Classification Data Explained

Have you ever wondered how JAMAR accurately calculates vehicle classification data when processing a tube style ATR?

Maybe you have asked how we can be confident in our ability to classify accurately?

What about differences in classification results when compared to other equipment manufacturers?

Brief Background:

When using tube style ATRs, collecting accurate classification data can be a complex process. High volume, high speed roadways provide traffic patterns that send air pulses to an ATR at incredibly fast speeds. Even a calm residential roadway can generate hundreds of thousands of pulses per count, all needing to be accepted, processed and timestamped, within milliseconds. To complicate the matter further, the sheer number and variety of vehicle types in the United States can be overwhelming from a data collection perspective.

A high-quality ATR should be capable of accepting these air pulses and saving the timestamps with a high level of verifiable accuracy. The JAMAR Apollyon, for example, will time stamp air pulses to better than three one hundred thousandths of a second.

Admittedly, along with JAMAR, there are other manufacturers of traffic data collection equipment that create hardware capable of accurately accepting, processing and timestamping air pulses. The questions then become that of what JAMAR, and other manufacturers, are doing with the timestamped data once it is saved. How are we, as an industry, determining vehicle classification? If my data and your data is being classed differently, is one of us wrong?

The answer is in the software!

Assuming your traffic counter has accurately timestamped the axle hits, it is then up to advanced software algorithms to 'make sense' of these timestamps. JAMAR's TRAXPro Software, for example, does this by considering relevant information (tube spacing, tube length, dead time, pulse strength, layout, etc.) to determine how the recorded axle hits translate to vehicle data and specifically to the spacing between the axles.

To those of us in the industry, none of this information should be all that surprising. However, what may be surprising is this:

"The FHWA does not endorse any specific algorithm or system for interpreting axle spacings." (TMG, 2016, Page 1-10)

There is currently no formal system of vehicle axle spacing in place. On one hand, this leaves open a very wide window of interpretation. On the other hand, this approach makes perfect sense, considering the versatile nature of our country.

> *"Axle spacing characteristics for different vehicle classes are known to change from State to State, by region of the country … It is the responsibility of each agency to develop, test and calibrate the classification algorithm they use."* (TMG, 2016, Page 1-10)

How does this information help us answer the original questions asked above?

First, it is important to know that the FHWA does define vehicles by visual characteristics (aka the FHWA 13 Vehicle Category Classification), but they also point out that the visual identification does not define the exact axle spacings.

Second, it is critical that you know and understand how your traffic data collection equipment is collecting and processing classification data.

Have you ever wondered how JAMAR accurately calculates vehicle classification data when processing a tube style ATR?

Traffic data collection software programs use a variety of Classification Tables to determine what classification their axle timestamps (aka vehicles) will fall into.

JAMAR's TRAXPro Software uses a table called 'Modified Scheme F'. An excerpt of this table can be seen below (Table 1):

Table 1

JAMAR Modified Scheme F					Axle 1-2		Axle 2-3		Axle 3-4		Axle 4-5		Axle 5-6		Axle 6-7	
Spec. No.	Spec. Description	Class No.	Class Description	No. Axles	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	Bike/Motorcycle	1	Bikes	2	12	72	-	-	-	-	-	-	-	-	-	-
2	Car	2	Cars & Trailers	2	72	118	-	-	-	-	-	-	-	-	-	-
3	2 Axle Long	3	2 Axle Long	2	118	146	-	-	-	-	-	-	-	-	-	-
4	6 Tire Truck	5	2 Axle 6 Tire	2	146	234	-	-	-	-	-	-	-	-	-	-
5	Buses	4	Buses	2	234	480	-	-	-	-	-	-	-	-	-	-

TRAXPro allows you to see exactly how JAMAR's Classification Table is defined. We have gone into great detail as to how we define the possible axle spacings of each class. We breakdown the 13 vehicle classes into 34 possible spacings. This detailed breakdown gives a highly accurate interpretation of possible axle spacings. TRAXPro includes additional pre-programmed Class Tables which can be user modified, as well as the ability to create user defined tables from scratch.

Maybe you have asked how we can be confident in our ability to classify accurately?

As a comparison, the below table (Table 2) shows a Classification Table excerpt from a different manufacturer's software:

Table 2

Other Manufacturer					SP1		SP2		SP3		SP4		SP5		SP6		SP7		SP8	
Spec. No.	Spec. Description	Class No.	Class Description	No. Axles	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
-	-	1	-	2	12	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	2	-	2	72	122.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	3	-	2	122.4	156	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	5	-	2	156	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	4	-	2	240	480	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Compared to Table 1, you can see that the other manufacturer has defined the axle spacings a bit differently. Their breakdown of the axle spacings is only shown in 24 possible spacings, compared to the 34 detailed possibilities in the JAMAR table. Although this manufacturer's class table is not incorrect; it isimportant to understand that their interpretation is slightly different. It is this difference in interpretation that creates differences in reported vehicle classification.

What about differences in classification results when compared to other equipment manufacturers?

If you and I each have our own interpretation of a Class 2 and a Class 3, it would make perfect sense that our data would be distributed differently. To demonstrate this, JAMAR has taken the exact same data set and ran it through our TRAXPro Software and through another manufacturer's software.

Because of the different interpretations of classes described in the above two tables, when we ran the same data set through both tables, we can clearly see a difference in how the classes were distributed. The results are show in the below table (Table 3):

Table 3

NB															
Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Total**
JAMAR: Mod Scheme F	12	725	413	18	131	5	0	10	2	0	0	0	0	2	**1318**
Other Manufacturer	10	898	314	17	65	5	0	8	5	0	0	0	0	1	**1323**
Difference	*-2*	*173*	*-99*	*-1*	*-66*	*0*	*0*	*-2*	*3*	*0*	*0*	*0*	*0*	*-1*	***5***

You can see that although the total count is very close, Classes 2, 3 and 5 have been distributed differently because of the difference in each manufacturer's class definitions.

To continue the comparison, JAMAR utilized TRAXPro's ability to easily create user generated class schemes. We input into TRAXPro a very close replica of the above Table 2 (aka the other manufacturer's class table). This next table (Table 4) shows what the same data set looks like, when run through the custom class scheme in TRAXPro. You can see that the class distributions are now almost identical.

Table 4

NB															
Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Total**
JAMAR	14	895	312	15	71	5	0	3	2	0	0	0	0	4	**1321**
Other Manufacturer	10	898	314	17	65	5	0	8	5	0	0	0	0	1	**1323**
Difference	*-4*	*3*	*2*	*2*	*-6*	*0*	*0*	*5*	*3*	*0*	*0*	*0*	*0*	*-3*	***2***

So what does this mean?

"Vehicle classification data are a critical component of a well-designed traffic monitoring program because substantial amounts of classification data are needed to understand motorcycle, bus, and truck travel on highways." (TMG, 2016, Page 2-5)

We know that accurate tube counter hardware, quality accessories, proper tube installs, etc. are all important to a successful class count. The above data shows that advanced software capabilities are also a critical part of the equation.

As seen above, the same data can be classed/distributed very differently from one program to the next. The 'Other Manufacturer' referenced in the above data comparisons is a respected and reputable company in this industry, but it is important to recognize that other popular traffic data collection equipment manufacturers are much less detailed than the ones shown here.

As someone tasked with collecting accurate vehicle classification you should be able to verify your system is calculating your data the way you prefer. It is important to make the distinction between the data being *collected badly* vs. the data being *processed differently*. In Table 3, it could be argued that one of the manufacturers has collected incorrect data. However, we know that the same exact data set was used for that table. The only difference was in the software that processed it.

Next Steps?

Since the FHWA does not endorse a specific spacing algorithm it is important that those conducting class counts know how their classes are being calculated. The right questions need to be asked of your hardware/software supplier:

Can I see your Class Tables?

How do you define each axle spacing?

How far do you go in breaking down the possible axle spacings for each Class?

Can I change/edit your Class Tables to meet my needs?

Can I create custom Class Tables from scratch?

Can I see every collected timestamp?

Can I see every individual vehicle?

Can you verify to me that the data collected is being classed properly?

More Information?

For more information on this, and other related topics, feel free to contact JAMAR Technologies.

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