

A Signalized Intersection for Experimentation and Evaluation of Traffic Signal and Detection System Technology

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TRAFFIC OPERATIONS AND SAFETY LABORATORY
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TOPS LAB REPORT

A Signalized Intersection for Experimentation and Evaluation of Traffic Signal and Detection System Technology

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INTRODUCTION

The Traffic Operations and Safety Laboratory (TOPS Lab) evaluated the performance of seven vehicle detection systems for stop bar detection for the Wisconsin Department of Transportation (WisDOT). The evaluation was conducted at the Wisconsin Experimental Intersection which is composed of the instrumented Eastbound Approach of the High Crossing Blvd and American Parkway intersection in Madison, WI. An aerial and cross sectional view of the intersection is shown in Figure 1. The software/firmware version of all the systems installed as of December 2012 is also included in the figure. The findings presented in this report correspond to the second phase of the project (December 2012 through April 2013). Readers interested in the findings from the portion of the study corresponding to the period before December 2012 can obtain a previously-released interim technical memo from www.topslab.wisc.edu¹.

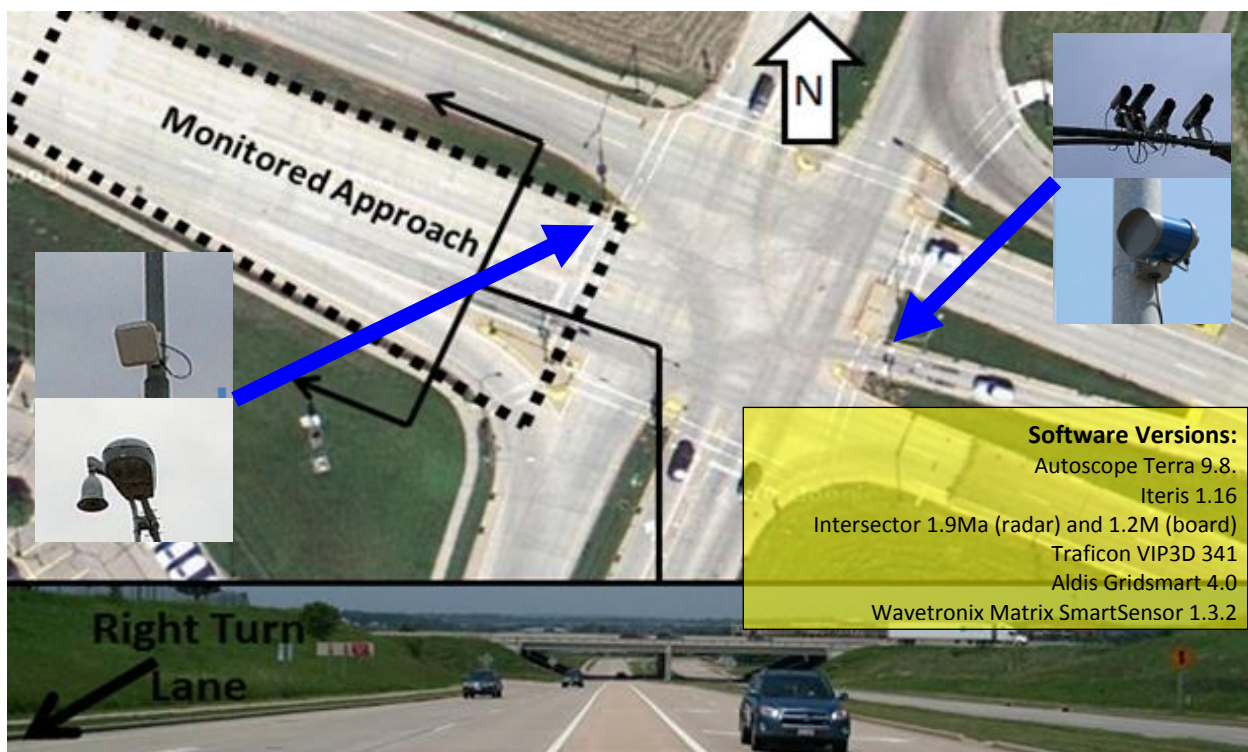


Figure 1. Aerial and Cross Sectional View of Intersection and System Versions

The reader should note that the Aldis system uses one or two sensors (cameras) for an entire intersection while all other systems require one sensor per approach. As only a single approach was studied, the performance reported may or may not reflect performance of Aldis for all approaches. Another system makes use of a FLIR-SR thermal camera (facing the approaching traffic) and is connected to a Traficon VIP3D system. Finally, two additional systems rely on the use of radar technology to detect vehicles at the intersection; one of the systems (Wavetronix Matrix SmartSensor) is installed on the side of the road at the stop bar while the other one (Intersector) is installed facing the approaching traffic on the same pole as the video detection systems.

¹ Also available directly by visiting: <http://goo.gl/ChBuW>

Project Timeline

All systems were installed and configured by the corresponding manufacturer representative or distributor. The involvement of research team and WisDOT personnel was limited to providing the bucket truck and access to the cabinet for installation. The representative for each of the systems provided everything required for the installation. After the installation, vendors were provided with an initial dataset summarizing the performance of their systems and had the opportunity to make adjustments to the system. After the initial adjustment opportunity, another dataset summarizing the performance was provided and was followed by another chance to adjust the installation/configuration of the system.

Evaluation began on September 1, 2011 and no changes were allowed to the systems until February 2012. In February 2012, modifications to the zone configurations were allowed after a plow truck hit the pole on which Autoscope, Iteris, Traficon, and Intersector systems were installed and the zones monitored by the systems shifted position as a result of the impact. Only zone configurations were allowed to be modified to fix the shift in position, no firmware updates were permitted.

In December 2012 an interim technical memo was published documenting the performance of the systems until November 2012. Results were presented for Night, Sunny Day, and Windy Day in terms of missed calls and false calls. Readers interested in those conditions are directed to the interim memo. The memo also provides readers with a breakdown of the observed reasons for false calls.

The 2011-2012 winter was very mild and rainfall was limited. Therefore, evaluation of the systems was extended to enable evaluation under snow and rain conditions. By the end of 2012 the systems had already been running for over a year and new versions of firmware were available. In November 2012, vendors were given an opportunity to perform firmware updates, clean lenses, replace equipment, and shift the position of their system.

All the vendors for the systems (Aldis, Autoscope, Iteris, Intersector, Traficon, and Wavetronix) updated their systems with their newest software/firmware versions and made changes to their zone configurations. Additional maintenance tasks such as cleaning of lenses were also performed. Summit-Crest (the Wavetronix Representative) decided to change the location of their unit in order to improve performance of the left turn lanes. MsSedco deployed a unit with the newest software version instead of upgrading the previously installed unit. Aldis conducted all their software updates remotely and conducted no physical maintenance on their equipment. Autoscope and Iteris (through their respective distributors) cleaned their systems' lenses and changed the configuration of the zones on-site. Traficon (through their distributor) cleaned the lens of the optical camera system and replaced the previously installed FLIR camera with a new one. The research team was told that the previous FLIR camera was set to operate in security mode instead of traffic. Following all the changes, sample video/data were provided to all vendors and were given an opportunity to make any changes. Evaluation for Phase 2 began in December 2012.

Participation of Traficon and FLIR

FLIR acquired Traficon in early 2013. On February 27, 2013 research team received an email from Dan Dietrich, Business Development Manager for FLIR ITS – North America. Dan Dietrich stated that standard policy of the Intelligent Transportation Systems Division of FLIR was not to participate in comparative such studies such as this one and requested removal of their products from the studies. Based on the vendor request and WisDOT project manager approval results from Traficon/FLIR products are not included in this report.

DATA COLLECTION APPROACH

The research team developed a data collection methodology which relies on a data acquisition system (shown in Figure 2) and a custom software interface to collect timestamp as well as video data at the studied approach. Using the custom software, the research team is able to monitor calls made by all the systems as well as the status of the traffic signal indications for the approach. The status of the signals and each of the systems undergoing evaluation is logged approximately 66 times per second (66 Hz). Simultaneously, for systems with a video output, the video stream is recorded. Thus, hard evidence is maintained for each of the calls made by the systems. Data collected by the research team was used to evaluate the performance of each of the systems based on four performance measures: missed calls, false calls, dropped calls, and stuck on calls.

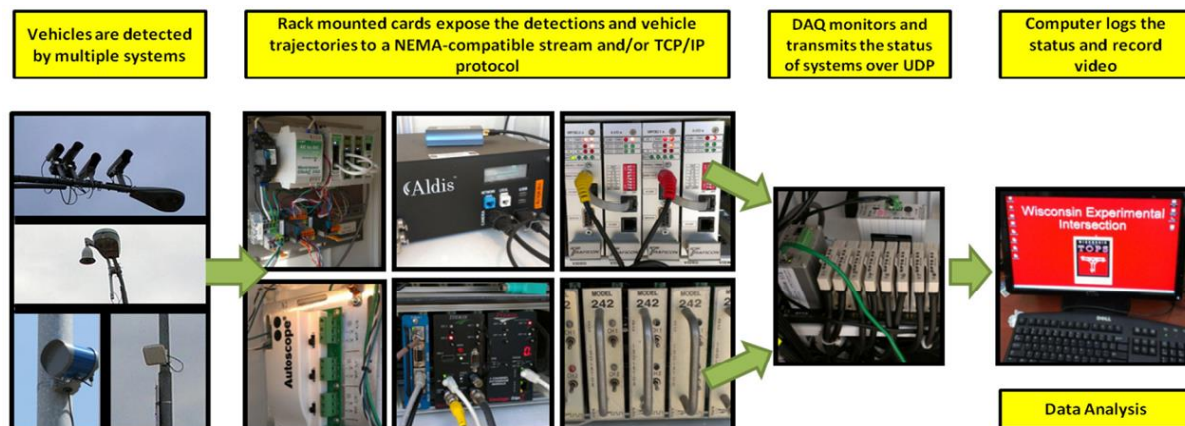


Figure 2. Data Acquisition System Summary

A missed call is said to have occurred when a vehicle is at the stop bar but a system fails to detect it. A false call occurs when there are no vehicles at the stop bar but a system places a call. A dropped call is when a system correctly identifies the presence of a vehicle but eventually drops the call even when the vehicle is still at the stop bar. A stuck on call refers to instances in which a vehicle is detected by a system but continues to place a call after the vehicle leaves the stop bar.

PERFORMANCE MEASURES IDENTIFICATION AND VALIDATION

A two stage process was used to identify missed, false, stuck-on, and dropped calls. In the first stage, the algorithm (summarized in Figure 3) identified the corresponding call classification. In the second stage of the process, results of the algorithm were manually verified using the recorded video to confirm or reject the algorithm classification. An example of a typical missed call validation is shown in Figure 4. As

the figure shows, when a vehicle goes over the rightmost through lane, the zone never changes color to white thus confirming the missed call classification. During the manual verification of the algorithm results the research team found that over 95 percent of the algorithm classifications were correct. Given the performance of the algorithm in the previous stage of the study no additional steps were taken to improve/verify the algorithm results for phase 2 of the project.

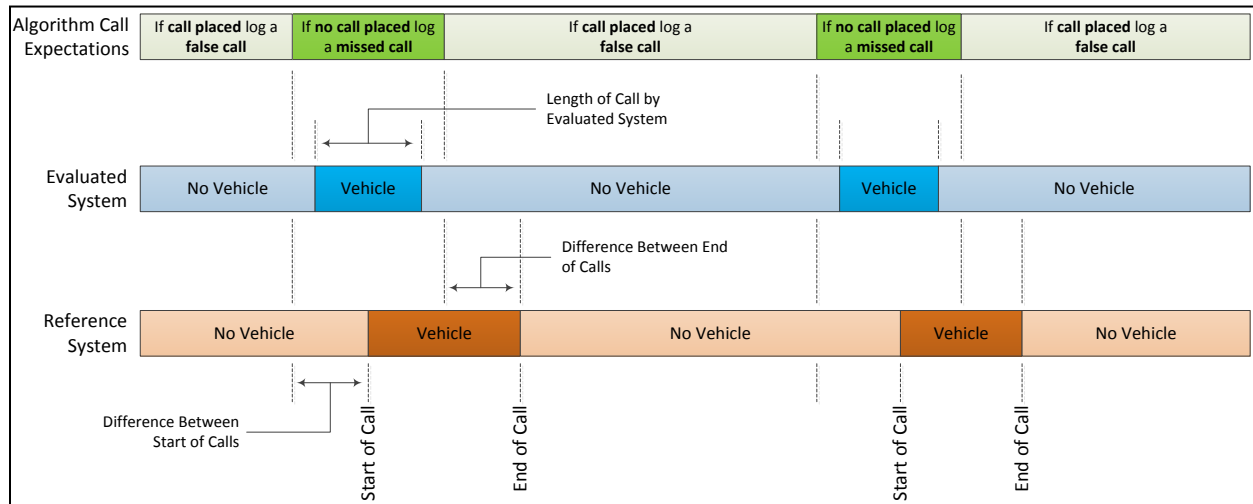


Figure 3. Summary of Algorithm Used for Missed and False Calls Identification

Figure 3 shows how the algorithm relies on a reference system to flag a potential false or missed call on each system undergoing evaluation². As shown in the figure, the typical behavior of each system, in terms of when a call is placed in comparison to a reference system, was determined. The difference in time between when a call is placed on a reference system and when that call is placed on the test system was defined as a delta. Through the use of the delta value the algorithm determines when a call is expected to be placed.



Figure 4. Screenshot of Typical Missed Call Validation

For consistency in the process, the same delta was used across all systems for identifying missed calls (± 6 seconds) and false calls (± 5 seconds). Many factors were considered in selection of the delta for

² Loop detectors were selected as the reference system. However, the reader should keep in mind that a call from a test system does not need to match the call from the loop.

each case, e.g., length of zones, speed of approaching vehicles, headlight presence, and lane type. A larger delta was used for false calls to account for the effect of headlights at night. The algorithm was designed with enough flexibility that if, for example, a call was started by a system during the expected time but continued after the expected end of the call because of a slower speed or length of the vehicle, among others, that call was not classified as a false call.

RESULTS

The sections below show the results of the analysis for missed, false, stuck-on, and dropped calls. A summary of the number of hours and the number of vehicles per condition is shown in Table 1 below. As shown in Table 1, the results of the study are based in a dataset of over 18,500 vehicles and over 80 hours. Results are summarized in charts presented in Figures 5 through 10 and are presented by vehicle detection system and weather and illumination conditions shown in Table 1 as well as by lane group.

Table 1. Summary of Conditions/Hours/Vehicles

Condition	Number of Hours	Number of Vehicles
Fog Day	7	2,026
Morning Clear	9	1,840
Night Clear	9	811
Overcast	11	2,783
Rain - Day	8	2,318
Rain - Night	9	948
Snow - Day	22	6,025
Snow - Night	14	1,899

Reporting Methodology

In Phase 1 of the study results for false and missed calls were presented on a lane-by-lane basis. For example, the percentage of false calls was reported for individual left and thru lanes. Based on conversations with WisDOT, in this report, performance of the systems based on lane groups is presented as well. By reporting the results on a lane group basis, the best possible scenario for false calls is presented. In Phase 1 of the study, a significant portion of the false calls observed were due to vehicles in adjacent lanes. A valid argument could be made that from an operations perspective, a false call placed on a lane by another vehicle in the same lane group does not have an impact on performance. Conversely, it could be argued that for an intersection with lane configuration different from the test intersection (e.g., three lanes with each lane assigned an individual movement) knowledge of the performance of systems on a lane-by-lane basis would be more useful. Therefore, performance of the systems on a lane-by-lane basis are presented in the appendix. Since there is only one right turn lane in the studied approach the results presented in Figures 5 through 10 for the right turn lane already correspond to an individual lane thus no right turn lane figures are included in the appendix.

Missed Calls Performance

Except for the performance of the one of the systems on limited conditions/lanes, even during inclement weather conditions all systems had a missed call rate of less than 5 percent with some of the systems having zero percent missed calls. The exception to the 5 percent missed call rate is limited to the following conditions for the Aldis system: thru lanes during foggy day (9.8), right lane during foggy day (32.4), right lane morning clear (11.8), right lane rainy night (19.5), and right lane with snow during the day (6.9). Furthermore, a closer look at the data reveals that lower than 1 percent missed calls is not uncommon except under a limited number of weather conditions and system combinations. Figures 5 through 7 and Table 2 show a summary of the missed calls performance. One question the reader might want answered is if loops had any observed missed calls in the dataset. Based on the analysis methodology used, there were no observed missed calls for loops.

False Calls Performance

During clear day and overcast conditions, false calls observed across all the systems were under 5 percent. On the other hand, during clear night conditions, false call rates ranged between 0 and 40.1 percent. For clear night conditions, as discussed in the interim memo, majority of the false calls observed were caused by the headlights of vehicles on an adjacent lane. Beside clear, overcast, and clear night conditions, when inclement weather such as rain, fog, and snow are involved, false calls ranged between 0 and 63.6 percent. Figures 8 through 10 and Table 3 show a summary of the missed calls performance.

An analysis of the breakdown of false calls by system reveals that optical video systems mounted facing the approach were the most vulnerable to show an increased false call rate followed by the optical system mounted above the approach. Systems relying on the use of radar technology for vehicle detection had a false call rate below 3 percent across all weather and illumination conditions. Rarely false calls were observed on loops. In those instances, large vehicles were present on an adjacent lane and false calls were placed by all the other systems as well. A false call by all the systems is not detectable by the algorithm. Unless each individual call placed is manually verified, quantifying such false calls is unfeasible.

Stuck-on and Dropped Calls

No dropped and stuck-on calls were detected. However, based on discussions with some of the vendors the possibility of having, e.g., stuck-on calls, those events happen on existing and future installations is real if the system settings are not configured properly. The research team recommends that, if available, the settings for maximum length of the calls be set by taking into consideration the cycle lengths, phase times, and traffic characteristics.

Table 2. Summary of Missed Calls Percentages by Condition and System

Condition	Aldis	Autoscope	Intersector	Iteris	Wavetronix
Left Lanes Group					
Fog Day	0.5	0.5	0.0	0.0	0.0
Morning Clear	0.0	0.0	0.0	0.0	0.0
Night Clear	0.6	2.4	1.2	0.6	1.2
Overcast	0.2	1.0	0.2	0.0	0.2
Rain - Day	0.0	0.0	0.0	0.0	0.0
Rain - Night	0.0	0.0	0.0	0.0	0.9
Snow - Day	0.7	1.0	0.2	0.1	0.4
Snow - Night	0.0	0.0	0.0	0.0	0.0
Thru Lanes Group					
Fog Day	9.8	0.5	0.2	0.0	0.5
Morning Clear	0.6	0.0	0.0	0.0	0.8
Night Clear	0.4	0.4	0.0	0.0	0.4
Overcast	0.0	0.0	0.0	0.0	0.4
Rain - Day	1.6	0.0	0.1	0.1	0.3
Rain - Night	0.8	0.0	0.0	0.0	0.8
Snow - Day	2.5	0.6	0.0	0.0	1.4
Snow - Night	0.2	0.0	0.0	0.0	0.2
Right Lane					
Fog Day	32.4	0.9	0.8	0.4	0.1
Morning Clear	11.8	0.0	0.7	0.4	0.4
Night Clear	1.5	0.0	1.0	0.0	0.0
Overcast	0.1	0.0	0.8	0.3	0.6
Rain - Day	2.8	0.8	1.4	0.3	0.9
Rain - Night	19.5	0.0	1.3	0.5	0.4
Snow - Day	6.9	3.1	0.6	0.1	0.8
Snow - Night	4.6	0.0	0.5	0.0	0.9

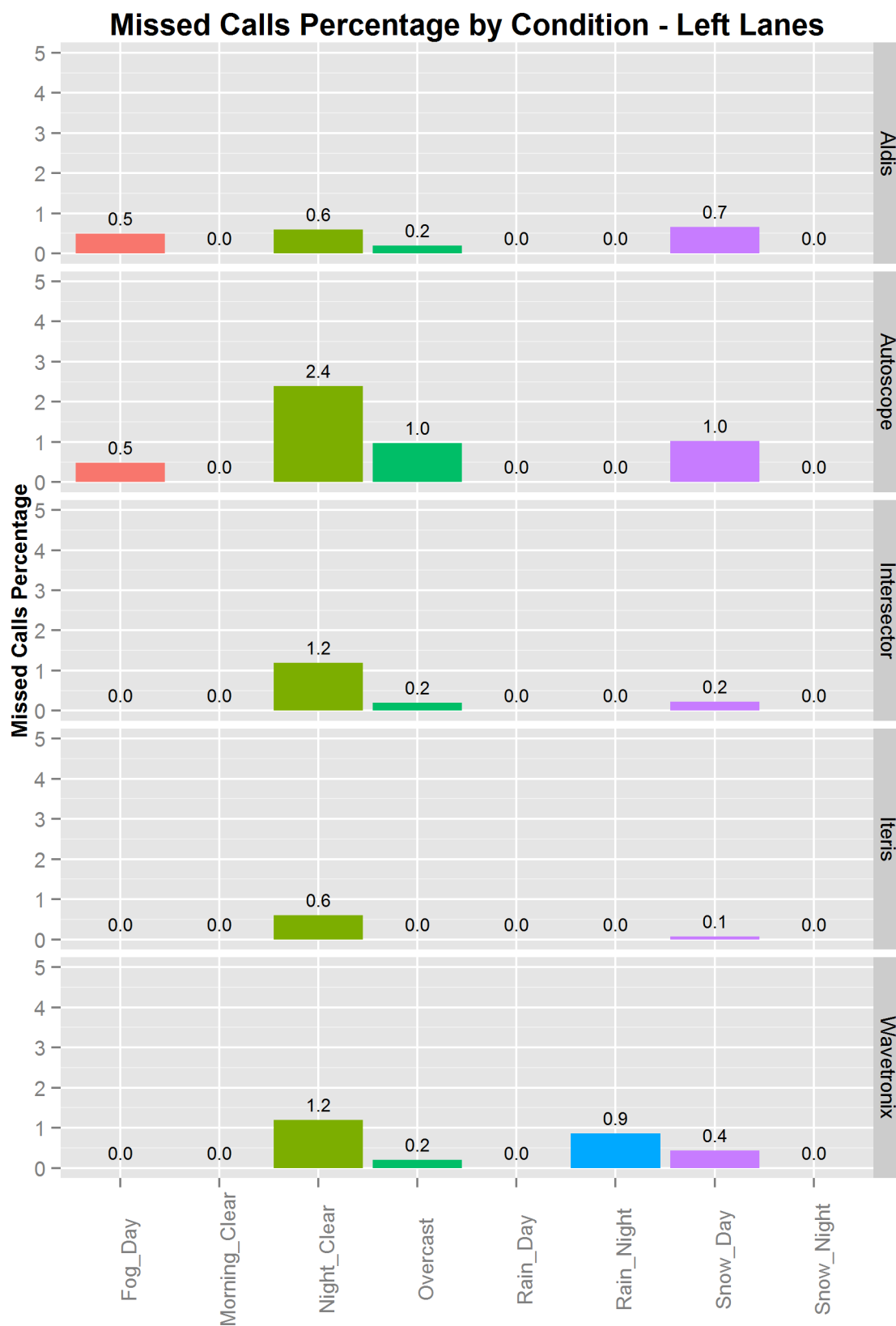


Figure 5. Missed Calls Left Lanes

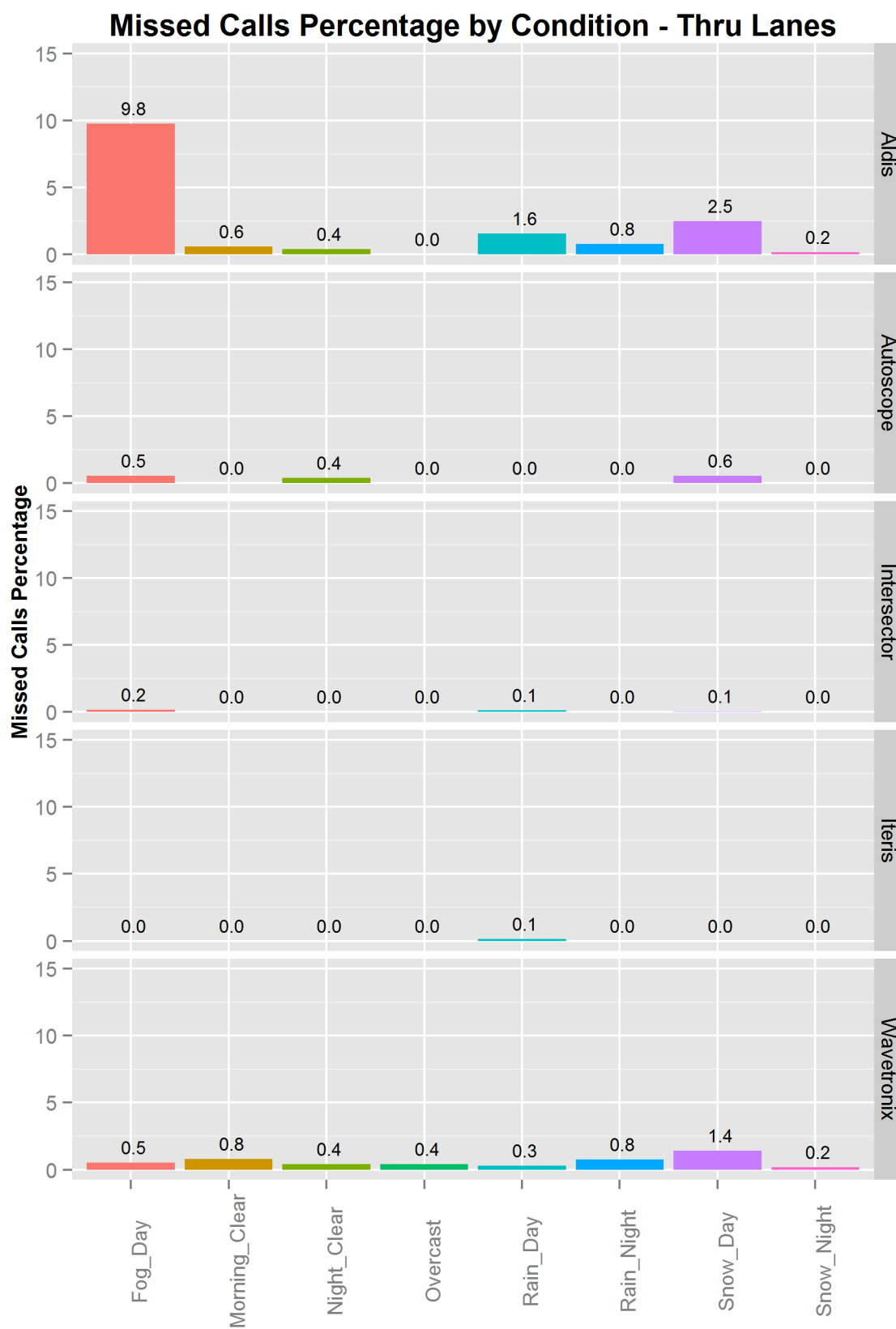


Figure 6. Missed Calls Thru Lanes

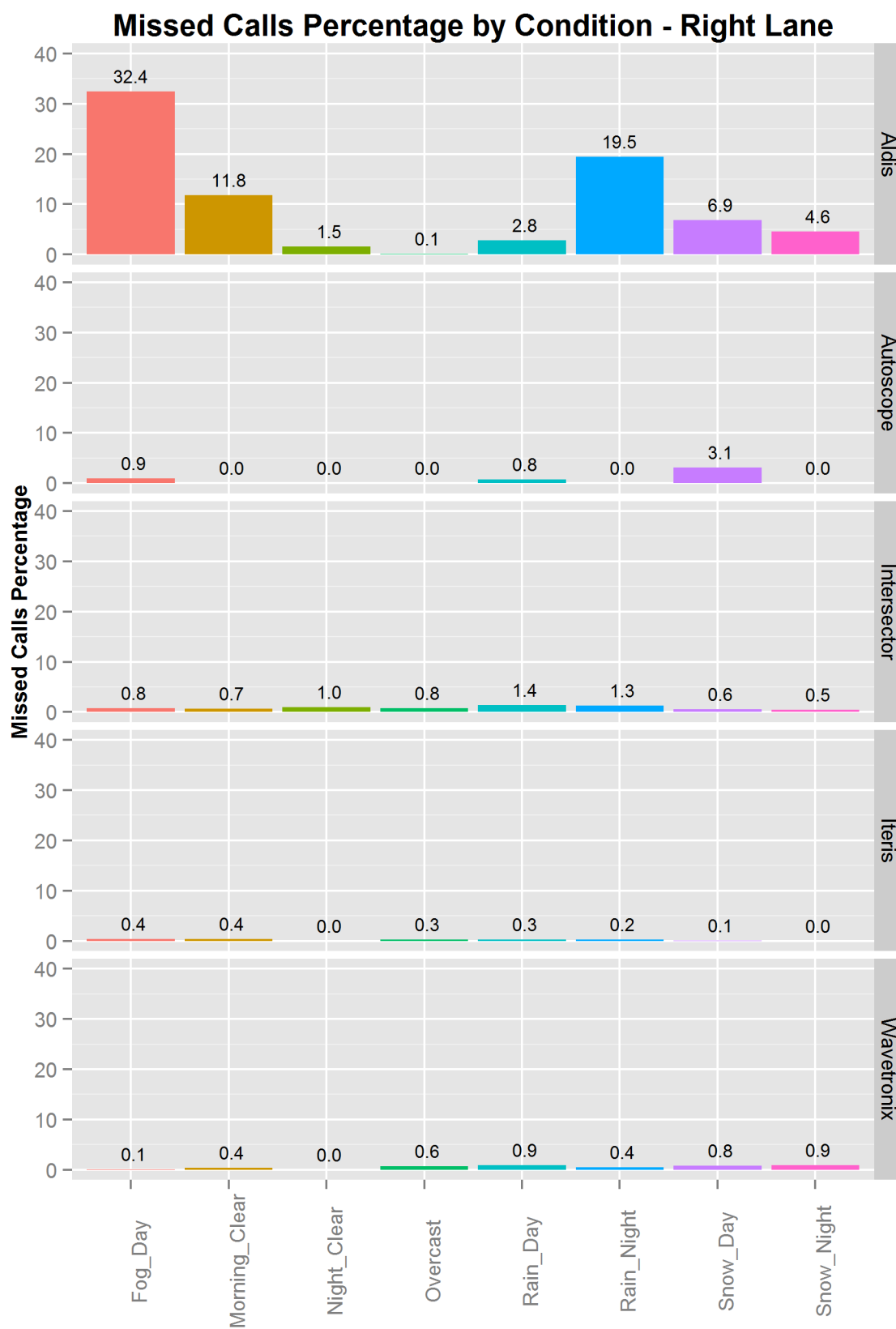


Figure 7. Missed Calls Right Lane

Table 3. Summary of False Calls Percentages by Condition and System

Condition	Aldis	Autoscope	Intersector	Iteris	Wavetronix
Left Lanes Group					
Fog Day	3.9	1.9	0.3	0.3	0.0
Morning Clear	2.9	1.5	0.4	2.7	0.4
Night Clear	0.0	1.8	0.7	2.6	0.6
Overcast	0.5	0.5	0.5	0.5	0.5
Rain - Day	0.0	0.9	0.3	1.4	1.9
Rain - Night	0.0	1.6	0.0	6.0	1.9
Snow - Day	0.1	1.7	0.1	1.6	2.9
Snow - Night	0.0	6.9	0.9	2.0	1.3
Thru Lanes Group					
Fog Day	1.1	9.0	0.4	8.5	2.4
Morning Clear	1.9	0.5	0.0	1.8	2.1
Night Clear	0.8	35.9	0.0	40.1	0.4
Overcast	1.1	0.8	0.3	0.3	1.6
Rain - Day	1.1	10.9	0.0	3.5	1.2
Rain - Night	2.1	54.3	0.0	63.6	0.4
Snow - Day	1.3	3.2	0.4	2.4	1.6
Snow - Night	14.7	16.8	0.2	25.5	0.7
Right Lane					
Fog Day	0.6	2.8	0.8	0.9	0.8
Morning Clear	2.3	0.6	0.5	3.2	0.6
Night Clear	1.0	0.0	0.8	13.5	0.3
Overcast	1.6	1.0	1.4	3.5	1.4
Rain - Day	2.0	0.6	0.3	3.7	1.7
Rain - Night	1.9	0.2	0.4	10.5	0.0
Snow - Day	1.6	1.2	0.4	3.5	0.7
Snow - Night	27.1	0.5	0.1	1.3	0.1



Figure 8. False Calls Left Lanes

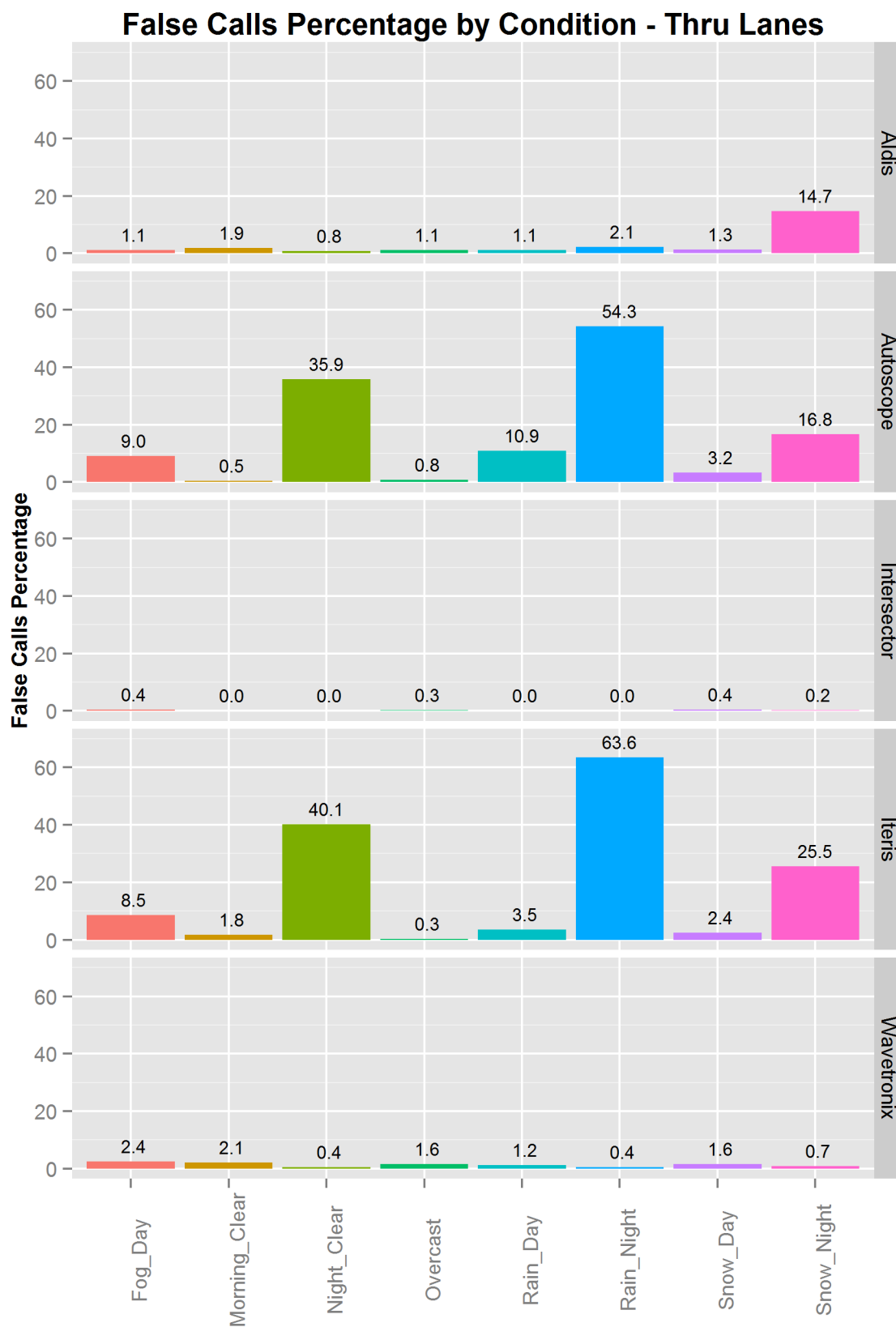


Figure 9. False Calls Thru Lanes

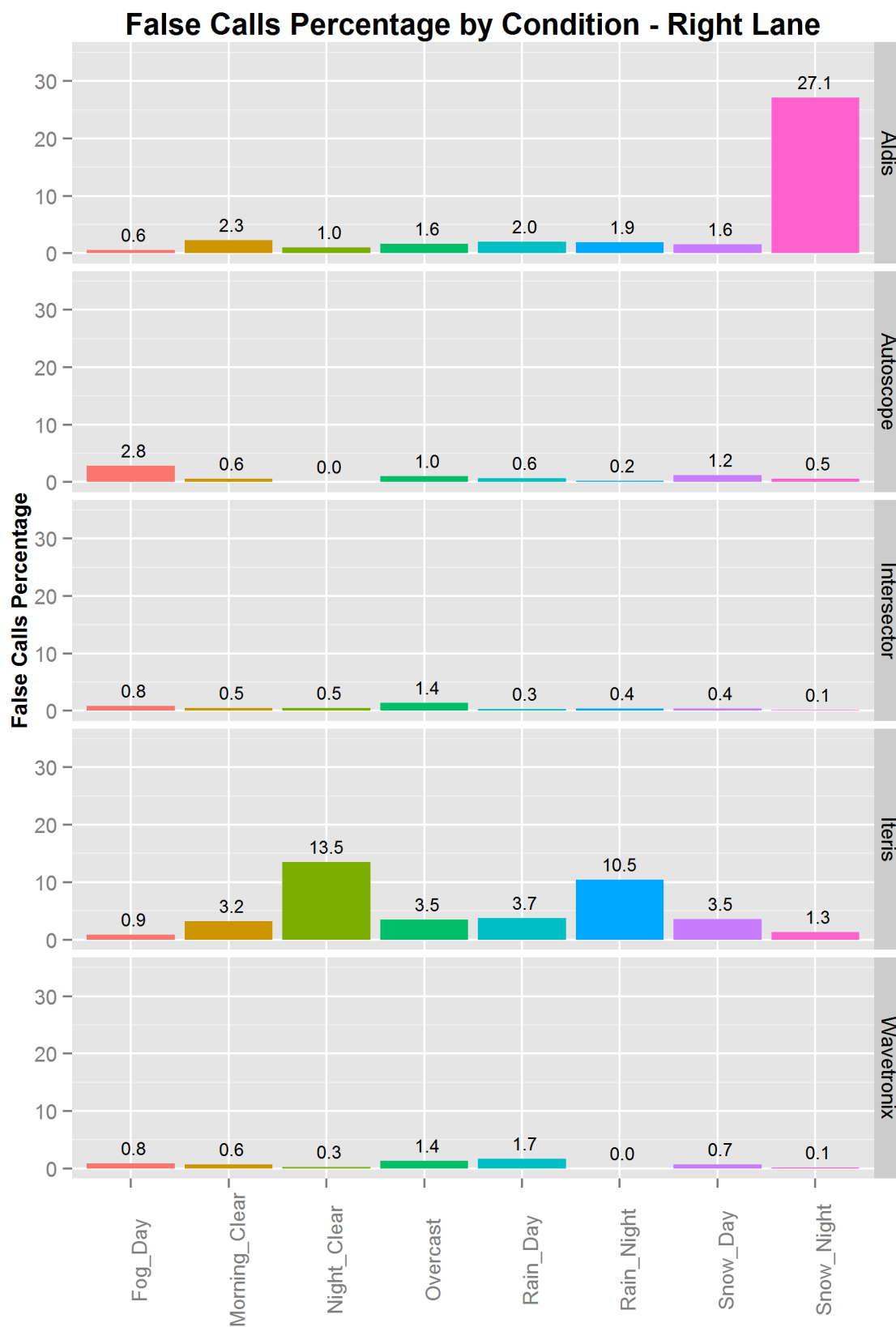


Figure 10. False Calls Right Lane

COMPARISON OF THE NUMBER OF CALLS BETWEEN SYSTEMS

Figures 11 through 13 show the total number of calls produced by each of the systems during the specified time periods and conditions. The number of calls is computed by combining overlapping calls between lanes of the same movement into a single call for that movement. For example, two vehicles traveling side by side on the two through lanes would be grouped into one call. Consequently, false calls produced by vehicles on an adjacent lane within the same lane group are no longer considered as false calls. The exclusion of these false calls from the numbers presented represents a best case scenario in which the lanes of an intersection are channelized by movement.

Detection Zone Size and Configuration

One might assume that difference in the number of calls between a system and a loop equals the number of false/missed calls. The statement is incorrect given the nature of the zone position and length used by different vendors. During the installation process vendors were asked to configure their system in the way they felt that their system would perform the best for stop bar vehicle detection at the test intersection. The zone configuration of each of the systems is shown in the Appendix. As a result, the position/size of the zones are not equal nor do they need to match the position/size of the loops. Two of the reasons, related to better detection performance, why the research team feels this approach to zone configuration and position is better than trying to match the position of loops are listed below:

If the zones are drawn further downstream than the traditional position of a single loop-per-lane installation the system could potentially detect vehicles that are stopped past the stop bar which the loop could potentially miss; and,

For intersections with actuated operation and low minimum green time during which a vehicle queue starts to clear and one of the vehicles upstream does not move for a period longer than the gap-out time this could result in the intersection controller falsely assuming that the queue was cleared. A system that drew their zones larger than the size of the loop could have potentially maintained a call if the distracted/stalled vehicle was inside the detection zone.

As a result of the zone size/configuration approach used in this study a lower number of calls by a system, when compared to the loops, could be the results of detection zones larger than a loop which means that two could be represented by a single call instead of multiple ones. Also, when the number of calls produced by a system is larger than the loop or any other system the difference in values should not necessarily be considered the total number of false calls detected. As the methodology previously shown in Figure 3 indicates there is a window of time around the arrival of a vehicle during which any call placed by a system is considered as a call for that vehicle. Therefore, in situations when a system “flickers” multiple calls spaced by a time smaller than the refresh rate of intersection controllers (10 Hz) are detected as separate by the data collection system used by the authors but grouped as one call since that is the way an intersection controller would see the multiple calls when used for detection.

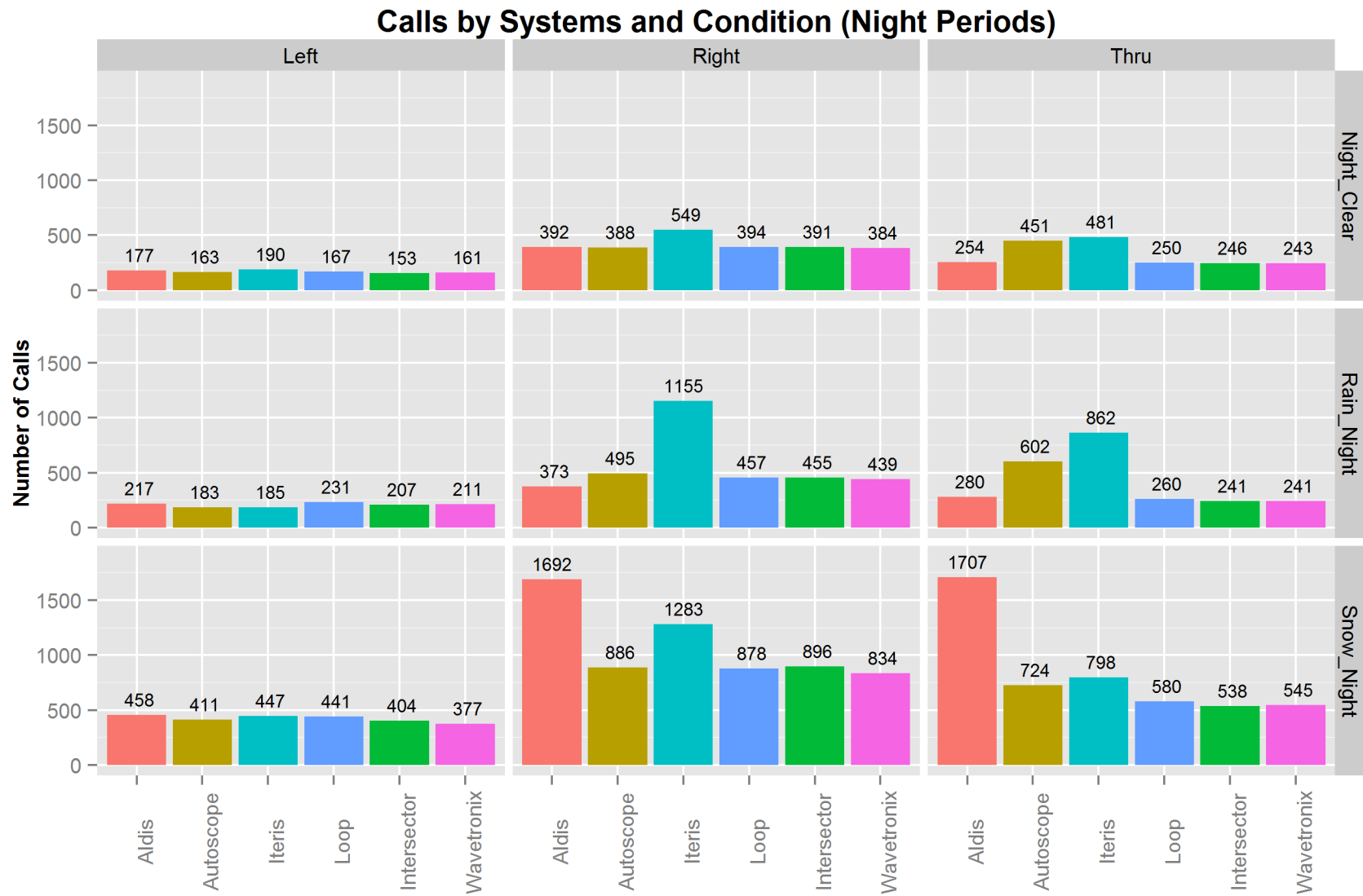


Figure 11. Comparison of Calls by Each of the Studied Systems and Loops During Night Periods

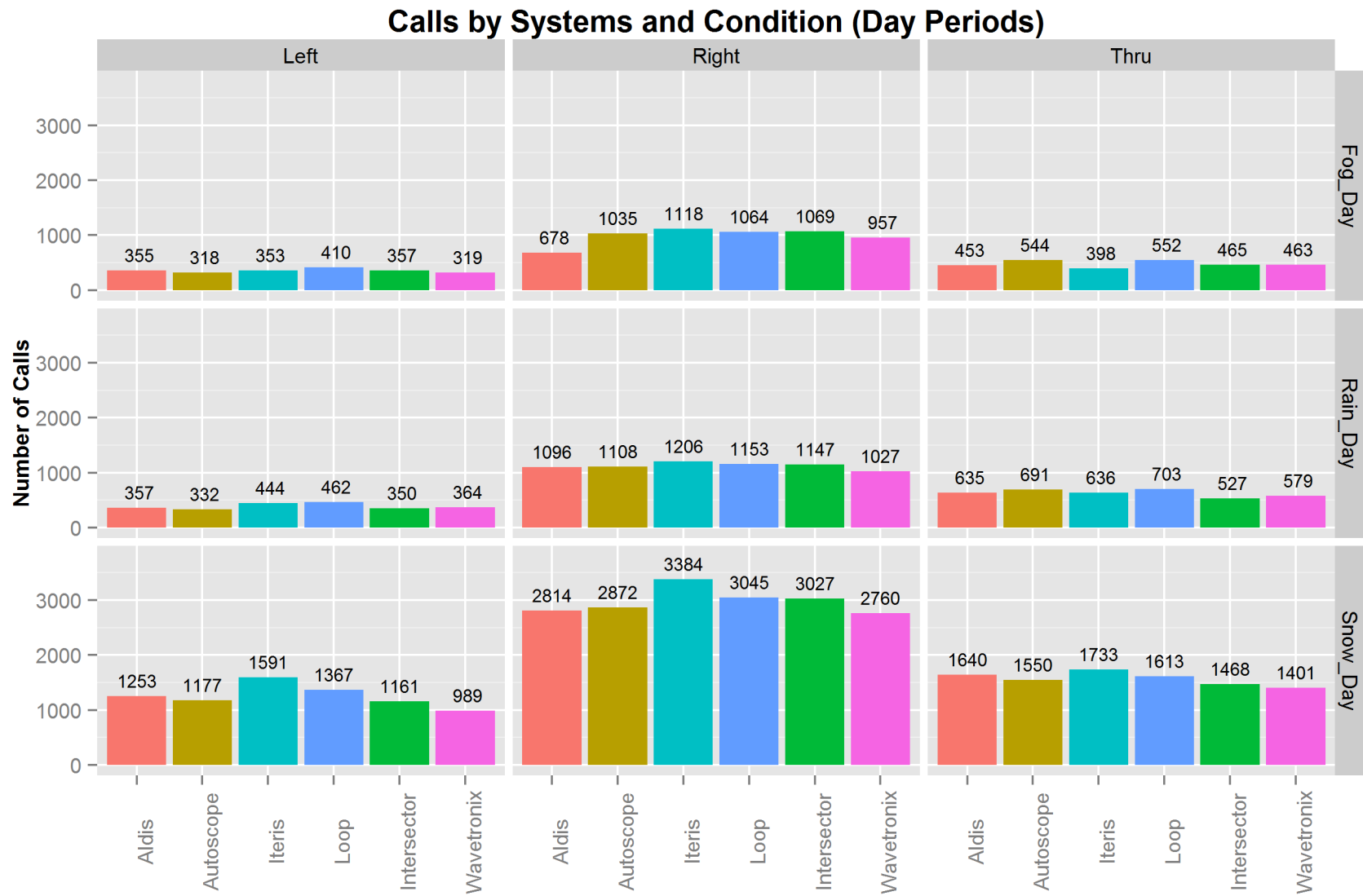


Figure 12. Comparison of Calls by Each of the Studied Systems and Loops During Day Periods

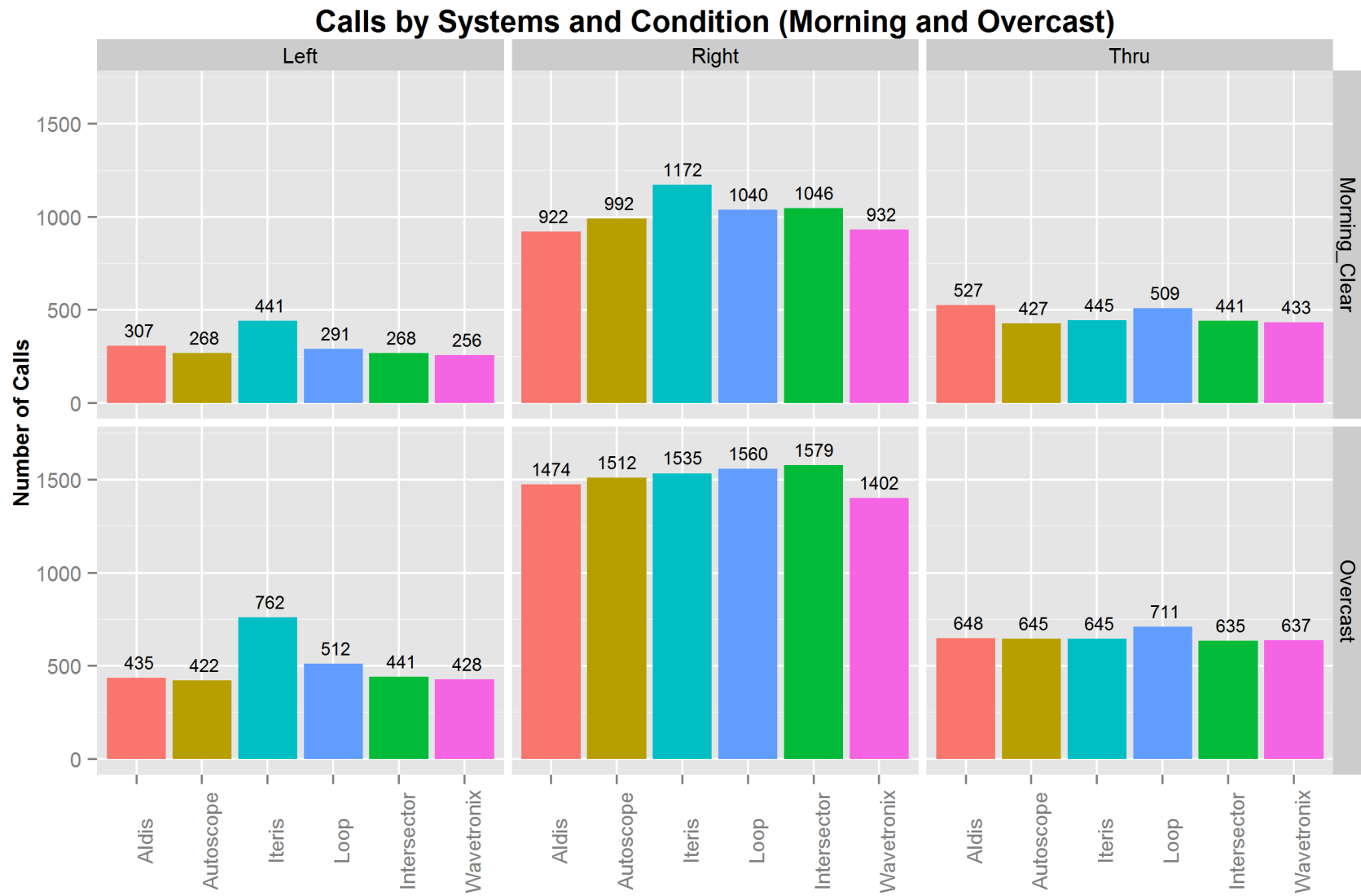


Figure 13. Comparison of Calls by Each of the Studied Systems and Loops During Morning and Overcast Conditions

IMPLEMENTATION CONSIDERATIONS

Aside from false and missed calls performance, each of the vendors differentiates their systems from others by providing an array of features which are not part of this evaluation. Some of the distinctive features of systems could result in benefits which could make a system more appealing to an agency. As a result, the authors feel that some of the factors, in combination with installation and maintenance costs, that should be considered when choosing a system are:

Tradeoff between the number of false and missed calls

Data suggests that except for radar-based systems that provide consistent false and missed call rates, a system with a low percentage of missed calls under a particular weather condition usually has a higher number of false calls for the same condition. From a safety perspective, missed calls should be minimized. Therefore, the trade-off between false calls and missed calls is justifiable as long as the additional false calls do not significantly impact the operational efficiency per the agency needs. However, from a decision maker point of view, a system is satisfactory if the ratio of “additional false calls produced” to “missed call avoided” is deemed acceptable based on their agency needs. Among the considerations for deeming a tradeoff as acceptable is comparing the safety gained by reducing missed calls vs. the operational impacts of increasing false calls.

Maintenance needs

Under tight economic conditions, maintenance needs to keep a system operating is an important consideration in order to minimize expenses and labor needs. Based on the experience at the test intersection, camera-based systems could require cleaning of the lenses from time to time. When provided with an opportunity to perform maintenance on their products, all camera vendors except Aldis cleaned their camera lens. While choosing a system the agency should account for the maintenance needs of the systems under consideration and factor the maintenance costs into the decision making process.

System Features

Each of the systems provides additional features and characteristics that distinguish them from their competitors. Some of these include remote management interfaces, vehicle count methods, installation procedures, configuration interfaces, compatibility with off-site software, capability of being used for advanced detection, etc. Systems based on some form of camera technology provide agencies with the ability to remotely view the intersection and could provide advanced detection capabilities while radar-based systems (evaluated in this study) provide agencies with trajectory data that could be post-processed through the use of specialized software to monitor queue lengths, delay, and speeds at intersections. When selecting a system, the decision maker should evaluate the benefits of the differentiating features that different systems provide and the requirements of the installation.

Consistency of Performance

An ideal system does not only have a low percentage of missed and false calls but also performs consistently over different weather conditions. However, as the results show, during inclement weather conditions, e.g. rain at night, some of the systems could increase their false calls to over 60 percent. Therefore, when selecting a system the decision maker should take into consideration the weather

conditions at the potential installation site. If there is a prevailing condition at the potential installation site then the decision of selecting a system over another could be made based on the performance of system under the prevailing condition. On the other hand, for places with well-defined seasonal weather the selection of a system should consider the performance of systems over all expected conditions and the trade-offs between false and missed calls made by the systems for each condition.

CONCLUSIONS

An evaluation of the performance of seven vehicle detection systems from six different vendors which provide an alternative to traditional inductive loop-based stop bar vehicle detection was conducted. Two detection systems (Traficon and Traficon with FLIR camera) withdrew from the evaluation. Therefore, results for systems from 5 vendors: Aldis, Autoscope, Intersector, Iteris, and Wavetronix are presented. All the systems were installed and configured by the vendor or manufacturer. Sample video data as well as performance measure results were provided to the vendors to enable them to make any necessary changes before Phase 2 evaluation began. Phase 2 evaluation began in December 2012. Systems were evaluated under eight different combinations of weather and illumination conditions: clear day, overcast day, clear night, fog in day, rain in day, rain in night, snow in day and snow in night. For each condition, several hours from multiple days were used for the analysis. The number of hours ranged from seven for fog in day to 22 for snow in day condition. The number of vehicles for different conditions ranged from 811 to 6,025.

Four performance measures were used for evaluating stop bar performance: missed calls, false calls, dropped calls, stuck-on calls. Performance measures were quantified in two different ways: lane group and individual lanes. In the lane group scenario, multiple lanes of the same movement type were grouped together. Under the lane group scenario, the number of missed and false calls is lesser than under individual lanes scenario. Results for individual lanes are presented in the appendix and would be invaluable when considering performance of a system at an intersection with a different lane configuration than the test intersection.

All results summarized in the conclusions section are for the lane group scenario. Under day (clear and overcast) conditions (between 1,840 and 2,783 vehicles in overcast for different lane groups), missed calls were under one percent for all but one system in the right turn lane. Under clear night conditions (811 vehicles for different lane groups) missed calls varied from 0 to 2.4 percent. Under inclement weather conditions, missed calls ranged from 0 to 32.4 percent. Several systems maintained similar missed call performance (as in day and night conditions) even under inclement weather conditions. Except under a limited number of weather conditions and system combinations, missed calls are under one percent. The factor that appears to differentiate the systems is the rate of false calls. An ideal system will have a low rate for both false and missed calls.

Under day (clear and overcast) conditions (between 1,840 and 2,783 vehicles for different lane groups), false calls ranged from 0 to 3.5 percent. Under clear night conditions (811 vehicles) false calls varied from 0 to 40.1 percent. Under inclement weather conditions, false calls ranged from 0 to 63.6 percent. Most false calls were due to headlight glare from vehicles in adjacent lane.

Ranking the systems or recommending systems is not the objective of this research. The reason being there are several factors that need to be considered in choosing the most appropriate system for an intersection or application. There is no one system that will meet everyone's requirements. Stop bar detection performance is one of the factors and is the subject of research. Some of the other factors that should be considered were presented earlier in the Implementation Considerations section. As such, the reader is invited to consider all factors before making a decision about a particular system.

Future Work

Manufacturers are constantly adding new capabilities, making changes to their vehicle detection technology, and introducing new products. In order for WisDOT to be able to independently validate the claims made by each of the systems in a rapidly-changing world there is need for a more agile and mobile testing procedure which could be deployed at sites where prospective technologies are already installed instead of asking manufacturers to install their technology at a test location. Such an approach will allow to increase the number of devices deemed satisfactory by WisDOT and to speed up the adoption and deployment of potentially beneficial equipment in terms of safety and operations throughout the transportation network.

Appendix A

False and Missed Calls by Individual Lanes

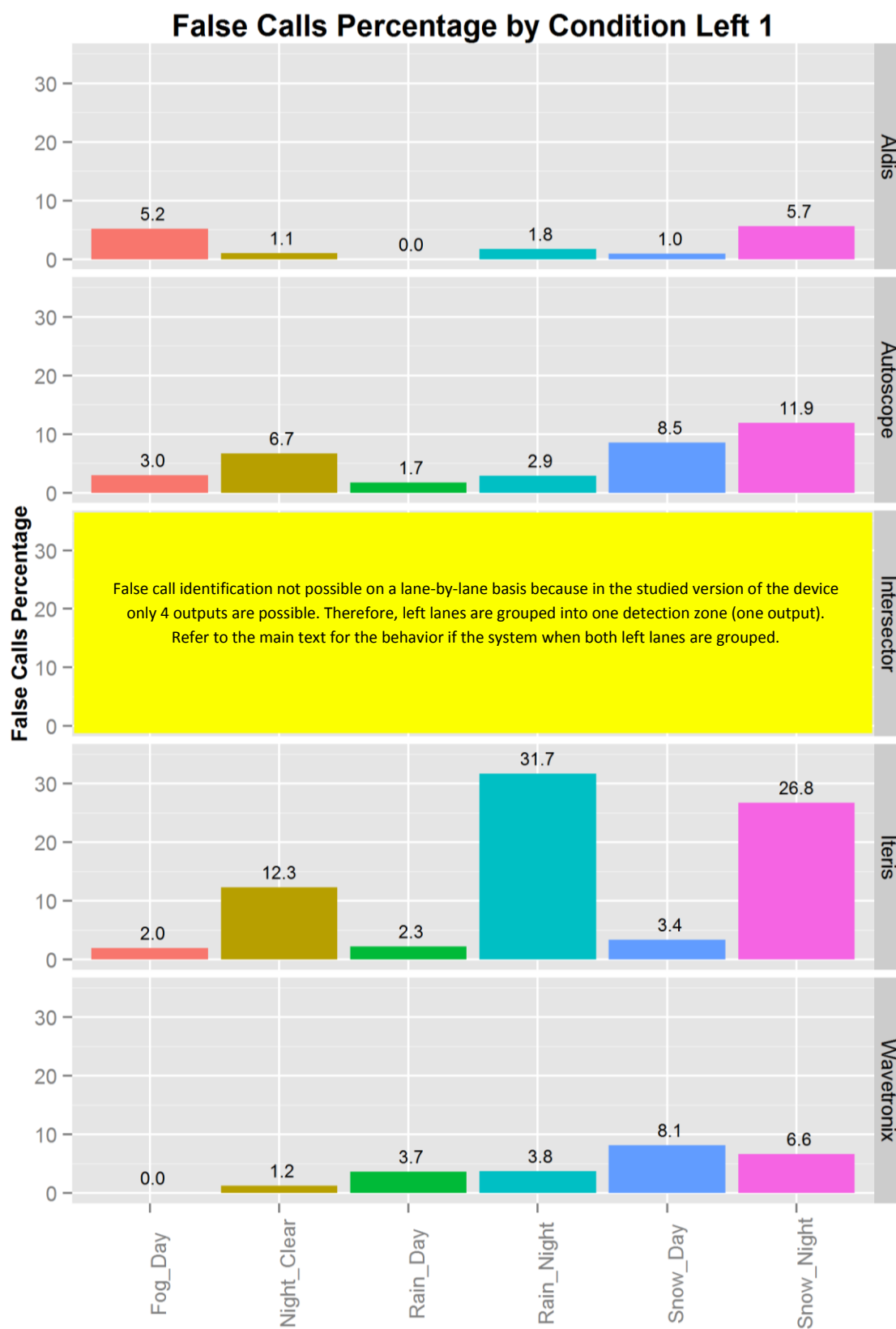
Definitions

Lane 1: Innermost left turn lane

Lane 2: Outermost left turn lane

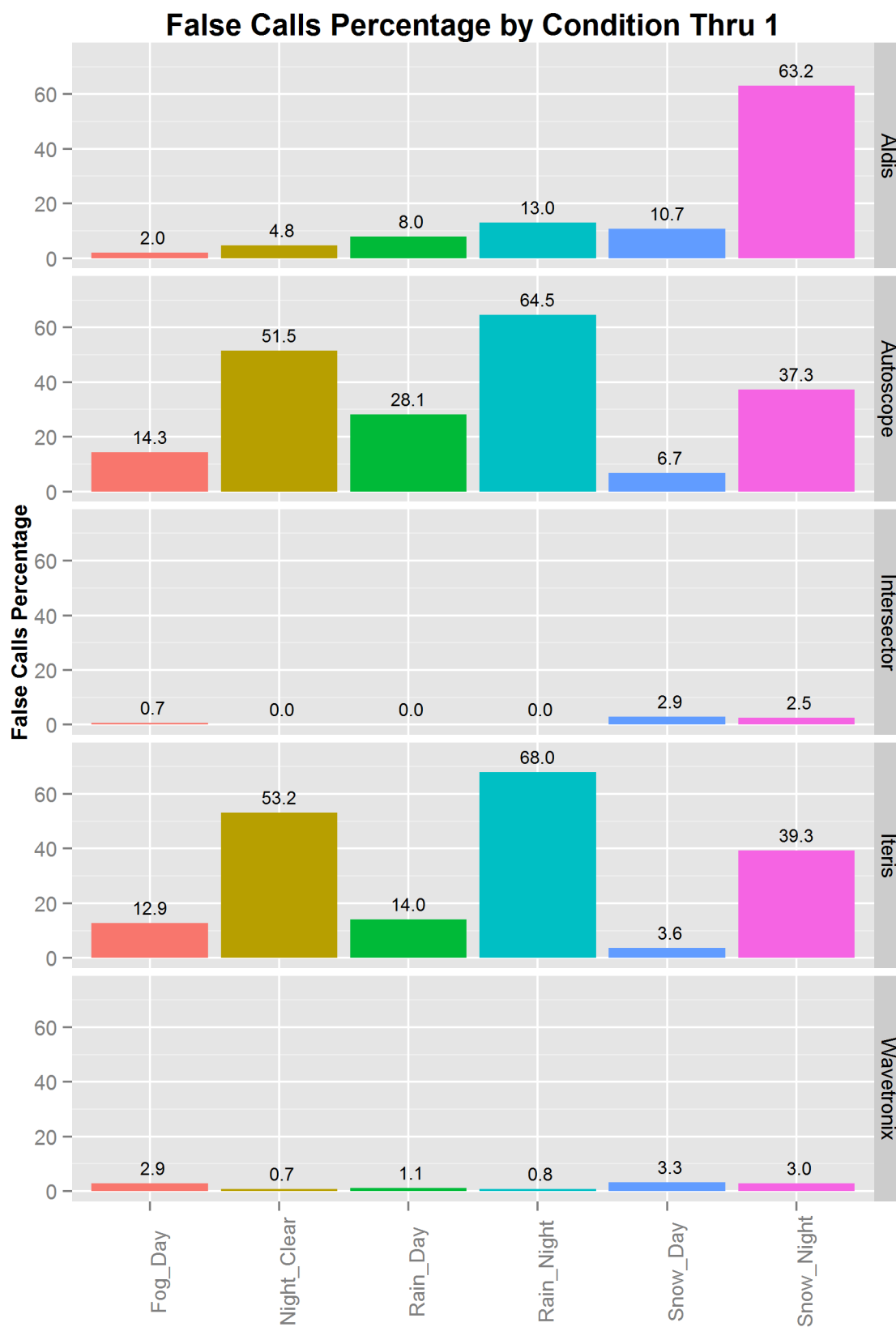
Thru 1: Innermost thru lane

Thru 2: Outermost thru lane

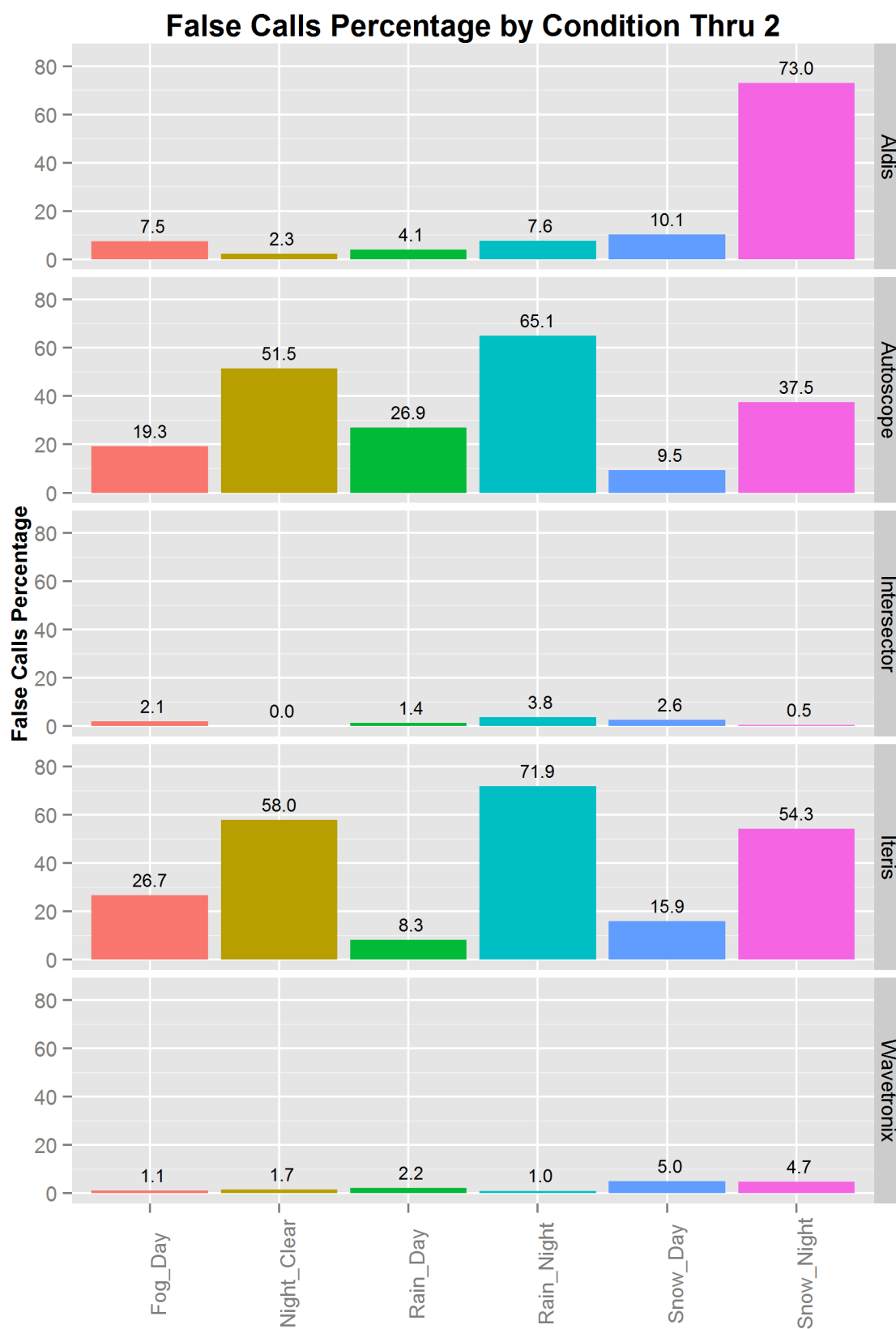


Appendix A1. False Calls Left Lane 1





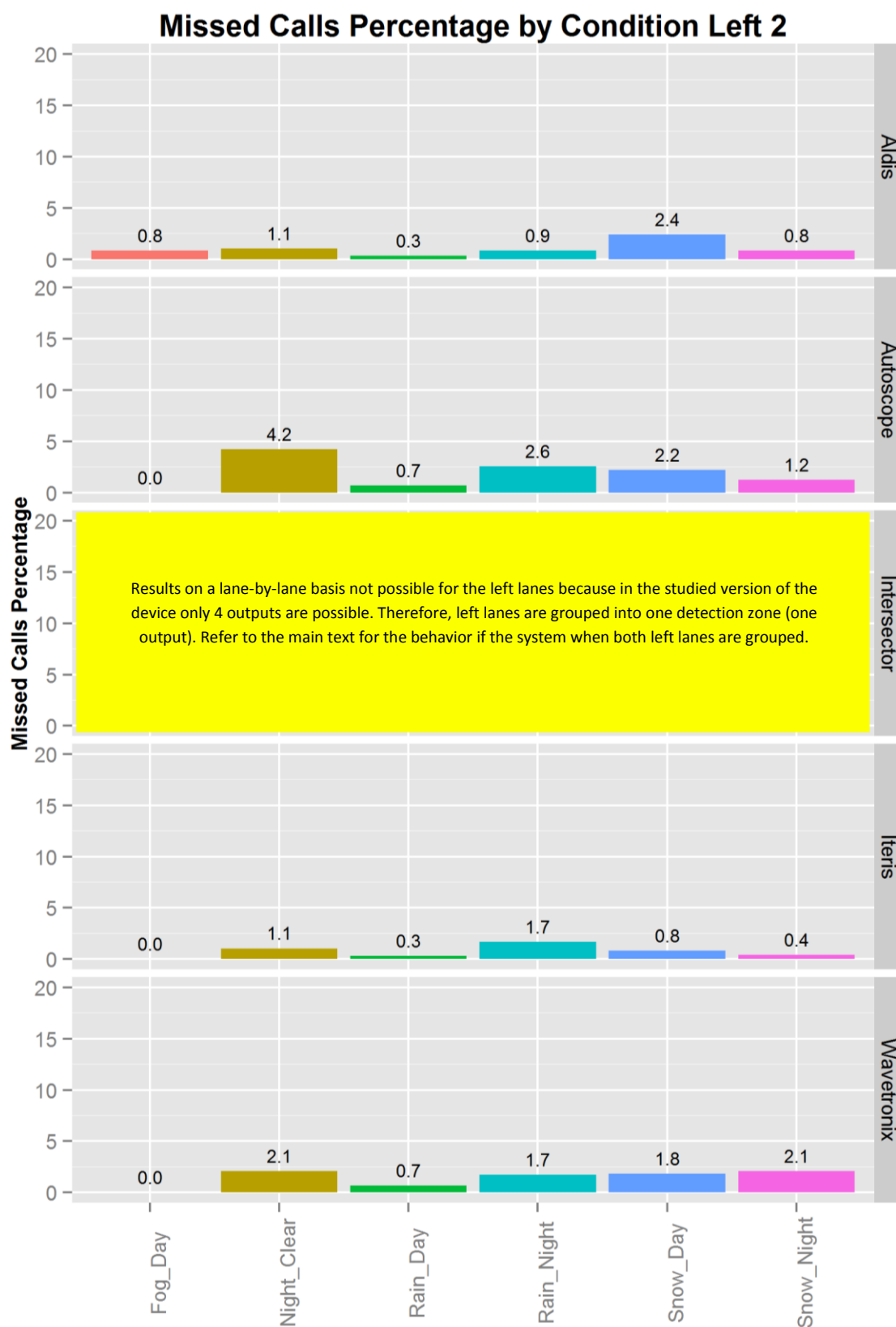
Appendix A3. False Calls Thru Lane 1



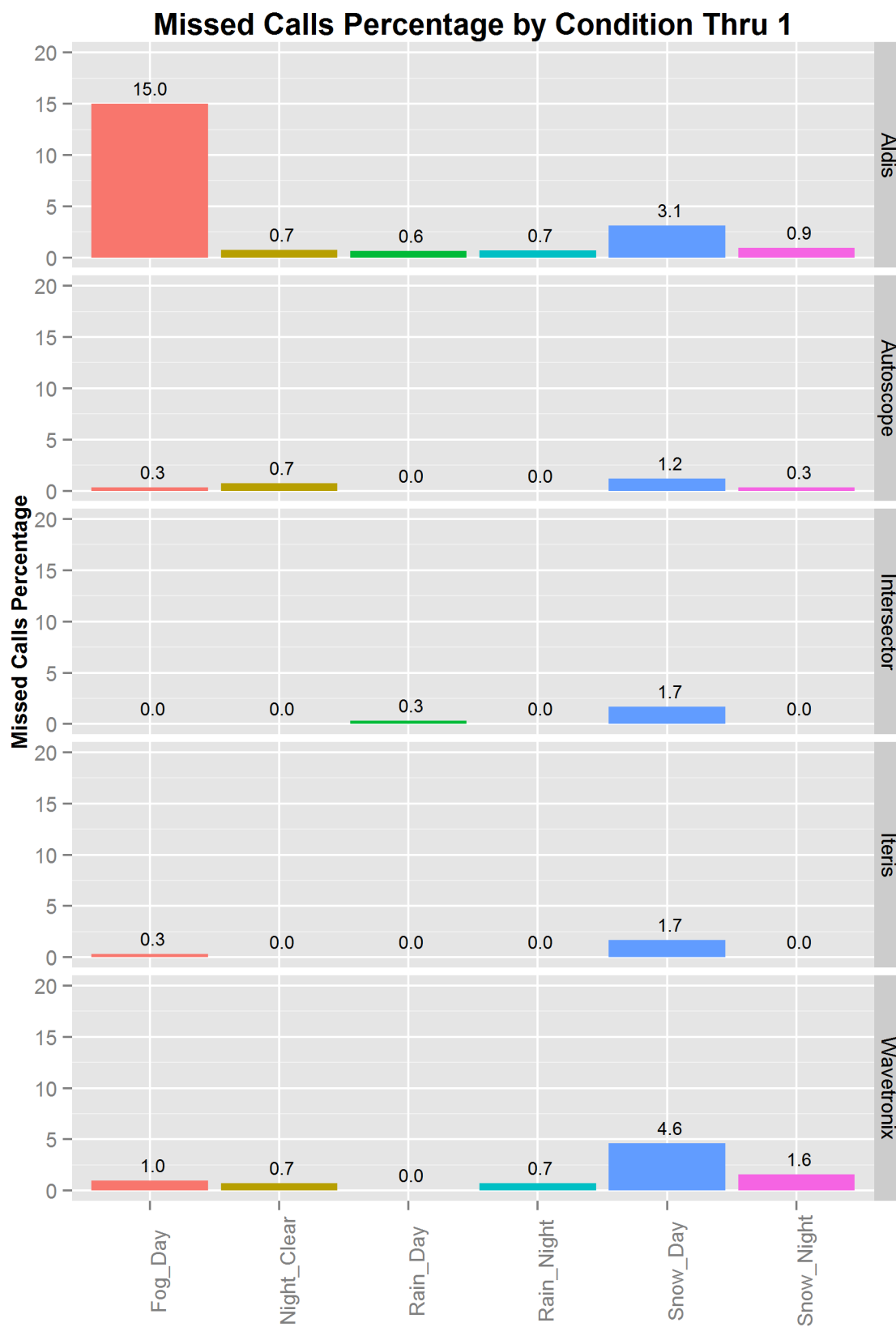
Appendix A4. False Calls Thru Lane 2



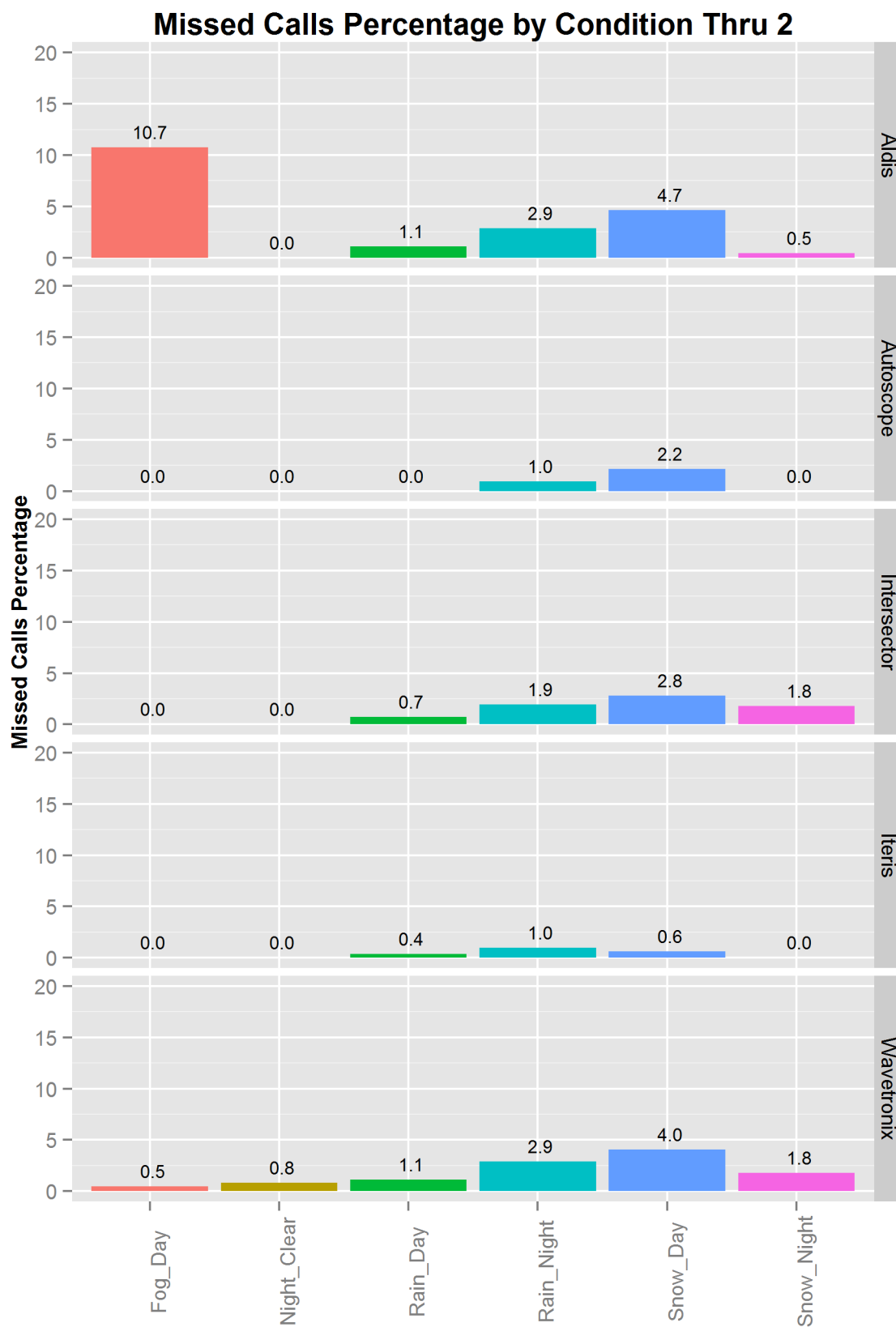
Appendix A5. Missed Calls Left Lane 1



Appendix A6. Missed Calls Left Lane 2



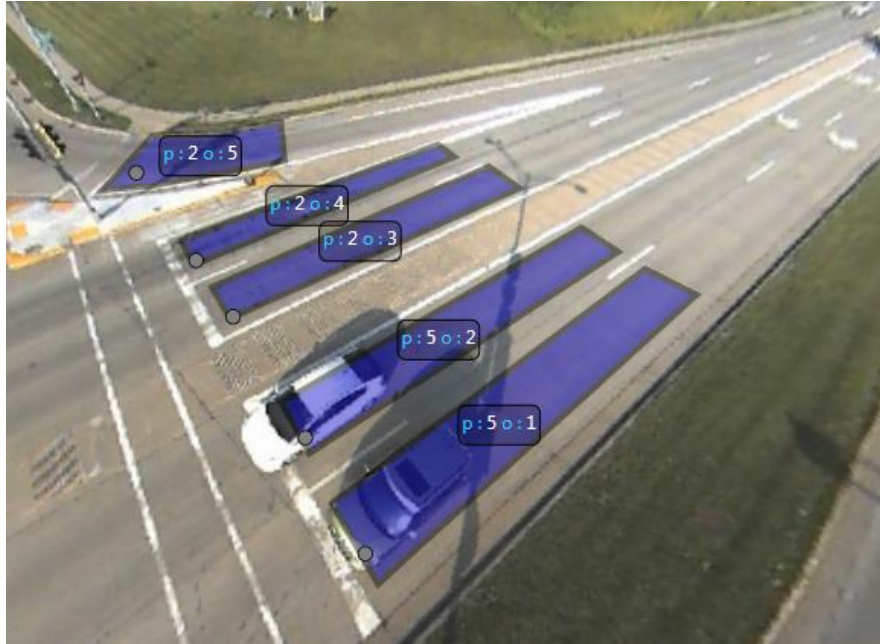
Appendix A7. Missed Calls Thru Lane 1



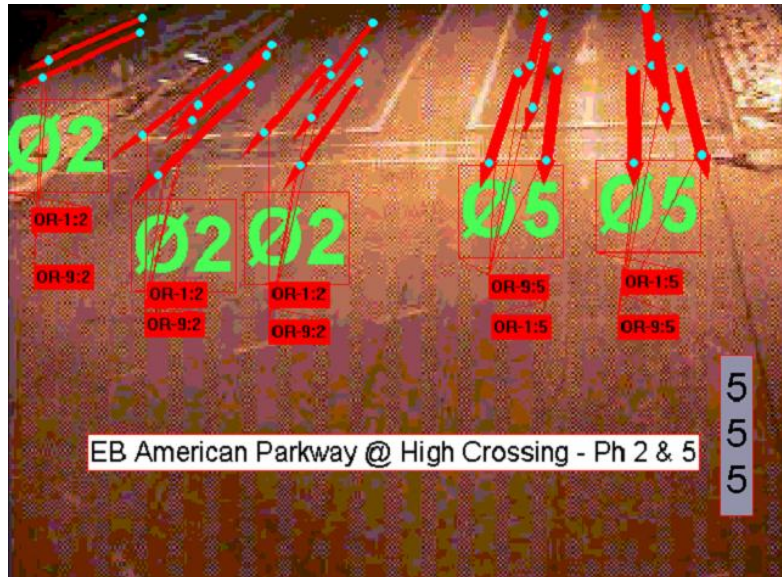
Appendix A8. Missed Calls Thru Lane 2

Appendix B

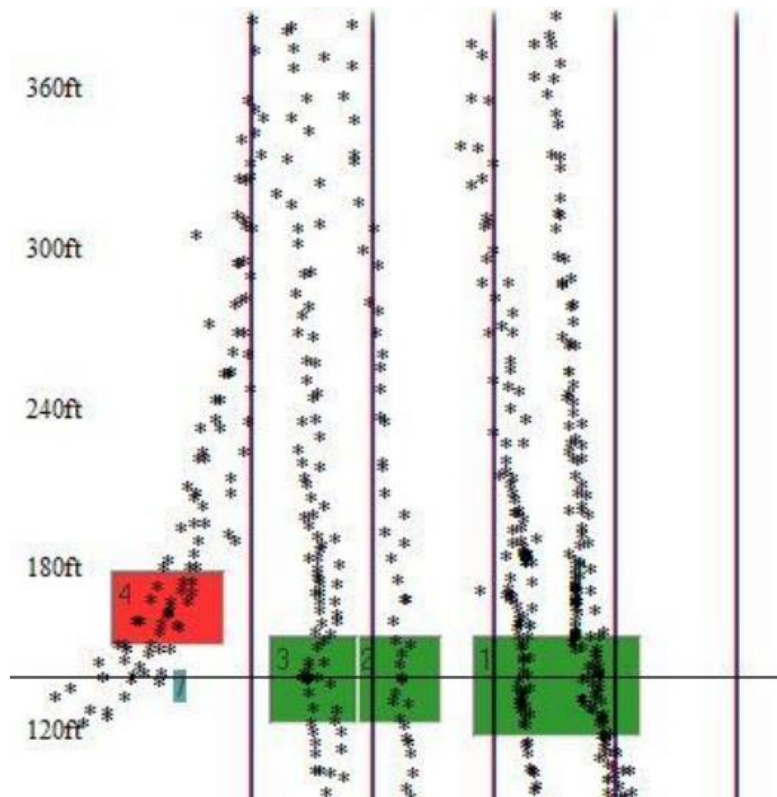
System Configurations



Appendix B1. Aldis Zone Configuration



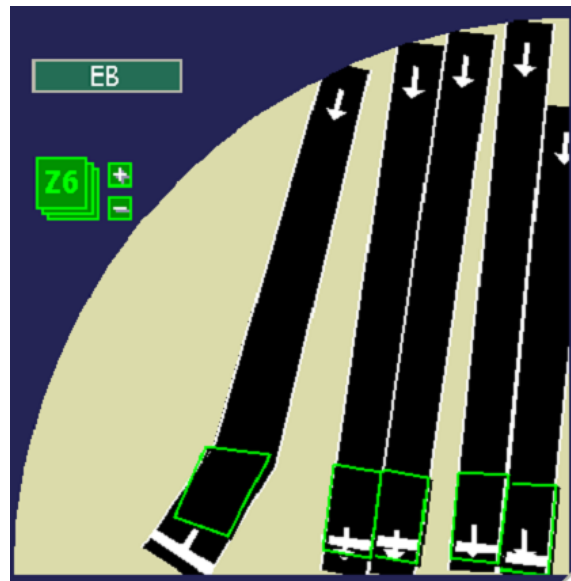
Appendix B2. Autoscope Zone Configuration



Appendix B3. Intersector Zone Configuration



Appendix B4. Iteris Zone Configuration



Appendix B5. Wavetronix Zone Configuration