Data Quality Review:
Accepted With Warning Fields by
Record Management System

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The overall purpose of the Accepted with Warning (AWW) project is to reduce the number of data quality warnings issued to police departments that electronically submit their crash reports to the Registry of Motor Vehicles (RMV). In lieu of rejecting a crash report for containing invalid/incomplete data, the RMV instead accepts the report in its original state while also issuing a warning stating that the report should be modified and resubmitted once the indicated fields are corrected.

Invalid/incomplete data entries may result from varying factors – the reporting officer not completing the field; police departments with outdated RMS software; RMSs without current RMV specifications; or technological upload/processing errors on the part of either the department, RMS, or the RMV. Due to the wide variability in causation, data trends and analysis must be completed from these multiple, varying facets. In this specific analysis, RMS crash reporting trends are examined in order to better understand possible global RMS issues as well as those for specific RMSs which could be remedied at the software capture, export or import level.

This analysis was conducted using electronically submitted police crash reports in the RMV's Crash Data System (CDS). As this report is a compilation of related tasks over time, the crash record timeframe and source date varies. It is important to note that during this analyzed time period, RMV law enforcement liaisons were providing technical assistance to the RMS vendors to remedy some of the known issues.

Distribution of Police Crash Reports by RMS

The analysis began with an examination of how many crash reports were submitted through each RMS for the period of July 2018 – June 2019. As shown in the chart below, IMC was utilized for close to 60% of all crash records electronically submitted in the period analyzed, followed by RAMS with almost 19%, and QED with 11.5%. There were also several smaller RMSs each submitting less than 5% of crash reports. These include Pamet (4.9%), Nexgen (2.3%), Microsystems (2.1%), Keystone (1.2%), MAACs (o.5%), and Larimore (0.3%).

However, as seen further below in Figure 2, IMC had a lower proportion of invalid/incomplete field entries relative to the number of crash reports submitted. In contrast, all other RMSs were over-represented in invalid/incomplete field entries, most significantly Larimore and QED.
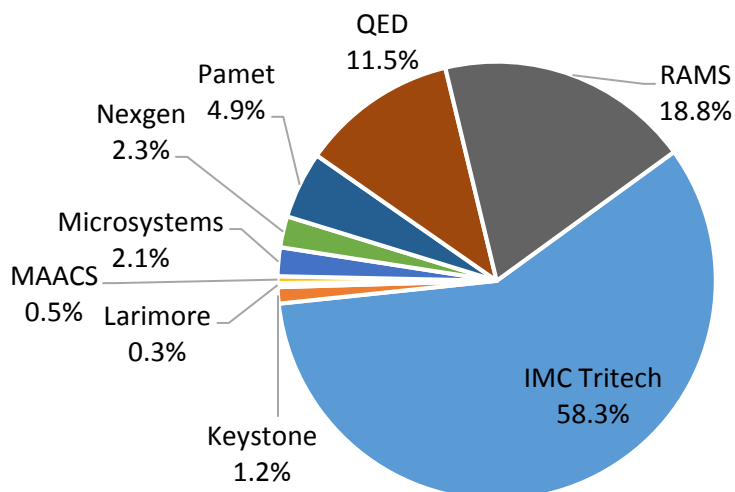
Figure 1: Crash Reports by RMS Submission
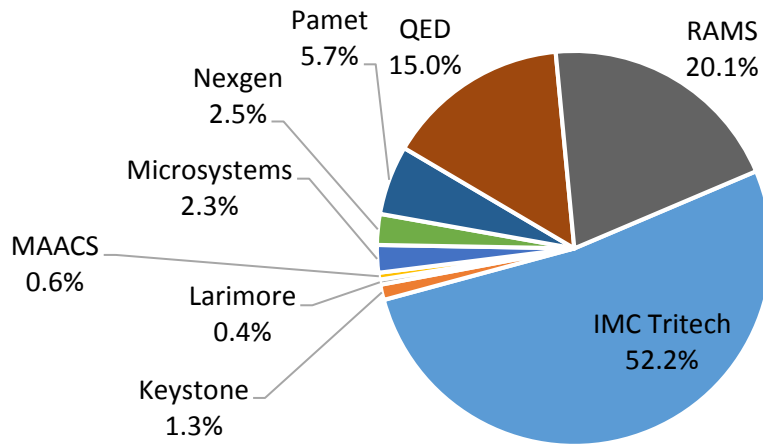
Figure 2: Percent Invalid/Incomplete in AWW Fields by RMS Submission

RMS Trends by Crash Report Field Type

Examining the total number of invalid/incomplete field entries by crash report section revealed that crash-level fields were not a significant problem, and alternatively, invalid/incomplete entries existed more often in the vehicle, driver and non-motorist sections. This analysis was conducted for the Jan 2019 –May 2019 period.

Table 1: % Invalid/Incomplete by AWW Field Category and RMS

RMS	Crash	Vehicle	Occupant	Driver	Non-Motorist
IMC	0%	4%	0%	2%	7%
QED	2%	15%	4%	23%	41%
Larimore	2%	21%	24%	26%	44%
RAMS	1%	1%	5%	11%	46%
Pamet	2%	2%	9%	9%	75%
Keystone	0%	9%	1%	2%	37%
Microsystems	1%	6%	4%	7%	15%
MAACS	6%	2%	3%	10%	7%
Nexgen	1%	2%	6%	4%	31%
State Total	0.8%	4.5%	2.5%	6.5%	28.7%

In the following sections, various fields of interest are examined. For the entirety of all fields by all vendors, refer to the attached Matrix table.

Crash Level Field Analysis

Analysis of crash level fields in crash reports submitted by each RMS found great variability in the occurrence of invalid/incomplete data. Many fields had a low occurrence rate of invalid/incomplete data, while others had a larger rate of invalid/incomplete data. However, in general, the crash level fields were of higher quality, with fewer invalid/incomplete responses than the vehicle, occupant, driver and non-motorist level fields. The table below outlines the findings.

Table 2: % Invalid/Incomplete of AWW Crash Level Fields by RMS

Field Name	ALL	IMC	RAMS	QED	Pamet	Nexgen	Micro-systems	Keystone	MAACS	Larimore
Light Conditions	0.1%	0.0%	0.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.6%
Weather Conditions	0.7%	0.0%	3.2%	0.0%	0.9%	0.0%	0.0%	0.0%	1.8%	0.0%
Traffic Control Device Type	0.4%	0.0%	0.7%	0.0%	2.4%	2.0%	0.0%	0.0%	4.0%	0.6%
Road Surface	0.1%	0.0%	0.2%	0.0%	0.8%	0.0%	0.0%	0.0%	8.4%	0.0%
Roadway Intersection Type	0.4%	0.0%	0.9%	0.0%	2.2%	4.0%	0.0%	0.0%	3.1%	0.6%
Trafficway Description	0.4%	0.1%	0.6%	0.0%	3.3%	2.6%	0.2%	0.0%	5.3%	2.5%
School Bus Related	0.1%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	13.3%	0.6%
Work Zone Related Code	0.2%	0.1%	0.4%	0.0%	0.0%	0.0%	0.3%	0.0%	6.2%	0.6%
First Harmful Event Location	0.3%	0.0%	0.8%	0.0%	1.2%	0.0%	0.0%	0.0%	7.6%	0.0%
First Harmful Event	0.2%	0.0%	0.7%	0.1%	1.3%	0.0%	0.0%	0.0%	0.0%	5.0%
Road Contributing Circumstances	2.3%	0.6%	2.0%	12.2%	3.3%	0.0%	0.1%	1.3%	6.2%	1.9%
Crash Narrative	1.3%	1.4%	0.4%	0.2%	5.9%	2.9%	0.5%	0.2%	0.0%	0.0%
Crash Diagram	0.2%	0.4%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	0.6%

In examining each crash level field included in the AWW criteria, rates of more than 5% invalid/incomplete by field were examined further:

- Road Surface: Crash reports submitted through MAACs had an 8.5% occurrence rate of invalid/incomplete entries.
- Trafficway Description: More than 5% of crash reports submitted through MAACS had invalid/incomplete entries.
- School Bus Related: Crash reports submitted through MAACS had more than 13% invalid/incomplete entries.
- Work Zone Related: Slightly more than 6% of crash reports submitted through MAACS had invalid/incomplete entries.
- First Harmful Event Location: Crash reports submitted through MAACS had 7.6% invalid/incomplete entries, almost all of which were null.
- First Harmful Event: 5% of crash reports submitted through Larimore had invalid/incomplete information.
- Roadway Contributing Circumstance: Crash reports submitted through QED had more than 12% invalid/incomplete entries.
- Crash Narrative: Crash reports submitted through Pamet had an invalid/incomplete occurrence rate of almost 6%.

Of all the crash level records which received a warning upon acceptance, the vast majority had incomplete cell values (empty/null or '98').

It is worth noting that although police crash reports submitted through MAACS had an overall higher rate of invalid/incomplete entries across most all crash level fields, MAACS only comprised a small portion of the total crash reports received by the RMV. Problematic areas in crash reports submitted through MAACS may also have more variability due to their smaller sample size.

Vehicle Level Field Analysis

All vehicle level fields were examined for invalid/incomplete data that could trigger the RMV AWW. Those with an occurrence of 5% or more were studied further.

Damaged Area Code

Table 3: % Invalid/Incomplete Damaged Area Code by RMS

RMS	Vehicle Records	Damaged Area Code % Invalid/Incomplete
IMC	48346	9.8%
RAMS	16649	2.0%
QED	9751	0.4%
Pamet	4487	4.0%
Nexgen	2467	1.6%
Microsystems	1933	3.3%
Keystone	1162	5.5%
MAACS	416	0.0%
Larimore	287	100.0%
TOTAL	85498	6.7%

Interestingly, the Damaged Area Code field experienced a higher occurrence rate of invalid/incomplete entries. This may be due to the formatting change in the last iteration of crash report edits when the diagram of the vehicle was removed. It appears that crash reports submitted via IMC had a high occurrence of '98' and null cells. Furthermore, Larimore-submitted records did not have any values for this field, resulting in a 100% AWW determination.

Towed From Scene

Table 4: % Invalid/Incomplete Towed from Scene by RMS

RMS	Vehicle Records	Towed from Scene? Invalid/Incomplete
IMC	48346	1.5%
RAMS	16649	0.2%
QED	9751	0.4%
Pamet	4487	0.2%
Nexgen	2467	5.4%
Microsystems	1933	2.9%
Keystone	1162	12.7%
MAACS	416	0.0%
Larimore	287	0.3%
TOTAL	85498	1.3%

As shown in the table above, crash reports submitted through Keystone RMS had an almost 13% occurrence rate of invalid/incomplete data for the Towed from Scene field, while those submitted through Nexgen had greater than 5%. The vast majority of these occurrences were due to the field being left empty.

Responding to Emergency:

Table 5: % Invalid/Incomplete Responding to Emergency by RMS

RMS	Vehicle Records	Responding to Emergency? Invalid/Incomplete
IMC	48346	5.2%
RAMS	16649	1.4%
QED	9751	99.5%
Pamet	4487	0.2%
Nexgen	2467	0.5%
Microsystems	1933	21.0%
Keystone	1162	25.9%
MAACS	416	4.1%
Larimore	287	21.3%
TOTAL	85498	15.5%

Interestingly, almost 100% of crash reports submitted though QED had invalid/incomplete entries for the Responding to Emergency field. Further examination of these records found a very small portion of properly used codes ('1' and '2'), with the remainder predominantly being incomplete, and a fraction containing '98'. However, the differences between a null entry versus a '98' entry has not yet been fully understood.

Vehicle Travel Direction:

Table 6: % Invalid/Incomplete Vehicle Travel Direction by RMS

RMS	Vehicle Records	Vehicle Travel Direction Invalid/Incomplete
IMC	48346	5.8%
RAMS	16649	1.7%
QED	9751	6.7%
Pamet	4487	7.6%
Nexgen	2467	5.3%
Microsystems	1933	10.8%
Keystone	1162	24.0%
MAACS	416	3.8%
Larimore	287	26.8%
TOTAL	85498	5.6%

Upon examination of the Vehicle Travel Direction field, an interesting trend of using numbers '6' and '8' as values was found. In contrast, the crash report form indicates use of letters N/S/E/W as proper entries. Specifically, the frequent use of '8' for crash reports submitted via Keystone and Larimore were likely an indicator of 'unknown', but this was not a coded attribute according to the Massachusetts Crash Report Form. Therefore, it has been quantified as invalid.

Occupant Level Field Analysis

All occupant level AWW fields were examined for invalid/incomplete data that would lead to a crash report being accepted with warning. Those with an occurrence of 5% or more were studied further.

Safety System

Table 7: % Invalid/Incomplete Safety System by RMS

RMS	Vehicle Records	Safety System Invalid/Incomplete
IMC	48346	0.6%
RAMS	16649	13.7%
QED	9751	3.9%
Pamet	4487	8.0%
Nexgen	2467	1.7%
Microsystems	1933	2.4%
Keystone	1162	3.0%
MAACS	416	1.6%
Larimore	287	29.1%
TOTAL	85498	4.1%

The Safety System field was examined for all vehicle occupants. Interestingly, there was a portion of records with '96' representing an invalid value, as well as a large occurrence of empty cells. Although crash reports submitted through Larimore had the highest rate of invalid/incomplete entries, those records are simply empty, whereas crash report submitted through RAMS (the 2nd highest invalid/incomplete rate) can be attributed to both empty and invalid values.

Airbag Status

Table 8: % Invalid/Incomplete Airbag Status by RMS

RMS	Vehicle Records	Airbag Status Invalid/Incomplete
IMC	48346	0.3%
RAMS	16649	4.6%
QED	9751	4.2%
Pamet	4487	9.8%
Nexgen	2467	1.7%
Microsystems	1933	1.2%
Keystone	1162	0.9%
MAACS	416	1.6%
Larimore	287	19.8%
TOTAL	85498	2.2%

Overall, Airbag Status was not a problematic field and the occurrences of invalid/incomplete records were largely due to empty cell values. Although crash reports submitted through Larimore and Pamet had the highest invalid/incomplete rates, there were no discernable patterns as to why.

Ejection Code

Table 9: % Invalid/Incomplete Ejection Code by RMS

RMS	Driver Records	Ejection Code Invalid/Incomplete
IMC	48346	0.3%
RAMS	16131	1.3%
QED	7968	4.4%
Pamet	4323	7.6%
Nexgen	2302	0.2%
Microsystems	1775	0.6%
Keystone	1025	0.9%
MAACS	404	1.8%
Larimore	176	23.1%
TOTAL	77650	1.4%

As anticipated, Ejection Code for all occupants closely mirrored Airbag Status. The majority of invalid/incomplete entries were due to empty cells, with crash reports submitted through Larimore and Pamet having a more frequent occurrence of empty records.

Injury Status

Table 10: % Invalid/Incomplete Injury Status by RMS

RMS	Driver Records	Injury Status Invalid/Incomplete
IMC	48346	0.3%
RAMS	16131	1.6%
QED	7968	0.1%
Pamet	4323	6.7%
Nexgen	2302	0.2%
Microsystems	1775	0.8%
Keystone	1025	0.9%
MAACS	404	0.0%
Larimore	176	21.6%
TOTAL	77650	1.0%

An update to the definitions and variable options for Injury Status was recently released for implementation across all RMSs at the time of this writing. While the use of entries '2', '3', '4', and '5' were scheduled to be discontinued, for the purposes of this analysis, they were accepted as valid entries. However, a preliminary look into the most recent two months of data revealed that most RMSs had either made these changes or were in the process of doing so. Crash reports submitted via QED and RAMS were the most frequent users of the new attribute codes, while Keystone and Nexgen were still submitting a large portion of the old codes.

Transported By

Table 11: % Invalid/Incomplete Transported by Code by RMS

RMS	Driver Records	Transported by Code Invalid/Incomplete
IMC	48346	0.6%
RAMS	16131	4.1%
QED	7968	3.4%
Pamet	4323	9.3%
Nexgen	2302	5.6%
Microsystems	1775	10.1%
Keystone	1025	0.9%
MAACS	404	0.0%
Larimore	176	22.4%
TOTAL	77650	2.5%

The completion of Transported By fields for all occupants closely mirrors the previous occupant fields, with no discernable usage patterns.

Driver Level Field Analysis

All driver level AWW fields were examined for invalid/incomplete data which would lead to a crash report being accepted with warning. Those with an occurrence of 5% or more were studied further.

License Class

Table 12: % Invalid/Incomplete License Class by RMS

RMS	Driver Records	License Class Invalid/Incomplete
IMC	48346	0.8%
RAMS	16131	8.6%
QED	7968	27.8%
Pamet	4323	10.8%
Nexgen	2302	2.1%
Microsystems	1775	3.7%
Keystone	1025	2.0%
MAACS	404	4.0%
Larimore	176	13.1%
TOTAL	77650	5.9%

Examining License Class values by RMS did not reveal any notable trends, with the majority of AWW occurrences resulting from an empty or '98' cell value. It is worth noting that both QED and MAACS had a slightly higher occurrence of code '96' (invalid) usage, at 1.5% and 1.0% respectively. Although not formally included in the overall AWW field analysis, License Class field two (for those drivers with multiple designations) was examined for trends and found to be empty or '98' 93% of the time.

Driver Contributing Code

Table 13: % Invalid/Incomplete Driver Contributing Code by RMS

RMS	Driver Records	Driver Contributing Code Invalid/Incomplete
IMC	48346	0.4%
RAMS	16131	6.5%
QED	7968	25.9%
Pamet	4323	9.5%
Nexgen	2302	2.6%
Microsystems	1775	7.3%
Keystone	1025	0.8%
MAACS	404	0.0%
Larimore	176	10.2%
TOTAL	77650	5.0%

It is interesting to note that Driver Contributing Code had varied usage across crash reports submitted through various RMSs. Most significantly, records from reports submitted via QED were found to be empty more than 25% of the time.

Driver Distracted By

Table 14: % Invalid/Incomplete Driver Distracted by RMS

RMS	Driver Records	Driver Distracted By Invalid/Incomplete
IMC	48346	2.8%
RAMS	16131	26.5%
QED	7968	39.4%
Pamet	4323	16.7%
Nexgen	2302	1.5%
Microsystems	1775	10.7%
Keystone	1025	3.6%
MAACS	404	38.9%
Larimore	176	73.9%
TOTAL	77650	12.8%

Similar to other driver/occupant fields where a high number of invalid/incomplete records were due to empty cells, Driver Distracted By additionally had a small portion of '96' (invalid). Because this was a new field in the specification update, the higher AWW rates for crash reports submitted by Larimore, QED and MAACS, may be due to delayed implementation.

Non-Motorist Level Field Analysis

All non-motorist AWW fields were examined for invalid/incomplete data.

Table 15: % Invalid/Incomplete of AWW Non-Motorist Level Fields by RMS

Field Name	All	IMC	RAMS	QED	Pamet	Nexgen	Micro-systems	Keystone	MAACS	Larimore
Sample Size	1273	559	89	384	152	2	35	22	2	28
NM Type	21%	0%	19%	30%	78%	0%	3%	5%	0%	21%
NM Action	23%	0%	27%	34%	80%	100%	3%	9%	0%	21%
NM Location	24%	0%	39%	35%	80%	100%	11%	18%	0%	21%
NM Condition	25%	0%	43%	36%	81%	100%	11%	9%	0%	21%
NM Safety System	63%	28%	79%	100%	91%	100%	29%	73%	50%	82%
NM Injury Status	7%	1%	15%	0%	36%	100%	0%	9%	0%	50%
NM Transported by Code	15%	9%	17%	4%	48%	50%	26%	50%	0%	54%

In general, non-motorist fields had a large amount of incomplete data. With the exception of crash reports submitted via IMC which had a low overall rate of invalid/incomplete non-motorist fields. While crash reports submitted by QED, Pamet, and RAMS had high occurrences. Non-motorist results for Nexgen and MAACS should not be used for comparison due to the significantly low sample size of 2 crashes. Other interesting findings include:

- Statewide, all non-motorist fields had higher than 5% invalid/incomplete data.
- The safety system field had the highest rate of incomplete data for all RMSs, with a statewide rate of 63%, most problematic for QED (100%), Pamet (91%) and RAMS (79%).
- IMC data quality was most complete, with only two fields with incomplete data - safety system (28%) and transported by (9%). Interestingly, these are the two fields which are utilized at the occupant level as well.

Comparative & Timeline Analysis

UMassSafe studied trends and improvements over time to examine the frequency of warnings relative to RMS submissions. Identifying the average ratio of invalid/incomplete AWW fields per report established that IMC Tritech, the most frequently used RMS, also had the best data quality, as show in in Figure 3.
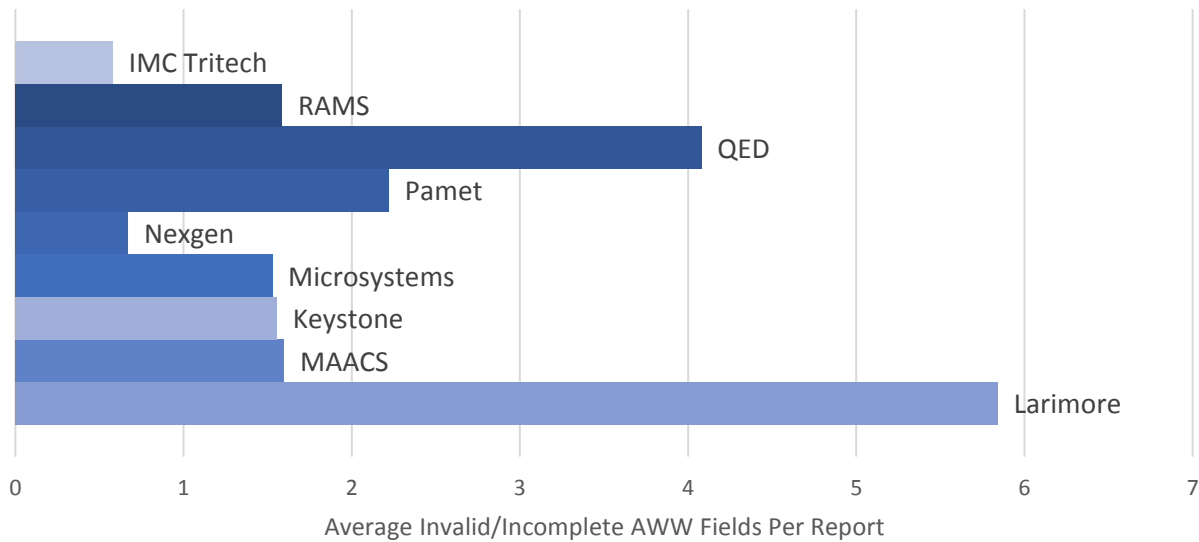
Figure 3: Average Count of Invalid/Incomplete AWW Fields per Report

Following these RMS ratios of invalid/incomplete AWW fields per crash report over time, Figure 4 illustrates notable improvements for Nexgen, as well as RAMS and Larimore. Also indicated below is the consistent higher ratio of invalid/incomplete fields for QED and Pamet, which experienced the least improvement.
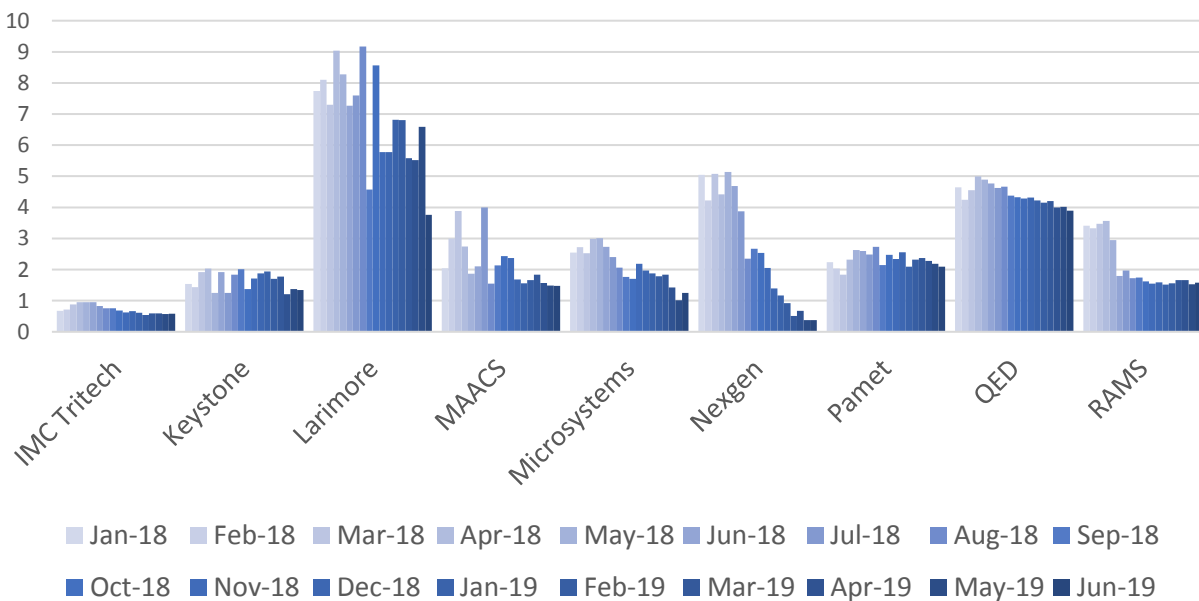
Figure 4: Count of Invalid/Incomplete AWW Fields per Report by Month/Year

As the project's ultimate goal was to reduce the number of crash reports accepted with warning, in addition to examining crash report fields, UMassSafe examined the total number of crash reports which included any AWW field which was invalid/incomplete, essentially mirroring an 'Accepted with Warning' determination. In this view, if a crash report had one invalid/incomplete field, it was just as significant as if it had ten.

Figure 5: % of Crash Reports by RMS with any Invalid/Incomplete AWW Field over Time

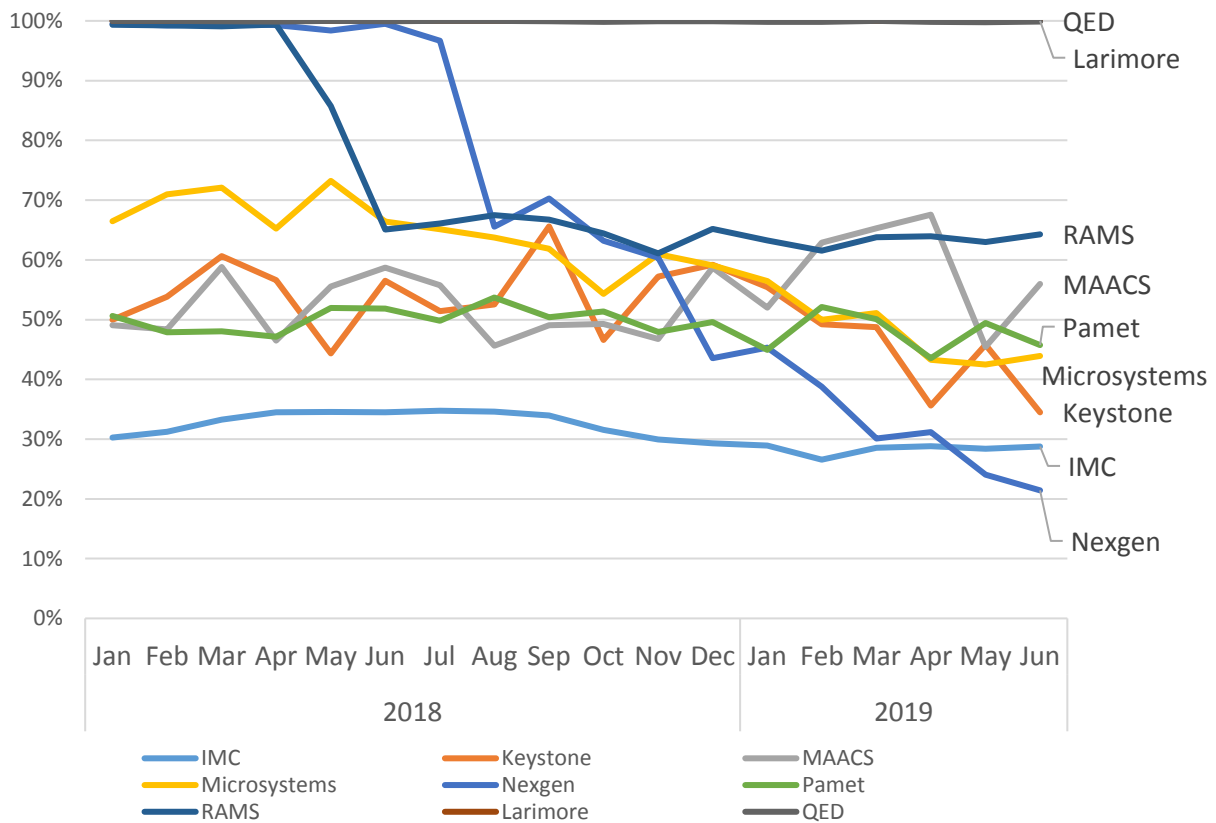As shown in Figure 5 above, crash reports submitted by the QED and Larimore RMS did not experience any fluctuation or improvement due to at least one field always remaining invalid/incomplete and resulting in 100% crash reports with any invalid/incomplete AWW fields. Specifically, QED did not have any field values present for Responding to Emergency, while Larimore did not have Damage Area Code. Outside of these two unique circumstances, it is interesting to note, as shown in the figure above, the fluctuation of crash records with at least one invalid/incomplete entry for the remaining RMSs.

Conclusions

In summary, crash level fields appeared to have less invalid/incomplete data across all RMSs. In contrast, almost all non-motorist fields, for all RMS, were problematic. Furthermore, the vast majority of data quality issues appear to have been due to fields left incomplete or incorrectly completed Each RMS may have different parameters for required fields, resulting in significantly different trends and problems as outlined above. In addition, when each crash report submitted via a specific RMS is found to have the same invalid/incomplete field as others, a systemic issue is the likely cause. Addressing this issue can systemically increase the overall quality most efficiently. Ultimately, these findings will assist the RMV in working with RMS vendors towards improving data quality processes via a reduction in invalid/incomplete data on crash reports.

Category	Field Name	Field #	Statewide	IMC Tritech	RAMS	QED	Pamet	Nexgen	Microsystems	Keystone	MAACS	Larimore
							Invalid/Incomplete %					
	Sample Size		46940	27026	8859	5213	2495	1291	1062	609	225	160
Crash	Light Conditions	1	0.1%	0.0%	0.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.6%
	Weather Conditions	2	0.7%	0.0%	3.2%	0.0%	0.9%	0.0%	0.0%	0.0%	1.8%	0.0%
	Traffic Control Device Type	4	0.4%	0.0%	0.7%	0.0%	2.4%	2.0%	0.0%	0.0%	4.0%	0.6%
	Road Surface	6	0.1%	0.0%	0.2%	0.0%	0.8%	0.0%	0.0%	0.0%	8.4%	0.0%
	Roadway Intersection Type	7	0.4%	0.0%	0.9%	0.0%	2.2%	4.0%	0.0%	0.0%	3.1%	0.6%
	Trafficway Description	8	0.4%	0.1%	0.6%	0.0%	3.3%	2.6%	0.2%	0.0%	5.3%	2.5%
	School Bus Related	9	0.1%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	13.3%	0.6%
	Work Zone Related Code	10	0.2%	0.1%	0.4%	0.0%	0.0%	0.0%	0.3%	0.0%	6.2%	0.6%
	First Harmful Event Location	12	0.3%	0.0%	0.8%	0.0%	1.2%	0.0%	0.0%	0.0%	7.6%	0.0%
	First Harmful Event	13	0.2%	0.0%	0.7%	0.1%	1.3%	0.0%	0.0%	0.0%	0.0%	5.0%
	Road Contributing Circumstances	14	2.3%	0.6%	2.0%	12.2%	3.3%	0.0%	0.1%	1.3%	6.2%	1.9%
	Crash Narrative		1.3%	1.4%	0.4%	0.2%	5.9%	2.9%	0.5%	0.2%	0.0%	0.0%
	Speed Limit*		~~78.9%~~	~~81.6%~~	~~67.6%~~	~~80.5%~~	~~83.1%~~	~~86.7%~~	~~72.2%~~	~~91.5%~~	~~80.4%~~	~~58.8%~~
	Crash Diagram		0.2%	0.4%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	0.6%
Vehicle	Vehicle Configuration	21	0.8%	0.8%	0.5%	0.9%	0.6%	0.3%	2.2%	0.2%	0.2%	0.3%
	Sequence of Events	23	1.3%	1.4%	1.0%	0.4%	1.5%	0.5%	4.0%	0.3%	0.0%	3.8%
	Damaged Area Code	27	6.7%	9.8%	2.0%	0.4%	4.0%	1.6%	3.3%	5.5%	0.0%	100.0%
	Towed from Scene?	33	1.3%	1.5%	0.2%	0.4%	0.2%	5.4%	2.9%	12.7%	0.0%	0.3%
	Registration #		0.4%	0.3%	0.3%	0.5%	0.2%	0.2%	1.9%	0.9%	0.2%	0.3%
	Responding to Emergency?		15.5%	5.2%	1.4%	99.5%	0.2%	0.5%	21.0%	25.9%	4.1%	21.3%
	Vehicle Travel Direction		5.6%	5.8%	1.7%	6.7%	7.6%	5.3%	10.8%	24.0%	3.8%	26.8%
Occupant	Safety System	35	4.1%	0.6%	13.7%	3.9%	8.0%	1.7%	2.4%	3.0%	1.6%	29.1%
	Airbag Status	36	2.2%	0.3%	4.6%	4.2%	9.8%	1.7%	1.2%	0.9%	1.6%	19.8%
	Ejection Code	37	1.4%	0.3%	1.3%	4.4%	7.6%	0.2%	0.6%	0.9%	1.8%	23.1%
	Injury Status	39	1.0%	0.3%	1.6%	0.1%	6.7%	0.2%	0.8%	0.9%	0.0%	21.6%
	Transported by Code	40	2.5%	0.6%	4.1%	3.4%	9.3%	5.6%	10.1%	0.9%	0.0%	22.4%
Driver	License Class	19	5.9%	0.8%	8.6%	27.8%	10.8%	2.1%	3.7%	2.0%	4.0%	13.1%
	Driver Contributing Code	25	5.0%	0.4%	6.5%	25.9%	9.5%	2.6%	7.3%	0.8%	0.0%	10.2%
	Driver Distracted By	26	12.8%	2.8%	26.5%	39.4%	16.7%	1.5%	10.7%	3.6%	38.9%	73.9%
	License #		0.7%	0.7%	1.1%	0.3%	0.0%	0.0%	1.1%	0.3%	0.0%	2.8%
Non-Motorist	NM Type	15	20.5%	0.4%	19.1%	30.2%	77.6%	0.0%	2.9%	4.5%	0.0%	21.4%
	NM Action	16	22.6%	0.4%	27.0%	33.9%	79.6%	100.0%	2.9%	9.1%	0.0%	21.4%
	NM Location	17	24.3%	0.4%	39.3%	35.2%	79.6%	100.0%	11.4%	18.2%	0.0%	21.4%
	NM Condition	18	24.7%	0.4%	42.7%	35.9%	80.9%	100.0%	11.4%	9.1%	0.0%	21.4%
	NM Safety System	35	62.8%	27.7%	78.7%	100.0%	91.4%	100.0%	28.6%	72.7%	50.0%	82.1%
	NM Injury Status	39	7.0%	0.5%	14.6%	0.3%	35.5%	100.0%	0.0%	9.1%	0.0%	50.0%
	NM Transported by Code	40	14.9%	8.8%	16.9%	4.4%	48.0%	50.0%	25.7%	50.0%	0.0%	53.6%

Analysis completed by UMassSafe using 2019 crash data as of 8/14/19.   Red highlights poor data quality with more than 10% invalid/empty, yellow illustrates less

*Statewide data error under investigation, temporarily disregard.   significant but still below average data quality performance.