HUMPHREY SCHOOL
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UNIVERSITY OF MINNESOTA

Exposure to Risk and the Built Environment, an Empirical Study of Bicycle Crashes in Minneapolis

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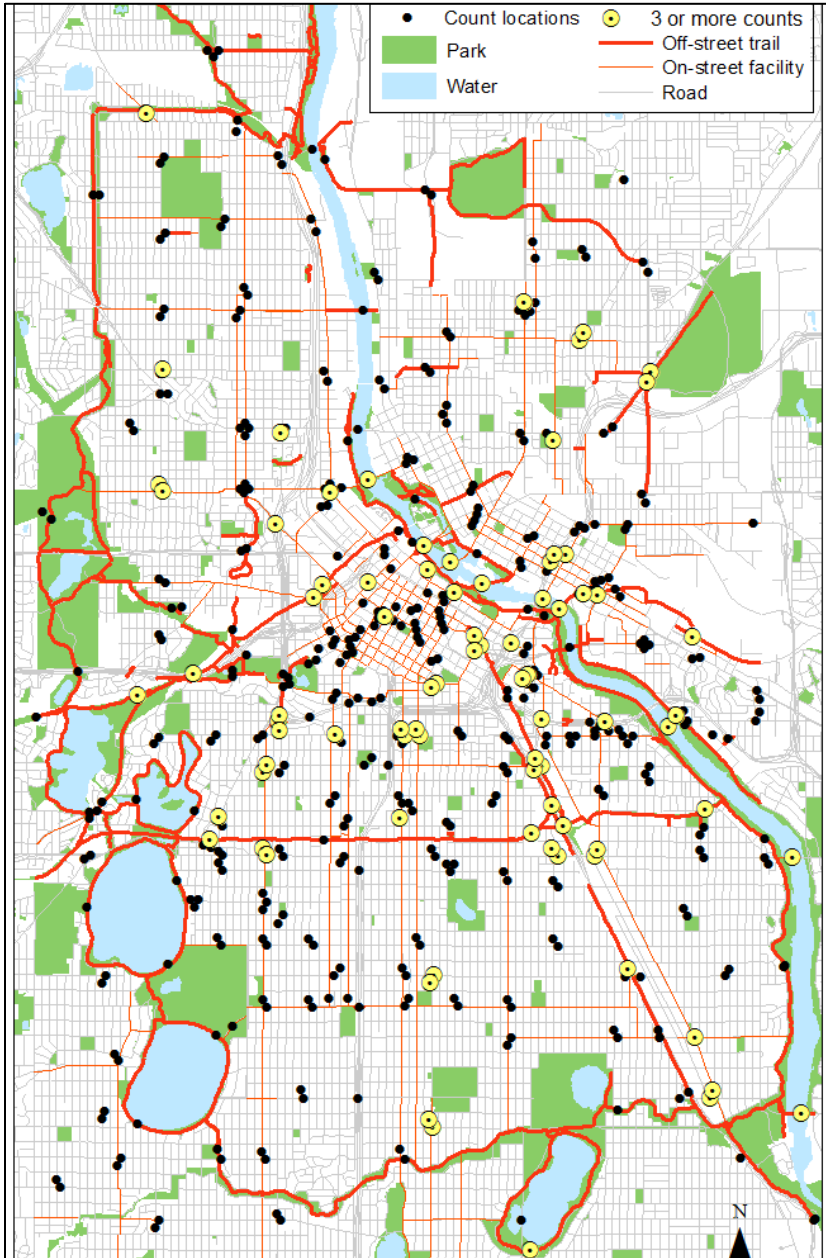
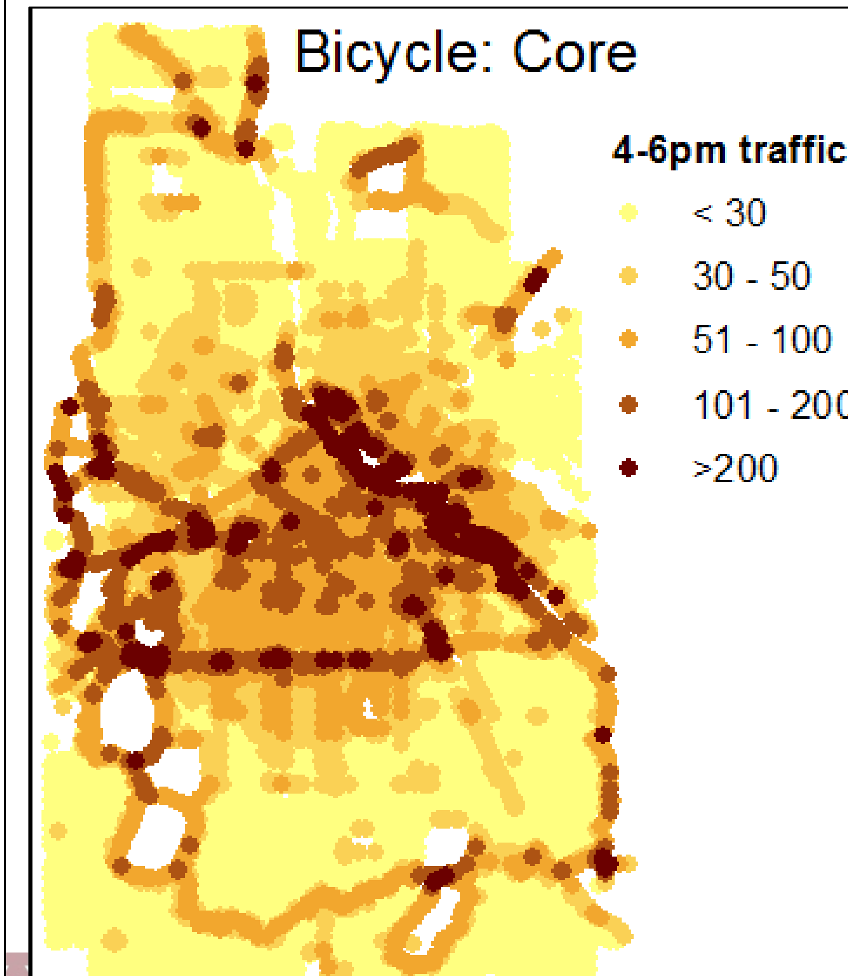
Research Objectives

- Test the "safety in number hypothesis" by using aggregated bicycle crashes and bicycling traffic (bicycling count and modeled bicycling count).
- Assess the potential of bicycle facility demand models to measure bicyclists' exposure to risk.
- Estimate the probability of crashes at intersections and street segment and assess the effects of built environment on the probability of crashes.

Data and Methods



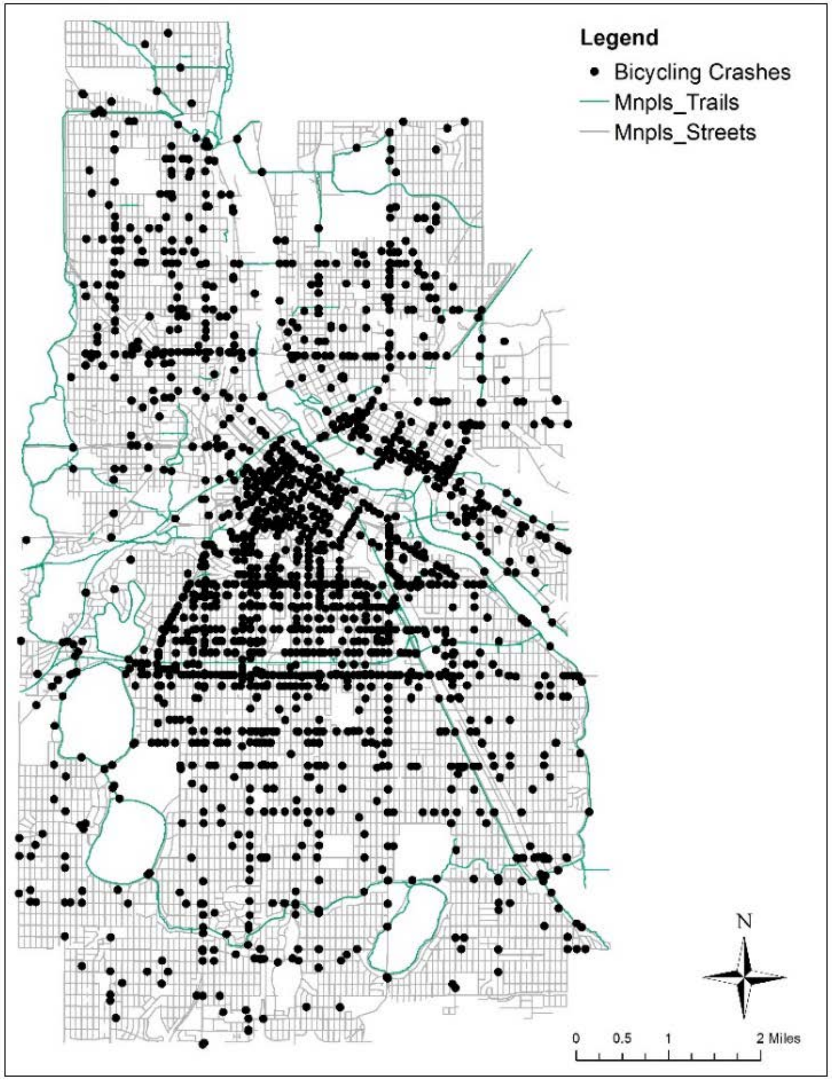
- 2007 – 2014 September 4-6 PM Traffic
- 954 Bicycling Counts
- 471 Count Locations



Source: Hankey & Lindsey Facility-demand models of peak-period pedestrian and bicycle traffic: A comparison of fully-specified and reduced-form models
Transportation Research Records 2016

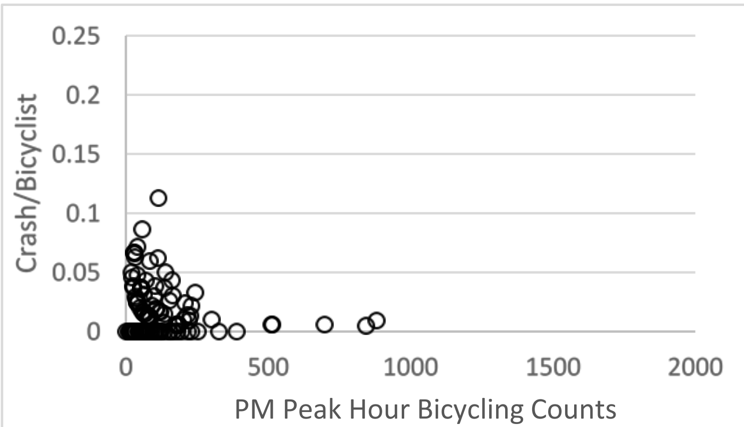
Data and Methods

2817 Crashes from 2005 to 2014

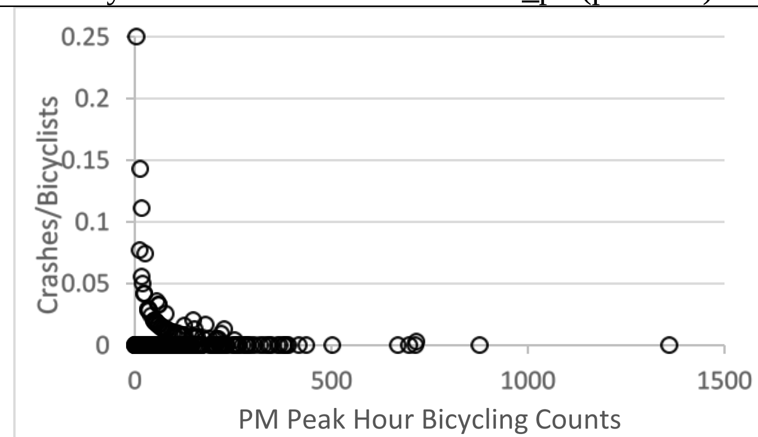


SIN Effect Evaluation

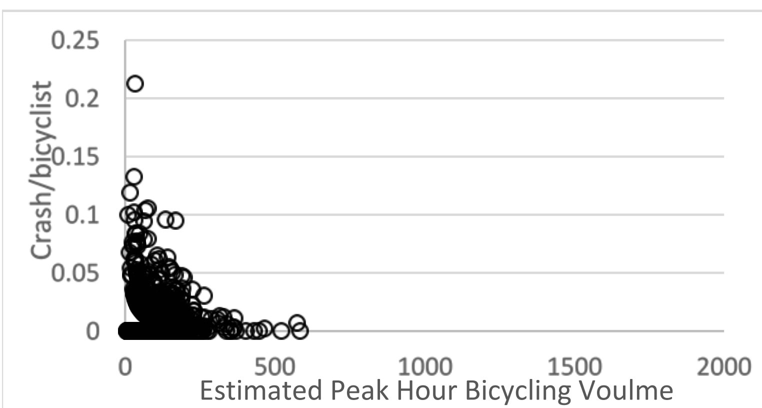
3A: Bicycling Crash Risk vs. Bike Counts at Intersections (N=123)
Per-bicyclist crash risk=-0.0025* lnbike_pk (p=0.241)



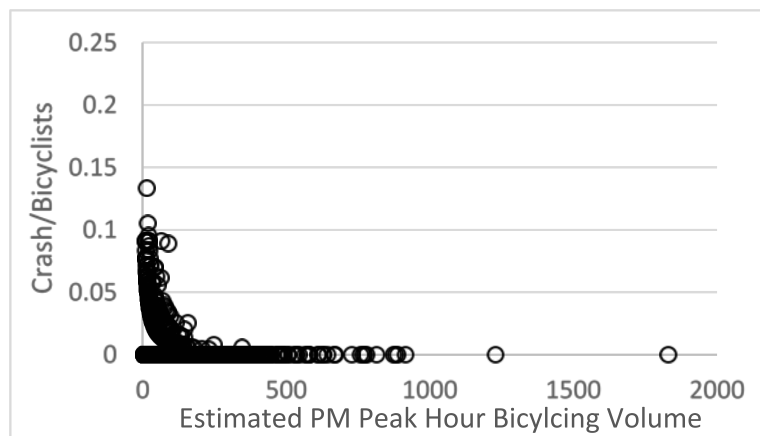
3B: Bicycling Crash Risk vs. Bike Counts at Street Segments (N=468)
Per-bicyclist crash risk=-0.001*lnbike_pk (p = 0.05)



3C: Bicycling Crash Risk vs. Modeled Bike Volume at Intersections (N=1017)
Per-bicyclist crash risk= -0.002 * lnbike_pk (p =0.009)



3D: Bicycling Crash Risk vs. Modeled Bike Volume at Street Segments (N=5311)
Per-bicyclist crash risk=-0.00076*lnbike_pk (p=0.000)



Crash Probability Model Results

	Intersection Level Model (N=257)	Street Segment Level Model (N=873)
Variables	Impacts	Impacts
Ln(Peak hour bike count)	+	++
Ln(Vehicle AADT)	++	++
Land Use Attributes		
Job accessibility	+	
Number of intersection	-	
Land use entropy		++
% commercial		++
Bike Facility Variables		
bike facility indicator		
Trail Crossing	+	
Prob>Chi2	0.0001	0.0000
AIC	226.41	370.17
BIC	258.41	408.34

Key Findings

- SIN

- facility demand models →exposure to risk.

- Intersection:

Higher job accessibility
Trail crossing
Poor Street Connectivity

- Street:

Mixed Land Use
Commercial Land Use

Implications

1) Improve understanding on bicycling crash by

- Implementing more comprehensive counting programs

2) and Improve safety by:

- Targeting intersections and street segments with high bicycle and traffic volumes for interventions and countermeasures—for example, priority signals or hybrid beacons at trail crossings.

- Interventions and countermeasures for the areas with mixed land use and higher % of commercial use (indicating more conflicts between bicyclists and vehicles).

Thank You !