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Assessment of the use of active road studs at spiral-marked roundabouts using the Swedish traffic conflict technique

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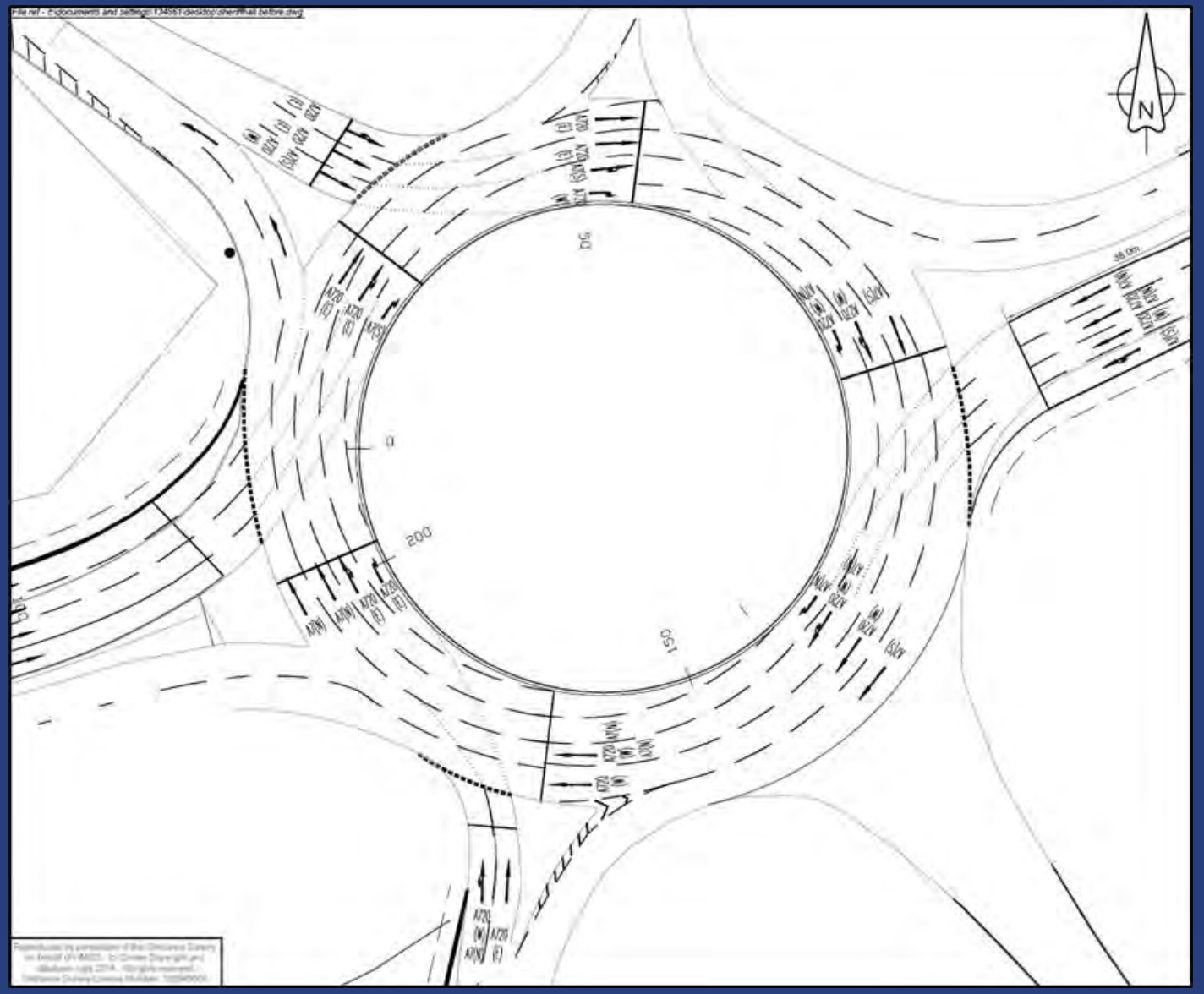
Background

PhD Aim

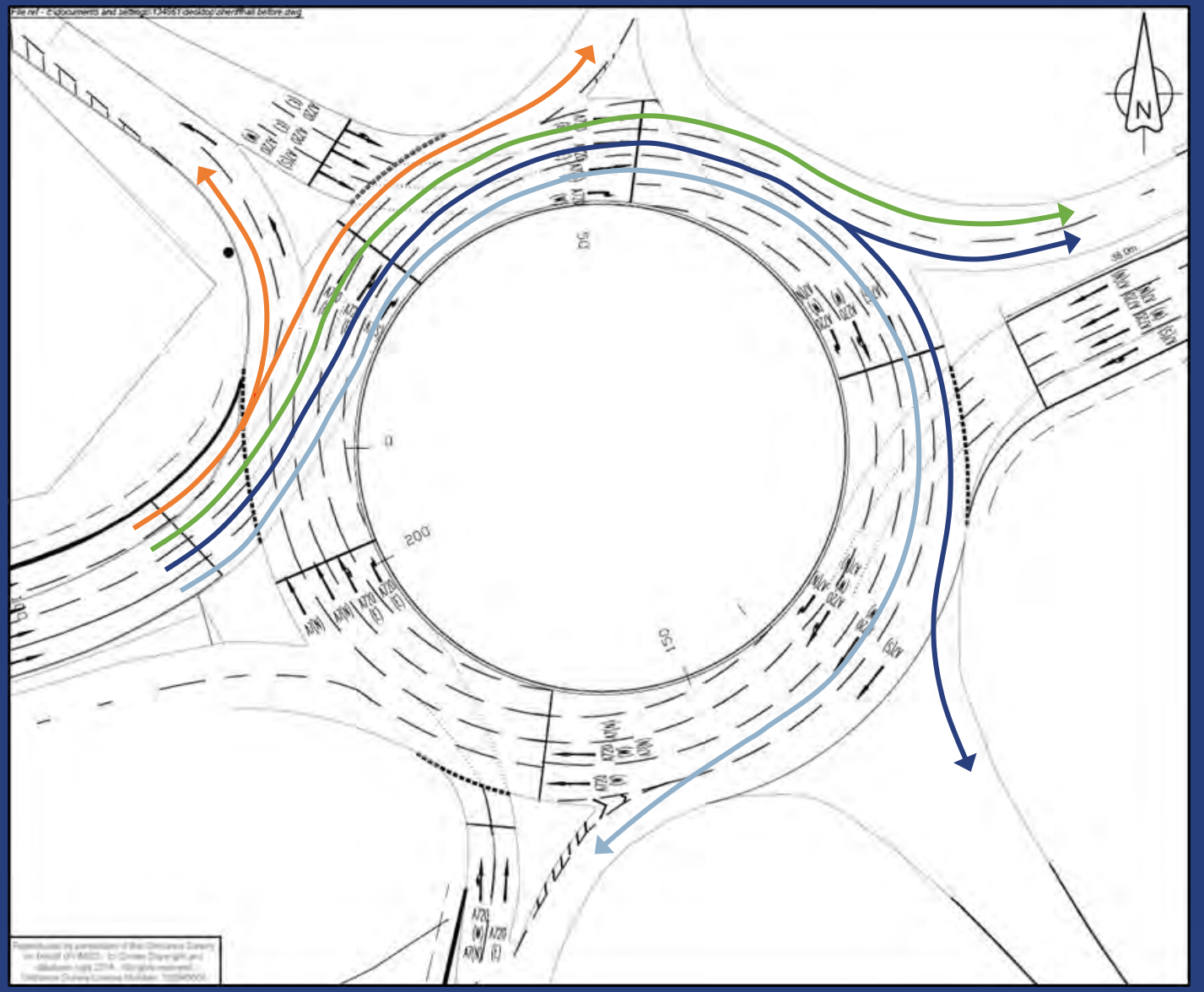
To identify and quantify the changes to driver behaviour, with a specific emphasis on safety, that result from the installation of active road studs when compared with conventional road marking technologies.

Case study location

Spiral markings layout



Theoretical vehicle paths

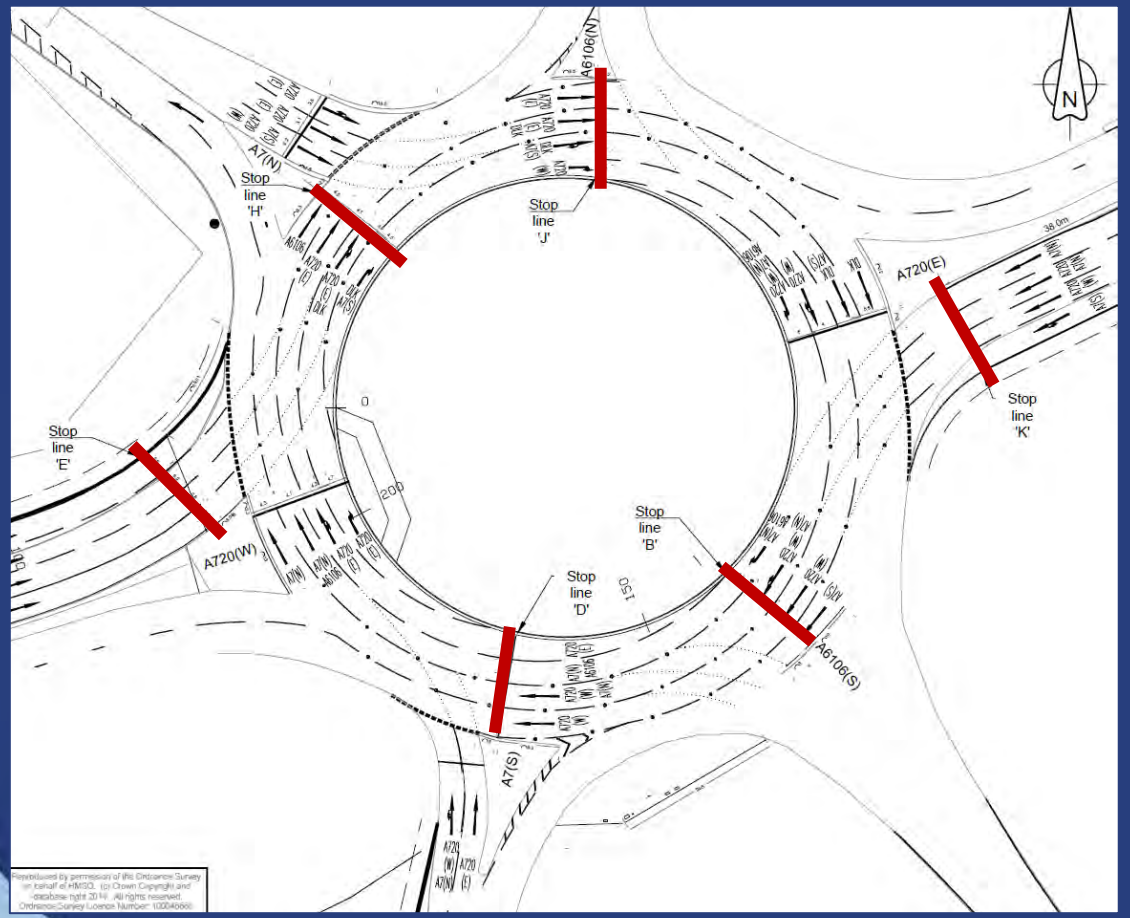


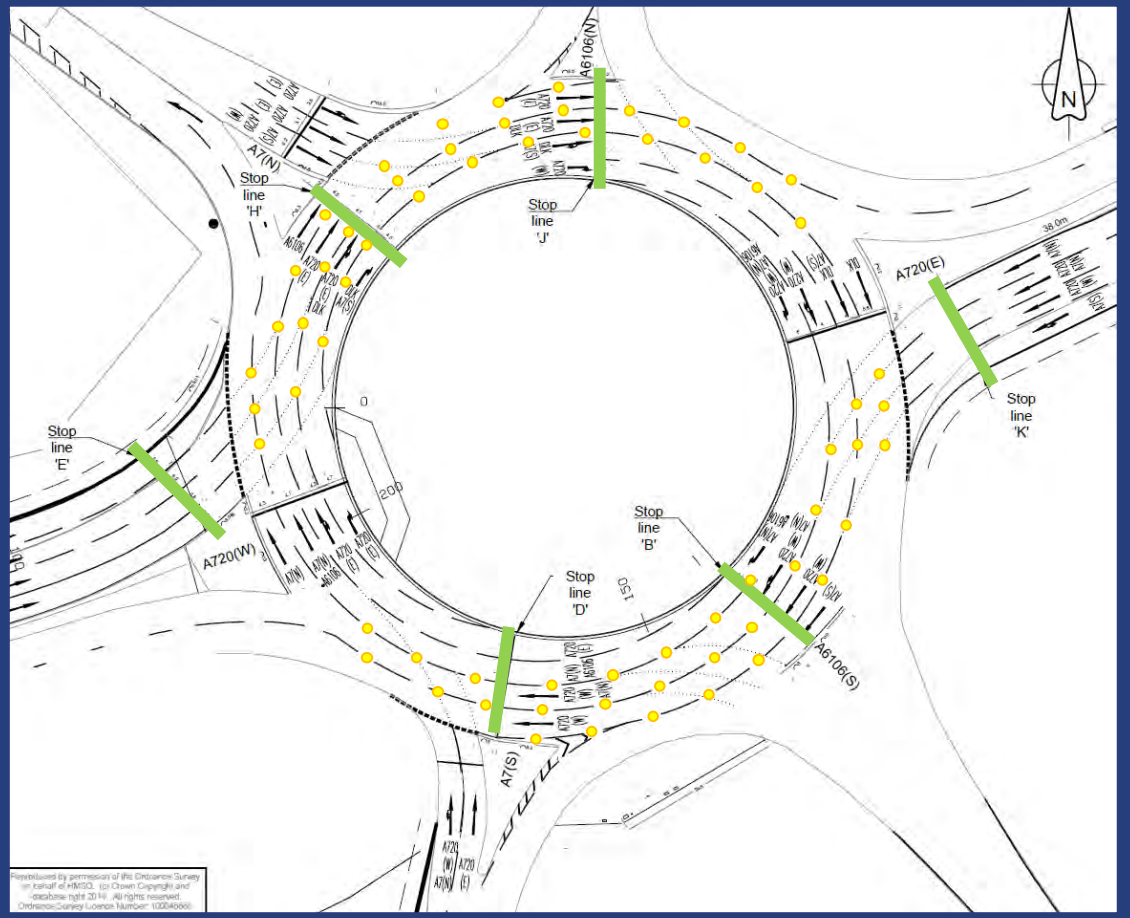
Entry on Approach

Lane 1 →
Lane 2 →
Lane 3 →
Lane 4 →

Collision issues

Method of operation (simplified)



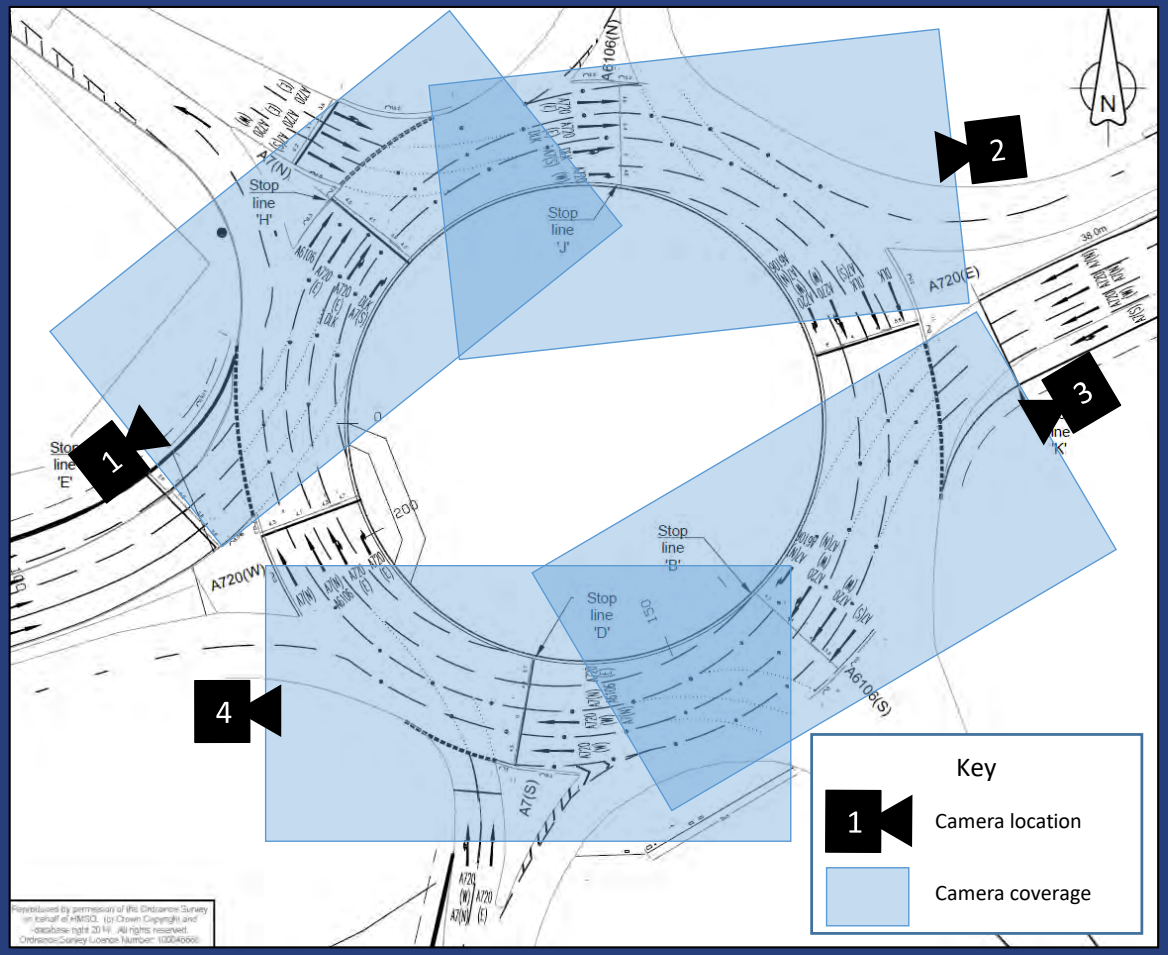


Stud layout at night

Research Method

Video survey

- Four high mast video cameras
- Weather, lighting and traffic controlled for
- Three survey scenarios:
  - Before
  - After
  - Two years after



Manual video transcribing

- Used Datavyu
- Custom video control / enumerating keypads
- Data gathered:
  - Traffic (by lane / type)
  - Traffic signal status
  - TTC / CS values
  - Lane changes
  - Other incidents

Results

Conflict examples

Consequences of a collision – serious/non-serious?

Lane change and conflict rate changes – Zone 1 (Entry Zone)

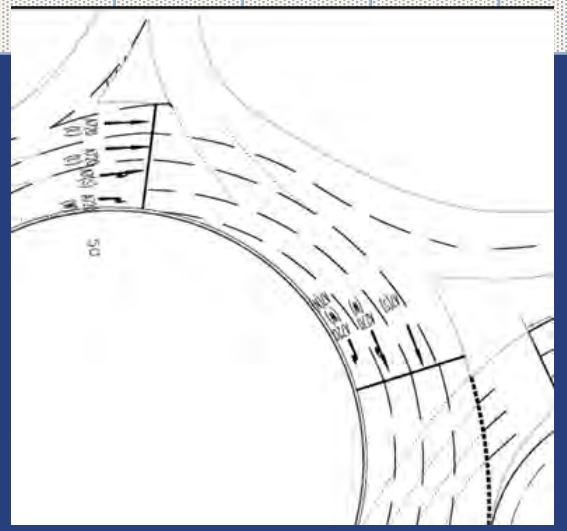
		Before			After			Rate change (abs.)			z			p		
Surface	**Variable**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**
Dry	**NCLC ***	41	21	**62**	31	15	**46**	-0.18%	-0.14%	**-0.16%**	-1.17	-1.17	**-1.68**	0.20	0.20	**0.10**
	Conflict	22	16	**38**	7	9	**16**	-0.27%	-0.15%	**-0.21%**	-2.78	-1.54	**-3.09**	0.01	0.12	**<0.01**
	Flow (n)	5555	5042	**10597**	5539	5335	**10874**									
Wet	**NCLC ***	30	27	**57**	48	26	**74**	0.94%	-0.56%	**0.15%**	4.07	-2.65	**0.99**	<0.01	0.01	**0.24**
	Conflict	30	13	**43**	4	7	**11**	-0.50%	-0.38%	**-0.46%**	-3.28	-2.95	**-4.69**	<0.01	0.01	**<0.01**
	Flow (n)	4745	2453	**7198**	3052	4806	**7858**									

* Non-Conflicting Lane Change

Lane change and conflict rate changes – Zone 2 (Exit Zone)

		Before			After			Rate change (abs.)			z			p		
Surface	**Variable**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**	**Dark**	**Light**	**All**
Dry	**NCLC ***	88	123	**211**	29	28	**57**	-0.66%	-1.16%	**-0.90%**	-5.10	-7.31	**-8.86**	<0.01	<0.01	**<0.01**
	Conflict	19	49	**68**	9	15	**24**	-0.11%	-0.41%	**-0.25%**	-1.71	-3.96	**-4.25**	0.09	<0.01	**<0.01**
	Flow (n)	8624	8032	**16656**	8040	7453	**15493**									
Wet	**NCLC ***	127	63	**190**	38	82	**42**	-0.44%	0.06%	**-0.43%**	-3.37	0.44	**-5.25**	<0.01	0.36	**<0.00**
	Conflict	36	6	**42**	2	13	**15**	-0.18%	0.04%	**-0.08%**	-2.81	0.71	**-1.92**	<0.01	0.31	**0.06**
	Flow (n)	6618	3331	**9949**	4022	6055	**10077**									

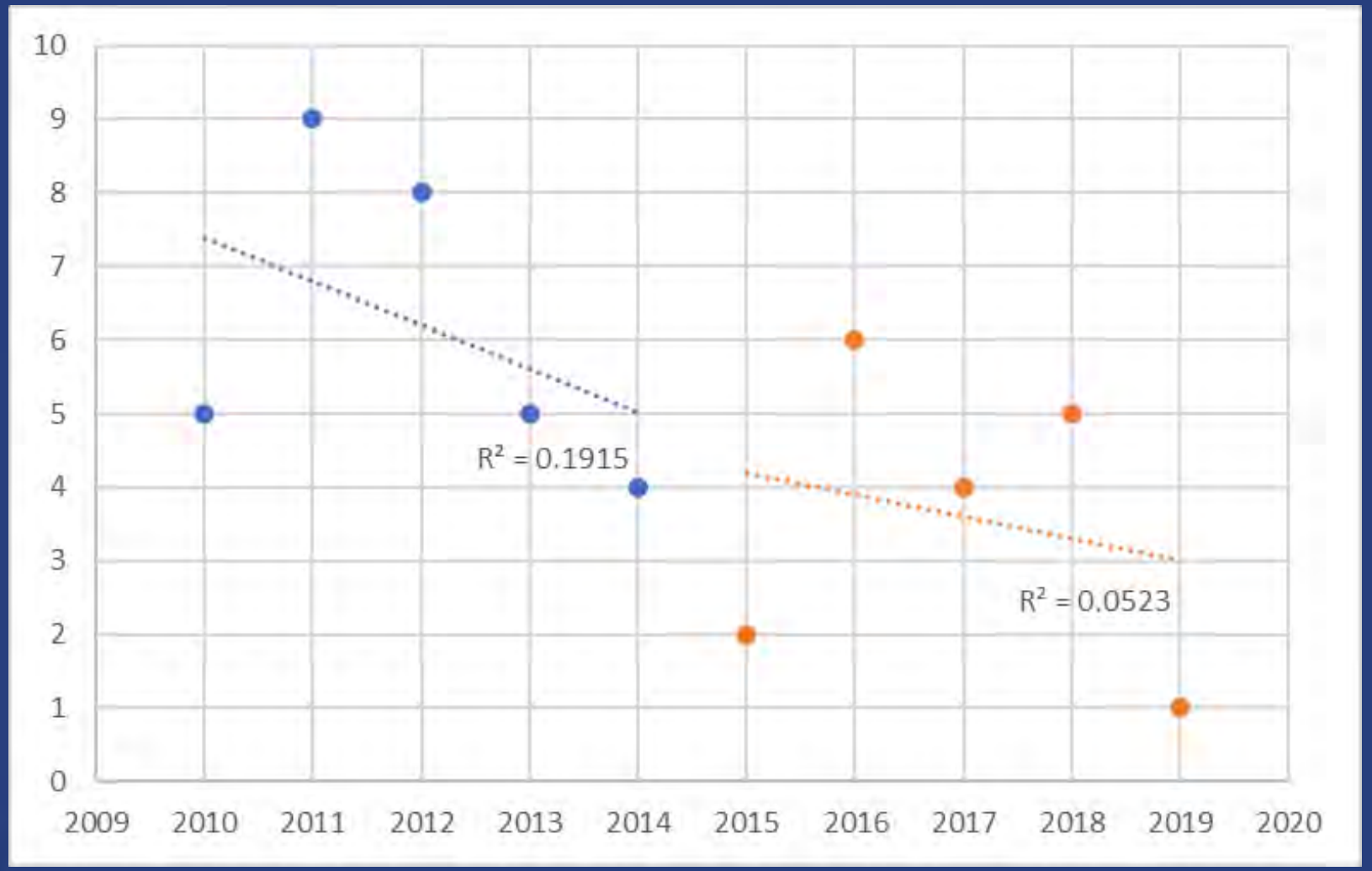
* Non-Conflicting Lane Change



Casualty changes - Absolute

Year	Fatal	Serious	Very Serious	Moderate	Less Serious	Slight	TOTAL
Before Installation							
2010	0	0	0	0	0	5	**5**
2011	0	0	0	0	0	9	**9**
2012	0	0	0	0	0	8	**8**
2013	0	0	0	0	0	5	**5**
2014	0	0	0	0	0	4	**4**
TOTAL	**0**	**0**	**0**	**0**	**0**	**31**	**31**
After Installation							
2015	0	1	0	0	0	1	**2**
2016	0	1	0	0	0	5	**6**
2017	0	0	0	0	0	4	**4**
2018	0	0	0	0	0	5	**5**
2019	0	0	0	0	0	1	**1**
TOTAL	**0**	**2**	**0**	**0**	**0**	**16**	**18**

Casualty changes – Five year trend



Conclusions

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- Reduction in entry and exit zone conflicts in all light and surface conditions associated with stud implementation
- Reduction in non-conflicting lane changes on roundabout exit associated with stud implementation
- Trend in reduction in casualties continues after stud installation
- Casualty reduction causation unclear – further data/research needed

Thank you

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