# Development of Crash Modification Factors for Cycling Facilities

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# Background

- Active Transportation (AT) facilities are becoming more popular in infrastructure planning

- As more municipalities incorporate AT facilities, there is a potential for increased collision rates between network users

# Study Goals

- Establish relationship between collisions and cycling facility type
- Develop Crash Modification Factors (CMFs) for cycling facilities
- Provide tools for municipalities to assess safety impacts of different cycling facilities

# Study Goals - Future

- Develop Crash Modification Functions (CMFunctions) for cycling facilities as more data becomes available

- Develop CMF and CMFunctions for active transportation networks

# Crash Modification Factor (CMF)

- CMFs represent relative change in crash frequency due to a change in one specific condition

- Expressed as a ratio:

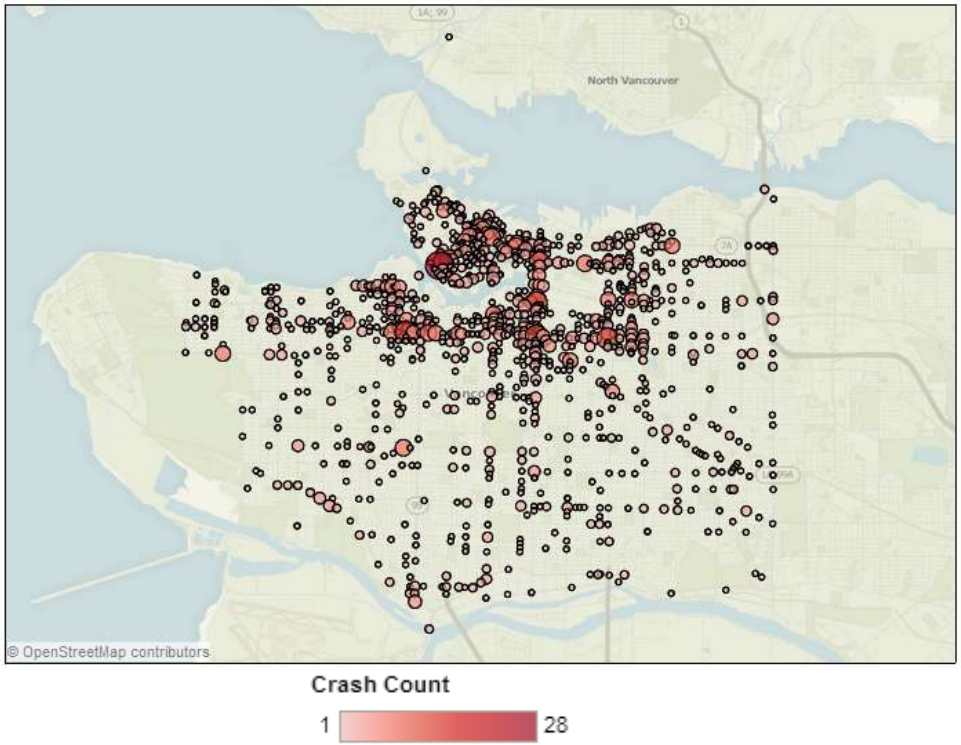
$$CMF_{facility} = \frac{[average\ crash\ frequency\ site\ condition\ B]}{[average\ crash\ frequency\ site\ condition\ A]}$$

# Crash Modification Function

- A formula used to compute the CMF for a specific site based on its characteristics
- Allows the CMF to change over the range of a variable or combination of variables
- Preferable to develop CMFunctions over single CMFs

# Data Collection

- This study used Insurance Corporation of British Columbia (ICBC) databases for crashes involving cyclists, 2008-2012



# Data Collection

- It also used Google Street View to verify cycling infrastructure in place at time of crash

# Cycling Infrastructure

## On-Road Bike Lanes

# Cycling Infrastructure

Sharrows

# Cycling Infrastructure

## Segregated Bike Lane

# Cycling Infrastructure

## Multi-Use Trail

# Cycling Infrastructure

No Facility

# Assumptions

- Street first identified in the ICBC database is the street on which the crash occurred

- Facilities identified in Google Street View were in place when the crash occurred

# CMF Development

- Before-and-After Studies
  - Derive CMFs based on comparison of safety data *before* and *after* site treatment
  - Require sufficient sample sizes
  - May be prone to sample bias

# CMF Development

- Cross-sectional Studies
  - Consider single time period over multiple sites
  - Assumes ratio of crash frequency is an estimation of CMF for implementing that feature
  - Useful where sufficient before-and-after data is not available
  - Difficult to account for unknown, or known but unmeasured, factors

# Results

## Total Overall Collisions, by Facility Type

| Facility Type | Total Collisions |
|---|---|
| **On-Road Bike Lanes** | 117 |
| **Sharrows** | 154 |
| **Segregated Bike Lanes** | 88 |
| **Multi-Use Trails** | 12 |
| **None** | 736 |

# Results

## Collisions per Year, by Facility Type

| Facility Type | Collisions per Year |
|---|---|
| **On-Road Bike Lanes** | 23.40 |
| **Sharrows** | 30.80 |
| **Segregated Bike Lanes** | 17.60 |
| **Multi-Use Trails** | 2.40 |
| **None** | 147.20 |

# Results

## Crash Modification Factor Calculation

*Example:*

$$CMF_{On-Road\ Bike\ Lanes} = \frac{[Collisions\ Per\ Year_{On-Road\ Bike\ Lanes}]}{[Collisions\ Per\ Year_{No\ Facilities}]} = \frac{23.40}{147.20} = 0.159$$

# Results

## Crash Modification Factors, by Facility Type

| Facility Type | CMF |
|---|---|
| **On-Road Bike Lanes** | 0.159 |
| **Sharrows** | 0.209 |
| **Segregated Bike Lanes** | 0.120 |
| **Multi-Use Trails** | 0.016 |
| **None** | 1.000 |

# Study Conclusions

- Significant reduction in yearly collision rate when comparing no facility to some type of facility
- Locations with on-road bike lanes experienced nearly 85% reduction in collision rates
- Locations designated with Sharrows experienced nearly 80% reduction in collision rates

# Study Conclusions

- Segregated bike lanes experienced substantial reductions in collision rates (88% reduction)
  - Likely due to the nature of this type of facility
  - Reasonable to assume most collisions with segregated bike lanes occur at intersections where physical separation does not exist

# Study Conclusions

- Multi-Use Trails typically do not follow parallel to roadways, reducing exposure which results in a large reduction in collision rates, nearly 99%

# Next Steps

- Refine CMFs through study of exposure limits of cyclist-to-motor vehicle traffic
- Conduct before-and-after study as more data becomes available and compare results
- Isolate external factors to calculate a more accurate CMF
- Develop CMFunctions based on above results