The Idaho Stop Law and the Severity of Bicycle Crashes: A Comparative Study

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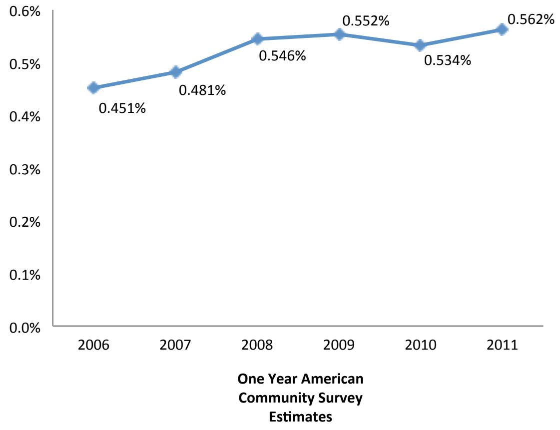
Abstract:

Cycling as a form of transportation has become increasing popular, as bicycle mode share nationwide steadily increases. Given this shift in travel, having a quality understanding of bicycle crashes, causes, and the relevant traffic regulations is crucial for planners, engineers, and public health officials. This paper analyzes one of the nation's most unique traffic laws, Idaho Statute § 49-720, or colloquially known as the Idaho Stop Law. This law permits cyclists to yield at stop signs and treat red traffic signals as conventional stop sign controlled intersections. The question asked is there any difference in bicycle crash severity between Boise, Idaho, and Champaign/Urbana, Illinois. Findings indicate there is a statistically significant difference in crash severity between the study areas, specifically at traffic signal controlled intersections.

1.1 Introduction

Cycling as a form of transportation has become increasing popular, as more and more people nationwide choose to travel by bicycle. Nationally, the United States has seen modest but steady increases in bicycling mode share. Figure 1 depicts this increase from 2006 to 2011 of .1% or approximately 154,000 new commuters. While this is a small increase nationally some communities such as Portland, Oregon and Minneapolis, Minnesota have seen impactful growth rates of two and one percent respectively (US Census 2006-2011). The nation is experiencing a significant mode shift to bicycle travel.

Figure 1
Unitied States National Cycling Mode Share (US Census 2006-2011)



Given this dynamic shift in travel, having a quality understanding of bicycle crashes, causes, and the relevant traffic regulations is crucial for planners, engineers, and public health officials alike. The focus of this paper is to analyze one of the nation's most unique traffic laws, Idaho Statute § 49-720, or colloquially known as the Idaho Stop Law. This law, established in its current form in 1988, allows cyclists to yield at stop signs instead of coming to a complete stop. Additionally they may treat red traffic signals as stop signs, crossing on a red signal so long as they deem the crossing safe (Id. Statues § 49-720, 1988). The Idaho Stop Law is unlike any other bicycling regulation in the country. The focus of this paper is to ascertain if there is any difference in bicycle crash severity between Boise, Idaho, which enforces Idaho Statute § 49-720 and Champaign/Urbana, Illinois, an area that enforces conventional traffic procedures.

2.1 Background

To understand the analysis that is to follow, it is important to understand how bicycle crash severity is judged, the exact nature of Idaho Statue § 49-720, and what existing knowledge regarding bicycle crash severity exists.

2.2 Injury Severity

Both Idaho and Illinois use the same injury classification system set out by the National Highway Transportation Safety Administration (NHTSA, 2008). This system is classified by fatal crashes and three levels of non-fatal injury: incapacitating injury, non-incapacitating injury, and possible injury. Finally, each state records crashes when no injury occurred but substantial property damage was generated. Idaho considers a property damage crash to have occurred when damage is over $750, while Illinois sets the limit at $500. (ITD, 2012 and IDOT, 2012). Injury severity is judged by the police officer at the scene and a specific definition is provided to ensure the most accurate classification. Figure 2 presents the actual language used to ascertain crash severity. The NHTSA has set up the State Data System, allow states to report their crash statics in order accumulate a national database of all crashes occurring within the United States (NHTSA, 2008). The injury severity classification codes used to compare Idaho bicycle crash data to Illinois are believed to be sufficiently standard and comparable. For the purposes of this study, a short hand system will be used to describe each level of crash severity. The shorthand system is depicted in Figure 3.

Figure 2
Injury Classification System
(Idaho Traffic Crashes 2011)

Fatal Injury (Death) - Any injury that results in the death of a person within 30 days of the crash in which the injury was sustained.

Serious Injury - (Incapacitating Injury) Any injury, other than a fatal injury, which prevents the injured person from walking, driving, or normally continuing the activities the person was capable of performing before the injury occurred.

Visible Injury - (Non-incapacitating, Evident Injury) Any injury, other than a fatal injury or incapacitating injury, which is evident to observers at the scene of the crash in which the injury occurred.

Possible Injury - Any injury reported or claimed which is not a fatal injury, incapacitating injury, or non-incapacitating, evident injury.

Figure 3
Injury Short Hand
Used in this Report

Fatal - Fatal Injury

Type A - Serious Injury

Type B - Visible Injury

Type C - Visible Injury

Property Damage - Property Damage

2.3 Idaho Statue § 49-720

The Idaho Stop Law, Id. Statute § 49-720 was originally established in 1982 as part of a larger update to the state's traffic code. Carl Bianchi, the Administrative Director of the Courts in Idaho at the time, spearheaded the inclusion of this language. Being an avid cyclist and holding the position of Administrative Director, Bianchi was accustomed to magistrates across Idaho voicing their frustration with having to hear so many cases regarding cyclists failing to put one foot down when crossing controlled intersections. These citations were becoming a nuisance in Bianchi's opinion and he implemented the change in bicycle regulation ,along with the overhaul of Idaho's traffic code. The law in its basic form has remained the same, save one minor adjustment in 1988 to remove the bicycle safety programs that were initially implemented with the legislation (Bernardi, 2009). The exact language of Id. Statute § 49-720 is available in the Appendix.

2.4 Existing Literature

Currently, the existing literature directly comparing the Idaho Stop Law to conventional bicycle traffic regulation does not exist. While research has been undertaken at the University of California at Berkeley in 2008, no such data or analysis has been published or made available at this time (Meggs, 2013). Given this lack of knowledge directly analyzing the nature of this unique law, looking at the ancillary research regarding general crash severity and frequency is required.

The nature of the bicycle facilities provided is one of the most important factors when considering safety for cyclists. In a review of data spanning 23 separate studies in both North American and Europe, Reyonals et al., indicated that sidewalks and multi-use trails are more hazardous than on-street facilities (2009). Of note, intersections were deemed to be the most likely instance for crashes to occur (2009). This was also found to be the case in the work done by Hunter et al. (Klop and Khattak 1999), when 3,000 bicycle crashes spanning six states were analyzed. Approximately three-fourths of all crashes occurred at intersections ,with 18 percent of all crashes being fatal. The severity of crashes at intersections was also successfully modeled by the work of Wang and Nihan (2009). Sidewalks, multi-use trails, and on street intersections account for a large amount of bicycle crashes, and some of the most severe. Finally, it has been shown that lower risks to cyclists exist on streets with bike-specific infrastructure, such as bike lanes and protected cycle tracks, and where speeds and traffic volumes are lowest (Teschke et al. 2012, SWOV 2010 Ewing and Dumbaugh 2009).

Another important yet surprising factor in bicycle safety is the observed concept of "safety in numbers." As bicycle mode share rises and more bicycles are found on the road, driver awareness and recognition of cyclists is believed to increase, thereby decreasing the severity and likelihood of bicycle and motor vehicle crashes (Jacobson, 2003). This concept was first noted by Jacobson in 2003 and then further corroborated by Marshall and Garrick when they analyzed 24 different California cities over 11 years for pedestrian, bicycle, and motor vehicle crashes. Their work focused on what effect bicycling mode share had on the level of crashes and severity of crashes for all road users when road network construction was taken into account. There findings showed that the most important factor in reducing crashes was the number of cyclists on the road. The level of bicycling mode share showed a correlation to reduced fatal or severe crashes for all road users, suggesting that as bicycling rates rise, safety increase, which they contend will increase bicycling rates in a reciprocal cycle (Marshall and Garrick, 2011). These findings are very interesting, suggesting the potential of greater safety for all road users if cycling mode share increases.

Lastly, there is a severe lack of ridership information available upon which to make complete judgments of safety. When total numbers of bicycle miles traveled are not available, it is difficult to know to what degree crashes occur and therefore difficult to know the overall level of safety for this mode of travel. Klop and Khattak note that to know how safe cycling is, you must know not only how many people are injured, but also how many people are uninjured (1999). Many cities have just begun gathering this data, and until this data exists, the true level of bicycle safety will remain unclear.

3.1 Data Sources

Crash data was gathered for Boise, Idaho and Champaign/Urbana, Illinois by requests made to the Idaho Transportation Department's Office of Highway Safety and the Illinois Department of Transportation's Division of Traffic Safety. Crashes involving only pedalcylces were selected for the years 2007 to 2011. From this group, only crashes in which neither party was intoxicated were examined. Crashes involving drugs or alcohol were deemed unrepresentative of the stated hypothesis. Examining data involving intoxicated operators would not be examining what effect the uniqueness of Idaho's bicycle laws have compared to more traditional regulations, as travelers under the influence are not generally responsive to the legal requirements of the road. After these adjustments were made, sample sizes were established as 258 crashes within the combined Champaign and Urbana city limits and 637 crashes within the Boise city limits. The total crashes and the total number of crashes at intersections is depicted in Figure 4.

Data was selected for these two study areas as they both were deemed to be similar in cycling mode share and road network. Cycling mode share for Boise was 3.9 percent and Champaign/Urbana possessed a 3.65 percent share. Note that these mode shares are based only on workers surveyed who were over 16 years of age from 2007 to 2011 who reported bicycling as their main mode of travel to work (US Census, 2011). Cycling mode share is shown in Table 1 on the following page. Cycling by younger people and those not making work trips is not represented in the mode share but is likely represented in the crash data and a significant source of ridership. These types of cyclists are not considered in this study due to a lack of overall ridership data.

The other factor used in selecting these two study areas was the nature of the street network. It has been shown that the construction of the street network, i.e., cul-de-sac-based systems vs. grid networks, plays a substantial role in

Figure 4
Crashes by Study Area
2007 to 2011
(Idaho DOT, 2012, Illinois DOT, 2012)

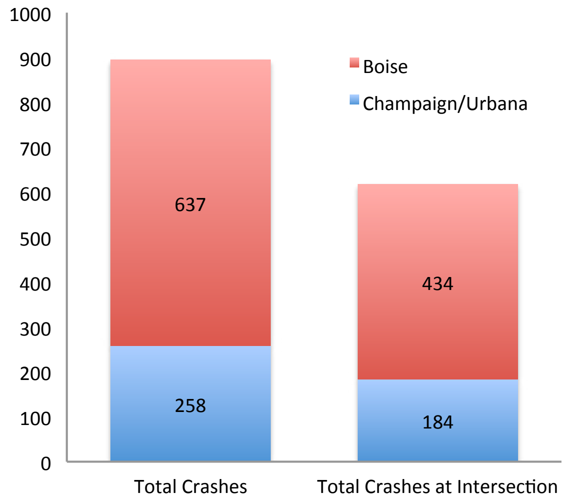


Table 1. Cycling Mode Share and Other Study Area Characteristics

	Boise	Champaign	Urbana	Champaign/Urbana
2011 Population	210,145	81,291	41,518	122,809
Land area (square/miles)	79.36	22.43	11.65	34.08
Persons Per square/mile	2,648	3,624	3,564	3,604
Workers 16 and Over	105,741	39,077	18,798	57,875
Bicycle Mode Share (Based on Share of Workers 16 and over)	3.90%	3.00%	5.00%	3.65%

Source: US Census 2007 to 2011 American Community Survey (2011)

determining the severity of bicycle crashes (Marshall and Garrick, 2011). Both study areas' road networks are grid based systems. This judgment is based on analysis of aerial imagery (Google Earth, 2013). This is a limitation in the analysis; no formal system is used to quantify grid network construction. Future analysis, especially when dealing with more than two cities, would be aided by knowledge of the density of intersections within the study area.

Population differs between Boise and Champaign/Urbana by approximately a two-to-one ratio (see Table 1). While this is not an ideal situation, the aforementioned similarities of road network construction and mode share were deemed to be more important variables. This is especially true when only the ratios of crash severity are considered within the two study areas and not the absolute levels of crash data.

Lastly, while Champaign and Urbana are two different cities, they are contiguous and very similar in character, and they have been analyzed as one unit so as to better compare to the construction and scale of Boise, Idaho. Similarly sized single cities in Illinois did not have similar road networks or cycling mode shares. The Champaign/Urbana study area possesses both of these qualities and is believed to be the best comparable unit to Boise, Idaho.

3.2 Data Limitations

Primary data gathering in both study areas is conducted by the police officer at the scene of the crash (ITD, 2012 and IDOT, 2012). Thus, the only data available is that which has been reported. It is very common for such data to under represent the actual crashes occurring, as most bicycle crashes go unreported (Poulous et al. 2011, Dougherty et al. 2000). The data gathered is in accordance with each state's Vehicle Collision Report ((ITD, 2012 and IDOT, 2012). Unfortunately, many areas of these two reporting systems are different. While both systems record the crash, vehicle, and person specifics, they do so in varying ways with different classification indicators. For instance, weather is listed as a possible cause for a crash in Illinois but not in Idaho. Further, whole sections of the two states' reporting systems can differ. Idaho does not collect information about the type of clothing, or visual indicators used by the cyclist involved in the crash, but Illinois does.

Beyond the differences present in collecting data, both forms allow for ambiguity in data collection and judgment of the reporting officer. Both reports allow for two contributing causes to be indicated and it is often not clear what it is that the officer believes caused the crash. For example, when inattention and vision obstruction are both listed, it is not clear which led to the crash, both are plausible. Further, some indicators were vague and more specific causal codes could have been provided. A failure to yield could also be considered inattention, an improper turn, or disregarding a traffic signal. For these reasons, the indicator of contributing causes recorded by the reporting officer in each state was not used in the analysis. This piece of data would be very valuable when attempting to analyze crash severity. To properly understand and use data, the aggregation of information from the direct police reports should be undertaken by the researcher and not the state's department of transportation (DOT). The data released by both DOTs has already been processed, and important facts were omitted. Available on the original reports is a written summary describing the crash in detail. This data was not used in this analysis, as the expense per copy was prohibitively expensive given the number of reports to review.

3.3 The Data Used

The data used were only fields that were clearly standard across both states' on-scene reporting systems. Road conditions, weather, traffic control devices at intersections, location of crashes by midblock or intersection, time of day, day of the week, and severity of crashes were the only data found to be comparable. Importantly, severity of crashes was recorded in almost the exact same fashion. Both Idaho and Illinois use the same scaling of crashes as described in Figure 2, the only significant difference is that property damage is only recorded in Idaho if the damage exceeds $750 whereas Illinois records when the damage exceeds $500 (IDT, 2012 and IDOT, 2012). This difference of $250 in reporting is assumed to not greatly effect the data comparability. Thus the severity of crashes is view to be directly comparable.

The judgment of crash severity is made by the reporting officer, and both states train officers to make this judgment under the same system, the judgments of the officers in both states are believed to be consistent.

4.1 Data Analysis Methodology

The aim of this analysis was to discern if any difference in crash severity was present between the two study areas. Thus, the absolute number of crashes occurring between the two cities was not considered. The ratio of crash severity between the two cities was the focus of this investigation. A null hypothesis was established stating that there would be no significant difference in the proportion of crash severity between the two study areas.

The proportion of crashes found in each level of crash severity from Fatal to Property Damage Only, was compared between the two cities. Beyond this comparison, crashes were considered from specific groups within the data. Investigation was conducted by comparing the differences in proportions for each level of severity for several different groupings of crashes: all crashes, crashes at midblock, crashes at intersections, crashes at controlled intersections, crashes with traffic signals controlling, and crashes with stop signs controlling. These proportions were estimated for statistically significant differences between both cities and within the cities themselves. Possible association between groups was investigated in order to establish an association within the data that provided a 95 percent confidence interval, that the differences between the study areas were statistically significant and likely not a result of chance.

A z-test for differences in two proportions was used with an alpha equal to .05. Figure 5 on the next page demonstrates the z-test applied. This test was selected, as the data provided is categorical in nature. More standard forms of regression could not be used due to a lack in

Figure 5. Testing for the Difference Between Two Proportions Z-Test

$$z = \frac{(\hat{p}_1 - \hat{p}_2)}{\sqrt{\hat{p}(1-\hat{p})}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$\alpha = 0.05$$

$$P(Z \leq z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{\frac{-u^2}{2}} du$$

continuous numerical data. Crash severity is difficult to quantify in this numerical manner. The equation used is demonstrated above in Figure 5. For any group or subgroup of crashes compared, only sample sizes of five or greater were used. If a subgroup did not have greater than or equal to five crashes, the resultant p-value was considered invalid and not considered.

A resultant p-value lower than .05 indicated a significant association between the proportions being compared. This finding would act to invalidate the null hypothesis, that the two proportions represented in the data are statistically the same, or more precisely that 95 percent of samples would return the true population parameter. Receiving a p-value less than .05 indicates that the difference found between our two samples is significant and not likely due to chance. It establishes an association between the two groups. This does not indicate to what magnitude or the exact nature of the association, only that an association is present. Inferences upon that association are made via the frequencies present in the data and based upon the current knowledge base available.

4.2 Limitations

This method is not without limitations. Lurking variables may be coloring the nature of each grouping, thus the two proportions being analyzed may not be the key proportions that describe the relationship between crashes and the legislation that attempts to prevent them. Some other variable not known or provided in the data may be more important. An association between two proportions can be correctly established, but this does not prove causation, or even correlation, between the groups.

Further, only two study areas are used in this investigation. These study areas are both large urban areas with different people and situations particular to themselves; there are many variables present that cannot be controlled for or have not been analyzed. This method would be greatly served by comparisons between other cities within Idaho and the nation.

Finally, this method would be improved if more directly comparable variables could be considered within both Boise and Champaign/Urbana, but as mentioned previously the nature of the primary data collection and secondary aggregation prevents this.

5.1 Results

The null hypothesis that there would be no difference in severity of bicycle crashes between Boise, Idaho and Champaign/Urbana, Illinois was invalidated only within certain levels of crash severity and within certain subgroups of crashes.

A statistically significant difference in proportions of crashes classified by severity was found between the two study areas for all crashes and for certain subgroups of crashes. Interestingly, these differences are found only with intersections that possess traffic signals but not stop signs. The comparisons are made in two distinct ways across the five levels of crash severity. Comparisons are made between Boise and Champaign/Urbana and also within each study area by the classification of crash, i.e. intersection versus midblock or controlled e.g. intersection versus uncontrolled intersection. This later comparison was made to see if either study area possessed an especially different level of severity within it, thus dramatically impacting the comparisons made between study areas. These results can be found on the following pages in Tables 2 and 3. Proportions marked in blue represent proportions whose sample sizes was less than five and thus resultant p-values could not be considered. Proportions marked in red possess p-values less than .05 and are thus deemed significant. The frequencies that correspond are also marked in red for reader convenience.

5.2 Results comparing Boise and Champaign/Urbana

The null hypothesis that there were no significant differences between crash severity proportions between study areas was invalidated within severity types B, C, and Property Damage when all crashes were considered (Table 2). When only intersection related crashes were considered, there was a significant difference only within Types B and C. At midblock, only Type 2 crashes proved significantly different. Drilling further down into subgroupings, only crashes occurring at traffic signals showed significant differences between study areas. These differences were only for crash Types B and C. This finding is important, as no significant differences were found between stop sign controlled intersections and all intersections or between controlled intersections of all kinds versus uncontrolled intersections. Frequency difference is also very large, with Champaign/Urbana having 21 percent of crashes classified Type C and 60 percent Type B, while Boise showed a more balanced 41 percent for Type C and 44 percent for Type B. Figures 8 and 9 depict the difference between stop sign and traffic signal controlled intersections.

Also worthy of note, there was no significant difference in the proportion of crashes at intersections versus midblock, not considering severity between Boise or Champaign/Urbana. Boise did not show a disproportionate amount of intersection related crashes when compared to Champaign/Urbana, suggesting that crashes are not any more likely to occur at the intersection in Boise than they would in Champaign/Urbana under the conventional traffic regulations (see Figure 7.)

No comparison was possible for any fatality related crashes, as total fatalities in both communities were fewer than five the sample

Table 2. Significant Differences in Bicycle Crash Severity Between Champaign/Urbana, Illinois and Boise, Idaho. 2007 - 2011

Proportion of Crashes Being Compared	Comparing Between	Crashes by Severity						Crash Frequency by Severity						P-Values				
		Property Damage	Type C	Type B	Type A	Fatal	Total	Property Damage	Type C	Type B	Type A	Fatal	Total	Property Damage	Type C	Type B	Type A	Fatal
All Crashes	Champaign/Urbana	15	62	140	40	1	258	6%	24%	54%	16%	0%	100%	0.002	0.000	0.010	0.242	0.866
	Boise	12	257	285	80	3	637	2%	40%	45%	13%	0%	100%					
Intersection Crashes	Champaign/Urbana	7	44	104	28	1	184	4%	24%	57%	15%	1%	100%	0.494	0.000	0.003	0.311	0.892
	Boise	12	179	188	53	2	434	3%	41%	43%	12%	0%	100%					
Midblock Crashes	Champaign/Urbana	8	18	36	12	0	74	11%	24%	49%	16%	0%	100%	0.000	0.029	0.898	0.537	0.545
	Boise	0	78	97	27	1	203	0%	38%	48%	13%	0%	100%					
Controlled Intersection Crashes	Champaign/Urbana	4	37	82	23	1	147	3%	25%	56%	16%	1%	100%	0.898	0.001	0.014	0.318	0.465
	Boise	10	162	174	49	1	396	3%	41%	44%	12%	0%	100%					
Traffic Signal Crashes	Champaign/Urbana	2	15	42	11	0	70	3%	21%	60%	16%	0%	100%	0.740	0.003	0.022	0.381	0.581
	Boise	5	94	102	27	1	229	2%	41%	44%	12%	0%	100%					
Stop Sign Crashes	Champaign/Urbana	2	22	40	12	1	77	3%	29%	52%	16%	1%	100%	0.857	0.063	0.182	0.626	0.576
	Boise	5	68	71	22	1	167	3%	41%	43%	13%	1%	101%					

🟥	*Significant difference in proportion exists when p <.05*
🟦	*Invalid test when sample size (n) < 5*

Source: Idaho Department of Transportation (2012), Illinois Department of Transportation (2012)

Figure 6
Crash Severity Proportions for all Crashes Comparing Champaign/Urbana and Boise 2007 to 2011 (Idaho DOT 2012, Illinois DOT 2012)

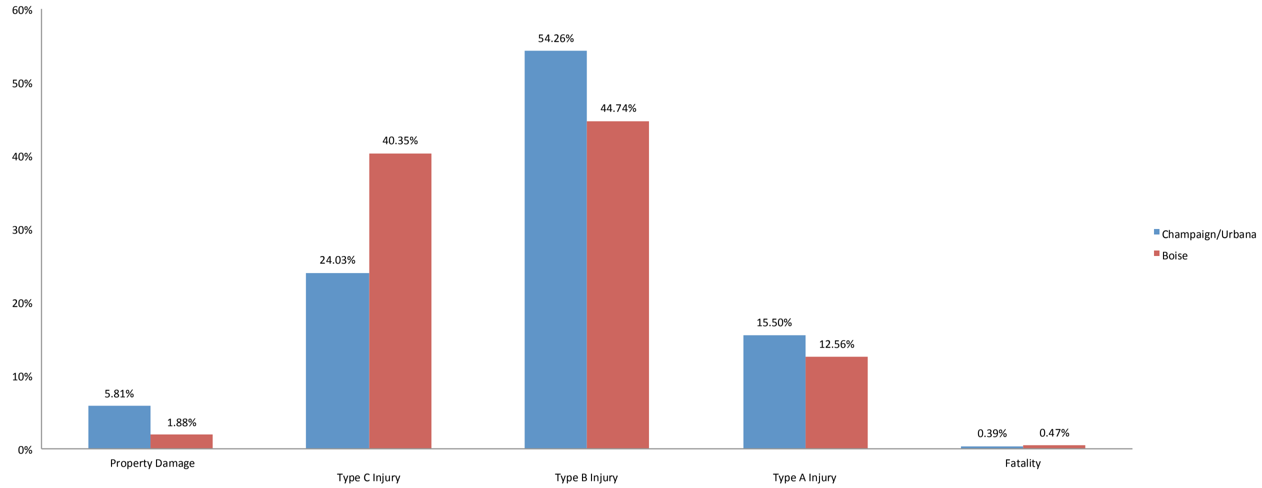


Table 3. Significant Differences in Bicycle Crash Severity Between within Champaign/Urbana Illinois and Boise Idaho. 2007 - 2011

Proportion of Crashes Being Compared	Comparing Between	Crashes by Severity						Crash Frequency by Severity						P-Values				
		Property Damage	Type C	Type B	Type A	Fatal	Total	Property Damage	Type C	Type B	Type A	Fatal	Total	Property Damage	Type C	Type B	Type A	Fatal
Within Champaign/Urbana	Uncontrolled Intersection	3	9	24	5	0	41	7%	22%	59%	12%	0%	100%	0.182	0.738	0.768	0.541	0.591
	Controlled Intersection	4	35	80	23	1	143	3%	24%	56%	16%	1%	100%					
	Midblock	8	18	36	12	0	74	11%	24%	49%	16%	0%	100%	0.030	0.944	0.251	0.841	0.525
	Intersection	7	44	104	28	1	184	4%	24%	57%	15%	1%	100%					
	No Traffic Signal	5	30	63	17	1	116	4%	26%	54%	15%	1%	100%	0.639	0.418	0.429	0.782	0.443
	Traffic Signal	2	14	41	11	0	68	3%	21%	60%	16%	0%	100%					
	No Stop Sign	5	23	65	16	0	109	5%	21%	60%	15%	0%	100%	0.503	0.281	0.305	0.806	0.227
	Stop Sign	2	21	39	12	1	75	3%	28%	52%	16%	1%	100%					
Within Boise	Uncontrolled Intersection	2	33	30	11	1	77	3%	43%	39%	14%	1%	100%	0.921	0.751	0.395	0.540	0.231
	Controlled Intersection	10	146	158	42	1	357	3%	41%	44%	12%	0%	100%					
	Midblock	0	78	97	27	1	203	0%	38%	48%	13%	0%	100%	0.017	0.499	0.291	0.699	0.956
	Intersection	12	179	188	53	2	434	3%	41%	43%	12%	0%	100%					
	No Traffic Signal	7	88	90	28	1	214	3%	41%	42%	13%	0%	100%	0.526	0.959	0.601	0.584	0.984
	Traffic Signal	5	91	98	25	1	220	2%	41%	45%	11%	0%	100%					
	No Stop Sign	7	124	128	36	2	297	2%	42%	43%	12%	1%	100%	0.445	0.752	0.892	0.932	0.336
	Stop Sign	5	55	60	17	0	137	4%	40%	44%	12%	0%	100%					

🟥	*Significant difference in proportion exists when p <.05*
🟦	*Invalid test when sample size (n) < 5*

Source: Idaho Department of Transportation (2012), Illinois Department of Transportation (2012)

Figure 7
Percent Crashes at Intersection
For Study Area Years 2007 - 2011
(Idaho DOT 2012, Illinois DOT 2012)

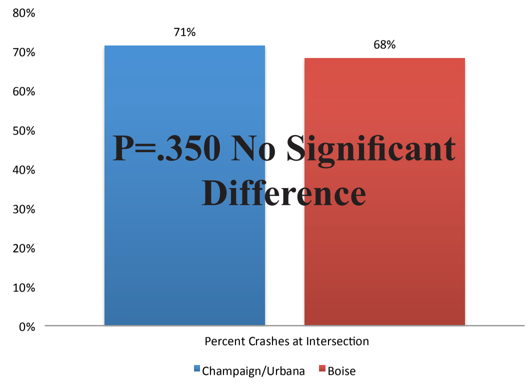


Figure 8
Percent Crashes at Traffic Signal Controlled Intersection For Study Area Years 2007 - 2011 (Idaho DOT 2012, Illinois DOT 2012)

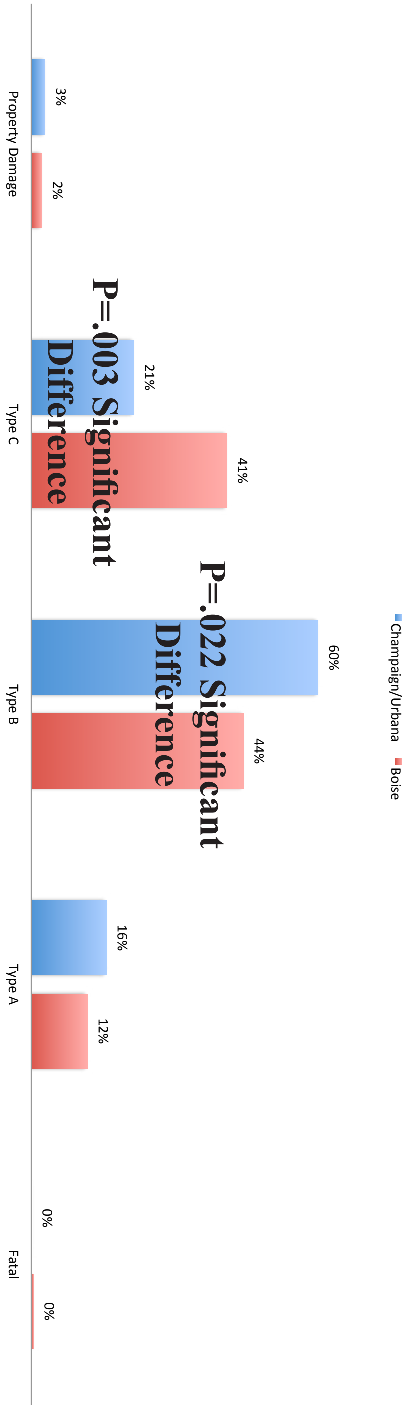
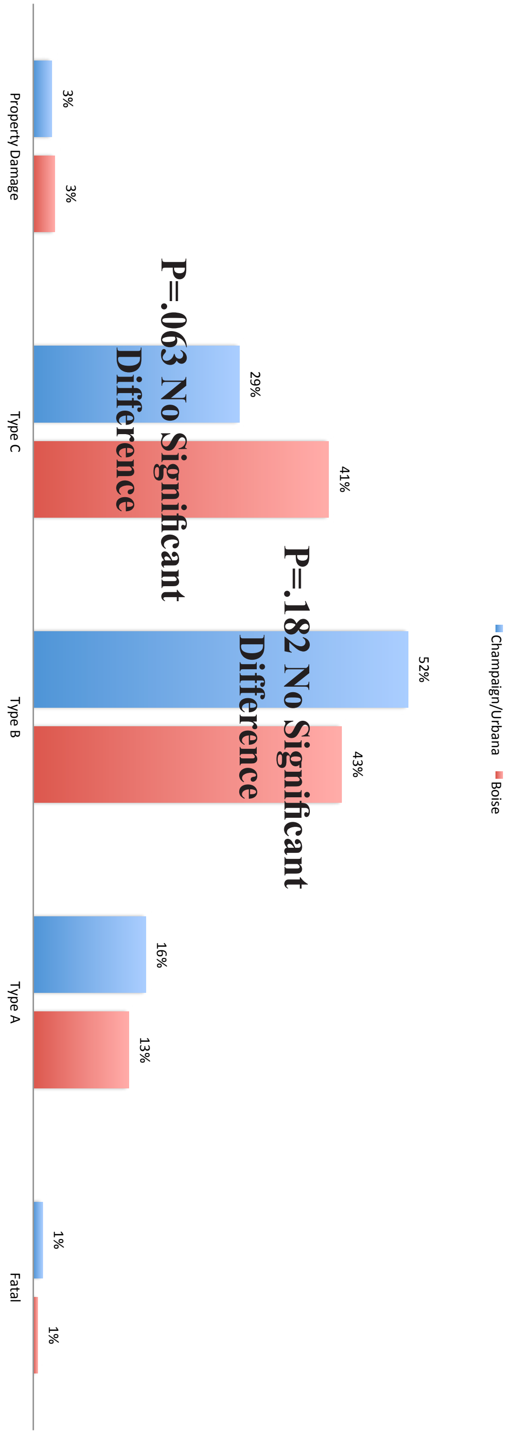


Figure 9
Percent Crashes at Stop Sign Controlled Intersection For Study Area Years 2007 - 2011 (Idaho DOT 2012, Illinois DOT 2012)



size needed to ensure a normal distribution.

For the more serious Type A incapacitating crash, no difference in proportion between any study area or for any subgroup was found.
Again, these findings only indicate associations between subgroups within the study areas. Inference must be made from the frequencies within the cities and the body of knowledge available; no correlation or causation is proven. For specific p-values and frequencies for each compared proportion, see Table 2.

4.3 Results within Boise and Champaign/Urbana for Different Subgroups

Findings of significant difference within the study areas showed no real difference in severity with one exception. Property damage was significantly different within Champaign/Urbana if the crash occurred midblock versus intersection. Frequency for midblock property damage was 10.8 percent versus 3.8 percent at the intersection. This may be a reflection of the literature that indicates that crashes are more severe at intersections than midblock, with midblock registering a disproportionate amount of the least severe crashes (Ref Ses Klop and Khattak 10). Of note here, there was no significant difference in severity classes between intersections and midblock within Boise, Idaho. As shown in Table 3. This is important, as the difference in legislation is only relevant to intersections in Idaho. Thus, one might speculate that intersections would experience more or less severe crashes compared to midblock; however, no significant difference exists. This is important, considering that when crashes are compared within the same study area, many of the variables that change when comparing the two different study areas are held constant. (For specific p-values and frequencies, see Table 3.)

5.1 Conclusion

The uniqueness of the Idaho Stop Law, Id. Statute § 49-720, begged the question *are citizens less safe by not being required to stop at stop signs and pause at red lights.* This study was not intended to answer this important question, but more specifically, to ascertain if any difference in crash severity between Boise (subject to this special legislation) and Champaign/Urbana (subject to the conventional rules of the road) existed in any meaningful manner.

Significant differences were found between Boise and Champaign/Urbana. While no significant difference in proportion of crashes exists at intersections verses midblock between the cities (Figure 7), there were differences in the severity of crashes overall (Figure 6). Champaign/Urbana held a 54 percent level of Type B crashes and a 24 percent level of Type C crashes. This compared to Boise's more balanced 45 percent and 40 percent respectively. Significant difference was also found within property damage. These differences were also found within intersections, controlled intersections and traffic signal controlled intersections to all approximately the same ratios in frequency. However, no significant difference was found between intersections controlled by stop signs. Regarding crashes at traffic signal controlled intersections, the 60 percent frequency of Type B crashes and 21.4 percent of type C in Champaign/Urbana is very different than the more balanced 44 percent and 40 percent found in Boise (Figures 8 and 9). It is possible that crashes occurring at traffic signal controlled intersections in Boise are proportionately more likely to result in possible injury vice evident injury. It is possible that cyclists in Boise are more accustomed to judging the traffic conditions that are safe for crossing. They may be more likely to use caution when crossing a signalized intersection, while their counterparts in Illinois, who are required to stop and wait at all controlled intersections, are not as skilled at judging a safe traffic crossing, thus resulting in a proportionately higher level of severity and one statistically different than in Boise.

Cyclists are known regardless of legal jurisdiction to not always make full stops at stop signs or red lights. A large part of their ability to avoid a crash or lessen the severity of a crash is incumbent upon their skill at navigating intersections. This is especially true when crossing intersections where opposing traffic has the right of way. The ability to yield to such traffic when crossing might very well be increased if at every crossing, the cyclist was required to make these judgments.

Another plausible explanation for these findings is that drivers are more likely to expect cyclists crossing at controlled intersections when the driver has the right of way. Thus, motorists may in fact be more likely to slow down and avoid a crash or greatly decrease the severity of crash. There is evidence of this possibility when considering the safety in numbers hypothesis by Jacobson (2003), and the work of Marshall and Garrick (2011). Their research indicates that as cycling mode share increases, severity of crashes for all modes decrease. Their hypothesis is that drivers are more likely to look for cyclists and consequently more likely to see all aspects of the road providing a better response to crashes as they occur.

For either of these possible explanations ,crossings at stop sign controlled intersections likely provide slow enough speeds for both drivers and cyclists to adjust to each others' actions, thus it is possible that no appreciable difference in crash severity is present, whether the cyclist stops or not at stop sign controlled intersections. The data show no significant difference between the study areas when crashes only occurring at stop signs are considered. In other words, whether a cyclist slows to yield or stops at the stop sign in both cases, the time allowed may be sufficient for generally safe crossing. Having the additional units of time provided by fully stopping at a stop sign do not improve the ability of cyclists or drivers to lessen the severity of crashes.

Overall, more research is needed in many areas of this inquiry. More complete and standardized data is needed to better compare municipalities. More municipalities need to be compared, as this analysis does not speak for the whole of the cities influenced by the Idaho Stop Law, but only compares Boise, to Champaign/Urbana. Also of importance to this study would be better knowledge of crash rates when compared to ridership. It is important to understand crash rates, in absolute terms and as a percentage of ridership. Do crash rates rise or fall in comparable Idaho cities to national ones? Another important question, to what extent do cyclists outside of Idaho already yield at stop signs and pause at red lights? It is quite possible that nationally the Idaho Stop Law is de facto procedure, but if it is not and most cyclists follow standard regulations, would this legislation act to increase mode share thereby leading to greater overall road safety? Many questions regarding bicycle crashes and cycling safety are left unanswered at this current time. The field of bicycle crash research is largely understudied, and given the rising ridership and interest in cycling, efforts made to decrease the severity of injury should be made. This cannot be properly done without quality crash data analysis.

6.1 Appendix

The Idaho Stop Law, Id Statue 49-720.
STOPPING -- TURN AND STOP SIGNALS.

(1) A person operating a bicycle or human-powered vehicle approaching a stop sign shall slow down and, if required for safety, stop before entering the intersection. After slowing to a reasonable speed or stopping, the person shall yield the right-of-way to any vehicle in the intersection or approaching on another highway so closely as to constitute an immediate hazard during the time the person is moving across or within the intersection or junction of highways, except that a person after slowing to a reasonable speed and yielding the right-of-way if required, may cautiously make a turn or proceed through the intersection without stopping.

(2) A person operating a bicycle or human-powered vehicle approaching a steady red traffic control light shall stop before entering the intersection and shall yield to all other traffic. Once the person has yielded, he may proceed through the steady red light with caution. Provided however, that a person after slowing to a reasonable speed and yielding the right-of-way if required, may cautiously make a right-hand turn. A left-hand turn onto a one-way highway may be made on a red light after stopping and yielding to other traffic.

(3) A person riding a bicycle shall comply with the provisions of section 49-643, Idaho Code.

(4) A signal of intention to turn right or left shall be given during not less than the last one hundred (100) feet traveled by the bicycle before turning, provided that a signal by hand and arm need not be given if the hand is needed in the control or operation of the bicycle.

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