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15. SLOVENSKI KONGRES

O PROMETU IN PROMETNI INFRASTRUKTURI

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ANALYSIS OF AVAILABLE SIGHT DISTANCES ON EXISTING ROADS WITH REFERENCE TO THEORY AND PRACTICE IN R. SERBIA

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1. INTRODUCTION (I)

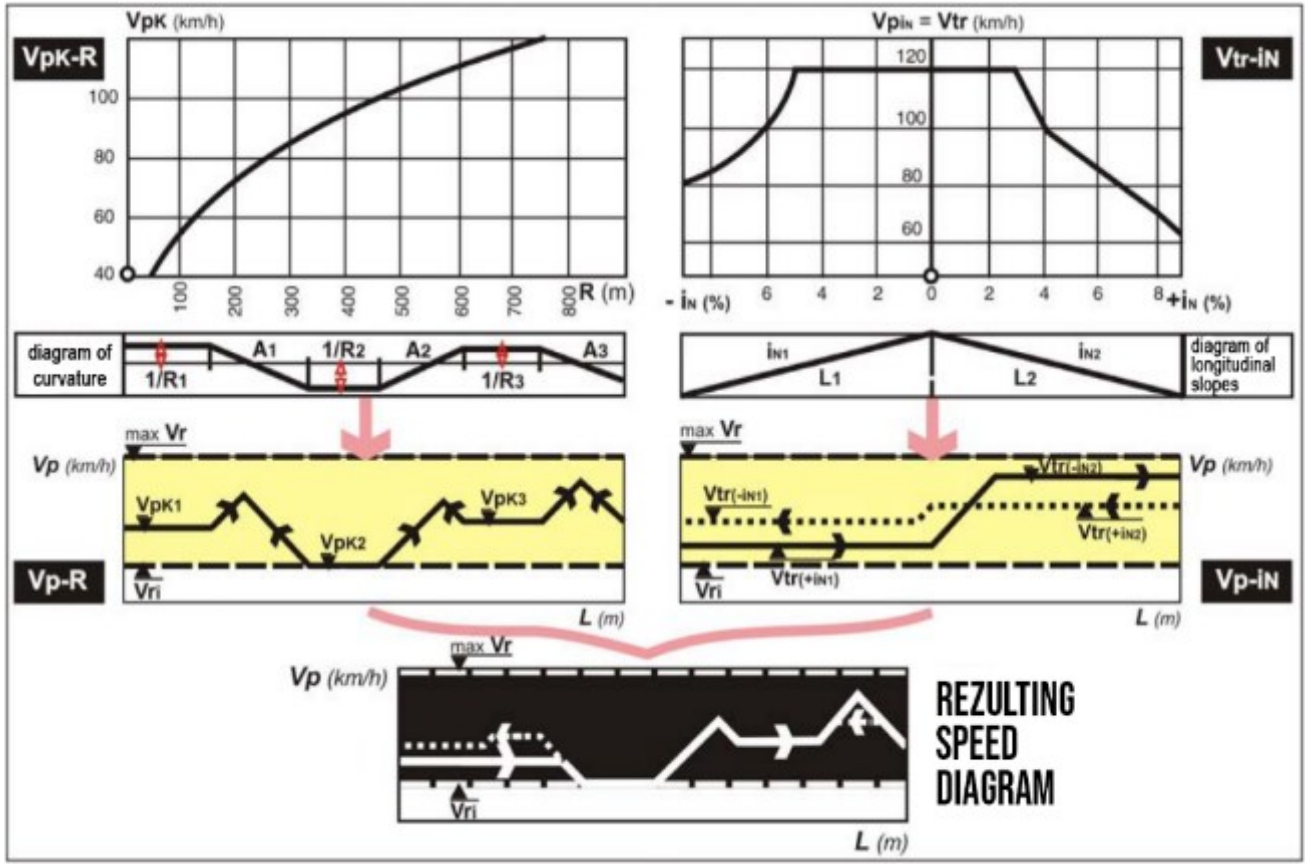
According to the data taken from the database available on the Internet portal of the Traffic Safety Agency in Republic of Serbia, in the period **2016-2020**., there were **2520 traffic accidents with fatalities**. Out of those 2520 accidents, **192** are classified in the group of influential factors **“Driver's omissions due to inadequate visibility and sight distances, ie complete experience and vision of the road and traffic”**. Of these 192 accidents, **71** are classified as influential factors: **“Impact of a stopped or parked vehicle”, “Impact of vegetation”, “Impact of road layout on driver visibility”, “Impact of buildings, billboards, traffic signals”**. If the mentioned figures are converted into percentages, it can be concluded that **7.6%** of all accidents with fatalities are classified as causes related to inadequate **visibility and sight distances**, while **2.8%** directly have inadequate **sight distance** as the cause.

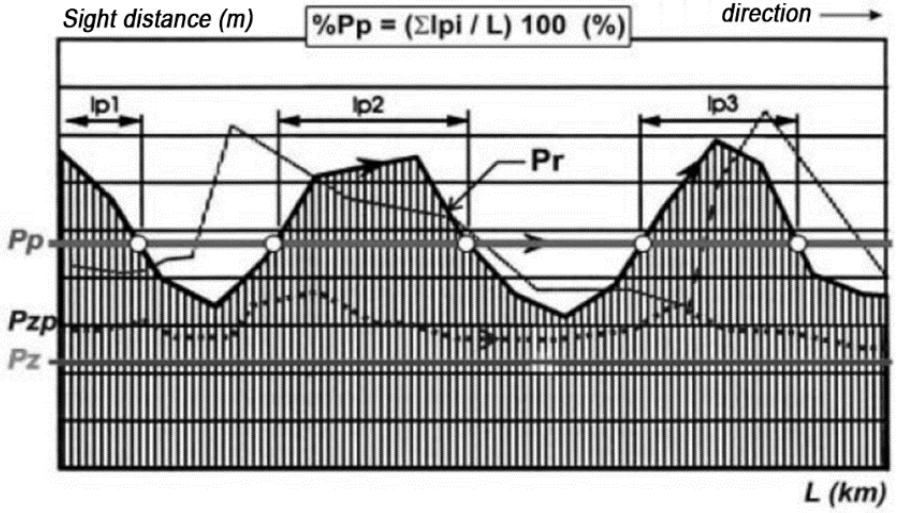
I.e., 70 persons died in Serbia in that period because we are not capable to deal with sight distance issues.

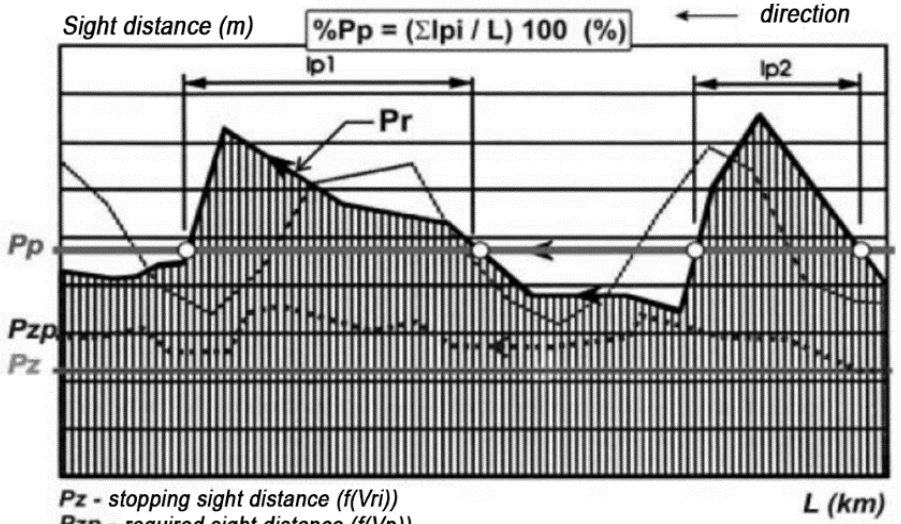
The mentioned values would probably be even higher if we take into account the fact that the impact of visibility on the occurrence of a traffic accident is very difficult to assess without adequate equipment and tools, i.e. that in many of them visibility is not recognized as an influential factor. For example, the authors of this paper did not find in the mentioned database the term **"overtaking"** as an influential factor, but if from the group of influential factors **“Wrong performance of traffic by the driver”**, selected is the influential factor **“Inadequate assessment of the route or speed of another traffic participant”**, there is an additional **94** traffic accidents with fatalities which most likely have inadequate **visibility** in the cause.

1. INTRODUCTION (II)

2. THEORETICAL BASIS







Pz - stopping sight distance (f(Vri))
Pzp - required sight distance (f(Vp))
Pp - overtaking sight distance (f(ΔV, t, Vri))
Pr - available sight distance (f(Ai, Ri, iNi, xi, yi,zi)

3. EXAMPLE FROM RSI IN R.SERBIA

State road IB223, section 02334 (Pakovraće-Kratovska Stena), L=17.745km

Required visibility was not met on:

- 7050m, for ahead direction (based on operating speed);

- 2825m, for ahead direction (based on posted speed);

- 7724m, for backward direction (based on operating speed);

- 2495m, for backward direction (based on posted speed).

On over 70% of segments where overtaking is allowed not only the overtaking sight distance wasn't met but required sight distance as well.

- **sight distance problem.wmv** (https://drive.google.com/file/d/1oEFlHq_rqFbnmCKvaPHgoOZpsnpqlRis/view?usp=sharing)

4. INTERNATIONAL/SERBIAN NORMS

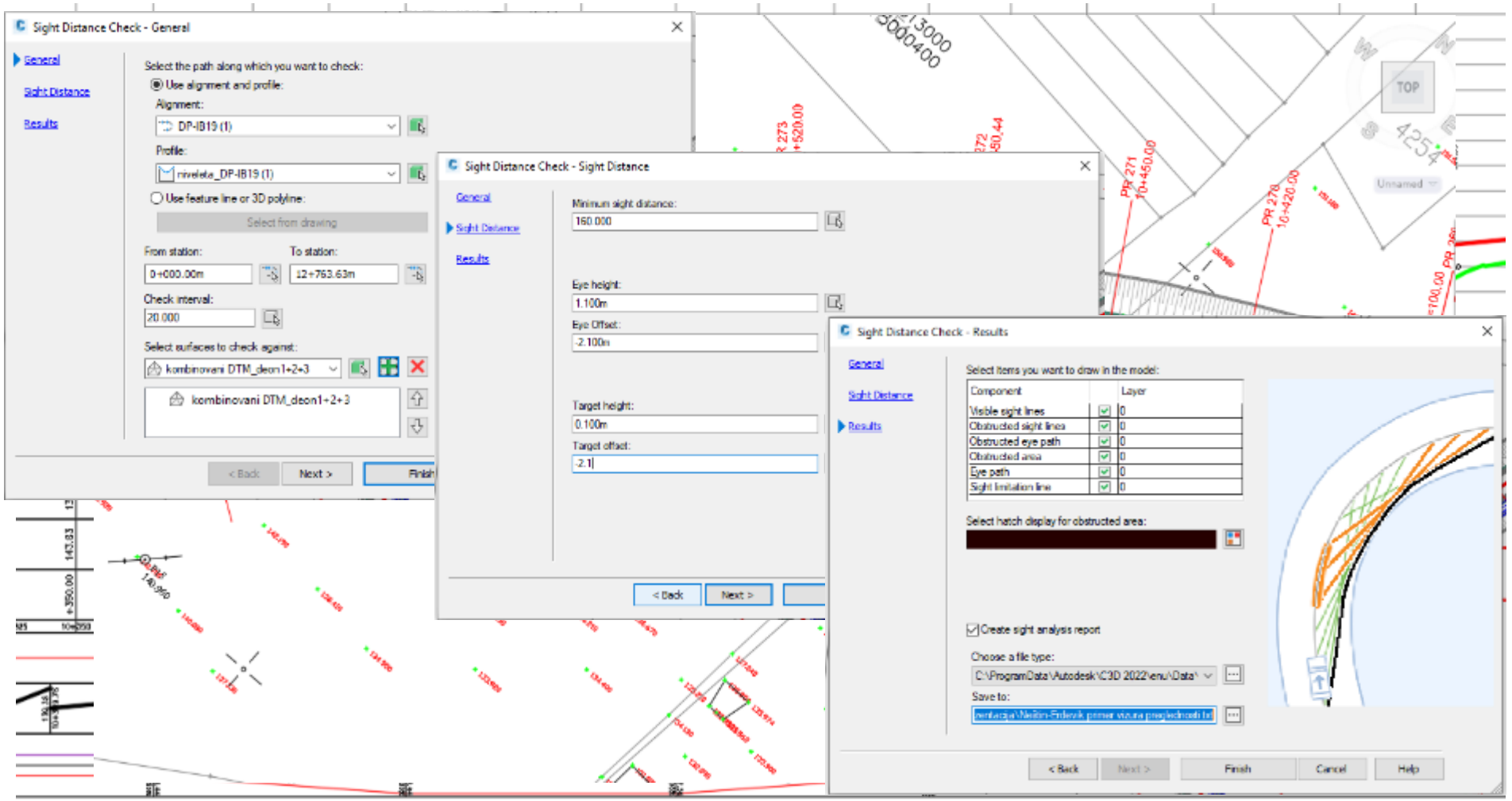
EUSight projekat (Conference of EU Directors of Road, https://www.cedr.eu/call-2013-safety)

Aspect	SSD default variables	Country values							Values based on	
		DK	FR	DE	IE	NL	CH	UK	Parameter study	Driving experiment
Road	Observation point position left curve (m)	1.5	2,0	1,8		1,25	2,0		1,3 - 1,5	
	Observation point position right curve (m)	1.5	2,0	1,8		2,25	2,0		1,3 - 1,5	
	Obstacle height (m)	0.5	0,5	0,5	0,26-2,0	0,5	0,15	0,26-2,0	0,4 - 0,6	
	Observed point height crest curve (m)	0.5	0,6	1,0	0,26-2,0	0,2-0,5	0,15	0,26-2,0		
	Observed point height sag curve (m)	0.5	0,6	1,0	0,26-2,0			0,26-2,0		
	Road Surface		wet	wet					wet	
	(Resulting) coefficient of friction	0.33 - 0.377		0,377		0,32-0,48	0,3-0,49			
	Tangential or braking coefficient of friction	0.377	0,46	0,25-0,32		0,32-0,48	0,3-0,49			
	Radial or side coefficient of friction			0,925* Ft						

Driver	Driver eye height Horizontal alignment (m)	1.0	1,0	1,0		1,1	1,0		1,10 - 1,16	
	Driver eye height Crest curve (m)	1.0	1,0	1,0	1,05	1,1	1,0	1,05	1,10 - 1,16	
	Driver eye height sag curve (m)	2.5		1,0			2,5			
	Perception-Reaction Time (s)	2	2	2	2	2	2	2	2	
Vehicle	Deceleration rate (m/s^2)	3.698	3,13-4,51	3,698	3,678			3,678	3,5 – 4,5	3,0-4,0
	Braking distance (m)									
	Design/ operating speed	Speed limit +20km/h	50-130	80-130	50-120	50-120	50-120	50-120	50-130	
Environment / Other	Light conditions	day		Day					day	
	Weather conditions	wet							wet	

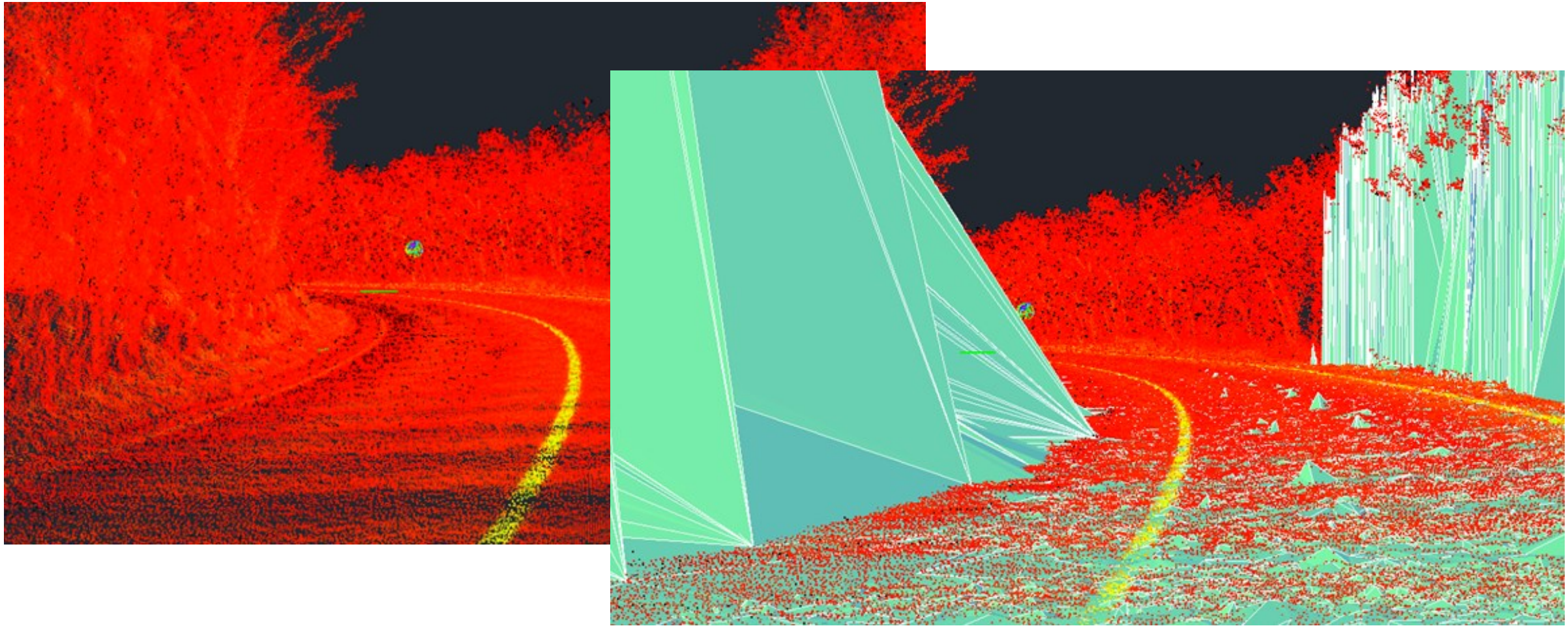
In R.Serbia, driver eye height = 1.1m, obstacle height = 0.1m, undependable of cases described in table above, observation point position 1.5m.

5. CURRENT PRACTICE (I)

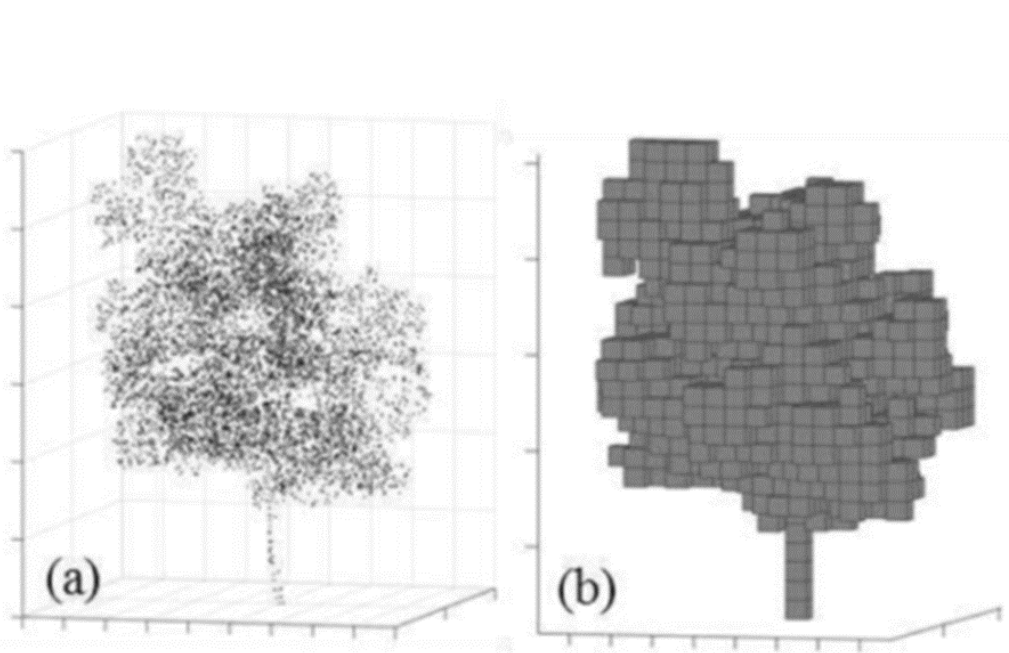


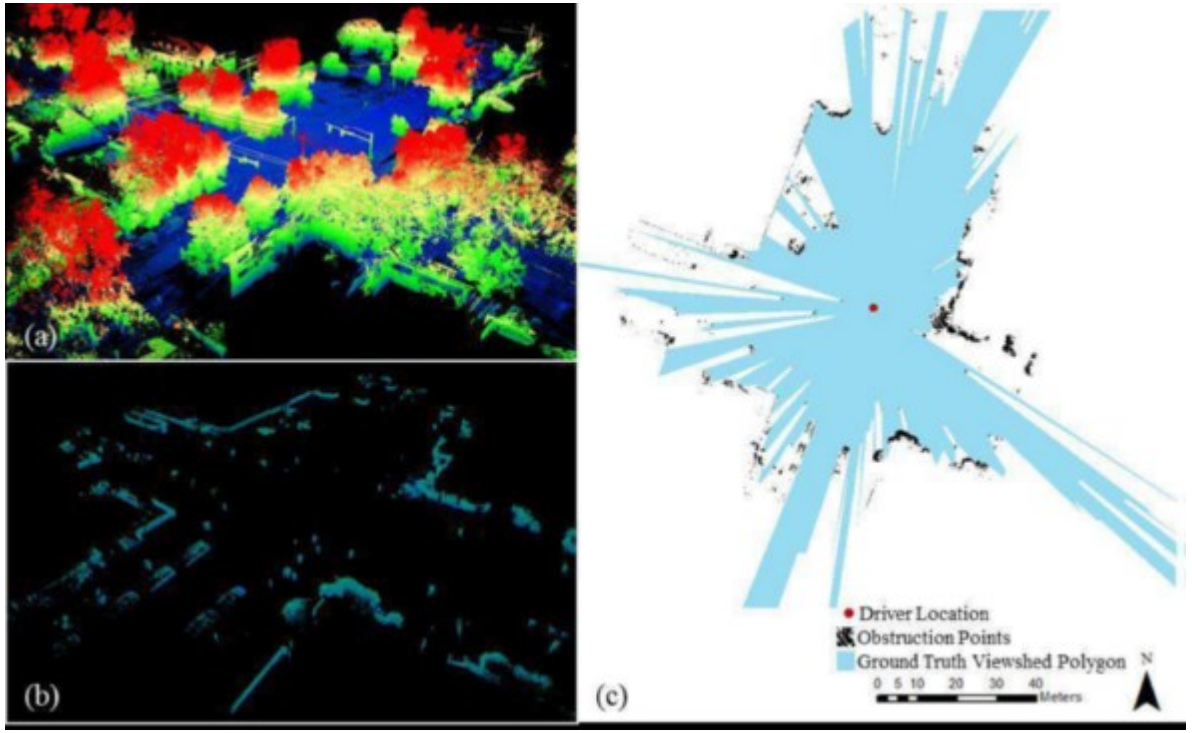
5. CURRENT PRACTICE (II)

5. CURRENT PRACTICE (III)



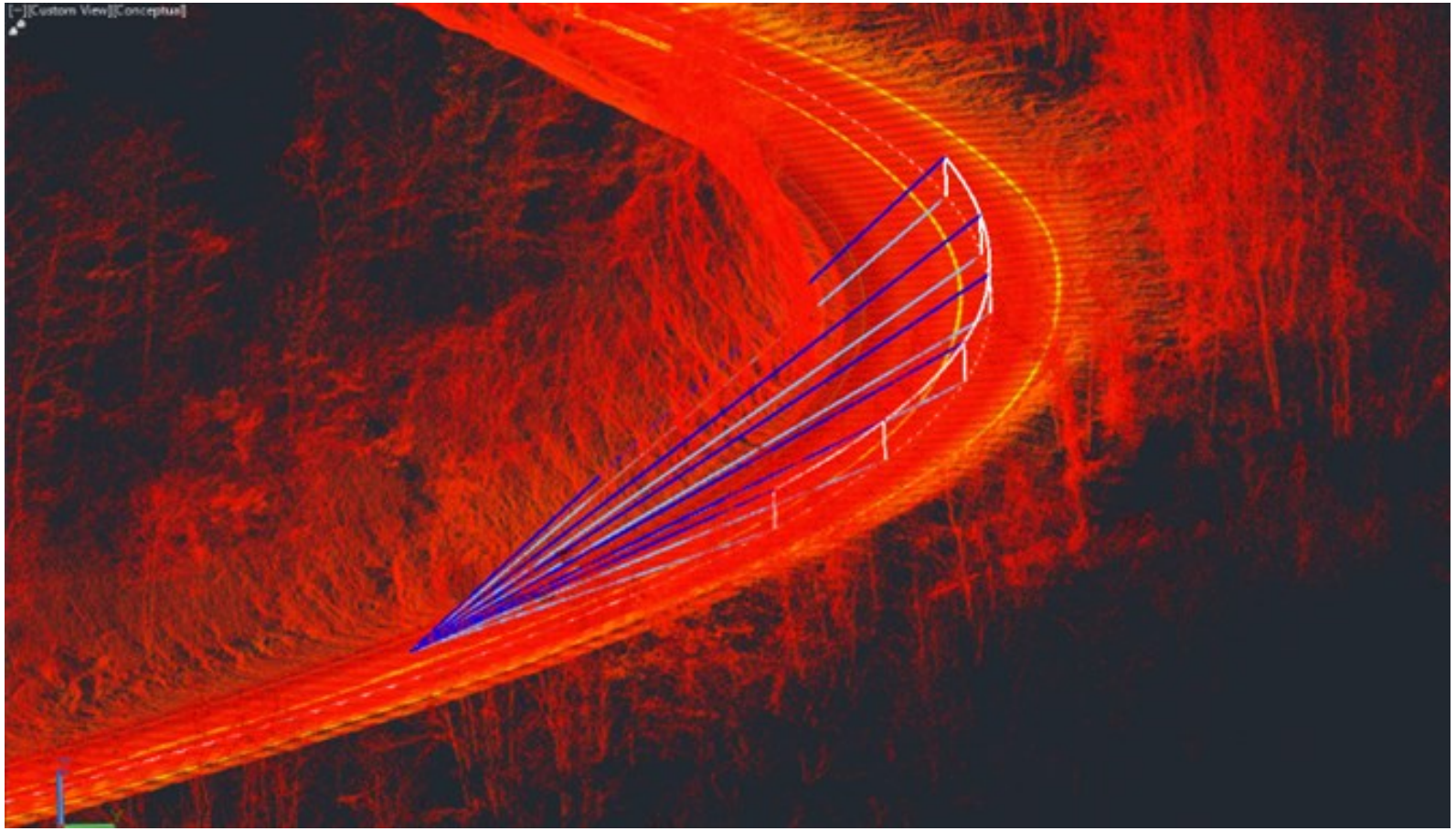
6. MODERN METHODS OF SIGHT DISTANCE ANALYSIS





US federal state of Oregon has applied this methodology on all its state roads in order to identify locations that have problems with sight distance and take measures to eliminate those problems, as well as to check locations of the highest priority once a year.

7. PROPOSED INNOVATIVE METHOD



8. BEFORE CONCLUSIONS

- Problem with SD-posted speed km109+750.avi (https://drive.google.com/file/d/1P-l6O5wxJawokZwfAQAlK28z-ViXuqLg/view?usp=sharing)
- Problem with SD-operating speed km109+750.avi (https://drive.google.com/file/d/1PJyw0I9phdqFoNooYd3E-tavAxpe2gON/view?usp=sharing)

9. CONCLUSIONS

- sight distance problems each year cause traffic accidents with fatalities consequences that are unacceptable considering that they can be prevented;
- with today's development of technology, there is no justification for not conducting activities related to the analysis of sight distances at any stage and procedure of planning, designing, safety revision and maintenance of roads, defined by law and bylaws regulations;
- considering the observed contradictions, it is necessary to reconsider the measures proposed for the purpose of improving traffic safety, but also a comprehensive review of the elements defined by the norms relating to the movement and stopping of vehicles, in accordance with modern development in technology and vehicles.

THANK YOU FOR YOUR ATTENTION