TACIS EU KOLARCTIC PROJECT

POLAR TRAFFIC SAFETY

БЕЗОПАСНОСТЬ ДОРОЖНОГО ДВИЖЕНИЯ В РАЙОНАХ КРАЙНЕГО СЕВЕРА

2007/139-580

Technical report WP3

Traffic Safety Audit on Archangelsk-Severodvinsk pilot road

May 2009

This project is funded
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Foreword

This report forms Technical Report WP3 in the context of the Tacis Kolarctic “Polar Traffic safety”-project. It is concerned with the traffic safety audit on Archangelsk-Severodvinsk pilot road.

Section 1 represents the results of kick-off meeting in Archangelsk with the representatives of the swedish Road administration, Northern region, the Arkhangelsk regional road administration “ArkhangelskAvtodor” and the Arkhangelsk regional road police (GIBDD), as well as local NGO and local traffic safety experts.

Section 2 represents the results of group of expert’s visit to the pilot road and their recommendations for developing the pilot project for 35 km Severodvinsk regional road.

Section 3 focuses on analysis of current and gives recommendations for the future AGTU (Arkhangelsk State Technical University) traffic safety training programs and lesson materials concerning traffic safety. Recommendations is prepared to develop traffic safety training programs and to provide lesson materials on Black Spot Management and Road Safety Audit.

Section 4 focuses on analysis of needs and gives recommendations of adult education in the traffic safety sector. Adult education is needed to strengthen know-how of all organisations responsible for their part of traffic safety work.

Section 5 represents the results of safety audit training in Arkhangelsk (covering planned roads and roads under construction as well as current roads).

Section 6 gives recommendations to improve Traffic Safety Board (Commission) work.

Section 7 is concerned with the dissemination of the results to the neighbouring regions via the Final project dissemination seminar in Arkhangelsk.

1 Start up the operations, involving the target groups and kick-off meetings.

The Archangelsk Region aims at increasing its institutional capacity to improve traffic safety. It is demanded by the transport strategy approved by the Russian Government and the increased numbers of fatal and injury accidents on the Archangelsk region roads.

The Arkhangelsk regional road administration “Arkhangelskavtodor” responsible for Archangelsk regional road assets together with Regional Road Police have started their common special efforts by launching a regionally financed Severodvisk road traffic safety project aiming to improve traffic safety on a pilot 35 km long road Acces to Severodvinsk from M8 with up-to-date methodologies. The project client was Arkhangelskavtodor and the project had been carried out by consortium of local transport institute, road police and technical university. Modest regional resources have prevented the invitation of foreign experts to the project. The mentioned road section was then proposed as pilot (or test) section for traffic Safety Audit within the Work Package 3 of the Polar Traffic Safety – project.

The first meeting where among other important issues the Work-Package 3 activities were discussed by the main partners was held on July,4, 2008. The participants of the meeting were as follows:

Vikstrom Elena	Swedish Road Administration
Maksimov Alexey	Arkhangelsk city road police
Kulizhnikov Denis	Arkhavtodor
Razheva Nadezhda	NGO on RTS “Green Wave”
Shabasheva Maria	Road traffic safety expert
Svatkova Elena	EU contact office expert in Arkhangelsk

The decision was made to distribute among the responsible parts and implement all the tasks mentioned in the project WP3 list, namely:

1. Joining as visiting experts to the group and making of recommendations (with economic justification) of developing of pilot project for 35 km Severodvinsk regional road.

2. Analysing current and preparing recommendations for the future AGTU (Archangelsk State Technical University) traffic safety training programs and lesson materials concerning traffic safety.

3. Analysing the needs and preparing the recommendations of adult education in the traffic safety sector

4. Safety Audit training in Archangelsk (covering planned roads and roads under construction as well as current roads).

5. Preparing recommendations to improve Traffic Safety Board (Commission) work (organ established based on Russian legislation).

6. Dissemination of results to neighbouring regions via the Final project dissemination seminar in Archangelsk.

The expected outputs were as follows:

Publications planned	Recommendations for Safety Audit in the pilot road
(The Technical Report)	Recommendations for Traffic Safety training in AGTU
	Recommendations for Traffic Safety adult training
	Recommendations to improve Traffic Safety Commission work
Traffic safety	Safer roads due to new methodologies (safety audit)
Dissemination	Results disseminated to neighboring regions

2 The results of experts' visit to the pilot road

Taking into the account previous work executed by Arkhangelskavtodor within its project on road safety audits the road "Access to Severodvinsk from M8" was taken as the main pilot section within the Polar traffic safety project. Two more roads of regional importance were also visited in order to obtain recommendations from the Swedish experts.

As stated in the Project's tasks the group of visiting experts from Sweden (Swedish Road Administration) and representatives from Russia (Arkhangelsk regional road administration, Arkhavtodor) gathered together in Arkhangelsk, held a meeting within the project and made a visit to the pilot road during October, 10- 13, 2007. The objectives of the visit were to prepare recommendations on traffic safety improvement on risky Arkhangelsk regional roads and develop of cooperation plan for 2007-2008.

The Swedish delegation were as follows:

Magnus Larsson	Swedish road Administration, road safety expert
Vikstrom Elena	Swedish Road Administration, project leader representative

The seminar "Traffic safety activities" was held on 12 October. The following reports were presented in framework of the seminar:

1. Current road safety situation on Arkhangelsk regional roads. Problems, searching the solution, and activities aimed at traffic safety improvement (Kulizhnikov Denis)
2. Measures aimed at pedestrians safety improvements in urban areas (Russian point of view) (Kulizhnikov Denis)
3. Measures aimed at pedestrians safety improvements in Sweden. Recommendations to improve pedestrians' traffic safety on 15-21 km section (Uima village) for Arkhangelsk-Belogorsky-Mezen road (Swedish team-work)
4. Road engineering arrangements (engineering instruments to reduce accidents on black spots in Sweden (Swedish TS expert)
5. Traffic accidents prevention during the dark period (Russian point of view, examples) (Kulizhnikov Denis)
6. Traffic safety provision on non-lighted road sections in Sweden (Swedish TS expert)
7. Development of cooperation plan (joint proposals).

The mass-media representatives were invited to the seminar to disseminate the information about the project to the population. The main objectives, the role of the project in the Program for Traffic Safety Improvement were explained, as well as the main participants of the project – Swedish road administration, Arkhangelsk regional road administration, Arkhangelsk City road police and NGO for TS "Green Wave" – were presented.

On October, 12-13 visits of experts to the following road black spots were organized:

- Uima road section of "Arkhangelsk-Belogorsky-Pinega-Kizhma-Mezen" (km15-20)
- "Access to Severodvinsk from M8" road
- "Arkhangelsk-airport Talagi" road.

The Arkhangelskavtodor experts briefly explained the situation and main problems of each of pilot road sections to the Swedish experts.

1. Uima road section of "Arkhangelsk-Belogorsky-Pinega-Kizhma-Mezen" (km15-20)

Road section name	Uima road section of the "Arkhangelsk-Belogorsky-Pinega-Kizhma-Mezen"-road (km15-20)
Road accidents statistics in 2008	4 serious accidents on 5 km section
The problem	Risky road section due to absence of sidewalks and insufficient lightning
Recommendations of the Russian partners and difficulties with implementation	▪ Reconstruction of road lighting system being on the balance of Uima settlement administration. Preliminary cost of works is 8,5 mln. RUR for 5 km road section with high pedet\strian traffic volume. The main client of these works should be Uemsky municipality as the road stretches along its lands. Arkhangelskavtodor is not responsible for road lighting system as it

	is beyond road administration's responsibility. Moreover, to start the road lighting works one has to prepare a design for it. Absense of financial resources prevents Uemsky municipality to start road lighting works resulting in new killed and injured in road accidents. ▪ Construction of sidewalks for pedestrians, which is complicated due to land restrictions (houses are located too close to the road). Sidewalks can be constructed only on Uima administration lands but design documentation is needed as the first step. Conclusion: Taking into acccount insufficient financing of road sector the Arkhangelsk regional road administration will not be able to finance the road safety measures like rpad lighting and sidewalk construction in the nearest future. Therefore a plan of road safety measures should be developed with the help of foreign experts.
What was done by Arkhavtodor:	In 2007 road humps were constructed on km 18+100-18+400 near the Uima school, the speed was limited to 20 km/h.
Comments and recommendations of the Swedish partners	Road humps were evaluated by the Swedish experts as a good inexpensive decision to quickly reduce pedestrian accidents on the section. The experts proposed to consider and treat

	the road section going through Uima as urban street and apply norms and standards that are applied to urban streets. Taking into account that without sidewalks pedestrians have to use carriageway (which is strongly prohibited by Traffic Rules) it was recommended to install road curbs on both edges of the carriageway. This will psychologically place the road as the street and the pedestrians will feel more safe. Moreover, drivers will visually interpret the road as an urban street and will not exceed the speed limit.
Decision of the Arkhangelsk road administration	The measures proposed by the Swedish partners were analysed and the decision was made to place the curbs together with the rehabilitation works on the road. The drainage system was also re-considered in order to prevent puddles on the carriageway.

2. Access to Severodvinsk from M8 "Kholmogory" federal road (km 0, intersection)

Road section name	Access to Severodvinsk
Road accidents statistics in 2008	6 serious accidents on km0
The problem	Federal and regional road intersection at grade. High traffic volumes. Bad driver orientation on the wide intersection area.
Recommendations of the Russian partners and difficulties with implementation	A roundabout was proposed within the previous Road Safety Audit project (2004-2007). As Russia hadn't modern design

	norms for rounabouts, the Swedish-Finnish norms were recommended for design.
What was done by Arkhavtodor:	In 2007 according to Arkhangelskavtodor's order the group of Russian designers under the supervision of Finnish and Swedish experts developed the design documentation on roundabout construction at km0 of the "Access to Severodvinsk". The design documenation was improved several times under the suoervision of Mr. Juha Hyvarinen, project expert (Finland).
Comments and recommendations of the Swedish partners	During the meeting on October, 13 the Swedish experts after having visited the place and analyzed the design documantation agreed the proposed roundabout.
Comments and decision of the Arkhangelsk road administration	Unfortunately, during the following months the road "Access to Severodvinsk" was nominated to become the road of federal importance with transferring it to the balance of the federal road administration of the M8 road. Arkhangelskavtodor having ready design documentation had to stop any works on the Access. The design documentatio was handed over to the probable new owner of the road. However, due to some reasons the Access to Severodvinsk had never been transferred to the new owner. Currently, the road ownership is still under consideration.

3. Arkhangelsk-Talagi airport road

Road section name	Arkhangelsk-Talagi airport road
Road accidents statistics in 2007	5 serious accidents
The problem	The turn at 90^0 on km 4+000 together with accessing Talagi oil base road represent real danger to road users.
Comments and recommendations of the Swedish partners	On October, 13 the multinational expert group visited the place. The road by its engineering and operational parameters was constructed in accordance to the current international road norms. Taking into account the planned rehabilitation works in 2008 on the road Arkhangelsk-Talagi airport, the experts proposed to consider the possibility of constructing a roundabout similar to that recommended for km0 of the Access to Severodvinsk.
Comments and decision of the Arkhangelsk road administration	Arkhangelskavtodor specialists are considering the expert's recommendation.

Conclusion: The group of Swedish experts confirmed that the work started by their Russian colleagues from Arkhangelskavtodor in the field of road safety audits was the right way to increase their institutional capacity to improve traffic safety. Attempts to construct the first roundabout designed in compliance to the latest Swedish and Finnish know-how was admitted as a good kick-off for road safety improvements in the region. The recommendations of Swedish partners on possible road safety solutions for 3 severe black spots were thoroughly analyzed by the Russian side and two of them at least will be implemented in future.

3 AGTU Traffic safety training programmes analysis and proposals for improvement

Analyzing current and preparing recommendations for the future AGTU (Archangelsk State Technical University) traffic safety training programs and lesson materials concerning traffic safety were made. Analysis showed insuffficient number of lecture hours spent on road traffic safety issues. The recommendations in a form of new lectures were prepared to develop traffic safety training programs and to provide lesson materials on black spot management, Road Safety Audit and other issues. The package of ready-to-use lectures is available on a CD in the format of Microsoft Word and Power Point presentations.

4 Traffic safety adult education

Adult education is needed to strengthen know-how of all organisations responsible for their part of traffic safety work. Therefore the project experts decided to focus both on future (AGTU Road department students) and those who teach them road safety.

Knowing the current needs and in order to prepare recommendations for adult education in the traffic safety sector a proposal was made to organize a Lecture Day in AGTU both for future and current road specialists. The Lecture Day «Transferring road safety advanced experience to Arkhangelsk adult population (future and current road specialists)» was hold on April, 23, 2009 in the lecture room of the Road department, AGTU during the period 9:00-15:00.
The Lecture Day Programme is available in **Annex 1**, all the presentations are on a Lecture Day CD.

The main topics discussed on the seminar were as follows:

1 Brief presentation of Polar traffic safety project
2 General presentation of road accident causes and their systematization in modern practice
3 Designing Road traffic safety programmes. Experience of the Baltic countries
4 «Vision Zero. Sweden»: Swedish road traffic safety strategy . The movie shot by the Arkhangelsk city road police in Sweden
5 Developing the Road Traffic safety Programme for regional roads of the Arkhangelsk region (project component, WP 2)
6 Conception “Road Safety Audit: Basic principles”
7 Actions and results of the project component WP3 “Traffic Safety Audit on Archangelsk-Severodvinsk pilot road”
8 Effective and low-cost measures to reduce traffic accidents in EU countries. Traffic calming concept.
9 Economic analysis applied in EU countries to justify road safety measures.
10 The role of civil society in road traffic safety provision
11 Experience of NGO of Northern countries in road safety improvement (Finland, Sweden)
12 Prospects of using Northern Countries’ road safety experience to reduce road accidents in

Arkhangelsk

13 Questionnaire of the audience: Lecture day evaluation

The total number of Lecture Day trainees was 40 persons including students of the 3rd, 4th and 5th course and lectors of the ASEU Road Department. The list of lecture Day participants is presented in **Annex 2**.

After the lectures a questionnaire of the audience was made aiming at Lecture day evaluation. The questionnaire form is available in **Annex 3**, the results of the questionnaire are as follows:

- The number of trainees who completed the Evaluation List is 28 persons.
- Most of the trainees (93%) think that their participation in the Lecture Day have improved their knowledge of road traffic safety issues.
- About 90% trainees evaluated the level of the Lecture Day organization as very high and high.
- Some 86% trainees evaluated the complexity of the Lecture Day Programme and materials as optimal.
- 97% of trainees descibed the Lecture Day as “Excellent” and “Very good”.
- The presentation on road safety audits was described as the best one by half of those who participated in the Lecture Day. The trainees specially marked the movie «Vision Zero. Sweden»: Swedish road traffic safety strategy, shot by the Arkhangelsk city road police in Sweden.

In general, the Lecture Day lectors have received very good marks from the trainees. Road safety issue was admitted as one of the core regional priorities.
The representatives of mass media participated in the Lecture Day to cover it in the local TV Programme “708th is on-line” (The programme of the Arkhangelsk city road police on the Arkhangelsk local TV channel). Both the lectors and Road Department students were interviewed.

Photo 1 Brief presentation of Polar traffic safety project by Juha Hyvarinen

Photo 2 General presentation of road accident causes and their systematization by Elena Svatkova

Photo 3 Lecture Day participants

Photo 4 Prospects of using Northern Countries' road safety experience to reduce road accidents in Arkhangelsk by Alexey Maksimov, head of the Arkhangelsk city road police

5 Traffic safety audit training

A short training course in a form of workshops was held in Archangelsk in order to familiarize the stakeholders with the Road Safety Audit Concept and provide practical Road safety audit of the draft design plan of Severodvinsk and Moscow roads intersection with roundabout.

To present the Road Safety Audit concept the document in **Annex 4** was developed. It provides a reference containing a local perspective of the road safety audit process and helps the trainees to familiarize themselves with road safety audit concept and principles. The document handed over to them provided a synthesis of existing documentation, an overview of practices and suggested issues to be considered for audits undertaken at different stages. (Seminar Presentation on road safety audit principles made in Power point is available in Russian, on CD).

After presentation of Road safety audit principles two workshops (July, August and October, 2007) were dedicated to the Road safety audit of the draft design plan of Severodvinsk and Moscow roads intersection with roundabout (See **Annex 5).**

Special audit training session was organized in order to give recommendations to improve road safety of the Moskovsky Av/Lenina St. junction within the design project “Construction of the Moskovsky avenue on the section from Galushina St. To Lenina St. In Arkhangelsk”. The results of road safety audit were compiled in a report available in **Annex 6**.

6 Recommendations to improve Traffic Safety Board work

Traffic Safety Board is a permanent existing body working on a regular basis in every region of Russia. The stakeholders participating in that include all organizations responsible for road traffic safety in the Arkhangelsk Region.

The review of Traffic Safety Board work and recommendations to strengthen it are presented below.

Comments and recommendations to Traffic Safety Commission work

On 30.06.2005 the Governor of the Arkhangelsk region signed the order to recommence the work of the Traffic Safety Commission. The aims are to form and provide the common state policy on traffic safety improvement, to coordinate the work of all structures for effective problem solving, to form basic methodological, organizational, scientific and technical systems for traffic safety improvment.

The main objectives of the Commission work are:

1) Coordinating the work of the regional executive authority, territorial bodies of the federal authority, and institutions of local authorities on traffic safety issues,
2) Managing development and implementation of programs, plans and measures aimed at traffic safety improvement,
3) Making proposals for traffic safety work improvement, as well as controlling work implementation.

The main functions of the Commission according to the main objectives are as follows:

- to consider the work on accident prevention in road transport organizations regardless the ownership status and private companies in the Arkhangelsk region and municipalities;
- to study accidents causes, to work out measures aimed at reduction of road accidents and their severity.
- to define the priority directions for road accident prevention together with regional executive authority and territorial bodies of the federal authority

- to manage development and implementation of regional traffic safety programme, to consider the financial, material and engineering issues,
- to offer assistance to local authorities in the Arkhangelsk region concerning traffic safety programme development and measures aimed at traffic safety improvement.
- to give conclusions and recommendations on regional and other traffic safety projects
- to coordinate research in the field of traffic safety improving
- to assist in cooperation with corresponding international bodies related to traffic safety improvement, to study and use successful international experience
- to arrange and hold meetings, conferences and exhibitions on traffic safety issues, to participate there and assist for suggestion implementation
- to cooperate with mass-media on traffic safety informing

The Commission is entitled to:

- ask necessary information from Road police, other state road and transport inspections, local authorities, organizations regardless of their ownership, private companies, public unions, etc.
- invite experts to study traffic safety questions and participate in commission work,
- form special groups from Commission's members for development work on specific traffic safety problems,
- listen to the reports made by the heads of regional executive authority, territorial bodies of federal authority, institutions of local authorities, public unions, organizations regardless their ownership, private companies, vehicles owners on traffic safety questions and regional program implementation,
- form working groups for in-depth study of severe accidents causes and conditions,
- make proposals for traffic safety improvement to corresponding bodies responsible for traffic safety problem solving,
- coordinate actions taken to control observation of legislative acts, as well as the acts signed by the President of Russia, the Russian Government, regional administration, other normative documents in the field of road safety by the road users,
- assist in development and implementation of the regional programme and scientific and engineering projects.

The Commission is headed by the first Vice-Governor of the Arkhangelsk region.

The Head of the Commission (or the Deputy Head when the head is absent) manages the Commission's work, distribute responsibility among the members, and defines the list of questions to be discussed in the meeting, gives instructions for commissioners and controls implementation of measures.

The weaknesses of the Commission work are as follows:

- frequent change of the Commission members,
- insufficient frequency of meetings (regional Traffic Safety Commission meets 1-3 times a year, while it's not enough to achieve the objectives),
- the questions considered during the Commission meetings are too narrow and specific (e.g. the Commission defines the owner of the railway crossing, appoints those who will be responsible for this or that road safety measure, etc.);
- commission's work is not based on any programme. If there was a concrete road safety programme, the Commission would have been responsible for controlling of implementation of the programme measures and making corrections in the programme if needed;
- sometimes the commission's decisions on road safety improvement are not executed, the execution of decisions is not controlled well and there is no any special penalty measures for that.

Recommendations to improve <u>Regional</u> Traffic Safety Commission work

It is recommended to:

1. consider the possibility of the Commission member stabilization in order to increase its effectiveness
2. define the procedure of organizing additional meetings of the Commission
3. turn to consideration of more scaled tasks of road safety than now
4. develop the programme base for the Commision work (the Commision will be responsible for controlling the achivement of Road Safety Programme objectives)
5. control the implementation of decisions made by the Commission

Recommendations to improve <u>City</u> Traffic Safety Commission work

It is recommended to:

1. develop the complex city road safety programme, which will join the resources of different organizations responsible for road safety, synchronize their actions and supplement infrastructure measures with those aimed at safer road behavior, better safety training, improved vehicle safety (passive and active equipment), etc.
2. support the following safety work irections aimed at reduction of most often accident types (pedestrian accidents and collisions):
    - traffic calming measures on road sections with potential accident risk using special road furniture elements (traffic islands, humps, raised pedestrian crossings, etc.)
    - special traffic flow management elements for the flow dividing and channeling (traffic islands, roundabouts, central barriers).
3. implement road safety measures on concrete places (black spots defined in safety analysis) in order to rationally use of budget resources.
4. provide more accurate collection of accident data (including clear accident addressing, participants, main reasons, patterns and regularity). This information will allow both implementation of “right place road safety measures” and forecasting risk accident periods and potentially risk sections (accident prevention)

7 Dissemination of WP3 results

Dissemination of the results to the neighboring regions will be provided via Final project dissemination seminar in Archangelsk on 20th of May, 2009. The representatives from the Murmansk region, Republic of Karelia, the Leningrad Region, The Permsky Krai, Nenets Autonomous Area as well as from the districts of the Arkhangelsk region will be invited to the seminar.

Annex 1 Lecture Day Programme

POLAR TRAFFIC SAFETY
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LECTURE DAY PROGRAMME

«Transferring road safety advanced experience to Arkhangelsk adult population (future and current road specialists)»

Venue: Lecture hall of Road Department, AGTU

Date: April, 23, 2009

Time: 9:00-14:00

Time	Presentation	Author
9:00-9:15	Brief presentation of Polar traffic safety project	Juha Hyvarinen, project expert, contractor representative
9:15-9:40	General presentation of road accident causes and their systematization in modern practice	Elena Svatkova, project expert
9:40-10:10	Designing Road traffic safety programmes. Experience of the Baltic countries	Maria Shabasheva, project local expert
10:10-10:40	«Vision Zero. Sweden»: Swedish road traffic safety strategy . The movie shot by the Arkhangelsk city road police in Sweden	Alexey Maximov, project Partner (Arkhangelsk City road police)
10:40-11:00	Developing the Road Traffic safety Programme for regional roads of the Arkhangelsk region (project component, WP 2)	Maria Shabasheva, project local expert
11:00-11:15	Coffee-break	
11:15-11:40	Conception “Road Safety Audit: Basic principles”	Maria Shabasheva, project local expert
11:40-12:10	Actions and results of the project component WP3 “Traffic Safety Audit on Archangelsk-Severodvinsk pilot road”	Denis Kulizhnikov, project Partner, Arkhangelsk regional road administration
12:10-12:30	Effective and low-cost measures to reduce traffic accidents in EU countries. Traffic calming concept.	Rashida Girfanova, project local expert

12:30-12:45	Economic analysis applied in EU countries to justify road safety measures.	Maria Shabasheva, project local expert
12:45-13:00	The role of civil society in road traffic safety provision	Nadezhda Razheva, project stakeholder, NGO “Greenwave” Director
13:00-13:30	Experience of NGO of Northern countries in road safety improvement (Finland, Sweden)	Nadezhda Razheva, project stakeholder, NGO “Greenwave” Director
13:30-13:50	Prospects of using Northern Countries’ road safety experience to reduce road accidents in Arkhangelsk	Alexey Maximov, project Partner (Arkhangelsk City road police)
13:50-14:00	Questionnaire of the audience: Lecture day evaluation	
	Questions, discussions, Lecture day summary.	

Annex 2 List of Lecture Day participants

THE LIST OF TRAINEES

of the Lecture Day «Transferring road safety advanced experience to Arkhangelsk adult population (future and current road specialists)»

Venue: **Arkhangelsk State Engineering University, Roads Department, lecture room #116**

Date: **23rd of April, 2009**

Time: **9:00-15:00**

The Original list of participants with their signatures is available in the Russian version of the Technical Report 3.

#	Trainee name	Date	Number of training days	Signature
1.	Antonov P.	23.04.09	1	
2.	Panarin A.	23.04.09	1	
3.	Lunyonok A.	23.04.09	1	
4.	Tsyvarev P.	23.04.09	1	
5.	Mokeeva E.	23.04.09	1	
6.	Dvortsov A.	23.04.09	1	
7.	Bogdanov I.	23.04.09	1	
8.	Kokorina U.	23.04.09	1	
9.	Denisova N.	23.04.09	1	
10.	Zarubina M.	23.04.09	1	
11.	Lyata N.	23.04.09	1	
12.	Popov L.	23.04.09	1	
13.	Sharygin E.	23.04.09	1	
14.	Okulov E.	23.04.09	1	
15.	Popova A.	23.04.09	1	
16.	Bochtaryova M.	23.04.09	1	
17.	Zakharov D.	23.04.09	1	

18.	Morozov D.	23.04.09	1	
19.	Vereschagin A.	23.04.09	1	
20.	Yarygina O.	23.04.09	1	
21.	Oshurkiva Yu.	23.04.09	1	
22.	Shilovskaya E.	23.04.09	1	
23.	Kostylev A.	23.04.09	1	
24.	Orlov M.	23.04.09	1	
25.	Borzy I.	23.04.09	1	
26.	Martyukov A.	23.04.09	1	
27.	Bakina N.	23.04.09	1	
28.	Rudakova M.	23.04.09	1	
29.	Moshnikov V.	23.04.09	1	
30.	Tonkaya M.	23.04.09	1	
31.	Galushin I.	23.04.09	1	
32.	Ryakhina E.	23.04.09	1	
33.	Pervunina M.	23.04.09	1	
34.	Epifanov M.	23.04.09	1	
35.	Gantsev A.	23.04.09	1	
36.	Rudakov V.	23.04.09	1	
37.	*Karzin E. (Head of the Road department)*			
38.	*Ignatyeva A (Lector of the Road department).*	23.04.09	1	
39.	*Nevzorova N. (Lector of the Road department).*	23.04.09	1	
40.	*Karzina V. (Lector of the Road department).*	23.04.09	1	

Annex 3 Lecture Day Evaluation List

EVALUATION LIST

of the Lecture Day «Transferring road safety advanced experience to Arkhangelsk adult population (future and current road specialists)»

The number of Lecture day listeners who have completed the evaluation list - 28 persons

A. Please mark the right cell in the tables below:

1. Do you think that your participation in the Lecture day have improved your knowledge of road traffic safety issues?

Yes, a lot					Not at all
12	14	2			
☺☺	☺	😐	☹	☹☹	
43%	**50%**	**7%**			

2. How do you evaluate the level of Lecture Day organization?

High					Low
16	9	3			
☺☺	☺	😐	☹	☹☹	
57%	**32%**	**11%**			

3. How do you evaluate the Lecture Day Programme?

Too complicated					Too easy
	3	24	1		
☹	😐	☺	😐	☹	
	11%	**86%**	**3%**		

4. What is your opinion of the Lecture Day in general?

Excellent					Poor
18	9	1			
☺☺	☺	😐	☹	☹☹	
65%	**32%**	**3%**			

Б. What part of the Lecture Day (presentation) did you like best?

№	Presentation	Number of trainees who liked the presentation
1	Brief presentation of Polar traffic safety project	
2	General presentation of road accident causes and their systematization in modern practice	1
3	Designing Road traffic safety programmes. Experience of the Baltic countries	1
4	«Vision Zero. Sweden»: Swedish road traffic safety strategy . The movie shot by the Arkhangelsk city road police in Sweden	7
5	Developing the Road Traffic safety Programme for regional roads of the Arkhangelsk region (project component, WP 2)	3
6	Conception “Road Safety Audit: Basic principles”	16
7	Actions and results of the project component WP3 “Traffic Safety Audit on Archangelsk- Severodvinsk pilot road”	
8	Effective and low-cost measures to reduce traffic accidents in EU countries. Traffic calming concept.	1
9	Economic analysis applied in EU countries to justify road safety measures.	3
10	The role of civil society (Green Wave) in road traffic safety provision. Experience of NGO of Northern countries in road safety improvement (Finland, Sweden)	2
12	Prospects of using Northern Countries’ road safety experience to reduce road accidents in Arkhangelsk	1
	All presentations	2

В. What can be improved?

- **Please make 5 minutes breaks every hour and air the room**
- **Please provide more active participation of the Road department lectors (especially young ones) in such Lecture days**
- **Please start Lecture Day a little bit later (9 a.m. is too early)**
- **Please provide more discussions and dialogues with the listeners**

Annex 4 ROAD SAFETY AUDIT GUIDELINES MATERIALS

1 INTRODUCTION

1.1 BACKGROUND

Although practiced elsewhere for nearly three decades, the concept of Road Safety Audits has only recently gained some acceptance in Russia. Originally developed in the United Kingdom in the 1980s as part of Accident Investigation and Prevention techniques, they have evolved to the point where they are now an integral component of the world road safety process.

The road safety audit process is best characterized as a proactive approach to road safety by addressing issues before accidents occur. This is a radically different approach to traditional *blackspot* analyses used to identify problem areas based on frequency of accident occurrence. A fundamental trait of road safety audits is that they are most effective when undertaken during the early stages of project development and design. Despite this, much of the promotion of road safety audits within Russia seems to focus on existing facilities where the potential influence is usually less than if applied during a design stage.

1.2 WHAT IS ROAD SAFETY AUDIT?

AUSTROADS, the national association of road transport and traffic authorities in Australia, defines a road safety audit as
*"....*a formal examination of an existing or future road or traffic project, or any project which interacts with road users, in which an independent, qualified examiner looks at the project's accident potential and safety performance*"* (1994).

Although many other definitions exist, most include the concept that a RSA is a *formal examination* which applies *safety principles* from a multi-disciplinary perspective. In all cases, RSAs are concerned with the safety of all road users.

The main objective of a RSA is to ensure a high level of safety from the onset of the project development by removing or mitigating preventable accident-producing elements.

1.3 WHY ROAD SAFETY AUDITS?

Over the years, road safety has become a principal concern of many transportation agencies. The rapid growth of the highway network, changing vehicle population, mixes of vehicles on the roads (smaller vehicles sharing the road with larger trucks), number and age of drivers, economic constraints in road construction, and technological advances, have contributed to an environment of increased accident potential. Furthermore, the three principal elements which contribute to highway accidents –driver, vehicle, and road– are also affected by the social and political environment under which they interact.

1.4 ROAD SAFETY AUDIT REVIEW IN LEADER COUNTRIES

UNITED KINGDOM

The concept of road safety audits originated in the United Kingdom during the 1980s. In 1987, the United Kingdom (UK) Department of Transport formulated strategies directed toward achieving a one-third reduction in the number of annual highway casualties by the year 2000. In 1988, the UK passed legislation requiring all road authorities in mainland Britain to take necessary steps to reduce crashes on new roads. This requirement led to the development of two key publications: *A Road Safety Code of Good Practice* (Local Authorities Association, 1989) and *Guidelines for the Safety Audit of Highways* (Institution of Highways and Transportation, 1990, revised 1996).

In 1991, the UK Department of Transport made road safety audits mandatory for all national trunk roads and freeways. It currently remains the responsibility of the individual highway organizations to determine what to audit and when as a function of their highway programs, design procedures, and type of project.

AUSTRALIA

In Australia, the national association of road transport and traffic authorities is known as AUSTROADS. In 1994, AUSTROADS released a publication entitled, *Road Safety Audit*. This

publication establishes a broad set of guidelines for a national road safety audit program. It includes widely adopted checklists, developed through close interaction with Transit New Zealand.

Individual states are incorporating road safety audits at different rates throughout Australia. The state of Victoria's road agency, Victoria Roads Corporation (VicRoads), considers the road safety audit to be an integral component of the quality management process. Road safety audits are carried out from project conception to construction completion on all projects costing in excess of A$5 million (CDN $4.8 million).

UNITED STATES

In 1996, the Federal Highway Administration (FHWA) dispatched a scanning team to evaluate the road safety audit process in Australia and New Zealand. The group consisted of a multi-disciplinary delegation of highway engineers, safety specialists, and educators. The scanning team concluded that road safety audits could maximize safety of roadways design and operation.

Subsequently, the FHWA started a Road Safety Audit Pilot Project in 1998 to determine the feasibility of national implementation of road safety audits into the process of roadway development, construction and operation. Fourteen states are currently involved in the pilot project.

CANADA

There is a growing recognition among Canadian provincial jurisdictions that a more proactive approach to road safety is needed. Although Ontario is currently establishing a structured framework to enhance safety, other efforts have focussed on isolated reviews of specific projects.

1.5 WHY CANADIAN AND BRITISH EXPERIENCE USED FOR RUSSIA?

The benefits of Road safety audit application during the last two decades and potential of prospect usage of the concept has defined the distribution of road safety audit practice in

Australia, New Zealand, USA, SAR, Denmark, Netherlands, Singapore, and the United Kingdom. Road safety audit manuals developed in the above mentioned countries often reflect local road systems, characteristics, design standards, climatic conditions and practices of the country in which the audit process is implemented.

For more detailed consideration of the road safety audits practice the British and Canadian methodologies are used. The British experience is so valuable because the UK:

- is the pioneer in the field of road safety audit,
- has the most overall and comprehensive experience of road safety audits (more than 20 years): many theoretical studies were made and road safety audits were implemented.
- Is one of the countries having and applying their own RSA guidelines.

The Canadian experience is very important as some British peculiarities (e.g. left-side traffic, absence of severe winter conditions and winter maintenance) prevent from using their practice in Russian without some adaptation. The Canadian conditions are as unique as Russian ones in many ways such as:

Climatic conditions: Road users in Canada experience arduous driving conditions resulting from snow, freezing rain and sleet during the winter months. Road maintenance issues such as snow plowing and storage are also important factors included within a Canadian manual.

Size of the country: Due to its size, most of Canada has large areas of sparsely populated land and long highway segments connecting population centers.

Fleet mixes: There are a wide variety of special vehicles that use the roads, and their mix is constantly changing. There are now more, longer, and heavier trucks sharing the road with smaller vehicles.

Traffic volumes: Most Canadian highways experience low traffic volumes. This requires careful consideration when incorporating safety principles in the design of highways.

2 ROAD SAFETY AUDIT PRINCIPLES

2.1 DEFINITION OF ROAD SAFETY AUDIT

A road safety audit has been defined as
". . . a formal examination of an existing or future road or traffic project, or any project that interacts with road users, in which an independent, qualified examiner reports on the project's accident potential and safety performance" (AUSTROADS, 1994).

The Road and Traffic Authority in New South Wales, describes a road safety audit as
". . . a means of checking the design, implementation and operation of road projects against a set of safety principles as a means of accident prevention and treatment." (RTA, 1991).

2.2 TASKS BEYOND A TRADITIONAL RSA

To avoid misconceptions, it is necessary to identify tasks that are beyond the scope of a traditional road safety audit. The following items have often been a source of confusion.

1 Road safety audits are not a project redesign.

Deficiencies should only be identified by the audit team. It is not within an audit's mandate for a redesign or recommendation to be made to mitigate a deficiency. This responsibility will rest with the project owners or their design staff. Auditors may suggest exemplary measures, but it is not their responsibility to make specific recommendations nor to promote a particular solution.

2 Road safety audits are not intended for high cost projects only.

In fact, experience has shown that RSAs can be particularly effective for smaller projects where design teams have limited labor and resources. Larger projects often have enough individuals involved with the required expertise so that internal checks become either inherent or a structured part of the design process.

3 Road safety audits are not informal checks or inspections.

Informal reviews should be a part of the normal design process separate from the service an RSA provides.

4 Road safety audits are not a means to select among alternative projects.

It is inappropriate to rely on the products of an audit to choose among alternative projects/alignments or to solve public opinion conflicts concerning route location.

5 Road safety audits should not be viewed as a check of standards compliance.

Highway safety goes well beyond adherence to a set of minimum design standards. An audit is meant to be a wholistic and multi-disciplinary review of the safety level provided by a facility.

2.3 ROAD SAFETY AUDIT STAGES

Road safety audits can be effective for most projects, regardless of size, and at any or all key milestones in the development of a highway project. Traditionally, audits have been undertaken at the following key stages:

1. feasibility (planning);
2. draft (preliminary/layout) design;
3. detailed design;
4. pre-opening; and
5. post-opening (including existing or in-service facilities).

The complexity and level of effort of the audit process changes with each stage. An overview of what each of the audit stages entails is provided below.

Feasibility (Planning) Stage

An audit at the feasibility stage assesses the potential safety performance of the conceptual design proposal with respect to the route location, road design standards, and the scope of

the project. Auditors should focus on how the facility will affect the continuity of the adjacent road network and identify the safety needs of all road users (*i.e.,* pedestrians, cyclists, motorists, and others). Audits can be very effective at this stage; changes or improvements to the project are often highly cost effective due to inexpensive implementation costs.

Draft (Preliminary/Layout) Design Stage

An audit may be conducted upon completion of the draft design plans. Primary objectives are to evaluate the relative safety of intersection or interchange layout, horizontal and vertical alignment, cross section, sight distance, and other design standards. Audits conducted at this stage should be completed before the finalization of land acquisition to avoid complications if significant alignment changes are required.

Detailed Design Stage

An audit should be undertaken upon completion of the detailed design plans and typically prior to the preparation of the contract documents. The geometric design, lighting, traffic signing, and landscaping plans are made available to the audit team and evaluated in relation to the operation of the facility.

Pre-Opening Stage

Immediately before opening a facility, the audit team should conduct a site inspection to ensure the safety needs of all road users (*i.e.*, pedestrians, cyclists, motorists, and others) are adequate. The audit team should conduct day and night drive through inspections and, if possible, perform the inspection in adverse weather conditions. This type of audit attempts to determine if hazardous conditions exist which were not evident in the previous audits.

Post-Opening (and Existing) Stage

Road safety audits can be undertaken soon after opening a new facility to the public. Insight into operational behaviour and subsequent problem areas can be gained through observation which may not have been readily apparent before opening the facility. Corrective measures, although much more expensive to carry out at this stage, may still be cost effective. RSAs can also be conducted on any section of an existing road network to identify safetyrelated deficiencies. The information collected from accident reports is an important component for these audits; however, as an extension of traditional *blackspot*

*a*nalyses they should be supplemented by informed judgements surrounding the potential for other accidents.

Recommended Stages for Various Projects

PROJECT	AUDIT STAGE				
	Feasibility	Preliminary Design	Detailed Design	Pre-Opening	Post-Opening
Major new highway	•	•	•	•	•
Minor new highway		•	•	•	•
Major rehab./retrofit		•	•	•	
Minor rehab./retrofit		•	•		
Major Development	•	•	•	•	•
Minor Development		•	•		
Traffic calming			•	•	•

te: • denotes recommended

Source: G. D. Hamilton Associates Consulting Ltd., *Introducing Road Safety Audits and Design Safety Reviews Draft Discussion Paper,* Vancouver, British Columbia, Canada, 1998.

Source: G. D. Hamilton Associates Consulting Ltd.*, Introducing Road Safety Audits and Design Safety Reviews Draft Discussion Paper,* Vancouver, British Columbia, Canada, 1998.

2.4 TYPES OF PROJECTS TO AUDIT

Road safety audits have been conducted on a wide range of projects varying in size, location, type, and classification. The types of projects that can be audited are categorized

under the following headings:

- Major Highway Projects
- Existing Facilities
- Minor Improvement Projects
- Traffic Management Schemes (construction)
- Development Schemes
- Municipal Streets

2.5 THE AUDIT TEAM

INDEPENDENCE

Most practitioners agree that road safety auditors should be independent of the project design team to ensure that those who are unbiassed and those who may have a different perspective are reviewing the project. Audit teams can be established within large organizations or by using consultant firms or consortia. It is essential that an environment exists which fosters good communication between the audit team and the client/design team to ensure the audit is effective.

QUALIFICATIONS

Road safety audits should be conducted by an individual or team with adequate experience in road safety engineering principles and practices, accident investigation and prevention, traffic engineering and road design. Additionally, members with experience in enforcement, maintenance, and human factors can be added to the team on a project by project basis and at different audit stages. Human factor expertise may, in selected areas, contribute to a road safety audit by providing an understanding of the interactive nature of user behaviour with the road environment.

EXPERIENCE

It is imperative that the audit team has substantial collective experience in the key areas noted in the pervious section. While audit checklists serve to identify critical items/areas to

be considered, they should only be considered memory aides for individuals with a wealth of experience and not an exhaustive listing of issues.
Australia has implemented a national accreditation for those conducting audits. Accredited auditors must have undertaken a two-day course in road safety audits and have articipated in at least five audits with an experienced auditor, including at least three at the design stages.

AUDIT TEAM SIZE

The associated benefits of conducting an audit with a multi-disciplinary team are the diverse knowledge and approaches of each individual, cross fertilization of ideas that can be the result of discussions, and more than one pair of eyes reviewing the project. Using a multi-disciplinary team also provides the opportunity to expand the number of persons in an organization that are experienced in the audit process.

The size of the audit team will vary depending upon the size and type of project. It is recommended that the team consist of two to five multi-disciplinary individuals. The use of at least two individuals provides cross fertilisation. When the team becomes too large, it becomes difficult to reach a consensus and develop a focussed/concise audit. Additional expertise may be added to the project team as required at different stages of the audit process (*i.e.*, police officers, maintenance personnel, human factors, and others).

There may be projects that –due to their size– only require the review of a single plan, a field visit, and a one page report. In this situation, an audit by two or more individuals may not be justified. A carefully-selected individual may be sufficient to conduct the audit and raise issues that could result in significant safety-related savings.

COMPOSITION BY AUDIT SIZE

The selection of an audit team depends on the size and type of project, the stage of the audit and available resources.

Feasibility and Preliminary Design (Stages 1 and 2)

Audits undertaken at both the feasibility and preliminary design stages should only be conducted by an experienced audit team which includes:

- road safety specialist experienced in:
    1. accident reconstruction and collision investigation;
    2. safety management;
    3. safety engineering;
    4. road safety audits; and
    5. knowledge of the latest safety research and standards.

- highway design engineer who has knowledge of the current road design standards and practices. Furthermore, the engineer must be able to visualise the three-dimensional layout of the project from two-dimensional plans.
- an individual experienced in conducting road safety audits who can prompt discussions, assist in the audit procedure, and preferably has expertise with at least one prospective aspect of the audit.

Individuals involved in this type of audit can cover more than one of the above areas. A road safety specialist may also be a highway design engineer, or traffic engineer, who is familiar with the current road design standards and practices, and traffic operating conditions.

Detailed Design (Stage 3)

An audit at the detailed design stage requires the expertise identified in the previous section and may include additional individuals with expertise and skills, depending on the nature of the project, in such areas as traffic signal control, intelligent transportation systems, cyclists and pedestrians, transit systems and facilities, street lighting and traffic calming.

Pre-Opening (Stage 4)

Pre-opening audits require the expertise identified for Stage 1 and 2 audits. However, additional expertise may be added to the team where required. This may include one or more of the following:

1. a police officer with traffic and safety experience;

2. an engineer or supervisor who is familiar with all aspects of facility maintenance including signage,lighting, traffic controls, vegetation, snow removal, and others; and
3. an individual with knowledge of human behavioural aspects of road safety.

Post-Opening (Stage 5)

Post-opening audits require the same team composition and expertise as identified in the pre-opening audit stage.

Existing (In-Service) Roads

To evaluate the safety issues associated with existing roads, an audit team requires members with similar qualifications and experience to those individuals outlined in the pre-opening stage.

2.6 ROLES AND RESPONSIBILITIES OF PARTICIPANTS

Terms of reference should be developed at the beginning of a project. This document should contain the scope of the audit and the roles and responsibilities of all parties (*i.e.*, client, design and audit team) involved in the audit. The terms of reference may be a standard agency document or one developed for a specific project. It should incorporate any special requirements of the audit (*i.e.*, a night site inspection during winter conditions) and describe the process for the presentation of the audit results.

It is the responsibility of all parties to maintain good communication throughout the audit. This is to ensure the audit is conducted efficiently and to provide a means for resolving conflicts.

The typical roles and responsibilities of all parties involved in the safety audit process are outlined below.

Client (Highway Authority)

Road safety audits should be considered an integral component of highway conception, feasibility and design processes. It is therefore essential that highway authorities allocate sufficient funding and resources to support the road safety audit process.

Highway authorities should:

1. consent to road safety audits as a quality management requirement
2. commission audits at the proper project stages
3. review the formal audit report and act upon recommendations whenever appropriate and feasible.

Without the client's full commitment to the process, particularly by giving genuine consideration to recommendations, the audit process becomes ineffective.

The highway authority should provide training at all levels within the organization to ensure that safety is an integral component of all phases of a highway project (*i.e.*, planning, design, construction, and maintenance). Correct training of personnel increases the potential of safety issues being identified by the audit team.

It is the responsibility of the highway authority to:

1. select an audit team with the appropriate training and experience
2. provide project documentation
3. ensure the auditors have satisfied the requirements described in the terms of reference
4. attend the initial and completion meetings; and (5) refer all design changes to the audit team.

Design Team/Project Manager

It is the responsibility of the design team/project manager to provide the audit group with project background information (including previous audit reports), design drawings, traffic composition and characteristics, accident reports where available, and any other documentation affecting the design. The design team/project manager initiates audits when required; attends the initial and completion meetings; and reviews the issues raised by the audit report. The design team/project manager in turn provides the audit team with a written response addressing all safety issues. This includes either:

1. accepting the possible mitigative measures and providing a design solution for the hazard or
2. rejecting the measures and

3. stating the reasons for this action.

It is the responsibility of the design team/project manager to assess financial and budget constraints to determine whether, how, or when to adopt an audit's suggested solutions. The design team/project manager is responsible for all design decisions; however, decisions may sometimes require the involvement of the highway authority (if design is being undertaken externally). Any design changes must be submitted to the audit team who decides whether to audit the revised design further or to incorporate it into the next audit stage.

Audit Team

The primary role of the audit team is to identify potential safety problems of a highway project by reviewing project documentation and drawings, and conducting site inspections. They typically do not redesign the project or implement changes. The audit team may use a developed set of checklists to assist them while conducting the audit. Checklists identify issues and problems that can arise at the relevant stages of an audit. These checklists are merely guides and should not be used as a substitute for experience. They also provide a measure of continuity from audit to audit.

The audit team is required to submit a report to the design team/project manager, identifying critical issues based on safety engineering experience. A completion meeting is held between the audit team, the design team/project manager, and the client to discuss the audit findings. The audit team is required to review the design team/project manager's response to the audit report. It is not the role of the audit team to approve of or agree with the obtained response.

2.7 ORGANIZATION OF ROAD SAFETY AUDITS

There are several methods of organizing a road safety audit while ensuring the audit team has the appropriate training, expertise and independence of the design team. There are three preferred ways of organizing a road safety audit:

1. audit by a specialist auditor or team
2. audit by other road designers

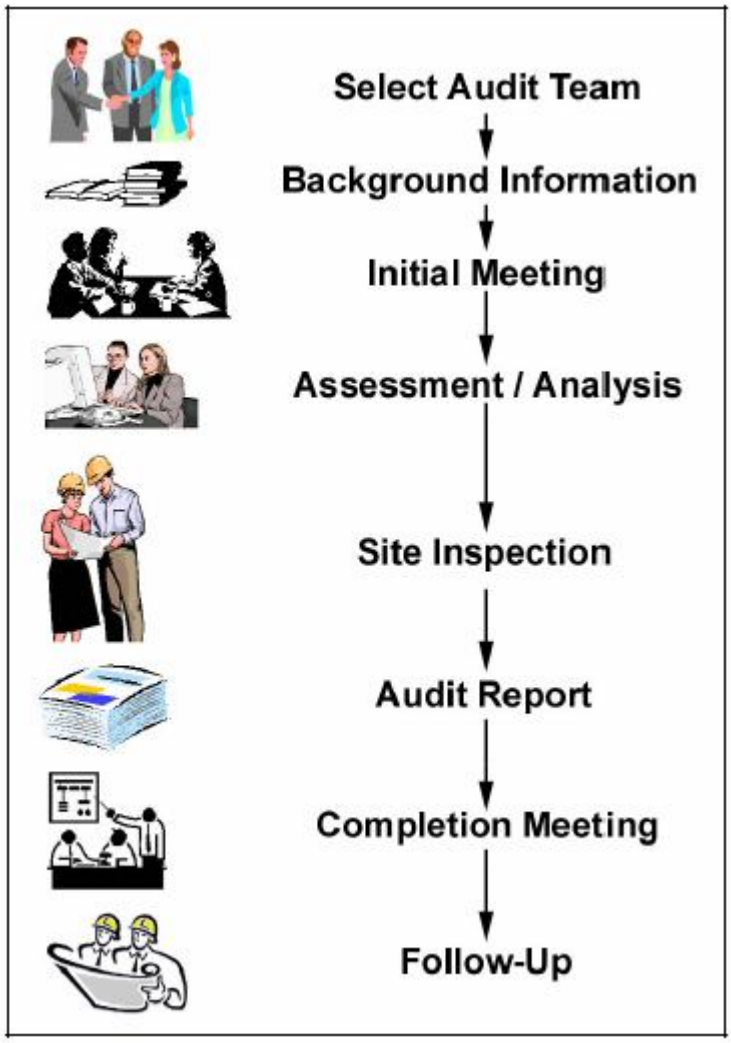
3. audit within the original design tea.

2.8 MONITORING AND EVALUATION

All highway organizations involved with safety audits should monitor and evaluate their road safety audit procedures. This may be accomplished by maintaining a complete record of the safety audit projects conducted by the organization. The record would contain a list of common deficiencies identified during all stages of road safety audits. This, in turn, provides feedback for designers and auditors performing future projects. The intent is to prevent recurring deficiencies from being designed into road projects. Otherwise, designers will continue to “build blackspots” into the road system.

3 ROAD SAFETY AUDIT PROCESS

The complete process, from the selection of the audit team to the completion meeting and follow-up is presented below



3.1 SELECTING THE AUDIT TEAM

It is the responsibility of the client to select the audit team. As previously noted, the audit team should be independent of the design team and have appropriate experience and training in road safety engineering. A list of potential auditors, including qualifications, would be beneficial to the client when selecting the audit team. An audit team leader should be selected who has experience in road safety engineering and has participated in previous audits. The client should exercise caution when selecting the audit team. The team with the lowest bid is not always the most experienced. In road safety audits, experience is paramount, and cost is secondary.

3.2 COLLECTION OF BACKGROUND INFORMATION

The client is responsible for providing all relevant project documentation; including reports, data, drawings, contract documents and where required traffic volumes. This information will be used by the audit team to assess the project from a safety perspective.

3.3 INITIAL MEETING

An initial meeting is normally held between the audit team, client and designer. The objective of this meeting is to familiarize the audit team with the project scope and safetyrelated information, exchange data, delegate responsibilities, and to set up communication lines.

The audit team can familiarize the designer and client with the audit process and familiarize the design team with the checklists to be used. The client/designer should inform the audit team of any problems encountered during the planning, design, and construction stages. The terms of reference identifying the project scope, and roles/responsibilities during the audit should be completed. Project schedules and special requirements should be identified and discussed at this stage.

3.4 METHODOLOGY

After the initial meeting, it is the responsibility of the audit team to assess the project documentation and to conduct site inspections (if appropriate) to determine the safetyrelated issues of the project. The following sections present the process used when conducting road safety audits for highways and isolated facilities.

3.4.1 Highway Audits

Background Information

For audits at the feasibility stage, the required background information may include:

- project scope, goals, and objectives;
- general project constraints;
- route choice and layout options;
- continuity with adjacent road networks and land uses; and
- environmental and geotechnical constraints.

For audits at the preliminary and detailed design stage, the required background

- information may include:
- standards and design criteria used;
- land acquisition;
- information about previous consultation with the community;
- design drawings;
- details of plans;
- plans showing adjacent roads which may be affected by the project;
- traffic forecasts;
- right-of-way; and
- potential/expected road users.

For audits at the pre-opening stage, it is necessary to provide the audit team with

- previous audit reports (if available) and
- other relevant information, such as road users expected to travel on that road.

Audits that are conducted at the post-opening stage or on existing facilities require background information regarding:

- traffic volumes for all road users;
- collision information;
- previous audit reports–if available; and
- as-built drawings.

Assessment/Analysis of Background Information

Once all the background information is collected, the audit team needs to assess/evaluate and analyze all the available information. For audits at the feasibility, preliminary design, or detailed design stage, the audit team should examine the details about the proposed project, details of plans and background information on a section by section basis. This provides an opportunity to consider the impact of the design on all road users.

If the audit is being conducted at the pre-opening or post-opening stage, or if this is an audit of an existing facility, the team should analyze all pertinent information such as accident reports (this does not apply to pre-opening stage), and all other relevant

information. The analysis of accident reports is not intended to be used as a blackspot analysis, but as an aid for the auditors in determining potential areas with safety problems. This would make the audit pro-active rather than reactive.

Site Inspections

Field inspections are required at all stages because they provide the team with a feel for the existing conditions. Prior to going to the field, the team should become familiar with checklists to ensure the inspection is productive and relevant concerns are raised. The use of checklists, in addition to background information, will assist the auditors to ensure that relevant safety aspects are addressed. Checklists should not be used as a substitute for experience, nor considered exhaustive.

For audits at the feasibility, preliminary design, and detailed design stages, the team conducts a site inspection, including 'green field' sites, upon completion of the preliminary assessment. The audit team should examine the transition between any new and existing roads to ensure consistency from a multi-modal perspective. This includes cyclists, elderly drivers, elderly pedestrians, truck and bus drivers, pedestrians, children, disabled, all terrain vehicles, and snowmobiles. Additionally, the team should focus on prevailing climate and geographic conditions.

Audits at the pre-opening and post-opening stage, as well as audits of existing facilities, review the physical characteristics of the project by conducting a site inspection. These inspections involve assessing the furniture, signs, lighting, markings, delineation, and geometric features from a multi-modal perspective. The team should identify issues that may affect the road users' perception of the road or restrict sight lines.

In the case of preopening audits, the inspection should be conducted as close as possible to the opening date but still allow time for the design team to implement any changes. For larger projects, preopening audits may be conducted in phases as the sections of the project become complete.

The audit team should conduct the inspection by driving and walking (if feasible) through the project in opposite directions. In addition, site inspections should be conducted at night and in adverse weather conditions if possible. The team should consider going beyond project limits to assess the adjacent road network, paying particular attention to the interface if it is a new project. Photographs and videotapes can be used to capture roadway

features for later discussions.

Audit Findings

Once the site inspections are completed, the audit report is prepared. The report should clearly and concisely describe the project, the audit stage, the audit team members, the process of the audit, any safety issues identified, and mitigative countermeasures. These countermeasures are conceptual in nature and should not provide the design team with design solutions. If time constraints are identified in pre-opening audits, a preliminary report may be developed immediately and submitted to the project manager before the final report is prepared.

3.5 DOCUMENTATION AND AUDIT REPORT

The audit report should clearly and concisely identify aspects of a project which could impact negatively on the level of safety for users. A road safety audit report should contain, as a minimum, the following sections:

1. Report title page

- Audit stage (*e.g.*, Stage 3: 50% Detailed Design Road Safety Audit)
- Project name
- Project location
- Date
- Audit team members and qualifications
- Clients name and address

2. Introduction

- Auditors and Audit Process
    - Stage of Audit
    - Location (Map)
    - Audit Process
    - Meetings (including with whom, date and reason for meeting)
    - Inspections (date and whether day or night)
    - Discuss documentation not provided and reasons
    - Discuss information that was not provided on plans

- Description of the procedure used to conduct the audit
- Statement regarding the disclaimer for liability of the audit team

- Description of Project

This section provides a brief description of the project.

- Deficiencies and ranking of safety issues

Description of the ranking system used for identifying: safety hazards which warrant immediate attention or removal; those that are considered to present a serious safety hazard; and, those requiring attention and are in the category of general safety concerns.

- Responding to the Audit Report

Identify that the client and designer are under no obligation to accept all safety issues raised by the audit team but must respond stating their acceptance/rejection of suggestions and reasons. Describe the format the design team may use to document their response to the audit findings. Example of a concise format:

AUDIT FINDINGS	AUDIT RECOMMENDATIONS	CLIENT RESPONSE	
		ACCEPT: YES/NO	REASONS/ COMMENTS

3. Safety Issues from Previous Audit Stages

Identify and list safety issues from any previous audits which still require attention.

4. Findings from Current Audit

Provide a brief statement of deficiencies identified during site inspections and review of documentation. Photographs may be used to illustrate deficiencies.

5. Next Audit Stage

The audit team may recommend when the next audit will be conducted if information was not provided to assess a portion of the project.

6. Concluding Statement

7. Names and Signatures of Auditors

3.6 COMPLETION MEETING

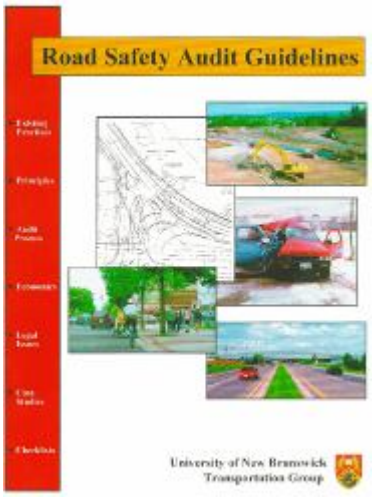
Once the audit report has reached the stage where all findings are clearly documented, a completion meeting should be held to allow all interested parties a chance to interact and discuss the results.

The objective of the completion meeting is to foster a constructive dialogue centred on the audit report findings. The meeting provides an opportunity to:

- formally present the audit findings and clarify or elaborate their meaning,
- suggest improvements to the report structure,
- discuss possible remedial measures for problems identified, and
- set a timetable for completion of client responses.

3.7 FOLLOW-UP

The follow up process is lead by the designer/project manager. The designer/project manager reviews the audit report and prepares a written response to each concern cited. For each audit suggestion rejected, justification (physical, economic, or social) should be documented in the report by the client. The designer/project manager should confirm the decided action for every suggestion in the audit report.



4 ROAD SAFETY AUDIT CHECKLISTS

The examples of road safety audit checklists are available in **Road Safety Audit Guidelines** developed by University of

New Brunswick, Transportation Group, Department of Civil Engineering Fredericton, New Brunswick, UNB Transportation Group 1999

Annex 5 Road safety audit of the draft plan of Severodvinsk and Moscow roads intersection with roundabout.

	Audit 1, July 2007 (the design documentation was done on 23.06.2006)	Audit 2 (07.08.2007)	Audit 3 (13.11.2007)
Audit object	Draft plan of Severodvinsk and Moscow roads intersection with roundabout up-dated 08.06.06 by SevDorProject	Draft plan of Severodvinsk and Moscow roads intersection with roundabout up-dated 03.07.07 by SevDorProject	Draft plan of Severodvinsk and Moscow roads intersection with roundabout up-dated 13.11.07 by SevDorProject
1. General idea of the design solution	The main idea -placing the planned roundabout on current junction at km0 using maximum of asphalt concrete pavement and minimum road embankment and pavement reconstruction – limits achieving the best geometry parameters (ensuring traffic fluency and safety) of the roundabout It is recommended to make design aiming at maximum safety of the junction in order to get maximum output from resources spent on modernization. When aiming at less costs and sacrifice the best rounabout parameters to this goal, then ratio of low costs to less effect reduces output of resources reserved for roundabout. In other words, if one decided to introduce world practice this must be done in a best way to ensure maximum output from budget resources.	<u>The main mistake wasn't corrected</u> – desire of the designers to place the planned roundabout on current junction at km0 using maximum of asphalt concrete pavement and minimum road embankment and pavement reconstruction. See the previous audit somments. It should be mentioned that the given project is a pilot one and everyone will judge about all roundabouts by the results of this pilot one. Thus, **the roundabout must become a model** with experience that could be distributed to other accident risky junctions not only in the Arkhangelsk regionn but in other regions, too.	The mistake of the general idea has been corrected. In this case the design is guided with the principles of optimal road capacity and safety but not with the principles of existing pavement and space.

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	Russian partners' have already savings because they will apply the practice, parameters and decisions proved with the time (some of the parameters were set by the Finnish road engineers during analysis and correction of mistakes made by them due to insufficient experience). Currently these parameters have been applied in Finland during the last 15 years and ensure the best effectiveness in similar climatic conditions.		
2. Roundabout geometry	Aimimg at better roundabout geometry it is recommended to replace the roundabout some meters forward to Arkhangelsk and increase the diameter to 40 m. Geometry parameters on Severodvinsk and Arkhangelsk approaches are designed well. From Moscow approach the entry is too opened allowing the vehicles to "rush" into the roundabout and cross it at maximum speed. In this case we loose the forecasted effect from roundabout - improving safety from traffic calming. Effect from resources spent on rounabout will be reduced in this case. Roundabout costs are made but one of the approaches hadn't become safer as the necessary "curvature" wasn't achived. Geometry improvement will improve safety and thus the outputs.	The geometry on Severodvinsk-Arkhangelsk direction is OK. Moscow approach the entry is still too opened allowing the vehicles to "rush" into the roundabout and cross it at maximum speed. This decision creates possibilities for accidents. See the previous audit comments.	The road geometry from Moscow direction is still, after some adjusting, too "open" allowing too direct (too high speed) driving of passenger cars. This leads to low traffic safety. The problem can be corrected by bending the incoming road more to left (3…5 meters). This way the incoming geometry is similar in all three directions.

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	Ideas to improve geometry: 1. remove road axis to the left (current shoulder should be strengthened) 2. Increase roundabout diameter to 40m and remove the axis some meters forward to Arkhangelsk.		
3. Roundabout pavement	The diameter of the roundabout is 35 m and carriageway 7 m. The last includes 1,5 m narrowing round with curb and round natural stones pavement. Additionally, a 2 meters inner ring with second curb and natural round stones pavement has been introduced. The ring is aimed at controlling of passenger car speed without any restrictions for trucks and buses. The additional lane allowed the heavy trucks to turn to the left using the external ring without destroying the plantings. The curb is to be placed 30mm higher than the pavement surface and made of natural stone or artificial bricks (the slope is to be 1:5). There should be enough space beyond the curb to allow fluent left turning of trucks The dimension and shape of this space is to be defined after inquiring of local enterprises having trucks in order to take into account specifics of dangerous, high-size and defence industry goods transportations.	The diameter of the roundabout is 35 m and carriageway 7 m. The last includes 1,5 m narrowing round with curb and round natural stones pavement. Additionally, a 2 meters inner ring with second curb and natural round stones pavement has been introduced. There are still two directions where there exists the risk for heavy vehicles: Severodvinsk-Moscow and Moscow-Severodvinsk. It is recommended to get known the dimensions of thetrucks that will use the roundabout (e.g. from "Zvyozdochka") and adapt the central ring to the needs and trajectory of the trucks	Concrete stones have been planned as pavement to 1,5 m narrowing part of the carriageway and to the inner 2 m ring. The extra 2 m inner ring should allow oversize lorries turn slowly to left through the roundabout going over both curbs without destroying plantings and green area. It is essential and advisable to use natural round stones in both rings as they are to calm the traffic but still allow a normal long vehicle (1,5 m narrowing part of the carriageway) and oversize vehicle (the inner 2 m ring) to turn without major obstacles. The only "obstacle" is not-even pavement, which on the other side calms the traffic of personal cars (not too direct driving lines = lower speeds = not heavy consequences in case of accident). There are two risky directions still left with oversize vehicles: Severodvisk-Moscow and Moscow-Severodvinsk, because there is no information about the specific "super" over-size vehicles (e.g. Svjosdishka trucks transporting submarine parts). They may still not match to all reserved parts of the

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		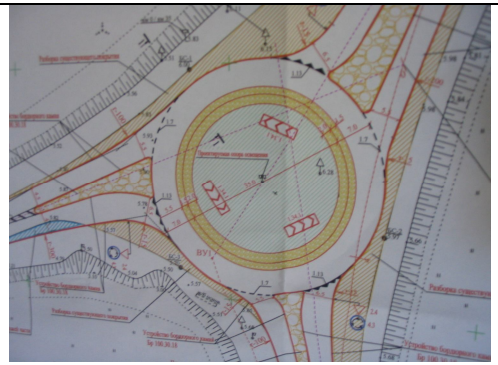 	roundabout. Therefore, it is advisable to leave 1…2 first meters of inner round (planned now as green area) without permanent or solid obstacles (like road signs or even bushes) on the forecasted trajectories of these directions. If, after one year exploitation of the roundabout, there is still ground (e.g. lorry tyre prints) to adjust the green area pavement (to cover the "super over-size" vehicle trajectories by round stones), it would be carried out according to additional decision.
4. Edge line arrangements	The incoming and outgoing curb lines should start and end on the level of middle islands. However, it would be recommended to construct them to 80 m to direction of Moscow and to Arkhangelsk. Severodvinsk direction is ok. In this way the curb lines would cover the whole changed area of the current intersection providing appropriate optical guidance for the drivers.	<u>The recommendations are not implemented fully (See the previous audit).</u> Curb line on Moscow-Severodvinsk has been corrected and functions as the optical trajectory for the drivers It is recommended to extend the curb line by 80m forward to Moscow and	There are middle islands in every direction separating in- and out-coming flows and dividing islands separating "free-right" lanes from the round. All are formed by curbs. The previous audit comments were taken into account.

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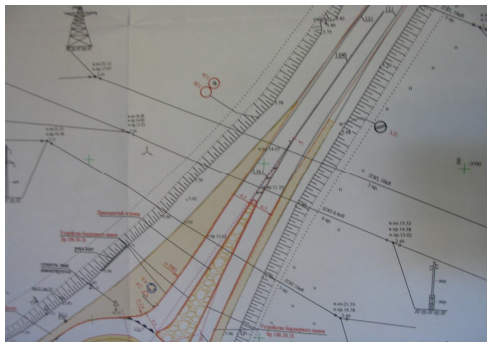
		Arkhangelsk. 	
5. Shoulders	As the shoulder on the starting points of curb seems to remain wide, four measures are recommended to avoid overdriving problems: a) the starting points should be shown by few polls or some other visible way and b) the starting of a curb line would be right to show by “narrowing road” signs. Without any measures the starting point of the curb and the shoulder will be overdriven and broken.	<u>The recommendations hadn’t been taken into account</u>. As the shoulder on the starting points of curb seems to remain wide, four measures are recommended to avoid overdriving problems: c) the starting points should be shown by few polls or some other visible way and d) the starting of a curb line would be right to show by “narrowing road” signs. e) the shoulder between the starting of curb and slope should be closed in physical barrier (fence or steel barrier). f) install concrete foundation under the curb (this may have been	There is still one principal question open; which out-going lane would have right-of way (the one coming from the round or the one with the “free-right)? This topic will be examined (arguments and experiences gathered) before decision

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		designed already in the draft) Without any measures the starting point of the curb and the shoulder will be overdriven and broken.	
6. Tree and grass planting	The curbs and green areas on the incoming R15 radiuses should be protected with a small (about 2 m wide lasting the whole radius length) stripe of round stone pavement behind the curb. This 15m radius curbs should be installed to concrete foundation under the curb (this may have been designed already in the draft). According to Finnish experience, the lorries would break the green area behind the curb, if it remains unprotected.	See the previous audit recommendations.	See the previous audit recommendations.
7. Traffic islands	On all 3 dividing islands it is proposed to implement one the following measures: ▪ paving them fully with natural stones ▪ paving 1 m wide lane (on which according to the Finnish norms shouldn't be any obstacles), adjacent to island curb. Inside this paved area some low bushes should be planted.	See the previous audit recommendation. In three dividing islands, it has been proposed to pave the whole areas with round stones. The proposal is aesthetic and well-justified.	There are middle islands in every direction separating in- and out-coming flows and dividing islands separating "free-right" lanes from the round. All are formed by curbs. It was advised to add 1,0 meter concrete stone strip (with additional small curb to green area side) in all of these islands. Even more sustainable would be 1,0 meter round stone strip, but the additional cost was the doubt by designers. It was advised to continue all the mid-islands as far (long) as they reach the 1,5 meter width. We would still make proposal to consider usage of round stones on the middle islands in every direction separating in- and

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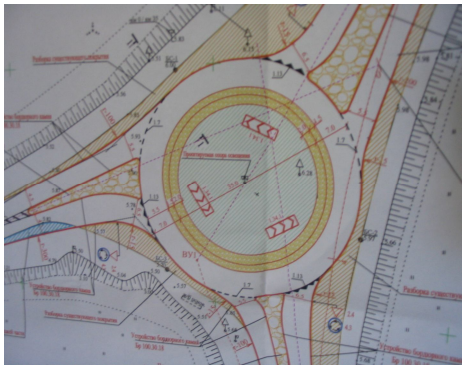
			out-coming flows.
8. Excess space on junction	Excess space is a danger as it provokes the drivers to more maneouvring , speeding and upsets traffic fluency and creates conflicts. Existing pavement which is not used in a new scheme should be used as follows: ▪ liquidate the non-used asphalt pavement ▪ plant all the space between the external curb and road edge	Non-used asphalt liquidation was taken into account in the Work Plan.. It is neccessary to plant all the space between the external curb and road edge with bushes or grass.	Using right turning lanes outside the ring thus eliminating the problem of excess space.
9. Traffic management, road marking, road signs	The priority must be given to the vehicles on the ring. The corresponding road signs must be installed. The road marking 1.7 of the ring must be extended, safety triangles must be marked with 1.13 marking at the point where the raised central traffic island ends (90 degrees).	No any critics to road signs and marking.  <u>Important:</u> To use the advantages of the roundabout the priority in traffic must be given to the vehicles moving on the ring. The necessary road signs are to be reserved.	Road signs are preliminary planned. Two comments were made. It was proposed to add: - one big table sign to every three direction to show the form of the roundabout and the main directions (Moscow, Severodvinsk, Arkhangelsk) - one portal sign over the road to every three directions on the place, where locates the division of lanes between incoming and passing (left lane= to ring and right lane= free right passing the ring). See the **photo**. <u>Important:</u> To use all the advantages of the roundabout the priority is to be given to the traffic moving on the ring. The signs “Yield way” should be reserved.
10. Road lighting	The question of roundabout lighting hasn’t been solved.	The question of roundabout lighting hasn’t been solved.	The roundabout lighting is designed by the other organization. The results will be

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			available in early December, 2007.
11. Information support	The Client is provided with: ▪ translated Finnish Guidelines on road lighting design– 3 pages., ▪ translated paragraphs of the Guidelines on detailed roundabout design – 3 pages ▪ CD with photos illustrating the last Finnish design decisions on roundabouts with the elements (traffic islands, external and internal rings, etc.)	Providing the Client with this report "Audit on the design stage".	Providing the Client with this report "Audit on the design stage". Providing the Client with the Booklet with recommendations on design stage road safety audit.  **Photo** Portal informing the road users about flow channelling
12. Improving road capacity according to the future needs (forecasted traffic growth)	The peak hour traffic volume was in 2006 in all incoming directions - **1715** passenger car units (PCU)s per hour in the morning 8:00…9:00 and - **1815** passenger car units per hour in the afternoon 17:30…18:30. The following conclusions were made: ▪ The roundabout being planned by the Client with 35m diameter is capable to serve up to 3000 passenger car units.	We may conclude that the traffic volumes can increase about **1,6…1,7 -times** without traffic congestion. In current forecasts this is likely to occur during the next 7…10 years. Because of this, it was recommended to make reservations for increasing the capacity in the future. The measures to be reserved are: <u>Stage 1</u> • construction of additional by-	Sevdoproject introduced a new variant, where already in the first, additional "free-right" lanes between all three directions were designed. This is a good proposal bringing in mind that two other variants to increase capacity (increase of round radius or to make the round 4-lane) are problematic. The full version with additional "free-right" lanes between all three directions provides additional capacity allowing **3.0…3,5 -times** traffic volume increase. This is enough to serve traffic in any foreseen future.

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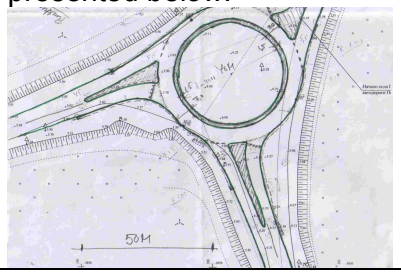
	▪ For the diameter 40m the road capacity will be a bit more than 3000 passenger cars per hour. Thus we may conclude that capacity problems may appear only when traffic volume increases by 60…70%. According to the forecasts it will happen no earlier than in 7-10 years. ▪ It is expedient to make reserve even now in a form of either: 1. new additional lane for right turning vehicles from Arkhangelsk to Severodvinsk (currently peak traffic volume is 482 passenger cars per hour in the evening), and similar lane on the direction Moscow-Arkhangelsk (437 passenger cars per hour in the morning rush hour) or **2.** increased roundabout radii, which is more costly as it will need reconstruction of the roundabout. Draft of the audited roundabout is presented below. 	passing lane from Arkhangelsk to Severodvinsk direction (currently 482 PCUs per afternoon peak hour) and possibly • construction of additional by-passing lane from Moscow direction to Arkhangelsk direction (currently 437 PCUs per morning peak hour) <u>Stage 2</u> construction of additional by-passing lane from Severodvinsk to Moscow direction. In case of sufficient resources it is possible to construct all additional lanes in all three directions. Additional “free-right” lanes between all three directions provides additional capacity allowing **3.0…3,5** -**times** traffic volume increase. This is enough to serve traffic in any foreseen future (even if motorization rate will be 450-500 vehicles per 1000 inhabitants.	Roundabout diameter – 35m, carriageway width 7m. The carriageway includes: ▪ Roundabout narrowing 1,5m with curb line made of natural stone or bricks. Additional ring is reserved 2 m wide (with the second ring made of curb line and more uneven pavement to allow movement of heavy trucks but not passenger cars.

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		 As alternatives to additional lanes are: ▪ Increased roundabout diameter ▪ Four lanes instead of two ones However, these alternatives require: ▪ more space for the rounabout, ▪ more construction work volumes ▪ less effective from the standpoint of traffic safety as they do not stricktly channelize traffic	

Comments to draft plan of Severodvinsk and Moscow roads intersection with roundabout introduced in the meeting 13.11.2007 at SevDorProject

General characteristics on the proposal 13.11.2007 by Sevdorproject

The diameter of the roundabout is 35 m and carriageway 7 m. The last includes 1,5 m narrowing round with curb and round natural stones pavement. Additionally, a 2 meters inner ring with second curb and natural round stones pavement has been introduced.

The capacity of the basic variant (without additional "free-right" lanes) is about **3000** personal car units per hour.

The peak hour traffic volume was in 15.07.2006 in all incoming directions
- **1715** passenger car units (PCU)s per hour in the morning 8:00…9:00 and
- **1815** passenger car units per hour in the afternoon 17:30…18:30.

We may conclude that the traffic volumes can increase about **1,6…1,7 -times** without traffic congestion, if 1-lane roundabout only will be implemented. In current forecasts this is likely to occur during the next 7…10 years. Because of this, it was recommended to make reservations for increasing the capacity in the future. The measures to be reserved were construction of additional by-passing lane from Arkhangelsk to Severodvinsk direction (currently 482 PCUs per afternoon peak hour) and possibly from Moscow direction to Arkhangelsk direction (currently 437 PCUs per morning peak hour)

Sevdoproject introduced a new variant, where already in the first, additional "free-right" lanes between all three directions were designed. This is a good proposal bringing in mind that two other variants to increase capacity (increase of round radius or to make the round 4-lane) are problematic. The full version with additional "free-right" lanes between all three directions provides additional capacity allowing **3.0…3,5** -**times** traffic volume increase. This is enough to serve traffic in any foreseen future.

Comments to correct the draft roundabout designed 13.11.2007 by Sevdorproject

1. Location of the new roundabout on the current asphalt pavement is not any more a principle. Now it is easier to carry out the roundabout design according to good principles

already tested (some of them have been reconsidered after mistakes) in the Nordic Countries during last 15 years.

2. The road geometry incoming from Severodvinsk side and from Arkhangelsk side is ok. The road geometry from Moscow direction is still, after some adjusting, too “open” allowing too direct (too high speed) driving of passenger cars. This leads to low traffic safety. The problem can be corrected by bending the incoming road more to left (3…5 meters). This way the incoming geometry is similar in all three directions.

3. Concrete stones have been planned as pavement to 1,5 m narrowing part of the carriageway and to the inner 2 m ring. The extra 2 m inner ring should allow oversize lorries turn slowly to left through the roundabout going over both curbs without destroying plantings and green area. It is essential and advisable to use natural round stones in both rings as they are to calm the traffic but still allow a normal long vehicle (1,5 m narrowing part of the carriageway) and oversize vehicle (the inner 2 m ring) to turn without major obstacles. The only “obstacle” is not-even pavement, which on the other side calms the traffic of personal cars (not too direct driving lines = lower speeds = not heavy consequences in case of accident).

There are two risky directions still left with oversize vehicles: Severodvisk-Moscow and Moscow-Severodvinsk, because there is no information about the specific “super” over-size vehicles (e.g. Svjosdishka trucks transporting submarine parts). They may still not match to all reserved parts of the roundabout. Therefore, it is advisable to leave 1…2 first meters of inner round (planned now as green area) without permanent or solid obstacles (like road signs or even bushes) on the forecasted trajectories of these directions. If, after one year exploitation of the roundabout, there is still ground (e.g. lorry tyre prints) to adjust the green area pavement (to cover the “super over-size” vehicle trajectories by round stones), it would be carried out according to additional decision.

4. There are middle islands in every direction separating in- and out-coming flows and dividing islands separating “free-right” lanes from the round. All are formed by curbs. It was advised to add 1,0 meter concrete stone strip (with additional small curb to green area side) in all of these islands. Even more sustainable would be 1,0 meter round stone strip, but the additional cost was the doubt by designers.

It was advised to continue all the mid-islands as far (long) as they reach the 1,5 meter width.

We would still make proposal to consider usage of round stones on the middle islands in every direction separating in- and out-coming flows.

5. There is still one principal question open; which out-going lane would have right-of way (the one coming from the round or the one with the “free-right)? This topic will be examined (arguments and experiences gathered) before decision.

6. Design for road lights are in process on the other institute. The designs would be given to expatriates for evaluation around the beginning of December 2007.

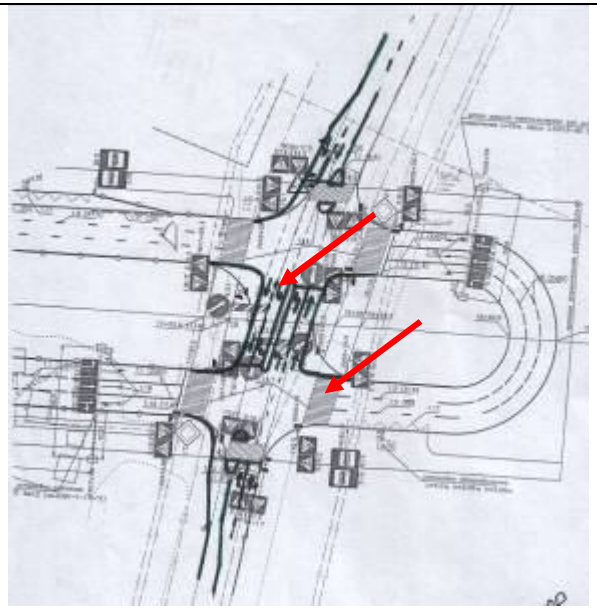
7. Road signs are preliminary planned. Two comments were made. It was proposed to add:
- one big table sign to every three direction to show the form of the roundabout and the main directions (Moscow, Severodvinsk, Arkhangelsk)
- one portal sign over the road to every three directions on the place, where locates the division of lanes between incoming and passing (left lane= to ring and right lane= free right passing the ring).

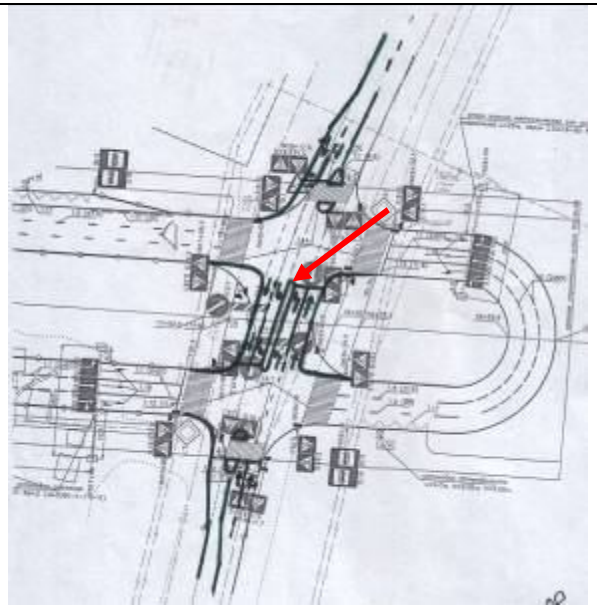
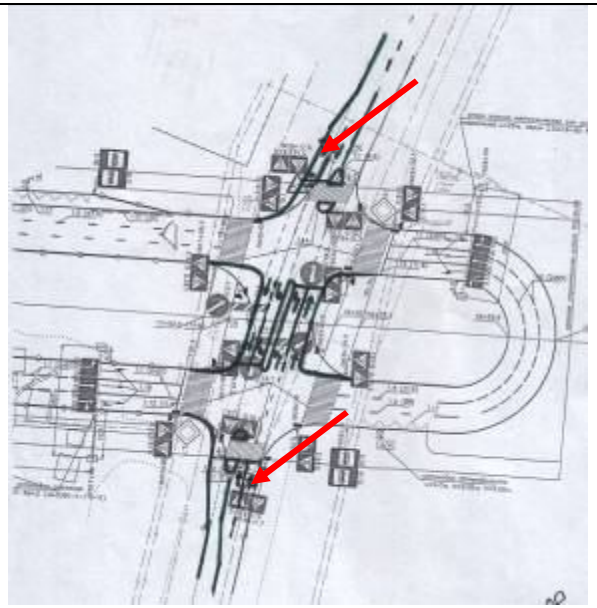
Annex 6 Recommendations to improve road safety and capacity of Moskovsky av./Lenina St. junction within the design project “Construction of Moskovsky avenue on the section from Galushina St. To Lenina St.”

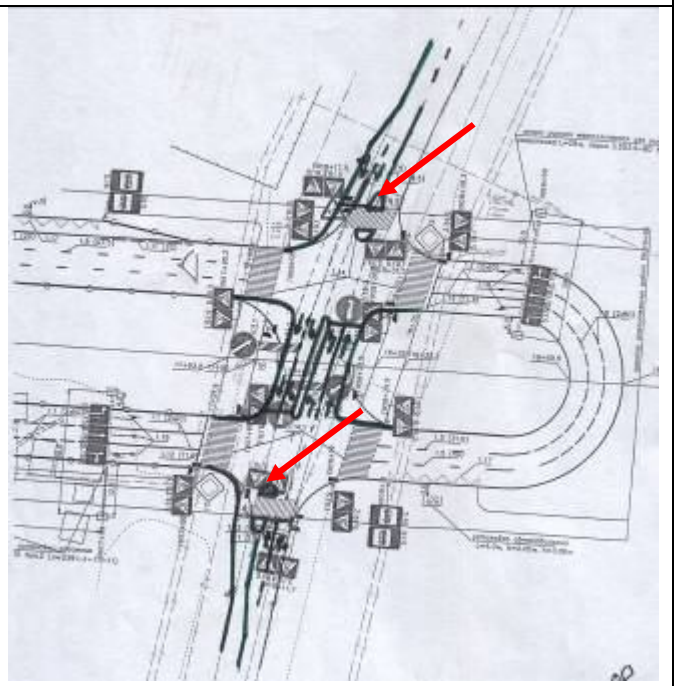
(06.11.2008 version)

Option #1: Proposals to improve road safety and capacity of Moskovsky av./Lenina St. junction

When developing Moskovsky av./Lenina St. Junction the main safety principle is broken – the geometric parameters of adjacent sections are not concerted. It is known that road capacity is defined with its narrowest section (bottle-neck). Low road capacity of Lenina St. creates a “dam” for traffic flows approaching from Moskovsky av. to Lenina St. Besides, traffic flow fluency of left turning traffic from Lenina St. to Moskovsky av. will be broken.

What's wrong	What can happen	What can be done	Scheme
Too big radii on medium dividing lane	Excess space on the junction: ▪ provokes the drivers to speeding ▪ makes maneouvres chaotic The consequence is high accident risk on the junction	Reducing radii on medium dividing lane	

Dividing island in the gap of the medium dividing lane is absent	No channelling results in: ▪ high risk of collision accidents ▪ non-fluent traffic flows ▪ Chaotic maneouvres of traffic The consequence is high accident risk on the junction	Constructing central dividing island to channelize traffic flows	
Only two traffic lanes are available on the aproach of Lenina St. to Moskovsky av.	▪Two-lane Lenina St. can't serve high traffic flows from six-lane Moskovsky av. Consequence: ▪Bottle-neck on approaches to Moskovsky av./Lenina St. junction, and thus reduction of Moskovsky	Alloting an additional traffic lane on the approach of Lenina St. to Moskovsky The following principle must work: one wide street must flow into another wide street.	

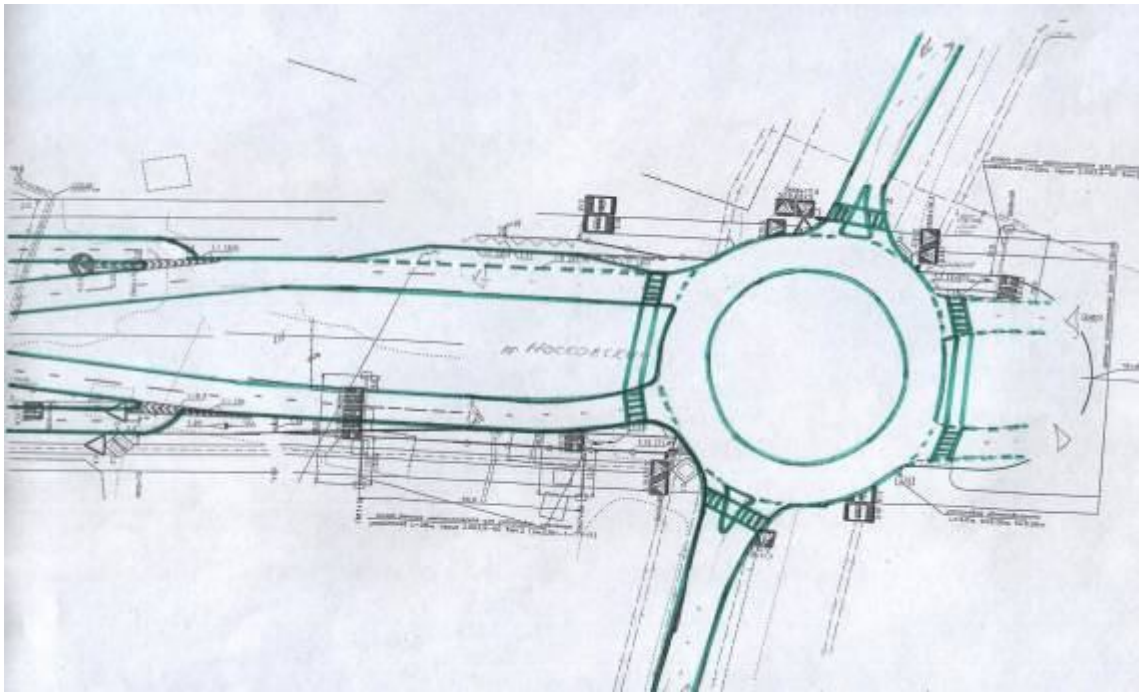
	av. capacity ▪High transport costs to the Community and no forecased economic effect from investments to construction of new Moskovsky av. section		
The raised traffic island on Lenina St. approaching Moskovsky av. is absent	▪Traffic flows are not chanellized by lanes ▪Chaotic maneouvring of vehicles ▪Vulnerability of pedestrians crossing the street The consequence is high accident risk both for vehicles and pedestrians	Constructing a raised traffic island on Lenina St. junction to Moskovsky av.	

Option #2: Constructing a roundabout on Moskovsky av./Lenina St. junction

The option #1 (**see the table above)** will improve road safety on Moskovsky av./Lenina St. junction, but the most effective measure is to make a roundabout on the junction as:

- Construction costs of both options are comparable while operational costs of roundabout are lower because of self-regulation of traffic and absence of traffic lights.
- The capacity of the junction and vehicle and pedestrian safety will improve, thus decreasing the costs to the community.

The Russian practice prooves that changing of X-junction into roundabout allows to reduce the number of accidents to 1.5 – 3.0 times if on each rounabout approach the sign “Yield way” is installed regardless of road hierarchy.

Proposals	▪ Changing the junction into rounabout with optimal engineering parameters. ▪ Reducing the number of lanes in Moskovsky av. from 3 to 2 in both directions on approaches to the junction ▪ Constructing traffic islands with pedestrian crossings on approaches to moskovsky av. from Lenina St. in order to provide good traffic flow channelling and pedestrian safety 
Advantages of the roundabout	▪ Opportunity to add new links without high investments to reconstruction, land-use development, etc. ▪ Continuous traffic flows with reduced speed due to self-regulation properties of the roundabout ▪ No traffic lights and additional operational costs

	Reduction of theoretical number of conflict points at junction from 32 (for normal X-junction) to 20 due to covering of the medium junction zone where all severe accidents occur with the help of roundabout. ▪ No left turns affecting opposite flows ▪ Reduced environmental impact due to fluent movement of traffic flows and less number of braking-stopping-acceleration cycles.