

LISBOA 2010
MAY 25/28

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SUSTAINABLE ROAD SAFETY: A NEW NEIGHBOURHOOD ROAD PATTERN

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 - Cities of Ottawa, Vancouver, and Victoria
 - Natural Sciences & Engineering Research Council

Outline

- Motivation
- Methodology
- Results
- Conclusions
- Questions?

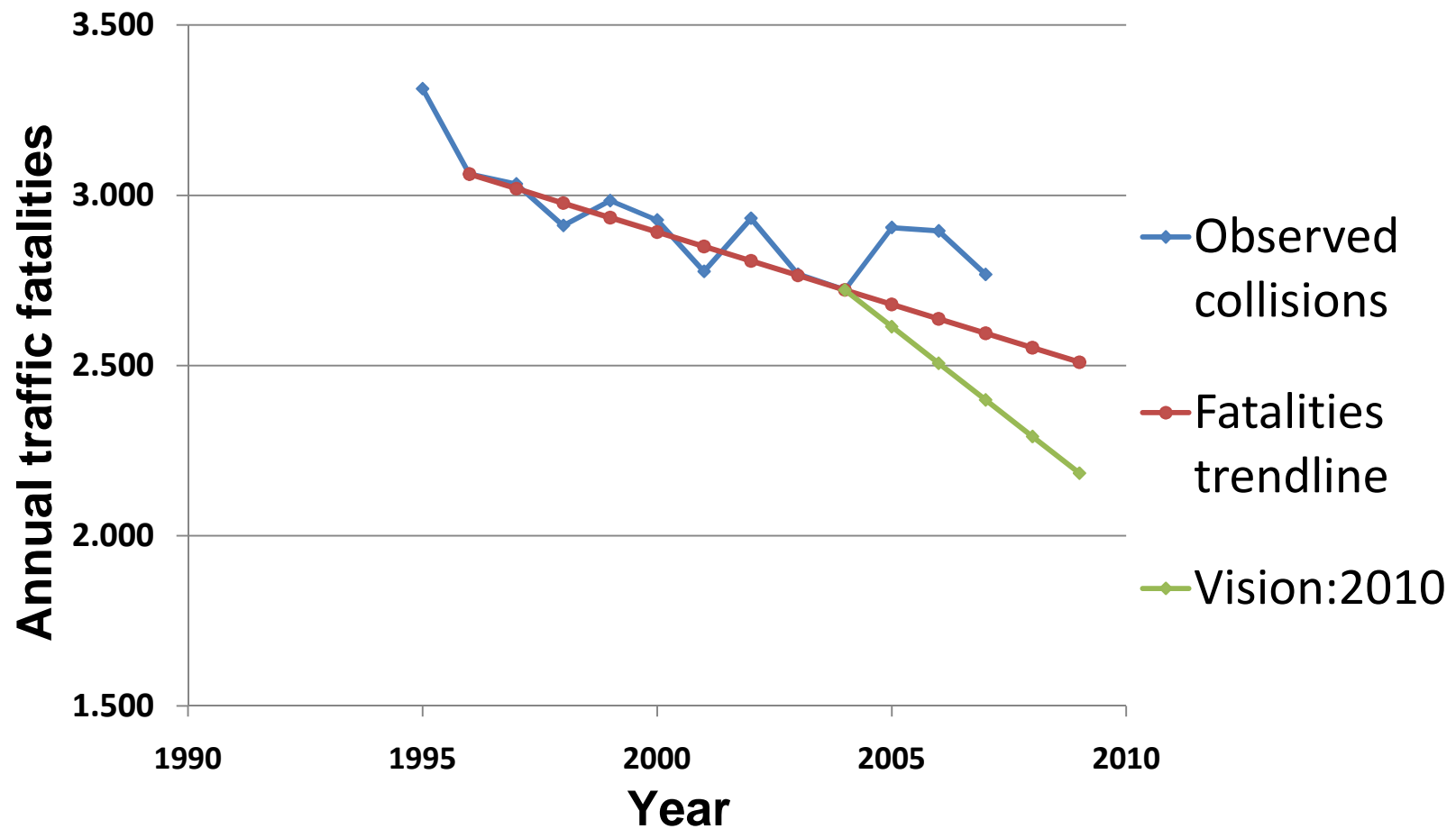
Motivation



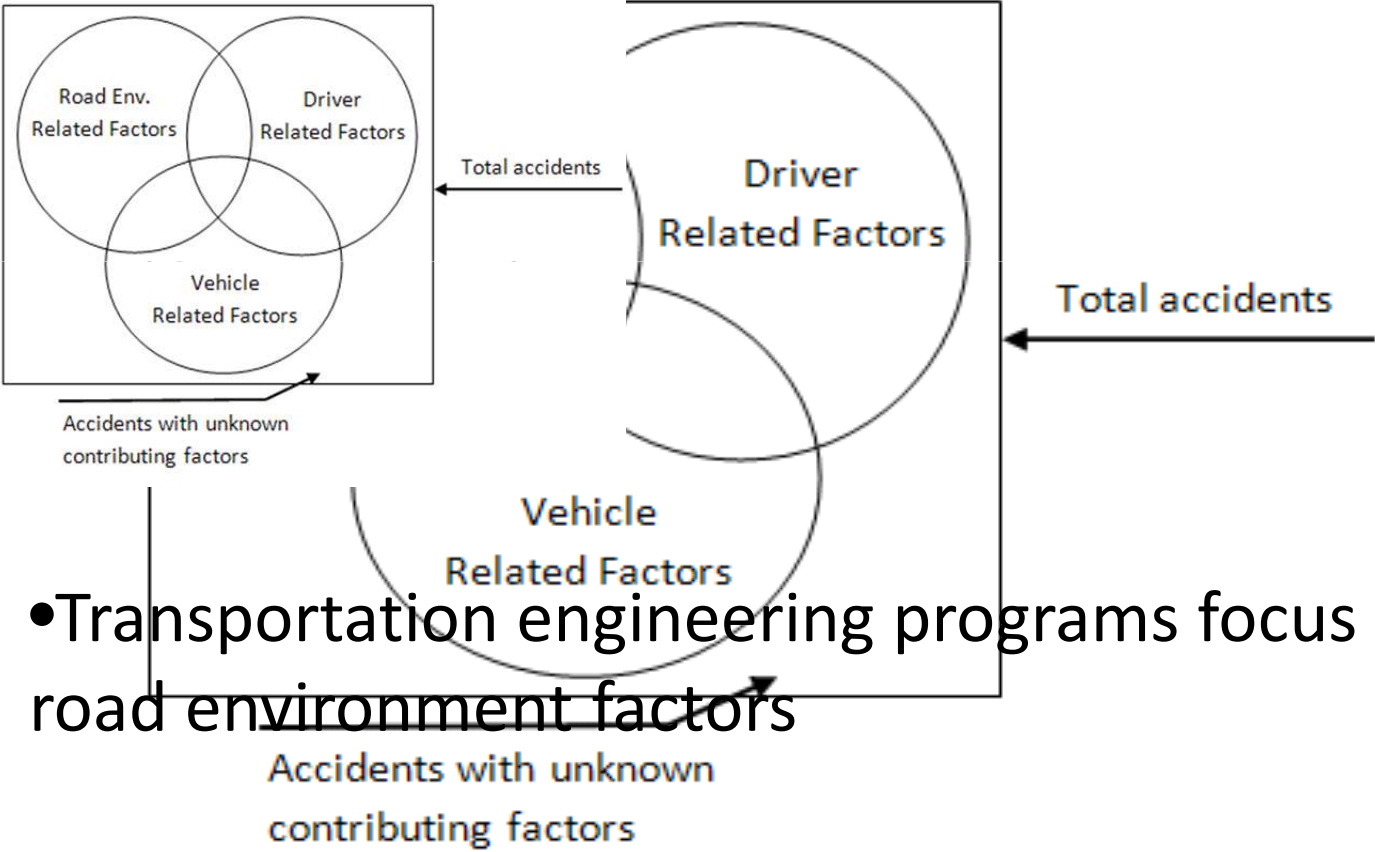
Road Safety Burden

- Economic cost of road injuries varies from 1% to 2% of Gross National Product (GNP).
- Economic cost : US\$ 518 billion annually worldwide.
(WHO 2004)
- The economic cost to Canadians is estimated to exceed \$25 billion annually. (Transport Canada 2004)
- Traffic collisions account for around 50% of all accidental deaths. (Transport Canada,2004)

Canadian Road Safety



Road Safety Improvement Programs (RSIPs)



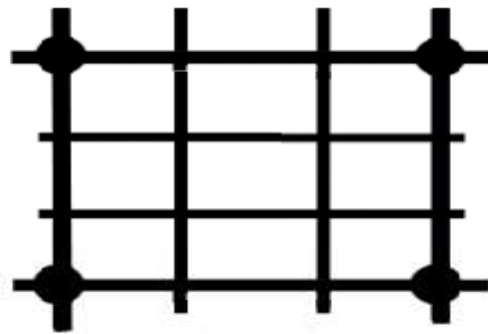
- Transportation engineering programs focus on road environment factors

Road Safety Improvement Programs (RSIPs)

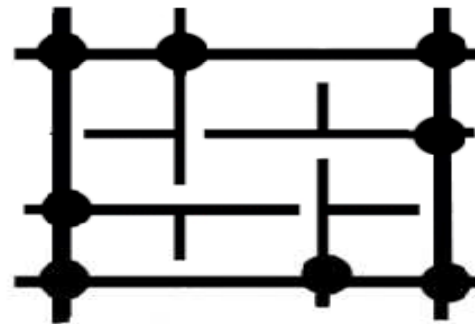
- Traditional RSIP approach:
 - Reactive
 - But.... (disadvantages)
- Proactive road safety
 - Focuses on predicting and improving the safety of planned facilities
 - Collision Prediction Models

Methodology

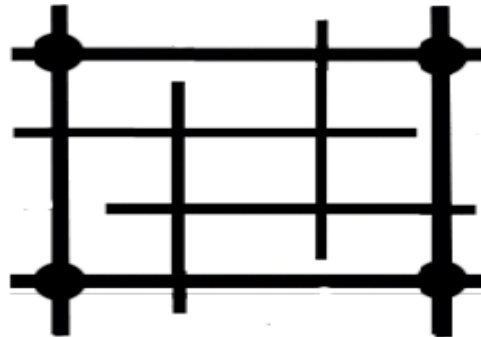
- Relate Road collisions to land use/road patterns
- Traditional neighbourhood road patterns:
 - Grid pattern
 - Loops and Culs-de-sac
- Emerging patterns:
 - Sustainable Road Safety (Dutch researchers)
 - 3-way Offset (UBC researchers)
 - Fused grid (CMHC researchers)



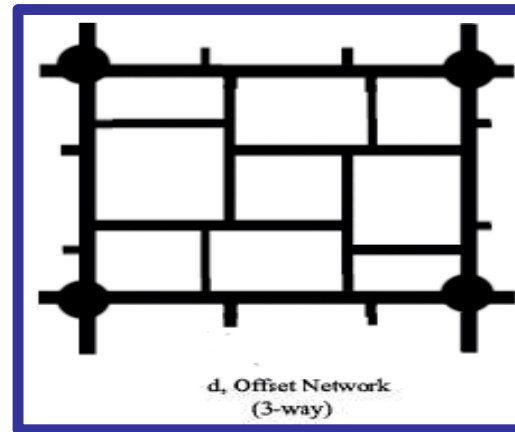
a, Grid Network
(Neo-Traditional)



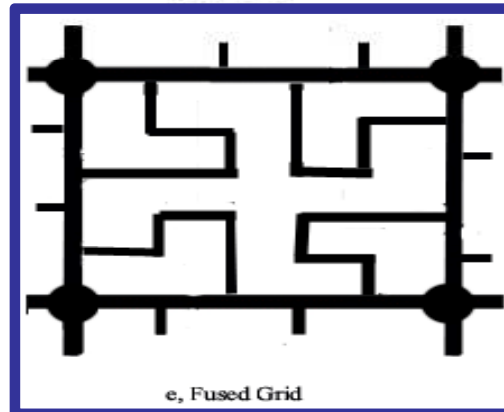
b, Conventional Network
(Culs-de-Sac)



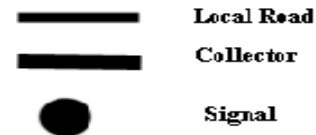
c, Limited Access
(Dutch SRS)



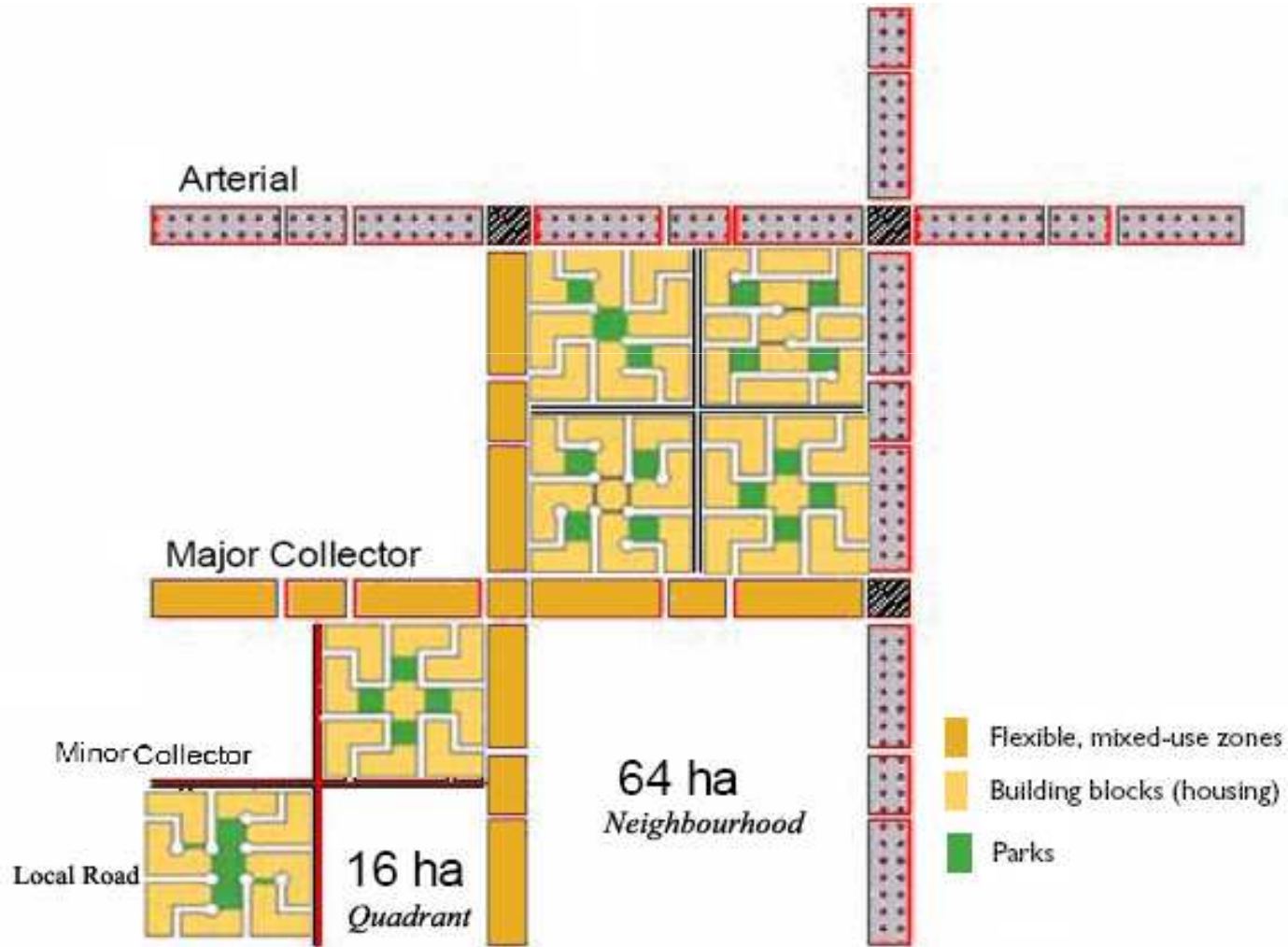
d, Offset Network
(3-way)



e, Fused Grid



Fused Grid



Data

- Sources:
 - Vancouver , Victoria, Ottawa, Census
 - Auto insurance claims, police records
- Types:
 - Collisions(severe, total), GIS, demographics, traffic volumes, mode splits, road network, signals

Variables

- **Stratification**

4 main themes related to neighbourhood traits

- **Exposure:** VKT, TLKM, VC
- **Socio-Demographic:** POPD, WKGD, FS, etc.
- **TDM:** TCM, DRIVE, SCC, etc.
- **Network:** INTD, SIGD, I3WP, etc.

VKT = Vehicle Km Travelled

VC = average congestion level

TLKM = Total Lane Km

POPD = Population Density = population/ha

SCC = ShortCut Capacity

INTD = INTersection Density = Intersections/ha

I3WP = 3-way Intersection Percentage = I3W / INT

Models

Themes	Land Use	Derivation	Group #
Exposure	Urban	Modeled	1
		Measured	2
	Rural	Modeled	3
		Measured	4
Socio-Demographic (SD)	Urban	Modeled	5
		Measured	6
	Rural	Modeled	7
		Measured	8
Transportation Demand Management(TDM)	Urban	Modeled	9
		Measured	10
	Rural	Modeled	11
		Measured	12
Network	Urban	Modeled	13
		Measured	14
	Rural	Modeled	15
		Measured	16

Models

- **Regression Technique**
 - Generalized Linear Modelling (GLM) regression method
 - Assumes a Negative Binominal error structure
- **Model Form**

$$E(\Lambda) = a_0 Z^{a_1} e^{\sum b_i X_i}$$

- $E(\Lambda)$ = predicted collision frequency
- a_0, a_1, b_j = model parameters
- Z = leading exposure variables (e.g. VKT, TLKM)
- X_j = explanatory variables (e.g. VC, POPD, INTD)

Results

- 32 models to analyze Victoria neighborhoods
- 32 models to analyze Ottawa
- 32 models to analyze Vancouver
- In each case, 16 Urban & 16 Rural models, at least one in each model group

Models

- **Exposure:**

$$\text{Total Collisions} / 3 \text{ yrs} = 0.3355VKT^{0.5685} e^{2.3364vc}$$

- **Socio-Demographic :**

$$\text{Total Collisions} / 3 \text{ yrs} = 0.2021VKT^{0.742} \cdot e^{(1.2967vc+0.002621wkgad+0.005645popd-0.254fs)}$$

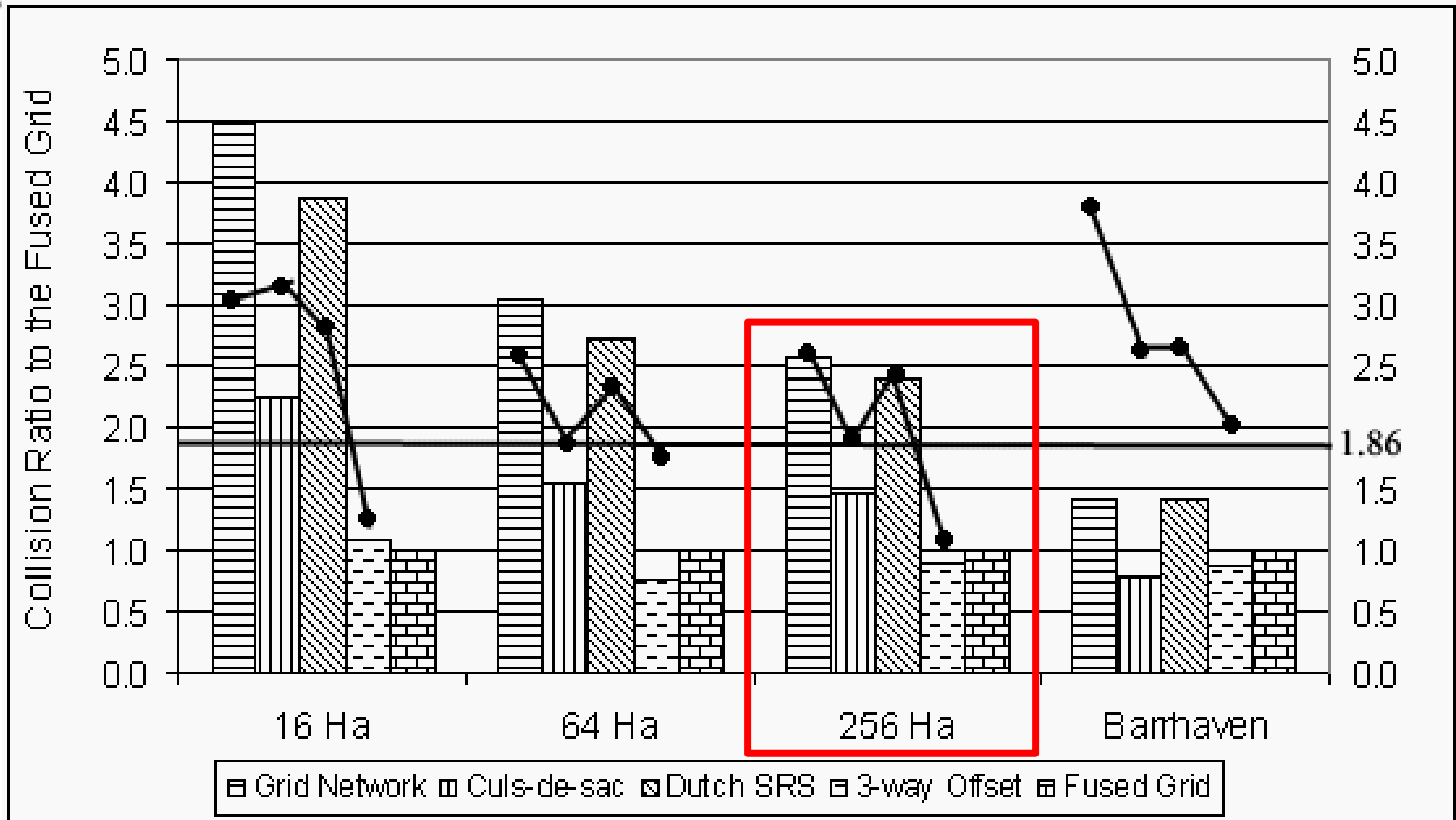
- **TDM:**

$$\text{Total Collisions} / 3 \text{ yrs} = 0.1028VKT^{0.915} \cdot e^{(0.0134scvc-0.0106core)}$$

- **Network:**

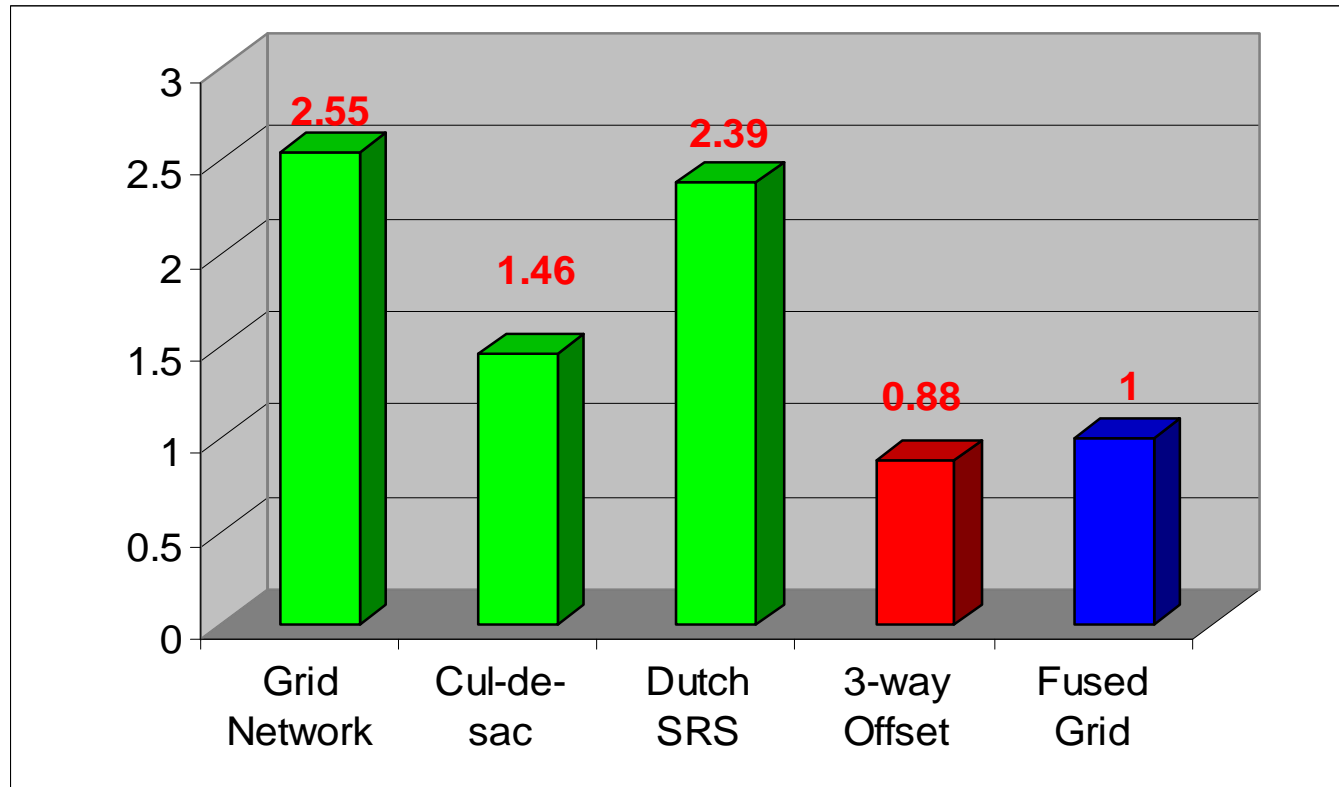
$$\text{Total Collisions} / 3 \text{ yrs} = 0.1757VKT^{0.8509} \cdot e^{(0.4246sgd+0.829intd-0.00405i3wp-0.0086llkp)}$$

Results



Results

256 hectare module



t-Statistics
($t_{8, 90\%} = 1.86$)

2.57

1.88

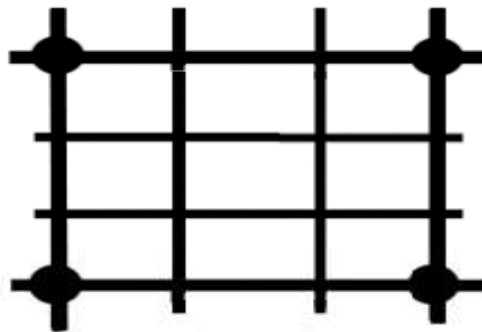
2.41

1.15

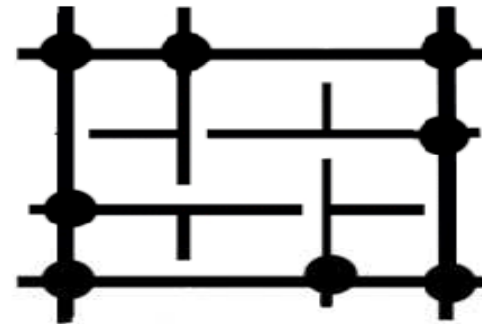
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Conclusions

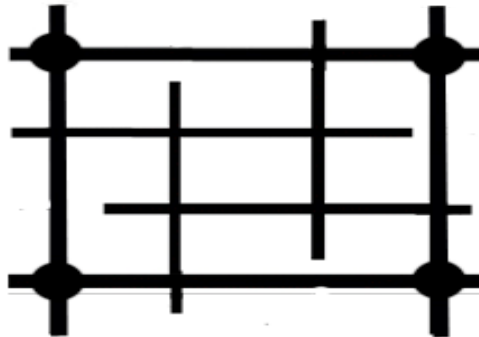
- Land use patterns effects road collisions
 - If we drive, we crash
- In traditional neighbourhoods
 - short-cutting is the dominant cause of road collisions
 - Traffic calming is needed, or, retro-fit with new patterns
- New neighbourhood road patterns safer by 50%:
 - 3-way Offset: Accessibility, mobility, & safety
 - Fused Grid: Accessibility via off-road paths needs
 - 30%-60% fewer road collisions – stay tuned!



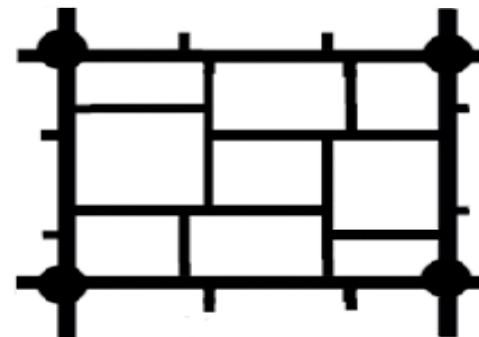
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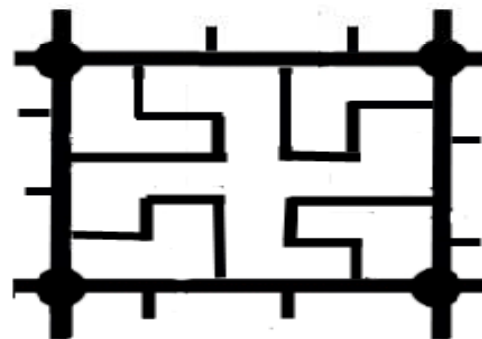
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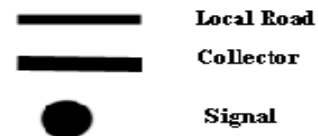
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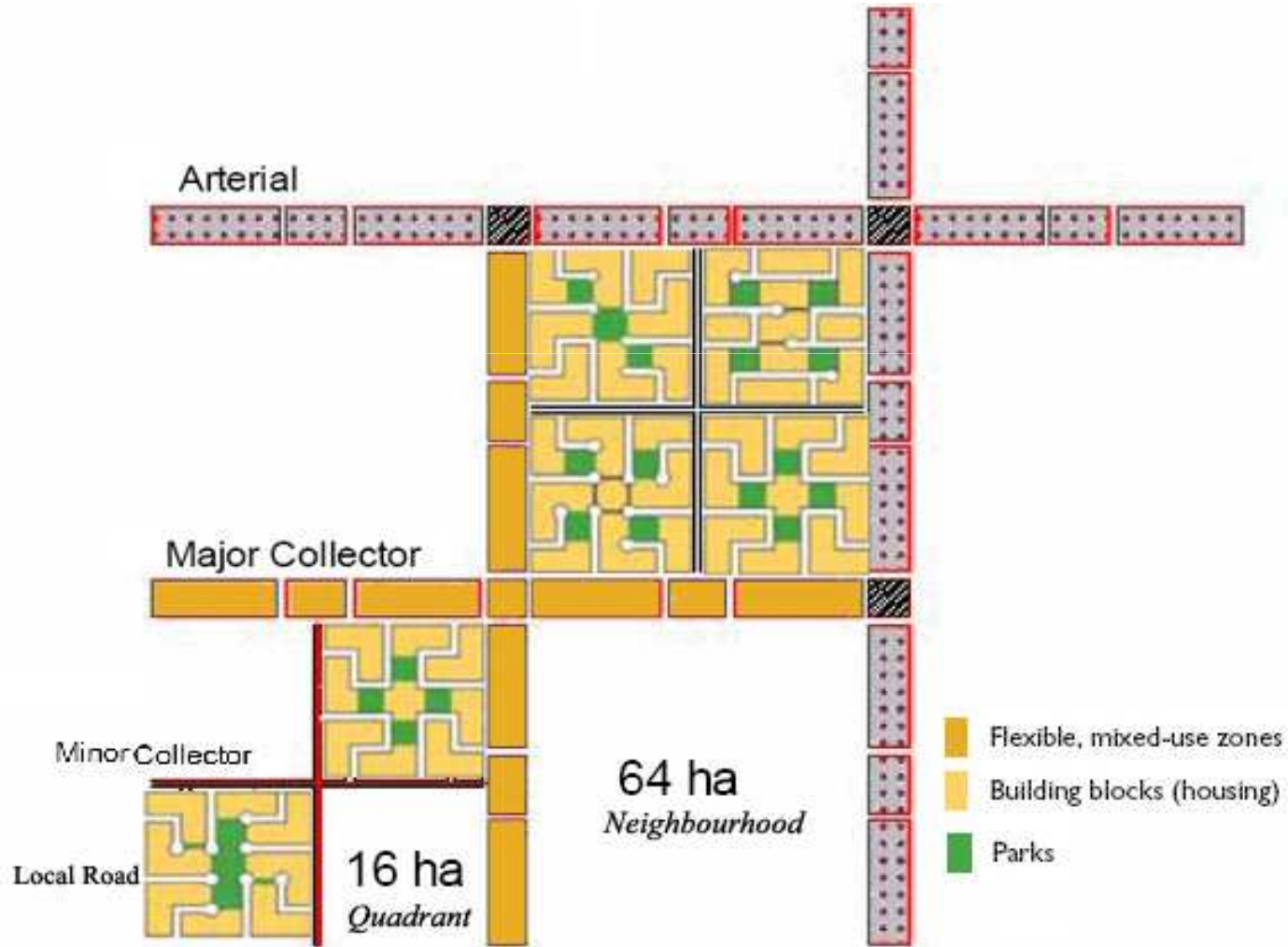
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