Linköpings Uniniversitet
Institute of Technology
Campus Norrköping

ROAD SAFETY AUDIT REPORT ON EXISTING ROADS

Vulnerable Road Users
Public Transport Users (safety problems)

ROAD LOCATION BEING AUDITED:
NORRKÖPING, KUNGSGATAN, SKVALLTORGET

DATE of ON-SITE INSPECTION: 2nd and 5th of October 2003
TIME: 9.30-10.30, 12.00-13.00

AUDITED BY TEAM:
Paulius Armonaitis, pauar245@student.liu.se
Srinivas Reddy Geedipally, srige565@student.liu.se
Alexander Liehske, aleli721@student.liu.se
Aline Muller, alimu587@student.liu.se
Slawomir Nowicki, slano234@student.liu.se
Maria-Jose Alvarez Plata, maral163@student.liu.se
Liubov Scemelinina, liusc280@student.liu.se
Dharmesh B Shah, darsh991@student.liu.se
Mathias Ashu Tako Tambe, matta495@student.liu.se
Yuan Yuan, yuayu315@student.liu.se

INSTRUCTORS: Kenneth Asp
Ghazwan al-Haji

Table of Contents

1 Introduction

1.1 Definition

Before starting with our project it is necessary to define what road safety audit and road safety audit review are and what they deal with.

"Road safety audit (RSA) is a formal procedure for independent assessment of the accident potential and likely safety performance of a specific design for a road or traffic scheme - whether new construction or an alteration to an existing road" (European Transport Safety Council, 1997). RSA conducts the road planning and design process with the purpose of preventing traffic accidents. "The main objective is to ensure that all new highway schemes operate as safely as is practicable. This means that safety should be considered throughout the whole preparation and construction of any project" (European Transport Safety Council, 1997).

Whereas road safety audit review (RSAR) intervenes into the design process or into the condition of existing roads, not into the planning. An independent safety team manages this.

1.2 Background

The concept of a safety checking procedure within transportation starts inventing about 150 years ago in UK. In the 1830s British Railway Engineers grasped a concept of road safety audit as a key of safe transportation system, because in that time mass transportations by train led to accidents, which were very common.

In the early 1980s British traffic engineers were the first who developed the idea of a Road Safety Audit operating as a safety check for new and improved road schemes. In 1990 UK Safety Audit guidelines for highways were introduced and later adapted by local authorities to local roads. In 1996 the guidelines were revised. RSA became more and more important because of increasing numbers of road accidents.

1.3 The objective of this case study

The projects aim is to act like a Road Safety Audit team. This means to describe the traffic situation and afterwards identify and analyze road safety problems at the crossing (Kungsgatan/Skvalltorget) in Norrköping for different road users: pedestrian, cyclists and public transport users. Furthermore recommendations and solutions should be found for preventing dangerous situations that might have appeared while the observation.

2 Road location being audited

2.1 Location

The intersection Skvalltorget, on Kungsgatan in Norrköping was chosen as the location of investigation for the Road Safety Audit. It is strategically important because of several factors. First of all, it is situated in the center of the town in a quite hectic and intense traffic and people mobility place. Secondly, the intersection is really large; it connects three roads from five different directions (Figure 1). So, it contains a greater risk for traffic accidents.

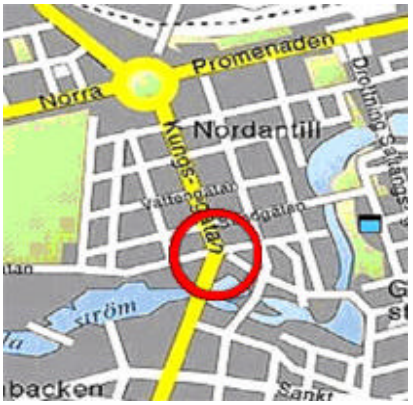


Figure 1 Location

Figure 3 shows the detailed sketch of the intersection with the directions of mobility of all road users: pedestrians, two-wheelers, cars and public transport. The main directions of transport flows, main traffic signs and bus stops are indicated to have the overall view on the intersection and make it easier to see problematic places.

Figure 2 View on the intersection

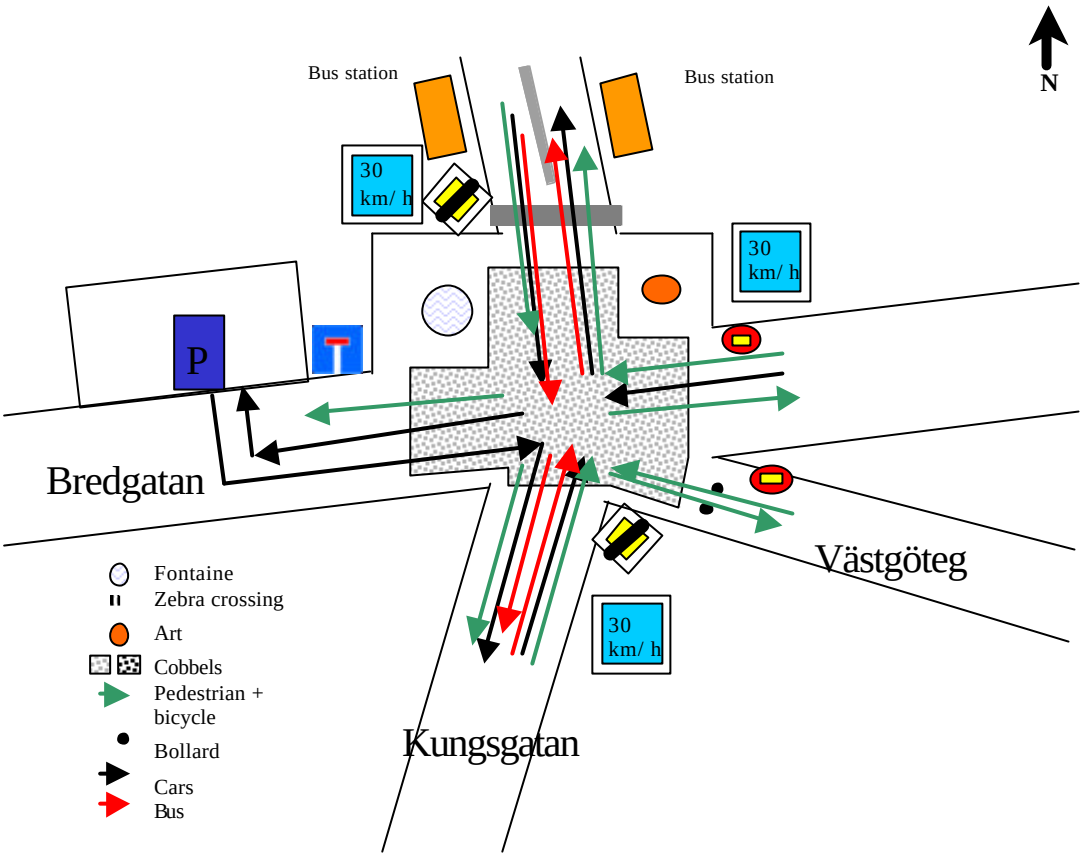


Figure 3 Sketch

2.2 The dates and time when the safety audit was carried out

Our teams decided that the safety audit should be carried out twice at different times during the day. This gave us a more precise and complete picture of the traffic situation, the risks for pedestrians, public transport users and two-wheelers. First observation took place on the 2nd of October, from 9.30 to 10.30 a.m. and the second one on the 6th of October, from 12.00 to 01.00 p.m. Besides, a group of students were estimating the traffic volume during the same days from 9.00 to 10.00 a.m. and from 05.00 to 06.00 p.m. The result of this survey is given in Appendix A.

2.3 Audit teams

For an analysis of traffic situation and safety audit on the intersection the group of students was divided into 2 teams. First team was focusing on the problems and risks of vulnerable road users; second team was observing public transport, the difficulties that people face using it every day.

3 Safety problems and recommendations for Vulnerable Road Users

3.1 Problems

There is no particular lane for pedestrian crossing (Figure 4)
People from all road arms are moving in haphazard directions on the raised intersection to cross the road.

Figure 4 Pedestrian crossing hazardously

Speed limit sign post is near to the intersection (Figure 5)
It is close to the intersection and beside the bus stop, thus, the driver does not have sufficient time to lower the speed as indicated on the sign. Also, most of the time, the sign is covered by the people waiting for the bus or the bus itself so vehicles and other road users from behind cannot see the post.

Figure 5 Signpost covered by bus

Poor visibility for the vehicles/people coming from rather down slope ICA direction
Due the structures (´Culturum') at the side of the road, it is not possible for the vehicles, cyclists and pedestrians to see the movement from the other directions.

Skidding chances on the raised intersection surface
This is applicable mostly in the wet season, when the stone surface is wet and slippery,

thus increasing the possibility for the pedestrians to slip while crossing, and also skidding of cyclists and vehicles when brakes are abruptly applied.

Parking of vehicles at the intersection (Figure 6)
Sometimes cars are parked at the intersection and this blocks the way which in turn reduces the space for pedestrians/cyclists to move around. This can also impair the visibility of the pedestrian crossing for the cars coming from other directions.

Figure 6 Vehicle parked in the intersection

Bus stop is close to the intersection
Being very close to the intersection; it causes congestion, blocks the visibility and causes mental tension to pedestrians crossing the road, which could be very dangerous.

3.2 Recommendations

Zebra Crossing should be provided at two arms, that is, one from the ´Cromwell House' to ´ICA,' and the other from ´Culturum' into the university road arm. This would create two paths for pedestrians so the haphazard way of crossing is controlled.

Sign post for speed limit should be placed before the bus stop along with the no-priority sign in front of 'bankomat'. This will make it more visible to the drivers and provide sufficient reaction time to reduce the speed and apply the brakes.

Paint 30 mph roundels on patches of red surface on the road arms approaching the intersection. (Proctor et al. 2001)

´3D-mirror' be placed which enables the cyclists and the pedestrians to see the vehicle movement from other directions. Also this can help the driver coming from other direction wanting to take a right turn.

Anti-skid painting should be applied on the intersection pavement and also few meters on the road arms approaching the intersection. This would reduce the risk of skidding of vehicles and cyclists in wet conditions. (Proctor et al. 2001)

Strict measures have to be implemented by making the intersection a No-Parking zone. Thus, this would go a long way to solve the problem of congestion by the different categories of road users at the intersection.

4 Problems and recommendations for Public Transport Users

4.1 Problems

Bus stop is too close to intersection

The bus stops under investigation are located on both sides of the Kungsgatan. One of the stations is on the same side of the street as ICA shop; another is on the same side as the university. Yet what we noticed at once, that both bus stops are located too close to the intersection. Firstly, this lacks safety because the intersection, which is mostly paved in stones, reminds more a town hall than a strategic intersection. This distracts people\s attention, they feel too safe. As we have seen from the photos, pedestrians quite often decide not to use zebra-crossings (as it would make their trip longer), but rather go straight through. This might easily lead to an accident, especially if a pedestrian starts running to catch a bus in a poor visibility conditions (in rain, for instance).

Placement of the traffic lights

Traffic lights are situated not exactly at the intersection, and even not at the bus stop, but some 20 metres to it. Somebody might argue that from the viewpoint of safety, it is a serious problem. However, if we would solve the problem mentioned above (the bus station would be moved away from the intersection), this will no more be a problem. We should keep in mind that from the viewpoint of traffic, building traffic lights in an intersection with five arms will definitely result in road congestion.

The design of the bus stop

Both stops do not have any additional part of the road for a bus, as shows Figure 7.

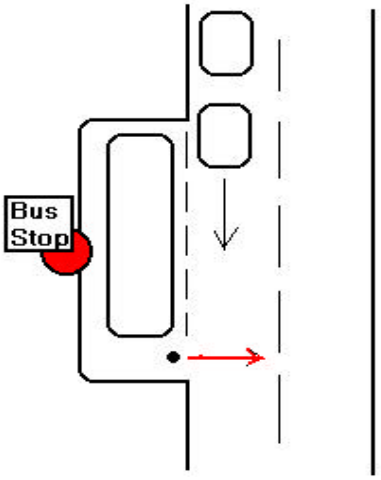


Figure 7

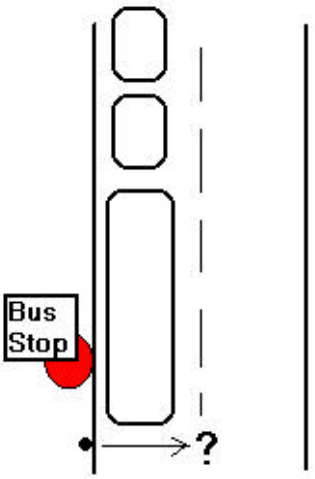


Figure 8

We could discuss that this leads to a serious problem because when the bus stops, we have traffic congestion. This is what we have noticed ourselves, and the photos also show this. However, the intersection doesn't have a constant traffic volume. There are no traffic lights in it. Moreover, from the viewpoint of safety, this stop is much safer than in the Figure 8. When passengers get out of the bus in the bus stop Figure 7, they see the

bus in front of them. Cars, also seeing the bus slow down, and in the case of our intersection, the road is narrow, and they stop at all, together with the bus. Thus, the passenger sees the bus in front of him, and, because it looks dangerous, he wouldn't cross the street. And even if he does, the cars are standing. Meanwhile, if the person decides to cross the street in Figure 8, the danger is much higher. Firstly, he feels no threat from the bus. The cars here go in much higher speeds because the bus is not on the road. So, from the viewpoint of safety, the bus stop Figure 7 is much safer, and this is what we have in our investigated intersection.

The procedure of getting in and out of the bus

As the tables in Appendix B show, busses go in intervals of approximately 10 minutes. Therefore, even during the peak time of the day (between 12 am and 1 pm), the number of bus passengers that gather at the bus stops are not large. So, they have no problem in getting into and out of the bus. Normally, people get in through the front door, but if there are people with vehicles for babies or disabled people, bus drivers open the middle door, which is much wider. In this way, there are no congestions, and people do not cause any safety problems.

Figure 9

Figure 10

Crossing the street after getting out of the bus

The zebra-crossing is situated very conveniently, just between the bus stop and intersection, so the majority of people use it to cross the street after they leave the bus. Although we have noticed some cases when people crossed the street not using the zebra-crossing, this is something that happens in many city centres, and there are no effective measures to remove this problem completely. One way is traffic calming which is already present here. Speed limits are 30 km/h.

Another thing that can be noticed from the table is that the majority of the public road users are students. Thus they do not cross the street when they arrive at the university-side bus stop. When they get out of the bus at ICA-side bus stop, they naturally do not cross the street in front of the bus because they would have to go some distance to the opposite side than the university, and because of the design of the bus stop (see Figure 7). People naturally tend to use the shortest way, and we see the great majority of the bus passengers use the zebra-crossing.

Buses cause a car queue behind when they stop at the station.
When the bus stop doesn't have a stopping area, buses have to stop on a road which impedes car movement and creates jams. Looking from car drivers' point of view, it's very inconvenient and risky, because cars have to wait bumper-to-bumper.

Figure 11 Car row behind the stopped bus

4.2 Recommendations

Generally speaking, after having observed the road in the morning and the peak time of the day, we noticed that even during the hours when traffic volume increases quite a lot, and students have a break between lectures, the number of bus passengers does not increase significantly.

Further on, the safety of the public transport users is good because of already implemented safety measures. These include traffic calming, good design of the bus stops, the frequent interval of busses, and zebra-crossings in proper position (when we have in mind public road users).

Set a special lane for buses. It makes traffic safer and faster, buses and cars are separated and don't conflict.

Crosswalk and traffic lights should be placed where there is the bus stop. Whenever a pedestrian wants to cross the street, bus drivers can notice it in advance. In that case, bus drivers may not accelerate the buses at once.

Our only suggestion is to move the bus stop at least 30 metres from the current position away from the intersection, as it would decrease the possibility of an accident, a model of which is described above.

5 References

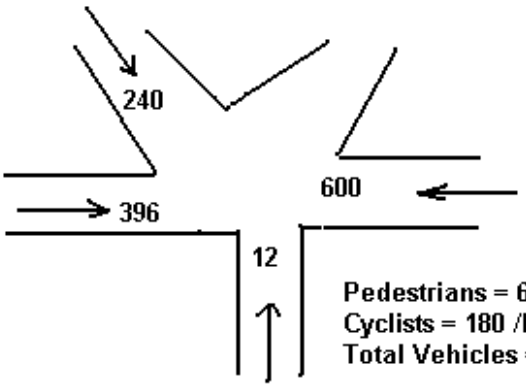
Proctor, S. et al. (2001), Practical Road Safety Auditing. London, Thomas Telford , 2001. ISBN 0727729381.

European Transport Safety Council (1997), Road Safety Audit and Safety Impact Assessment. http://www.etsc.be/roadaudit.pdf 2003-10-10.

http://www.itn.liu.se/~ghaal/Road%20Safety%20Audit/RSA%20Letcures.ppt

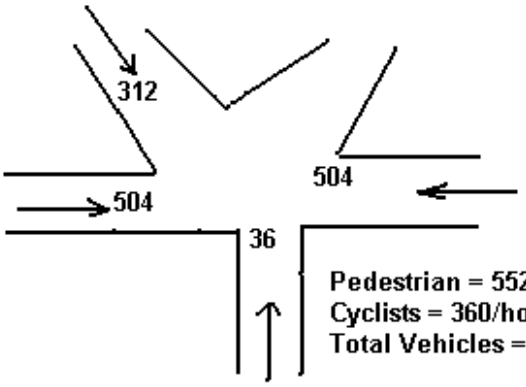
Appendix A

Traffic Volume Studies between 0900 hrs to 1000hrs on 2nd of Oct.



Pedestrians = 612 /hour
Cyclists = 180 /hour
Total Vehicles = 1248 / hour

Traffic Volume Studies between 1700 to 1800 hrs on 6th of Oct.



Pedestrian = 552/hour
Cyclists = 360/hour
Total Vehicles = 1356 /hour

Appendix B

Time	Elderly	Adults	Students/Children	Total number
9.30-10.30 a.m.	19	17	37	73
12.00-01.00 p.m.	6	14	28	48

Table1 Number of public transport users by category

Time	ICA side		University side		Total
	No. of people IN	No. of people OUT	No. of people IN	No. of people OUT	
9.30-10.30	7	22	15	29	73
12.00-13.00	5	16	21	6	48

Table 2 Number of people entering and leaving busses