

Effects of building a bypass highway on road safety: A case study of a rural road in Serbia

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Introduction

Highways -the safest road type

- divided roads
- full access control
- grade-separated

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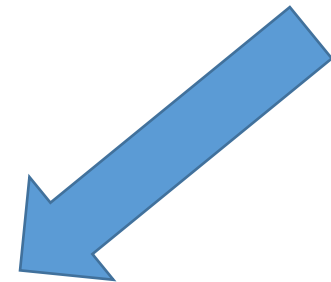


Single carriageways - riskier road type

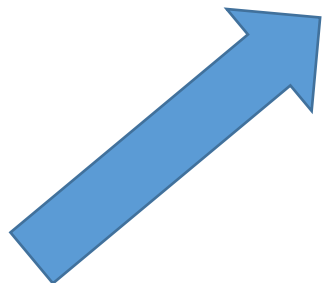
the risk of road fatalities is 4 to 6 times higher than on highways

The need to build fast roads in Serbia

Introduction



The aim of this study: **to investigate** into the risks of occurrence of accidents on both road sections (single and dual carriageway), **after** the completion of the dual carriageway, as well as into **the effects of changes** in AADT or traffic flow speed on the occurrence of road accidents.



Traffic flow features and risk of road accidents



Traffic flow



Speed



Density



Data

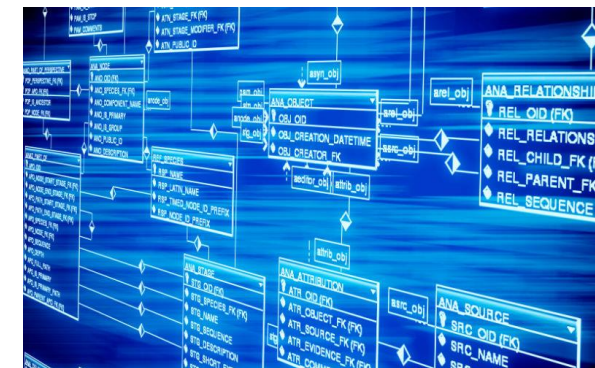
Data on accidents occurred on the analysed roads & data collected in investigations carried out by police authorities

Period of 4 years

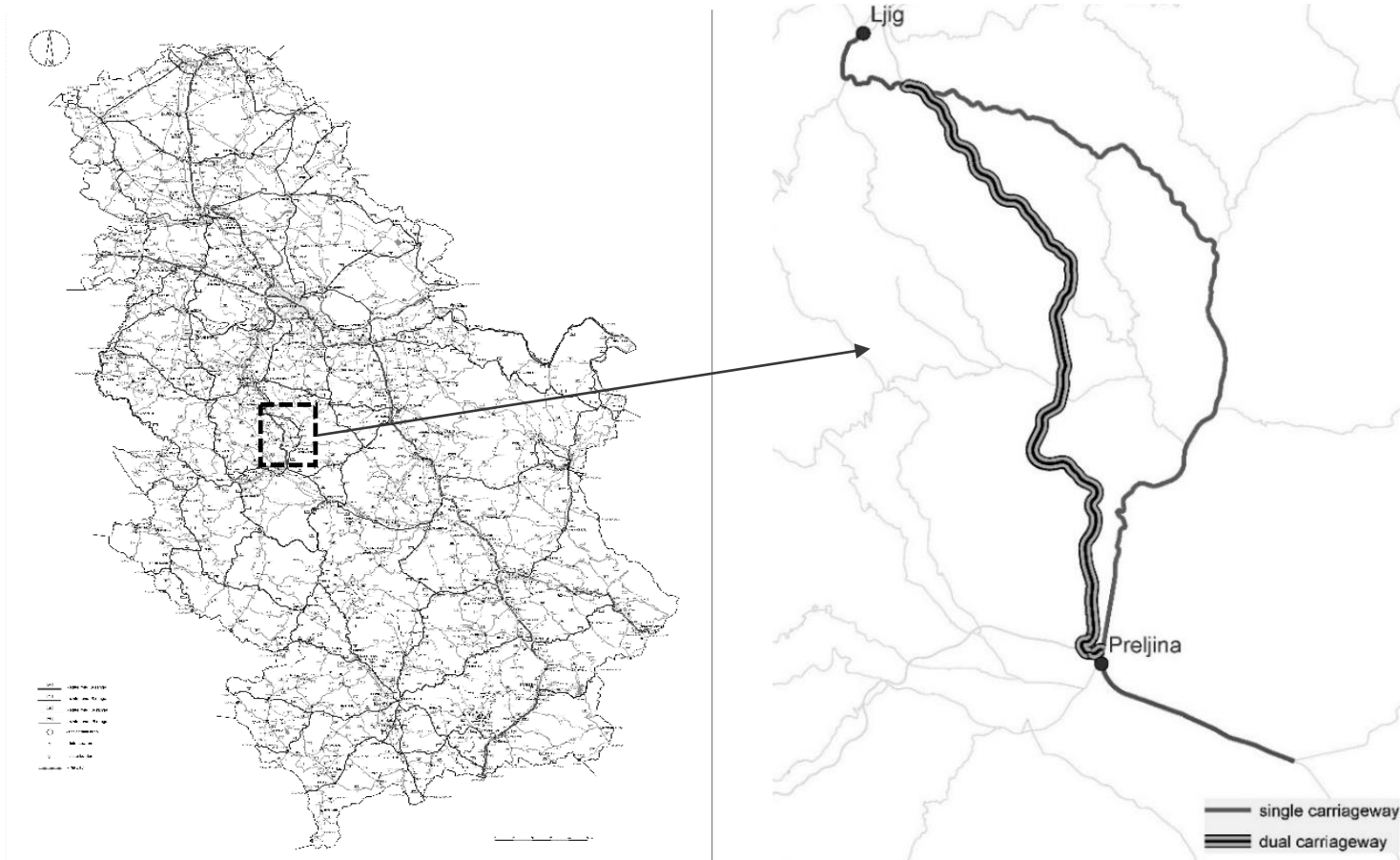
Two databases

Public Enterprise
“Roads of Serbia”

automated traffic
counters



Data



368 road crashes:
single carriageway: 328
dual carriageway: 40

Different speed limit

Methodology

The aim of the study : to analyse the odds of occurrence of accidents depending on severity and changes in conditions of a traffic flow.

The relative risk (OR)- calculated for the single carriageway, before and after the construction of the dual carriageway, for the risk of single- and dual carriageway, for the risk of crash types on the single- and dual carriageway.

$$OR = \frac{Type(SC_i)/Type(DC_i)}{All(SC)/All(DC)}$$

where :

Type (SC_i) is type i – a road crash on the **single** carriageway;
Type (DC_i) is type i – a road crash on the **dual** carriageway.

Methodology

$$OR_{Sci} = \frac{Type(BDC_i)/Type(ADC_i)}{All(BDC)/All(ADC)}$$

where

Sci is the analysed impact i characteristic for the traffic flow on the single carriageway;

Type (BDCi) is the type i – a road crash on the single carriageway **before** the construction of the dual carriageway;

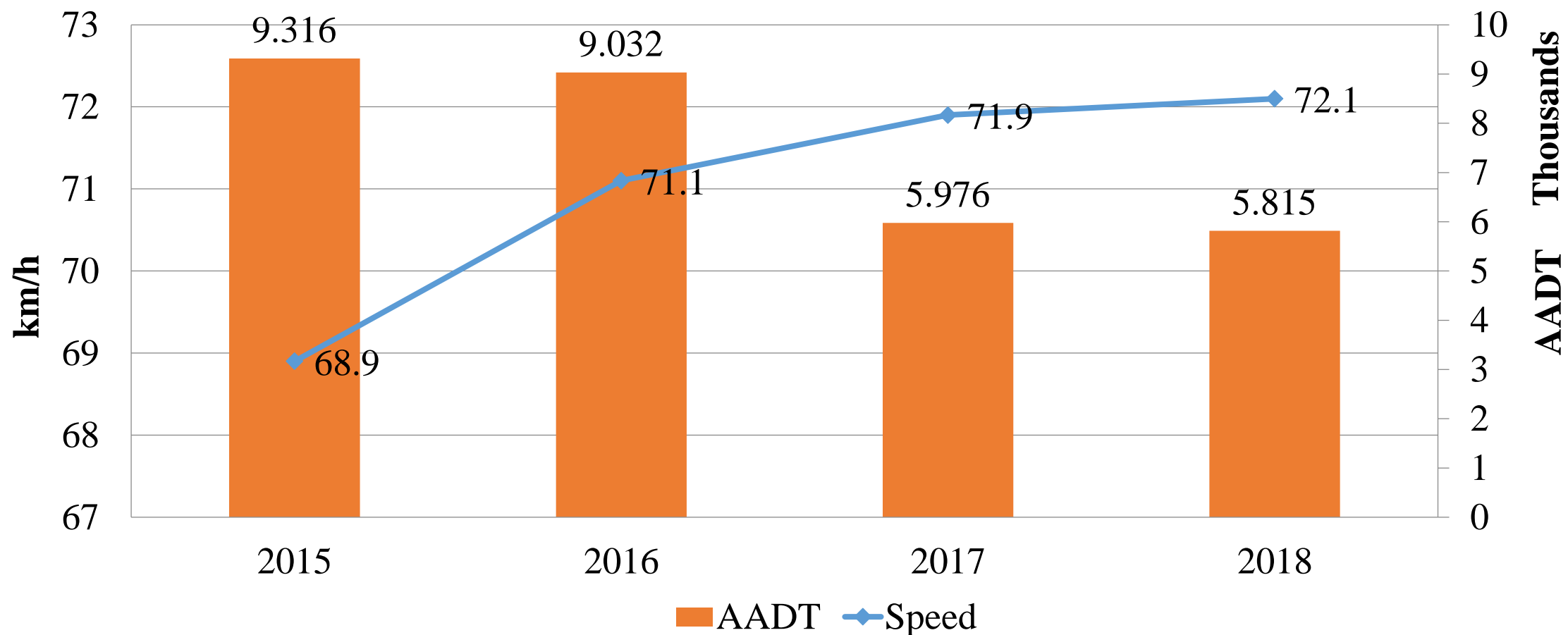
Type (ADCi) is the type i – a road crash on the single carriageway **after** the construction of the dual carriageway.



The sample of characteristics of the road accidents

Variables	Property damage	Injury	Fatal	Total
Dual carriageway	25	14	1	40
no intersection	25	14	1	40
dry	14	8	1	23
wet	7	6		13
snow or ice	4			4
Single carriageway	143	166	19	328
no intersection	132	150	18	300
dry	90	117	13	220
wet	33	25	4	62
snow or ice	9	6		15
unknown		2	1	3
intersection	11	16	1	28
dry	6	11	1	18
wet	5	4		9
snow or ice		1		1
Total	168	180	20	368

Changes in AADT and speed- single carriageway



Comparison of the risk of road crashes

	Dual carriageway		Single carriageway		OR
	crash	AADT	crash	AADT	
Σ	40		140		4
Damage	25		58		2,58
Injury	14	6,558	70	5,896	5,56
Fatalites	1		12		13,35

The risk of road crashes after the reduction in traffic flow on the single carriageway

	before bulding dual carriageway		after bulding dual carriageway		OR _{sc}
	crash	AADT	crash	AADT	
Σ	188		140		1,16
Damage	85	9,174	58	5,896	1,06
Injury	96		70		1,13
Fatalites	7		12		2,67

The impact of the increase in traffic flow speed on the risk of occurrence of road crashes

	crash	Average speed flow	crash	Average speed flow	OR _{sc}
Σ	188		140		0,72
Damage	85		58		0,66
Injury	96	70,0	70	72,0	0,71
Fatalites	7		12		1,67

The odds ratio for single-vehicle crashes and crashes involving several vehicles after decreasing the AADT and increasing the speed of the traffic flow on the single carriageway

	Before dual carriageway		After dual carriageway		OR _{sc} (MV) OR _{sc} (SV)	
	MV	SV	MV	SV		
Property damage	28	13	37	21	0,96	0,73
Injury	36	7	45	20	0,91	1,30
Fatal	2		9	3	3,26	1,36

MV – crashes with two or more vehicle; SV – single vehicle accident.

Discussion

impact on road safety by building highway

the growth of total AADT (2015- 2018) - **34%**
drop in the number of accidents (2015-2018)- **35%**



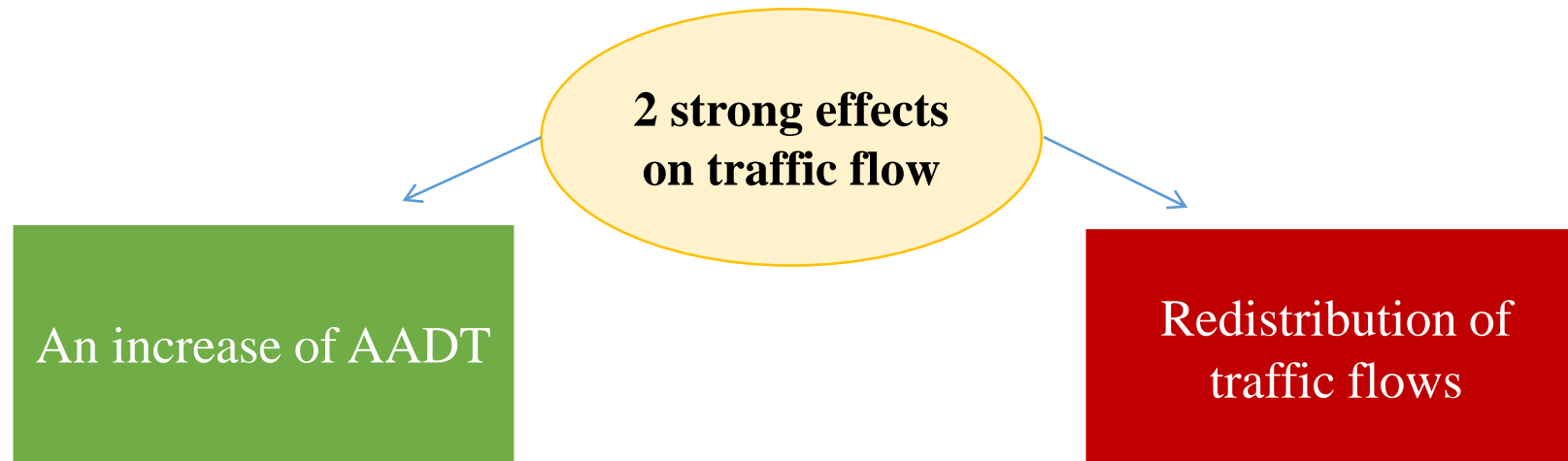
The share of fatal crashes occurred on the single carriageway is 89%, while it is 11% on the dual carriageway.

Reduced AADT - increased average speed



the growing risk of occurrence of fatal crashes

Conclusions



mean speeds and the risk of road crashes are mutually connected

higher involvement of commercial vehicles in crashes



Conclusions

The results of this study are of importance not only for Serbia, but also for other road sections in the world where construction of an alternative highway road connecting two towns is taking place.

The limitation of this study is in aggregating data on an annual basis.

The research into the effects of changes in the road network on road safety should be conducted for various types of roads, in order to consider possible negative effects in detail.

This study has shown that there are negative effects on road safety in cases of reducing the AADT on single carriageways, which should be in the focus in the stages of designing and constructing new highway corridors.

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