



Polycon Industries

***Lift Truck Impact
Analysis Report***

***Prepared For:
Polycon Industries***

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Preface

The information contained in this report includes a high level summary of the findings of analysing the Polycon Industries "Impact Analysis" data recorded by the BoleroWireless.com monitoring solution during the months of March 1, 2012 to October 18, 2012.

The author's findings in this report are an independent third-party looking at the Polycon data from purely a "data" perspective. In certain analysis, individual Lift Trucks have been highlighted. Without real life operational day-to-day knowledge, these analysis may have scenarios that the author is not aware of which may explains the findings.

Restrictions

This report contains confidential information proprietary to Bolero Wireless, Magna and Polycon Industries. The information contained herein shall not be disclosed to any third party without the express written permission of the Bolero Wireless and/or Polycon Project Managers.

Intended Audience

This document is intended for anyone involved with the Polycon "Impact Alert" monitoring Project.

Revisions

Release No	Date	Description
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1. EXECUTIVE SUMMARY

Introduction

Bill Hewlett, co-founder of Hewlett-Packard, once stated, "You cannot manage what you cannot measure. And what gets measured gets done."

This is true today in 2012 as it was when Bill first stated it back in the later part of the 1980s. In fact, this is a fundamental management principal that forms the heart of the Bolero Wireless solution today and that will continue to drive us into the future.

After a number of meetings with Polycon, it was determined that the Management team at Polycon needed the data to measure all impact events occurring in the Plant by its fleet operation on a day-to-day basis, in real time. The ultimate vision was to build systems to be proactive and reduce overall maintenance costs on these newly acquired corporate assets.

With this Vision in mind, Bolero Wireless and Integrated Visual Data Technology (IVDT) partnered on this project to build a world class solution for Polycon to help measure and record the Impacts events in the Polycon 700,000 square foot car manufacturing plant. With Bolero Wireless's expertise in the machine-to-machine (M2M) industry and IVDT's in-depth knowledge of the Lift Truck industry, an "Impact Monitoring" solution was developed and installed on 30 newly purchased Lift Trucks by the organization.

The vision and success factors for this project are as follows:

- a) **Measure:** Seamlessly "Data Log" every Impact Event for future analysis – without human intervention. This data gives management at Polycon the ability to understand "today", and manage the "tomorrow" by measuring the Impact Events occurring in the Plant on a day-to-day basis, in real-time.
- b) **Educate:** Implement an audible buzzer into the solution. The intent of the solution was not to be "Big Brother", but rather to educate THE operator when impacts occurred and explain proper operational procedures. The vision of this project was not to "reprimand" an operator, but rather to raise operator awareness through education when issues occur.
- c) **Reduce:** With seamless data logging and supporting education, the vision was ultimately to reduce overall maintenance costs of the fleet being monitored.

The data documented in this report summarizes the data collected from the Polycon Plant from 30 Lift Trucks operating in the Guelph, ON region on the Rogers Network from March 1, 2012 to October 18, 2012 (i.e., the "reporting period").

The remainder of this report will provide the reader with a detailed summary of the data captured during the reporting period, and will delve deeper into various metrics developed including:

- Summary of Impacts by Plant by Month (Overall Impact Trend)
- Impacts by Equipment by Month
- Impacts by Department by Month
- Impacts by Shift by Month
- Impacts by Day of Week

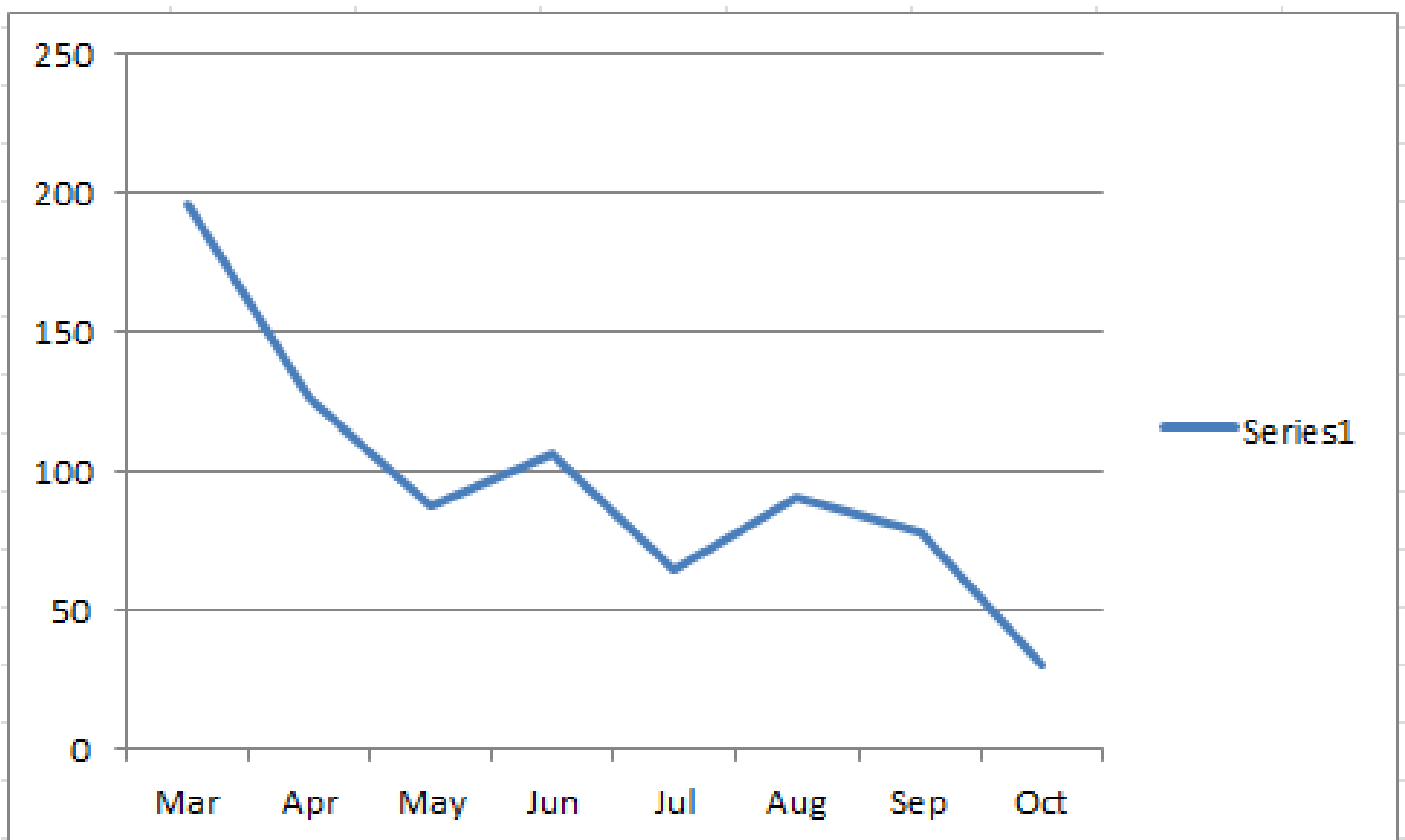
A secondary benefit of the system is the ability to track Lift Truck starts (Ignition On) events occurring in the Plant. Every time the ignition system turned on, an event is logged in the Bolero Wireless back-end website. We have included these metrics in this report as it may be useful for other analysis. Statistics gathered include:

- Lift Truck Start Metrics by Equipment by Month
- Lift Truck Start Metrics by Department by Month
- Lift Truck Start Metrics by Shift by Month
- Lift Truck Start Metrics by Day of Week

Overall Trend Summary

In summary, the overall trend has been a steady positive decrease in the impacts recorded during the reporting period. From looking at the data aggregated across all departments, Impact events went from **196** impact (an average of 6.75) event recorded during the month of March, 2012 down to **78** (an average of 2.68) impact events recorded during the month of September, 2012. **This represents an overall reduction of 60% in the number of impacts recorded by the solution during this reporting period.**

The Impact Data by Plant by Month data is depicted in the following graph:



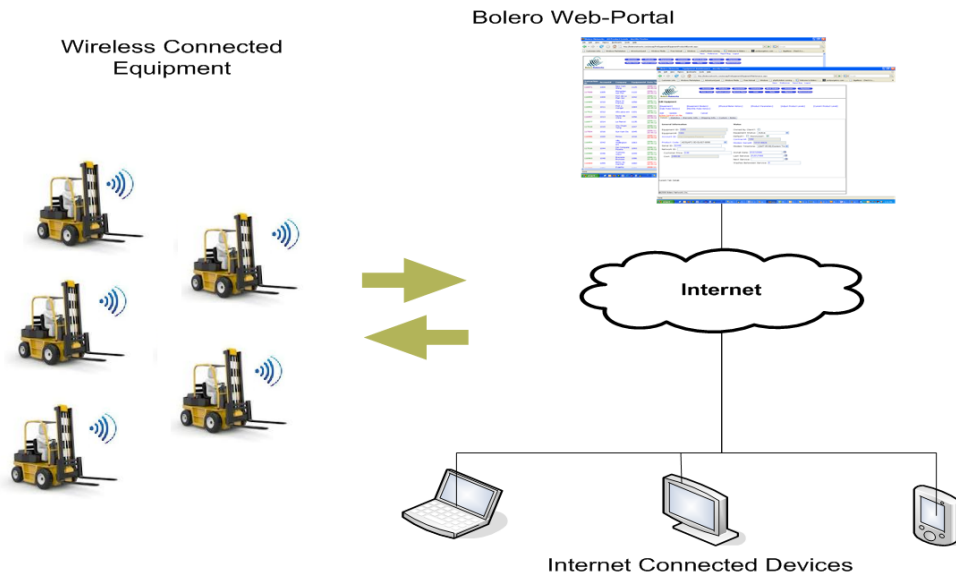
As can be seen by the preceding graph, the trend is consistently downward from month to month with the overall trend of recorded Impact Events moving downwards.

As of October 18, 2012 at 12:00 noon, the number of impacts that have occurred in the plant in October are currently down to 35. Based on this data, it is anticipated that the overall number of impacts in October will be around 70 and potentially the lowest month yet since the installation of the Impact monitoring solution at the Polycon Plant.

Conceptual Architecture and Method of Data Capture

This section provides a high level overview of the overall technical architecture of the solution of the BoleroWireless.com solution. The selected technical architecture has proven to be highly reliable and consistent in reporting impact events anywhere in the plant. The communication backbone incorporated into the solution includes a high speed GPRS/GPS network.

The following diagram depicts the overall conceptual architecture on which the solution being used by Polycon is based.



Wireless Connected Equipment

All thirty (30) Lift trucks have been installed with the Impact Monitoring solution made up of the following components

- Impact Alert module including 1.5g Sensor and audible Buzzer (IVDT);
- Bolero Wireless GPRS/GPS Wireless Modem.

Each time an Impact Event occurs on the Lift truck:

- A 10 second buzzer is sounded letting the Operator know an impact was recorded;
- A cellular GPRS message is sent to the cellular Network and lands in the Bolero back-end;
- The Event is logged real-time in the Bolero database and Bolero Live! Web Portal.

Bolero Live! Web Portal

The Bolero Web portal is a Web-enabled business application that allows the Supervisors, Departmental managers and other authorized users to monitor and analyse the impact events recorded by the system. All data collected by the system can be easily exported at the click of a button. This is the data that was used to create this report.

Summary of Findings

As can be seen by the data gathered in this report, the number of impacts have reduced from **196** impact events recorded in March to **78** impact events recorded during the month of September. This represents a total reduction of **60%** since the system was installed.

The ability to collect the data wirelessly has proven that the solution integrated into the Polycon Plant is seamless with the current operation and does not require any human intervention. The volume of data collected concludes that all transactions have been successfully processed by the solution and that the GPRS signal is strong in the plant.

Based on the data found in this report, it is anticipated that the maintenance costs on the Lift Trucks being monitored will be lower with the introduction of the new system. It would be interesting to overlay the maintenance time and cost metrics associated with these Lift Trucks to validate that the maintenance and costs associated with these Lift Trucks has also been reduced.

Recommendations

Based on the findings in this report, Bolero Wireless makes the following recommendations to Polycon:

Recommendation #1

Now that the system is in place and operating consistently in the Plant, it is recommended that Polycon continue to collect the data being captured by the system. From the data analysed by the author, the system is providing the required metrics to management and the data shows that the impact events in the plant have dropped significantly since the installation of the system.

Recommendation #2

It is recommended that Polycon record the maintenance records and maintenance costs of the Lift Trucks being monitored and record the total hours of maintenance and total cost and per equipment to date (by month if possible). This data can be overlaid with the existing Impact analysis event data recorded to date and will provide a valuable management tool in ensuring lowered maintenance costs on the equipment now and in the future.

Recommendation #3

It is recommended that all remaining Lift Trucks be equipped with the same Impact monitoring solution as the newly acquired fleet. This will ensure Polycon is getting the full picture on all Lift Trucks in the Plant. It is also recommended that the time and cost equipment records be pulled for these additional Lift Trucks for future data analysis.

Recommendation #4

It is recommended that this same report be developed by Bolero Wireless at the end of the next reporting period (i.e., Oct 31, 2013) which will allow us to perform an a similar analysis based on two years of data including such analysis "" Impacts this month this year' to 'same month last year', 'Maintenance costs by Equipment' , etc." and additional type analysis.

Recommendation #5

From an overall management perspective, this project can be considered a success. From the data captured and the analysis provided in this report, it is evident that the reduction in Impact Events has dramatically reduced since the day the system was introduced into the Plant. It is also evident from the raw data that the decrease in impacts is consistent in the decrease month over month. It is recommended that **the successes achieved by this project at the Polycon Plant should be replicated to all Magna facilities.**

The economy of scale and ROI introduced by this monitoring system across Magma is large compared to the low costs in monitoring all lift trucks and increasing operator awareness. It has been proven that the system implemented has resulted in the overall vision lowering impact events across the organization.

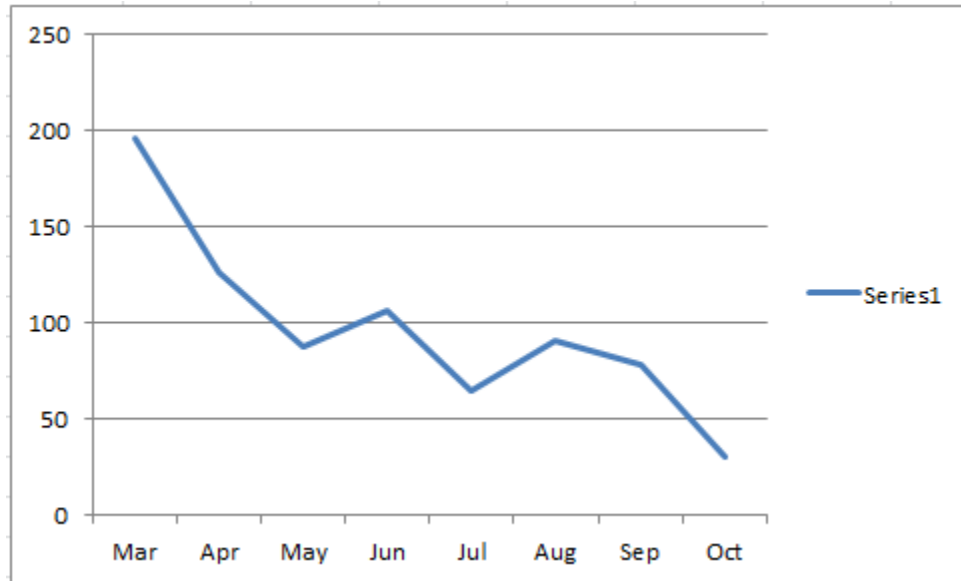
2. LIFT TRUCK IMPACT ANALYSIS

This section of the report provides the high level statistics on number of impacts recorded across all Departments. In total, 785 Impact events were recorded during the reporting period.

Overall Impact Trend

The number of impacts recorded across all Departments has been falling consistently since the implementation of the project and collection of the data since March 2012.

Overall, the Impact statistics are as follows



Impact Monthly Data

Metric	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
# Impacts	196	126	88	106	65	91	78	35
Delta from Previous Reporting period (PRP)		-70	-38	+18	-41	+26**	-13	

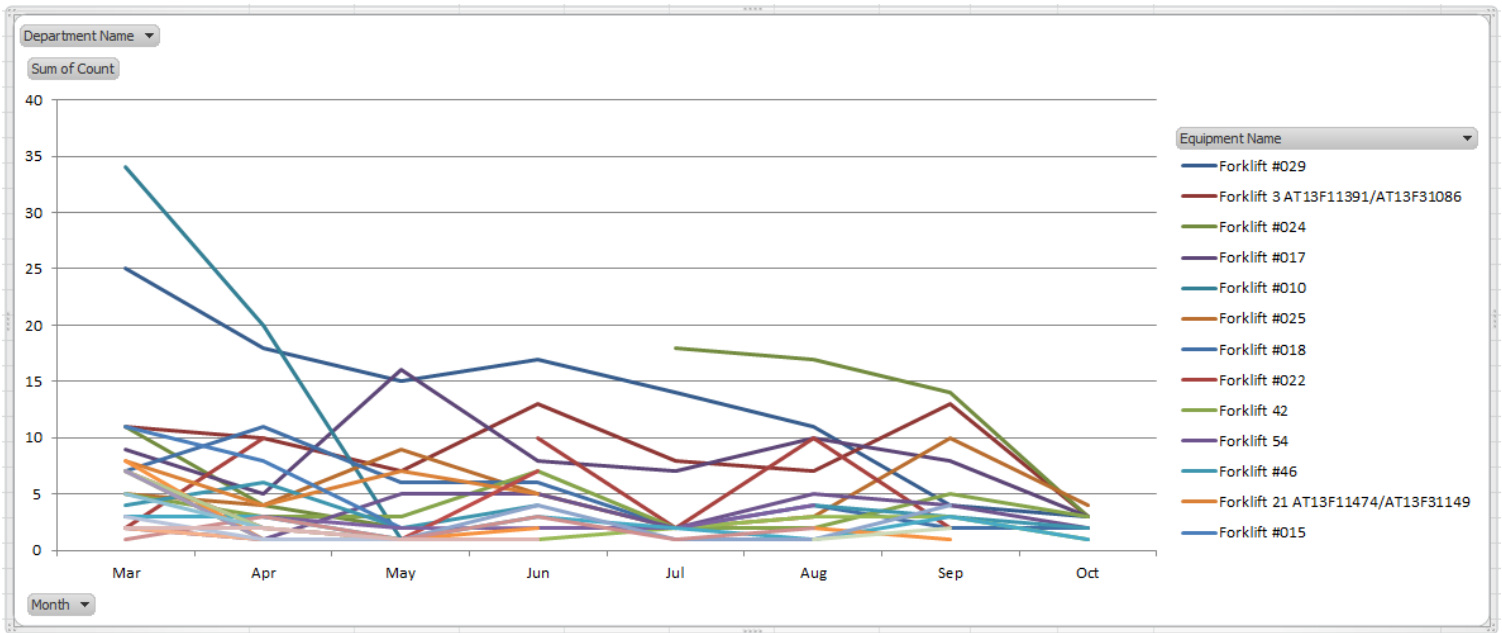
** An increase in the Vehicle Start data activity indicates that the activity in the plant rose considerably in August as identified in the Vehicle start data in this month as depicted in the following data.

Metric	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Vehicle Starts	26153	25400	25356	24401	22082	28026	23665	13817
Delta from PRP		-753	-44	-955	-2319	+5944	-4361	

This is most likely the explanation for the rise in impacts in the month of August. The rise of impact in June can only be explained by legitimate impacts recorded by the system. Plant activity was about the same from the previous reported month.

Impacts by Equipment

This graph shows the Impacts by Equipment by Month.



As can be seen in this graph, the overall trend is a positive reduction in the number of impacts recorded across all equipment that is being monitored. The increase in the number of impacts in the month of June appears to be caused primarily by higher impacts by the following two Forklifts:

Lift Truck	May	June	Total
Forklift 3 AT 13F11891	7	13	20
Forklift #022	0	10	10

Top 3 Vehicles Impacted

Based on the data collected, the following 3 Lift Trucks recorded the highest amount of impacts recorded during this reporting period:

Lift Truck	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
Forklift #029	25	18	15	17	14	11	4	3	107
Forklift 3 AT13F11391/ AT13F31086	11	10	7	13	8	7	13	3	72
Forklift #024	11	4	2		18	17	14	3	69

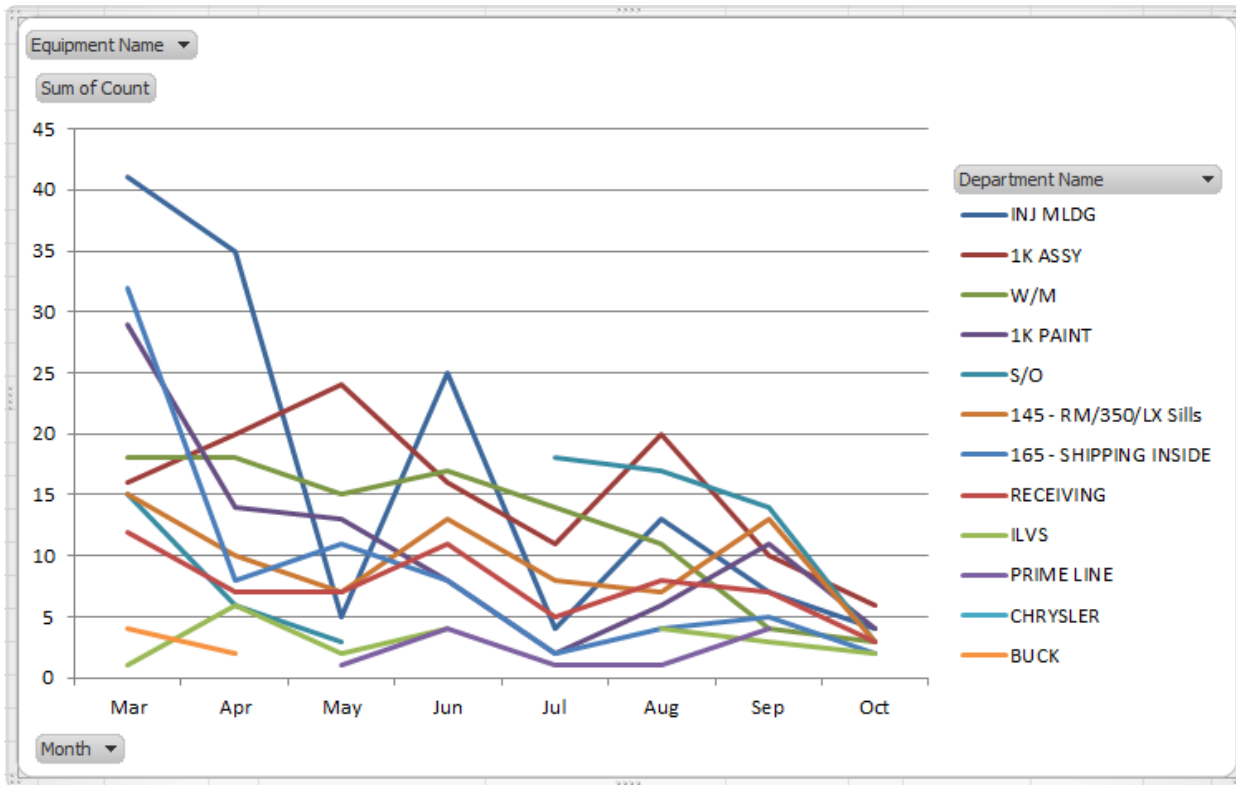
Bottom 3 Vehicles Impacted

Based on the data collected, the following 3 Lift Trucks had the least amount of impacts recorded during this reporting period:

Lift Truck	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
Forklift #011 AT13F31080	2		1			1	2		6
Forklift #16	3								3
Forklift #7	1			1					2

Impacts by Department

This graph shows the Impacts by Equipment by Month.



Like the previous graph, the overall trend from a Departmental perspective is a positive reduction in the number of impacts recorded across all Departments that are being monitored.

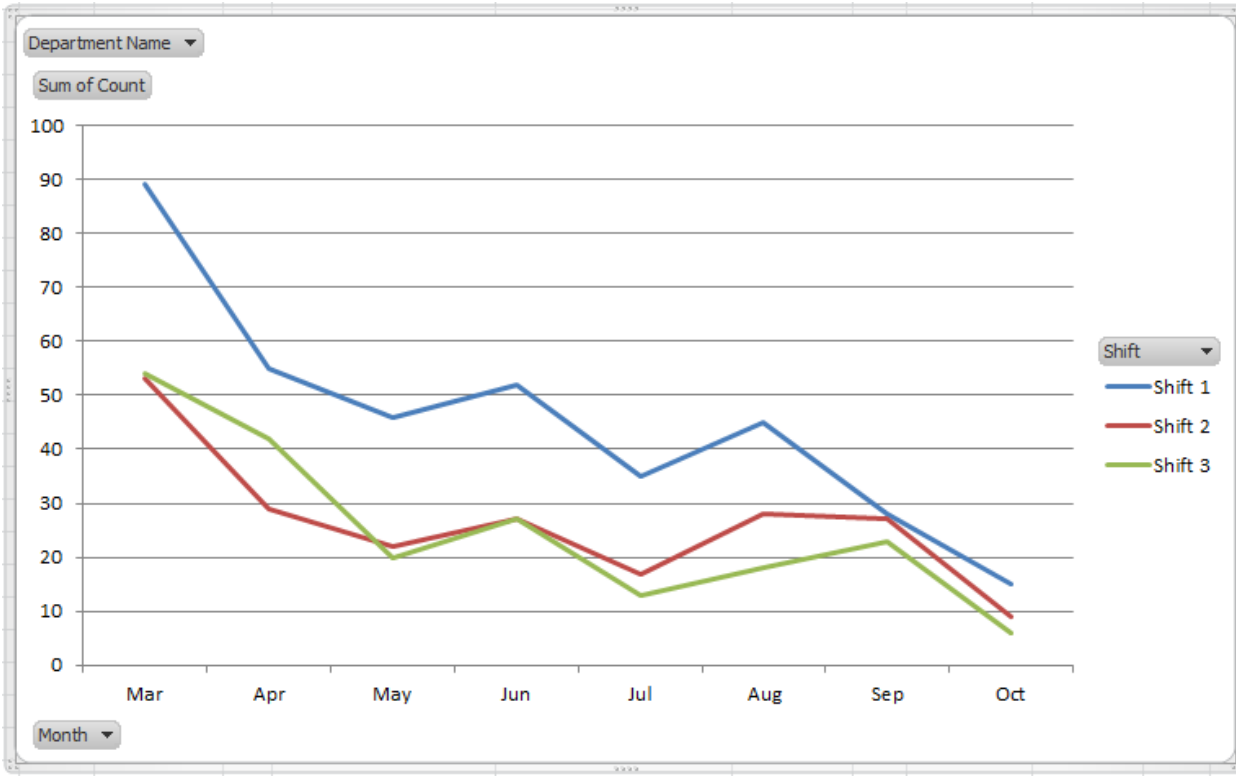
Vehicle Impacts by Department

The Impact Events recorded by Department is as follows:

Department	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
INJ MLDG	41	35	5	25	4	13	7	4	134
1K ASSY	16	20	24	16	11	20	10	6	123
W/M	18	18	15	17	14	11	4	4	101
1K PAINT	29	14	13	8	2	6	11	7	90
S/O	15	6	3		18	17	14	4	77
145 - RM/350/LX Sills	15	10	7	13	8	7	13	3	76
165 - SHIPPING INSIDE	32	8	11	8	2	4	5	2	72
RECEIVING	12	7	7	11	5	8	7	3	60
ILVS	1	6	2	4		4	3	2	22
PRIME LINE	1		1	4	1	1	4		12
CHRYSLER	7								7
BUCK	4	2							6
RIM	4								4
2K PAINT	1								1
Grand Total	196	126	88	106	65	91	78	35	785

Impacts by Shift

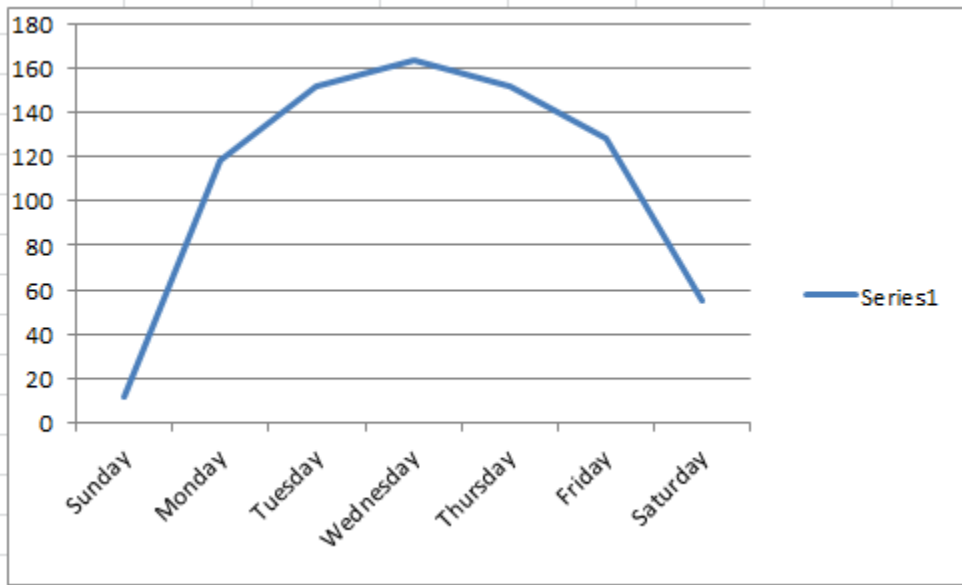
We understand that Polycon does not operate on a standard 7-3, 3-11 and 11-7 shift schedule, but do understand that many shifts are based on this cycle. In this analysis, we analyse the overall trend by shift based on a standard shift schedule. This data is depicted in the following graph:



On a whole, the shift data is consistent with the other data points and shows a consistent positive downward trend across all shifts.

Impacts by Day of Week

The middle of the week is when most impacts occur. This is likely due to a rise in productivity in the Plant during these days.



3. VEHICLE START METRICS

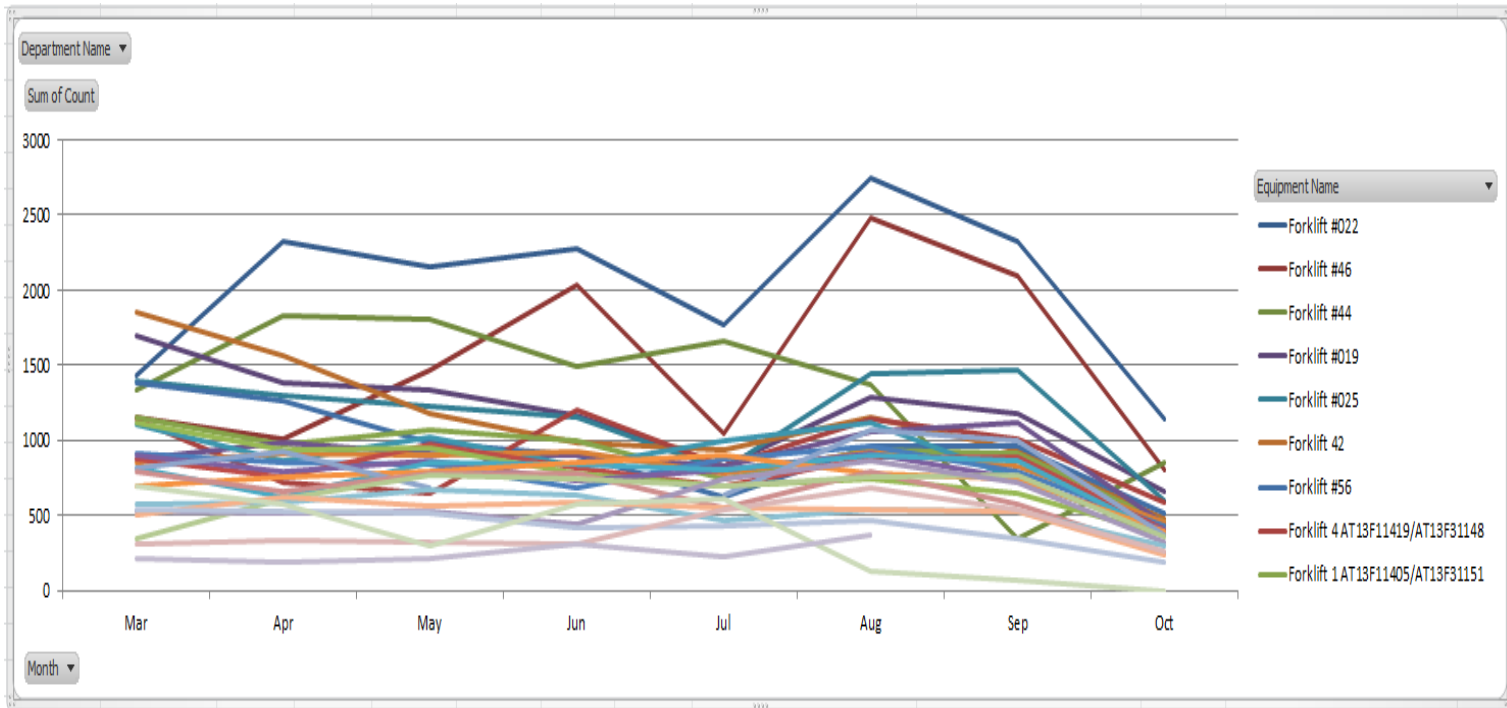
In addition to the Impact Analyses recoding that was implemented, the system was designed to record the time each time a Lift truck was Started in the plant. While a secondary, residual metric of the system implemented, we decided to analyse this data point to see what it revealed. The analysis in this section is based on **188,900** Lift Truck Start events recorded by the system.

The following averages were calculated:

- an average of **6513** starts by Lift Truck over the reporting period
- an average of **814** starts by Lift Truck by Day
- an average of **271** starts by Lift Truck by Shift

Vehicle Starts by Equipment

Upon initial analysis of the data, the initial data point that is highlighted is the rise in vehicle start activity during the month of August. It is assumed that this month represented significant increased activity in the Plant. This data point also explains the increased impact analysis event activity recorded by the system during the August reporting period.



Top 3 Vehicle Starts

Based on the data collected, the following 3 Lift Trucks recorded the highest amount of vehicle starts recorded during this reporting period:

Lift Truck	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
Forklift #022	1437	2329	2156	2282	1767	2745	2322	1292	16330
Forklift #46	1157	1006	1468	2030	1041	2485	2094	942	12223
Forklift #44	1336	1829	1802	1494	1665	1372	344	945	10787

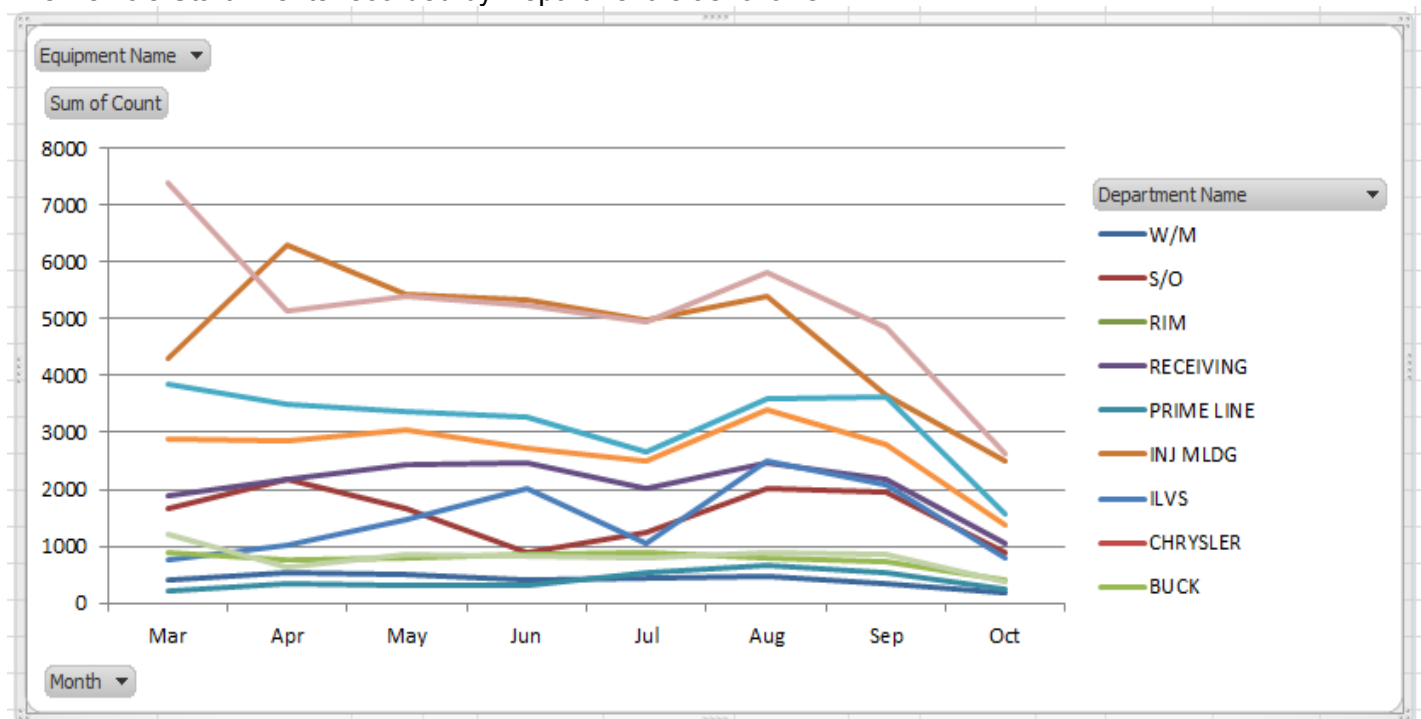
Bottom 3 Vehicle Starts

Based on the data collected, the following 3 Lift Trucks had the least amount of starts recorded during this reporting period:

Lift Truck	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
Forklift #010	695	573	294	573	613	133	65	3	2949
Forklift #31	218	192	217	307	228	369			1531
Forklift #16	107								107

Vehicle Starts by Department

The Vehicle Start Events recorded by Department is as follows:



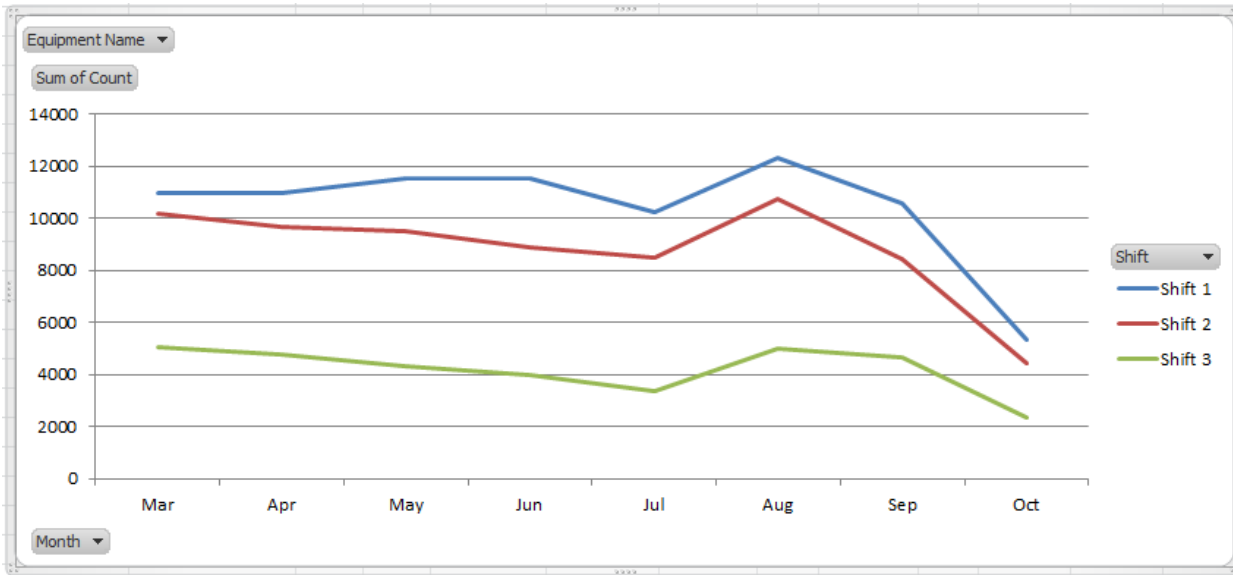
Vehicle Starts by Department

The Vehicle Start Events recorded by Department is as follows:

Department	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
165 - SHIPPING INSIDE	7400	5138	5410	5231	4946	5809	4847	2979	41760
INJ MLDG	4313	6292	5435	5340	4984	5407	3670	2791	38232
1K PAINT	3845	3491	3379	3281	2661	3581	3641	1860	25739
1K ASSY	2887	2852	3059	2736	2493	3407	2801	1576	21811
RECEIVING	1876	2180	2443	2455	2024	2468	2164	1231	16841
S/O	1670	2181	1677	898	1258	2031	1952	1041	12708
ILVS	766	1006	1468	2030	1041	2485	2094	942	11832
145 - RM/350/LX Sills	1207	628	856	840	805	907	865	438	6546
BUCK	898	761	789	857	897	784	745	438	6169
W/M	404	533	515	424	436	466	344	222	3344
PRIME LINE	225	338	325	309	537	681	542	299	3256
CHRYSLER	315								315
2K PAINT	188								188
165 - SHIPPING OUTSIDE	80								80
RIM	79								79
Grand Total	26153	25400	25356	24401	22082	28026	23665	13817	188900

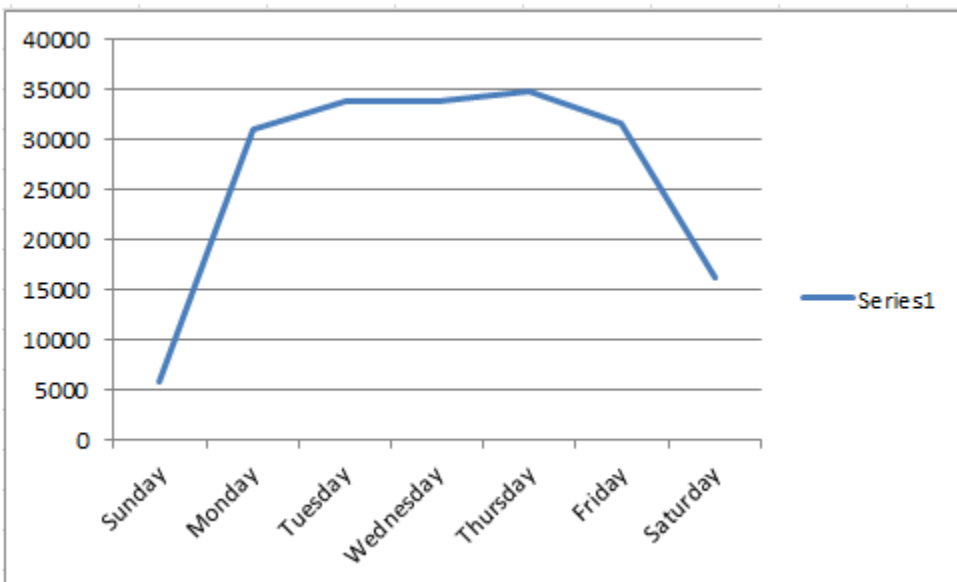
Vehicle Starts by Shift

The Vehicle Start Events recorded by Shift* is as follows:



Vehicle Starts by Day of Week

The Vehicle Start Events recorded by day-of-week is as follows:



4. APPENDIX A – VEHICLE IMPACTS BY TRUCK

Lift Truck	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
Forklift #029	25	18	15	17	14	11	4	4	108
Forklift 3 AT13F11391/AT13F31086	11	10	7	13	8	7	13	3	72
Forklift #024	11	4	2		18	17	14	3	69
Forklift #017	9	5	16	8	7	10	8	3	66
Forklift #010	34	20	1	1					56
Forklift #025	5	4	9	5	2	3	10	7	45
Forklift #018	7	11	6	6	2	4	2	2	40
Forklift #022	2	10		10	2	10	2		36
Forklift 42	5	3	3	7	2	2	5	3	30
Forklift 54	2	1	5	5	2	5	4	2	26
Forklift #46	4	6	2	4		4	3	2	25
Forklift 21 AT13F11474/AT13F31149	8	4	7	5					24
Forklift #015	11	8	2						21
Forklift #44	7	2	1	7		1		1	19
Forklift #020	7	1	1	1	2	3	3	1	19
Forklift #019	3	3	2	2	2	4		1	17
Forklift #8	3	3	1	3	2	1	3	1	17
Forklift #014	8	1	1	2		2	1		15
Forklift #32	1		1	4	1	1	4		12
Forklift #012	1	3	1	3	1	2			11
Forklift #56	7	2	1					1	11
Forklift #31	7	1				2			10
Forklift #027	5	2							7
Forklift #013	2	1	1	1		1			6
Forklift 4 AT13F11419/AT13F31148	3	1	1					1	6
Forklift 1 AT13F11405/AT13F31151	2	2	1	1					6
Forklift #011 AT13F31080	2		1			1	2		6
Forklift #16	3								3
Forklift #7	1			1					2
Grand Total	196	126	88	106	65	91	78	35	785

5. APPENDIX B – VEHICLE STARTS BY TRUCK

Lift Truck	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Grand Total
Forklift #022	1437	2329	2156	2282	1767	2745	2322	1292	16330
Forklift #46	1157	1006	1468	2030	1041	2485	2094	942	12223
Forklift #44	1336	1829	1802	1494	1665	1372	344	945	10787
Forklift #019	1697	1386	1337	1167	827	1287	1183	751	9635
Forklift #025	1392	1297	1228	1152	802	1439	1467	731	9508
Forklift 42	1851	1561	1183	991	939	1157	939	551	9172
Forklift #56	1380	1261	991	898	620	959	958	585	7652
Forklift 4 AT13F11419/AT13F31148	1142	724	649	1207	831	1143	1016	641	7353
Forklift 1 AT13F11405/AT13F31151	1158	969	1076	997	743	934	912	513	7302
Forklift #014	873	991	911	907	835	1060	1122	525	7224
Forklift 21 AT13F11474/AT13F31149	1107	862	1024	831	1000	1115	741	439	7119
Forklift #8	849	908	898	925	776	926	825	519	6626
Forklift #7	919	857	839	681	880	959	795	486	6416
Forklift #017	882	760	975	817	691	890	893	482	6390
Forklift #020	1122	939	955	778	692	749	644	438	6317
Forklift #011 AT13F31080	898	787	867	737	800	909	739	462	6199
Forklift 3 AT13F11391/AT13F31086	819	628	856	840	805	907	865	438	6158
Forklift #027	702	761	789	857	897	784	745	438	5973
Forklift #024	822	920	686		638	1072	994	456	5588
Forklift 54	792	659	776	785	555	788	572	303	5230
Forklift #012	349	613	769	745	693	754	767	409	5099
Forklift #018	526	514	530	445	747	861	725	343	4691
Forklift #013	577	585	671	638	467	541	530	340	4349
Forklift #015	498	618	569	584	557	541	522	264	4153
Forklift #029	543	533	515	424	436	466	344	222	3483
Forklift #32	305	338	325	309	537	681	542	299	3336
Forklift #010	695	573	294	573	613	133	65	3	2949
Forklift #31	218	192	217	307	228	369			1531
Forklift #16	107								107
Grand Total	26153	25400	25356	24401	22082	28026	23665	13817	188900