

# Identifying the Riskiest Situations for Pedestrians

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**UMTRI**

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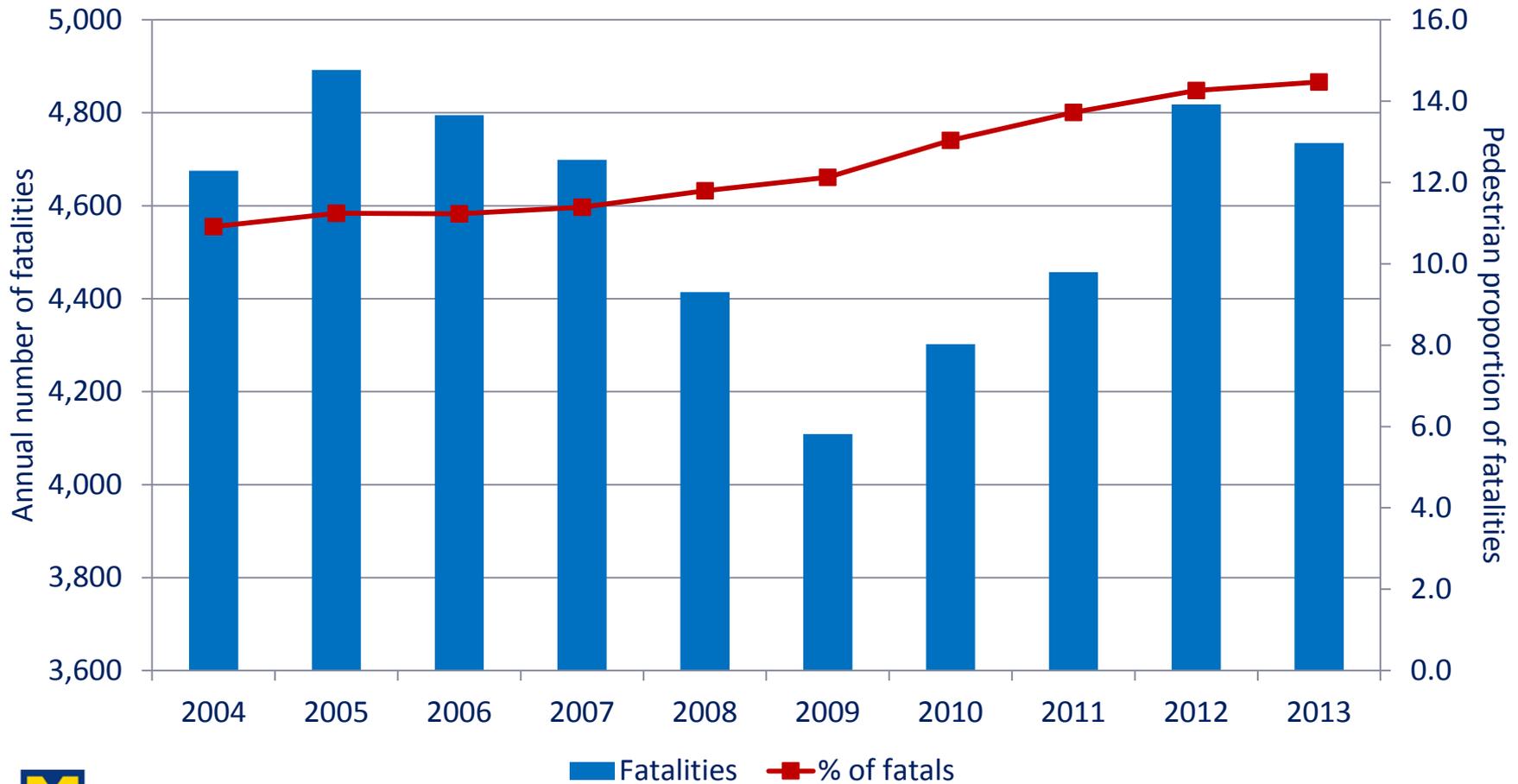
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# Pedestrian Crash Toll

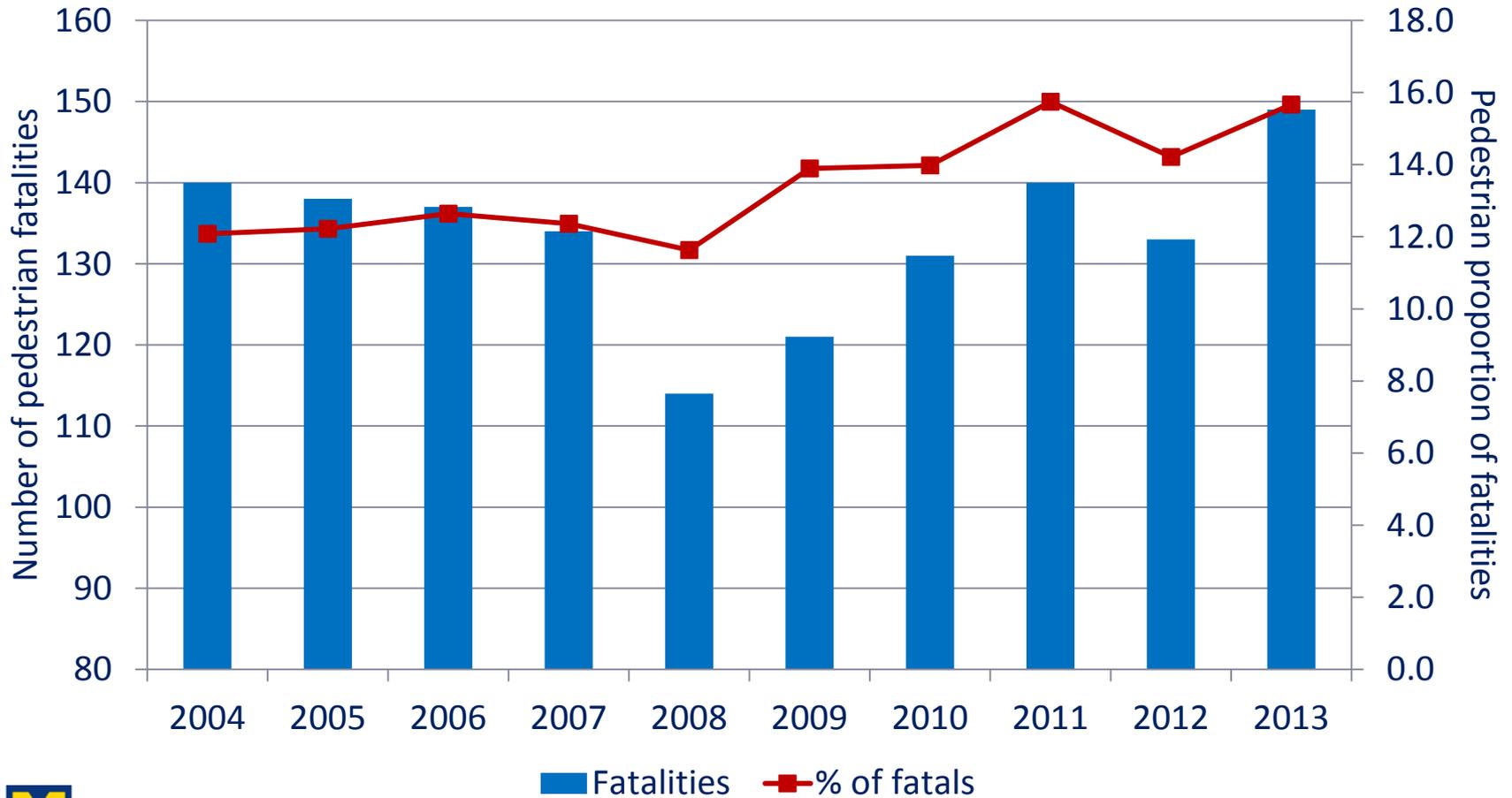
Average Pedestrian Fatalities and Injuries		
Injury severity	U.S.	Michigan
Fatal	4,485	135
Incapacitating	12,958	395
Non-incapacitating	25,474	663
Possible	29,399	857
Total	72,316	2,050



# Trends in National Pedestrian Fatalities



# Trends in Michigan Pedestrian Fatalities



## Goal of the project

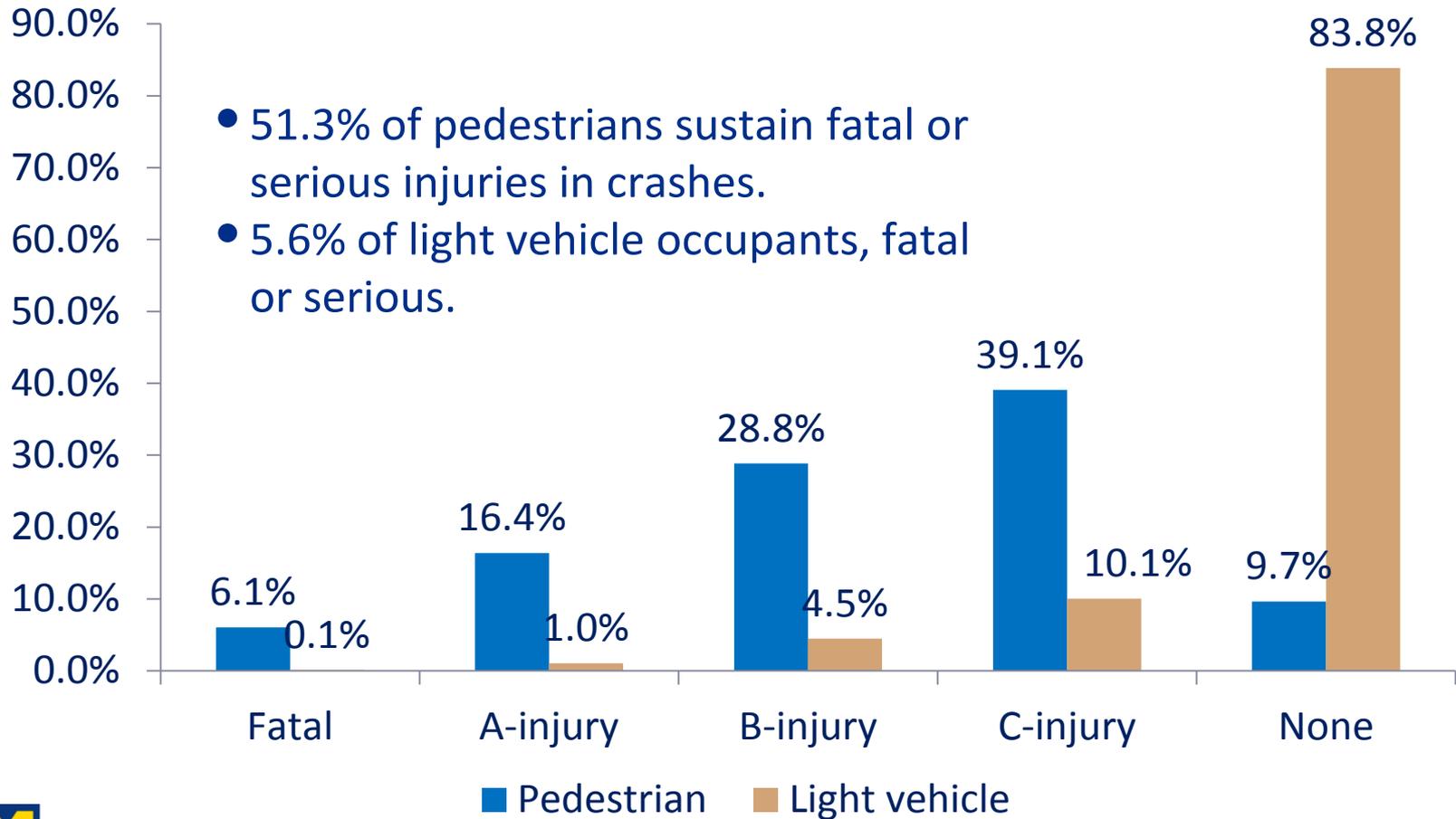
- Develop pedestrian crash scenarios relevant to vehicle-based crash avoidance technologies.
- Scenarios based on:
  - Roadway location.
  - Movement of pedestrian.
  - Movement of striking vehicle.
  - Accounting for light condition.
- Identify and rank in terms of:
  - Frequency.
  - Societal costs (accounting for injury severity).



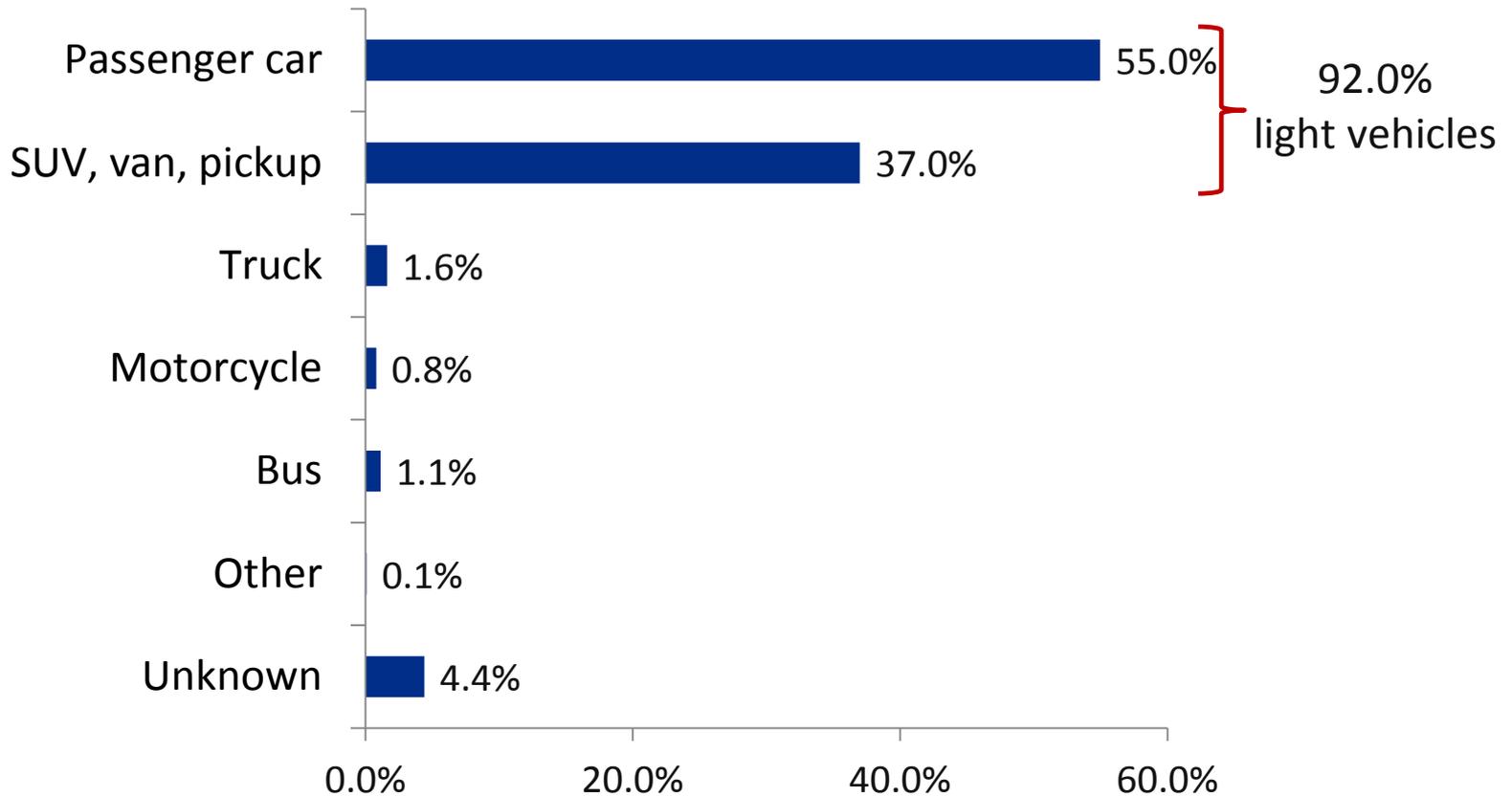
## Data

- FARS: Fatality Analysis Reporting System.
- GES: General Estimates System
- Years: 2010-2012
- Estimates of pedestrian crash costs.
- Project developed scenarios at the national level.
- Michigan data used to illustrate relevance to our State.

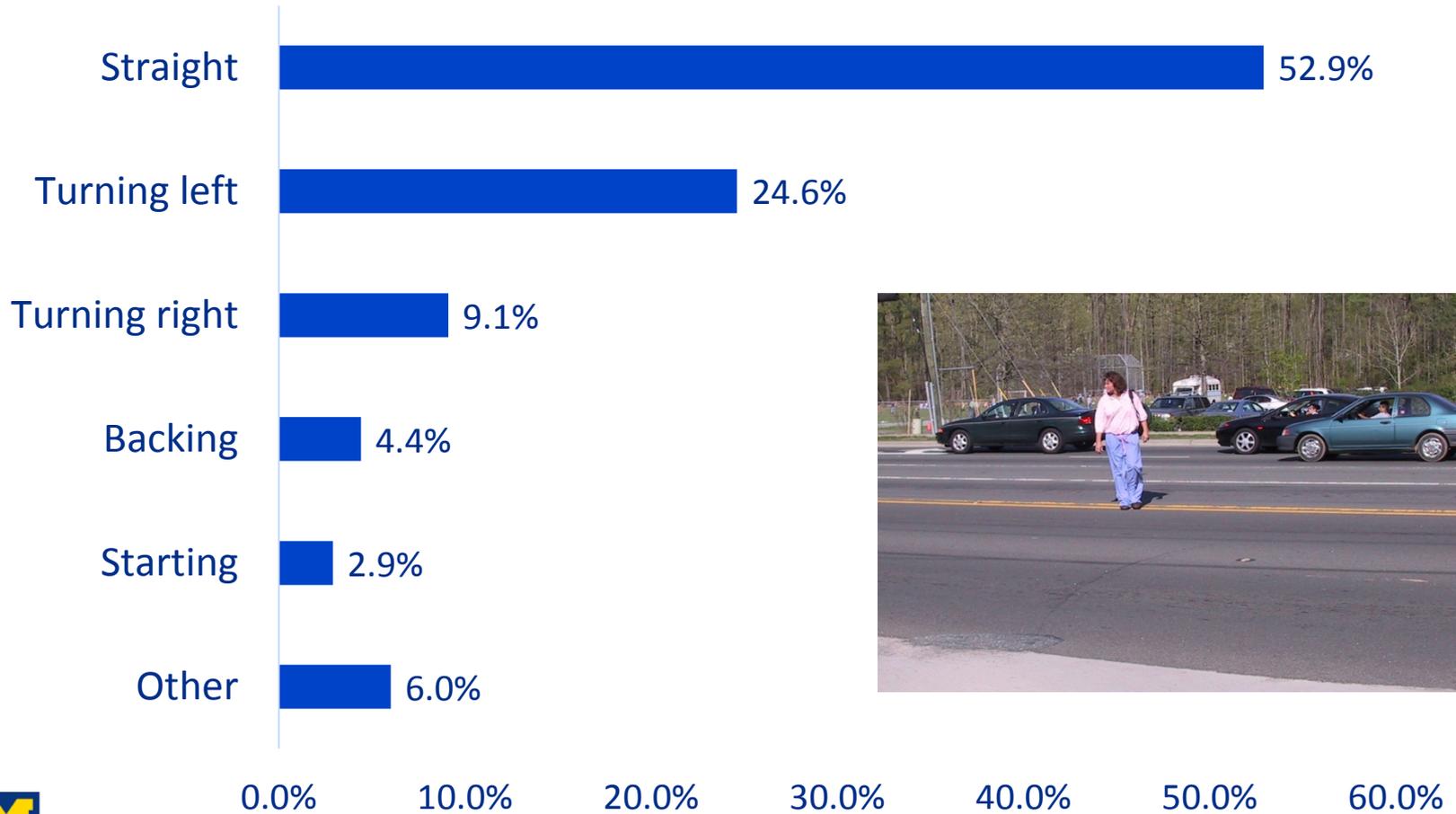
# Comparison of Injury Severity for Pedestrians and Light Vehicle Occupants



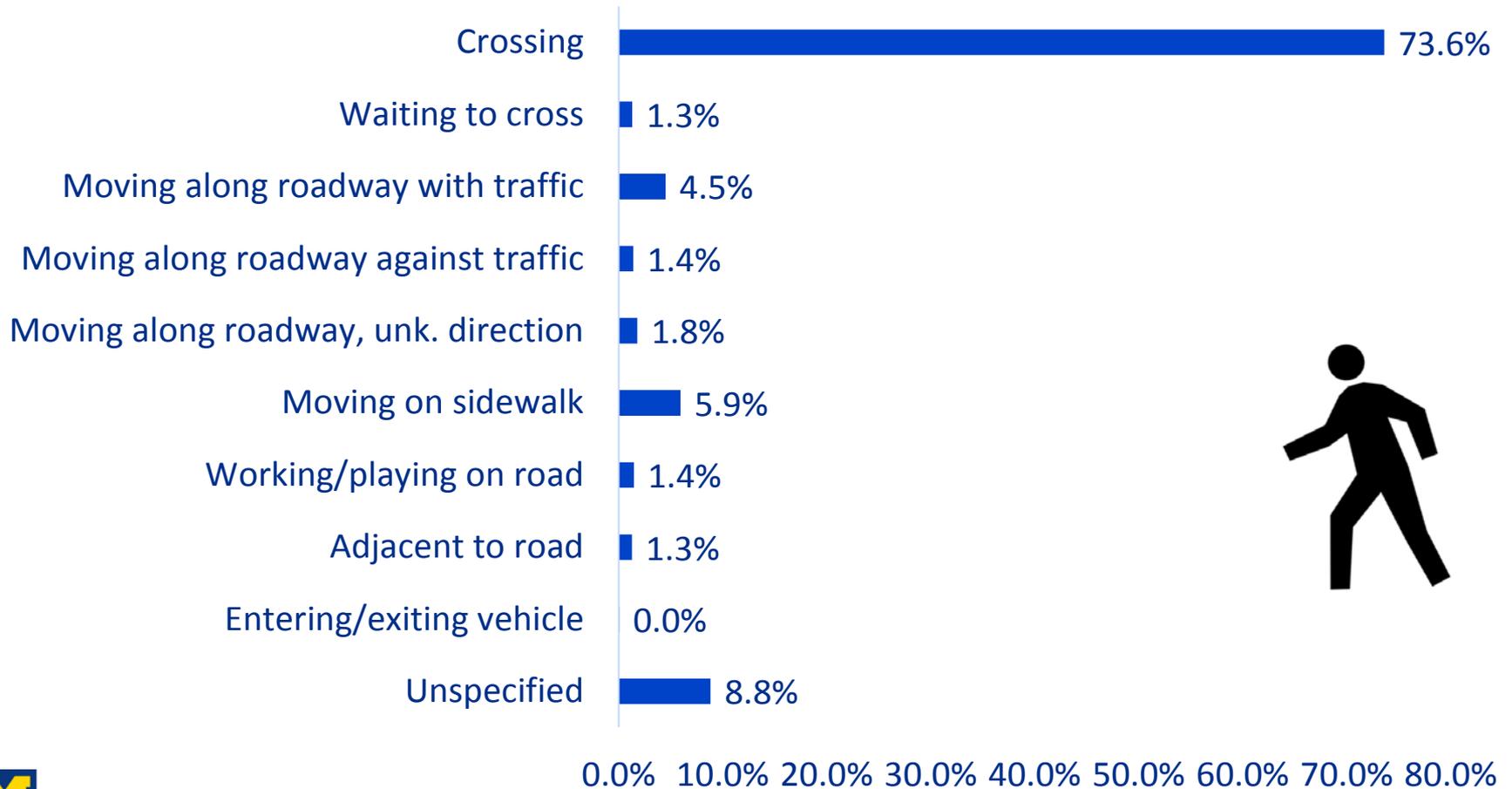
# Motor vehicle type in pedestrian crashes



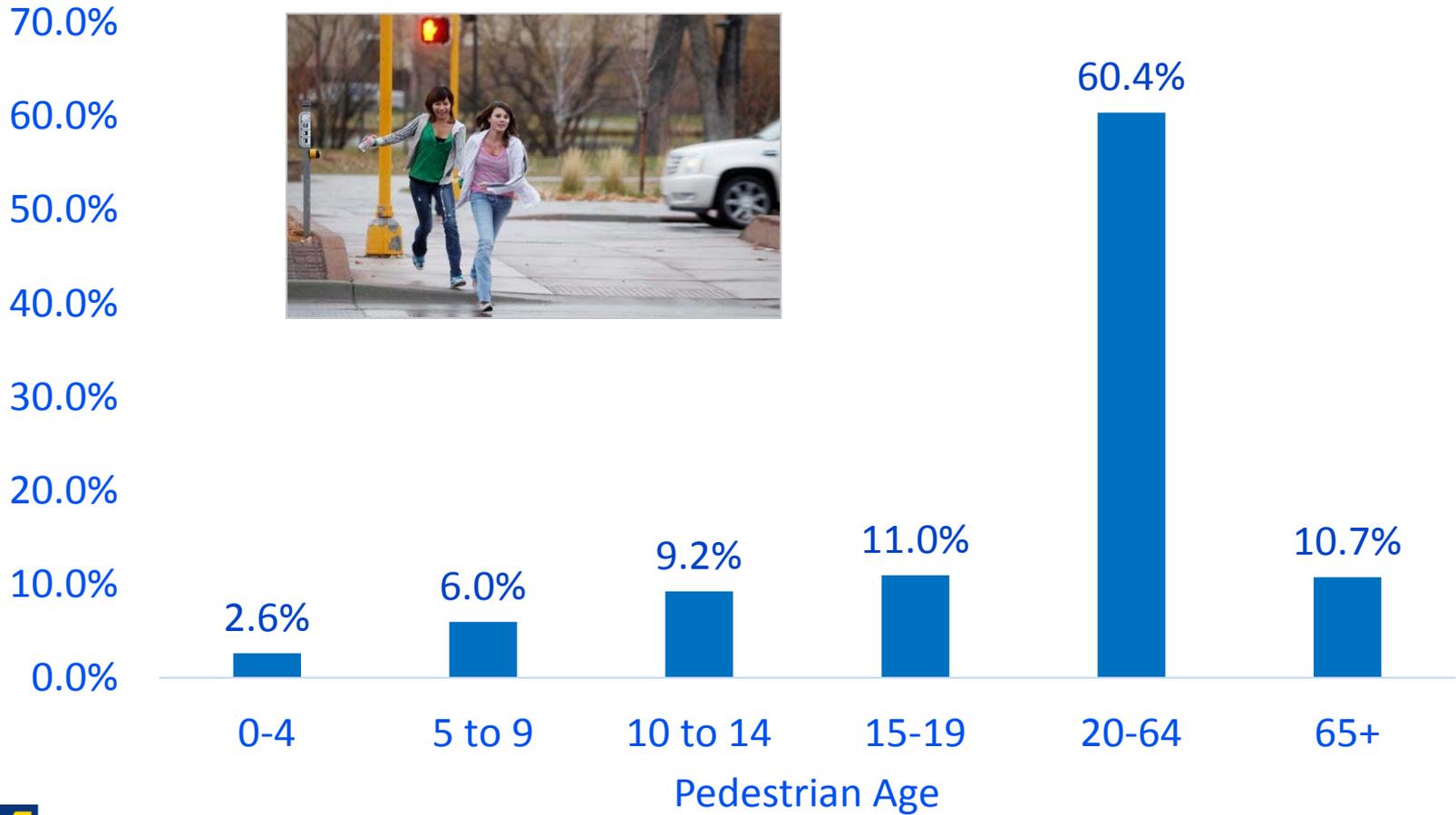
# Light vehicle pre-crash movement



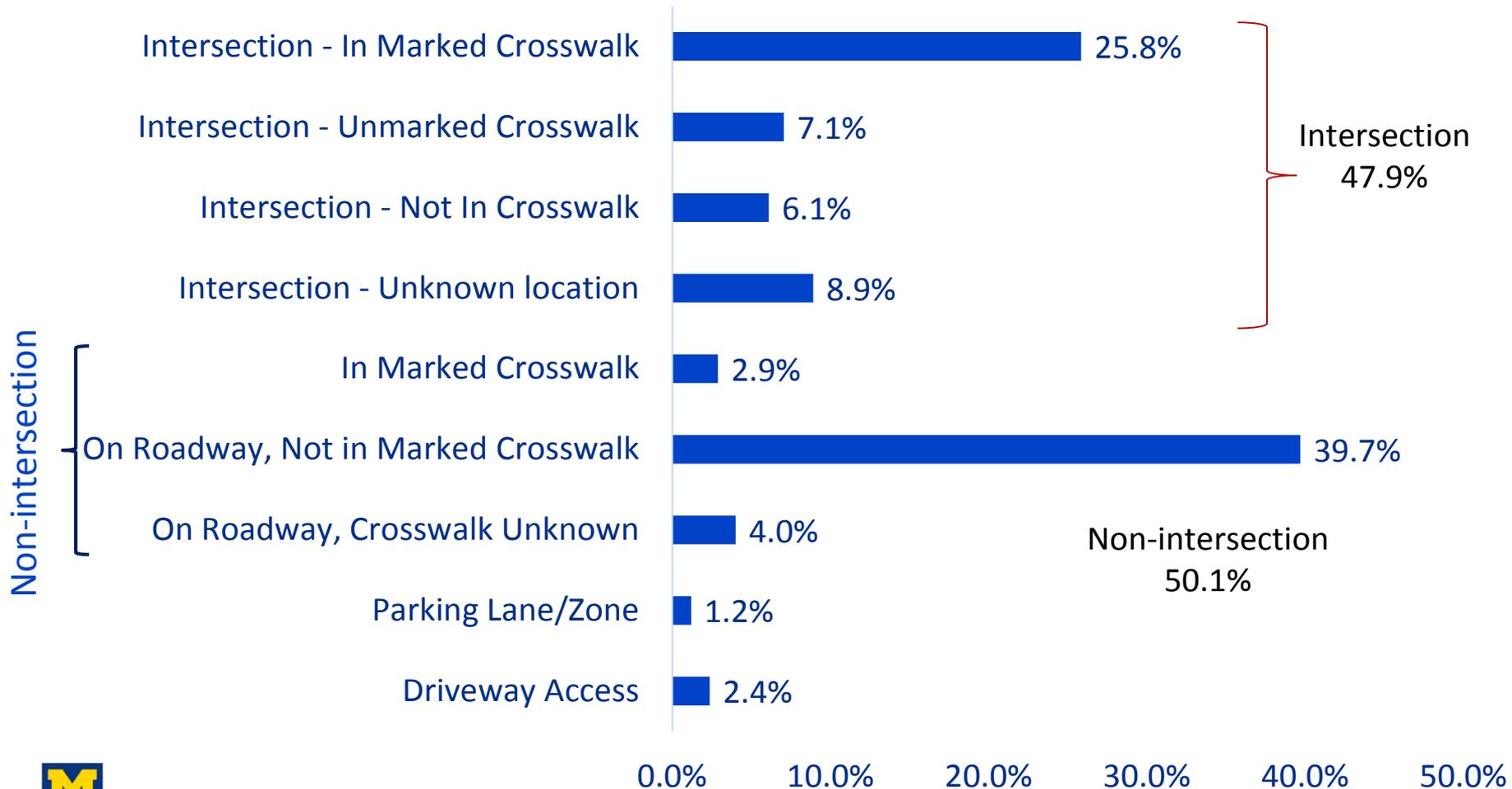
# Pedestrian pre-crash movement



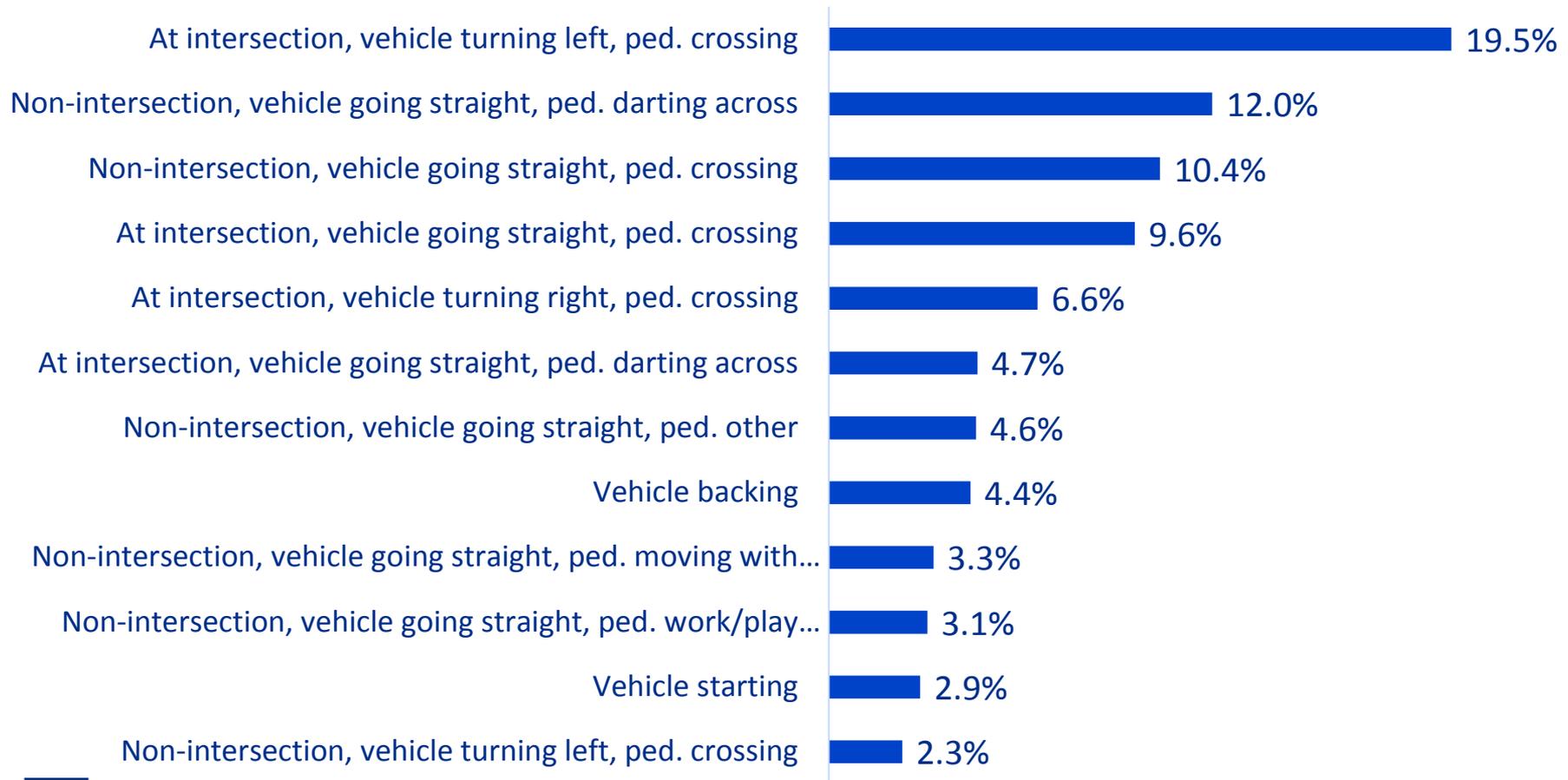
# Pedestrian Age



# Roadway location of pedestrian crashes



# Top 12 Scenarios Account for 83.5% of Pedestrian/Light Vehicle Crashes



0.0% 5.0% 10.0% 15.0% 20.0%



## Top Pedestrian Crash Scenarios by Frequency

- Most common (19.5%): at intersection, vehicle turning left.
- Four of top six are at intersection, pedestrians crossing in front of vehicle.
- At intersection, left turns 3 times as common as right.
- Away from intersection, vehicle almost always going straight.
- Backing or starting relatively uncommon.
- 12 scenarios account for 83.5% of ped crashes.



# Top Pedestrian Crash Scenarios by Societal Costs

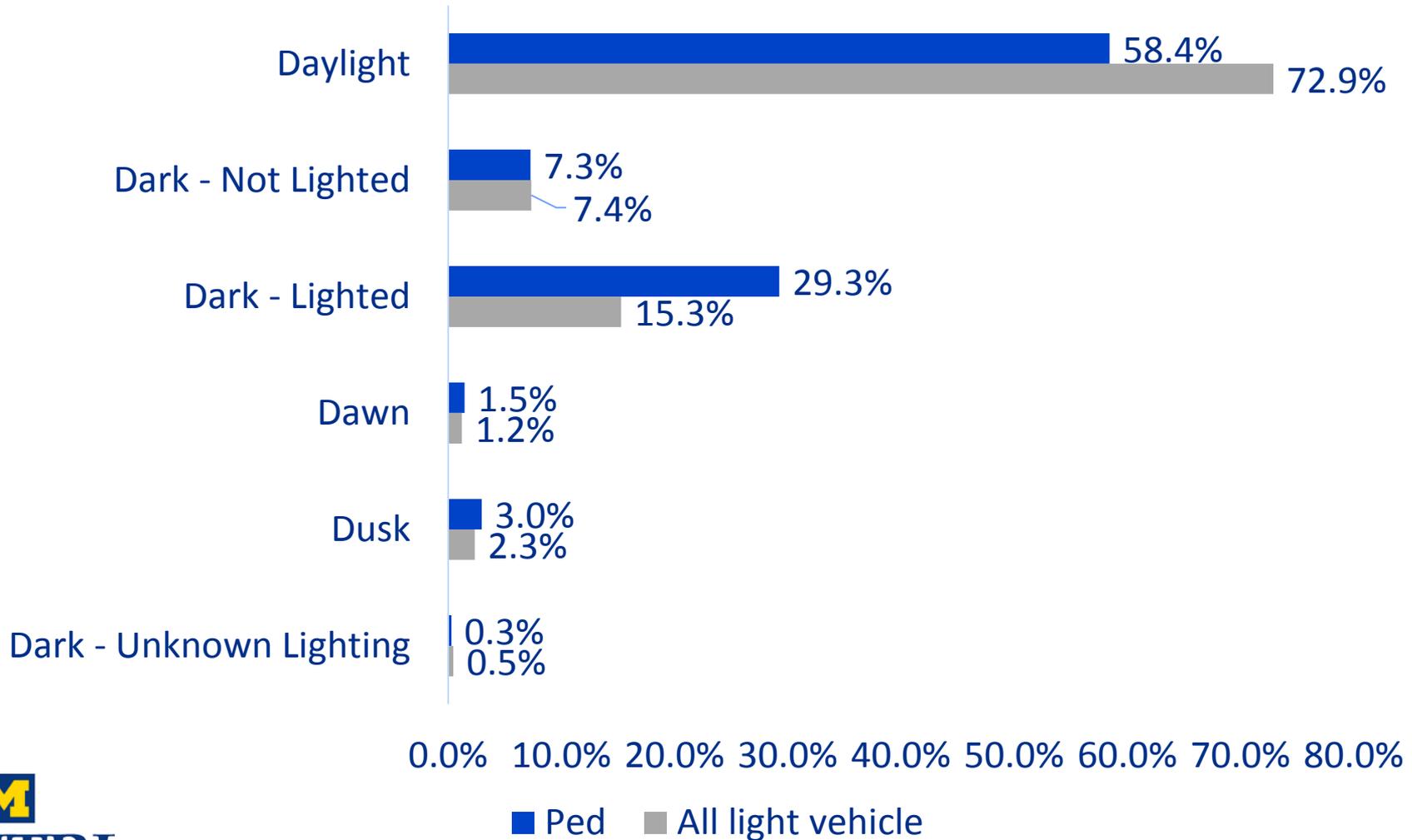
Location, vehicle maneuver, pedestrian action	Costs (millions)	% of costs	Freq. rank
Non-intersection, vehicle going straight, pedestrian crossing	3,046.41	27.6	3
Non-intersection, vehicle going straight, pedestrian darting across	1,501.96	13.6	2
Non-intersection, vehicle going straight, pedestrian work/play in road	1,331.02	12.1	10
At intersection, vehicle going straight, pedestrian crossing	1,303.81	11.8	4
Non-intersection, vehicle going straight, pedestrian moving with traffic	816.48	7.4	9
Non-intersection, vehicle going straight, pedestrian other	564.08	5.1	7
At intersection, vehicle turning left, pedestrian crossing	464.80	4.2	1
At intersection, vehicle going straight, pedestrian darting across	399.06	3.6	6
Non-intersection, vehicle going straight, pedestrian moving against traffic	177.97	1.6	16
Non-intersection, vehicle going straight, pedestrian enter/exit vehicle	157.77	1.4	22
At intersection, vehicle turning right, pedestrian crossing	155.08	1.4	5
 Vehicle backing	142.90	1.3	8

## Top Pedestrian Crash Scenarios by Costs

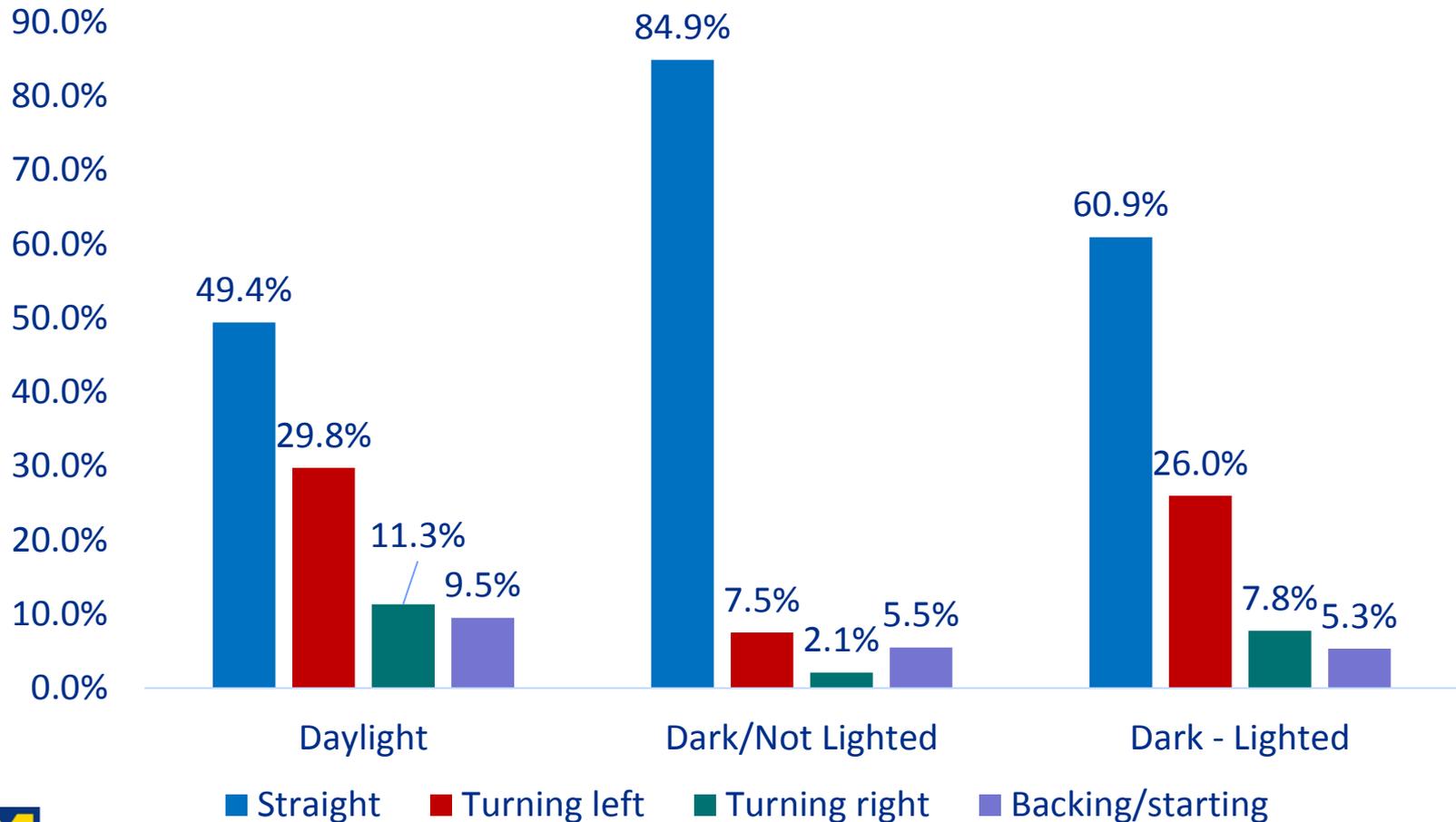
- Three scenarios account for half of pedestrian crash costs.
- Non-intersection, vehicle going straight predominate because of vehicle speed.
- Pedestrian crossing predominates.
- But pedestrian working/playing or walking along the road in 20%.
- Intersection crashes tend to be less severe.



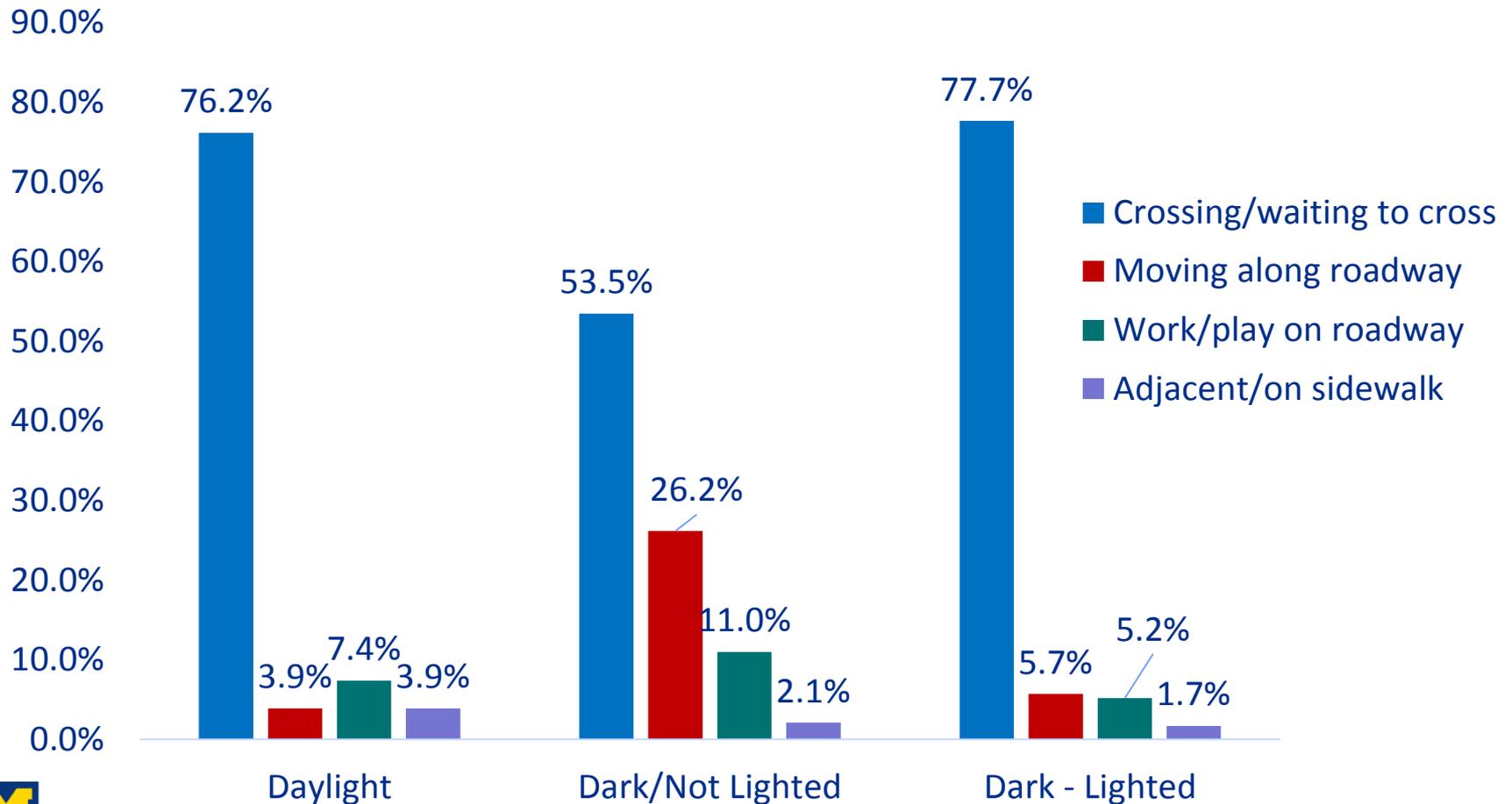
# Light Condition in Pedestrian Crashes (all light vehicle crashes shown for comparison)



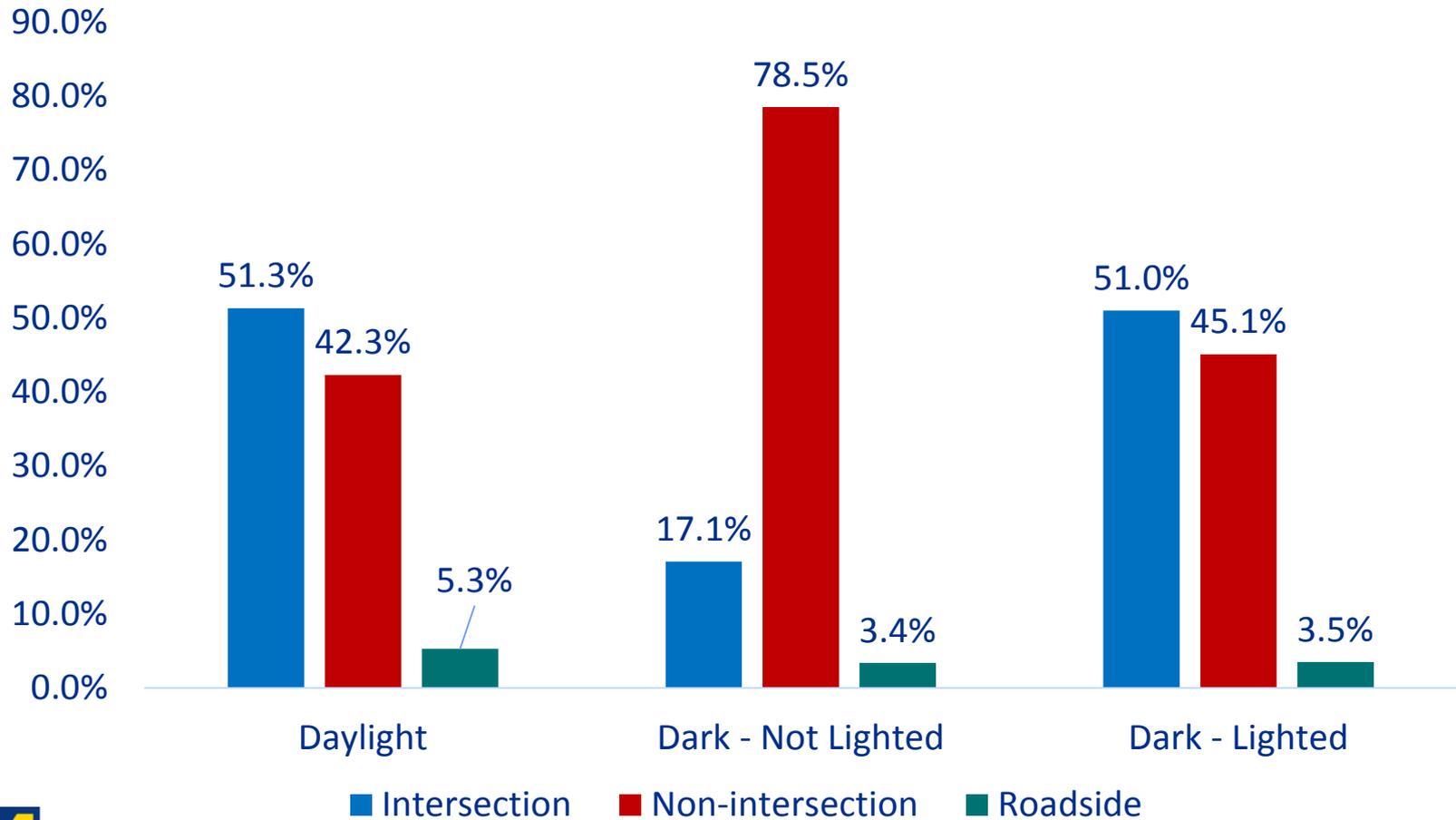
# Light Vehicle Pre-crash Maneuver Varies by Light Condition



# Pedestrian Pre-crash Action Varies by Light Condition



# Roadway Location Varies by Light Condition



## Effect of Light Condition

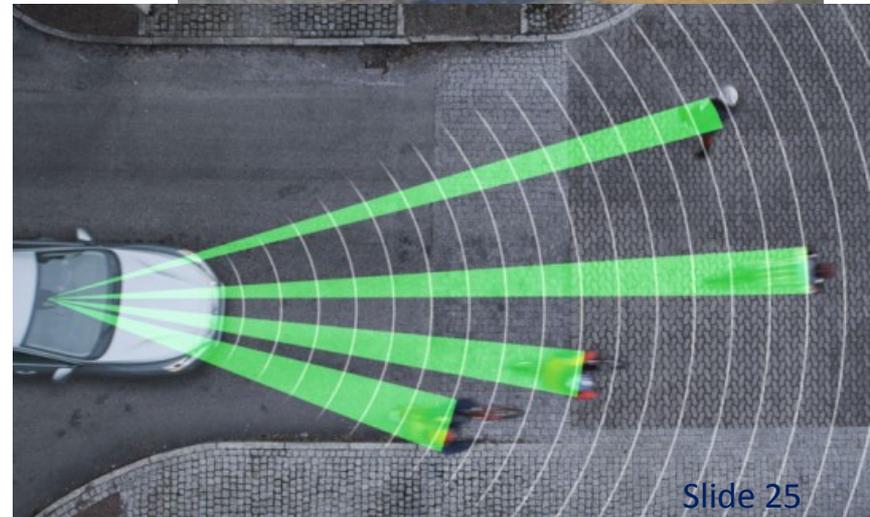
- Darkness increases the risk of pedestrian crashes 3-7 times (Sullivan & Flannaga, 2002).
- Pedestrians significantly less visible to drivers.
  - Drivers over-drive visibility on low beams.
  - In turns, particularly to the left, pedestrians are out of the field of illumination.
- At night, pedestrians more likely to be struck while walking in/along roads.

## Conclusions / Interventions

- Relatively few scenarios account for most pedestrian crashes.
  - Non-intersections, vehicle going straight, & pedestrian crossing in front.
  - Non-intersection, vehicle going straight, pedestrian in or along the road, particularly at night.
  - Intersection, vehicle going straight, & pedestrian crossing.
  - Left turns at intersections, particularly in the dark.

## Vehicle-based Interventions

- Forward collision pedestrian detection.
- Automatic emergency braking.
- Improved headlamps, particularly in turns.
- Backing sensors & cameras.
- Energy-absorbing hood and fender designs.



# Roadway interventions

- Raised medians and media islands.
- Fewer lanes.
- Pedestrian crossing signals & signal timing for protected pedestrian crossing.
- Remove left-turn only signals.
- Improved nighttime lighting.
- Restrict street parking near intersections.
- Prohibit right-turn on red.



Thank you!

Questions?

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