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Recommendation for purchase of LOADMAN CAT 776D Coal Hauler Payload Monitoring System

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Executive Summary

Inconsistent loading of the 776D coal hauler fleet has been the catalyst for reduced productivities and increased failure frequency on wheel group components caused by overloading. The ability to produce repeatable and consistent payloads would help manage these issues. Payload monitoring would offer a solution to the problem of inconsistent loading. The opportunity presented itself to investigate payload monitoring technologies. After researching the marketplace, a promising system was located. The system, involving precise loadcells and a display computer unit, proved itself to be accurate, repeatable and durable enough for a test run. It was determined that one coal hauler would be tested over a month to two month period. Initial results which compared the systems readings to a weigh scale readings saw the payload monitoring system measurements within 1.2% of the scale, on average. The two months of data collection proved the systems ability to collect data that was useful in determining overloading and underloading situations. A wireless display for loaders was also explored. This option helped the loader operator load the trucks more efficiently. Weigh scale comparisons and a month and half of field-testing have proved that the system is an asset and should be purchased for the test coal hauler.

Introduction

The Highvale coal hauler fleet has been plagued with inconsistent payloads since its inception. Numerous weigh scale studies have confirmed this fact. Inconsistent payloads cause decreased productivities, premature tire wear, excessive wear on truck components and unnecessary spillage. Overloading is more prevalent especially during the spring when the trucks carry a great deal of mud.

An effective means to monitor payloads would promote more consistent loads, increase productivity, decrease maintenance costs and give management a tool to analysis and evaluate the coal hauler fleet effectiveness.

An opportunity exists to assess new payload monitoring technology available in the marketplace. However, a majority of the payload management systems available for mining vehicles produce large payload variances (in the order of 10 to 15% on the flat) and are not repeatable over the same load.

Discussion

A new payload monitoring technology offered by Loadman Onboard Weight Management Systems out of Renton, Washington, originally used in logging trucks, refuse trucks and most recently underground mine haul trucks, has provided accuracy and repeatability in terms of load measurement.

Loadman's loadcells provide the measurement and accuracy in the system. They are claiming a 1% accuracy for payload measurement. It was determined that a trial system would be installed on one coal hauler in the fleet and tested over a two month period. The accuracy and applicability for the Highvale mine site would be determined based on the testing.

A wireless data transmittal to the loader operator is also being investigated. Loading units would have the same payload displayed as the truck display unit, which would allow loader operators to fill the trucks more effectively and reduce overloading situations.

System Description

The Loadman payload monitoring system installed on the 776D coal hauler (Unit #5426) consists of four (4) load cells, two (2) digital decoders and a Loadman display unit for the cab plus wiring. The load cell pins replaced the CAT Factory upper suspension strut pins in the drive axle and trailer axle struts. The pins are suitable to support the structure and do not void the warranty of the trucks. The steering axle weight is assumed to be a constant and is calculated by the display unit during calibration. The loadcells, when weight is applied, produces a weak analog signal, which travels to the digital decoder. The signal is amplified and sent to the Loadman display unit, which acts as the brain of the system. The display unit has been customized to show tonnes.

Load information data is recorded into the display unit through a button on a RS232 type "punch box" connection located on the passenger side dash. The operator simply presses the record button when (s) he reaches the appropriate load weight. The display unit has the ability to store months of data. Data, consisting of time of load and payload, can be downloaded onto a laptop by the Loadman Fleet management software where it can be exported into Microsoft Excel or other programs such as Access

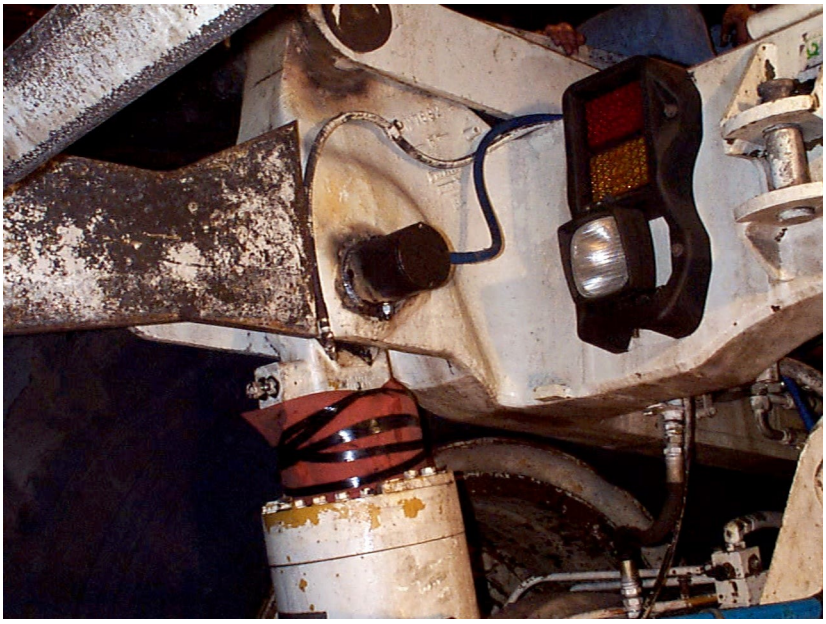
The wireless unit was installed on 1337 Shovel for the test duration. The Loadman system on the loader unit consists of a display unit, a wireless receiver which is attached to the window and wiring to a 12V power source. The operator turns the power onto the unit and when a truck approaches the loader, a wireless signal is picked and displayed in the loader cab. In the event of the whole fleet being outfitted with payload systems, each truck will offer a unique signal identifier for uninterrupted wireless transmission.

Installation

Installation of the system was undertaken over a two-day period. Luscar personnel (one maintenance man and one electrician) completed the install with supervision from Loadman representatives. The display unit was installed in the upper right-hand corner of the cab. This allows the driver to look back at loading while watching the display unit. All wiring has been covered with a protective sheath or is protected in the body of the tractor or trailer.

Calibration requires an onsite scale. Minimal training is required for future calibrations. Tare weights were determined with a clean empty truck and entered into the system via the Loadman display unit. Payload display is available in "NET" or "GROSS". A loaded truck weight, by axle, was measured on the scale to determine a known weight. These numbers were entered into the display unit. The calibration is basically complete. Calibration is rarely if ever needed, as the system should not drift.

Front Drive Axle Loadcell during Installation



Kal Tire Scale Comparison

On May 2-4, 2001, Kal-Tire out of Kamloops was on site with a weigh scale system. Payloads by axle were weighed with the scale system and compared with axle payloads generated by the Loadman system.

Over the course of the two days, seven loads were compared. On May 3, Unit 5426 went down all day with a damaged turbo. The table below illustrates the results achieved by the Loadman system versus the weigh scale:

May 2-4, 2001 Kal-Tire Weigh Scale readings as compared to Loadman readings

				Kal-Tire	LoadMan	Difference	% Difference
10:35	04-May-01	2 SEAM COAL	992 LOADER	150.4	147.9	2.5	**1.65%**
11:03	04-May-01	2 SEAM COAL	993 LOADER	171.8	168.4	3.4	**2.00%**
11:45	04-May-01	2 SEAM COAL	994 LOADER	157.0	157.8	0.8	**0.53%**
12:12	04-May-01	2 SEAM COAL	995 LOADER	159.6	156.8	2.8	**1.75%**
12:40	04-May-01	2 SEAM COAL	996 LOADER	154.7	154.1	0.6	**0.39%**
13:27	04-May-01	2 SEAM COAL	997 LOADER	162.2	164.7	2.5	**1.55%**
14:13	04-May-01	2 SEAM COAL	998 LOADER	162.1	161.6	0.5	**0.30%**
							1.17%

Based on the above results, the accuracy of the Loadman system is exceptional considering the weigh scale system is accurate to 2% while Loadman is offering 1% accuracy.

Field Observations

The Loadman system was easy to operate and reliable. Operation of the system involved turning the power on at the display unit and pressing the record button after each load.

The tonnage on the display shifted around between 0.1 and 0.3 tonnes when stationary and about 10 tonnes when at full speed on the haulroad. This was due to the shifting of mass from loadcell to loadcell as the vehicle moved. Loading on flats produced excellent repeatability from loading area compared to at the hopper. Variances were noticed when loading occurred on an angle. The difference on an 8^{o} grade, for example, was approximately 10 tonnes or 9%. Loading occurs on extreme slopes approximately 20% of the time. Similar variances (7% to 10%) are encountered by other manufacturer's systems when measuring payloads on the flat.

A barcode system was also tested. This system allowed the driver, with the aid of a hand held scanner, to scan in a product type (i.e. seam 6 or 4 seam parting) and a location (i.e. Pit 06 or Sundance 5/6) into the display unit and track each load by these parameters. Based on observations and conversations, this technology has not been ruggedized enough to be applicable in the mining industry.

Data download was accomplished easily. A laptop was attached to the display unit via a serial cable with data dumping occurring through the Loadman fleet management software. Other methods of data retrieval are available such as the potential to download using cell phones or using a smartalker toolkit (about the size of a package of cigerretes that plugs into the display unit thus eliminating the bulky laptop.

The table below summarizes the data collected from May 14th, 2001 to June 27th, 2001:

Frequency Chart of Payloads, as recorded by Loadman

Gross Payload Range (t)	*Gross Payload Frequency*	*Gross Payload Range (t)*	*Gross Payload Frequency*
240.00	6	278.00	15
250.00	9	280.00	15
260.00	41	282.00	10
262.00	10	284.00	11
264.00	23	286.00	7
266.00	26	288.00	8
268.00	18	290.00	3
270.00	24	295.00	4
272.00	21	300.00	3
274.00	27	More	2
276.00	28	**Total**	**311**

- Raw data from the collection period and a histogram are attached as appendices.

Average	269.38
Optimal Payload	272.00
Max	304.12
Min	214.52
Standard Deviation	37.18

*****NOTE*** A tare weight of 116.72 is assumed, based on weigh scale tests completed May 2, 2001**

Based on the data displayed above and in the appendices, loading can best be described as inconsistent. The average is slightly below the optimal gross payload. Overloading past the break test limit occurred in 133 of the 311 loads or 42.8% of the loads. Underloading, assuming an acceptable gross payload is within 3 tonnes, occurred in 133 of the 311 loads or 42.8% of the loads. Optimal loading (270-272 tonnes) occurred 45 of the 311 loads or 14.4% of the loads.

Cost

The cost of the Loadman system for one (1) coal hauler is as follows:

• Loadman System- Loadcells, load decoders and wiring		$23,373.21
• Metric Display Unit		$4,544.59
• Wiring Harness and Overload Relay		$489.55
• Smarttalker Data Management Software		$6,993.56
		$35,400.91
	+ GST	$2,478.06
		$37,878.97

The Smartalker Data Management Software purchase is a software license purchase and is a one-time purchase. Future systems will cost **$30,395.86** per coal hauler.

The cost of the wireless system for a loader is as follows:

• Wireless Metric Display Unit		$4,544.59
• Wiring Harness and Overload Relay		$489.55
		$5,034.14
	+ GST	$352.39
		$5,386.53

The total cost to equip the entire coal hauler fleet and all loading units is as follows:

• Nine (9) Loadman Systems	$210,358.89
• Metric Display Unit (9 for haulers & 5 for loaders)	$63,624.26

• Wiring Harness and Overload Relay		$6,853.70
• Smarttalker Data Management Software		$6,993.56
		$287,830.41
	+ GST	$20,148.53
		$307,978.94

Recommendation

It is recommended that Fuel Supply purchase the trial system with the following components and further investigate the potential for additional systems. Additional testing will encompass cold weather operation, load cell drift potential and overall operational stability.

It is also recommended that Fuel Supply immediately investigate the Loadman system for the ash hauler fleet as the trucks provide an excellent platform for the system as loading always occurs on the flat. The systems accuracy when measuring on flat ground will provide excellent payload results, which will translate into consistent loading of the trucks. Loadman has indicated that the ash hauler design would allow for a system to be installed with the ease of the coal hauler setup.

The system will allow Fuel Supply and Luscar to monitor current loads on a monthly basis. Management will be able to examine payload distributions and determine if underloading or overloading is occurring and the overall load distribution by truck. The addition of a display unit in the cab of the loading units will also promote repeatable loading of the coal hauler units. Loader operators will be able see the same display as the truck unit.

The system will integrate into any future mine management system such as Modular or Mine Star. These mine management systems rely on the fact that the hauling units have a payload system to interact with. Due to Loadman's use of an RS232 connection, the system will integrate easily.

APPENDICES