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INTRODUCTION TO STATISTICAL STUDY OF BUS ACCIDENT

ARE THE BUSES SAFE OR NOT?

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Presented by
Dr. MATOLCSY Mátyás
Expert of Hungary

CONTENT OF THE STUDY

The total number of bus occupant casualties is small
in the casualty statistics of road accidents
compared to the car, motorcycle, etc. casualty figures

Does it mean that the buses are safe?

No, the reason of the small bus occupant casualty
figures is the small number of bus accidents
in the total road accident statistics

THE BUS ACCIDENTS ARE RARE, INFREQUENT

1. **Dynamic „picture”**

   German statistics: running vehicles were counted on highways during one day

   daily average, percentage of buses: 0,4%

2. **Static „picture”**

   In registered national road vehicle fleet (8 European countries)

   average ratio of buses: 0,25-0,3%

Therefore it is difficult to get reliable bus accident information for the international regulatory work

SOLUTION

- collect large data set from around the world, including all kind of bus accidents
  - continues data collection
  - electronic data base
  - using all kind of data sources

- set up statistical samples from the large data set
  - based on the principles of mathematical statistics
  - sampling according to the studied problem
  - safety level evaluation based on casualty figures

Possible, considerable sources of bus accident information:

- police reports
- bus manufacturers collections
- insurance company's data
- fire brigade reports
- ambulance team (medical) reports
- media reports (radio, TV, newspapers, etc.)
- internet
- etc.

Some principles, definitions of mathematical statistics

- Event: individual element of the data set (bus accident) with the belonging information
- Sample: collection of events having certain common feature, group of bus accidents
- Sampling parameter: the basis of selecting events from the data set (bus category, type of accident, region, etc.)
- Homogeneous sample: in which the events were selected strictly by the same sampling parameter
- Representative sample: homogeneous sample with large sample size.

ONLY THE REPRESENTATIVE SAMPLE PROVIDES VALID, ACCEPTABLE CONCLUSION

Some words about the **Data set**, which is the basis of this study:

- Information collection started 15 years ago with rollover of large buses
- The „subject” was later, step by step extended (small buses, frontal collision, all kind of accidents, etc.)
- The information sources were also extended step by step
- The Data set is „paper-based”, not computerized
- Today the number of events in the Data set exceeds 1550 (accidents) together with the belonging information

General overview about the Data set
(at the end of 2014)

Type of accident / Region	Rollover R	Frontal collision FC	Rear and side collision RSC	Direct fire F	Combined accident CA	Collision with train CT	Special accidents S	Total
Hungary	176	335	28	65	11	6	19	645
Europe	168	96	7	13	28	12	5	324
World	201	124	2	20	146	15	17	525
Σ	545	555	37	98	185	33	41	1494

Bus category	R	FC	RSC	F	CA	CT	S	Total
Class I City	9	81	5	41	4	-	11	151
Class II Interurban	84	139	14	21	30	8	11	307
Class III Tourist	205	99	6	19	43	4	4	380
Double decker (DD)	29	12	-	3	3	1	5	53
Small bus (SB)	88	150	10	2	18	8	4	280
Other	23	18	1	4	16	4	1	67
Not known	107	56	1	8	71	8	5	256
Σ	545	555	37	98	185	33	41	1494

EXAMPLE: STATISTICAL ANALYSIS IN ROLLOVER-I.

Sampling parameter:
Sub categories of rollover
All kind of buses

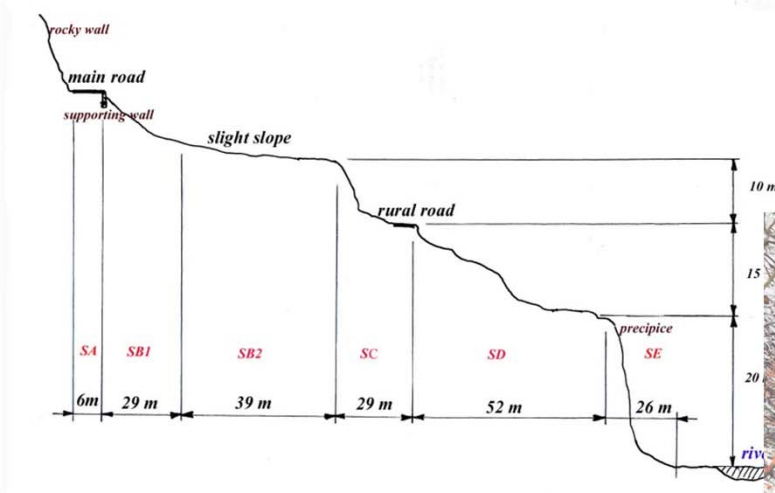
All large buses

Tourist coaches

HD and DD tourist coaches

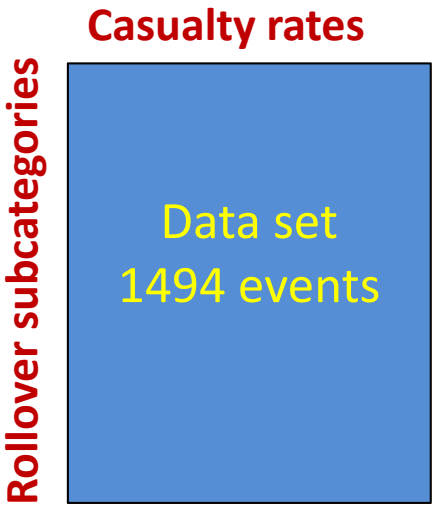
Turn on side

Rolling down (max. 2 rotations)



Severe rollover (more than 2 rotations)

EXAMPLE: STATISTICAL ANALYSIS IN ROLLOVER-II.



Rollover subcategory \ Casualty rates	Number of events	Accident casualty rates (ACR_x)		
		Fatality rate (R_F)	Injury rate (R_I)	All casualty rate (R_A)
a) turn on side	196	1,8	13,7	15,5
b) rolling down	217	8,8	17,5	26,3
c) severe rollover	132	16,5	13,7	30,2
all rollover together	545	11,0	14,1	25,1
combined rollover	116	21,7	7,4	29,1

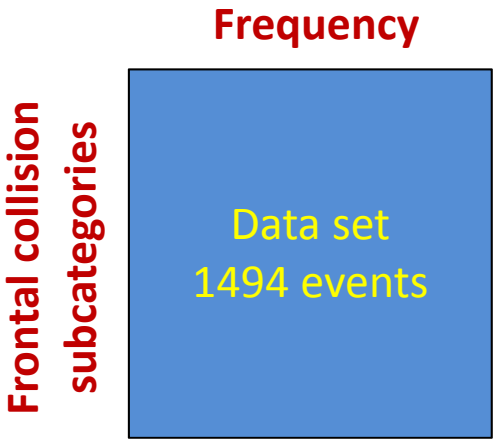
Proving the effectiveness of Reg.66:

strong superstructure (intact SS)

week super-structure (damaged SS)

Rollover subcategory \ Casualty rates	Number of events	Accident casualty rates (ACR_x)		
		Fatality rate (R_F)	Injury rate (R_I)	All casualty rate (R_A)
All PRA (a+b)	413	5,5	16,1	21,6
Intact survival space (SS)	123	0,9	11,8	12,7
Damaged survival space (SS)	188	13,8	12,9	26,7

EXAMPLE: STATISTICAL ANALYSIS IN FRONTAL COLLISION



Subcategories of bus frontal collisions			Number of events
All small bus (SB) frontal collisions			150
All large buses (LB)	Full frontal collision		77
	Partial collisions	on service door side	42
		on driver side	34
		full width, but limited height	6
		with pole-like object	18
		with small partner, object	147
	not known, not specified above		81
		Σ	555

Full frontal

Partial, door side

Partial, driver side

Small and large bus

EXAMPLE: STATISTICAL ANALYSIS OF REAR AND SIDE IMPACT

Casualty rates

Data set
1494 events

	Number of events	Accident casualty rate (ACR_x)		
		Fatality	Injury	All casualties
Rear impact	25	1,5	9,9	11,4
Side impact	12			

Low frequency

Low casualty rates

Less important issue in international regulatory work

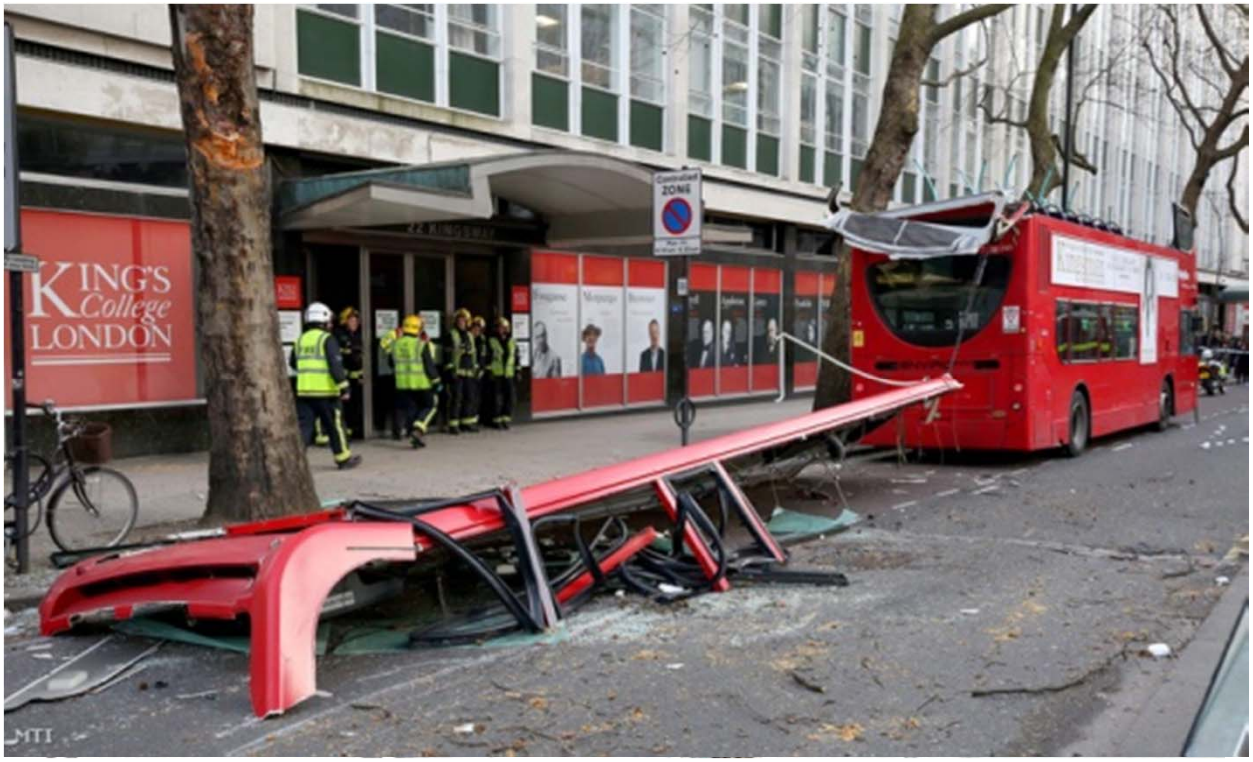
Rear impact

Side impact

SPECIAL BUS ACCIDENTS

To have a complete picture, the special bus accidents shall be also considered. (Number of events in the Data set: 41)

After this boring statistical presentation, just to wake up the audience, some funny, unbelievable special accidents are shown:



Road pavement broke in under the bus (after long heavy rain the running water undermined the ground)

Falling down from a bridge: is it rollover or frontal collision? Unbelievable!

Strong tree-branch scalped the DD city bus

Unnamable accident!

SPECIAL BUS ACCIDENTS

Finally an unwanted „passenger”, a deer through the broken windscreen

SUMMARY

- The international regulatory work needs reliable bus accident information
- The bus accidents are rare in consequence of the small ratio of buses in the complete road vehicle fleet
- Using all possible data sources large data set can be collected from around the world
- From the data set different statistical samples can be set up and analysed, reaching useful information and strong evidences.
- This paper shows the method generally and gives some examples based on an existing Data set containing around 1500 bus accidents with the belonging information.
- Today all the technical background, conditions are given to collect and build up efficient data sets.

THANK YOU FOR YOUR ATTENTION