Phase Two-B: National Applied Research Project

Study of by-pass software for use with RFID systems at auction markets and buying stations in Canada

December 2011

Canadian Cattle Identification Agency

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EXECUTIVE SUMMARY

The Canadian Cattle Identification Agency sponsored a multi-phase research project to evaluate the impact of RFID systems at auction markets and buying stations. The first two phases of the research evaluated the efficiency and effectiveness of the hardware, and then evaluated the different options for recording and reporting software. This report details the final phase of the research, studying by-pass software for tag recording and reporting.

Phase One was a proof of concept that showed the hardware was efficient and effective for the collection of tag numbers. The speed of commerce was affected by the location when the system was not placed within the normal process flow. Global read accuracy in Phase One was 93% based on a total of 144,197 head of cattle scanned in 31,736 groups through nine systems. The software was custom designed and installed on a laptop operated by project personnel.

Phase Two evaluated software that was integrated with enterprise systems. It was found that integrated systems, with software that linked to enterprise systems, was complicated, costly and test site operators did not perceive any benefits to the buyer, the consigner or the business operation. Read accuracy dropped to a global average of 89% as a result of software errors and one site that had extensive problems with the system. In total, 393,474 head of cattle were scanned in over 107,423 groups.

The variable in the RFID system is the type of software used to record and report the tag numbers. Each facility is unique in its business process and flow of cattle. As such, there is no one standard software or hardware solution. Three variations of tag recording software were evaluated in Phase Two. Option One reflects the processes used in Phase One, Option Two reflects the process from Phase Two and Option Three reflects of hybrid of both phases that was further tested in Phase Two-B. The Phase Two report details that Option Two software (integrated with management systems) has the highest impact on speed of commerce, costs and labor requirements. It also concluded that when evaluating a single movement report without consigner or group information, it is evident that Option Three (stand alone or by-pass software) has the least impact and least cost to industry. The only data recorded under an Option Three scenario is the total number of tag numbers scanned in one day; there is no listing of consigner or group number.

As a result of promising results using Option Three in Phase Two, further testing of the by-pass system was recommended. Six of the original test sites volunteered to continue testing basic functionality software that by-passed the enterprise systems, to record animal movement over a 24-hour period rather than in individual groups/lots. The test sites used the hardware from Phase Two, but changed all software to a by-pass system, loaded on a laptop or an office computer. One report was generated with the total number of head through the system in one day, without detailing the consigner or number in the group. The test took place at six auction markets for a 15-week period from the first of September to the end of November 2011. A total of 118,200 head of cattle were scanned over 15 weeks.

Two software vendors were used, Viewtrak Technologies - Manifest Manager, and Integrated Traceability Solutions (ITS) - Stockman Software. The key factors in choosing this software for a test of the by-pass or stand alone software systems were:

- Affordability
- Training
- Ease of use

The retail cost of both software packages was under $2,000, but Manifest Manager has an annual license and maintenance fee of $1,800 versus $300 for Stockman. Viewtrak software is deployed electronically and training is provided by telephone. In contrast, ITS did onsite installations of the software and provide onsite training.

Both software packages had high ease of use and functionality.

The software was loaded on office computers and laptops. If the data entry device is linked to the RFID hardware at the time of installation, linking these two devices is not complicated. However, linking data devices to hardware after the hardware has been installed is a more complicated and costly process.

Table One:

Auction Market	Software	RFID Hardware Location	Data Entry Device
Gladstone Auction Mart	Stockman Software	Receiving	Office computer
Ontario Stockyards	Manifest Manager	Sale ring entrance	Panasonic Tough Notebook at sale ring
Saskatoon Livestock	Stockman Software	Sale ring exit	Laptop in auction booth
Spiritwood Stockyards	Stockman Software	Sale ring exit	Office computer
Ste Rose Auction Mart	Stockman Software	Receiving	Laptop at receiving
Winnipeg Auction Mart	Stockman Software	Receiving	Laptop in office

The installation on office computers was the most effective:

1. The office staff always remembered to open and engage the software. When located at other areas, the staff sometimes forgot to turn on the software.
2. Reporting was easier as the computer was linked to the internet and did not have to be moved to transfer the reports and data to CLTS.
3. The computer was protected from the elements.

When the data entry device was placed in locations other than the office, there were a greater number of issues:

1. There were days that the yard staff forgot to turn on the computer and therefore did not collect and record tag numbers from scanning.
2. Often the reports were delayed as the yard staff had to move the laptop from the receiving area into the office to use the internet to send the files.
3. When there were software errors, this was not discovered until after the scanning day, resulting in inaccurate reads.
4. Dust and cold affect laptops at receiving, even when placed in a receiving booth.

Table Two:

Auction Market	Phase Two-B		Phase One	Change Phase One-Two B		Phase Two	Change Phase Two-2B
Gladstone Auction Mart	93%		93%	0%		86%	7%
Ontario Stockyards	91%		94%	-3%		89%	2%
Saskatoon Livestock	58%		93%	-35%		96%	-38%
Spiritwood Stockyards	96%		91%	5%		89%	7%
Ste Rose Auction Mart	83%		97%	-14%		84%	-1%
Winnipeg Auction Mart	92%		90%	2%		88%	4%

The variance in read accuracy from Phase One to Two-B indicates a decrease in half the sites and remained the same or increased in three sites. The software used in Phase One was operated by a project person, entering each group individually.

1. **Gladstone-no change**: Notable even though there was a change from dual alley to wide alley system.
2. **Ontario Stockyards-decrease**: On one scanning day the system was not turned on until half way through the sale day causing a read accuracy of 66%. If this day was eliminated from the data set, the read accuracy would have equaled Phase One.
3. **Saskatoon- decrease**: An electrical power failure caused the system (hardware, software or data entry device) failure that was never resolved throughout the test period.
4. **Spiritwood-increase**: As a result of an ambient interference test done between Phase One and Two-B, the electrical interference was decreased, therefore increasing read accuracy.
5. Ste Rose- decrease: A change from a single alley system to multiple systems with a combination of single and dual alleys.
6. **Winnipeg- increase**: No apparent reason for the increase.

The variation is most significant from Phase Two to Two-B, with only one facility having a dramatically lower rate (Saskatoon Livestock Sales) and one other not having a material difference (Ste Rose). The increase in read accuracy is coupled with the benefit of not having extensive labor involvement in the data entry by consigner or buyer. The by-pass software had very low labor requirement.

The assumption stated in the Phase Two report was that the by-pass software would collect and record tag numbers with a higher rate of accuracy than what was achieved with integrated software where data entry was done by market personnel. Eliminating the data set from the system failure at Saskatoon Livestock, the by-pass system generally out-performed the integrated systems from Phase Two with regards to read accuracy. Benefits are: low labor requirement, efficient reporting and low cost.

The factor that was substantiated once again was that having a dedicated project person, such as in Phase One, will show more favorable results than either integrated or by-pass software where the data is entered by market personnel. Market personnel have busy positions and adding the responsibility for managing the RFID system adds work load and stress. A dedicated resource, trained in the operation of the hardware and software, is accountable for ensuring that both are operating at the highest levels of performance, that errors are corrected in a timely fashion, and that all cattle are moved through an operating system on scanning day is critical to success.

There is no one solution that will work in every facility, but this test indicates that by-pass software will work efficiently, cost effectively and have a low labor requirement as the software component for an RFID system. Even with cost effective software, the cost of hardware and installation must be considered when evaluating the investment of RFID systems for traceability. The impact on business process, cost and speed of commerce will be directly proportional to the level of detail required in reporting and the level of integration of the systems.

Agriculture and Agri-Food Canada, through the Growing Forward Program, funded this multi-phase study in support of animal movement reporting for traceability. There were a total of 13 test sites: 10 auction market and three buying stations. Systems from three manufacturers were installed in auction markets at receiving and both before and after the sale ring. A total of 655,871 cattle were scanned through the three phases of the project.

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BACKGROUND

Canadian Cattle Identification Agency sponsored a multi-phase research project, commencing in 2009 and ending in 2011, to study the impact of RFID systems at auction markets and buying stations. The metrics evaluated were:

1. Speed of commerce
2. Animal health and safety
3. Business process efficiency and effectiveness
4. Read accuracy

It is important to note that in the collection of the data, no additional measures were employed to impact the read of the RFID tag as the cattle moved through the scanners. As such, the data collected reflects the impact RFID systems will have in operating auction markets and buying stations for the collection of tag numbers for traceability.

Phase One was a proof of concept on the RFID hardware and it was found that the hardware was efficient and effective for the collection of RFID tag numbers. The speed of commerce was affected by the location when the system was not placed within the normal process flow. Global read accuracy in Phase One was 93% based on a total of 144,197 head of cattle scanned in 31,736 groups through nine systems. The software was custom designed and installed on a laptop operated by project personnel.

Phase Two advanced the evaluation of RFID systems by integrating the tag collection and reporting software with the enterprise software. This integration enabled the tag numbers to be recorded on consigner and buyer invoices as well as settlement documentation. In some cases, it also provided age verification information to buyers. Four of the test sites were equipped with new hardware to replace systems that did not perform well in Phase One and to test a four panel wide alley system and a new type of dual alley system. Further, four of the test sites were equipped with multiple RFID systems to cover numerous intake areas in the facilities. The same metrics were evaluated in Phase Two. It was found that integrated systems, with software that linked to enterprise systems, was complicated, costly and test site operators did not perceive any benefits to the buyer, the consigner or the business operation. The labor requirements to operate the software was higher at receiving than at the sale ring, but in both locations, personnel have high stress, busy positions and the requirement to enter data to link with RFID tag numbers added extra time to their day without benefit to the operations. Read accuracy dropped to a global average of 89% as a result of software errors and one site that had extensive problems with the system. In total, 393,474 head of cattle were scanned in 107,423 groups.

Phase Two-B was developed as a result of research that showed integrated software to be cumbersome, costly and labor intensive. Six of the original test sites volunteered to continue testing basic functionality software that by-passed the enterprise systems, to record animal movement over a 24-hour period rather than in individual groups/lots. The test sites used the hardware from Phase Two, but changed all software to a by-pass system, loaded on a laptop or an office computer. The key factor of “no intervention” continued through this phase with software turned on in the morning and off at night. One report was generated based on the total number of head through the system in one day. In all, 118,200 head of cattle were scanned over 15 weeks.

Agriculture and Agri-Food Canada, Growing Forward Program, funded this multi-phase study to research animal movement reporting for traceability. There were a total of 13 test sites: 10 auction market and three buying stations. Systems from three manufacturers were installed in auction markets at receiving both before and after the sale ring. A total of 655,871 cattle were scanned through the three phases of the project.

SOFTWARE OPTIONS

The variable in the RFID system is the type of software used to record and report the tag numbers. The study found that where the software does not align with business process and operating objectives, it will not be efficient or effective. As each facility is unique in its business process and flow of cattle, there is no one standard software or hardware solution.

Three variations of tag recording software were evaluated in Phase Two. Option One reflects the processes used in Phase One. Option Two reflects the process from Phase Two and Option Three reflects of hybrid of both phases that was further tested in Phase Two-B.

Option One and Three: Software with basic functionality records the read accuracy by group/lot, then totals the read accuracy for the scanning day and creates a movement file for submission to the Canadian Livestock Tracking System (CLTS). An alternative to scanning individual groups is to allow cattle to move through the scanners for 24 hours, recording the total number of head scanned and creating a movement report based on that total number. The software is called stand alone, or by-pass, as it is not integrated with the enterprise software and does not link with invoices, statements or transactional data (settlement sheets). The software can run on any platform as it does not have to be linked to the enterprise servers. The RFID hardware can be linked to any computer through a serial hub and CAT5 cables. It is important that the computer that houses the software has access to the internet for transfer of the movement files.

Option Two: Software with a broader functionality that is integrated with the enterprise software allows tag numbers to be made available on invoices, statements and transactional data. This software is an add-on module to enterprise software so the entry of specific information (such as the name of the consigner) must be entered at the same time as the tag capture. Because it runs on the same platform and network as the enterprise software, the RFID hardware must be linked to the enterprise servers in order to communicate between the hardware and the software.

Table One:

Option One **Stand alone software with third party entering information by group. In Phase One this person was a paid project employee**	**Option Two** **Integrated software with site personnel entering information by group. In Phase Two, test site employees entered the data**	**Option Three** **Stand alone software with once daily input of total head handled by site personnel. In Phase Two-B, test site employees turned on the software**
RFID hardware located either at receiving or sale ring: single, wide or dual lane scanning alley		
• Software to record and report tag numbers stands outside of business process (by-pass) • Information entry by a third party at the location of the system • No integration with enterprise software or operations processes • Can collect and report by group size, tag number and consigner or buyer	• Software that links with enterprise software to record and report tag numbers • Information entry by site personnel at the location of the system • Integration with enterprise servers, software and operation processes • Can collect and report by group size, tag number and consigner or buyer	• Software to record and report tag numbers stands outside of business process • Daily total entered by site staff • Software resides on administrative computers • No integration with enterprise software and operation processes • Collects and reports tag number only
Software creates a report showing read accuracy for that scanning day and a converting spreadsheet data file (.csv) configured in the proper format for a movement file for submission to the CLTS.		
The movement file is submitted to the Canadian Livestock Tracking System		

SOFTWARE EFFICIENCY AND VALUE CREATION FINDINGS IN PHASE TWO

Option One: No impact
The business process did not change as a dedicated project person operated the software (the Field Research Associate worked for the project and not the test sites). There were no benefits to the test sites from the use of the RFID systems in Phase One because they were not linked with enterprise software. The software was effective as it recorded the tag numbers with minimal to no errors. Global read accuracy was 93% without any intervention to affect the read rates.

Option Two: Inefficient
The tag recording software introduced in Phase Two was found to be inefficient because it did not improve process flow, minimize errors, or add value. Some of the complaints from auction market operators included: software crashing and stalling or interrupting the sale, technical functionality issues requiring many hours on technical support, difficulties with communication between the hardware and software and a negative impact on speed of commerce at all locations of the auction markets.

Most auction markets and buying stations have customized their enterprise software to align with their business processes. As such, any software that is integrated with enterprise systems often requires customization as well. This increases the cost and complexity of the new modules.

When RFID hardware is linked to enterprise systems, it must be networked through the enterprise servers. In two test sites the computer hardware was too old to support networking. New computer hardware and servers was required at a cost of over $16,000. This is a cost that must be considered prior to choosing an integrated system.

The two sites that found the systems to be efficient were Ottawa Livestock Exchange and Ontario Stockyards. Both of these sites deal in Quebec cattle with ATQ tags. Consigners get a rebate from ATQ when the tag is registered on the sales draft. As such, these sites both installed systems that were able to collect 100% of the readable ATQ tag numbers and report them on behalf of the customers. However, these systems are highly labor intensive and cannot process high volumes of cattle at one time. One facility said, “this is an efficient system because we are providing a service that has been requested by our customers.” However, the benefit was not to the auction market or buying station. A potential benefit was not met because the age verification numbers were low; between 7.8% and 42.4% of all head scanned.

Most sites found the software operated effectively and collected and recorded the tag numbers for movement reporting at a reasonable rate of accuracy. Yet, there were a few anomalies. Gladstone experienced a 12.8% error rate as a result of capture and recording of improper tag numbers and formats. It was thought that these errors were a result flaws in the data entry device and software that was unique to Gladstone.

Buying stations were introduced in Phase Two and each site was equipped with multiple RFID alleys at the loading areas of the facilities. It was difficult to link into the enterprise software as a result of the unique business process of each of the facilities. New stand alone software was developed that operated on a Windows-based protocol. This software supported recording both move in and move out. In some cases, the information was entered in the software in the office when time was available. There was no requirement to enter each group as it moved through the systems, although McCall Livestock did enter each load. The information was not available to the buyer or seller. Large groups of cattle would move through the system and be allocated to a vendor at a later time, therefore not requiring immediate attention from the yard staff. The buying station software is reflective of Option Three as the software was not integrated to operating software. As there was no immediate requirement to enter the data in a timely manner, this did not affect the speed of commerce on lots that were not tracked individually.

Phase Two read accuracy dropped to a global average of 89% as a result of software errors and one site that had extensive problems with the system. In all, 393,474 head of cattle were scanned in 107,423 groups.

Option Three: Neutral
No change in the business process was required provided there was no intervention required for tags that are unreadable or cattle that are untagged. Data entry took place in the office where staff was computer competent. Only minimal training was required as the software is not complicated; determining the total number of head handled throughout the day may take some time to complete, but the data itself only takes seconds to enter. As there was no integration with the business software, any technical difficulties did not affect sales transactions. Manifest Manager software, by Viewtrak Technologies, was effective and efficient as it recorded the tag number with minimal to no errors.

SUMMARY

The Phase Two report details that Option Two software (integrated with management systems) has the highest impact on speed of commerce, costs and labor requirements. Further it was concluded [i] "when evaluating a single movement report without consigner or group information, it is evident that Option Three (stand alone or by-pass software) has the least impact and least cost to industry. This alternative system would not provide any value-add components, such as age verification on invoicing, as a result of not being linked to enterprise systems. Option Three would be the most efficient and effective method for sited events at auction markets and buying stations." The only data recorded under an Option Three scenario is the total number of tag numbers scanned in one day; there is no listing of consigner or group number.

As a result of promising results using Option Three in Phase Two, further testing of the by-pass system was recommended in the Phase Two report summary.

INTRODUCTION

The research discussed in this report is an extension of Phase Two of the multi-phase Applied Research Project and is referred to in this document as Phase Two-B. This report details the findings of a test on the by-pass or stand-alone software system as detailed in the Phase Two report and called Option Three. The test took place at six auction markets for a 15-week period from the first of September to the end of November 2011.

The RFID installed in Phase One and Two was used and the new software was compatible with all three types of RFID hardware that was installed in the facilities.

In Phase One, the test period was 11 weeks and scanned 144,000 cattle at 10 auction markets. Phase Two-B operated for 15 weeks and scanned 118,200 head in six auction markets. Both of these tests ran throughout the fall run, therefore the test results from Phase Two-B are comparable in data set to those obtained in Phase One.

SOFTWARE AND DATA ENTRY DEVICES

The key factors in choosing the software for a test of the by-pass or stand alone software systems were:

- Affordability
- Training
- Ease of use

These factors were identified as a result of Phase Two research indicating that the cost of the customized software was high for the value it delivered. Many of the test sites were disappointed in the level of training provided on the integrated software. The additional labor requirements for operating and data entry on integrated software were also criticized. Another issue identified was the shortage of livestock market personnel that were comfortable and competent using computers.

Six auction markets participated in the study, the details are as follows:

Table Two:

Auction Market	Software	RFID Hardware Location	Data Entry Device
Gladstone Auction Mart	Stockman Software	Receiving	Office computer
Ontario Stockyards	Manifest Manager	Sale ring entrance	Panasonic Tough Notebook at sale ring
Saskatoon Livestock	Stockman Software	Sale ring exit	Laptop in auction booth
Spiritwood Stockyards	Stockman Software	Sale ring exit	Office computer
Ste Rose Auction Mart	Stockman Software	Receiving	Laptop at receiving
Winnipeg Auction Mart	Stockman Software	Receiving	Laptop in office

Stockman Software by Integrated Traceability Solutions (ITS)

"The Stockman Software is designed as CLTS reporting software. This software allows birth date registration to be done as well as age verification on individual animals. Also and cross referencing of old to new CCIA tags that needs to be done can be accomplished with this program. Birth certificates can be produced with this software in accordance with the Canadian Cattle Identification agency. This software is also connected directly to the CCIA database which allows immediate birth date recognition when an animal is scanned." [ii] Stockman runs on a Windows operating system.

Stockman was chosen as it has an exceptionally high ease of use and it allows internet based data transfer to the CLTS for reporting tag numbers. Further, it was developed to scan out invalid tag numbers, eliminate duplications and notify the user of tag number errors. Stockman Software has high functionality for birth date registration,

inventory management and reporting. However, the only function that was used during the test was the creation of a move-in file with the total number of head during the scanning day. Groups and individual consigners were not recorded separately. The software was opened at the beginning of the scanning day, with the tag numbers recorded throughout the day. At the end of the scanning day, the total number of head scanned was entered and the report created. A pdf file of the report was emailed to the Project Manager, and an internet transfer of the tag numbers to the CLTS was started.

Retail cost on Stockman Software is $2,000 which includes a one-year license, installation, onsite training and one year of telephone support. The annual license and support fee is $300. All test sites reported being satisfied with the onsite installation and onsite training, as well as the availability of telephone support. Site installations were done on time, travel was not charged and the vendor worked with each test site to link the RFID hardware with the data entry device housing the software. In some cases, a laptop was provided as it was less expensive than linking the RFID hardware with the office computers.

Manifest Manager Software, Viewtrak Technologies

Manifest Manager, by Viewtrak Technologies, is custom software that was employed in Phase One of the research project. It also operates on a Windows platform. This software was designed to capture tag numbers by consigner and lot size. It then generates a report that details the total number of cattle through the scanners, the read rate on the group and the total read accuracy for the day. A separate report, generated in a Comma Separated Value file, requires manual submission to the CLTS for data recording as the software was not developed for web based reporting. Manifest Manager is the software that was used by Killarney Auction Mart during Phase Two with exceptional results. This software does not have the same level of functionality as Stockman because it was not developed for birth date registration or internet based reporting.

Groups and individual consigners were not recorded separately. The software was opened at the beginning of the scanning day. The tag numbers were recorded throughout the day and, at the end of the scanning day, the total number of head scanned was entered and the reports created. As this software was not designed to submit the data via the internet to the CLTS, the user submitted the movement files through the CLTS staging servers.

The annual license fee for Manifest Manager is 1,500, which includes installation by electronic download, telephone support and training. The annual support fee is $500. At Ontario Stockyards, the software was made available and their IT department installed the software on a Panasonic Tough Notebook purchased in Phase Two to enable data entry at the sale ring. There was no onsite training provided.

Manifest Manager is exceptionally easy to use, and has a high degree of functionality for capturing tag numbers either by group or as a whole on scanning day.

Data Entry Devices

The Phase Two report discusses the importance of having the software determined in advance of the hardware choice. This is important because linking the hardware and software requires extensive cabling, network devices and ensuring that the data feed is without electronic interference. Having the software installed prior to the hardware enables the hardware vendor to install the necessary equipment to link to the data entry device.

The Phase Two report noted, it is efficient to have the software loaded on the office computers. [iii] This saves the cost of additional data entry devices and enables use by individuals that are comfortable and competent using computers. Problems linking the hardware to the data entry device in the office were experienced in this phase, with Integrated Traceability Solutions personnel having to research the best method to link the hardware to the office computers. Additional electronic networking devices were required to link some of the systems.

The installation on office computers was the most effective:

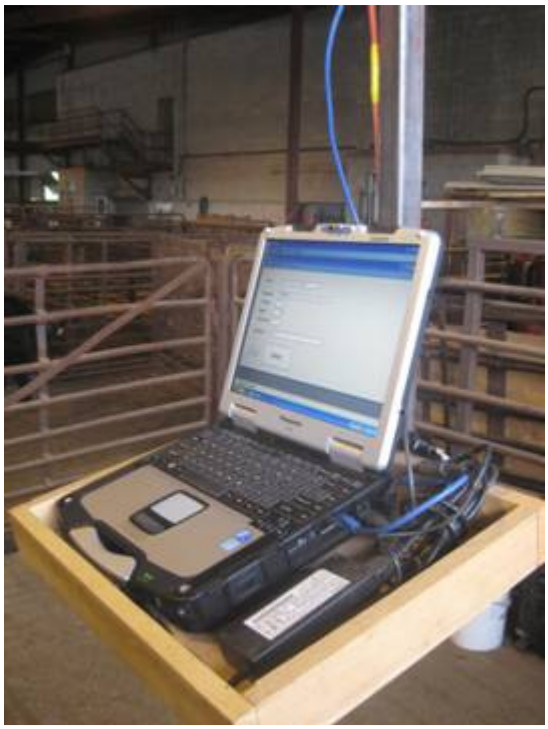
1. The office staff always remembered to open and engage the software. When located at other areas, the staff sometimes forgot to turn on the software.
2. Reporting was easier as the computer was linked to the internet and did not have to be moved to transfer the reports and data to CLTS.
3. The computer was protected from the elements.

When the data entry device was placed in locations other than the office, there were a greater number of issues:

1. There were days that the yard staff forgot to turn on the computer and therefore did not collect and record tag numbers from scanning.
2. Often the reports were delayed as the yard staff had to move the laptop from the receiving area into the office to use the internet to send the files.
3. When there were software errors, this was not discovered until after the scanning day, resulting in inaccurate reads.
4. Dust and cold affect laptops at receiving, even when placed in a receiving booth.

In summary, as detailed in the Phase Two report, it was found that the office is the most effective location for data entry device for by-pass software. If the data entry device is linked to the RFID hardware at the time of installation, linking these two devices is not complicated. However, linking data devices to hardware after the hardware has been installed is a more complicated and costly process.

Photo One: Panasonic Tough Notebook- Ontario Stockyards

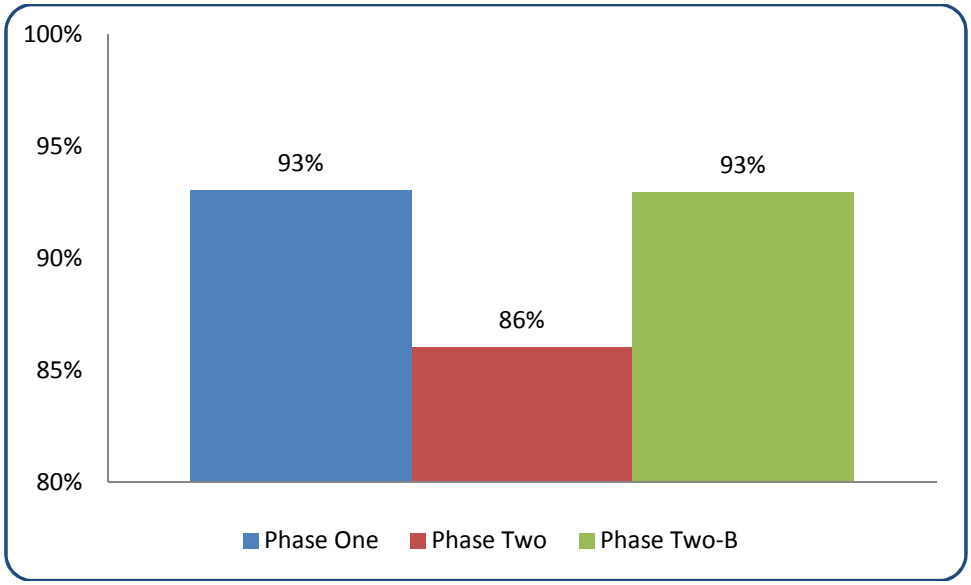


RESULTS

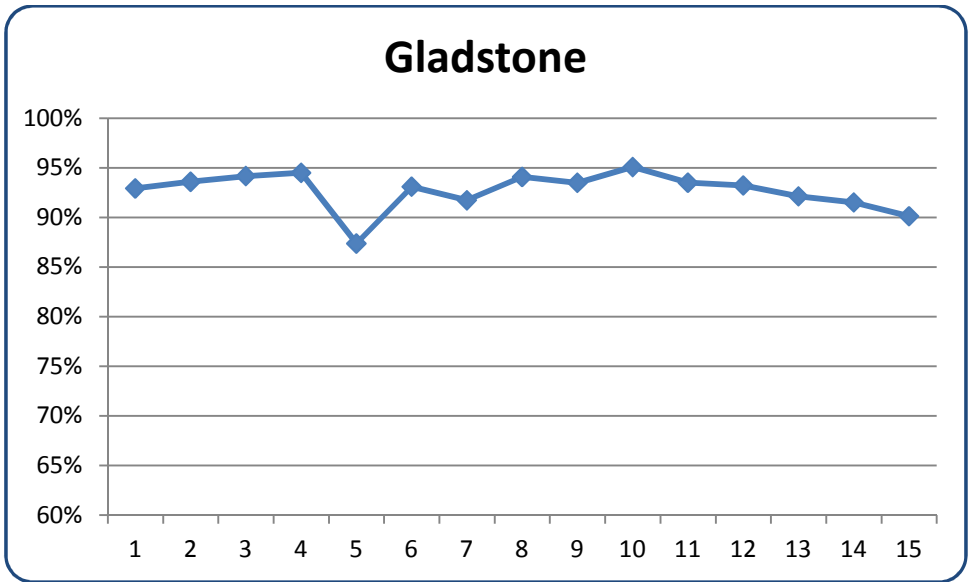
The results of this test are based on the read accuracy variances between the by-pass system and the systems used in Phase One and Phase Two.

Gladstone

This market had a four panel wide alley hardware at receiving and Stockman software loaded on the office computer. In Phase One, the RFID hardware at Gladstone was a dual alley and in Phase Two, it was changed to a four panel wide alley. A dual alley system should get a higher read accuracy due to the close proximity of the tags to the readers. It is notable that the read accuracy from Phase One to Phase Two-B is the same at 93%. The difference between Phase Two and Two-B is exceptional with a 7% increase using the by-pass system. In Phase Two this facility experienced a 12.8% error rate as a result of capture and recording of improper tag numbers and formats. With the by-pass system, there were no more than three invalid tag numbers per scanning day. This indicates the problems at Gladstone in Phase Two were a result of either the software or the DT500 as the data entry device.

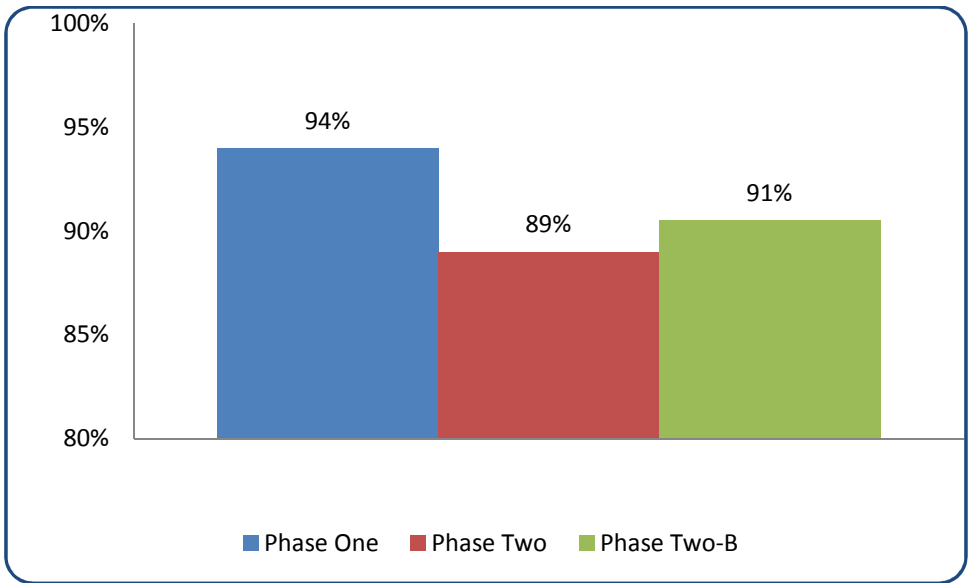


The read accuracy per week stayed consistently high (90% and above) with the exception of one week with a read of 87%.

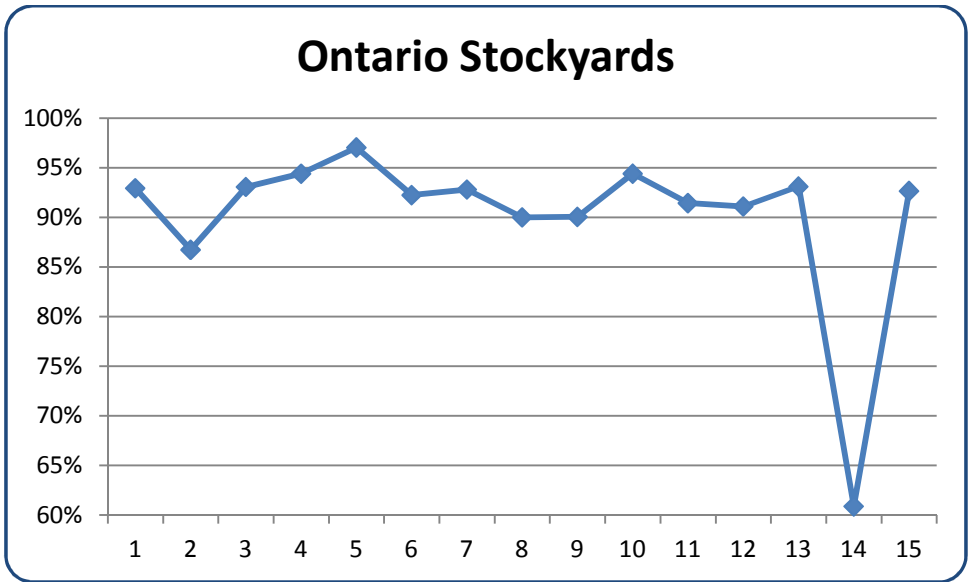


Ontario Stockyards

This market had an eight panel wide alley before the sale ring and Viewtrak Manifest Manager software installed on a Panasonic Tough Notebook used at the entrance to the scanning alley. The by-pass system had a higher read accuracy than the integrated software; however it was lower than Phase One. The reason for the 3% variance from Phase One to Two-B is a result of one scanning day when the software was not turned on until half way through the sale. The read accuracy obtained that day was 61%. If that one day was eliminated from the data accuracy would equal that obtained in Phase One.

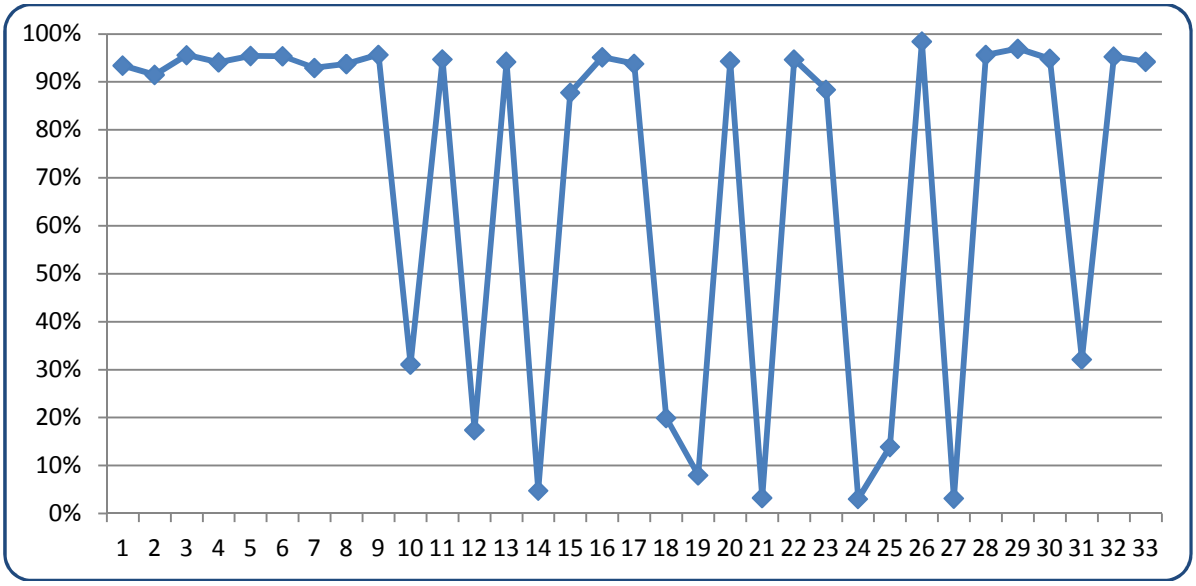


This chart indicates that the read accuracy stayed consistently high (over 90%) with two exceptions, one with a read accuracy of 87% in week two and one of 61% in week 14.

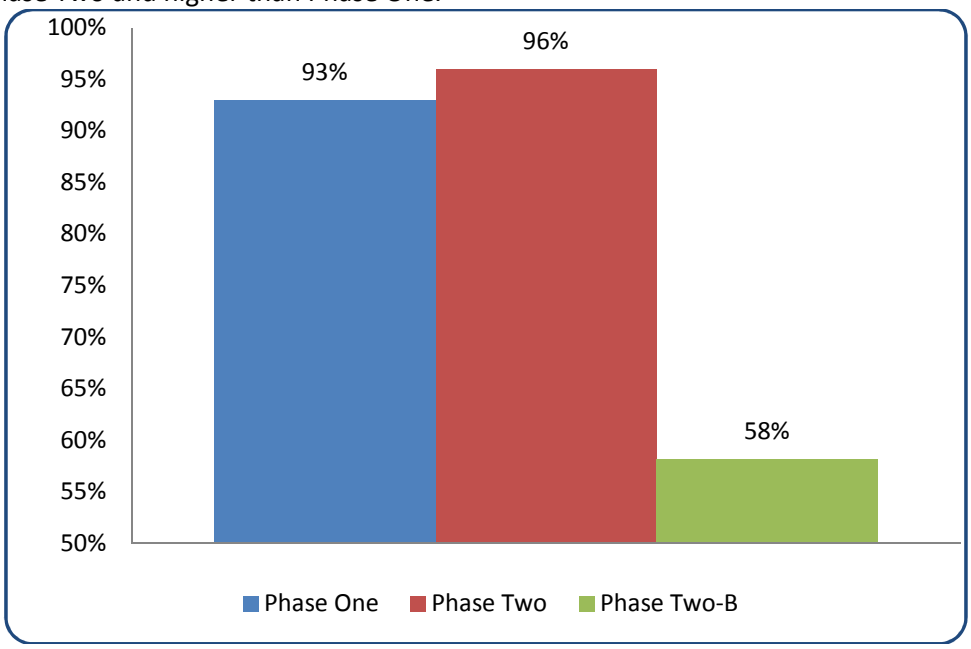


Saskatoon Livestock Sales

This market had an eight panel wide alley off the sale ring and Stockman software loaded on a laptop in the auctioneer's booth and monitored by the sales clerk. The clerk position is very busy and requires exceptional attention to detail. Adding the accountability for recording and reporting RFID numbers adds another dimension of time and stress. As such, if the data was not being recorded accurately, that information was not known until after the sale. The data collection at this facility was highly irregular as a result of a power outage early in the test. That outage affected the panels, laptop or the software to such a great extent that out of 33 scanning days, only 23 had any significant percentage of tags recorded. For the first nine sales, the read accuracy was 94% and it continued to be high on the days when the software was working. The chart below shows the erratic nature of the daily reads after the power outage.

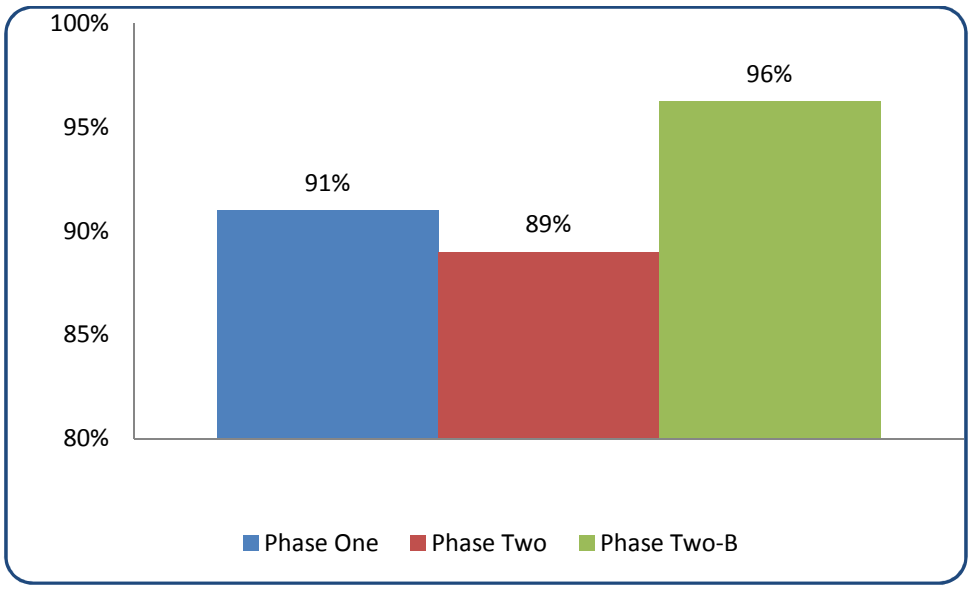


The read accuracy in Phase Two-B dropped dramatically over both Phase One and Two. If the data was cleansed to remove the scanning days where the system was not collecting tag numbers, the read accuracy would have been 95%, similar to Phase Two and higher than Phase One.

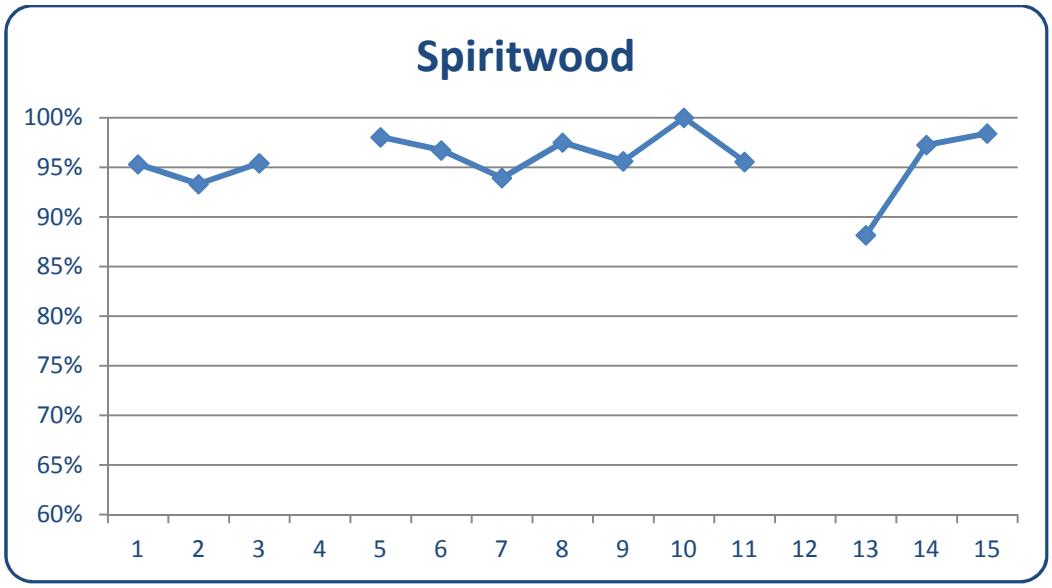


Spiritwood Stockyards

This market had an eight panel wide alley after the sale ring, and Stockman software loaded on the office computer. The Phase One and Two read accuracy at this facility showed disappointing results for the Aleis wide alley system that was operating at high read accuracy in other locations. After Phase Two, an in-depth electrical interference test was performed at a cost of $10,000.This interference test observed and rectified electrical interference issues that had caused the reduced accuracy in Phase One and Two. As such, the read accuracy in Phase Two-B showed a dramatic increase of 5% over Phase One and 7% over Phase Two.

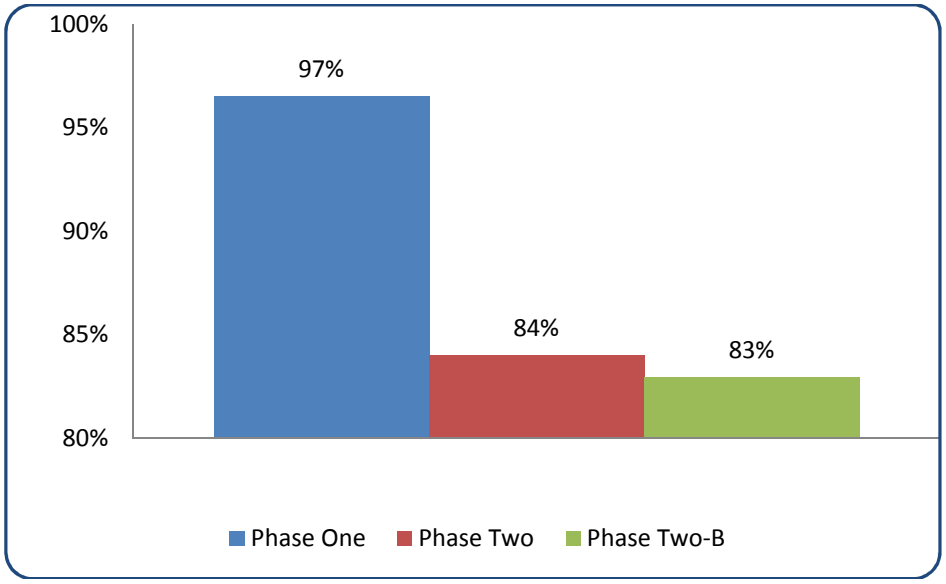


As the chart below indicates, there were two weeks when the data was unavailable as a result of computer failure. Note that the read accuracy stays primarily above 93% and was often as high as 98-100% with the exception of one week at 88%.

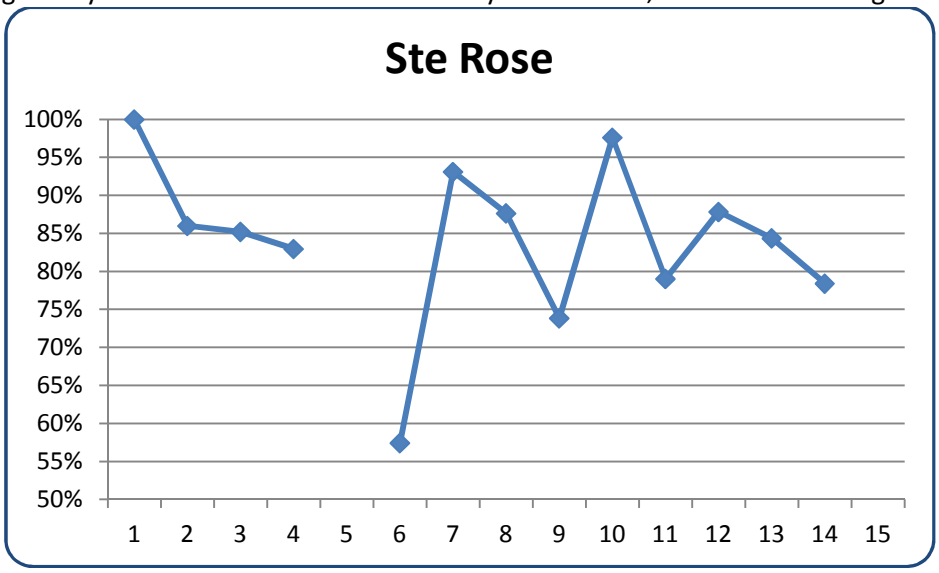


Ste Rose Auction Mart

This market had multiple RFID hardware alleys located at receiving and Stockman software loaded on a laptop that was used in a receiving booth. In Phase One the RFID hardware was a single alley system and as a result of proximity of the tags to the reader panels, the read accuracy was very high at 97%. In Phase Two the RFID hardware was changed to one dual alley for ground loading trailers and two single alleys on intake chutes for semi-trailers. It is thought that the 42-inch width of the intake chutes for the semi-trailers may be too wide, allowing for multiple cattle to be in the read field, therefore causing data collision and lower read accuracy. As such, the read accuracy in Phase Two dropped to 84%. In Phase Two-B, the read rates were consistent with Phase Two at 83%.



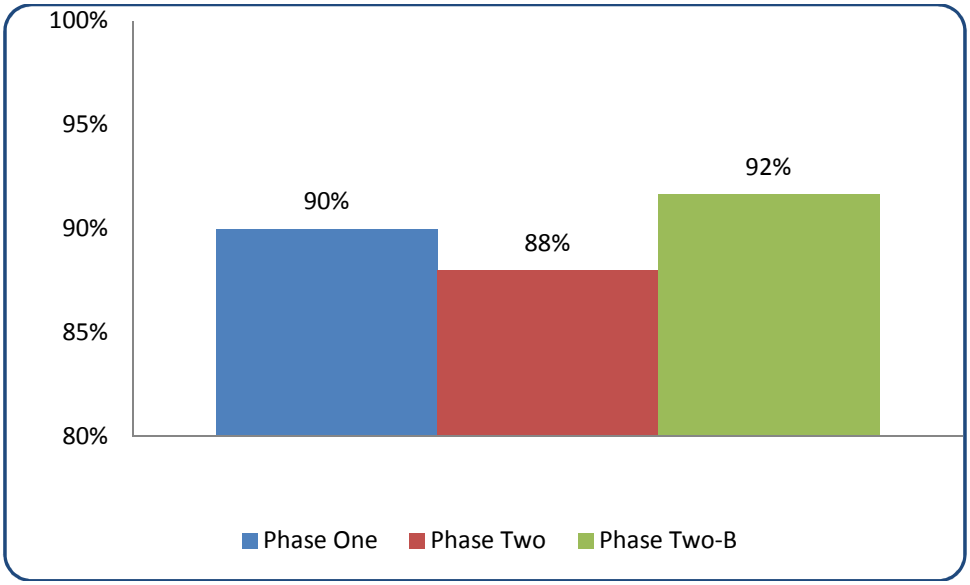
The graph below shows the fluctuating read accuracy that occurred at this facility. The market operator suggested that the inconsistencies could be a result of cattle being received that are not tagged, the number of which fluctuates weekly. T he variations could also be a result of the different read accuracy in the dual alley system and the single alley on intake chutes. If the number of cattle received on ground loading trailers was high one week, the read accuracy would be higher versus the weeks with higher numbers of cattle received on semi-trailers and scanned on the single alley chutes with a read field that may be too wide, therefore reducing accuracy.



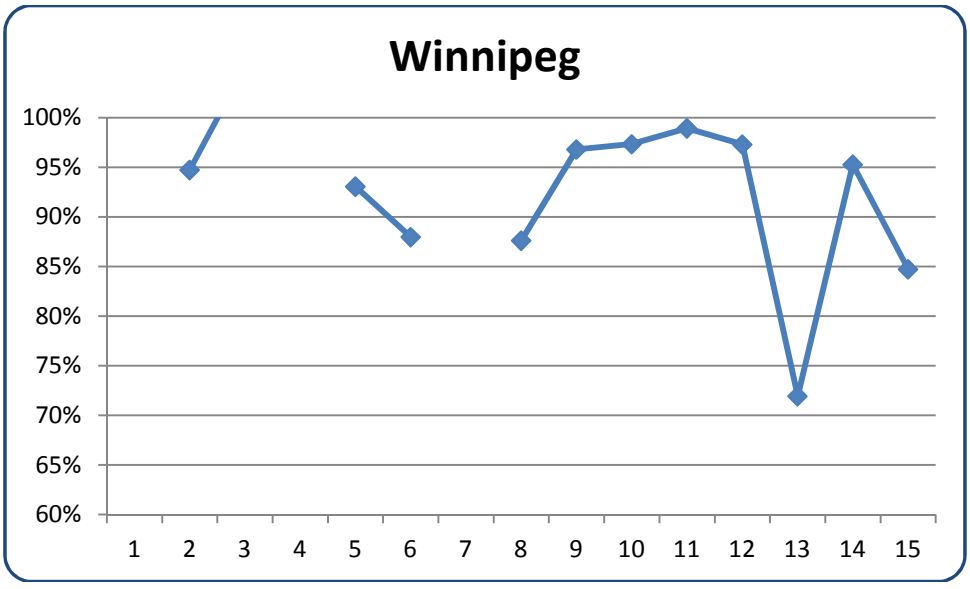
Winnipeg Auction Mart

The market had an eight panel wide alley at receiving and a laptop with Stockman software in the office. Originally the laptop was placed at receiving for data collection but moved to the office once a network link was installed. This enabled data transfer through the CAT5 cables into the office. This facility could have had the software installed on the office computers, had the network link been available at the time of installation.

As indicated on the following graph, the read accuracy in Phase Two B exceeded both Phase One and Two, with a 4% margin in the latter. The test period was 14 weeks as the market was not set up in week one. Further, it missed one week of recording as the software was not turned on for the scanning day.



Throughout the twelve weeks of testing, the read accuracy was 93% and higher for eight of those weeks. There were four weeks in which the read accuracy was in the mid to high 80% and one week with a read rate of 72% which affects the global average.



READ ACCURACY SUMMARY

The following table details the variances between the read accuracy attained in Phase Two-B (using by-pass software with minimal labor requirements and human interaction) and the other two phases with significant participation by market and project personnel.

The variance from Phase One to Two-B indicates the read accuracy decreased in half the sites and remained the same or increased in three sites. The software used in Phase One was operated by a project person, entering each group individually.

1. **Gladstone-no change**: Notable even though there was a change from dual alley to wide alley system.
2. **Ontario Stockyards-decrease**: On one scanning day the system was not turned on until half way through the sale day causing a read accuracy of 66%. If this day was eliminated from the data set, the read accuracy would have equaled Phase One.
3. **Saskatoon- decrease**: An electrical power failure caused the system (hardware, software or data entry device) failure that was never resolved throughout the test period.
4. **Spiritwood-increase**: As a result of an ambient interference test done between Phase One and Two-B, the electrical interference was decreased, therefore increasing read accuracy.
5. **Ste Rose- decrease:** A change from a single alley system to multiple systems with a combination of single and dual alleys.
6. **Winnipeg- increase**: No apparent reason for the increase.

The variation is most significant from Phase Two to Two-B, with only one facility having a dramatically lower rate (Saskatoon Livestock Sales) and one other not having a material difference (Ste Rose). The increase in read accuracy is coupled with the benefit of not having extensive labor involvement in the data entry by consigner or buyer. The by-pass software had very low labor requirement.

Table Three:

Auction Market	Phase Two-B		Phase One	Change Phase One-Two B		Phase Two	Change Phase Two-2B
Gladstone Auction Mart	93%		93%	0%		86%	7%
Ontario Stockyards	91%		94%	-3%		89%	2%
Saskatoon Livestock	58%		93%	-35%		96%	-38%
Spiritwood Stockyards	96%		91%	5%		89%	7%
Ste Rose Auction Mart	83%		97%	-14%		84%	-1%
Winnipeg Auction Mart	92%		90%	2%		88%	4%

This short test indicates that in comparison with integrated software with data entry by group, the by-pass software recording the total head in a scanning day increased the read accuracy in four of the six markets. It did reduce labor demands. In most facilities it was efficient in the recording and reporting of RFID numbers and it had no affect on the speed of commerce.

CONCLUSION

The assumption stated in the Phase Two report was that the by-pass software would collect and record tag numbers with a higher rate of accuracy than what was achieved with integrated software where data entry was done by market personnel. Eliminating the data set from the system failure at Saskatoon Livestock, the by-pass system generally out-performed the integrated systems from Phase Two with regards to read accuracy.

The cost of by-pass software is dramatically lower; being approximately $2,000 versus $4,000 to$8,000 for integrated software. As well, the labor requirements on by-pass software are minimal; only requiring a few minutes a day to open the software and then two mouse clicks to create the report and have it sent electronically to the CLTS.

The factor substantiated once again was that having a dedicated project person, such as in Phase One, will show more favorable results than either integrated or by-pass software where the data is entered by market personnel. Market personnel have busy positions and adding the responsibility for managing the RFID system adds work load and stress. A dedicated resource trained in the operation of the hardware and software, accountable for ensuring that both are operating at the highest levels of performance and ensuring errors are corrected in a timely fashion, as well as moving cattle through the system on scanning day is critical to the success of the system operation.

In both Phase One and Two, it was observed that technology is not at the point where 100% of tags are readable without an impact on speed of commerce and business process. This phase shows the progression of accuracy with both hardware and software over three seasons. Improvements made to systems including the following:

- Gladstone's new software and data entry device increased read accuracy by 7% between Phase Two and Two-B. The change in hardware from a dual alley to a four panel wide alley did not affect read accuracy between Phase One and Two-B, but did improve process flow.

- Spiritwood had an electrical interference test performed between Phase Two and Two-B. The source of interference was located and rectified; thereby increasing read accuracy by 5% over Phase One and 7% over Phase Two.

- Ste Rose demonstrated that changing hardware was not the answer to higher read rates, but it had less impact on speed of commerce. More testing is required to see if narrowing the alleys on an intake chute will increase read accuracy.

There is no one solution that will work in every facility, but this test indicates that by-pass software will work efficiently, cost effectively and have a lower labor requirement when chosen as the software component for an RFID system. Even with cost effective software, the cost of hardware and installation must be considered when evaluating the investment of RFID systems for traceability. The impact on business process, cost and speed of commerce will be directly proportional to the level of detail required in reporting and the level of integration of the systems.

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Spiritwood Livestock Sales: Pat and Brian Jacobsen

Ste Rose Auction Mart: Myles Mason

Winnipeg Livestock Sales: Scott Anderson

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[i] Phase Two National Applied Research Project: June 2011 (Page 108) Donna Henuset et al-Canadian Cattle Identification Agency www.canadaid.ca

[ii] http://www.itslivestock.ca/products/software Accessed December 6, 2011

[iii] Phase Two National Applied Research Project: June 2011 (Page 92) Donna Henuset et al- Canadian Cattle Identification Agency www.canadaid.ca

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