



Institut für Verkehrsplanung und Transportsysteme
Institute for Transport Planning and Systems



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

ROAD SAFETY AT NODES

SVT

The impact of nodes operation on accident patterns

Marco Rothenfluh

Traffic Engineering group, IVT

STRC Conference

May 2016

Outline



- Relevance of the topic
- Definition of elements
- Network preparation
- Results
 - Accident rates
- Next research steps

Introduction



- Capacity check before safety aspects
- Safety aspects: Number of accidents, severity of accidents
- Accident severity
 - FSI CHF 696'000/acc
 - MI CHF 84'000/acc
 - PDO CHF 45'000/acc
- Goals
 - Assessment of node type on road safety performance
 - Impact of nodes on approaching road inlets

Literature



General findings

- Contradictory results due to different sample sizes, definitions, different key figures
- Impacting factors: Location, Road type, operation, traffic volumes, segment lengths, number of inlets, speed limit

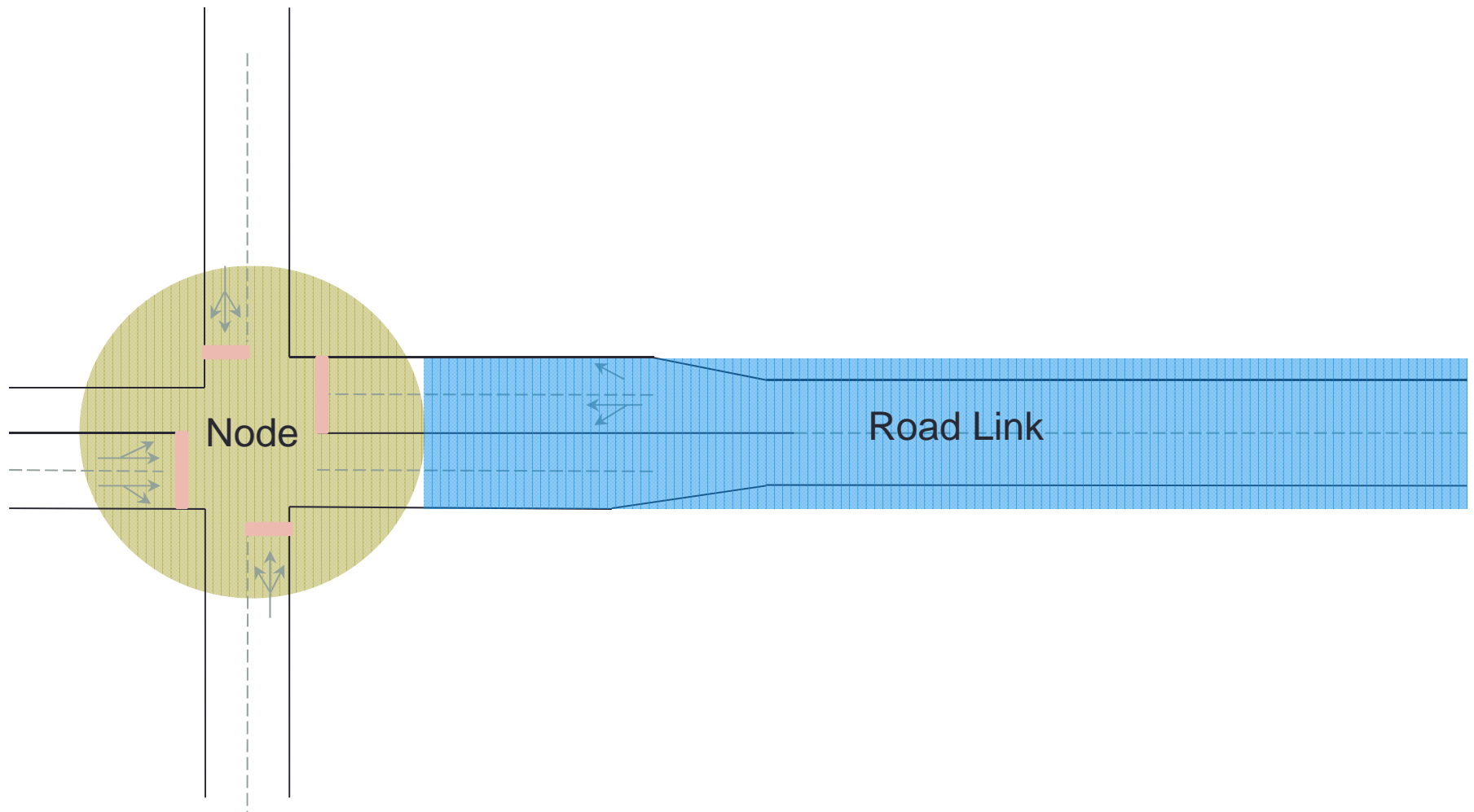
Ranking	Node type
1	Small roundabouts
2	Level-free intersections
3	Traffic signal with separate left-turn
4	- Give priority - Traffic signal without separate left-turn

K. Eckstein, Meewes V. (2002)

Problematics

SVT

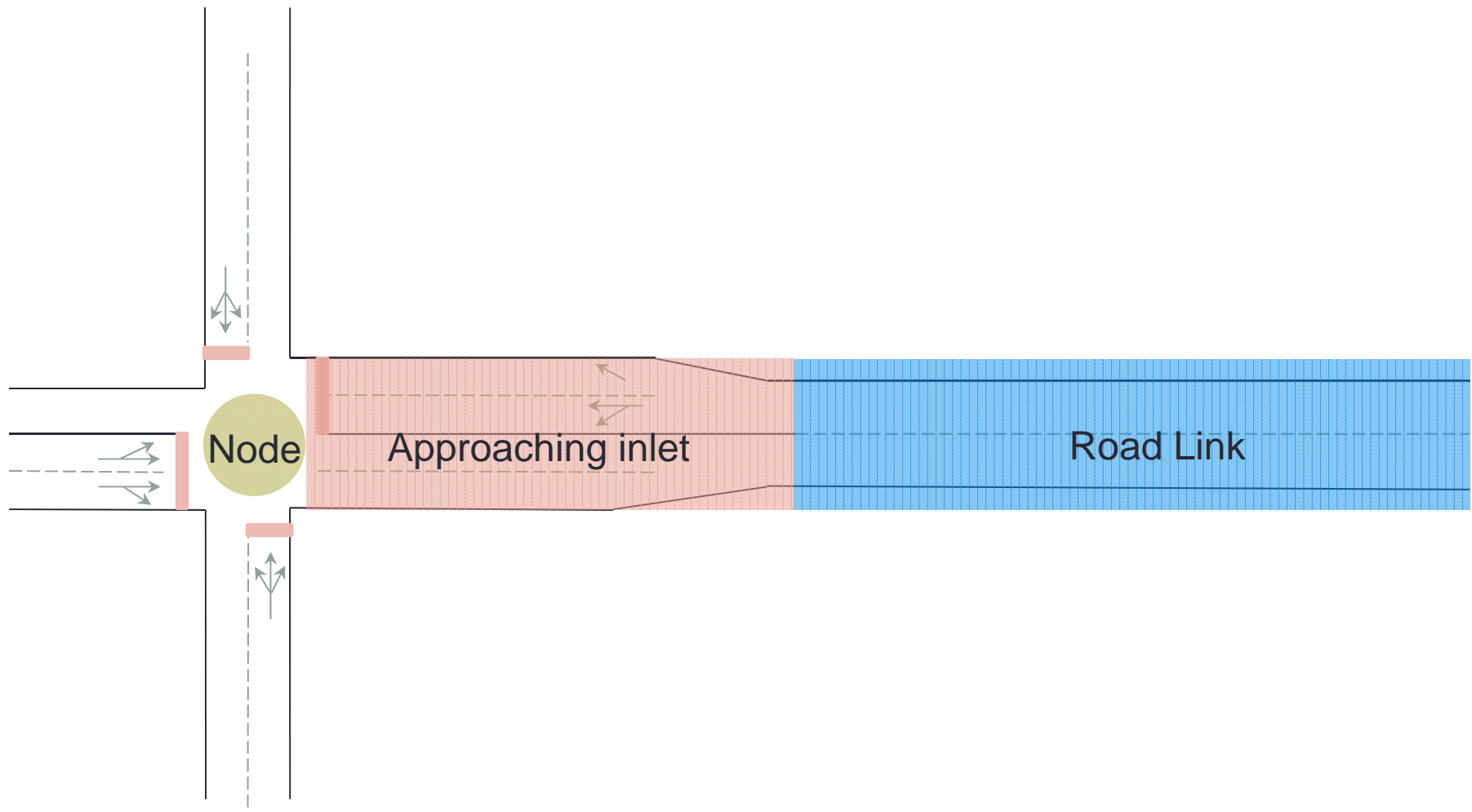
Description of elements



Problematics

SVT

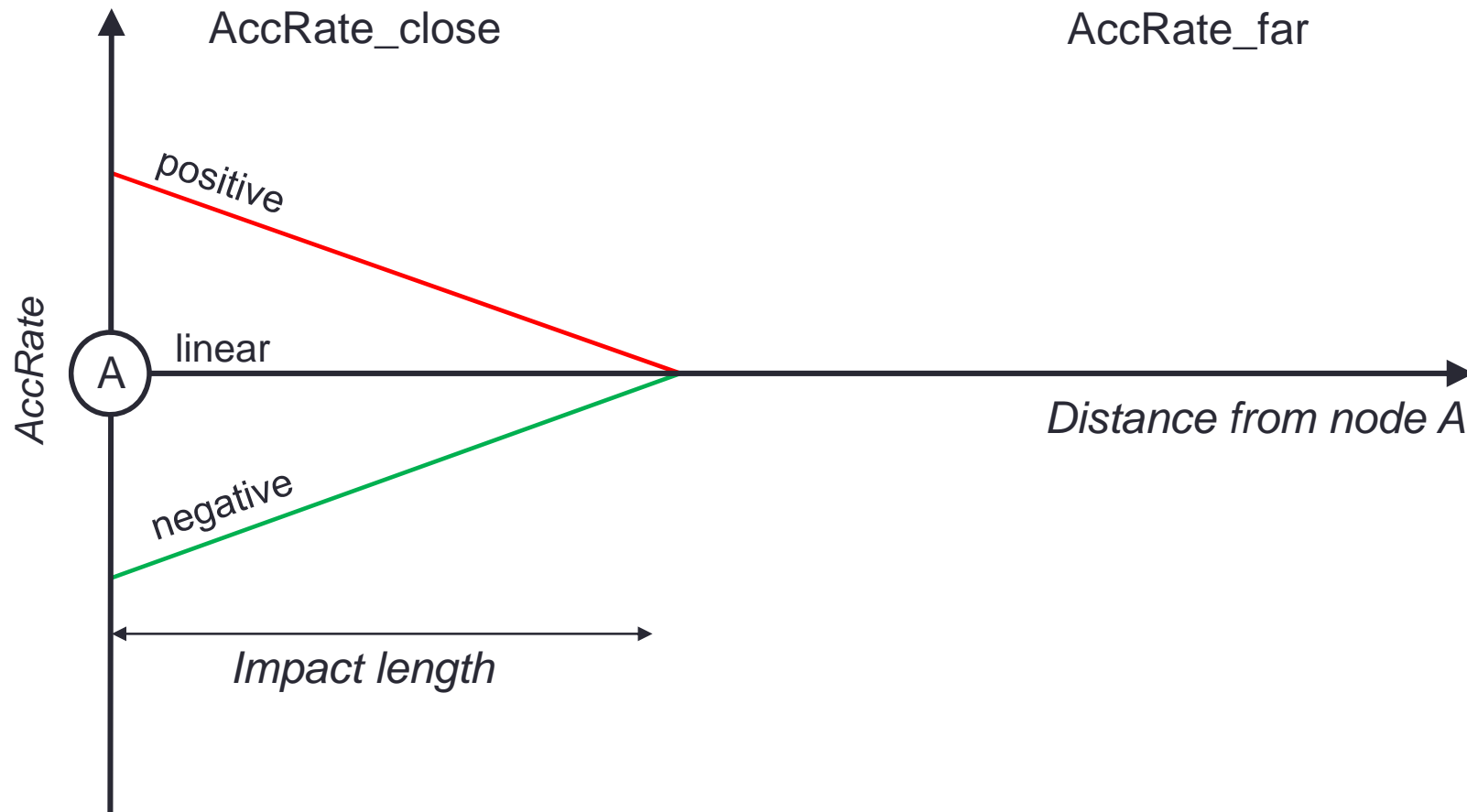
Description of elements



Introduction

SVT

Propagation of accident rate

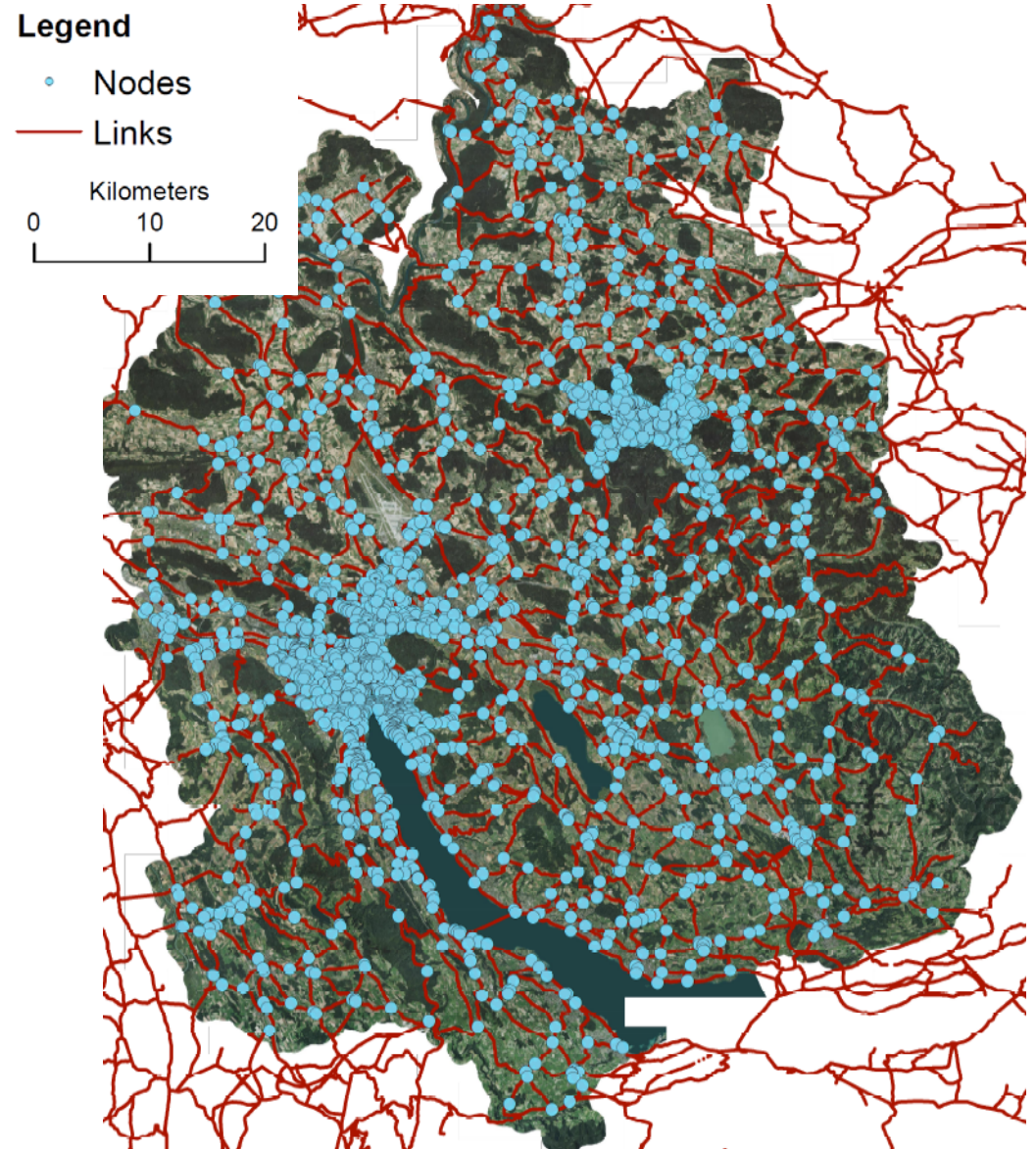


Network

SVT

Canton of ZH

- **Links**
 - >19'000 Link segments
 - > 2'500 km road
- **Nodes**
 - 2356 nodes
 - 4 node types
- **Accidents**
 - >36'000 accidents
2010 - 2014



Network

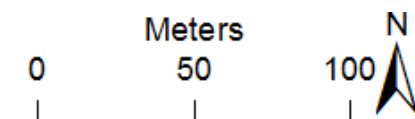
Difficulties

- GIS representation: Different section lengths
- > 2 approaching inlets per node
- Unique assignment of accidents



Legend

- ▲ Accident
- Node
- Links



Network



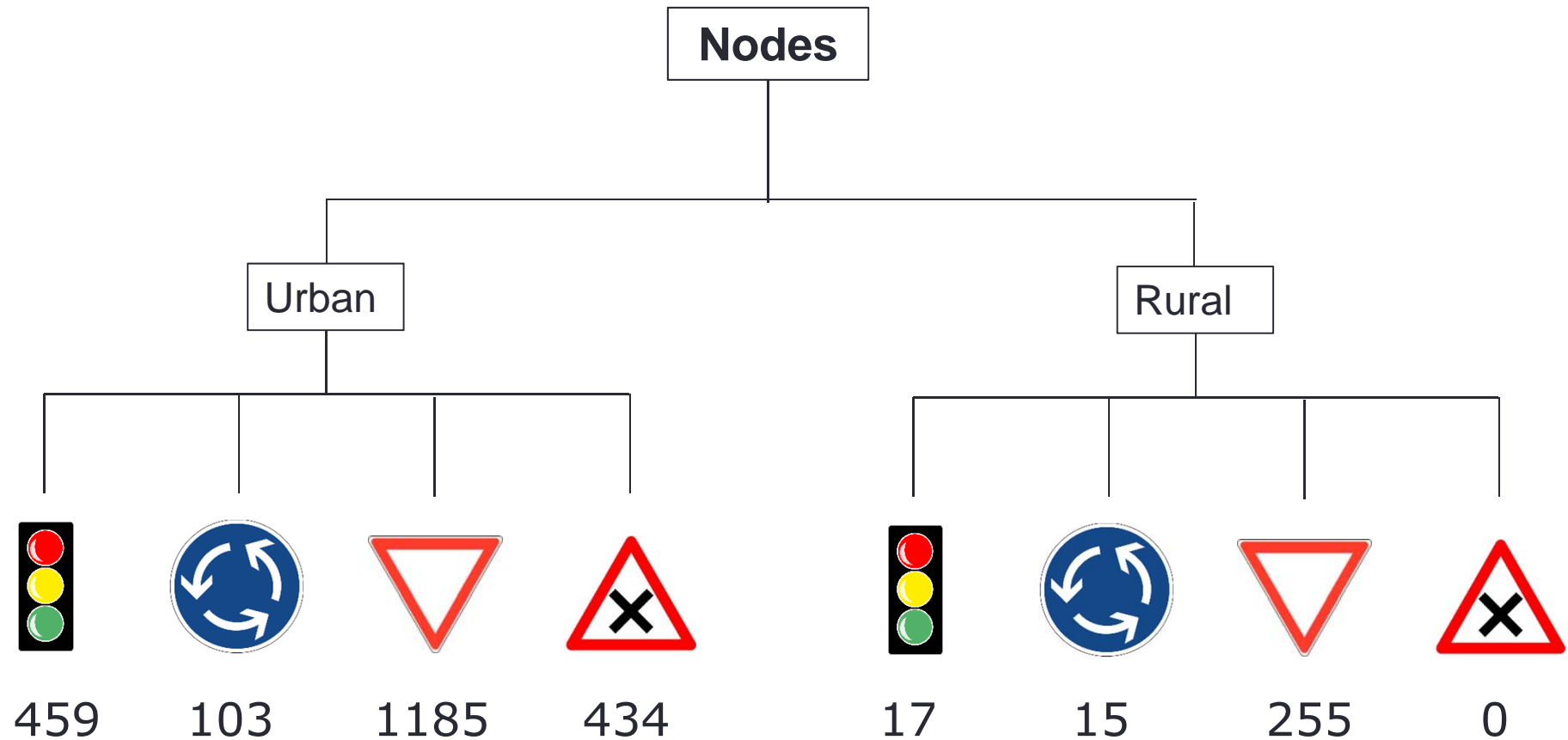
Road information

Links	Nodes	Accidents
Location	Location	Location
Length	Node type	Accident type
AADT	$AADT_{max}$	Accident severity
Public transport	$AADT_{min}$	Road name
V_{max}	V_{max}	V_{max}
% heavy vehicle	V_{min}	
Number of lanes	Number of inlets	
Slope		
Cycling infrastructure		
Access density		
Existence of zebras		

Results

SVT

Node categories

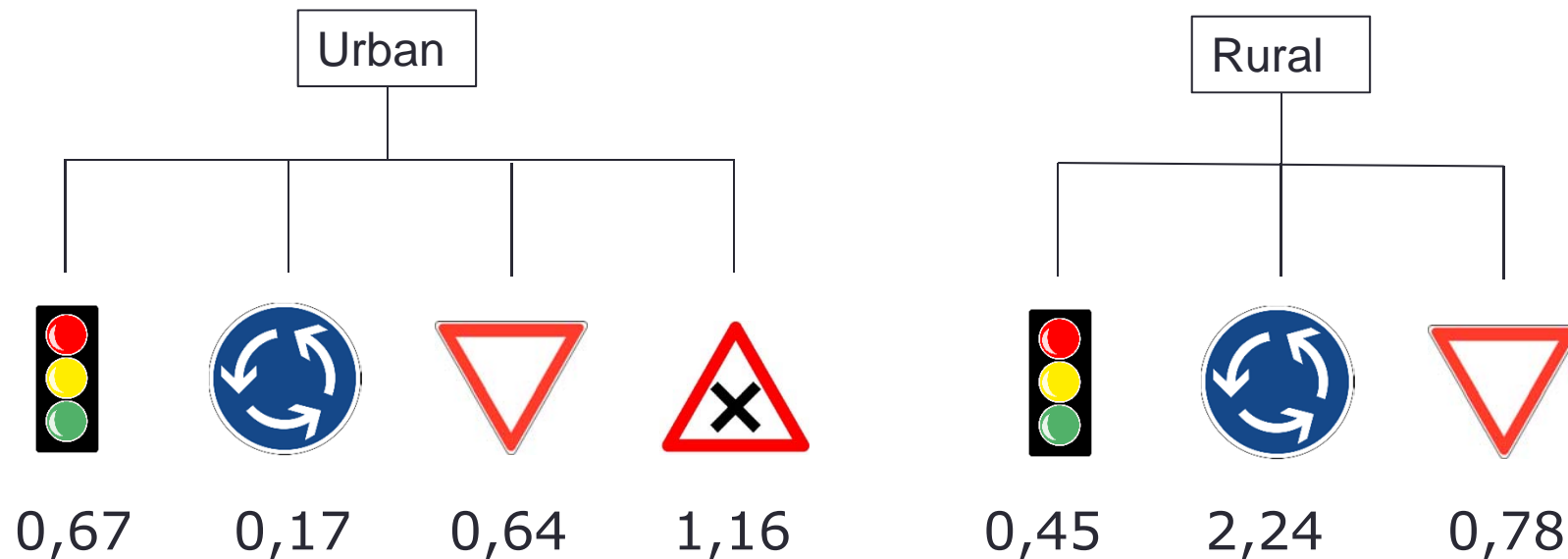


Number of each node type

Results

SVT

Node categories



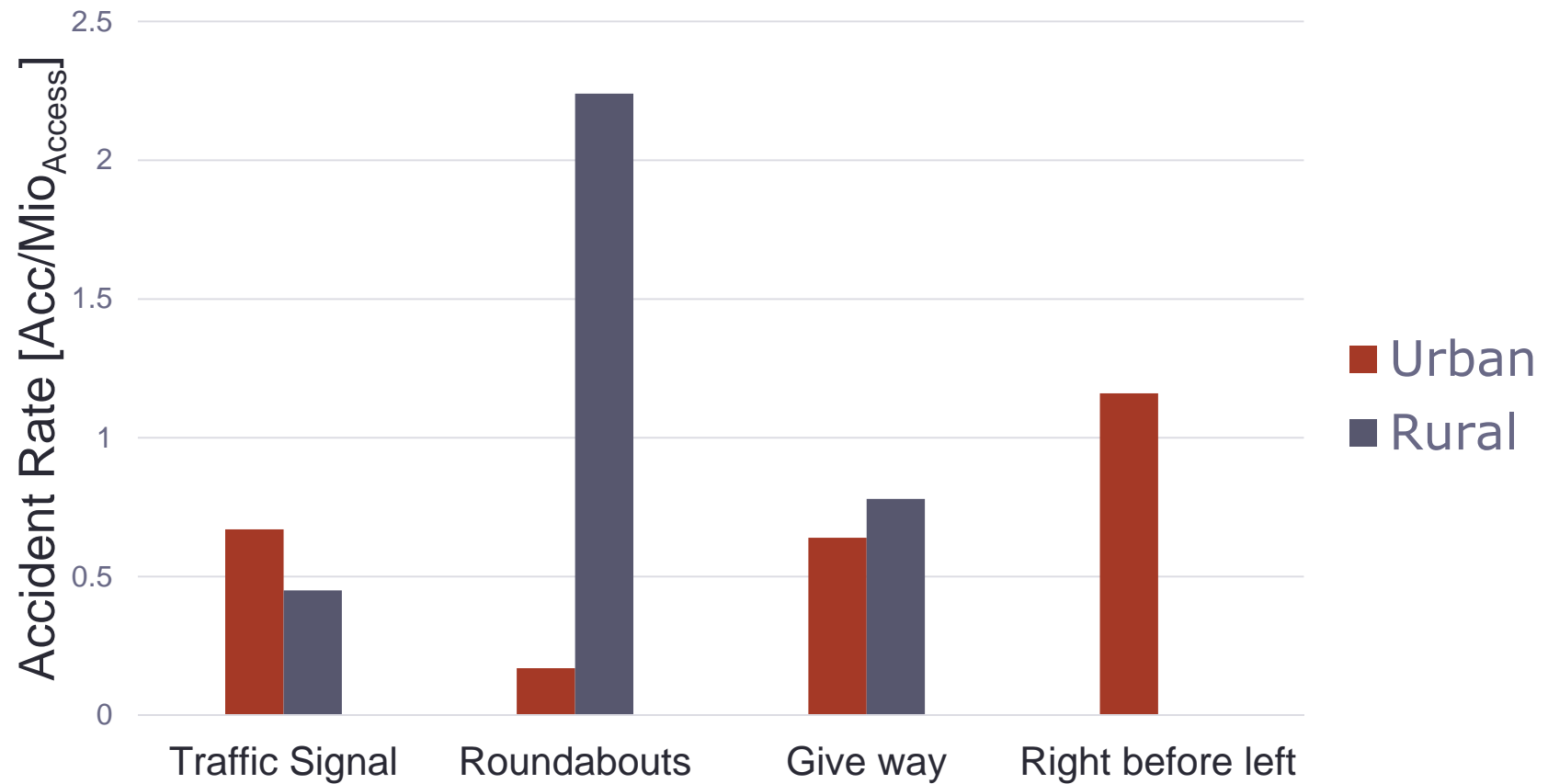
$$AccRate = \frac{n \cdot 10^6}{\sqrt{AADT_{max} \cdot AADT_{min}} \cdot 365 \cdot a} \quad [Acc/Mio_{Access}]$$

n = accidents, *a* = years of investigation

Results

SVT

Accident Rates

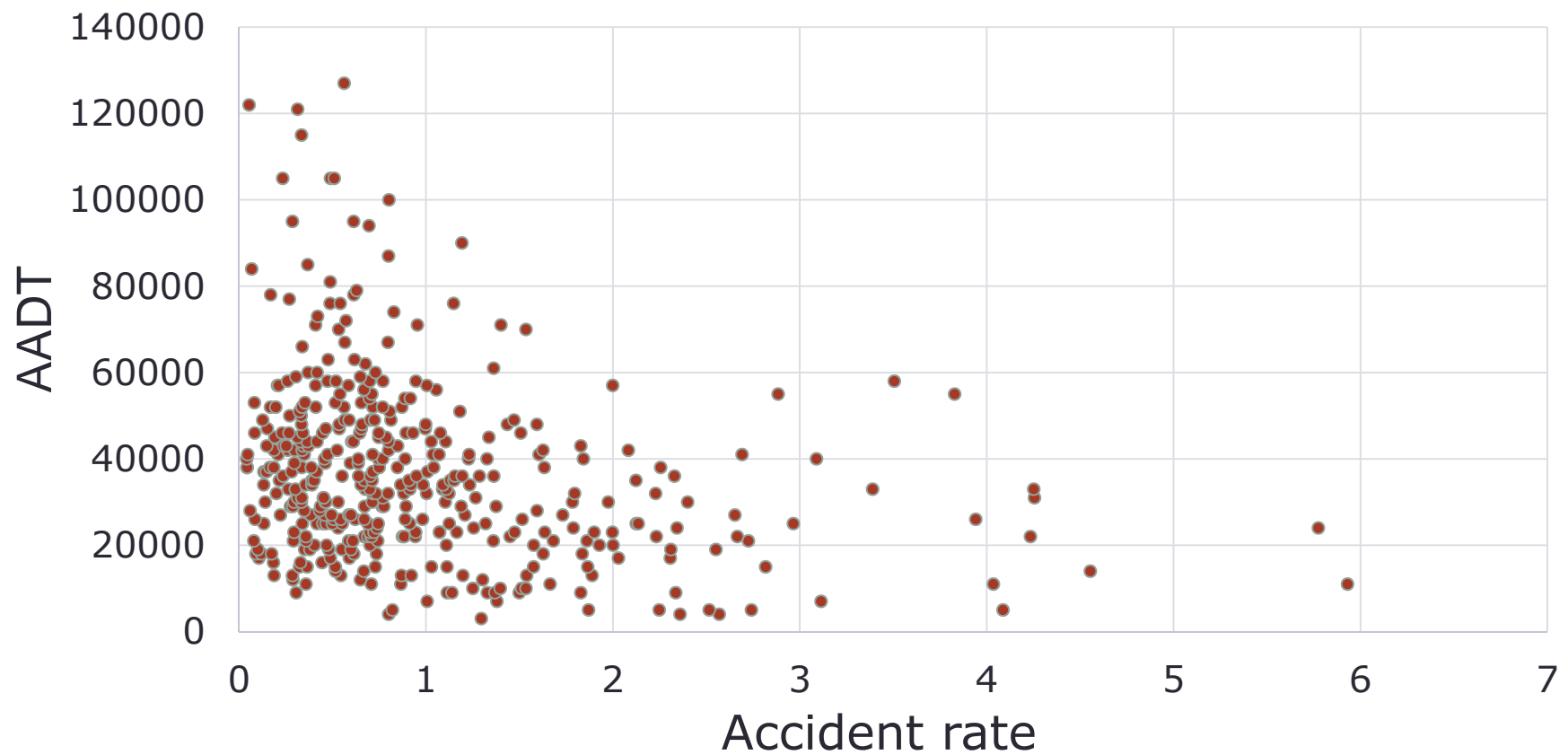


Results



Accident Rates

Accident Rate of urban Traffic signals



Next steps



- Different node sizes
- Modelling of network characteristics

$$\mu = \alpha \cdot L^{\beta_1} \cdot Q^{\beta_2} \cdot e^{\sum \gamma_i \cdot x_i}$$

μ = Expected number of accidents

α = constant β/ γ = coefficients

- Prediction for road links
- Length of the approaching inlet
- Prediction of accident cost

Conclusion

The logo for SVT (Swedish Television) is located in the top right corner of the slide. It consists of the letters 'SVT' in a stylized, orange, sans-serif font.

- Workload to create a homogenous network
- Definition of boundaries
 - Included accidents (spatial location)
 - Minimal and Max lengths of nodes/segments
 - Accuracy of data (aggregation levels)
- Different accident patterns in rural and urban areas
- Roundabout is the safest node type
- Traffic signal as safe as Give way node types
- Approaching inlet has by trend positive effect

References



- BfS, Bundesamt für Statistik (2014), Verkehrsunfälle in der Schweiz 2013, Mobilität und Verkehr, Neuchâtel
- Eckstein, K., and V. Meewes, Sicherheit von Landstraßen-Knotenpunkten, Knotenpunktgrundformen Verkehrsregelung Zufahrten, Mitteilungen 40 (2002).



Besten Dank für Ihre Aufmerksamkeit!