



**INNOVATIVE APPROACH IN ROAD
INFRASTRUCTURE SAFETY MANAGEMENT
AND ROAD SAFETY IMPACT ASSESSMENT**

CRASH PREDICTION



Tomorrow at 11:34 a crash will happen here.

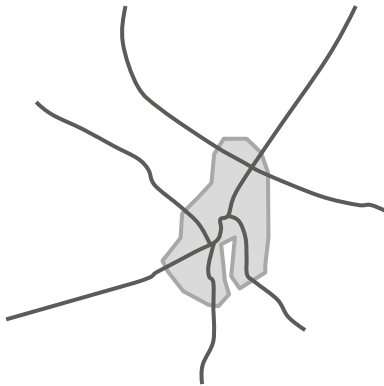
CRASH PREDICTION



**In 2014 about 10 million cars will use this road.
About three crashes will occur on this segment.**

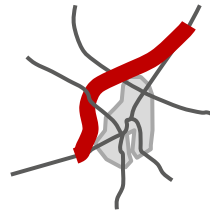
ROAD SAFETY IMPACT ASSESSMENT

Current status

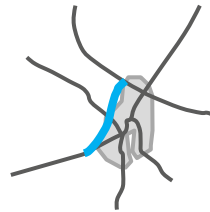


Layouts

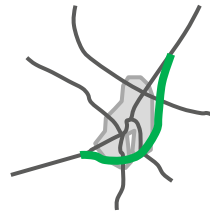
A



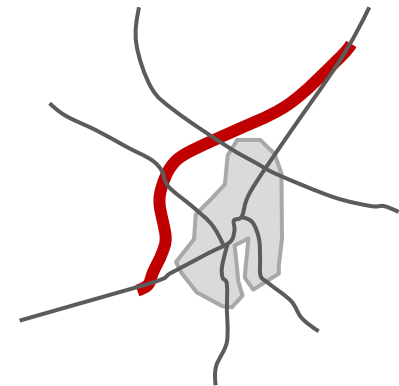
B



C

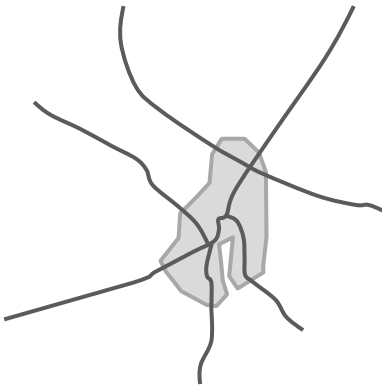


Safest Layout

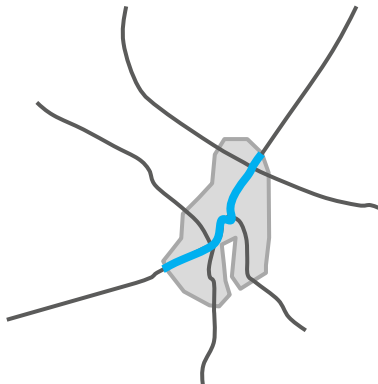


ROAD SAFETY IMPACT ASSESSMENT

Current status

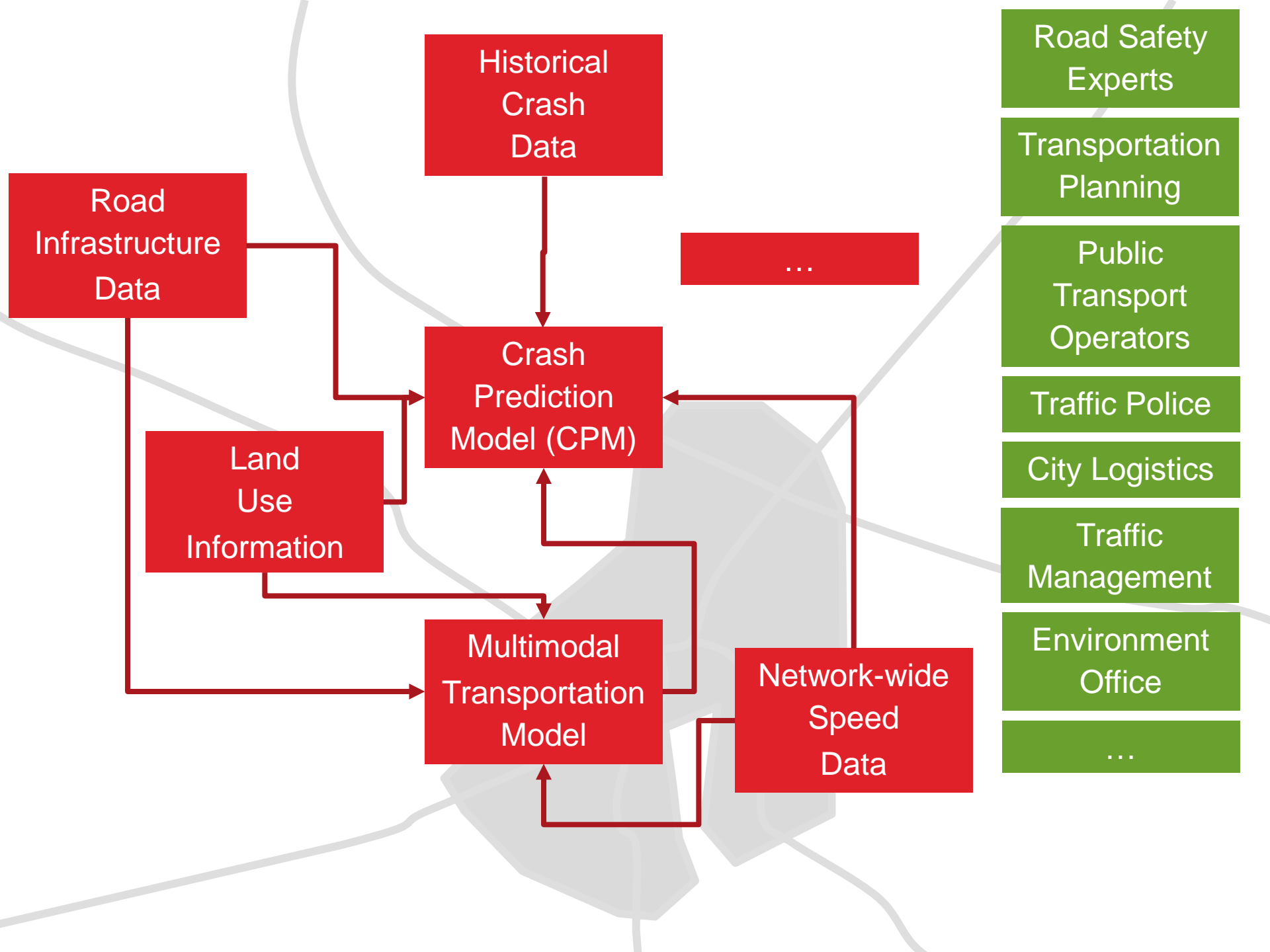


New Bus Route



Safety Impact

Per year e.g.
 Δ -25 crashes
 Δ -6 injuries
 Δ -1 fatality
 Δ -2 million \$
crash costs



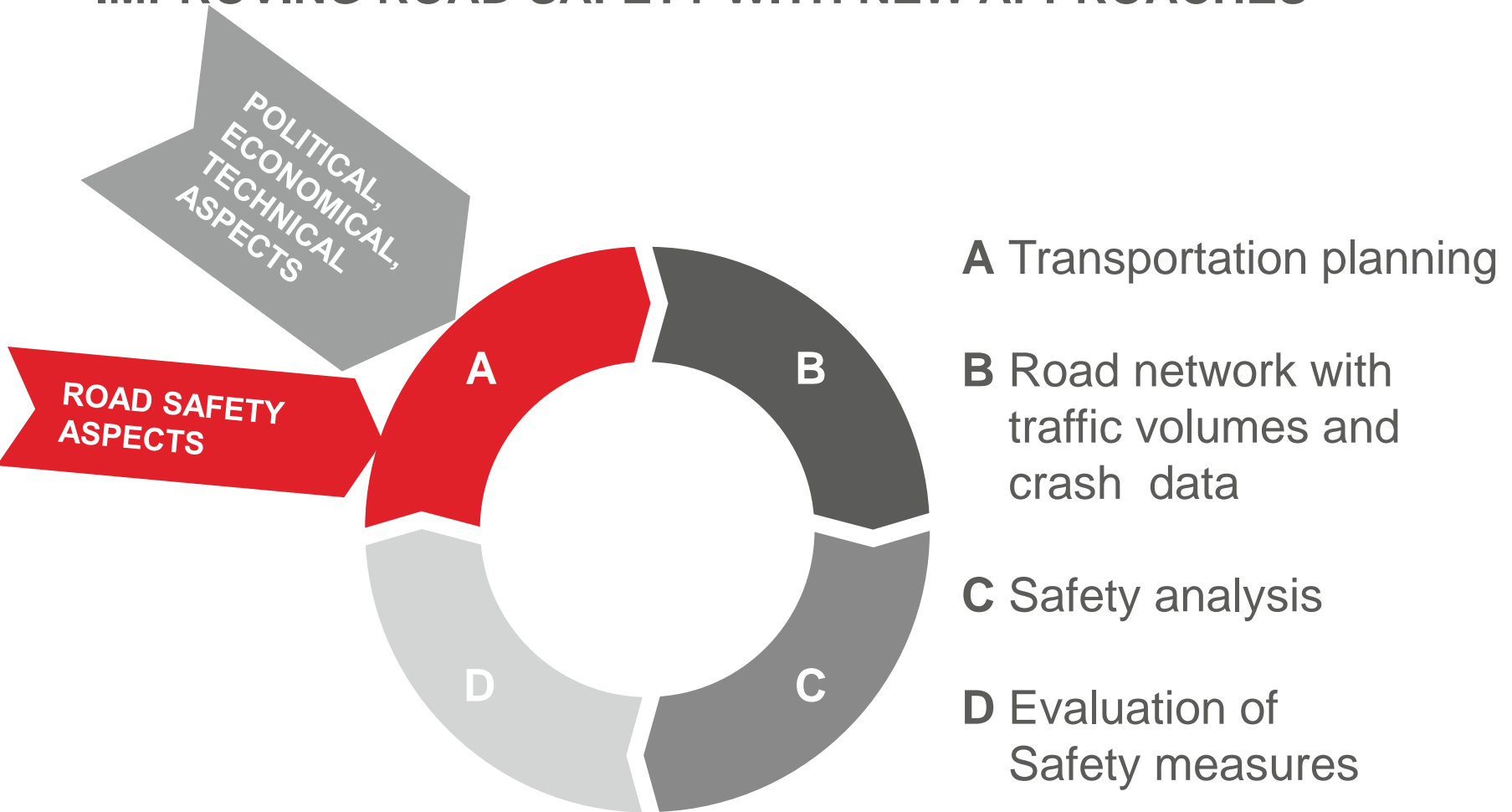
RE SHAPE THINKING ON TRANSPORTATION AND ROAD SAFETY



Michael Replogle (ITDP)

„Breaking out of the institutional silos of transportation!“

IMPROVING ROAD SAFETY WITH NEW APPROACHES

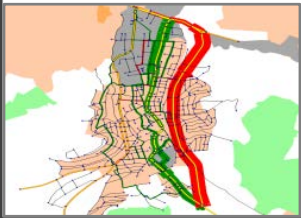


ROAD INFRASTRUCTURE SAFETY MANAGEMENT

EU Directive 2008/EC/96

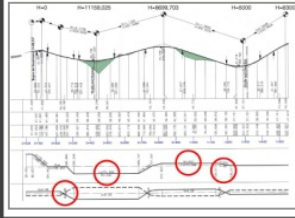
**Road Safety
Impact
Assessment**

(RIA)



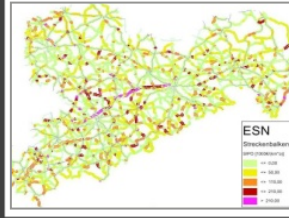
**Road Safety
Audit**

(RSA)



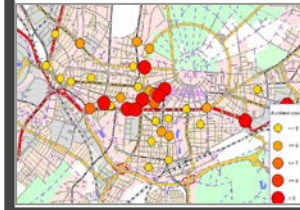
**Network
Safety
Management**

(NSM)



**Black Spot
Management**

(BSM)



**Road Safety
Inspection**

(RSI)

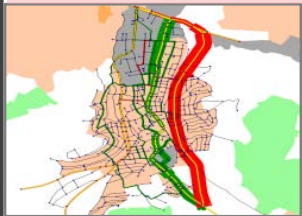


ROAD INFRASTRUCTURE SAFETY MANAGEMENT

Crash Data

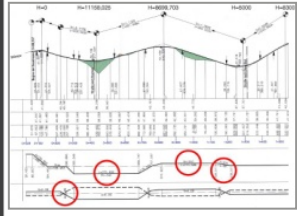
Road Safety
Impact
Assessment

(RIA)



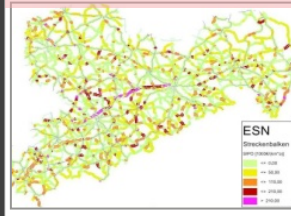
Road Safety
Audit

(RSA)



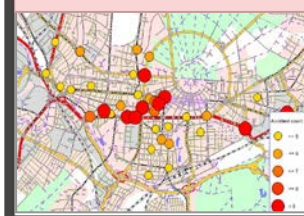
Network
Safety
Management

(NSM)



Black Spot
Management

(BSM)



Road Safety
Inspection

(RSI)



Necessity for and benefits of using software

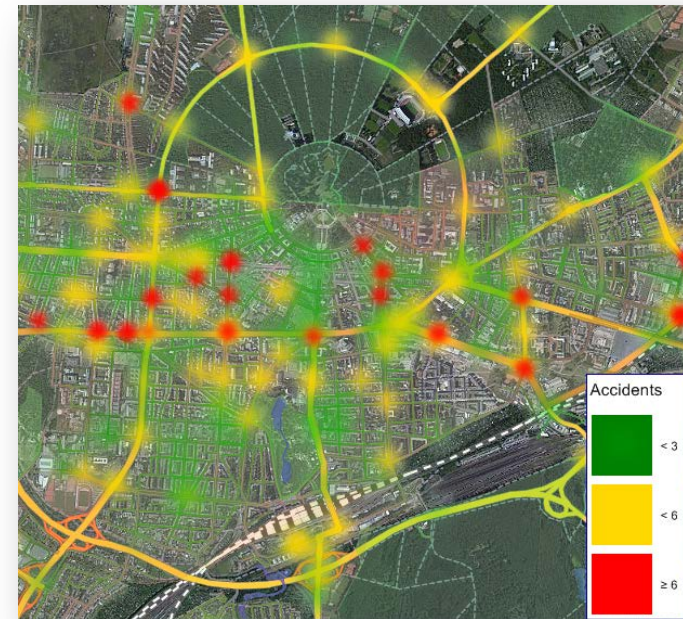
INTEGRATED ROAD SAFETY MANAGEMENT

Road administrations need to take action on the operational level....

Black Spot
Management

(BSM)

- Identify black spots (sites with high crash frequency) based on historical crash data
- Analyze similarities and contributing factors
- Find countermeasures



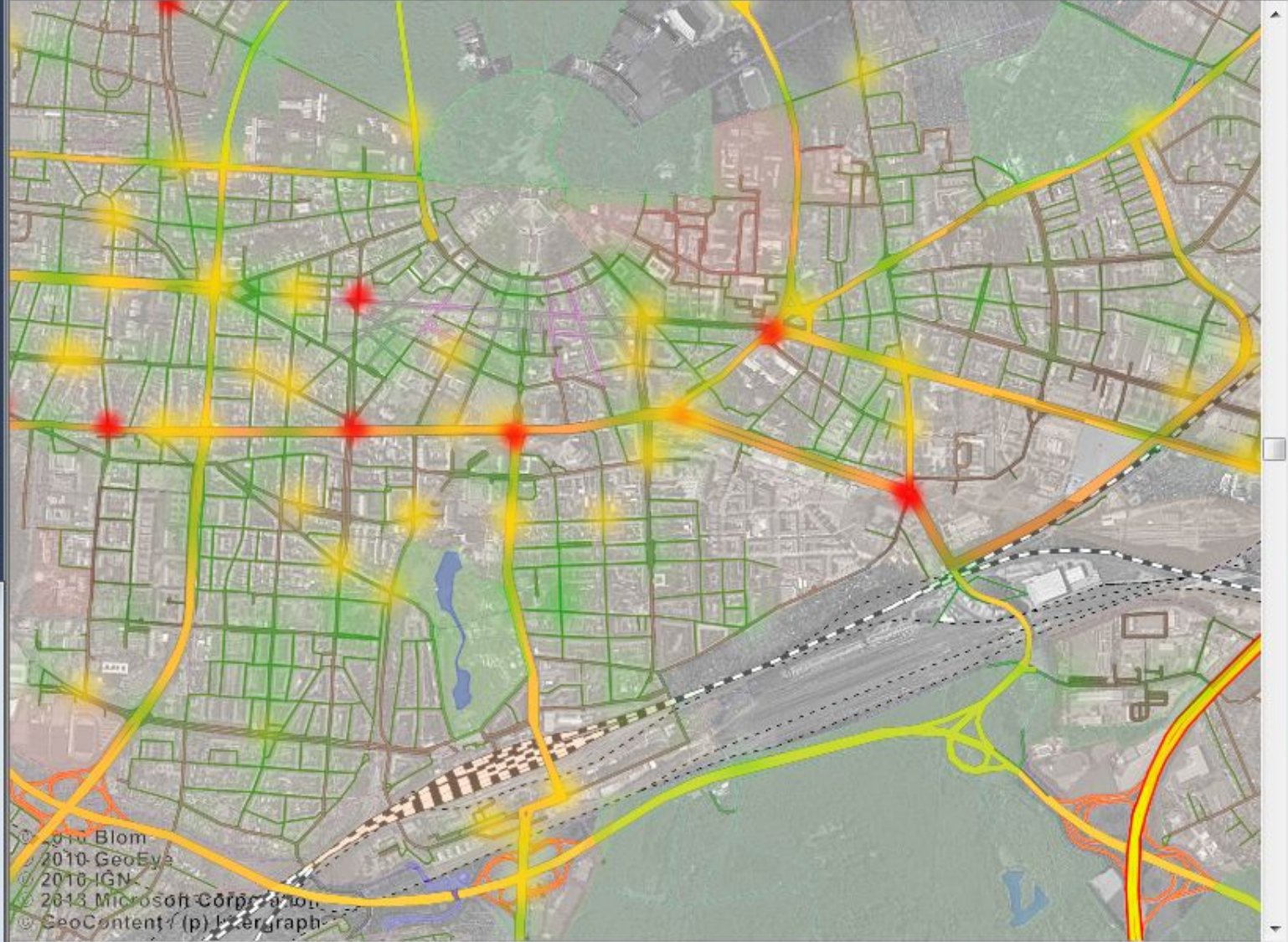
- Nodes
- Links
- Turns
- Zones
- Connectors
- Main nodes
- Main turns
- Territories
- POIs
- Count locations
- Detectors
- Backgrounds
- Texts

Network x Matrices

- PTV Visum Safety
- Accidents
 - Black Spots
 - Links
 - Nodes

Help icons and information buttons

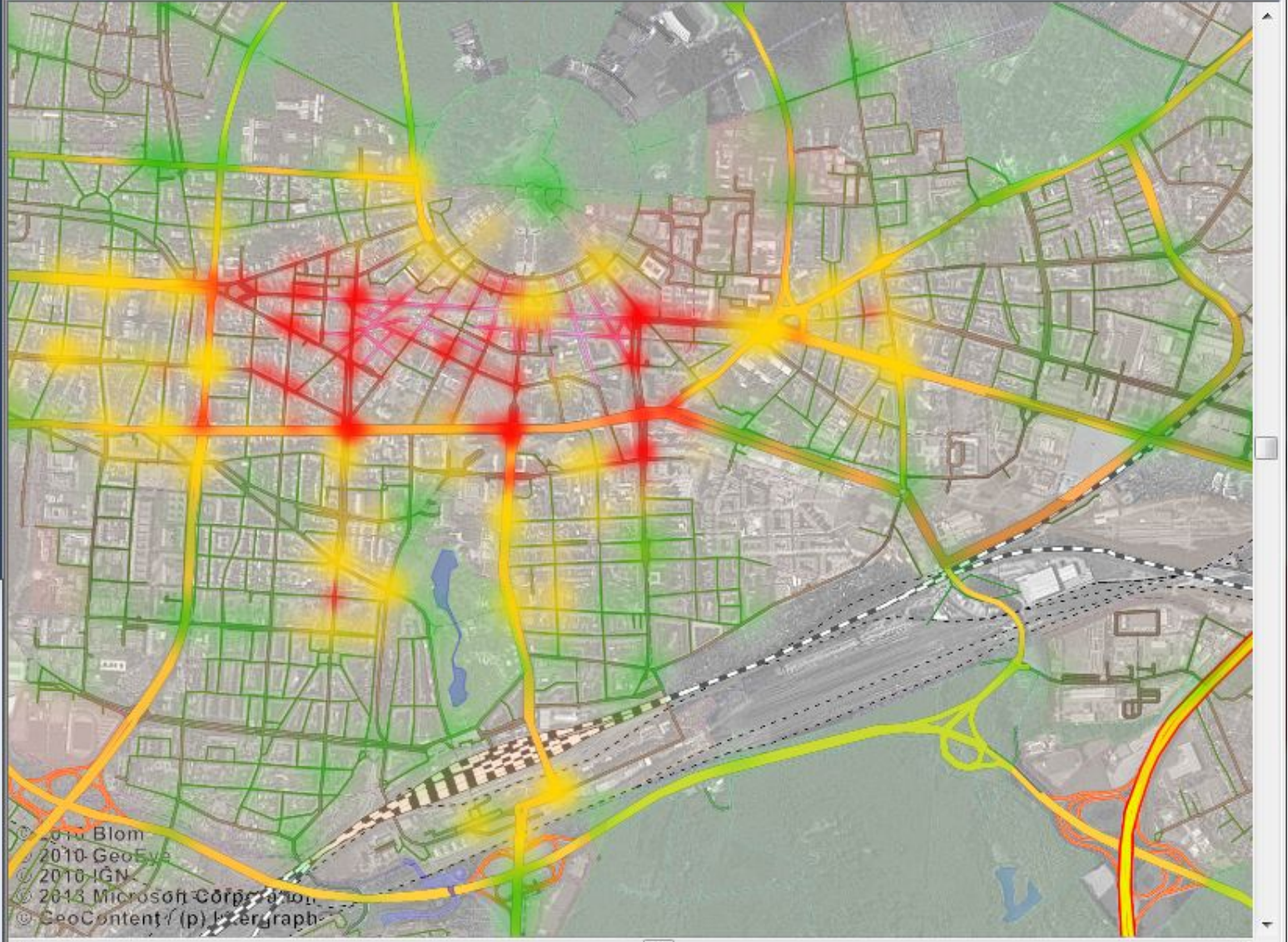
Network editor (Edit: Nodes) toolbar with icons for selection, zoom, and editing.



- Network
- Nodes
- Links
- Turns
- Zones
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- Main nodes
- Main turns
- Territories
- POIs
- Count locations
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- Backgrounds
- Texts
- Network
- Matrices

Network editor (Edit: Nodes)

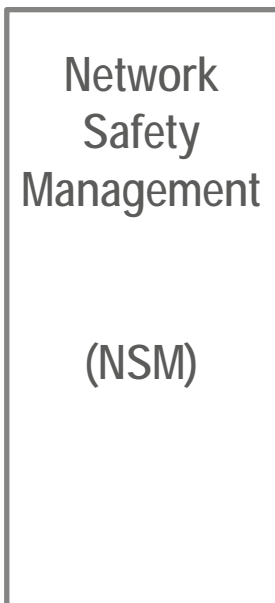
Select GPar...



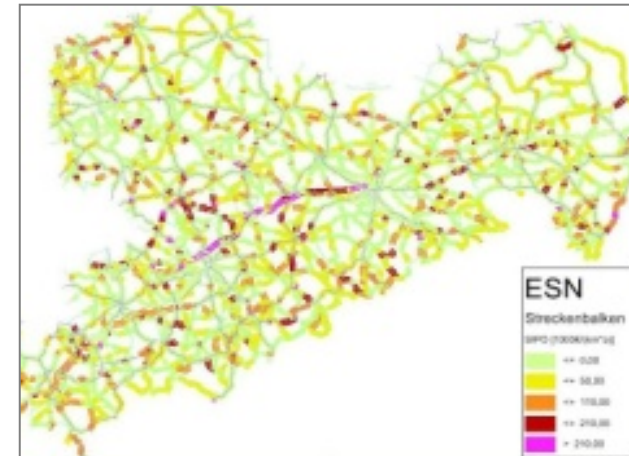
- PTV Visum Safety
- Accidents
 - Black Spots
 - Links
 - Nodes
-

INTEGRATED ROAD SAFETY MANAGEMENT

Transportation authorities identify “need for action” on strategic level



- Road traffic planning based on the macroscopic safety situation
- Safety assessment considers historical crash data, traffic volumes and road infrastructure data
- Ranking of road segments in terms of high risk sections and severity
- Describing safety potential = road segments with high crash saving potential



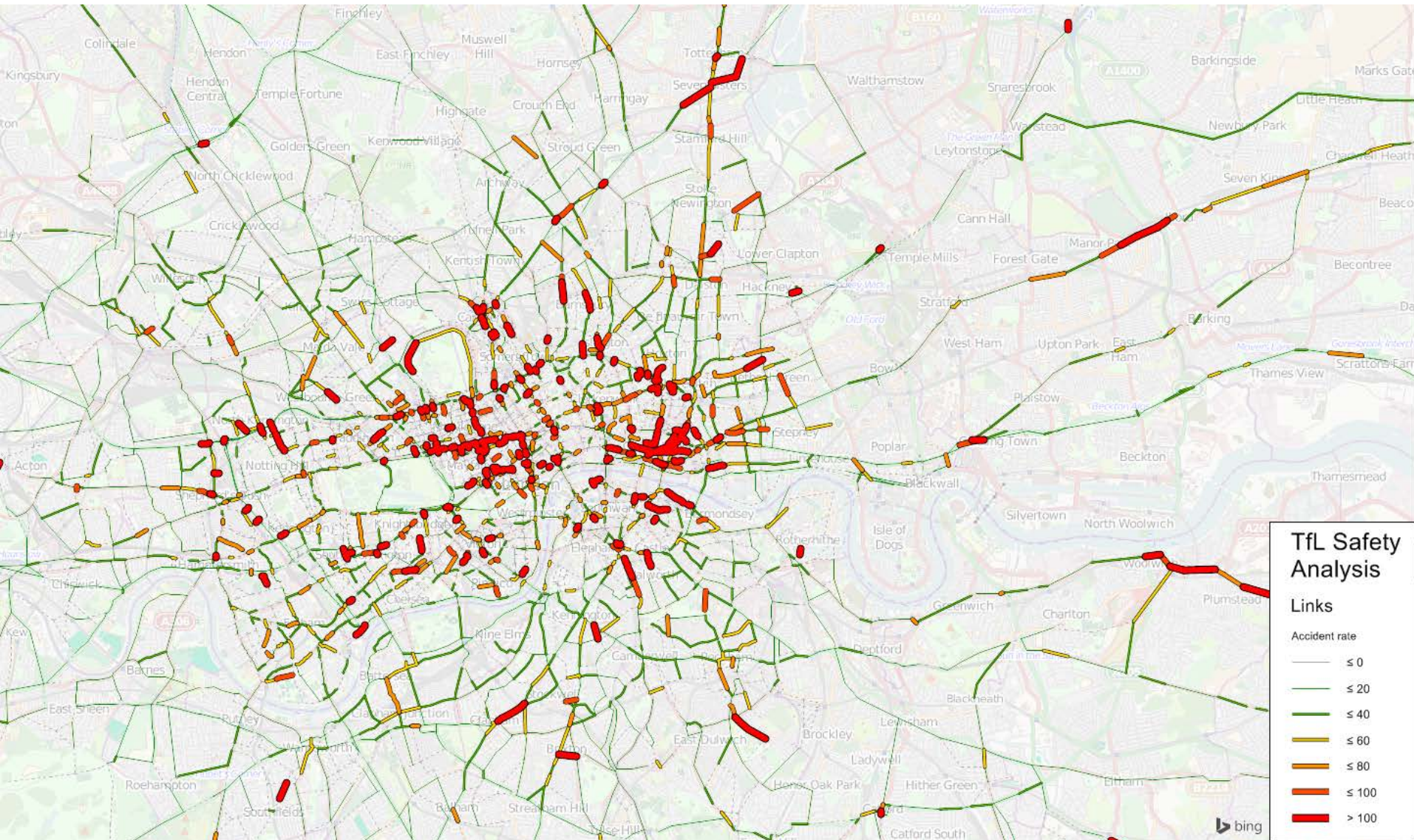
2010-2012 CRASH COUNT ON LINKS



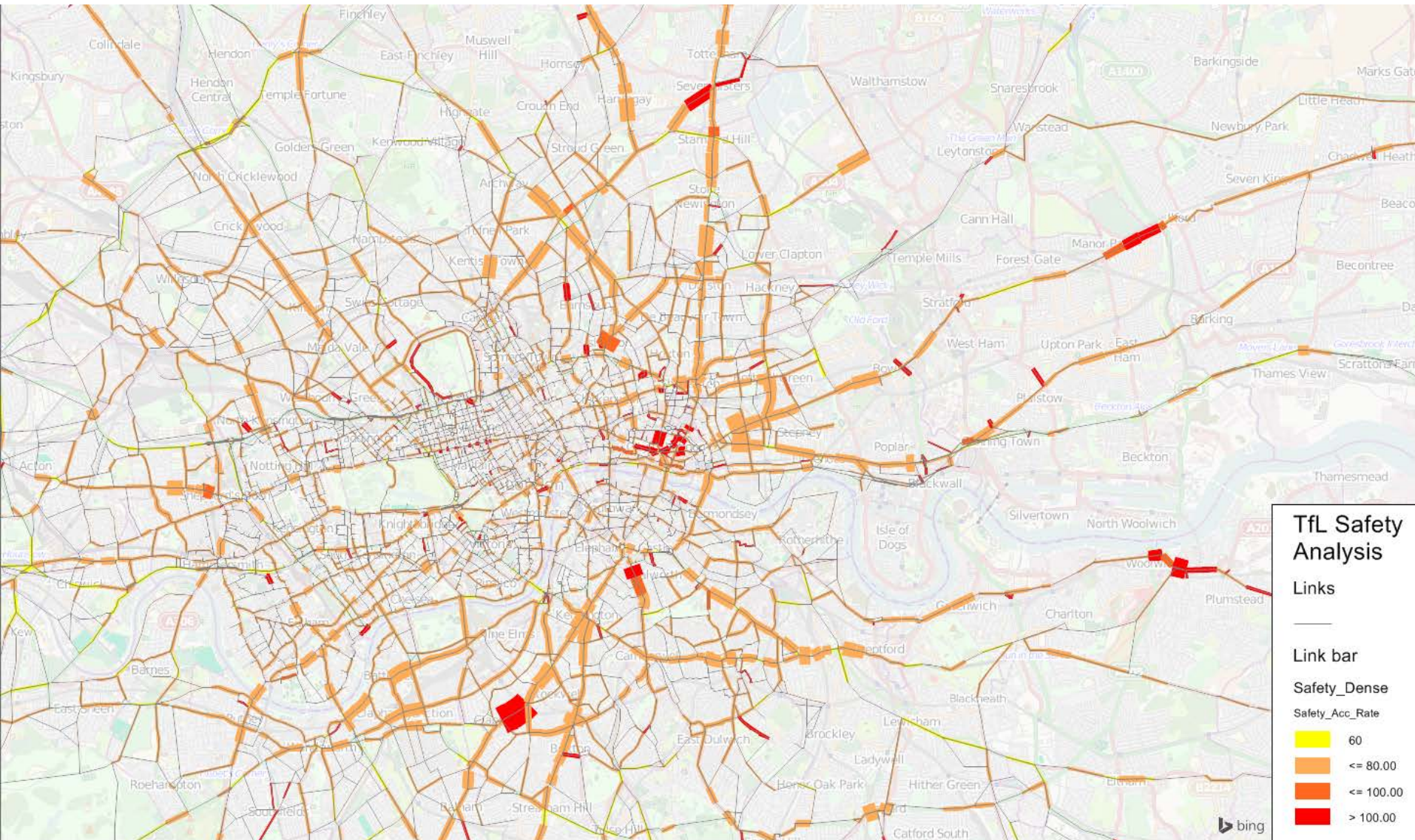
2010-2012 CRASH DENSITY ON LINKS



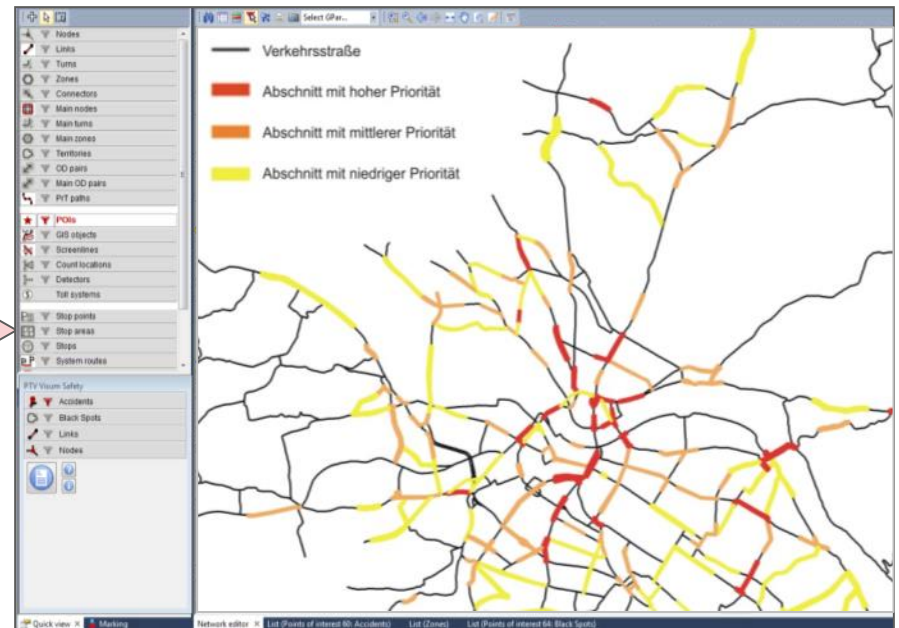
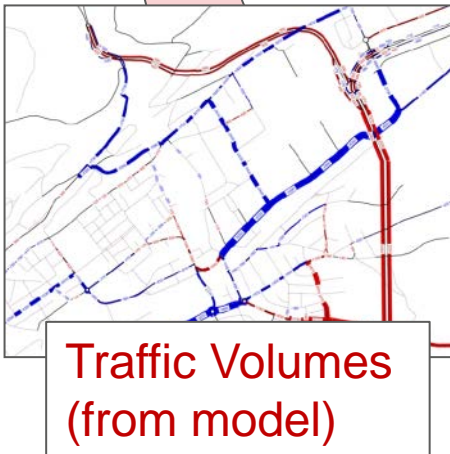
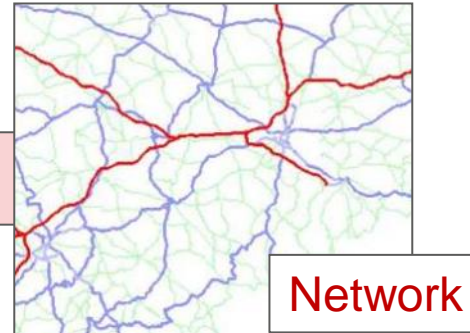
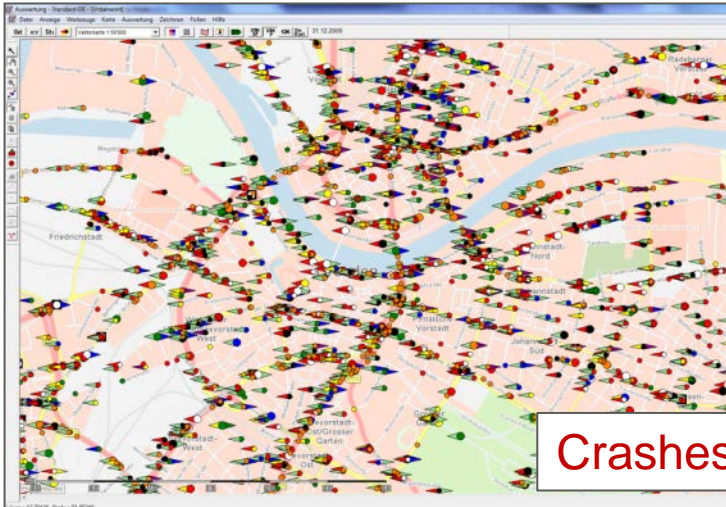
2010-2012 CRASH RATES ON LINKS



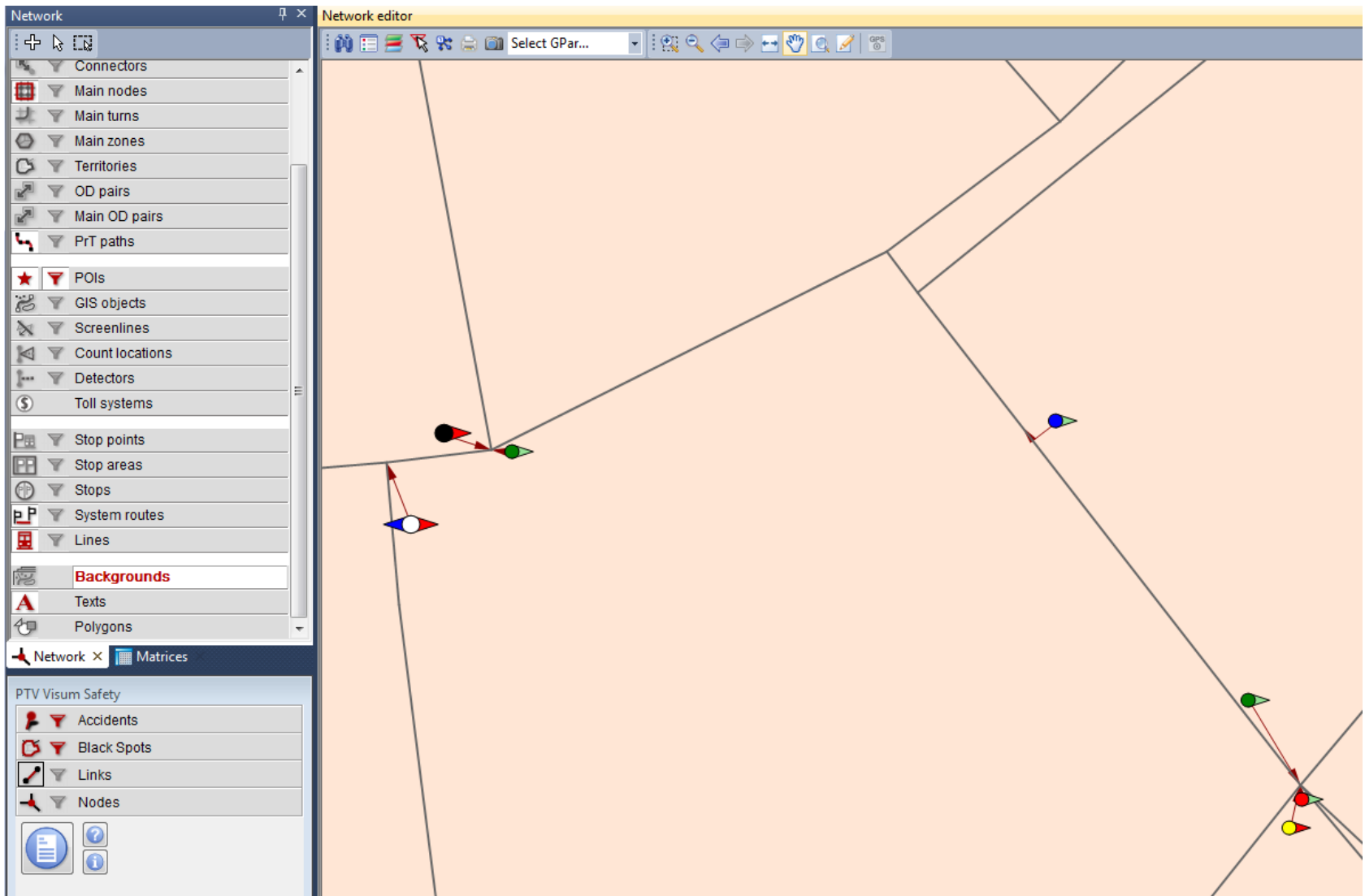
2010-2012 CRASH RATES & DENSITY ON LINKS



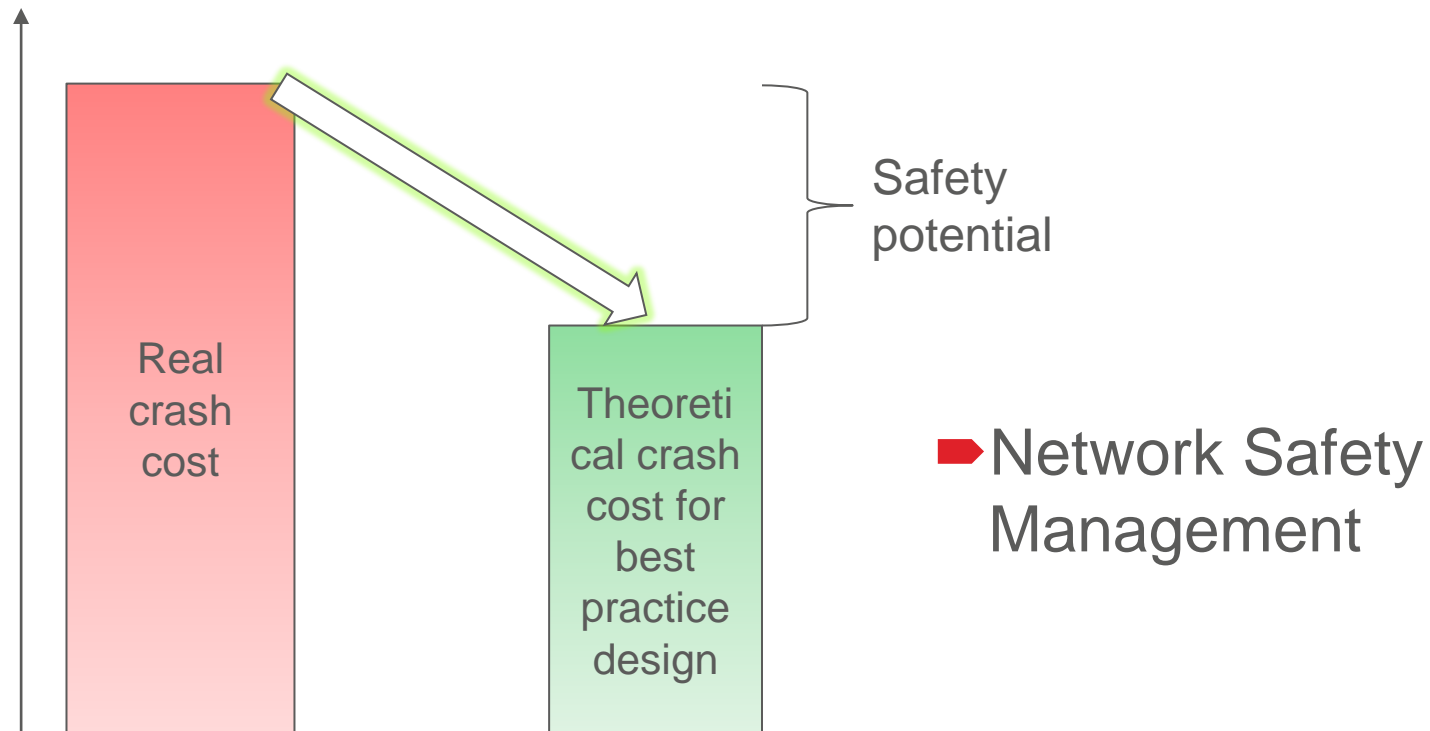
COMBINATION OF TRANSPORTATION NETWORK/MODEL WITH CRASH DATA



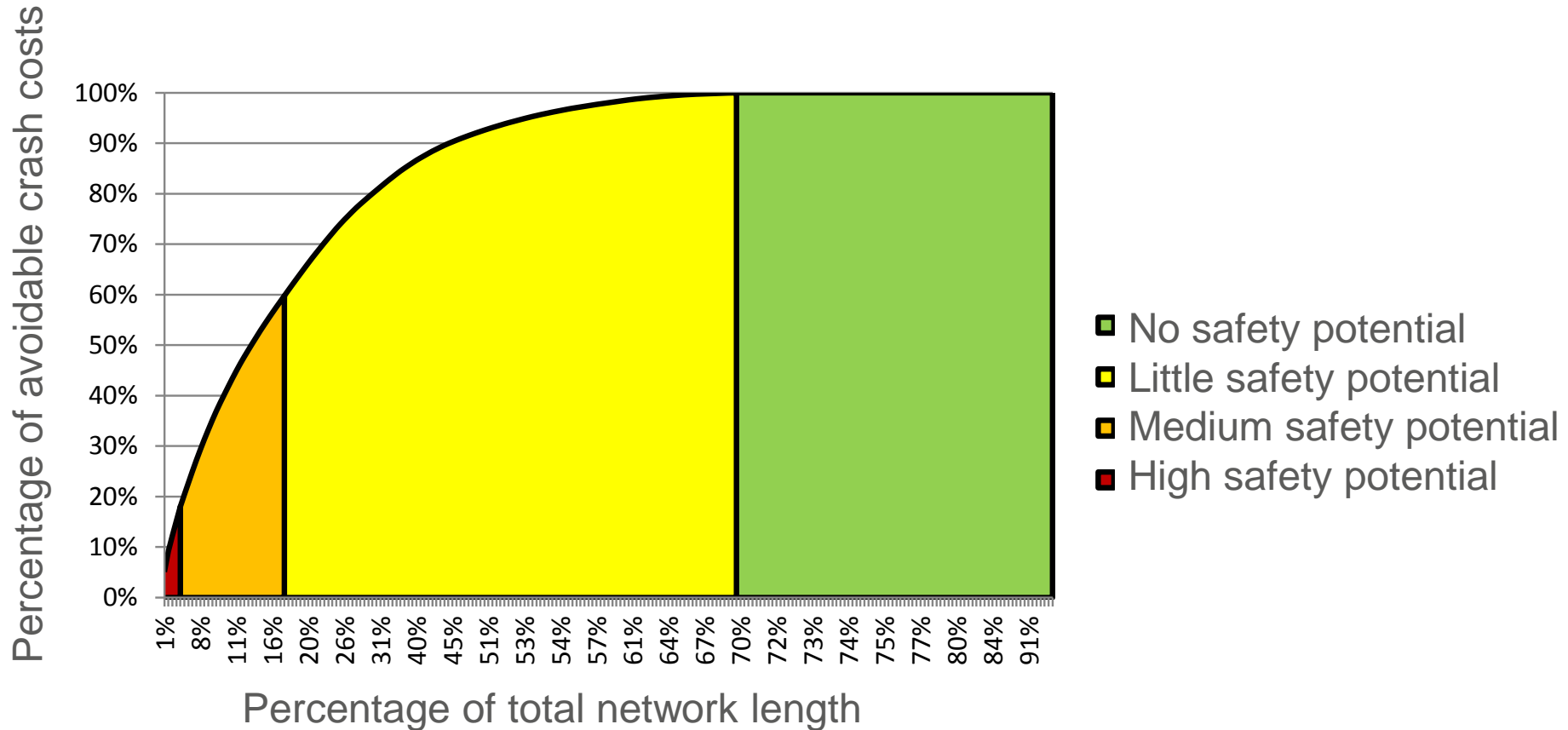
ALLOCATION OF CRASHES TO ROAD NETWORK



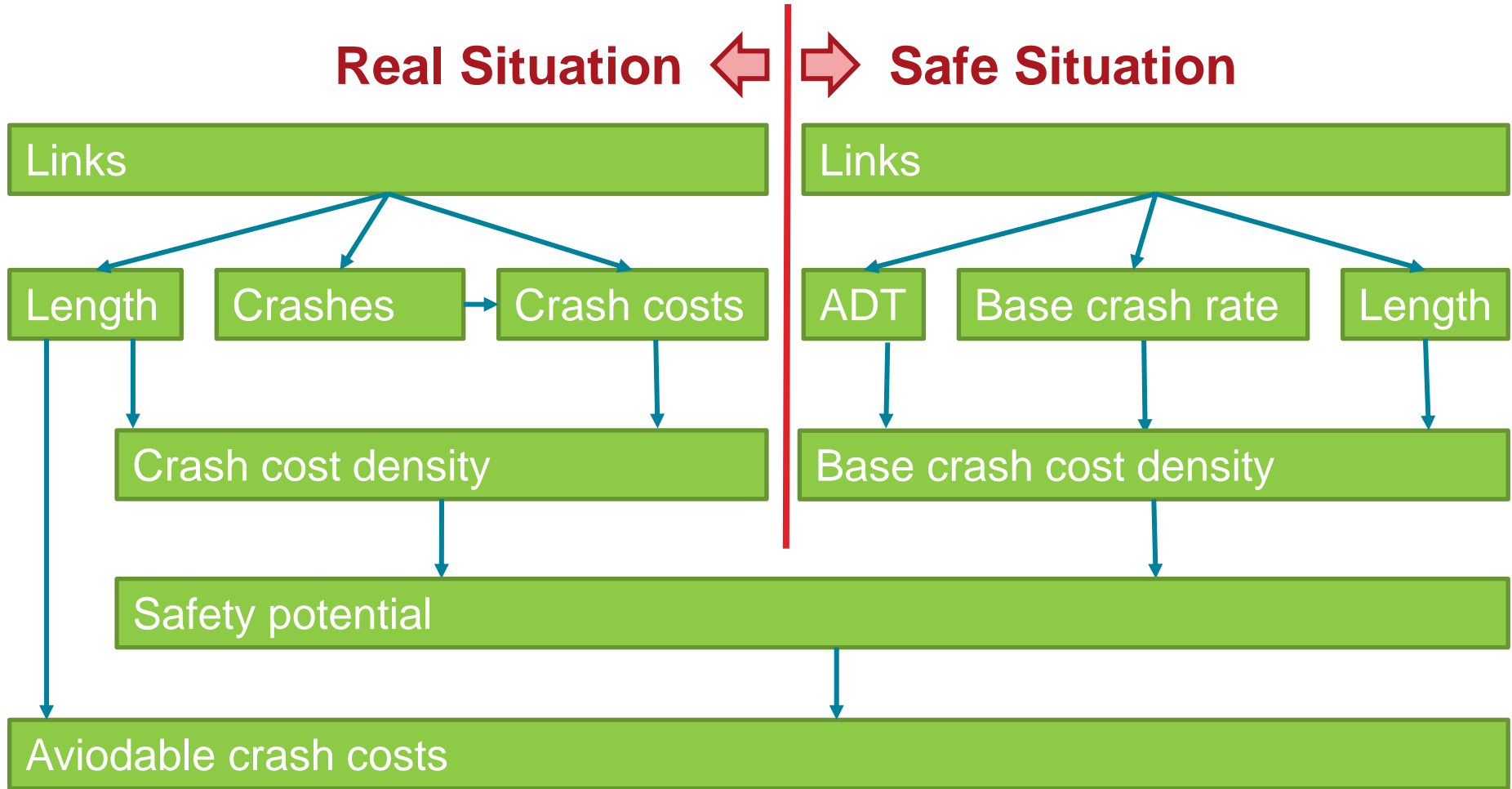
GOAL OF NETWORK SAFETY MANAGEMENT

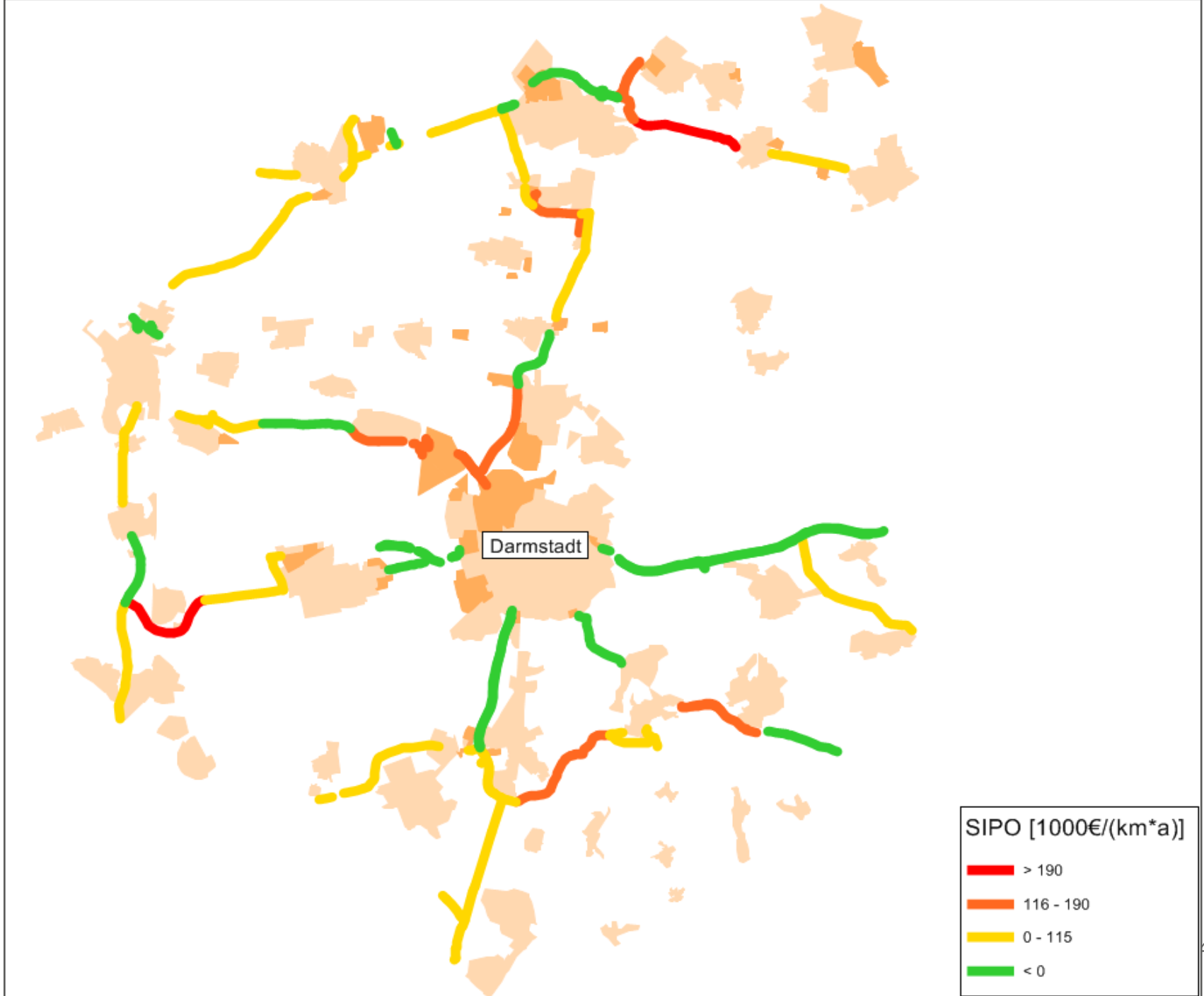


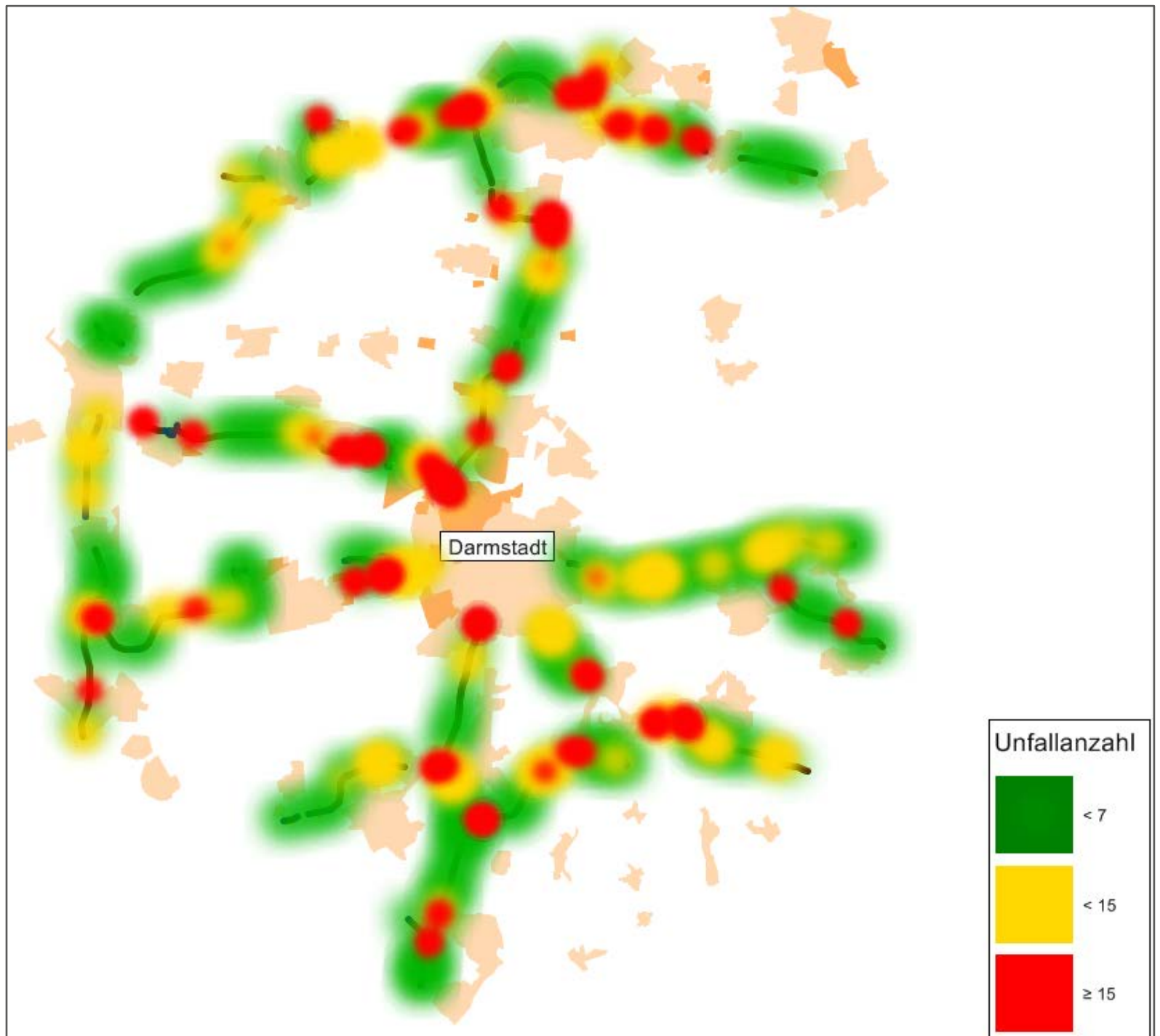
THE ROAD SAFETY LORENZ CURVE – BASIC PRINCIPLE FOR NSM



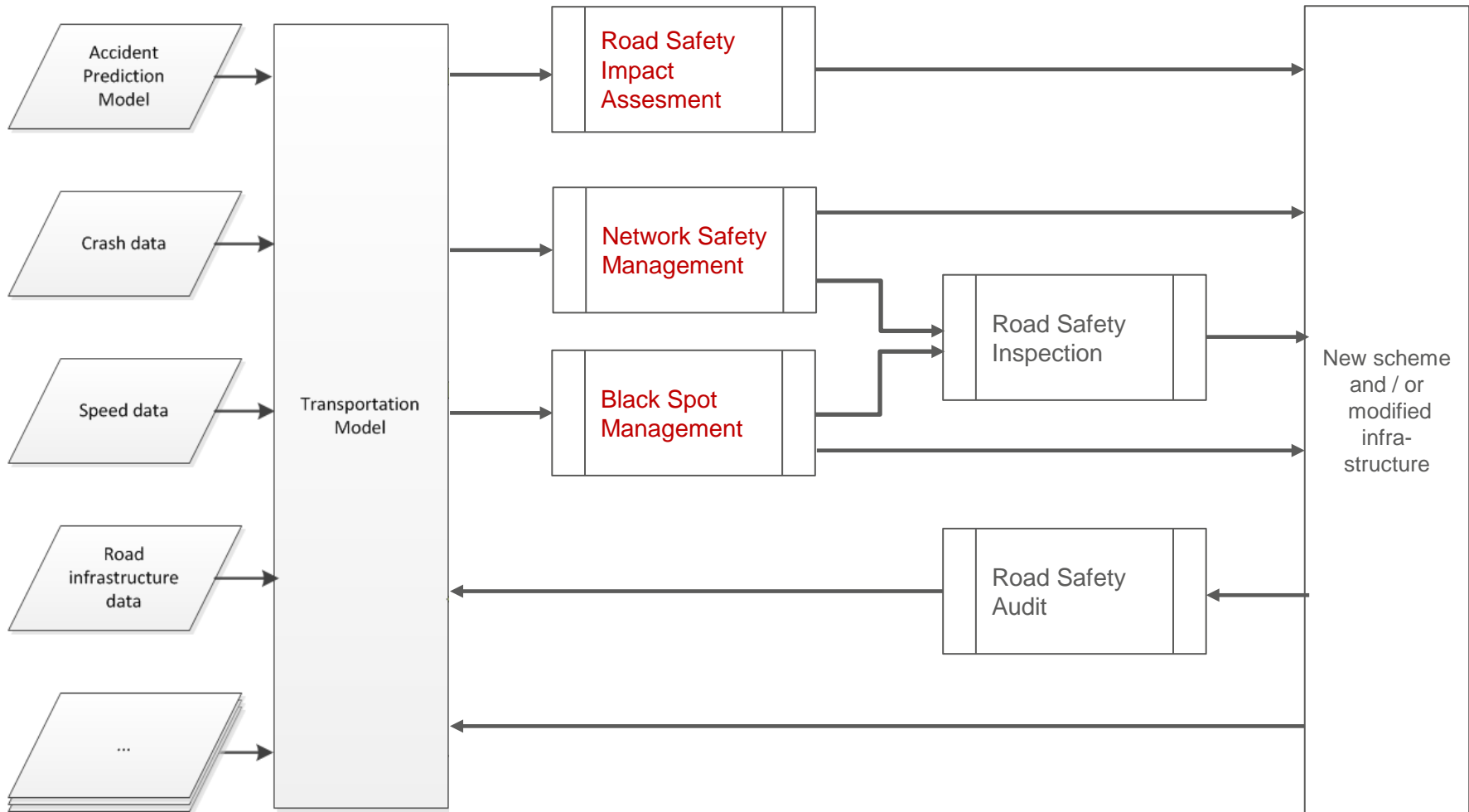
SAFETY POTENTIAL AND AVOIDABLE CRASH COSTS



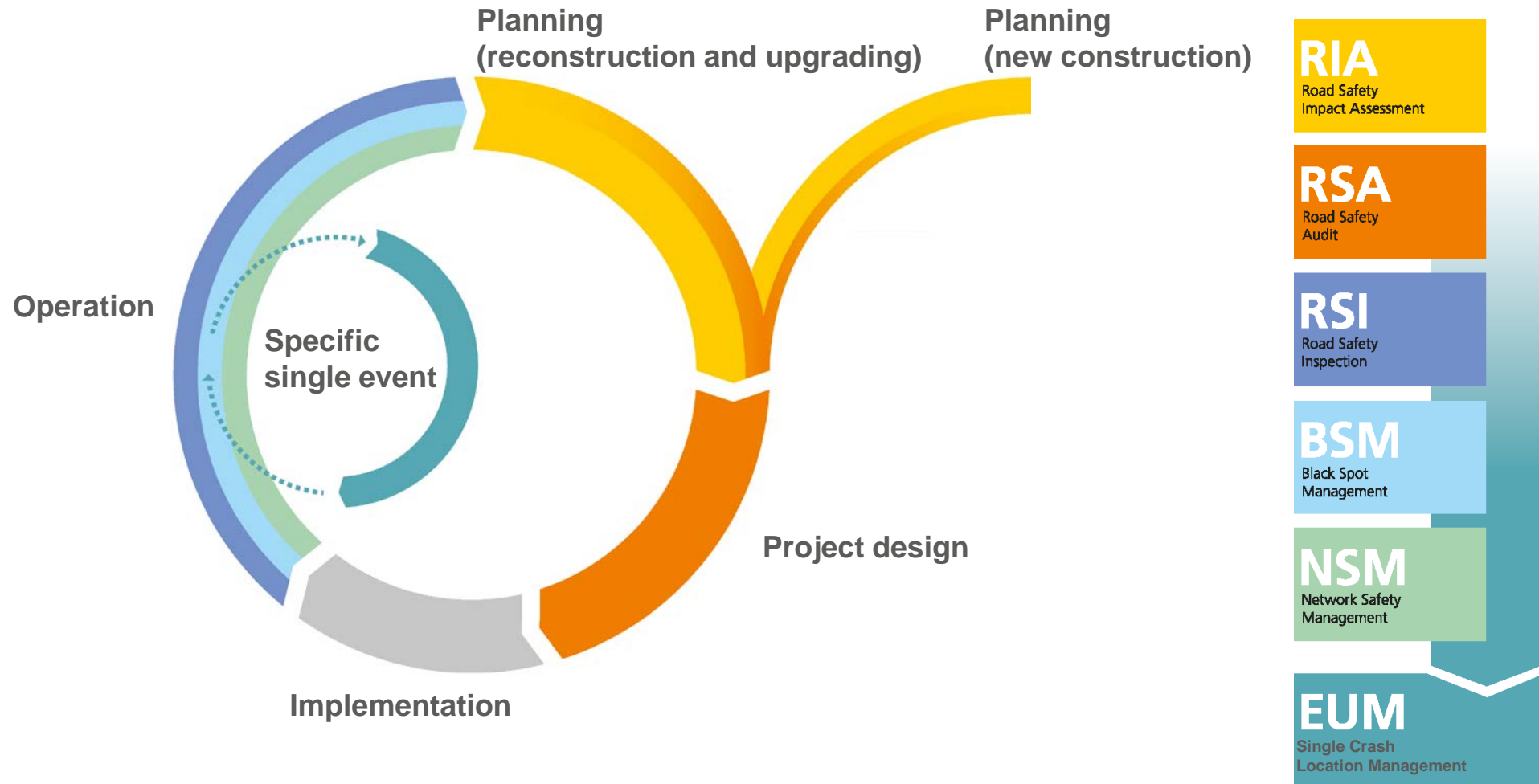




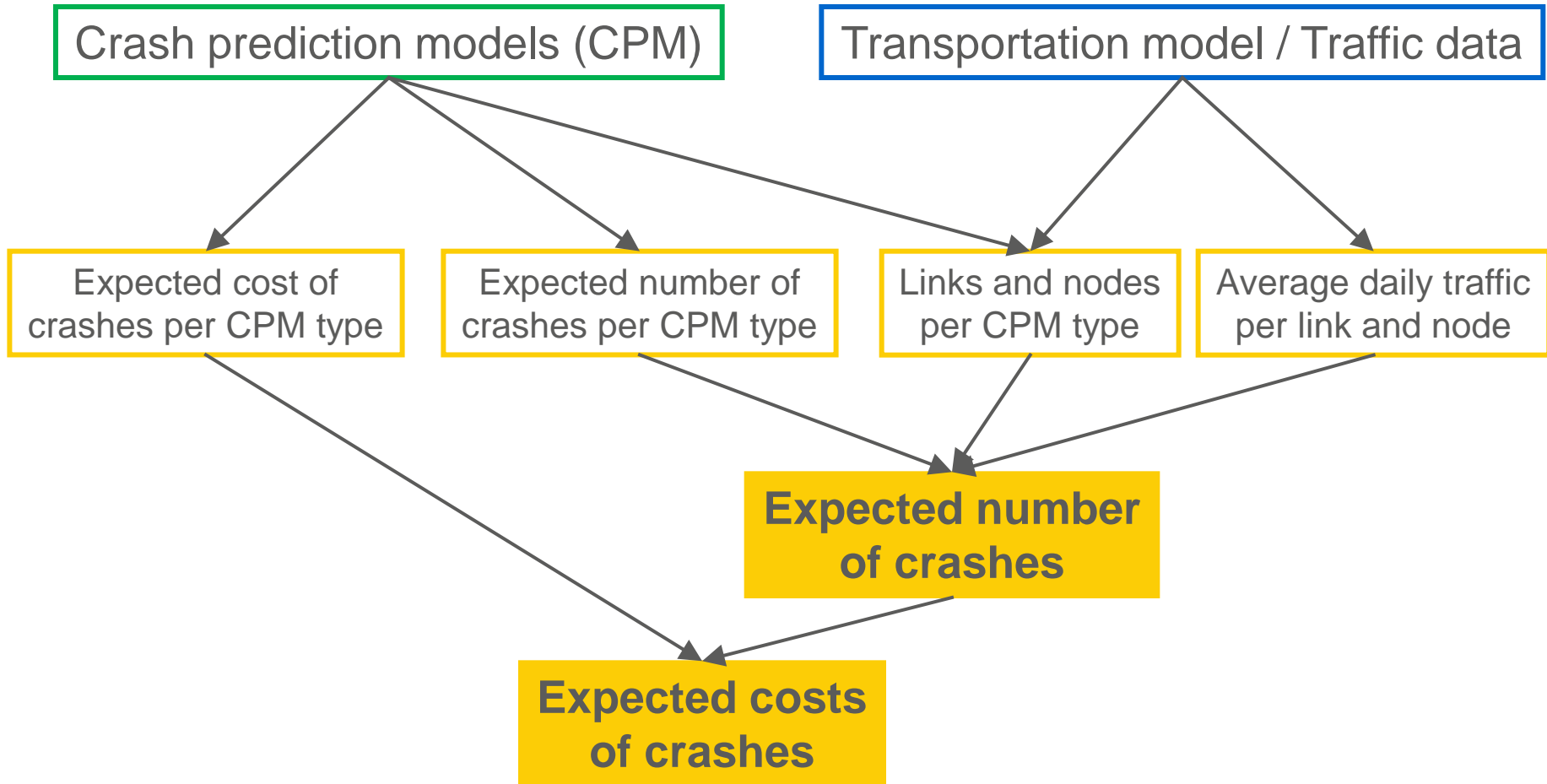
IMPROVING ROAD SAFETY WITH AN INTEGRATED APPROACH



ROAD INFRASTRUCTURE LIFE CYCLE AND THE SAFETY TOOLS IN SWITZERLAND



THE CAUSAL DIAGRAM OF THE RIA METHOD



SWISS RIA METHOD: ROAD SEGMENTS

Road type	Other conditions	Crash rate
Major motorway	≤ 2 lanes	0.46
	> 2 lanes	0.55
Minor motorway	1 lane	0.48
	> 1 lanes	0.57
Tunnel		0.53
Major rural road		0.78
Major urban road	physical separation	1.85
	no physical separation	3.49
Major urban road with high commercial use	physical separation	2.69
	no physical separation	5.10
Minor urban road	with traffic calming	1.50
	without traffic calming	3.00

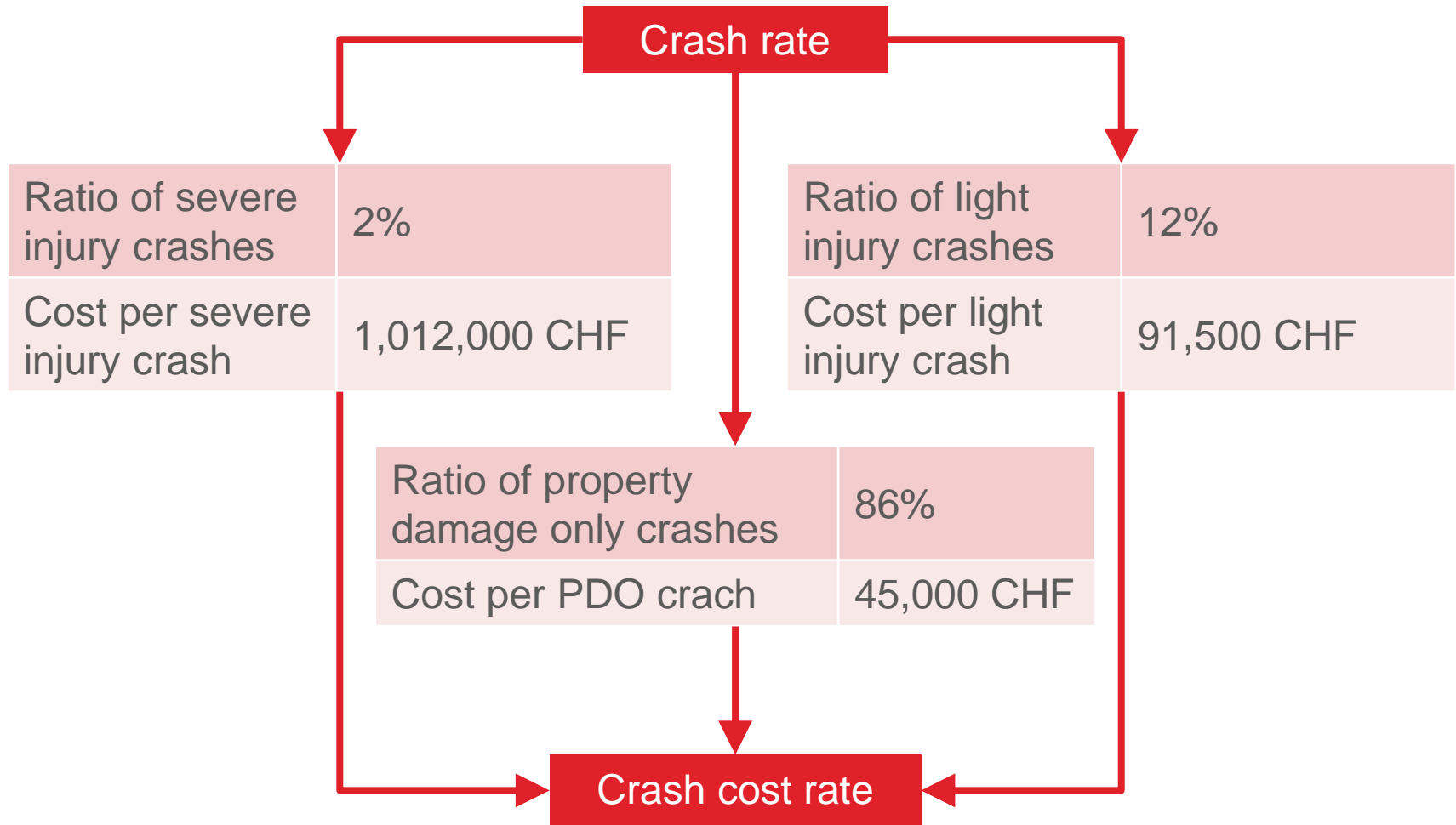
Crashes per million vehicles per kilometer

SWISS RIA METHOD: INTERSECTIONS

Road type	Control Type	Legs	Crash rate
Rural	uncontrolled	> 3	0.97
		3	0.65
	signalized	> 3	0.41
		3	0.27
	roundabout	> 3	0.53
		3	0.36
Urban	uncontrolled	> 3	1.20
		3	0.64
	signalized	> 3	0.25
		3	0.71
	roundabout	> 3	0.45
		3	0.27

Crashes per million vehicles

SWISS RIA METHOD: COST RATES



SWISS RIA METHOD: CRASH PREDICTION MODEL



Road types & volumes



Crash rate



Crash density & counts

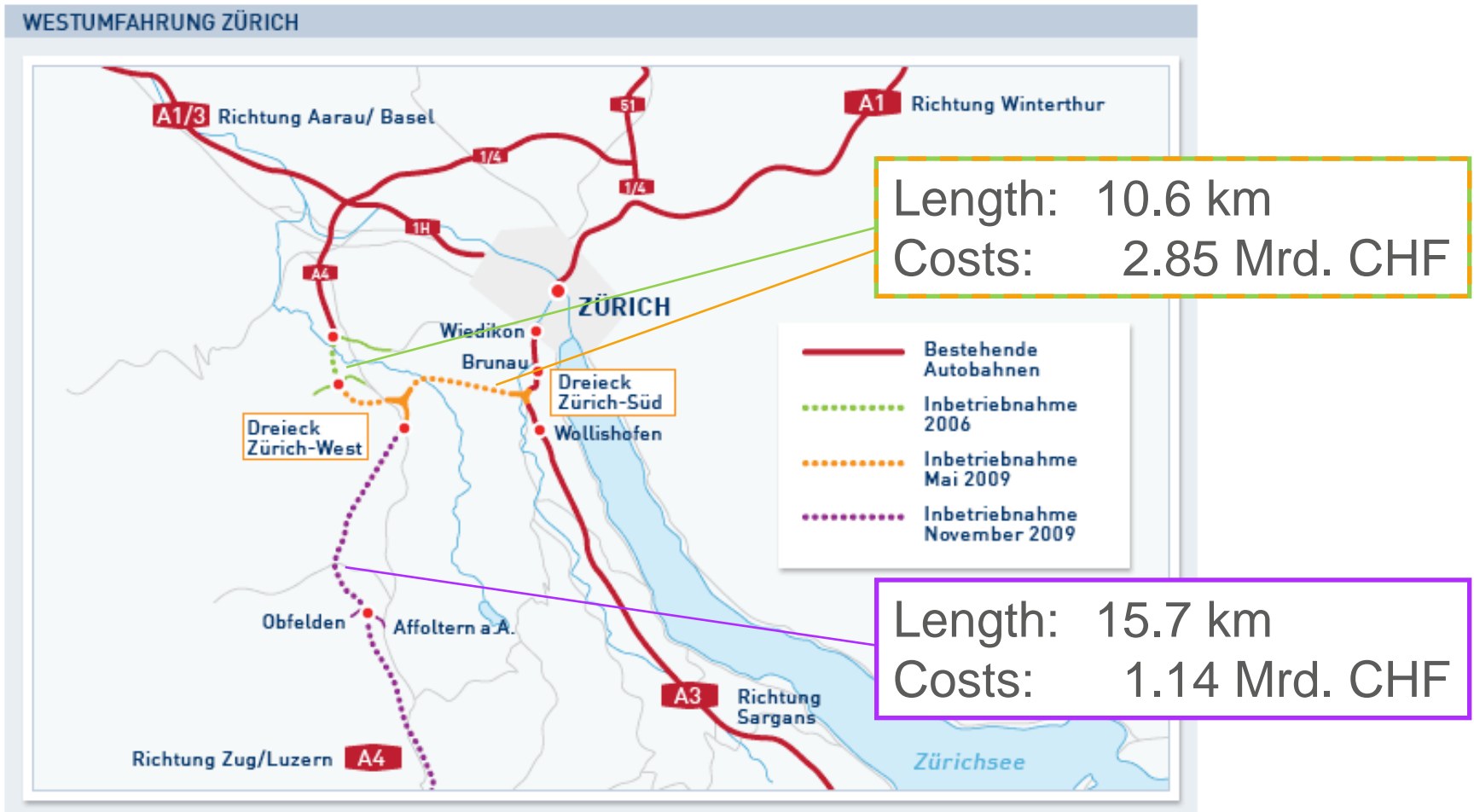
- Use a traffic model to calculate expected traffic volume
- Use traffic volume and road types as input parameter for CPM
- Calculate crash rates based on network attributes
- Calculate crash densities and counts

IS THIS STATE-OF-THE-ART?

- No, there are more advanced CPM approaches
- US Highway Safety Manual proposes Safety Performance Functions and Crash Modification Factors



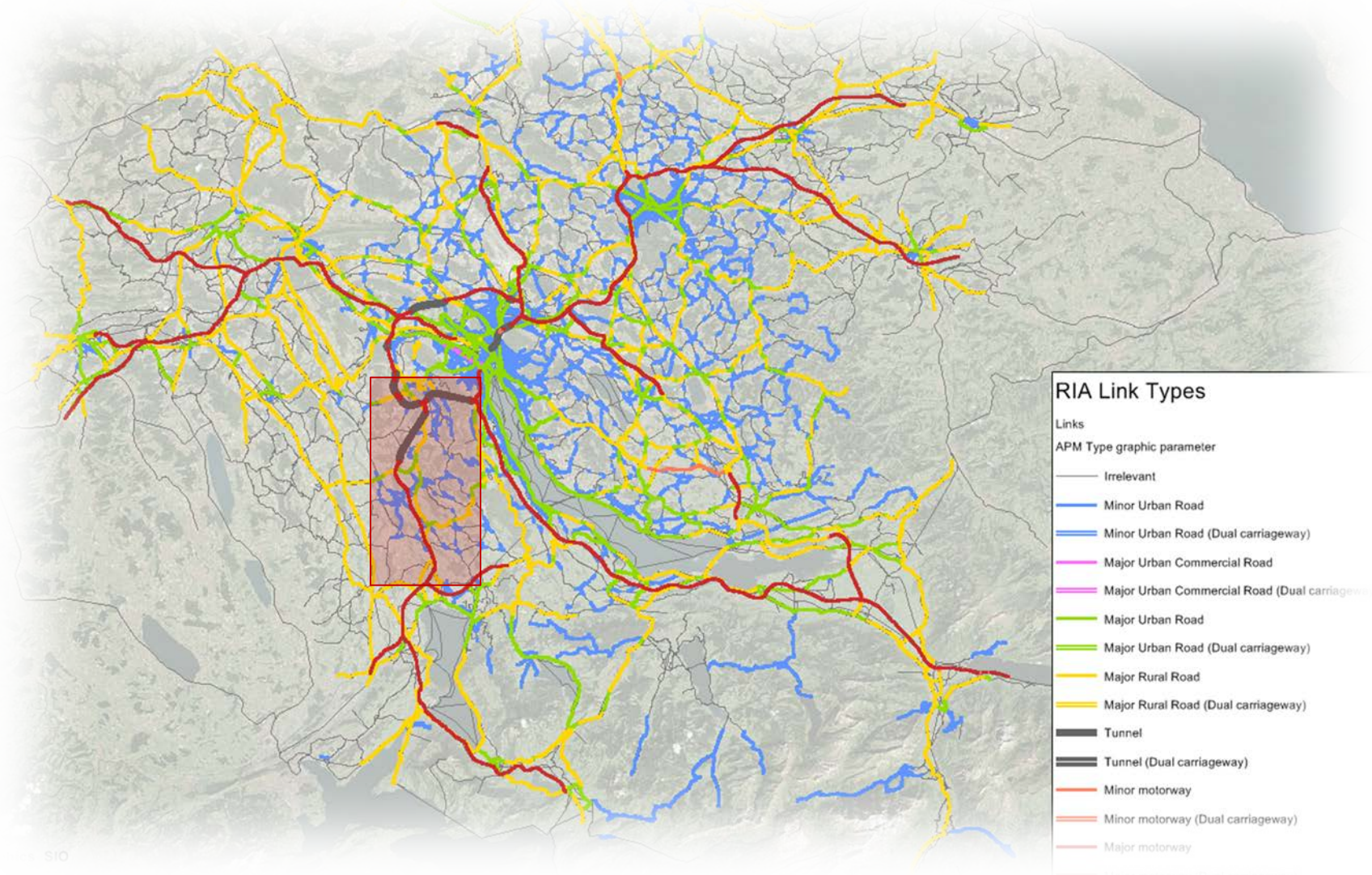
PILOT PROJECT FOR ZÜRICH– NEW MOTORWAY SEGMENT (1)



Quelle: westumfahrung.ch

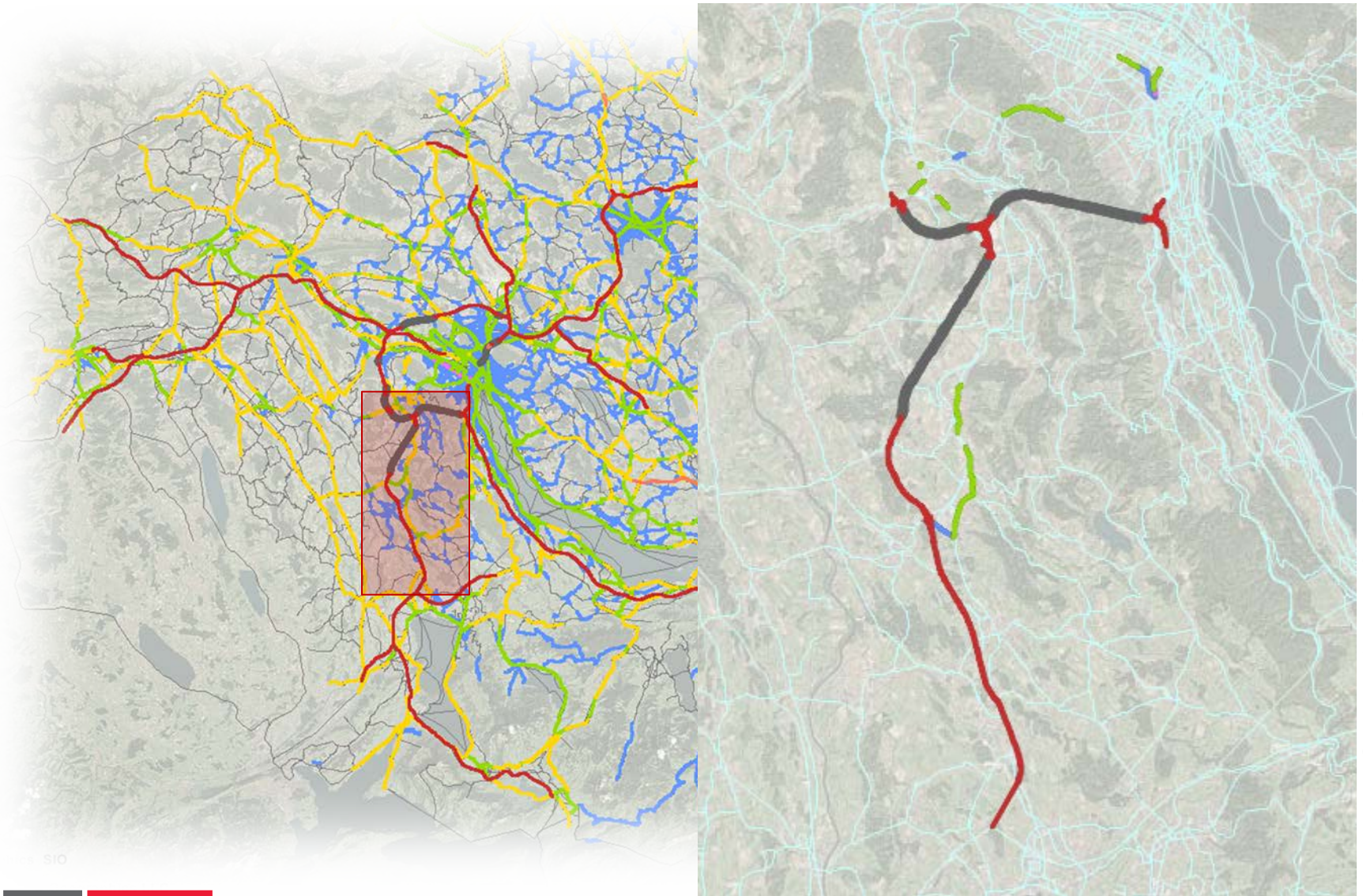
presented by swissinfo

THE MEASURE – NEW MOTORWAY SEGMENT (2)



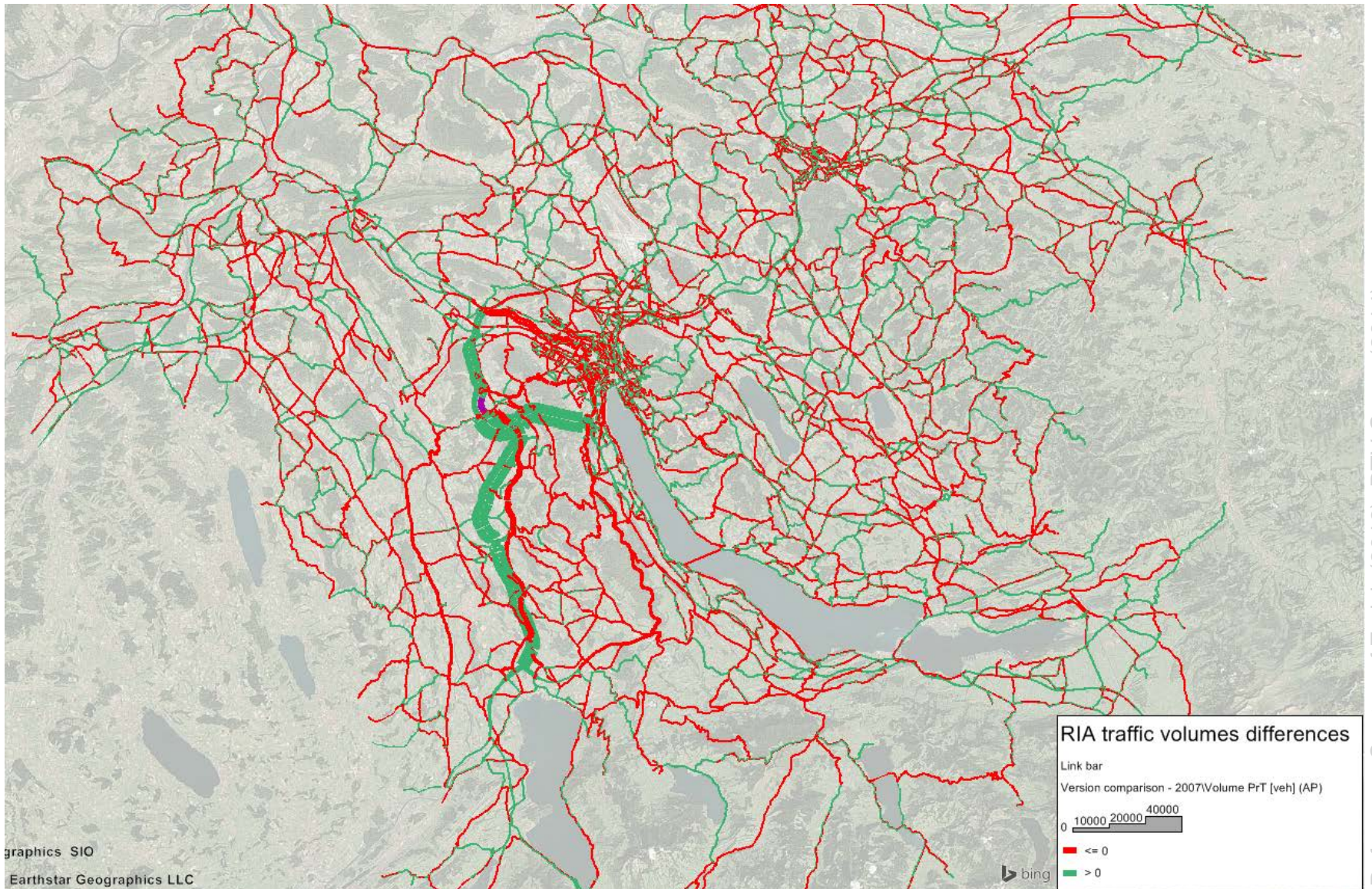
Reference: Canton of Zurich (2012), PTV Group (2014)

THE MEASURE – NEW MOTORWAY SEGMENT (3)



Reference: Canton of Zurich (2012), PTV Group (2014)

THE IMPACT OF THE MEASURE (1)



graphics SIO

Earthstar Geographics LLC

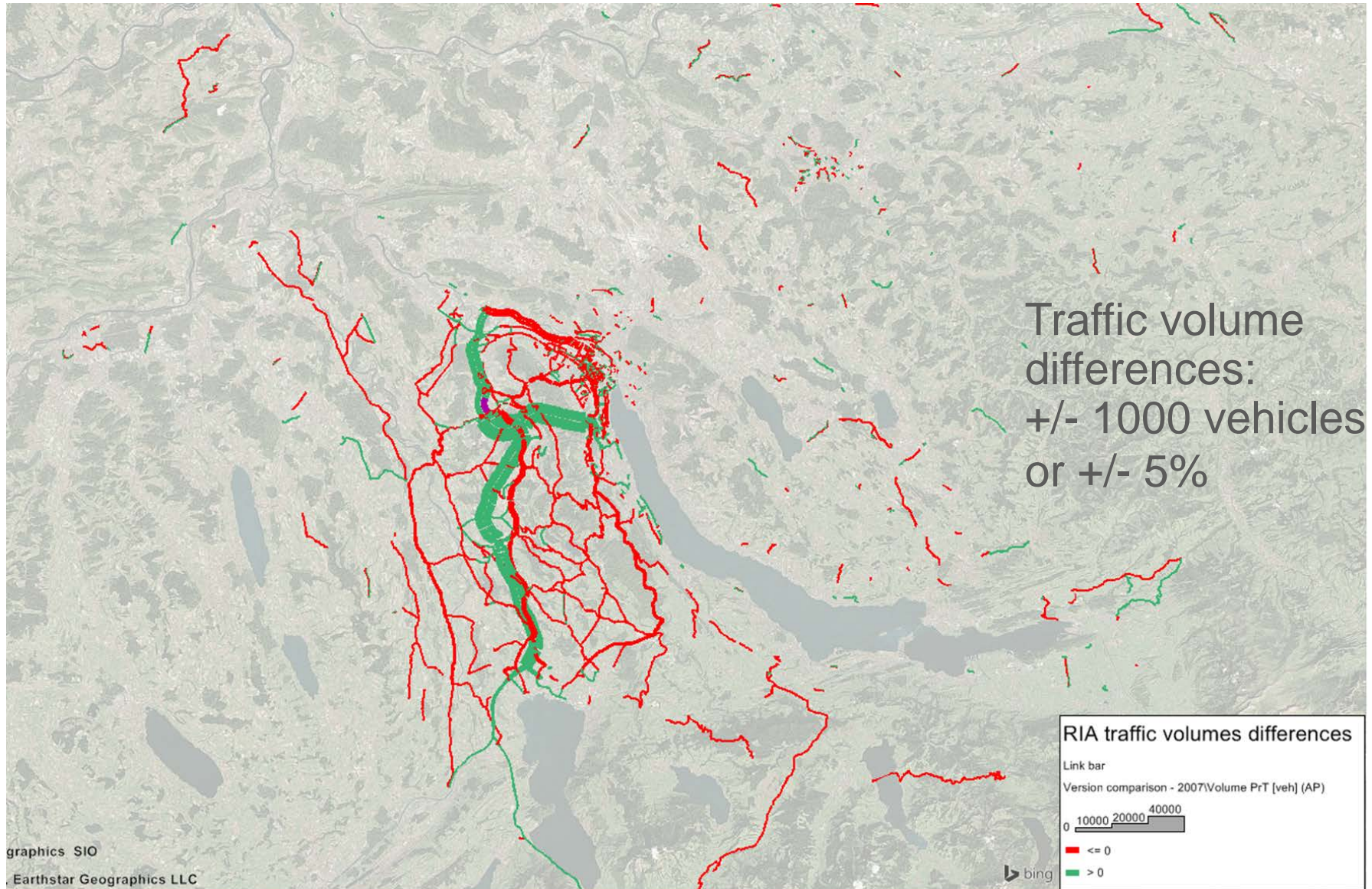
PTV GROUP

www.ptvgroup.com

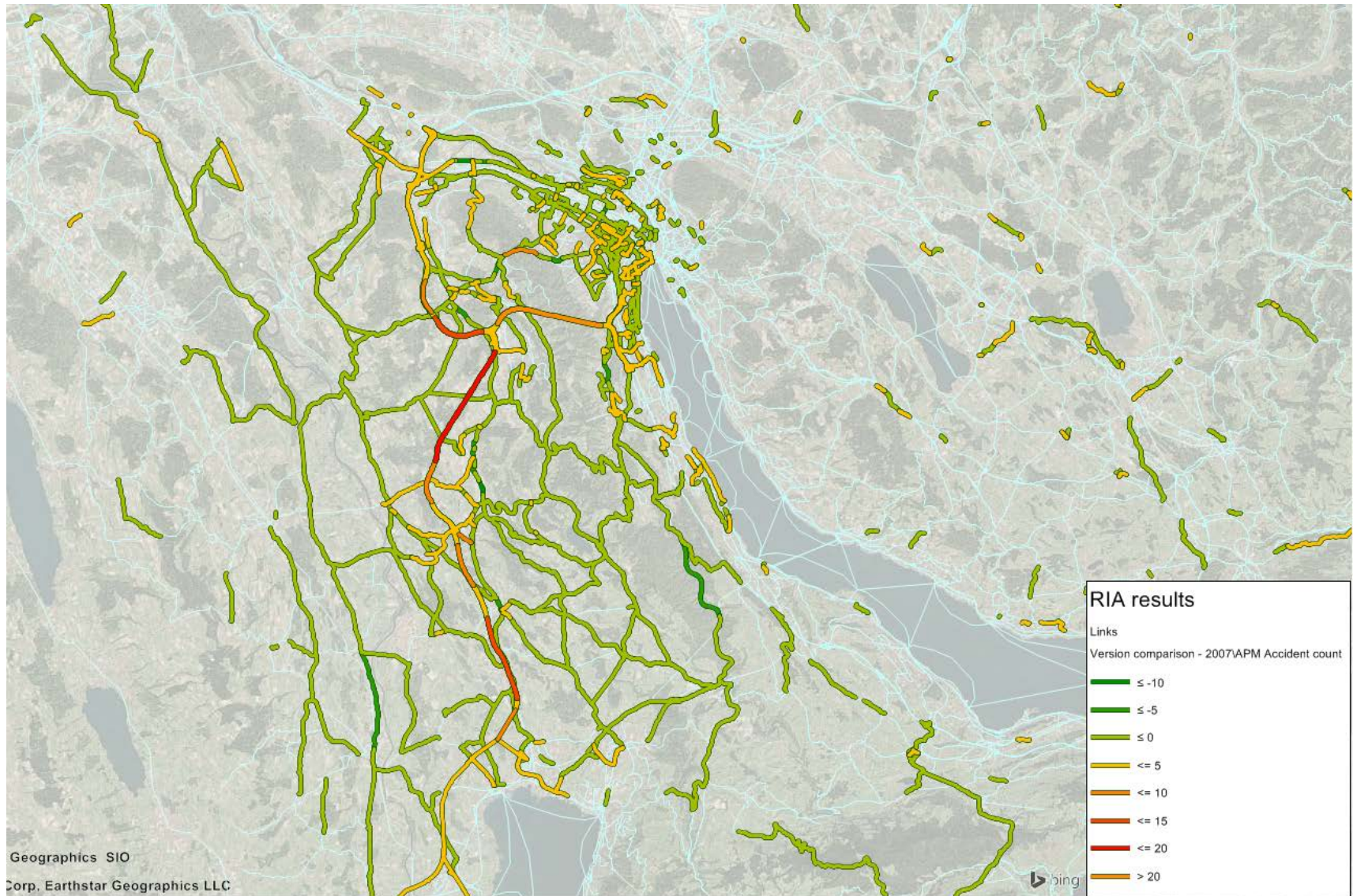
Stadt Zürich
Dienstabteilung Verkehr

Reference: Canton of Zurich (2012), PTV Group (2014)

THE IMPACT OF THE MEASURE (2)

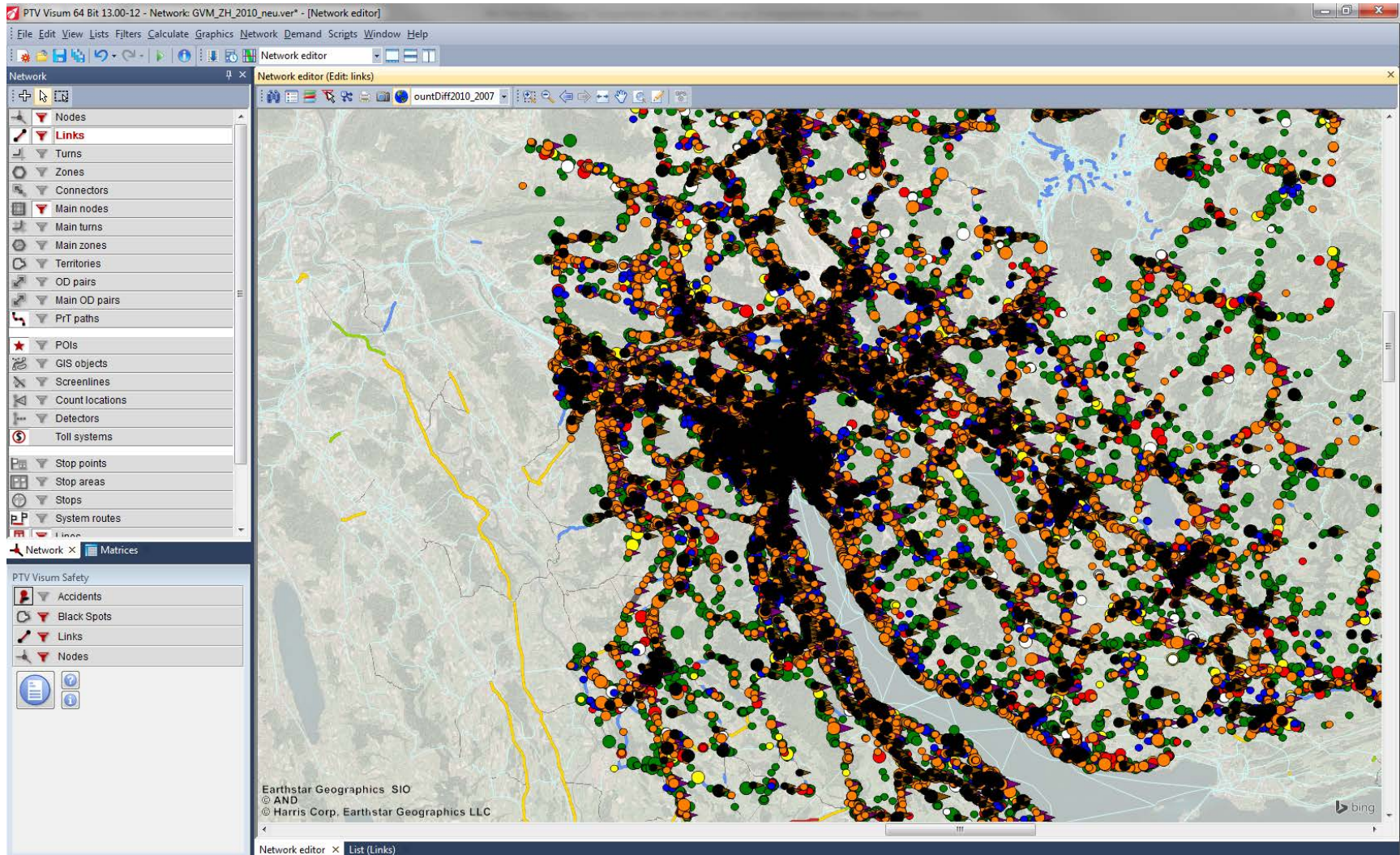


THE IMPACT OF THE MEASURE (3)



Reference: Canton of Zurich (2012), PTV Group (2014)

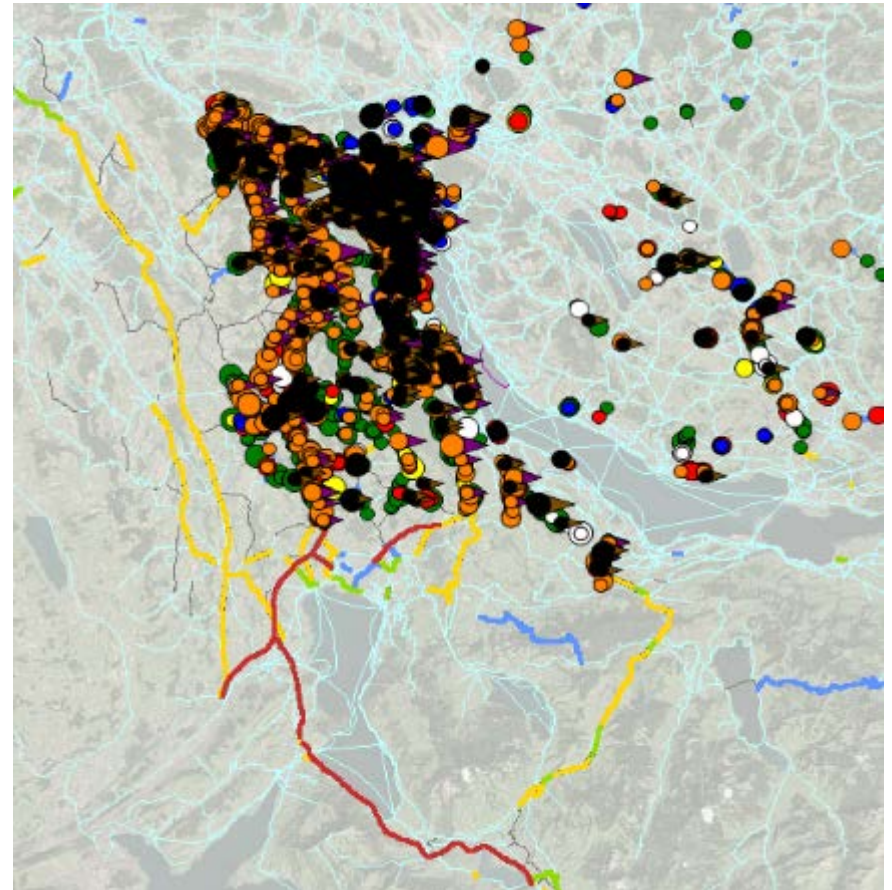
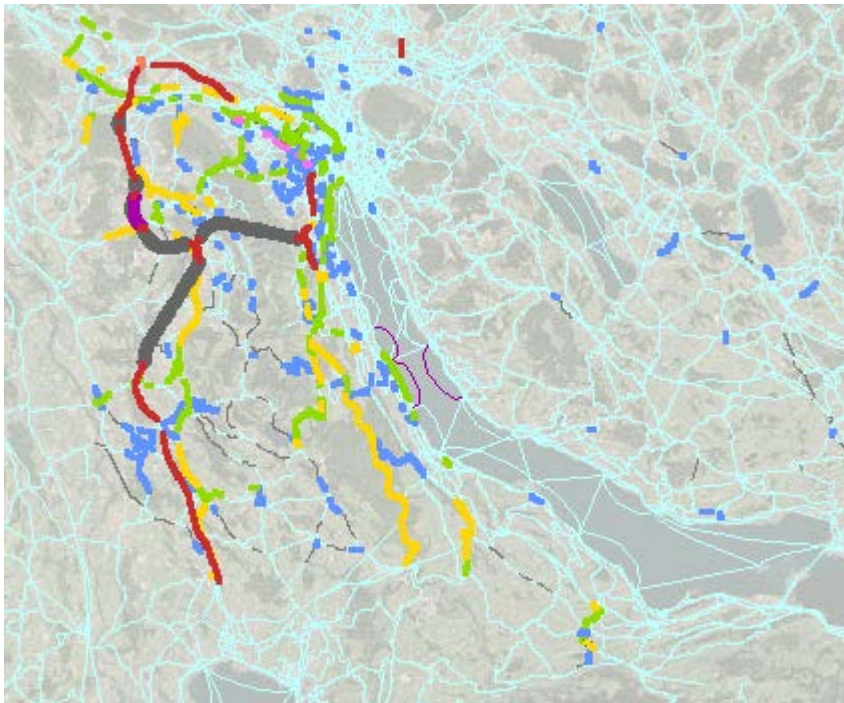
HISTORICAL CRASH DATA



Reference: Canton of Zurich (2012), PTV Group (2014)

MAIN RESULTS

	RIA crash counts	historical crash counts
Before	3'129	4'862
After	2'617	4'356
Δ	-512	-506
Δ in [%]	-16,4%	-10,4%



Reference: Canton of Zurich (2012), PTV Group (2014)

CLOSING REMARKS

- PTV Visum Safety offers functionalities for different road infrastructure safety management methods
- Need for an integrative approach
- Data availability is an issue
 - Easy to use, pragmatic solutions are beneficial
 - Complexity can be added at a later stage
- Don't wait – act now!



PTV GROUP

the mind of movement