ARC RSS
Data Analysis

February 17, 2022

Background

- Key steps in the FHWA's Systemic Safety Project Selection Tool:
  - Focus crash type.
  - Focus facility type.

- Crash Summary Templates used to identify focus crash types based on Georgia SHSP emphasis areas.

- Four key focus crash types for network analysis:
  - Roadway departure.
  - Intersections.
  - Pedestrians.
  - Bicyclists.

Accessibility: OFF

Crash Data Summary Template

ARC	KA Crashes							BCO Crashes						
	ARC							ARC						
	Year 1 - Year 5	%	2016	2017	2018	2019	2020	Year 1 - Year 5	%	2016	2017	2018	2019	2020
Bicycles														
No	14936	99.0%	2,399	2,589	2,991	3,368	3,589	1,138,625	99.9%	243,785	246,264	243,312	240,026	165,238
Yes	150	1.0%	19	33	29	44	25	1,484	0.1%	347	298	292	310	237
Pedestrians														
No	13399	88.8%	2,079	2,234	2,692	3,099	3,295	1,132,751	99.4%	242,336	244,871	242,183	238,828	164,533
Yes	1687	11.2%	339	388	328	313	319	7,358	0.6%	1,796	1,691	1,421	1,508	942
Motorcycles														

Background

- Deeper analysis for focus crash types reveal key characteristics for focus facility types.

- Crash trees reveal top facility types based on frequency alone:
  - Urban.
  - GDOT-owned.
  - 4 lanes.
  - Other Principal Arterial.

- Exposure tables refine crash trees to better understand overrepresentation – is the frequency expected or unique?

- Next step, network for risk factors.

All Roads Lane Miles	% Difference between % of KA Crashes and % of Exposure						
County	Interstate	Other NHS	Non-NHS	Minor Art	Major Col	Minor Col	Local
Barrow	-1%	0%	3%	22%	14%	-5%	-33%
Carroll	8%	0%	0%	30%	22%	5%	-65%
Cherokee	7%	0%	24%	20%	2%	-3%	-49%
Clayton	-3%	0%	31%	26%	2%	0%	-55%
Cobb	1%	0%	19%	38%	1%	0%	-59%
Coweta	0%	0%	19%	35%	-7%	-2%	-45%
Dawson	0%	0%	33%	-1%	32%	-7%	-57%
DeKalb	2%	1%	19%	30%	4%	0%	-56%
Douglas	-1%	0%	27%	27%	0%	-1%	-51%
Fayette	0%	0%	17%	48%	-7%	0%	-57%
Forsyth	0%	1%	20%	32%	4%	-1%	-56%
Fulton	5%	0%	16%	28%	0%	-1%	-49%
Gwinnett	-1%	-1%	14%	27%	8%	0%	-48%
Henry	7%	0%	19%	31%	-6%	-1%	-51%
Newton	2%	0%	19%	23%	7%	-2%	-49%
Paulding	0%	0%	26%	19%	1%	4%	-50%
Rockdale	17%	0%	15%	11%	9%	-1%	-51%
Spalding	0%	-1%	30%	11%	-1%	-1%	-38%
Walton	0%	0%	18%	31%	5%	-1%	-53%
	2%	0%	19%	26%	5%	-1%	-51%

All Roads Lane Miles	% Difference between % of K							
	1	2	3	4	5	6	7	8
Barrow	0%	-2%	-1%	3%	0%	0%	0%	0%
Carroll	-1%	-18%	-1%	8%	7%	5%	0%	0%
Cherokee	3%	-28%	0%	21%	3%	-1%	3%	0%
Clayton	-1%	-43%	1%	32%	2%	10%	0%	-1%
Cobb	0%	-49%	-1%	42%	1%	5%	0%	-1%
Coweta	0%	-6%	-1%	2%	0%	3%	0%	3%
Dawson	0%	-37%	0%	38%	0%	0%	0%	0%
DeKalb	1%	-46%	1%	28%	1%	14%	0%	1%
Douglas	-1%	-44%	2%	37%	0%	6%	0%	0%
Fayette	0%	-43%	-1%	36%	0%	7%	0%	0%
Forsyth	0%	-42%	0%	39%	0%	4%	0%	0%
Fulton	1%	-46%	1%	28%	4%	8%	0%	3%
Gwinnett	-1%	-37%	1%	28%	1%	8%	0%	-1%
Henry	0%	-34%	0%	27%	2%	0%	0%	5%
Newton	0%	-21%	0%	20%	0%	2%	0%	0%
Paulding	0%	-20%	2%	15%	0%	3%	0%	0%
Rockdale	0%	-30%	2%	-1%	0%	30%	0%	0%
Spalding	-1%	-26%	-1%	25%	3%	0%	0%	0%
Walton	0%	-7%	0%	7%	0%	0%	0%	0%
	0%	-31%	0%	23%	1%	5%	0%	1%

Focusing on Pedestrians/Bicyclists - Method

- Major challenge – no comprehensive measure of pedestrian activity.
  - Several possible surrogates and indicators:
    - Model trips.
    - WBT propensity.
    - Census data.

- Binary logistic regression helps side-step key assumptions needed in other safety models (i.e., count models).
  - Probability based on the characteristics of the road, the number of segments with those characteristics, and the likelihood that a KA pedestrian crash occurred.

- Odds ratios represent model coefficients.
  - An odds ratio >1 indicates a higher probability that a crash occurred.
  - An odds ratio <1 indicates a lower probability that a crash occurred.

Potential Inputs (So Far)

Operations/Geometry	Exposure	Socioeconomic	Transit	Other Context

▪ Thru lanes
▪ Annual average daily traffic (AADT)
▪ Median present (pedestrian traversable)
▪ Posted speed limit
▪ Ownership
	▪ Population
	▪ Employment
	  • Retail
	  • Education
	  • Arts and entertainment
	  • Accommodation and food services
	▪ Bike and walk trips (model trips)
	▪ Walk, Bike, Thrive (WBT) propensity (weighted to the TAZ-level)
		▪ Poverty proportion
		▪ Median household income
		▪ Non-white proportion
		▪ Proportion/Density over 65
		▪ Proportion/Density under 18
		▪ Proportion/Density non-motorized commuters
		▪ K-12 enrollment density
		▪ Disability proportion
		▪ Zero vehicle household proportion
		▪ Limited English proficiency proportion
		▪ College educated proportion
			▪ Bus stop present
			▪ Streetcar stop present
			▪ Heavy rail stop present
			▪ WBT (2015) transit service area by type/frequency
				▪ K-12 school proximity
				▪ College proximity
				▪ Hospital proximity
				▪ EMS station proximity
				▪ Park/Open space proximity
				▪ State Opportunity Zone proximity
				▪ Low Income Housing Tax Credit parcel proximity
				▪ Bike lane/Multi-use path proximity
				▪ Equitable Target Area (ETA; 2015)
				▪ Segment length
				▪ Urban/Rural
				▪ Development intensity
				▪ EJ communities (2019)

Key Inputs Identified - Pedestrian

Input	Other Principal Arterials & Minor Arterials	Other Principal Arterials Only	Minor Arterials Only
AADT over 9,000	+++	+	+++
4 or more thru lanes	+++	+	+++
GDOT Owned	+++	+++	+
Posted speed limit 35 mph and under	---	-	-
Population density rank	+++	+++	+++
Bus stop within 100 ft (2021)	+++	+++	+++
High frequency bus service (3/4 Qtr Mi; 2015)	++	+++	n/a
Proportion of the population that is non-white or 2 or more races ranks	+++	n/a	+++
Median household income rank	---	---	n/a
Environmental Justice component score >= 7	+++	+	+++
Urban Area	+++	+++	n/a
High intensity development (NLCD criteria)	+++	+++	+++
Not adjacent to high or medium intensity development	--	n/a	--
Segment length (Mi)	+++	+++	+++

+++/--- = $p < 0.01$ ++/-- = $p < 0.05$ +/- = $p < 0.2$

Key Inputs Identified - Bicycle

| Input	Minor Arterials & Major Collectors	Minor Arterials Only	Major Collectors Only
Population density rank	+++	+++	+++
Employment density rank	+++	+++	+++
AADT over 20,000	+++	+++	n/a
4 or more thru lanes	++	n/a	+
GDOT Owned	+	n/a	n/a
High frequency bus service (3/4 Qtr Mi; 2015)	+	+	n/a
Bus stop within 100 ft (2021)	+++	+++	+++
Median household income rank	+++	+++	n/a
Bicycle lane (non-separated)	+++	++	n/a
Multi-use path within 100 feet	+++	+++	+++
Urban Area	++	+	++
Proportion of employment in the retail sector (NAICS 44-45)	+++	+++	n/a
High intensity development (NLCD criteria)	+++	+++	+++
Not adjacent to high or medium intensity development	-	n/a	n/a
Segment length (Mi)	+++	+++	+++

+++/--- = $p < 0.01$ **++/--** = $p < 0.05$ **+/-** = $p < 0.2$

How Does This Perform?

- Most efficient outcomes – segment has been flagged by WBT and the model risk factors.
  - ~70% of pedestrian KA crashes to ~8% of the non-interstate network.
  - ~62% of bicycle KABCO crashes to ~7% of the non-interstate network.

- Segments that only have one flag still perform well, but not as efficient.

- Segments that don't have either make up most of the non-interstate network (>75%) with only a minority of target crashes (~20%).
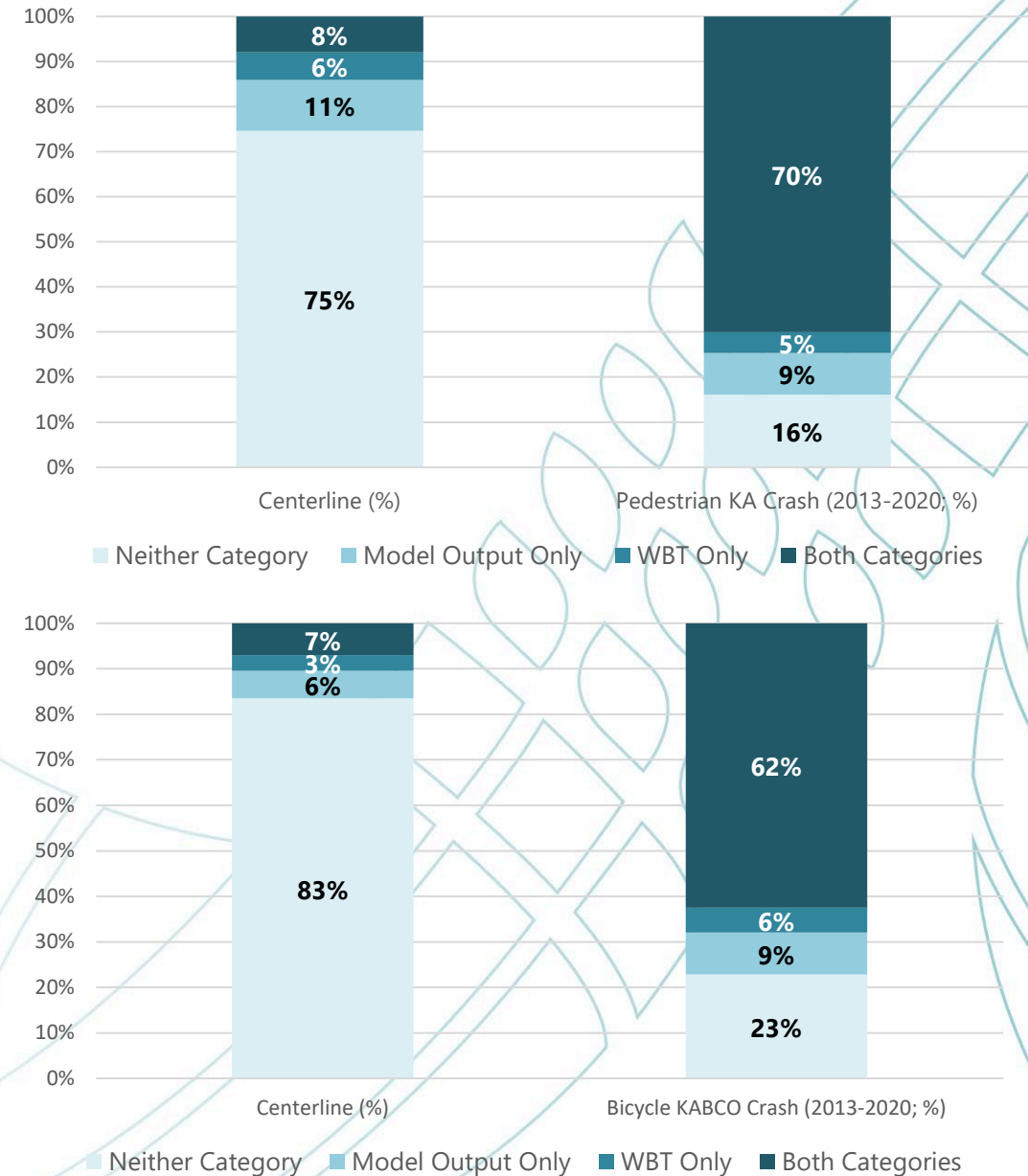
Discussion & Key Trends

- Common trends between bicyclists and pedestrians:
  - High traffic volumes.
  - Wide roads (4+ lanes).
  - GDOT-owned.
  - Urban area.
  - Minor arterials.
  - Adjacent to high intensity development.
    - Higher population, employment densities, as well as higher WBT propensity values.
    - less likely to occur with low intensity development to no development.
  - Access to transit, particularly (high frequency) bus.

Discussion & Key Trends

- Pedestrian-focused trends:
  - Greater focus on principal arterials.
  - Higher risk associated with higher posted speed limits.
  - Higher risk in more vulnerable, marginalized communities:
    - Greater proportion of non-white population or 2 or more races.
    - Lower household incomes.
    - Communities with higher EJ scores.

- Bicyclist-focused trends:
  - Principal arterials less of a focus, major collectors higher priority.
  - Higher risk in high retail employment areas (destination focus?).
  - Higher household incomes.
  - Access to multi-use paths and off-road bikeways.
  - Bicycle lanes tend to be present (induced demand?).