INDOT/JTRP FY-2018 Strategic Research Plan

# Research Needs Statement (RNS):

## RNS Title: Performance of Right-turn lanes, behind large traffic islands

## Focus Group:

## Traffic, Mobility and Safety (TMS)

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## Background & Problem Statement:

Intersection-related crashes are one of the main contributions in total crashes. In 2014, intersection-related crashes contributed for 47% and 28% of all crashes and fatal crashes in the US, as reported by the National Highway Traffic Safety Administration (NHTSA). Within Indiana, they contributed for 33 % of total crashed and 28% of fatal crashes (INDOT 2014). In addition, the Federal Highway Administration (FHWA) estimated the economic and societal costs of intersection-related crashes were close to $50 billion annually (FHWA 2015).

Despite the numbers of intersection-related crashes slightly reduce yearly, they still considerably impact on society. Therefore, practical engineers and researchers have been looking for alternative ways to improve the safety and operations at intersections. Researches are commonly focused on examining the relationships of the intersections’ geometry designs and types of crashes. One of recent concerns is about the right-turn lanes which include right-turn lanes with a pavement marking and channelized right-turn lanes.

Numerous districts have discovered that large yield controlled, channelized right-turn lanes often have high crash rates.  The problem appears to be that driver expectancy varies between the vehicles that yield, and those following.   Also, the driver yielding must turn to check oncoming traffic almost 180 degrees behind them.  Additionally, it has been discovered that right-turn lanes may actually be contributing to higher crash rates due to blocking visibility of approaching vehicles in the adjacent through lanes. Therefore, to figure out certain design configurations which are associated with higher crash rates, there is a need of evaluations of right-turn lanes design, especially for channelized-right turn lanes.

Some states have conducted experiments to solve this problem. For example, Illinoi Department of Transportation has been implemented a modifications to the right-turn lanes approaches to improve the line of sight of the right-turning passenger vehicles in the Peoria area. The analysis of data of three years before (i.e. 2003) and three years after (i.e. 2016) the modification of right-turn lane designs provide insights of safety impacts. As such, the results reveal a statistically significantly reduction for both younger and older driver right-turn crashes at 66% and 70%, respectively. In addition, this experiments provide a set of modification factors for the right-turn lane designs which are a good reference to extend the experiment to other areas.

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| **Figure 1** |

Within Indian, there are multiple intersections which have high crash rates. Figure 1 is an example located on SR-43 at the northbound I-65 off ramp, in Tippecanoe County. This intersection had 66 WB to NB Right Turn Rear End crashes in a 3-year period (7/1/2012 to 6/30/2015).

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| **Figure 2** |

Figure 2 is an example located at the eastern intersection of US-40 with SR-267/Quaker Blvd, in the Town of Plainfield. It includes an EB right turn lane to SB SR-267/Quaker Blvd. There were 17 NB to EB Right Turn Rear End crashes in a 3-year period from 2013-2015, and there were 10 EB to SB Right Turn Rear End crashes in a 3-year period from 2013-2015.

Functionally, right-turn lanes provide distance for lower speed and space for storage vehicles. They are generally used in the situations where there are moderate to high level of through traffic flows to eliminate conflict points and potential crashes. Depends on the traffic control methods and design elements used, right-turn lanes can be designed in different forms. However, each form has its own advantages and disadvantages. Constructing appropriate right-turn lanes will improve traffic safety, increase travel speed, reduce delay, and reduce congestion. However, there are various factors influence on the decision on whether right-turn lanes should be used, and if yes, which right-turn lane design should designers follow. Currently, the INDOT does not have guidelines to use for alternative turn-right lane designs. This is critical to have guidelines for designers so they can quickly narrow down options for consideration. A tool is needed to utilize at high crash intersections to improve safety.

The objective of the proposed research project is to develop guidelines to use for alternative intersection designs, and to also improve safety. The guidelines is suggested based on the combination of performance measures obtained from the analysis.

**Proposed Scope of Work**:

This study is divided into three tasks. Task 1 primarily focuses on synthesis of existing body of knowledge and best practice about right-turn lane. Based on the findings in Task 1, a report will be submitted to INDOT. A presentation will be given and input will be taken from the SAC on finalizing study roads for the next tasks. Data will be collected from the study roads and analyzed in Task 2 and Task 3.

**Task 1: Studying Literature and best Practice.**

The existing literature on free flowing right-turn lanes and islands will be studied. Best practices will be gathered from other States, and local governments.

**Task 2: Selecting study roads.**

The focus of this study is on all situations with existing large yield controlled traffic islands. Study locations will be at interstate ramps, local, and State road intersections. Medium to high volume intersections will be investigated.

**Task 3: Statistical analysis.**

We will utilize some statistical models to validate recommendations. In the models, the factors, which are generally considered by designers for the right-turn lane designs, will be examined. Then, the set of variables which are related to the safety performance will be identified. Based on the developed quantitative safety effectiveness measures, a guidelines for installation design improvements involving alternative right-turn lane designs will be developed.

Implementation Potential:

The deliveries for this project are:

(1) *A list of right-turn lane design alternatives*. A list of right turn lane design alternatives and key factors will be provided. The key factors help to select which right-turn lane should be used.

(2) *Guidelines that will serve as a tool to utilize at high crash intersections*. Decision making over multidimensional and complex systems can be difficult. This guidelines facilitate the process by collecting the right performance measures, analyzing them internally, and summarizing a set of alternatives that guide INDOT's decisions on selection of right-turn lane designs. A hardcopy with clear guidance will be provided.

Implementation Impact on Priority Areas: (select the primary priority area implementation of this project will impact)

***Describe the expected benefits of the research results in the following table and rank\*order the benefits in order of importance (with 1 being the most important).***

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| --- | --- | --- | --- |
| **Rank** | **BENEFITS** | | **DESCRIPTION OF BENEFIT** |
| **1** | **Cost Savings (avoidance and revenue enhancement)** | | |
|  | *(such as: construction costs, material costs, early project completion, in-house labor and equipment costs, improve design to avoid over design, permit fees, direct revenues, etc.)* |  |
| **2** | **Safety** | | |
| **1** | *(such as: crash mitigation, reducing truck and vehicles conflicts, reducing INDOT’s tort exposure, etc.)* | Reduction in crashes, and meeting driver expectancy. |
| **3** | **Mobility/Reduced Congestion** | | |
|  | *(such as: travel time reliability, customer satisfaction in travel times, congestion relieve, ride quality, maintaining speed limit in construction zones, etc.)* |  |
| **4** | **Quality** | | |
| **2** | *(such as: improved processes/procedures, asset preservation, improved design, updated specifications, extends the life of infrastructure, etc.)* | Future intersection designs will be improved. |
| **0** | **Time Savings** | | |
|  | *(such as: improve construction scheduling, early project completion, quicker maintenance or rehabilitation, etc.)* |  |
| **0** | **Other (other tangible and intangible benefits)** | | |
|  | *(such as: employee development/training, economic development, proof of concept, etc.)* |  |

***\* If there is no benefit in a particular category rank that category as 0.***

**Estimated Cost Table**

***Proposed Project Period: y months***

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| --- | --- | --- | --- | --- |
| **Estimated Level of Effort**  **(JTRP Office will coordinate with Pre-award for $ estimates based on Person-Month effort)** | | | | |
|  | Y1 | Y2 | Y3 | Total |
| Person-Months of Faculty Effort |  |  |  |  |
| Person-Months of Staff Time |  |  |  |  |
| Person-Months of Grad Student (@ 50% FTE) |  |  |  |  |
| Hours of Undergraduate time |  |  |  |  |
| **Other Estimated Direct Costs** | | | | |
| Travel |  |  |  |  |
| Supplies |  |  |  |  |
| Capital |  |  |  |  |
| Other (Specify) |  |  |  |  |

**Total Estimated Costs: $**

**Review Comments**

**References**

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