

FW: SICK VPS Follow up

From: SOLIMAN Samer <"/o=rta/ou=exchange administrative group (fydibohf23spdlit)/cn=recipients/cn=solimans">
To: ducktape69 [REDACTED]
Date: Fri, 01 Jul 2016 20:34:24 +1000
Attachments: ATT00002.jpg (1.14 kB); ATT00003.jpg (1.16 kB); ATT00004.jpg (1.13 kB); ATT00005.gif (688 bytes); ATT00006.jpg (646 bytes); VPS Results Report.pdf (2.53 MB)

From: Steven Down [mailto:steven.down [REDACTED]]
Sent: Tuesday, 14 June 2016 12:29 PM
To: SOLIMAN Samer
Cc: SINGH Jai
Subject: Re: SICK VPS Follow up

Hi guys

Please finalised report on the VPS system.

Let me know if you need any clarification

Cheers
Steven

Steven Down
Industry Specialist | Intralogistics and Transport

SICK Pty Ltd | Unit 1, 17 Stanton Rd | Seven Hills, NSW, 2147 | AUSTRALIA
Phone +61 3 9457-0600 | Mobile [REDACTED] | Fax +61 3 9457-2023 | [steven.down \[REDACTED\]](mailto:steven.down [REDACTED])
| <http://www.sick.com.au>

From: SOLIMAN Samer <Samer.SOLIMAN@rms.nsw.gov.au>
To: Steven Down <steven.down [REDACTED]>
Cc: SINGH Jai <Jai.SINGH@rms.nsw.gov.au>
Date: 10/06/2016 09:51 AM
Subject: Re: SICK VPS Follow up

Jai,
Can you speak to Greg Watson when you attend marulan to confirm what is the most appropriate tolerance of the measuring stick/tape measure?

Cheers,
Samer

Sent from my iPhone

On 10 Jun 2016, at 9:49 AM, Steven Down <[steven.down \[REDACTED\]](mailto:steven.down [REDACTED])> wrote:

Hi Samer

See attached description of the comparison methodology

Without some kind of estimate on the accuracy of the manual measurement, allowing for human error and measurement error, there is no way to report the validity of the results. Can we make an assumption of 30mm for height stick and 50mm for tape measure?

The "Error bars" in the attached description indicate the manual measurement potential error.

Best Regards
Steven

Steven Down
Industry Specialist | Intralogistics and Transport
<ATT00001.jpg>

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From: SOLIMAN Samer <Samer.SOLIMAN@rms.nsw.gov.au>
To: Steven Down <[steven.down@\[REDACTED\]](mailto:steven.down@[REDACTED])>
Cc: SINGH Jai <Jai.SINGH@rms.nsw.gov.au>
Date: 10/06/2016 09:28 AM
Subject: Re: SICK VPS Follow up

Ok...although there is no documented 'tolerance' of the measuring tape, so I'm just suggesting you assume it is a 100% accurate benchmark for the purpose of the trial.

Cheers,
Samer

Sent from my iPhone

On 10 Jun 2016, at 8:54 AM, Steven Down <[steven.down@\[REDACTED\]](mailto:steven.down@[REDACTED])> wrote:

Hi Samer

We will report on the deviation between scanner and manual measure however we need an indication of the accuracy and tolerance of the manual measurement to incorporate the measurement uncertainty of the base line, otherwise the comparison is irrelevant.

Cheers
Steven

Steven Down
Industry Specialist | Intralogistics and Transport
<ATT00001.jpg>

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From: SOLIMAN Samer <Samer.SOLIMAN@rms.nsw.gov.au>
To: Steven Down <[steven.down@\[REDACTED\]](mailto:steven.down@[REDACTED])>
Cc: SINGH Jai <Jai.SINGH@rms.nsw.gov.au>
Date: 10/06/2016 08:49 AM
Subject: Re: SICK VPS Follow up

Assume the tape measure is 100% accurate(this gives us the benchmark). I'm just interested in the accuracy of the dimension scanner measurements.

Cheers,
Samer

Sent from my iPhone

On 9 Jun 2016, at 8:49 PM, Steven Down <[steven.down@\[REDACTED\]](mailto:steven.down@[REDACTED])> wrote:

Hi Jai

When do you want to start the official trial?

Im free to start Tuesday?

Also as per our discussion on Wednesday can you please advise what the calibrated accuracy is for the inspectors tape measure and height measuring stick. Also please advise what the tolerance's the inspectors use when deciding if a vehicle is over dimensions.

Thanks for your help

Steven

Steven Down
Industry Specialist | Intralogistics and Transport
<ATT00011.jpg>

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----- Forwarded by Steven Down/GAU/SICK on 09/06/2016 08:45 PM -----

From: SOLIMAN Samer <Samer.SOLIMAN@rms.nsw.gov.au>
To: 'Steven Down' <[steven.down@\[REDACTED\]](mailto:steven.down@[REDACTED])>, SINGH Jai <Jai.SINGH@rms.nsw.gov.au>
Cc: Massimo Sacchi <[massimo.sacchi@\[REDACTED\]](mailto:massimo.sacchi@[REDACTED])>
Date: 09/06/2016 06:02 PM
Subject: RE: SICK VPS Follow up

ive reviewed the document. There isnt any commentary regarding the expected accuracy/tolerances compared to the actual tolerances measured/achieved.

So, could you pls add some commentary on this?

It would also be good to have an extra column in the table 3.0 which shows the accuracy level achieved for that vehicle measurement(eg: within +-1% of measured height) so we can essentially 'pass' or 'fail' the scanner for each measurement(ie/ was the measurement within stated tolerances?) when the trial formally begins(next week?) now that it is calibrated.

Could you pls work with Jai to agree on when the trial formally begins so we can begin collecting data. I assume you will attend at marulan with Jai on the first day or two? I'd like to give this proof of concept every chance to pass so we can progress.

Cheers,
Samer

From: Steven Down [[mailto:steven.down@\[REDACTED\]](mailto:steven.down@[REDACTED])]
Sent: Thursday, 9 June 2016 3:53 PM
To: SOLIMAN Samer
Cc: SINGH Jai; Massimo Sacchi
Subject: RE: SICK VPS Follow up

Hi Samer.

As you are aware we attended site on Monday to rectify the alignment and of the VPS system and re-calibrate it. We completed this work and were successful in resolving the length error. I am putting together a report to outline the what was done and the results. I have attached a draft for your reference. Please take a look, I would appreciate your feedback.

We have also had a formal response from NMI regarding the certification of the system (see below)

The Legal Metrology Branch of NMI has reviewed your request regarding the pattern approval of a VPS system: multidimensional measuring system for vehicles and has decided that NMI will not approve this measuring instrument for legal use.

As stated in your email, the VPS multidimensional measuring system for vehicles that you are requesting be pattern approved is "aimed to measure vehicles for detection of exceeding dimensions in respect to road regulations." NMI regulates instruments for trade use, but does not regulate instruments for the purpose of administering road regulations. Under the legislation that NMI administers pattern approval of this instrument is not required for the purposes described above.

I encourage you to contact the relevant roads and traffic authority with respect to the requirements for the application of this instrument to road regulations.

Please do not hesitate to contact me if you have any further questions.

Best regards,
Greg Harrington

Dr Greg Harrington
Senior Policy Officer

P: +61 2 8467 3849 | F: +61 2 8467 3849

gregory.harrington@measurement.gov.au

Given that it is outside the NMI scope to certify this system we need to work out where to form here. For this we will need guidance from RMS.

One potential solution is that SICK put together a procedure for testing and verifying the accuracy of the VPS that RMS approves. Then we can carry out the test on a periodic basis as a service to RMS. Would this meet your requirements?

Are you available for a meeting on Monday to discuss this?

Cheers
Steven

Steven Down
Industry Specialist | Intralogistics and Transport
<ATT00001.jpg>

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[REDACTED]

From: Steven Down/GAU/SICK
To: SOLIMAN Samer <Samer.SOLIMAN@rms.nsw.gov.au>
Cc: SINGH Jai <Jai.SINGH@rms.nsw.gov.au>, Massimo Sacchi/GAU/SICK [REDACTED]
Date: 02/06/2016 12:04 PM
Subject: RE: SICK VPS Follow up

Hi Samer

Fair enough, I understand your position. It is disappointing that the focus on purchasing additional system is no longer a priority for this financial year as we had previously discussed. I have put a lot of pressure on our team internally to get us in a position to get this over the line in the timeline.

In any case I will be on site on Monday to do the calibration and realignment. This will at least tick one of the boxes.

I will keep you posted as to the progress of both the Calibration and the Certification. In the mean time let me know if there is anything else you need from us to prove the concept.

Best Regards
Steven Down

From: SOLIMAN Samer <Samer.SOLIMAN@rms.nsw.gov.au>
To: Steven Down <steven.down> [REDACTED]
Cc: SINGH Jai <Jai.SINGH@rms.nsw.gov.au>, Massimo Sacchi <massimo.sacchi> [REDACTED]
Date: 02/06/2016 11:49 AM
Subject: RE: SICK VPS Follow up

Hi Steven,

appreciate the updates.

At this stage, 1 week turn around for NMI to have some answers is acceptable, as this is new scope for them, and they usually take much longer than this. However, if you do not have traction after 1 week, pls contact us and we will organise a collective meeting with RMS, SICK, NMI.

Lets not worry too much about funding more units this financial year; we can still procure next financial year. The KEY at the moment is to ensure **calibration and certification**.

Until I have the trial unit at marulan calibrated(working to the highest accuracy possible) and certified for enforcement, I would not yet have proven concept and definitely can not procure more units(via tender or otherwise).

Samer Soliman
Manager Heavy Vehicle Programs
Compliance Operations

From: Steven Down [<mailto:steven.down>] [REDACTED]

Sent: Thursday, 2 June 2016 11:12 AM
To: SOLIMAN Samer
Cc: SINGH Jai; Massimo Sacchi
Subject: RE: SICK VPS Follow up

Hi Samer

Our Systems Manager (Massimo Sacchi) has been in contact with NMI as per our discussions to give you confidence that the VPS system can be certified to some kind of standard recognised in Australia. Currently we are at a bit of a standstill and I wanted to update you on the situation.

We have asked NMI for advice on what the requirements would be to get the system certified in terms of documentation, planning and costs.

NMI are having internal discussion on what needs to be done and have advised they will get back to us in about a week.

Due to the tight time frames you have outlined (as I understand you need to have an invoice for an additional 8 systems by end of June), I am concerned that at this pace we will not get to a reasonable position in time.

The contact we have at NMI is Chris Davies (details below).

Chris Davies
Head, Weighing and Electromagnetic Susceptibility
Pattern Approval Section | Legal Metrology Branch | National Measurement Institute
P: +61 2 8467 3843 | F: +61 2 8467 3846 | NTM Hotline: 1300 686 664
chris.davies@measurement.gov.au

We do have a certificate from the Swiss Institute of Meteorology for the VPS system which I have attached (unfortunately it's in German). Is this sufficient to give you the confidence you need to move forward?

If not please let me know as we need to put a plan in place to get there.

Thanks and Best Regards.
Steven

Steven Down
Industry Specialist | Intralogistics and Transport
<ATT00002.jpg>

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From: SOLIMAN Samer <Samer.SOLIMAN@rms.nsw.gov.au>
To: Steven Down <steven.down@measurement.gov.au>, SINGH Jai <Jai.SINGH@rms.nsw.gov.au>
Date: 26/05/2016 11:19 AM
Subject: RE: SICK VPS Follow up

Thanks Steven.

1) Jai is organising a cherry picker again for the 2nd round of tuning so SICK can get the accuracy within the documented tolerances.

2) We will not implement this feature during this initial trial period. to be re-assessed after the trial.

3) Certification of this is the most pressing issue; without certification, this unit can not be used for enforcement, so any further procurement is pending especially on this.

Samer Soliman
Manager Heavy Vehicle Programs
Compliance Operations

From: Steven Down [<mailto:steven.down@measurement.gov.au>]
Sent: Monday, 23 May 2016 11:51 AM
To: SOLIMAN Samer; SINGH Jai
Subject: SICK VPS Follow up

Hi Samer / Jai

This is just a quick not to give you an update of the current position ion outstanding items for the VPS system at Marulan

1. Length Accuracy:

We have identified that the most likely cause of the length inaccuracy of approximately 15-20cm is a misaligned scanner. This means that we will need to return to site and adjust the position of the scanner and calibrate the system. Are you able to provide a boom / scissor lift and an operator so we can gain access to the scanner? We will need to lock in a date to do this work so I can ensure we have everything ready on our side.

2. Removal of the measurement of mirrors (width) antenna (height)

This can be done by adjusting the point at which the height and width measurements are taken based on the length of the vehicle. We basically ignore the width and height measurement on the first X meters of the vehicle

If you want to implement this feature I need guidance from you as to how much of the vehicle you want to ignore for both width and height measurement

<ATT00003.gif>

<ATT00004.gif>

3. Certification of the system

We are currently working with our colleagues in our over seas factory to ascertain exactly what certification we currently have and how applicable it would be to NMI Certification in Australia. Our next step will be to approach NMI to determine the process to get the system certified and what the associated costs will be. As discussed there is no way the system could be certified this financial year so it is our intention to ask for some kind of guidance form NMI to confirm the system will be certifiable in the future.

I think that covers off the outstanding issues. If I have missed anything let me know.

What do you need on your side from us to get you in a position to place the order for the additional 8 systems?

Best Regards
Steven

Steven Down
Industry Specialist | Intralogistics and Transport
<ATT00005.jpg>

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<Chart Description.pdf>

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SICK Vehicle Profiling System Results Report

After Final Alignment & Calibration
(6th June 2016)



Vehicle Profiling System - Results Report

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Vehicle Profiling System - Results Report

1.0 Introduction

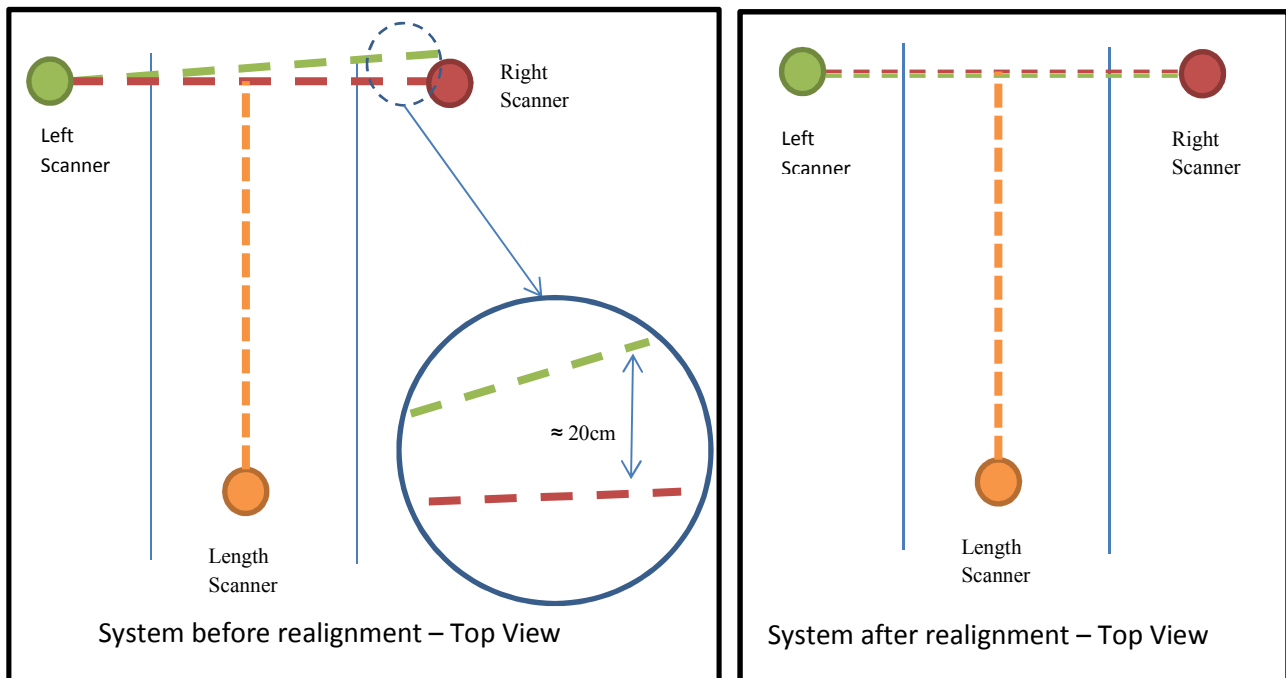
A SICK Vehicle Profiling System (VPS) has been installed at the RMS Heavy Vehicle Checking Station - Marulan South. The purpose of the installation is to prove the VPS's accuracy and ensure the suitability of the system for heavy vehicle dimensional measurement.

After the system was initially installed testing showed a systematic error of approximately 15 to 20cm in the length measurement. Both width and height measurement were found to be accurate.

It was determined by SICK that the cause of the length inaccuracy was due to the misalignment of one of the installed scanners. This document outlines the results found after the re-alignment and re-calibration of the system.

2.0 Overview of work:

Realignment of left scanner was carried out (as shown below) and full recalibration was carried out. Seventeen vehicles were then run through the system and VPS measurements were compared to manual measurements taken by checking station operators.



Vehicle Profiling System - Results Report

3.0 Recorder Data (overview)

| Vehicle Number | VPS Data | | | | RMS Manual Measure | | | Comparison | | | Comment |
|----------------|----------|-------|--------|---------|--------------------|-------|--------|------------|--------|--------|--|
| | Length | Width | Height | km/h | Length | Width | Height | Length | Width | Height | |
| 1915 | 17.653 | 2.91 | 4.327 | 13.212 | 17.59 | 2.49 | 4.3 | -0.063 | -0.42 | -0.027 | Width: did not exclude mirror on VPS |
| 1916 | 17.335 | 3.503 | 4.319 | 6.75 | 17.35 | 2.49 | 4.284 | 0.015 | -1.013 | -0.035 | Width: did not exclude mirror on VPS |
| 1917 | 19.098 | 2.825 | 4.348 | 9.1548 | 19.4 | 2.5 | 4.338 | 0.302 | -0.325 | -0.01 | Length: possible operator error Width: did not exclude mirror on VPS |
| 1918 | 17.621 | 3.937 | 3.291 | 5.9904 | 17.59 | NM | 3.31 | -0.031 | | 0.019 | Width: did not exclude mirror on VPS |
| 1919 | 18.964 | 3.519 | 4.296 | 7.4376 | 19 | NM | 4.275 | 0.036 | | -0.021 | Width: did not exclude mirror on VPS |
| 1920 | 19.118 | 3.854 | 4.308 | 7.6932 | 19.07 | 2.5 | 4.285 | -0.048 | -1.354 | -0.023 | Width: Noise on measurement from VPS |
| 1921 | 23.899 | 2.584 | 3.661 | 4.5684 | No Measurement | | | | | | |
| 1922 | 11.538 | 2.61 | 4.042 | 7.1712 | 11.4 | 2.485 | 3.89 | -0.138 | -0.125 | -0.152 | Height: RMS Measure may not be at highest point. Length: RMS missed cables at back of truck Width: RMS did no measure chains |
| 1923 | 25.714 | 2.613 | 4.103 | 3.1824 | 25.6 | 2.49 | 4.085 | -0.114 | -0.123 | -0.018 | Width: RMS did not measure widest point Length: Missed outer length on RMS measure |
| 1924 | 20.969 | 3.476 | 4.463 | 5.58 | 20.89 | 3.27 | 4.46 | -0.079 | -0.206 | -0.003 | Width: Flag sticking out not measured by RMS |
| 1925 | 25.975 | 3.15 | 4.506 | 5.8248 | 25.85 | 2.5 | 4.485 | -0.125 | -0.65 | -0.021 | Width: Noise on measurement from VPS Length: Measured missed the end of vehicle from RMS |
| 1926 | 21.044 | 2.952 | 4.601 | 6.2172 | NM | 2.455 | 4.62 | | -0.497 | 0.019 | Width: Noise on width measurement Length: RMS could not measure |
| 1927 | 19.075 | 2.581 | 4.367 | 6.3648 | No Measurement | | | | | | |
| 1928 | 7.967 | 2.527 | 2.72 | 14.5368 | 7.89 | 2.495 | 2.74 | -0.077 | -0.032 | 0.02 | Length: Front bumper angled |
| 1929 | 11.035 | 2.618 | 3.522 | 16.0884 | 10.99 | 2.5 | 3.54 | -0.045 | -0.118 | 0.018 | Width: Slight noise on reflectors |
| 1930 | 19.142 | 2.611 | 4.234 | 9.1116 | 19.09 | 2.458 | 4.2 | -0.052 | -0.153 | -0.034 | Width: RMS did not measure Chains |
| 1931 | 18.938 | 3.393 | 4.762 | 6.5772 | 18.94 | 3.33 | 4.01 | 0.002 | -0.063 | -0.752 | Height: Noise point |

Table 3.0.1

Vehicle Profiling System - Results Report

4.0 Comparison

Some data has been excluded from the analysis. Data has been excluded if there was an issue with the manual measurement (such as RMS inspectors did not measure outer most point) or if there was an issue with the VPS measurement (such as “noise” being created on highly shiny surfaces)

4.0.1 Observations

Length: Realignment of the VPS System has improved the length measurement accuracy within the specification. Prior to realignment the average error was approximately -18cm over 32 valid vehicle measurements. After realignment the average error was approximately -3cm over 9 valid vehicle measurements.

Width: Testing the width measurement for accuracy proved to be quite difficult. This is due to the fact that the operators generally only measure the widest point on the vehicles trailer while the VPS will measure the widest points on the entire vehicle. The widest point measured by the VPS is most commonly vehicle mirrors or straps / chains used to restrain the load.

Operators will need to use the graphical user interface to determine if the width measurement of the VPS is valid or can be disregarded.

Height: The results of the height measurement we consistently accurate. The only issue encountered was the VPS detecting the vehicles antenna. In this case the operator would need to use the graphical user interface to determine if the height measurement is relevant.

Vehicle Profiling System - Results Report

4.1 Length

| Vehicle Number | Valid Measurement | VPS Speed (km/h) | VPS Width (m) | RMS Width (m) | Deviation (m) | RMS Accuracy (m) | VPS Accuracy (m) | Error % of Manual Measure |
|----------------|-------------------|------------------|---------------|---------------|---------------|------------------|------------------|---------------------------|
| 1915 | Yes | 13.212 | 17.653 | 17.59 | -0.063 | ±0.11 | ±0.05 | -0.36% |
| 1916 | Yes | 6.75 | 17.335 | 17.35 | 0.015 | ±0.11 | ±0.05 | 0.09% |
| 1917 | No | 9.1548 | 19.098 | 19.4 | 0.302 | ±0.11 | ±0.05 | 1.56% |
| 1918 | Yes | 5.9904 | 17.621 | 17.59 | -0.031 | ±0.11 | ±0.05 | -0.18% |
| 1919 | Yes | 7.4376 | 18.964 | 19 | 0.036 | ±0.11 | ±0.05 | 0.19% |
| 1920 | Yes | 7.6932 | 19.118 | 19.07 | -0.048 | ±0.11 | ±0.05 | -0.25% |
| 1921 | No | 4.5684 | 23.899 | NM | NA | ±0.11 | ±0.05 | NA |
| 1922 | No | 7.1712 | 11.538 | 11.4 | -0.138 | ±0.11 | ±0.05 | -1.21% |
| 1923 | No | 3.1824 | 25.714 | 25.6 | -0.114 | ±0.11 | ±0.05 | -0.45% |
| 1924 | Yes | 5.58 | 20.969 | 20.89 | -0.079 | ±0.11 | ±0.05 | -0.38% |
| 1925 | No | 5.8248 | 25.975 | 25.85 | -0.125 | ±0.11 | ±0.05 | -0.48% |
| 1926 | No | 6.2172 | 21.044 | NM | NA | ±0.11 | ±0.05 | NA |
| 1927 | No | 6.3648 | 19.075 | NM | NA | ±0.11 | ±0.05 | NA |
| 1928 | No | 14.5368 | 7.967 | 7.89 | -0.077 | ±0.11 | ±0.05 | -0.98% |
| 1929 | Yes | 16.0884 | 11.035 | 10.99 | -0.045 | ±0.11 | ±0.05 | -0.41% |
| 1930 | Yes | 9.1116 | 19.142 | 19.09 | -0.052 | ±0.11 | ±0.05 | -0.27% |
| 1931 | Yes | 6.5772 | 18.938 | 18.94 | 0.002 | ±0.11 | ±0.05 | 0.01% |

NM = No Measurement

Table 4.1.1

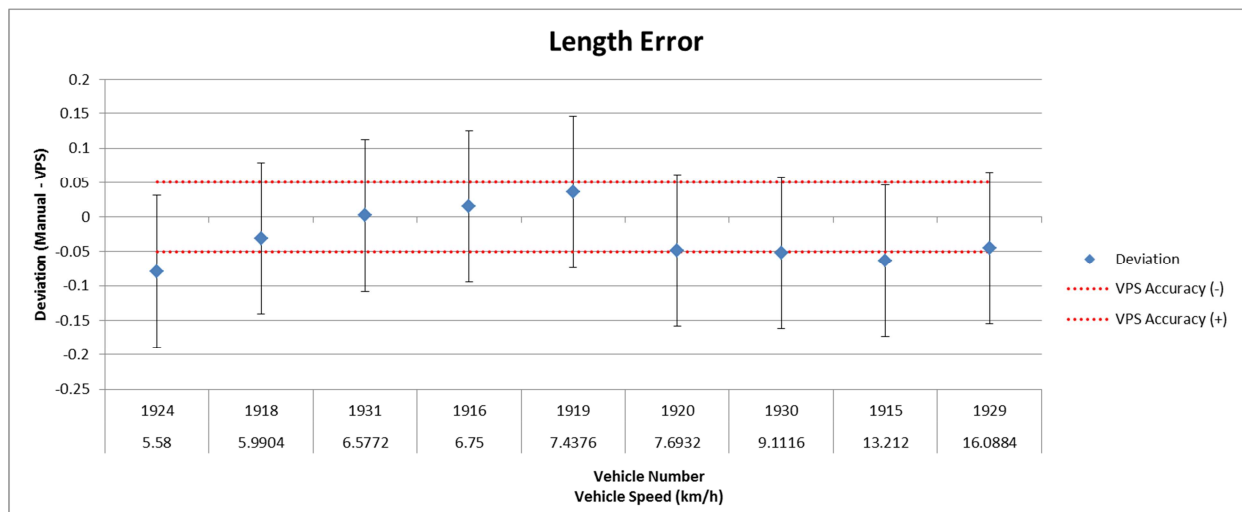


Chart 4.1.1

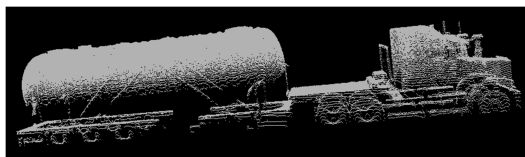


Image 4.1.1 (Vehicle 1924)

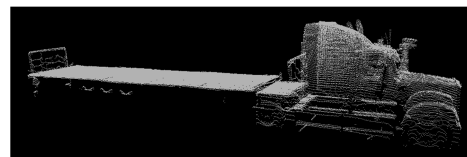


Image 4.1.2 (Vehicle 1931)

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4.2 Width

| Vehicle Number | Valid Measurement | VPS Speed (km/h) | VPS Width (m) | RMS Width (m) | Deviation (m) | RMS Accuracy (m) | VPS Accuracy (m) | Error % of Manual Measure |
|----------------|-------------------|------------------|---------------|---------------|---------------|------------------|------------------|---------------------------|
| 1915 | No | 13.212 | 2.91 | 2.49 | -0.42 | ±0.03 | ±0.03 | -16.87% |
| 1916 | No | 6.75 | 3.503 | 2.49 | -1.013 | ±0.03 | ±0.03 | -40.68% |
| 1917 | No | 9.1548 | 2.825 | 2.5 | -0.325 | ±0.03 | ±0.03 | -13.00% |
| 1918 | No | 5.9904 | 3.937 | NM | NA | ±0.03 | ±0.03 | NA |
| 1919 | No | 7.4376 | 3.519 | NM | NA | ±0.03 | ±0.03 | NA |
| 1920 | No | 7.6932 | 3.854 | 2.5 | -1.354 | ±0.03 | ±0.03 | -54.16% |
| 1921 | No | 4.5684 | 2.584 | NM | NA | ±0.03 | ±0.03 | NA |
| 1922 | No | 7.1712 | 2.61 | 2.485 | -0.125 | ±0.03 | ±0.03 | -5.03% |
| 1923 | No | 3.1824 | 2.613 | 2.49 | -0.123 | ±0.03 | ±0.03 | -4.94% |
| 1924 | No | 5.58 | 3.476 | 3.27 | -0.206 | ±0.03 | ±0.03 | -6.30% |
| 1925 | No | 5.8248 | 3.15 | 2.5 | -0.65 | ±0.03 | ±0.03 | -26.00% |
| 1926 | No | 6.2172 | 2.952 | 2.455 | -0.497 | ±0.03 | ±0.03 | -20.24% |
| 1927 | No | 6.3648 | 2.581 | NM | NA | ±0.03 | ±0.03 | NA |
| 1928 | Yes | 14.5368 | 2.527 | 2.495 | -0.032 | ±0.03 | ±0.03 | -1.28% |
| 1929 | No | 16.0884 | 2.618 | 2.5 | -0.118 | ±0.03 | ±0.03 | -4.72% |
| 1930 | No | 9.1116 | 2.611 | 2.458 | -0.153 | ±0.03 | ±0.03 | -6.22% |
| 1931 | Yes | 6.5772 | 3.393 | 3.33 | -0.063 | ±0.03 | ±0.03 | -1.89% |

NM = No Measurement

Table 4.2.1

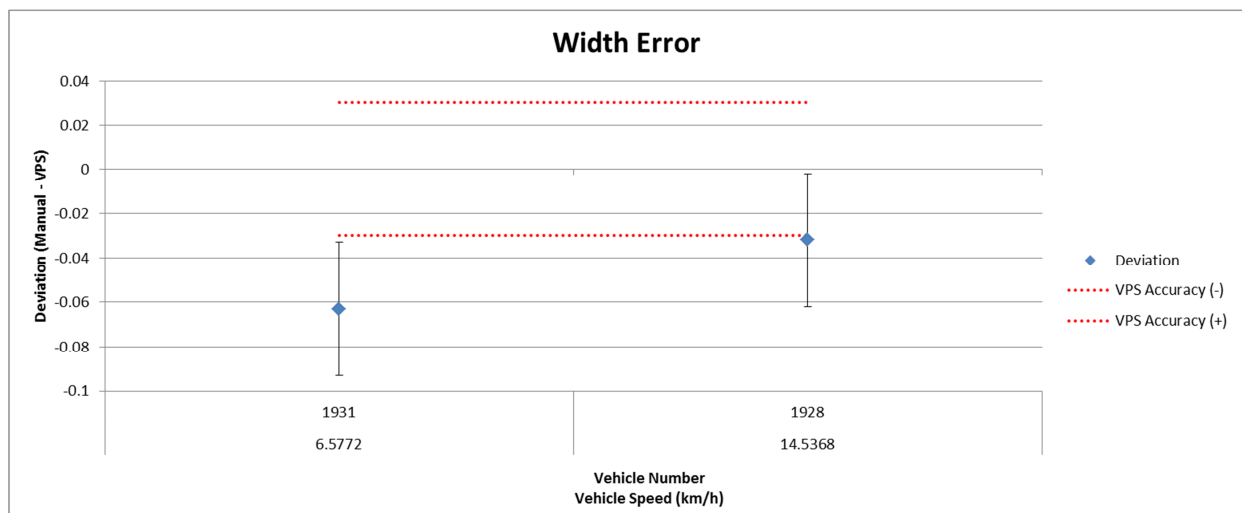


Chart 4.2.1

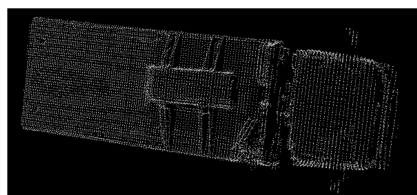


Image 4.2.1 (Vehicle 1928)

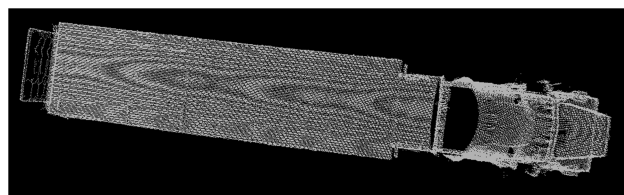


Image 4.2.2 (Vehicle 1931)

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4.3 Height

| Vehicle Number | Valid Measurement | VPS Speed (km/h) | VPS Width (m) | RMS Width (m) | Deviation (m) | RMS Accuracy (m) | VPS Accuracy (m) | Error % of Manual Measure |
|----------------|-------------------|------------------|---------------|---------------|---------------|------------------|------------------|---------------------------|
| 1915 | Yes | 13.212 | 4.327 | 4.3 | -0.027 | ±0.04 | ±0.03 | -0.63% |
| 1916 | Yes | 6.75 | 4.319 | 4.284 | -0.035 | ±0.04 | ±0.03 | -0.82% |
| 1917 | Yes | 9.1548 | 4.348 | 4.338 | -0.01 | ±0.04 | ±0.03 | -0.23% |
| 1918 | Yes | 5.9904 | 3.291 | 3.31 | 0.019 | ±0.04 | ±0.03 | 0.57% |
| 1919 | Yes | 7.4376 | 4.296 | 4.275 | -0.021 | ±0.04 | ±0.03 | -0.49% |
| 1920 | Yes | 7.6932 | 4.308 | 4.285 | -0.023 | ±0.04 | ±0.03 | -0.54% |
| 1921 | No | 4.5684 | 3.661 | NM | NA | ±0.04 | ±0.03 | NA |
| 1922 | No | 7.1712 | 4.042 | 3.89 | -0.152 | ±0.04 | ±0.03 | -3.91% |
| 1923 | Yes | 3.1824 | 4.103 | 4.085 | -0.018 | ±0.04 | ±0.03 | -0.44% |
| 1924 | Yes | 5.58 | 4.463 | 4.46 | -0.003 | ±0.04 | ±0.03 | -0.07% |
| 1925 | Yes | 5.8248 | 4.506 | 4.485 | -0.021 | ±0.04 | ±0.03 | -0.47% |
| 1926 | Yes | 6.2172 | 4.601 | 4.62 | 0.019 | ±0.04 | ±0.03 | 0.41% |
| 1927 | No | 6.3648 | 4.367 | NM | NA | ±0.04 | ±0.03 | NA |
| 1928 | Yes | 14.5368 | 2.72 | 2.74 | 0.02 | ±0.04 | ±0.03 | 0.73% |
| 1929 | Yes | 16.0884 | 3.522 | 3.54 | 0.018 | ±0.04 | ±0.03 | 0.51% |
| 1930 | Yes | 9.1116 | 4.234 | 4.2 | -0.034 | ±0.04 | ±0.03 | -0.81% |
| 1931 | No | 6.5772 | 4.762 | 4.01 | -0.752 | ±0.04 | ±0.03 | -18.75% |

NM = No Measurement

Table 4.3.1

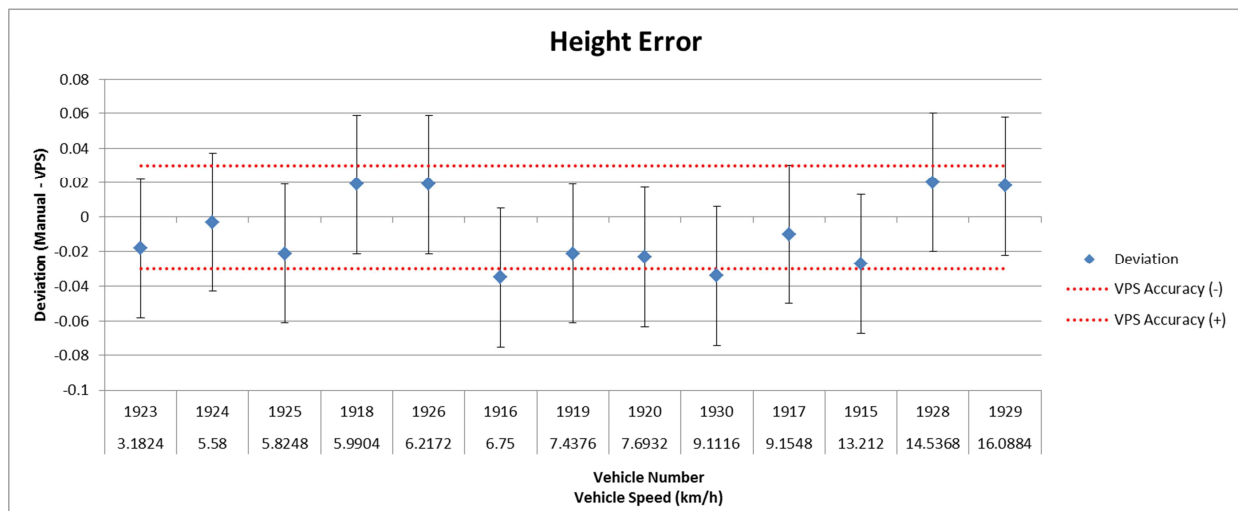


Chart 4.3.1

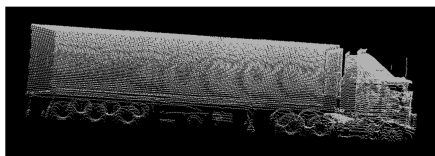


Image 4.3.1 (Vehicle 1916)

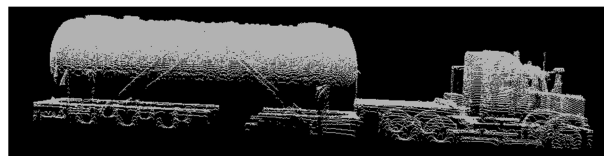


Image 4.3.2 (Vehicle 1924)

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5.0 Conclusion

Final results indicate that the VPS is operating within accuracy specification for length, width and height.

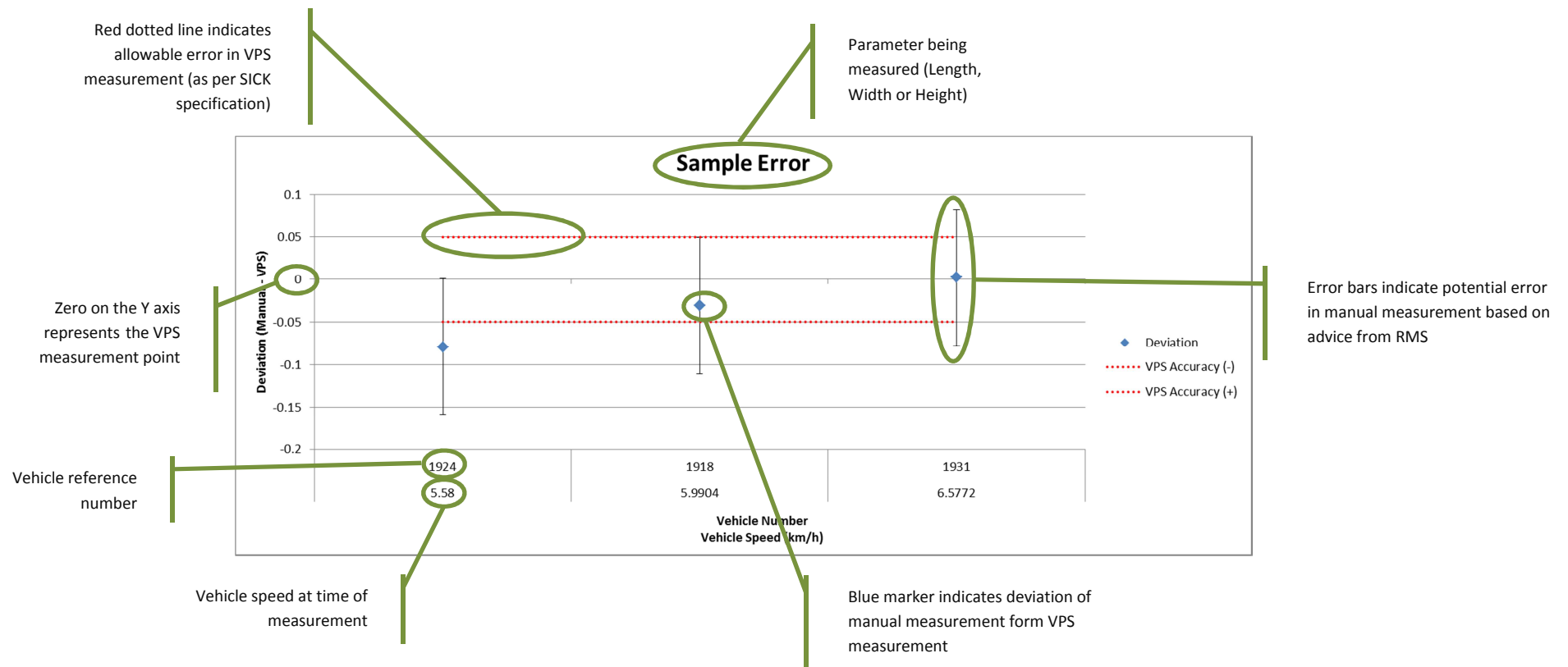
In some instances operators will need to use the graphical user interface to determine that the measurement points are valid and relevant.

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Appendix A – Results Chart Description

Sample Data

| Vehicle reference number | Vehicle Speed (km/h) | VPS Measurement (m) | Manual Measurement (m) | Deviation (m) | Deviation (%) = Deviation / Manual Measurement * 100 | VPS measurement allowable error (m) | Manual measurement uncertainty (m) |
|--------------------------|----------------------|---------------------|------------------------|---------------|--|-------------------------------------|------------------------------------|
| 1924 | 5.58 | 2.000 | 1.921 | -0.079 | -4.11% | ± 0.05 | ± 0.08 |
| 1918 | 5.9904 | 3.000 | 2.969 | -0.031 | -1.04% | ± 0.05 | ± 0.08 |
| 1931 | 6.5772 | 4.000 | 4.002 | +0.002 | +0.05% | ± 0.05 | ± 0.08 |



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