

# The Impact of Traffic Control Devices on Dangerous Pedestrian Crossings and Violations at Signalized Intersections: A Case Study in Montreal

Nicolas Saunier, Luis Miranda-Moreno, Marilyne Brosseau, Sohail Zangenehpour and Kevin Le Mouël

WORLD-CLASS ENGINEERING

POLYTECHNIQUE  
MONTRÉAL



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# MOTIVATION

- Pedestrians are vulnerable road users and the most vulnerable when crossing the street
- What factors influence pedestrians' decision to commit a violation at a signalized crossing?
  - Well documented factors: intersection and pedestrian characteristics
  - Effect of phasing?

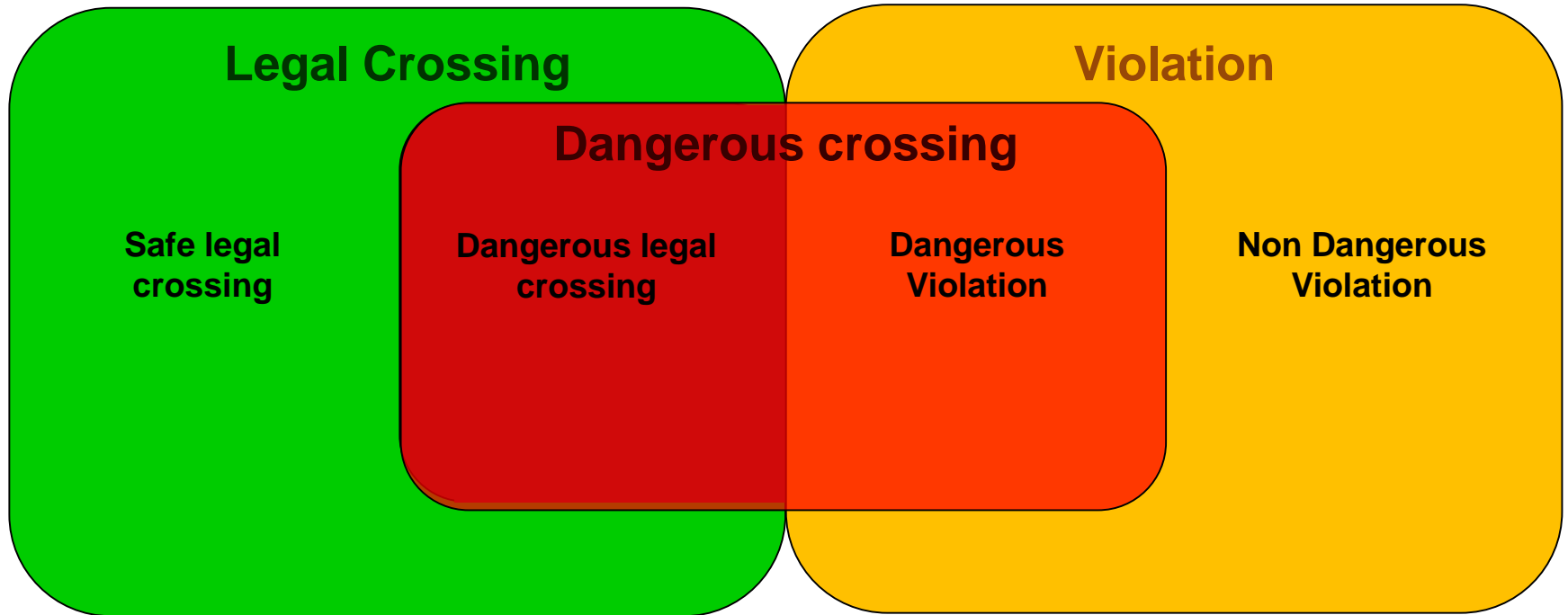


# OBJECTIVES

1. Study the effect of **maximum waiting time** (red length), **time of arrival**, and the presence and type of **pedestrian signal** on the proportion of infractions
2. Analyze factors with a known effect in the **Montreal** context at a large number of intersections



# CROSSING EVENT



# METHODOLOGY: SITE SELECTION

- Large sample of intersections: 13 intersections with
  - Similar vehicle flow
  - Similar geometry
  - Similar geographical area: Plateau-Mont-Royal borough, 12/13 on Sherbrooke street
  - Traffic lights:
    - Different red lengths
      - Short MWT:  $40 \text{ s} \leq \text{red phase} \leq 45 \text{ s}$
      - Moderate MWT:  $46 \text{ s} \leq \text{red phase} \leq 55 \text{ s}$
      - Long MWT:  $\text{red phase} \geq 56 \text{ s}$
    - Different types of pedestrian traffic lights
      - None
      - Pedestrian traffic signal
      - Countdown



# METHODOLOGY: MANUAL DATA COLLECTION

- Pedestrians (general information)
    - Sex
    - Age group
    - Group size and number of pedestrians waiting at the corner at the beginning of the crossing
  - Infractions/dangerous crossings (detailed information)
    - Phase of arrival at intersection
    - Phase of start of crossing
    - Phase of end of crossing
    - Speed of crossing
- walking man / green
  - flashing hand
  - steady hand / yellow
  - beginning of red (first third of the red light)
  - middle of red (second third of the red light)
  - end of red (last third of the red light)
  - anticipation of green (only for the start time of crossing)

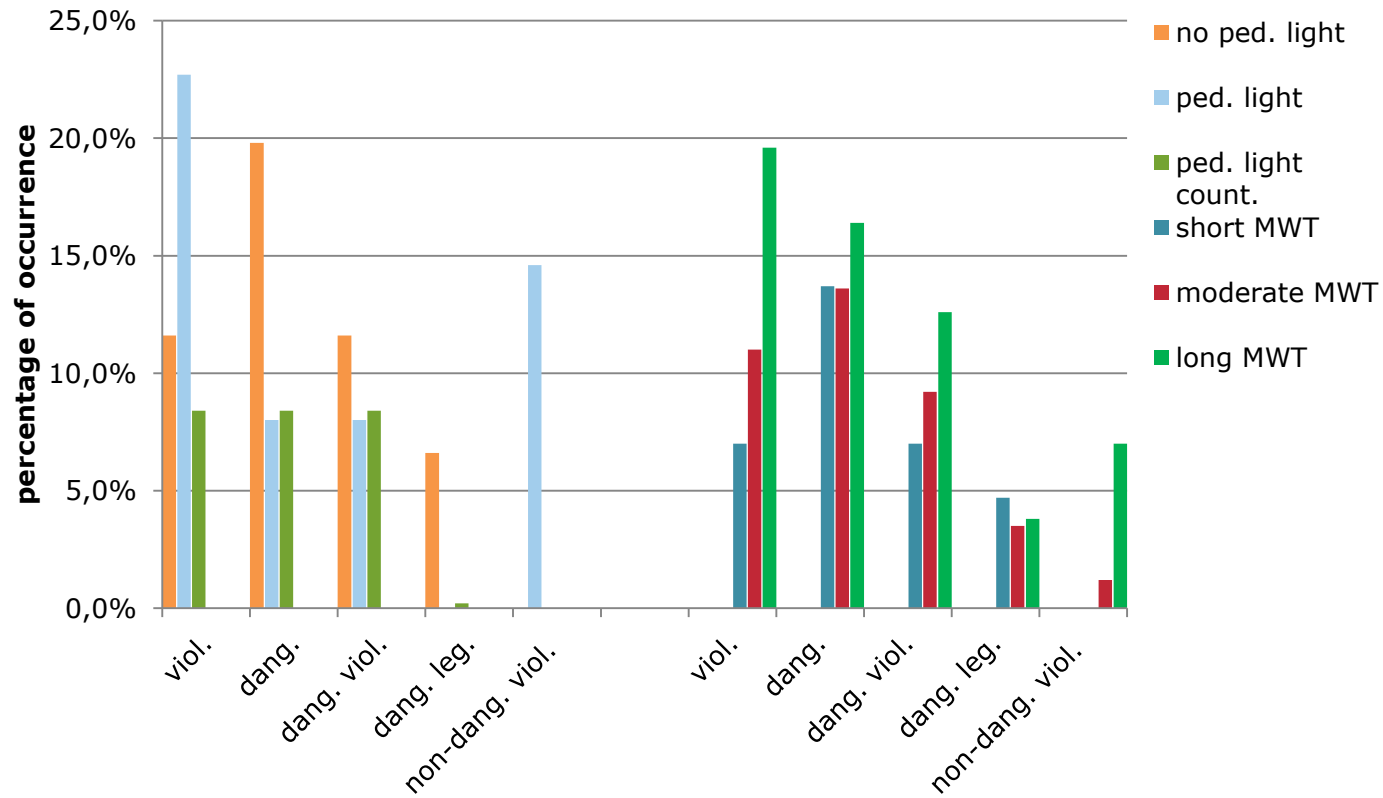


# SELECTED INTERSECTIONS



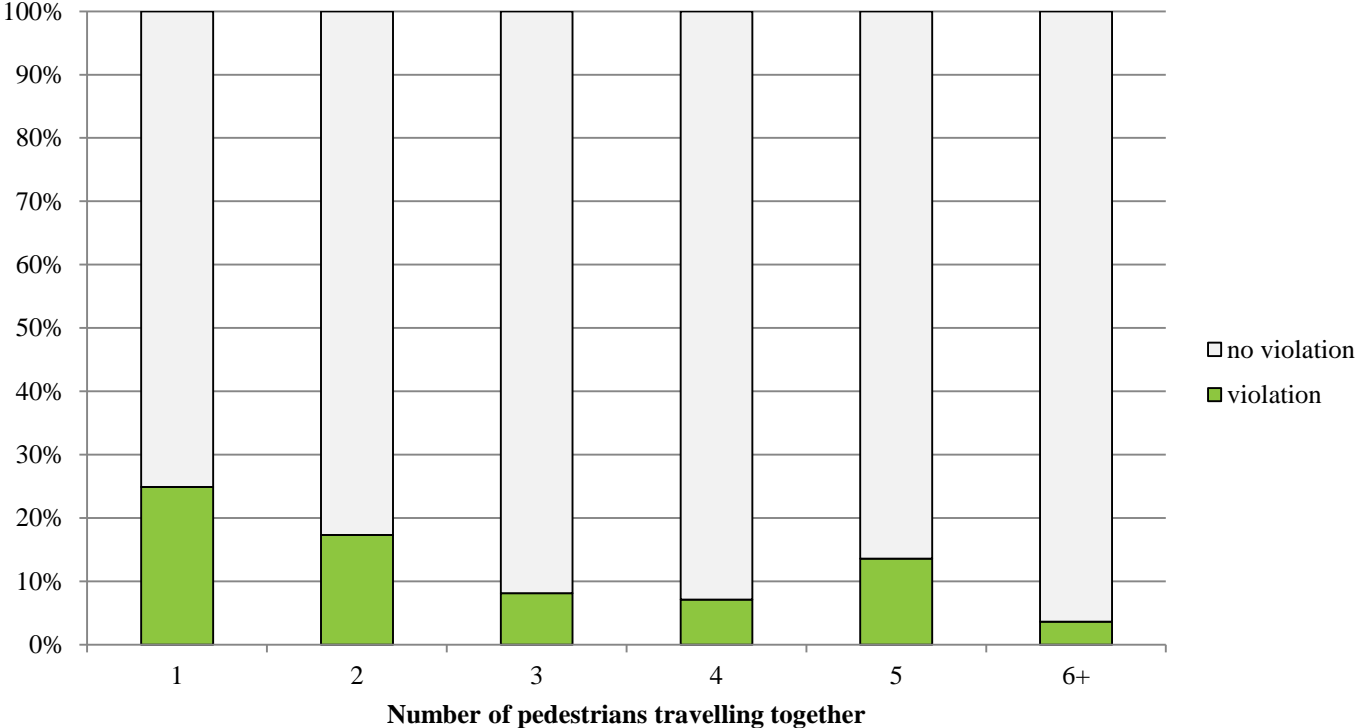
Intersection	MWT (s)	Pedestrian Signal
Amherst/Sherbrooke	short 42	no
Frontenac/Sherbrooke	short 42	no
Peel/Sherbrooke	short 42	no
Fullum/Sherbrooke	medium 46	no
Iberville/Sherbrooke	medium 46	yes
Crescent/Sherbrooke	medium 50	yes, countdown
Hôtel-de-ville/Sherbrooke	medium 51	no
Panet/Sherbrooke	medium 52	yes, countdown
Montcalm/Sherbrooke (West crossing)	long 56	no
Montcalm/Sherbrooke (East crossing)	long 80	yes, on call
Jeanne-Mance/Sherbrooke	long 54	yes
Saint-André/Sherbrooke	long 58	no
Saint-Urbain/Sherbrooke	long 60	yes, countdown
Saint-Denis/Des Pins	long 57	yes

# RESULTS: OCCURRENCE OF VIOLATIONS

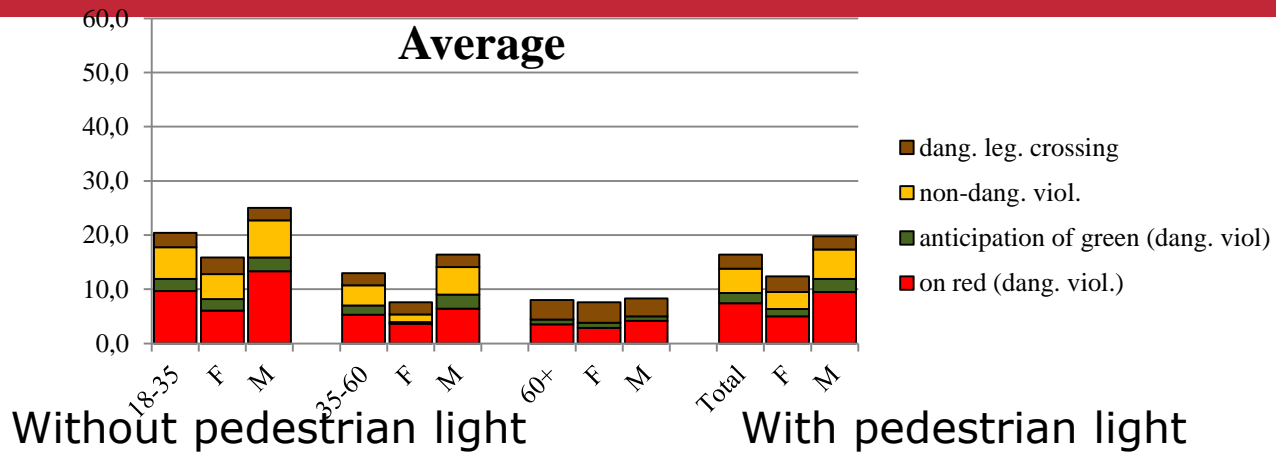




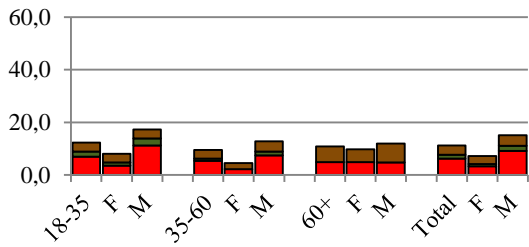
# RESULTS: NUMBER OF PEOPLE TRAVELING TOGETHER



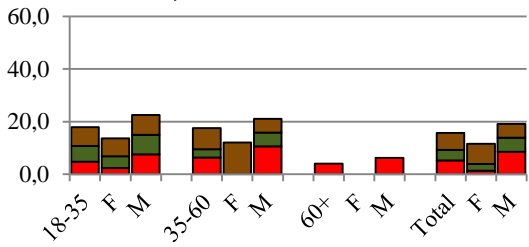
# RESULTS: PEDESTRIAN ATTRIBUTES



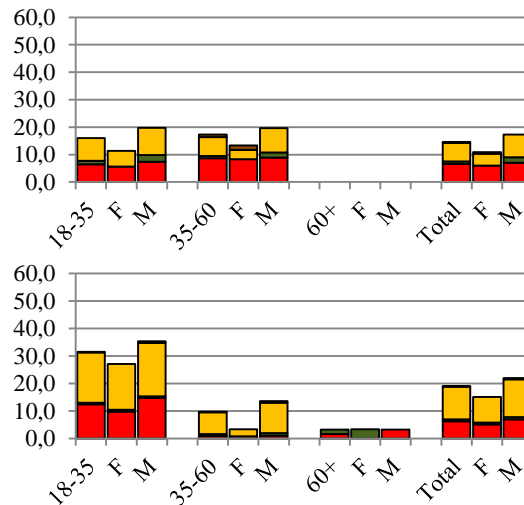
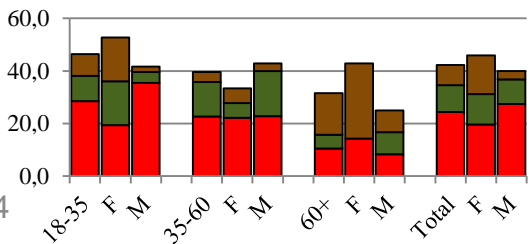
Short MWT



Medium MWT



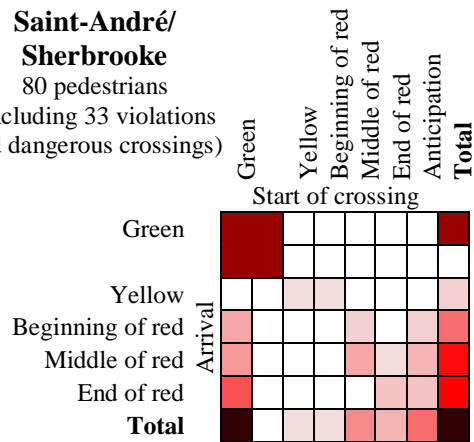
Long MWT



# RESULTS: EFFECT OF TIME OF ARRIVAL

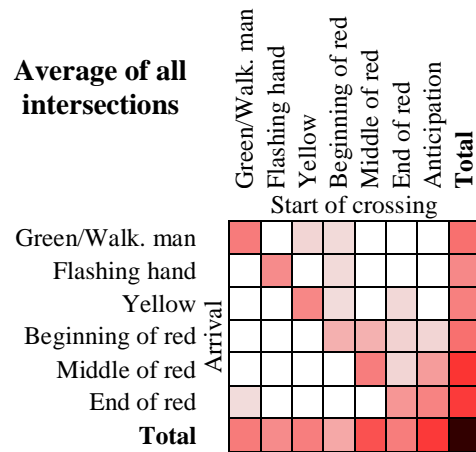
## All crossings

**Saint-André/  
Sherbrooke**  
80 pedestrians  
(including 33 violations  
and dangerous crossings)



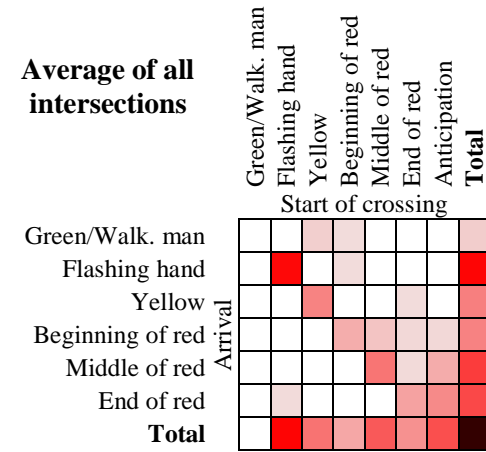
## Dangerous crossings

**Average of all  
intersections**



## Violations

**Average of all  
intersections**



# RESULTS: LOGISTIC MODELS

	Model 1: All violations (viol.+)			Model 2: Dangerous violations only (dang. viol.)			Model 3: All dangerous crossings (dang.++)		
	Coef.	elasticity	p-value	Coef.	elasticity	p-value	Coef.	elasticity	p-value
<b>Constant</b>	-5.76	-	0.00	-3.74	-	0.00	-2.94	-	0.00
<b>Standard Ped. Signal</b>	-			-0.980	-5.2%	0.00	-1.41	-10.7%	0.00
<b>Count. Ped. Signal</b>	-1.54	-15.9%	0.00	-1.48	-7.3%	0.00	-2.30	-15.7%	0.00
<b>Group size</b>	-0.319	-0.9%	0.00	-0.383	-0.5%	0.00	-0.326	-0.7%	0.00
<b>Sex (M=1)</b>	0.501	6.6%	0.00	0.719	4.6%	0.00	0.326	3.2%	0.01
<b>Age: 18-35</b>	0.543	7.3%	0.00	0.543	3.6%	0.00	0.345	3.4%	0.01
<b>Ped. flow (in hundreds)</b>	-0.0469	-0.6%	0.00	-0.0936	-0.6%	0.00	-0.113	-1.1%	0.00
<b>MWT</b>	0.102	7.9%	0.00	0.0585	2.1%	0.00	0.0663	3.6%	0.00
<b>Log-likelihood ratio</b>		1367.9			2019.1			1654.2	
<b>Number of observations</b>		2475			2475			2475	
<b>Rho-square</b>		0.40			0.59			0.48	

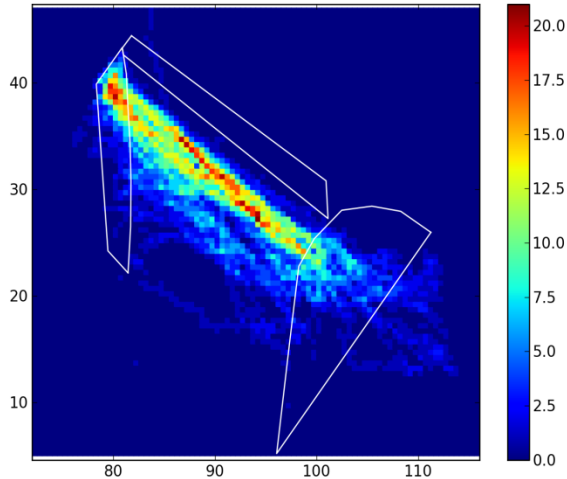
+ viol. = dang. viol. + non-dang. viol.

++ dang. = dang. viol. + dang. leg.

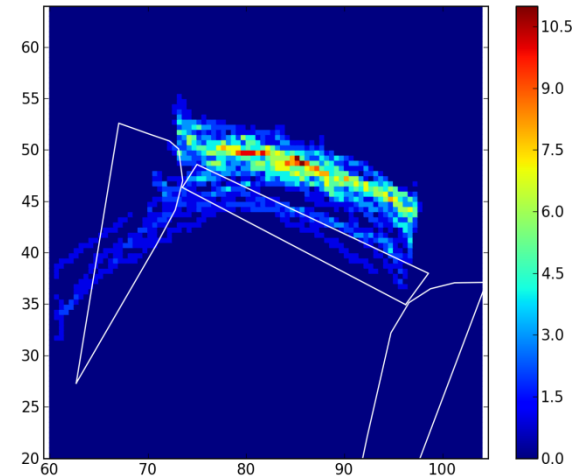
# AUTOMATED VIDEO ANALYSIS



Spatial density of pedestrians crossings at Amherst/Sherbrooke



Spatial density of pedestrians crossings at Iberville/Sherbrooke



# CONCLUSION

- Validation of impact of certain variables:
  - Being a male, a young adult, and the MWT **increase** the proportion of violations
  - Presence of a pedestrian signal or group size **decrease** the proportion of violations
- Importance of engineering countermeasures: minimize MWT, adjust clearing time
- Future work
  - Confirmation at more sites, other cities
  - Automated video analysis



# ACKNOWLEDGEMENTS

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