to obtain a higher rate of response.
- **Recommendation 3 -** There should be a clear distinguishing of *experienced/perceived* traffic safety/speed levels and *actual* traffic safety/speed levels when evaluating the measure. The experiences can be affected by increased awareness. It is recommended to also measure the actual traffic safety and speed levels.

Measure title: **Traffic speed reduction zones in Aalborg**

City: **Aalborg** *Project:* **ARCHIMEDES** *Measure number:* **43**

E Summary time schedule



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