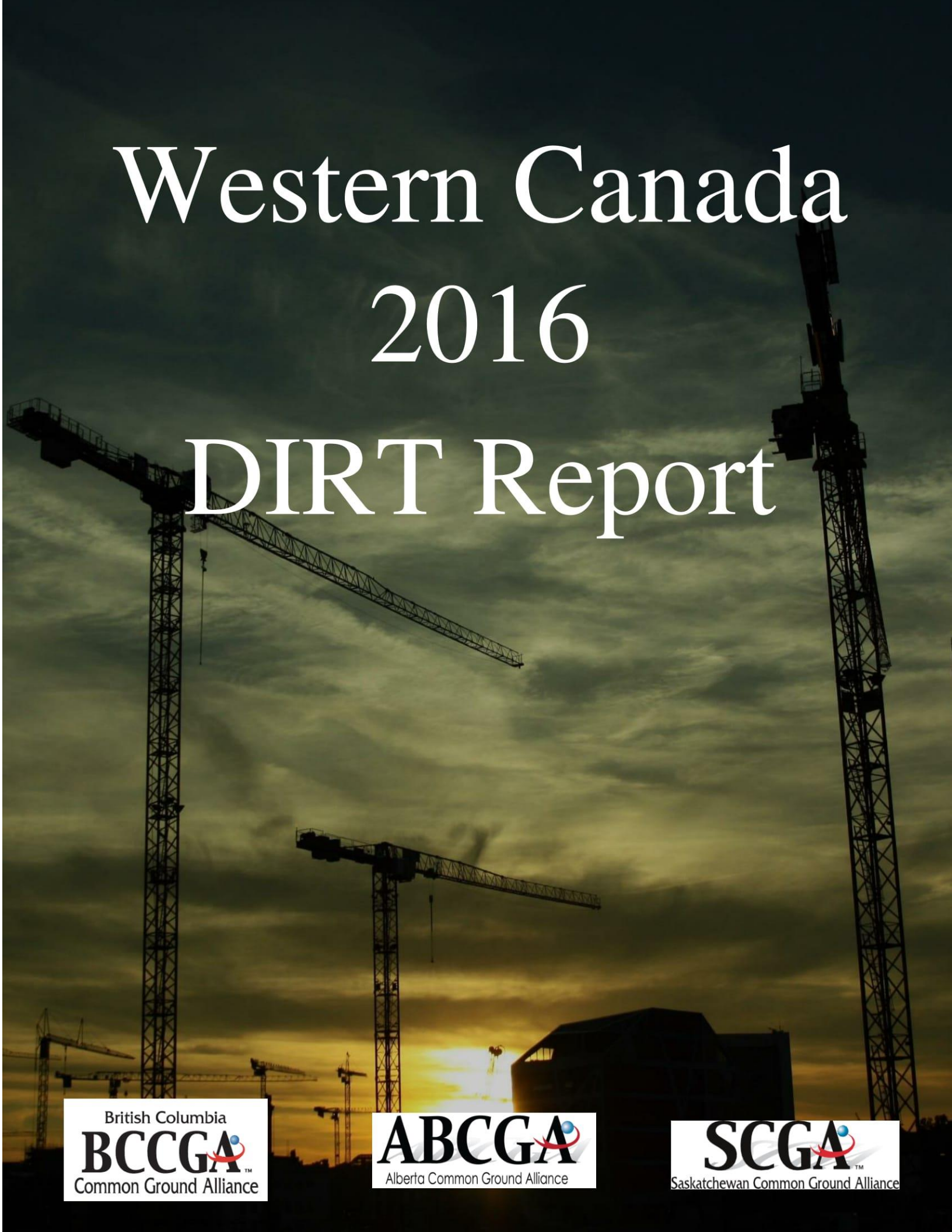
Western Canada 2016 DIRT Report



British Columbia BCCGA Common Ground Alliance

ABCGA Alberta Common Ground Alliance

SCGA Saskatchewan Common Ground Alliance

Contents

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Executive Summary

The Western Canada 2016 Damage Information Reporting Tool (DIRT) Report provides detailed analyses and recommendations pertaining to buried asset damage events reported in British Columbia, Alberta, and Saskatchewan.

The 2015 DIRT Report was the first to present all three provinces with a year-over-year report. For 2016, the report presents a three-year trend wherever possible, allowing a more sophisticated and in-depth analysis including more tables and charts for each province. It is also clear from the data that 2016 represents the most comprehensive data set to date. It is difficult to quantitatively assess increase in participation and reporting due to the anonymous nature of the reporting, however, members should be congratulated on the continued commitment and improvement to data reporting.

Results for 2016 show a remarkable uptick in the overall number of reported damage events, driven in large part by Alberta. Due to the anonymous nature of DIRT reporting, the addition of new stakeholders or the increase in participation rate reporting to DIRT from any of the Common Ground Associations in Western Canada is not quantified in this report. As a result, it is difficult to conclude whether this uptick represents an actual increase in damage events or rather a simple reflection of the increase participation rates. Anecdotal evidence from the Common Ground Associations suggest the latter is most likely the explanation. While examining the details of all damage events is a key part of the CGA's activities, the increase in damage reports is an expected outcome as new stakeholders adopt the DIRT system.

Highlights

- There were **6258 damage events reported** across the three provinces, representing **a 37% increase over 2015**, split between 1270 events in BC (a 12% increase over 2015), 4356 in Alberta (a 65% increase), and 632 in SK (a 20% decrease).
- As was the case in previous years, a majority or plurality of reported events were associated with **contractors** in all three provinces.
- **In all three provinces, peak reported events were concentrated in summer**, with August as the leading month for reported events in 2016 in BC and Saskatchewan, and June in Alberta.
- **The most commonly affected asset type varied from province to province.** In BC, Natural Gas was by far the type of facility most commonly affected in in 2016. In Alberta, it was Water-related facilities, and in Saskatchewan, Telecommunications.
- In BC, the **Fraser Valley and Coastal BC region saw the most reported events**, while In Alberta, most occurred in **Edmonton Region. Prince Albert** was the region most frequently affected in Saskatchewan.
- As in previous years, **private land** was the most commonly affected land type in all three provinces.
- In BC, the most common root cause of reported events was that **no call was made to the One-Call Center**. In Alberta, it was that **wrong information was provided to the excavator**, while in Saskatchewan**, insufficient excavation practices were the lead cause**.

- **Inconsistency in reporting** remains a concern, as is the voluntary nature of many of the data fields.
- Based on cost calculations developed for Quebec's Info-Excavation in 2014 estimating an average of just over $100,000 per damage event in direct and indirect costs combined, **the 6258 damage events in 2016 could cost as much as $661 million**.

Recommendations

- **Ensure that diligence is maintained as new stakeholders are added.** Recognizing that expanding the number of stakeholders is an important and ongoing process for each provincial association, extra effort must be made to ensure that new stakeholders can maintain and improve existing DIRT reporting practices as quickly as possible.
- **Consider a sampling approach to data collection.** The voluntary self-selecting nature of data collection results presents some difficulty in drawing conclusions from the data both within a given year, and in the year over year trends. As shown in this report, the total reported number of events has increased. This is likely the result of positive trends in the participation rate. Developing a representative sample from the industry or alternatively a measure of participation rate would help normalize the data and/or confirm influence of greater participation, allowing greater insight to be drawn from the results.
- **Consider the development of benchmarks** in line with those used in industry (e.g. incidents per kilometer of buried asset).
- **Develop an annual cost estimate** such as that produced for Info-Excavation Quebec to better educate stakeholders and decision-makers of the cost of underground infrastructure damage.
- **Encourage current stakeholders to use the DIRT tool more often** and continue expansion to new stakeholders to improve the breadth and richness of the data.
- **Focus on contractors, private land, and one-call practices.**

Introduction

The Damage Information Reporting Tool (DIRT) is the result of the efforts of the Common Ground Alliance (CGA) to gather meaningful data regarding the occurrence of buried asset damage events. An event is defined by the CGA DIRT User's Guide as "the occurrence of downtime, damages, and near misses." DIRT allows industry stakeholders to submit data anonymously to a comprehensive database that is used to analyze the factors leading to events. Since reducing the occurrence of damage events is in everyone's interest, the data provided in DIRT is an invaluable tool in directing efforts to the incidence of such events in a cost-efficient and effective manner. This report presents a detailed overview of where events occurred in Canada's three westernmost provinces from 2016, what sort of activity precipitated it, what happened, and what sort of equipment was involved.

The goal of this report is to help improve worker and public safety, protect underground infrastructure, and reduce the significant direct and indirect costs of damage to buried assets. A comprehensive picture of contributing issues is vital to foster a stronger culture of underground safety.

The data for 2016 varies in both quality and quantity between AB, SK, and BC, reflecting the different stages that each province's DIRT stakeholders are at in their efforts to collect data through DIRT. This combined DIRT report is the third annual report for Western Canada. For 2016, 6258 events were submitted, with 70% of the events (4356) reported in Alberta. This represents an increase of 30% over 2015 and a 27% increase over 2014, driven primarily by Alberta, with a smaller increase in BC and a small decrease in Saskatchewan.

This report is organized as follows: the first section provides a brief summary and comparison of the three western provinces; individual sections then follow for BC, Alberta, and Saskatchewan. Each unique provincial section contains an introduction, data analysis, summary, and recommendations. Data groupings for each province as well as the DIRT field reporting form are provided as appendices to the report.

The information below (as well as that contained in each provincial section) is organized to match the structure of the Damage Information Reporting Field Form. More specifically, the regional comparison of the data is organized around the following section headings:

- Part A: Information Providers
- Part B: Date and Location of Events
- Part C: Affected Facilities
- Part D: Excavation Information
- Part E, F, H & G: Notification, Locating and Marking, Excavator Downtime, and Cost of Damage
- Part I: Root Causes

Regional Comparison

In total, there were 6258 reported events reported in the western provinces in 2016. Figure 1 provides a summary of the events by province and year of reporting, with provinces represented by the vertical bars and the annual total by the yellow line. Figure 1 shows the extent to which the overall growth in reported events was driven by Alberta.

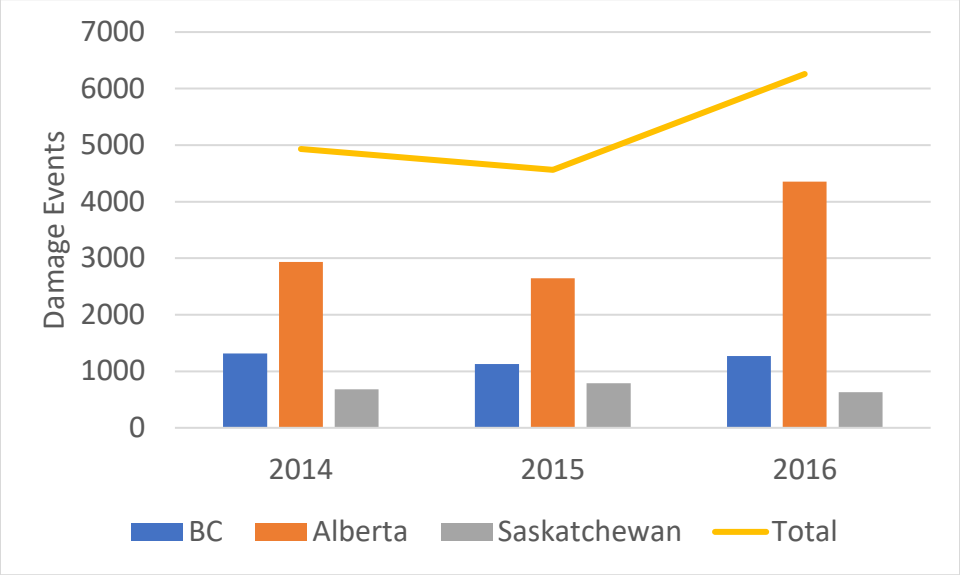

Figure 1. Summary of damage event reports by province.

In British Columbia, there were 1270 reported events, representing 20.3% of the 2016 interprovincial total; in Alberta there were 4356 events, representing 69.6% of the 2016 total; and in Saskatchewan there were 632 events, representing just 10.1% of the total.

Part A: Information Providers

In BC, 89.6% of the damage event reports originated from *Natural Gas*, followed distantly by *Telecommunications* at 6.8%. Alberta's distribution of information providers was much more varied, with *Telecommunications* at 49.6% of all reports, *State Regulator* reporting for the first time with 23.9% of all reports, and *Electric*, *Natural Gas*, and *One-Call Center* each contributing 5% or more of the 2016 annual total. Saskatchewan was largely split between *Telecommunications* (43.5%), *Electric* (34.8%), and *Natural Gas* (20.6%).

Part B: Date and Location of Events

The main season for reported events in BC ranged from April to September with the peak number of events in 2016 occurring in August (156). In Alberta, the main season took place from May to October with the peak number of reported events in 2016 occurring in June (603). Saskatchewan's high season in 2016 lasted from May to September, with its peak in August (87).

In BC, most events occurred in Greater Vancouver (26.7%), Interior (23.9%), or Fraser Valley and Coastal BC (23.1%). In Alberta, 41.9% of events occurred in the Edmonton region, followed by Central (24.1%). Saskatchewan's events mostly occurred in Prince Albert (21.2%), Weyburn (19.6%), and Regina (16.6%).

Part C: Affected Facilities

Mirroring the distribution of reports by stakeholder, 89.7% of BC's reported events in 2016 occurred around *Natural Gas* infrastructure. Alberta's affected facilities were more varied, with 45.4% of events affecting *Water* infrastructure, 10.7% affecting *Natural Gas*, and 9% *Cable TV.* In Saskatchewan, 43.5% of events affected *Telecommunications* infrastructure, 34.8% affected *Electric* and 20.7% *Natural Gas.*

Part D: Excavation Information

In terms of type of work performed, BC's reported events were distributed across *Water* (25.4%), *Construction/Development* (16.2%), *Energy/Telecommunications* (10.1%) and *Street* work (9.7%), with 22.9% of damage reports listing "*Data Not Collected".* Alberta's reported events primarily occurred in the course of *Construction/Development* work (41.3%) and *Street* work (39.3%). In Saskatchewan, events by type of work performed was a split between *Construction/Development*(16.5%), *Energy/Telecommunications* (12.4%), and *Water* (9.7%), with *Unknown/Other* accounting for 11.4% and an overall plurality of reports showing *Data Not Collected* (31.8%).

Part E, F, G, & H: Notification, Locating and Marking, Excavator Downtime, and Cost of Damage

The DIRT data allows for the easy comparison of various ratios across jurisdictions. Table 1 provides a summary of the damage ratio per 1,000 locates, the ratio of notifications to locate requests, and the damage ratio per 1,000 notifications in BC, Alberta, and Saskatchewan over the years of available data.

Table 1. 2014-2016 DIRT data ratios by jurisdiction, with year-over-year change percentages.

British Columbia					
2014-2016 Data Ratios	**2014**	**2015**	**2016**	**2015-2016 %**	**2014-2016%**
Reported events per 1,000 locates	8.9	6.9	7	1.4	-21.3
Ratio of notifications to locate requests	4.6	4.7	4.2	-10.6	-8.7
Reported events per 1,000 notifications	1.9	1.5	1.7	13.3	-10.5

Alberta					
2014-2015 Data Ratios	**2014**	**2015**	**2016**	**2015-2016 %**	**2014-2016%**
Reported events per 1,000 locates	7.0	6.4	10.78	68.4	54.0
Ratio of notifications to locate requests	4.5	4.7	4	-14.9	-11.1
Reported events per 1,000 notifications	1.6	1.4	2.7	92.9	68.8

Saskatchewan					
2014-2015 Data Ratios	**2014**	**2015**	**2016**	**2015-2016 %**	**2014-2016%**
Reported events per 1,000 locates	5	5.6	4.8	-64.8%	-138.1
Ratio of notifications to locate requests	2.6	5.4	3.0	-42.9%	13.3
Reported events per 1,000 notifications	1.9	1.0	1.6	60.0%	-18.8

Part I: Root Causes

The damage event root causes varied by province. In BC, the most common root cause (56.1%) was *One Call-No notification made to the one-call center*. In contrast, the most common root cause in Alberta was *Miscellaneous-Data Not Collected* (58.7%). Like BC, *One Call-No notification made to the one-call center* was also the most important single cause in Saskatchewan (26.9%), followed by *Excavation practices not sufficient* (21.8%).

British Columbia 2016 DIRT Data & Analysis

British Columbia DIRT

This report provides a high-level snapshot of damage statistics related to British Columbia's underground infrastructure. The goal of this report is to help improve worker and public safety and protect underground infrastructure in BC. A comprehensive picture of contributing issues is vital to foster a stronger culture of underground safety.

This report utilizes information collected using the USA Common Ground Alliance (CGA) Damage Information Reporting Tool (DIRT). The British Columbia Common Ground Alliance (BCCGA) encourages all interested parties to submit their damage reports to the BC Virtual Private DIRT by visiting www.cga-dirt.com. Once registered, users can submit damage information or generate reports on the existing data. This report presents the data collected from the Virtual Private DIRT website for years 2014, 2015 and 2016.

The following limitations should be noted with regards to the presentation of the 2016 data:

> While every effort has been made to ensure that the most up-to-date information is employed in this report, the voluntary nature of DIRT reporting means that this report does not include all the events that occurred in BC in 2016. Not all stakeholders in BC have chosen to report in this edition, while new stakeholders may not yet be using DIRT as effectively as possible: efforts by the new administration of DIRT for British Columbia to market its use to BC companies have yielded new members.
>
> The BC Virtual Private DIRT is still relatively new and it appears that some operators did not collect information in all DIRT fields. As such, in many cases, fields have not been completed. The BCCGA will continue to improve the quality of data by educating users on what information is most valuable to collect. A coordinating body managing the reporting of incidents may improve the overall data quality as not all submitters have access to full information about an event. For example, a utility provider may not have access to information about contractor down time or costs.

As a principle, the BCCGA is committed to improving the data collection process.

About the BCCGA

The BC Common Ground Alliance (BCCGA) is a unique consensus-driven organization with a direct conduit to regulatory innovation. It is open to any individual or organization with an interest in safety and underground infrastructure. The BCCGA considers that all involved with underground infrastructure or disturbance are responsible and accountable for the safety of their own procedures. It acknowledges, however, that it is in everyone's best interest to work together to develop safe and consistent practices.

The BCCGA works to offer practical tools and to foster an environment in which anyone living or doing business in British Columbia is aware of and compliant with best practices in regards to underground infrastructure to ensure the safest possible environment for the citizens and workers of the province.

BCCGA is coordinating working groups to develop and deliver:

- Best Practice Guidelines for Safe Excavation
- Safety Recognition – City of Excellence Award
- Education – Ground Disturbance Seminars and Contractor Breakfasts
- National level priorities

- Advocacy for use of the DIRT tool (statistical database of hits)
- Networking and collaborating
- Improving stakeholder engagement
- Responding to calls for input into regulatory amendments
- Circulation of relevant information regarding safety and industry practice.

In BC, quantifying damage to underground infrastructure has often lacked consistency. In some cases, statistics have not been maintained. As a result, stakeholders have not been able to effectively determine how many damage events occur each year, the causes of these events, nor the circumstances surrounding these events. The Damage Information Reporting Tool allows the BCCGA to generate a high-level picture of safety and damage prevention in relation to excavation practices and the protection of underground infrastructure. This, in turn, should help all involved improve worker and public safety and protect underground infrastructure in BC.

The primary purpose in collecting underground facility damage data is to analyze data, learn why events occur, and determine what actions by industry can prevent them in the future, thereby ensuring the safety and protection of people and infrastructure. The use of BC Virtual Private DIRT allows the BCCGA to identify root causes, perform trend analyses, and ultimately help educate all stakeholders so that damages can be reduced through more effective practices and procedures.

Data Analysis

The British Columbia 2016 DIRT Report presents a 3-year trend whenever possible, allowing a more sophisticated and in-depth analysis including several new tables and charts. It is also clear from the data that 2016 represents the most comprehensive data set to date. It is difficult to quantitatively assess increase in participation and reporting due to the anonymous nature of the reporting, however, members should be congratulated on the continued commitment and improvement to data reporting.

The information provided in this report is generally organized to match the structure of the Damage Information Reporting Field Form of the BC Virtual Private DIRT. More specifically, the analysis of the data is organized around the following section headings:

- Part A: Information Providers
- Part B: Date and Location of Events
- Part C: Affected Facilities
- Part D: Excavation Information
- Part E, F, G, and H: Notification, Locating and Marking, Excavator Downtime, and Cost of Damage
- Part I: Root Causes

Part A: Information Providers

In Table 2, columns labelled '2014', '2015', and '2016' give the total number of damage events reported by each stakeholder group in BC. The column '2016 %' shows the percentage of the total events for 2016 reported by each stakeholder group. '2015-2016%' and '2014-2016%' show the percentage growth for each stakeholder group from 2015 to 2016 and 2014 to 2016, respectively.

In total, the number of damage reports in 2016 (1270) increased by 12.4% over 2015 and decreased by 3.3% over 2014. BC has reported the most consistent result of the three provinces, with *Natural Gas* being the only main contributor of damage reports in the BCCGA (89.6% in 2016), followed at a significant distance by *Telecommunications* (6.8%) and *Liquid Pipeline* (3.5%). It should be noted that damage reports associated with *Liquid Pipeline* do not represent damages to the pipeline, but rather "unauthorized activities" (near misses).

Table 2. BC events by stakeholder group, 2014-2016

Stakeholder Group	2014	2015	2016	2016%	2015-2016%	2014-2016%
Electric	92	-	-	0.0	0.0	0.0
Liquid Pipeline	59	56	45	3.5	-19.6	-23.7
Natural Gas	1043	1075	1139	89.6	6.0	9.2
Public Works	1	-	-	0.0	0.0	-100.0
Telecommunications	87	-	86	6.8	0.0	-1.1
Unknown/Other	32	-	-	0.0	0.0	-100.0
Total	**1315**	**1131**	**1270**	**100.0**	**12.4**	**-3.3**

Part B: Date and Location of Events

In Table 3, columns labelled '2014', '2015', and '2016' give the total number of reported events per month in BC. The column '2016 %' shows the percentage of the total events for 2016 that occurred in each month. '2015-2016%' and '2014-2016%' show the percentage growth for each month from 2015 to 2016 and 2014 to 2016, respectively.

The total of 1270 damage event reports in 2016 translates to an average of 105.8 events/month, up from 94.25 events in 2015, though still somewhat lower than the average of 110 events/month in 2014.

Table 3: BC events per month, 2014-2016

Month	2014	2015	2016	2016%	2015-2016%	2014-2016%
January	70	49	49	3.9	0.0	-30.0
February	62	52	59	4.6	13.5	-4.8
March	76	80	80	6.3	0.0	5.3
April	134	101	119	9.4	17.8	-11.2
May	136	121	146	11.5	20.7	7.4
June	154	125	134	10.6	7.2	-13.0
July	150	145	132	10.4	-9.0	-12.0
August	146	109	156	12.3	43.1	6.8
September	130	137	152	12.0	10.9	16.9
October	118	97	103	8.1	6.2	-12.7
November	85	65	96	7.6	47.7	12.9
December	54	50	44	3.5	-12.0	-18.5
Total	**1315**	**1131**	**1270**	**100.0**	**12.3**	**-3.4**
Avg.	109.6	94.3	105.8	8.3	12.2	-4.4

Figure 2 below demonstrates how the extra 140 events in 2016 were distributed for each month. The 3-year trend reveals a noticeable consistency in relative distribution of events per month.

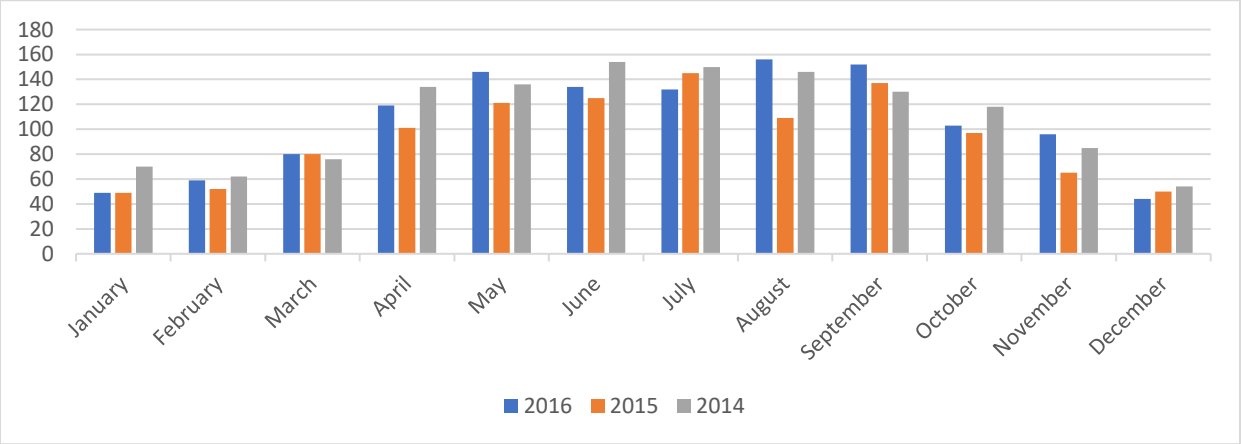

Figure 2. Events per month, 2014-2016

The above-average season for reported damage events (i.e. greater than the average of 105.8 events/month) extended from April through September, with a peak of 156 events in August (Table 2).

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Table 4 details the geographic distribution of events among BC's major regions. At 339 events (26.7%), the region of *Greater Vancouver* was host to the most reported events, followed by *Interior*, *Fraser Valley and Coastal* BC, and Vancouver *Island*.

Table 4: Events by BC region, 2014-2016

Region	2014	2015	2016	2016%	2015-2016%	2014-2016%
Greater Vancouver	505	479	339	26.7	-29.2	-32.9
Fraser Valley and Coastal BC	167	120	294	23.1	145.0	76.0
Interior	357	341	303	23.9	-11.1	-15.1
Northern	116	54	82	6.5	51.9	-29.3
Vancouver Island	170	137	252	19.8	83.9	48.2
Total	**1315**	**1131**	**1270**	**100.0**	**12.3**	**-3.4**

Figure 2 demonstrates visually how the accelerating decline of reported events in *Greater Vancouver* (-32.9% over 2014, and -29.5% over 2015) is offset by year-over-year increases in *Fraser Valley and Coastal BC* (+145%), *Vancouver Island* (+83.9%), and *Northern* BC (+51.9%), such that the total number of events declined by only 3.4%.

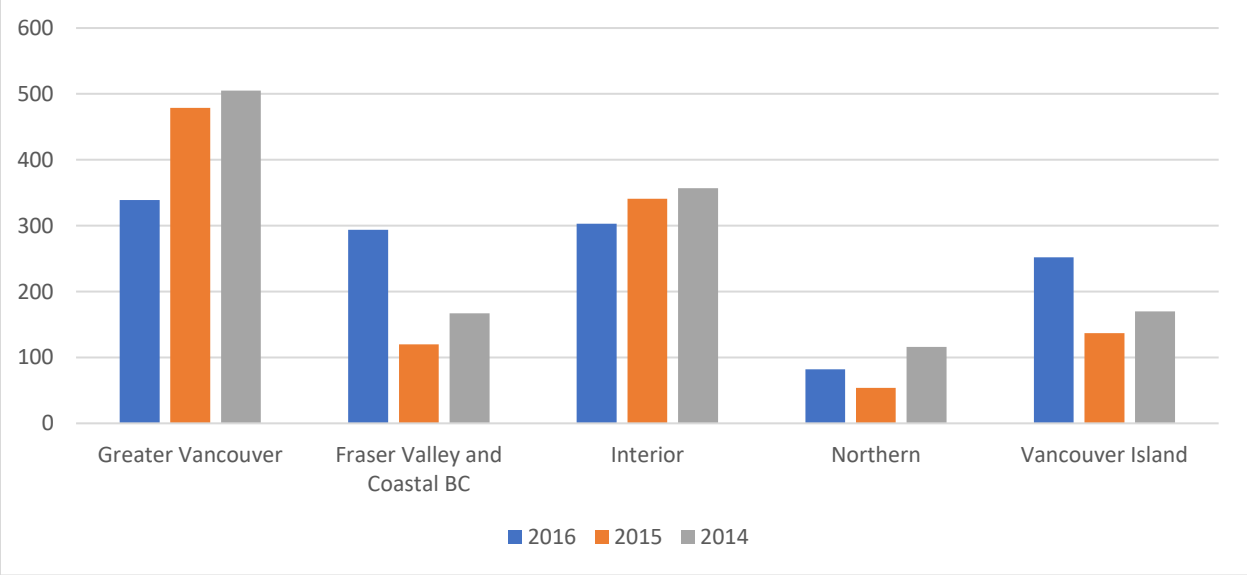


Figure 3. Events by BC region, 2014-2016

The distribution of reported events in 2016 (Table 5) saw an increase in *Private – Land Owner* (66.4%) which accounts for 72.6% (922 events) of all events that year. Events located on *Public – City Street*

declined 10.2%, leaving it the second-largest land type with 22.2% of 2016, while a 97.6% year-over-year reduction in events on *Private – Business* land (6 events in 2016) rendered that a negligible category.

Table 5: BC events by land type (right of way), 2014-2016

Land Type	2014	2015	2016	2016%	2015-2016%	2014-2016%
Data Not Collected	158	2	0	0	-100.0	-100.0
Federal Land	0	0	2	0.2	0.0	0.0
Pipeline	45	2	31	2.4	1450.0	-31.1
Power/Transmission Line	1	0	3	0.2	0.0	0.0
Private - Business	42	246	6	0.5	-97.6	-85.7
Private - Land Owner	603	554	922	72.6	66.4	52.9
Private Easement	1	2	3	0.2	50.0	200.0
Public - City Street	328	314	282	22.2	-10.2	-14.0
Public - County Road	4	3	5	0.4	66.7	25.0
Public - Other	108	2	3	0.2	50.0	-97.2
Public - State Highway	11	4	2	0.2	-50.0	-81.8
Unknown/Other	14	2	11	0.9	450.0	-21.4
Total	**1,315**	**1,131**	**1270**	**100**	**12.3**	**-3.4**

Part C: Affected Facilities

Reflecting the distribution of stakeholder reports, *Natural Gas* remained the major category of facilities affected in 2016 as in previous years (Table 6).

Table 6: BC events by facility affected, 2014-2016

Facility Damaged	2014	2015	2016	2016%	2015-2016%	2014-2016%
Electric	92	-	-	-	-	-
Natural Gas	1043	1,075	1139	89.7	6.0	9.2
Liquid Pipeline	59	56	45	3.5	-19.6	-23.7
Sewer	1	-	-	-	-	-
Telecommunications	87	-	51	4.0	-	-
Unknown/Other	34	-	35	2.8	-	-
Total	**1315**	**1131**	**1270**	**100.0**	**12.3**	**-3.4**

The 139 extra damage reports in 2016 were divided between the *Natural Gas* (+64 events), *Telecommunications* (+51 events), and *Unknown/Other* (+35 events) categories (Figure 4).

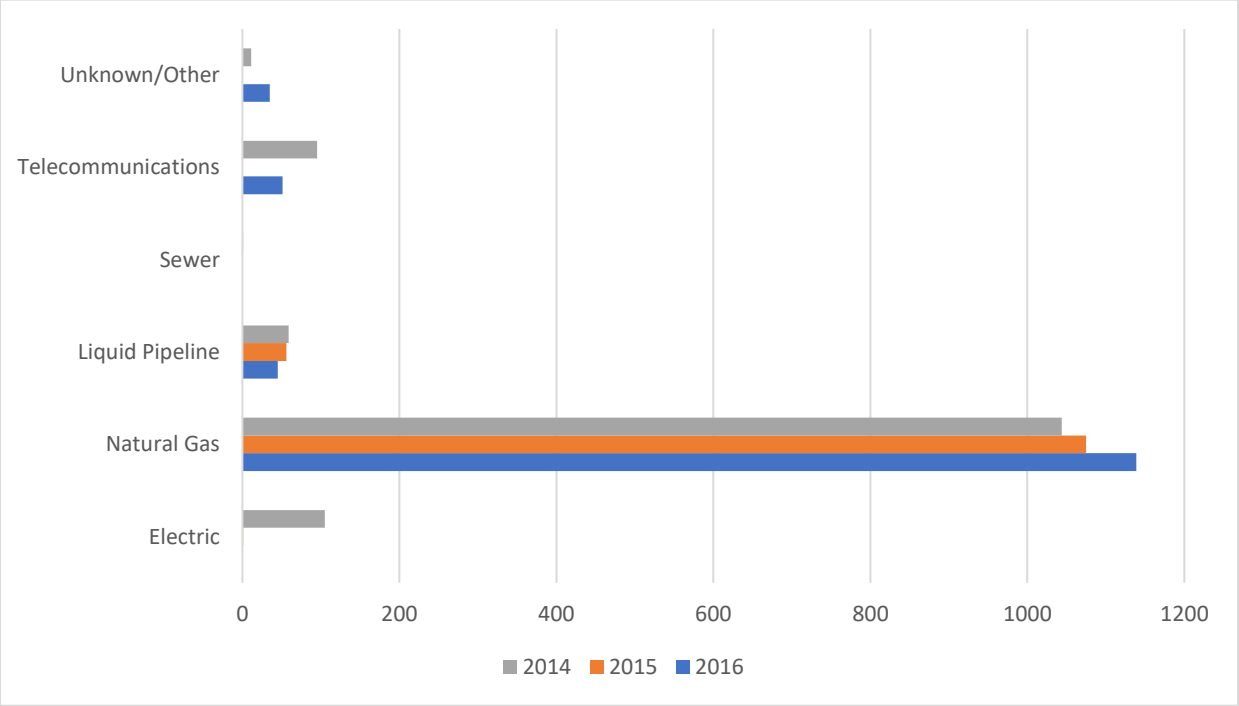


Figure 4. BC events by facility operation type, 2014-2016

Part D: Excavation Information

Table 7: BC events by excavator type, 2014-2016

Excavation Equipment	2014	2015	2016	2016%	2015-2016%	2014-2016%
Hoe/Trencher	794	722	526	41.4	-27.1	-33.8
Hand Tools	201	159	204	16.1	28.3	1.5
Drilling	26	18	29	2.3	61.1	11.5
Vacuum Equipment	5	2	1	0.1	-50.0	-80.0
Unknown/Other	149	230	147	11.6	-36.1	-1.3
Data not collected	140	-	363	28.6	-	159.3
Total	**1315**	**1131**	**1270**	**100.0**	**12.3**	**-3.4**

Table 7 above breaks down damage reports by excavator equipment type. Despite declining 27.1% over the previous year and 33.8% over 2014, *Hoe/Trencher* remains the most commonly cited equipment type in BC damage reports (41.4% of 2016). *Hand tools*, *Unknown/Other*, and *Drilling* remained similar over the three-year timespan.

However, the biggest gain across categories is for *Data not collected*, as Figure 5 demonstrates. The significant reduction in *Hoe/Trencher* excavation equipment type events (-196) is more than offset by the increase in *Data not collected* (+363), indicating an overall loss of data quality in Part D of the reporting form.

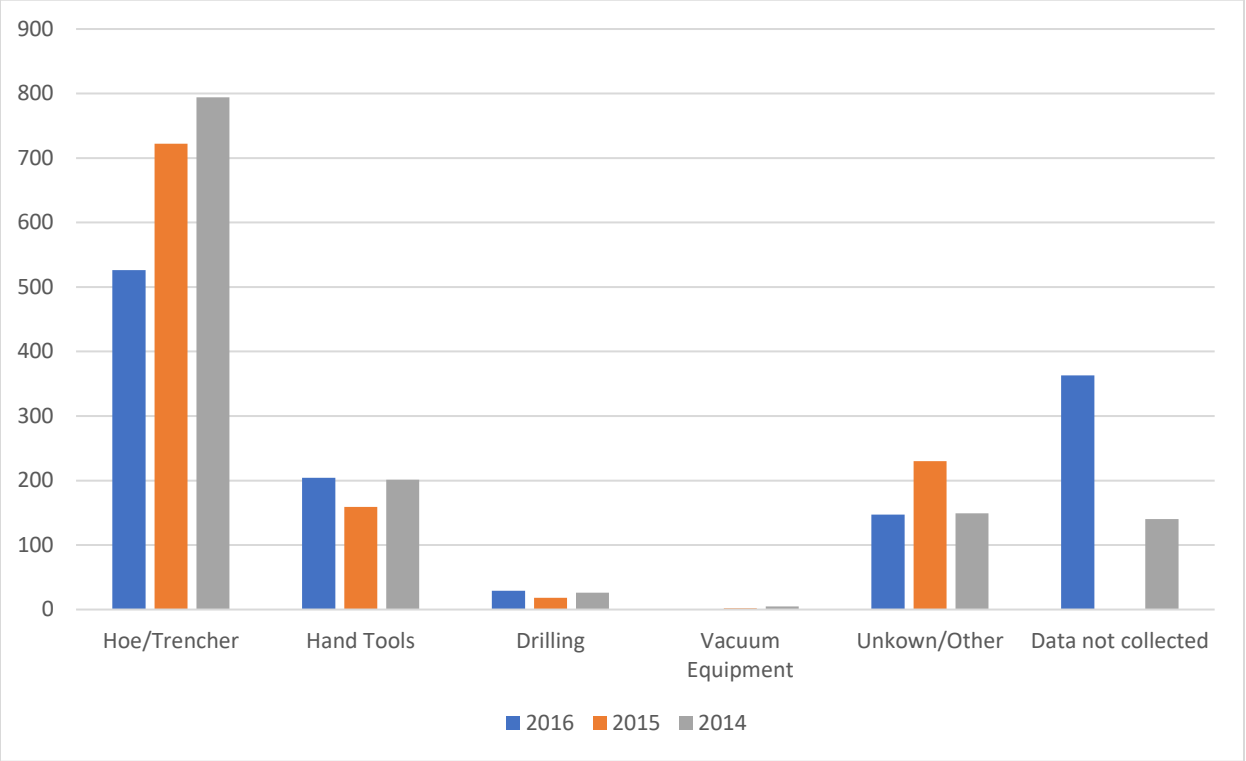


Figure 5. BC events by excavation equipment type, 2014-2016

Table 8 below breaks down the volume of events by type of excavator. A full 65.4% of all damage reports list *Contractor* as the excavator, while another 22.4% fall into the *Occupant* category and 5.4% into *Municipality*. Between 2015 and 2016, *Unknown/Other* grew from 6 to 42 events, *Occupant* grew from 233 to 284 events, and *Contractor* from 757 to 830 events. Year-over-year declines were seen in *Farmer* (from 32 to 17) and *Municipality* (from 75 to 68).

Table 8: BC events by excavator type, 2014-2016

Excavator Type	2014	2015	2016	2016%	2015-2016%	2014-2016%
Contractor	761	757	830	65.4	9.6	9.1
Data Not Collected	1	-	1	0.1	0.0	0.0
Developer	125	9	1	0.1	-88.9	-99.2
Farmer	22	32	17	1.3	-46.9	-22.7
Municipality	4	75	68	5.4	-9.3	1600.0
Occupant	76	233	284	22.4	21.9	273.7
Railroad	249	-	2	0.2	0.0	-99.2
Unknown/Other	61	6	42	3.3	600.0	-31.1
Utility	16	19	25	2.0	31.6	56.3
Total	**1315**	**1131**	**1270**	**100.0**	**12.3**	**-3.4**

Figure 6 demonstrates how *Contractor* has accounted for over half of all annual reported events from 2014 to 2016, even as other categories such as *Municipality* and *Railroad* have lost significance.

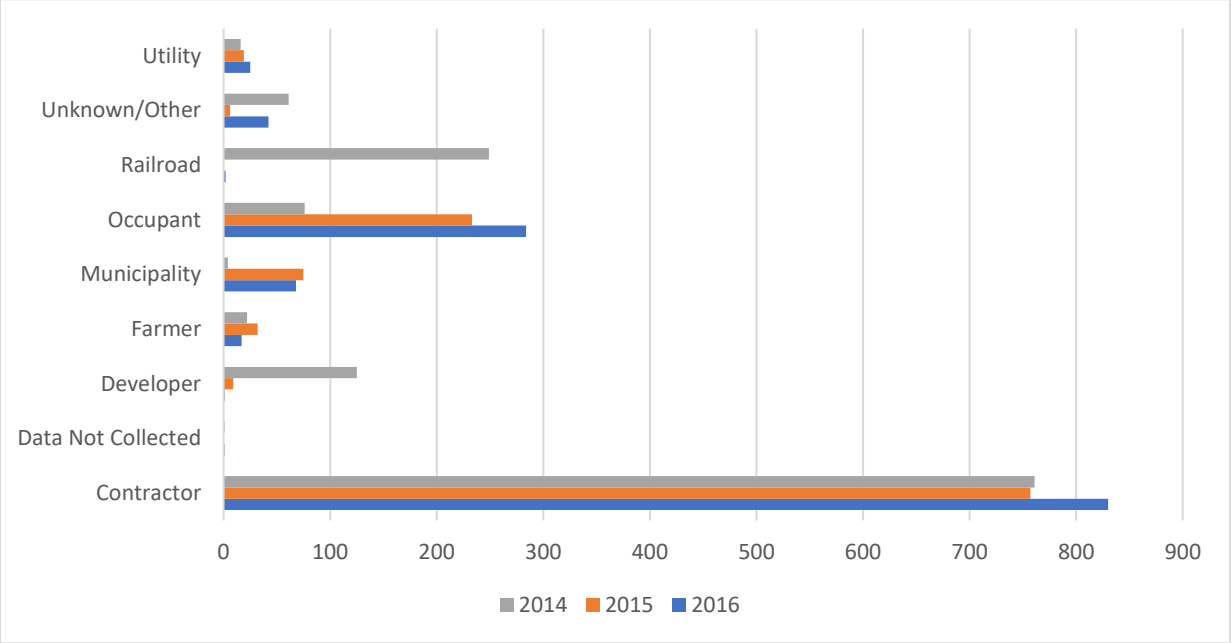


Figure 6: BC events by excavator, 2014-2016

Table 9: BC events by work performed, 2014-2016

Work Performed	2014	2015	2016	2016%	2015-2016%	2014-2016%
Agriculture	19	29	30	2.4	3.4	57.9
Construction/Development	412	516	206	16.2	-60.1	-50.0
Data not collected	169	45	291	22.9	546.7	72.2
Energy/Telecommunications	123	77	128	10.1	66.2	4.1
Landscaping/Fencing	81	126	109	8.6	-13.5	34.6
Street	112	82	123	9.7	50.0	9.8
Unknown/Other	87	16	61	4.8	281.3	-29.9
Water	312	240	322	25.4	34.2	3.2
Total	**1315**	**1131**	**1270**	**100.0**	**12.3**	**-3.4**

Table 9 above and Figure 7 below display the volume of reported events for the type of work performed. A 546.7% year-over-year increase in *Data Not Collected* occurred in 2016 (from 45 to 291 events, or 22.9% of the 2016 distribution) even after a drop in the previous year. *Energy/Telecommunications*, *Street*, and *Water* all report slightly higher values for 2016. Meanwhile, *Construction/Development* decreased by 60.1% to 206 events in 2016, after rising significantly from 2014 to 2015. *Landscaping* declined modestly from 126 events in 2015 to 109 in 2016.

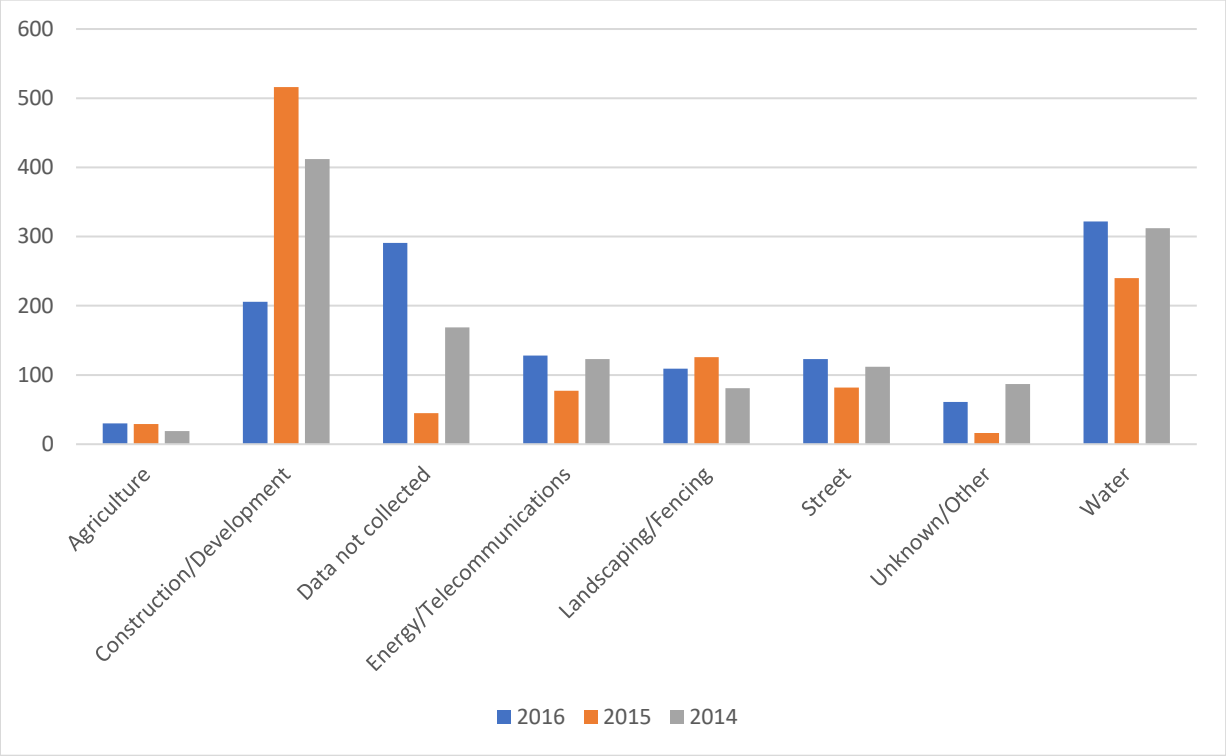


Figure 7. BC events by work performed. 2014-2016

Part E, F, G & H: Notification, Locating and Marking, and Excavator Downtime

As stated above, there were 1270 damage events reported in British Columbia in 2016, representing a 12.3% increase over 2015. Table 10 contains statistics on damage events, locates, notifications, and the calculated ratios of reported events to 1,000 locates and reported events to 1,000 notifications. In total, there were 180,285 locate requests to BC One-Call in 2016, a 9.8% increase since 2015 and a 21.7% increase since 2014. There were 757,197 notifications, a 1.5 % decrease over 2015, yielding a ratio of 4.2 notifications per locate request. The ratio of reported events per 1,000 locates was 1.4, and there was a ratio of 1.7 reported events per 1,000 notifications.

Table 10. BC One-Call notifications, locates, and damage ratios, 2014-2016

One-Call Notification	2014	2015	2016	2015-2016%	2014-2016%
Number of D. Events	1315	1131	1270	12.3	-3.4
Number of Locates	148,100	164,268	180,285	9.8	21.7
Damages/1000 Locates	8.9	6.9	7	1.4	-21.3
Ratio of Notifications:Locates	4.6	4.7	4.2	-10.6	-8.7
Number of Notifications	688,274	768,501	757,197	-1.5	10.0
Reported events:1000 Notif.	1.9	1.5	1.7	13.3	0.0

Table 11 below presents the incidence of service interruptions among reported events in BC in 2016, the first year that service interruptions are presented as part of the DIRT report. In BC, 86.5% of all reported events led to some sort of service interruption.

Table 11: BC events by service interruption occurrence, 2016

Service Interruption	2016	2016%
Yes	1099	86.5
No	95	7.5
Unknown	74	5.8
Data Not Collected	2	0.2
Total	1270	100.0

Part I: Root Causes

Table 12 provides the volume of damage event records by the general category of root cause. These categories each contain several root causes (Appendix A). As in 2015, most reported events in 2016 remain categorized as *One-Call Practices Not Sufficient* (63.5%) and *Excavation Practices Not Sufficient* (36.1%). Growth is evident in *Miscellaneous Root Cause* (6.1%, +76 events) and *Excavation Practices Not Sufficient* (+51 events). Overall, the growth in these root causes reflects the modest year-over-year growth without statistical anomalies.

Table 12. BC events by root cause, 2014-2016

Damage by Root Cause Category	2014	2015	2016	2016%	2015-2016%	2014-2016%
One-Call Practices Not Sufficient	694	718	723	56.9	0.7	4.2
Locating Practices Not Sufficient	19	3	10	0.8	233.3	-47.4
Excavation Practices Not Sufficient	421	408	459	36.1	12.5	9.0
Miscellaneous Root Cause	181	2	78	6.1	3800.0	-56.9
Total	**1315**	**1131**	**1270**	**100.0**	**12.3**	**-3.4**

Figure 8, the pie chart below, analyzes the top individual root causes, as opposed to the broader categories in Table 12.

Figure 8 reveals that *No notification made to one-call center* (56.1% of all events) and *Excavation practices not sufficient* (35.0%) are of paramount importance as causes of reported events.

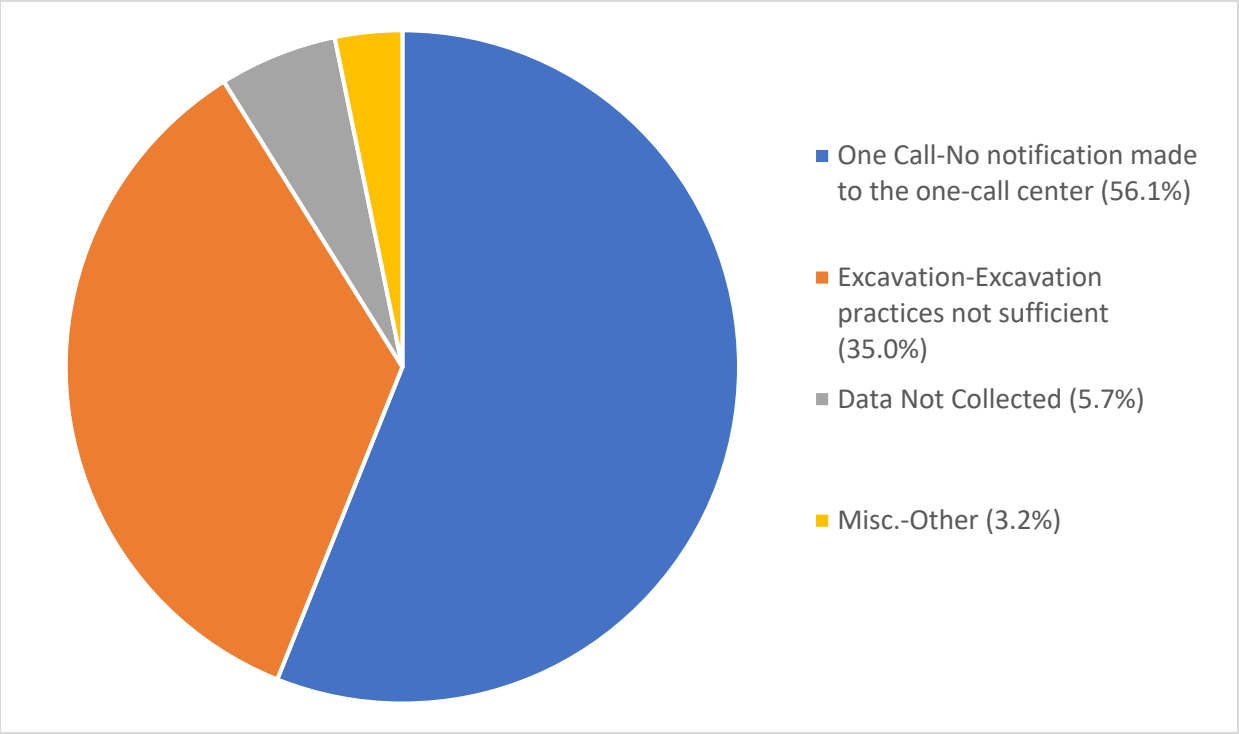


Figure 8: Reported events by root cause subcategory, 2014-2016

Data Quality

The Data Quality Index (DQI) consists of the evaluation of each of the 1270 damage records submitted in BC in 2016. It is divided into 8 categories (A, B, C, D, EF, G, H, and I) representing each portion of the DIRT reporting form. Each individual form has a percentile score for each category, as well as an overall score for the entire form. These scores can then be averaged across all forms for each category.

In previous years the DIRT report would organize the percentile DQI scores into quintiles and compare the relative number of each form that fell into each quintile, per form section. New in the 2016 report, average scores for each form section have been calculated for 2014, 2015 and 2016. We believe this approach offers greater clarity and insight.

Table 13: Average DQI per DIRT form section, 2014-2016

DQI Averages	2014	2015	2016	2015-2016%	2014-2016%
Part A	100.0	100.0	100.0	0.0	0.0
Part B	62.8	79.8	79.2	-0.7	26.2
Part C	90.3	98.4	93.7	-4.8	3.8
Part D	82.7	92.3	77.8	-15.7	-5.9
Part EF	76.6	78.3	77.5	-1.0	1.2
Part G	39.8	50.7	5.5	-89.1	-86.2
Part H	42.3	48.4	44.9	-7.2	6.3
Part I	86.6	99.9	93.9	-6.0	8.5
Overall Average	**74.1**	**83.7**	**76.2**	**-8.9**	**3.0**

Table 13 shows that the average DQI in 2016 decreased 8.9% over 2015 and increased 3.0% over 2014. The most significant decline was seen in Part G, which declined 89.1% over 2015, although Part G is generally not included in the Western Canada DIRT analysis report. Among reported-on categories, the 15.7% year-over-year decline in Part D is worrisome (Figure 9). Most other categories remained relatively steady.

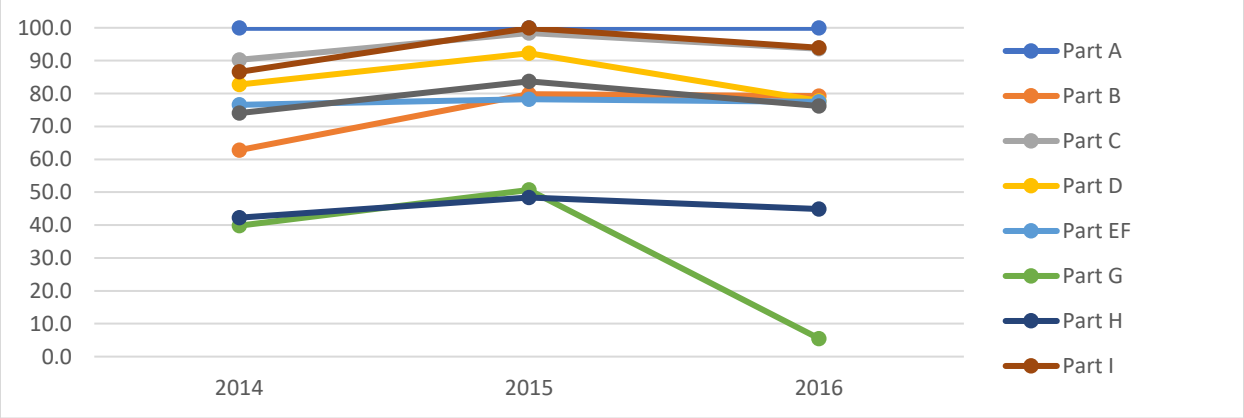


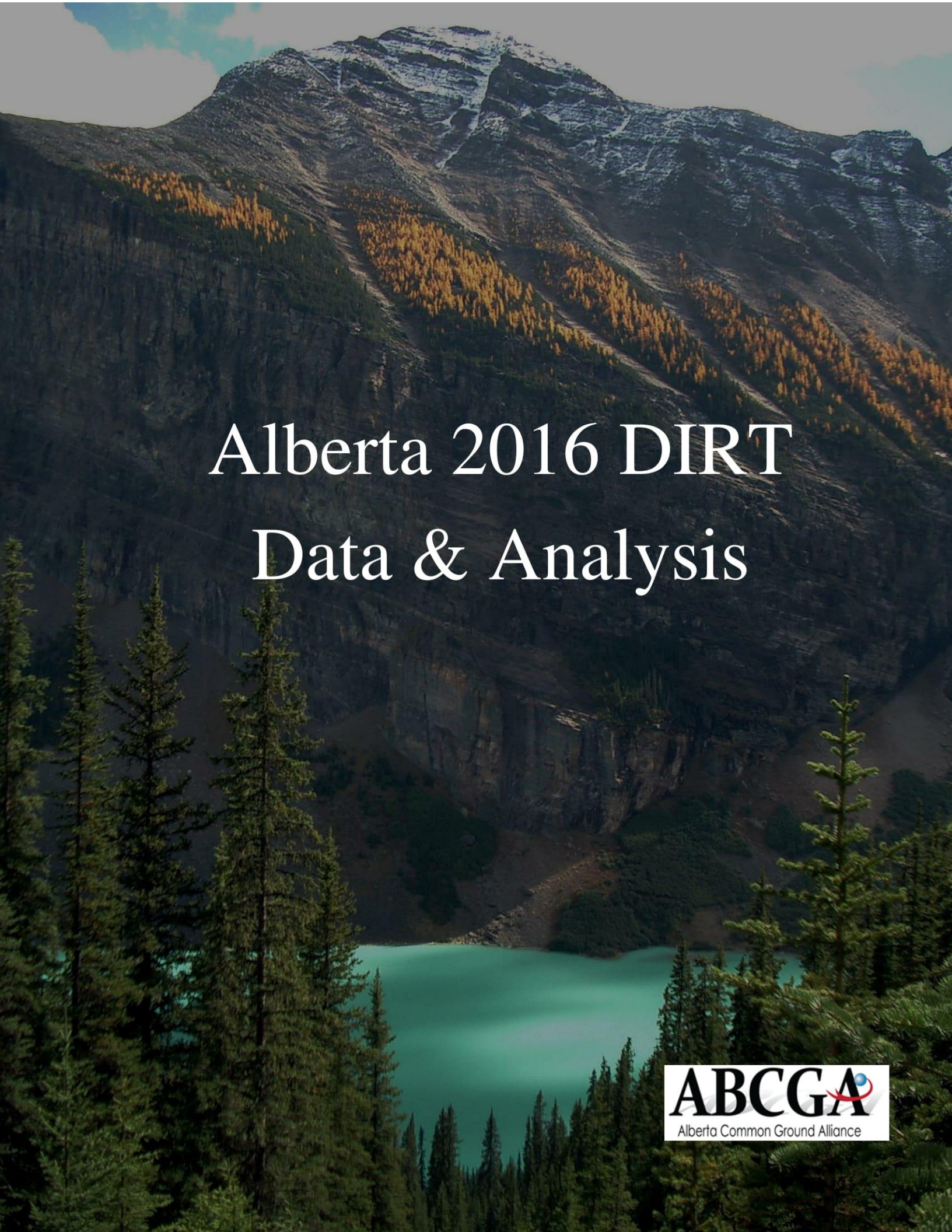
Figure 9: Average DQI per DIRT form section, 2014-2016

Recommendations

The following recommendations are intended to enhance industry efforts to reduce damage events and standardize the data collection process. Based on the analysis of the 2015 DIRT data, the recommendations are:

1. **Continue efforts to improve data quality**
    a. **Focus on increasing the DQI of Part D.** Part D covers the key area of excavation information. For each critical subsection on equipment type, excavator type, and work performed, more than 30% of the responses are "Data Not Collected." Ensuring that a higher proportion of damage reports collect the full suite of data in Part D will grant a much better understanding of what excavation practices are implicated in damage events.
    b. **Continue to encourage stakeholders to use DIRT.** By encouraging DIRT use among existing members, the entire reporting framework becomes more robust and useful to all.
    c. **Encourage stakeholders to re-visit reports.** To increase data quality and cut down on the number of "Data not collected" entries across several DIRT form sections, stakeholders should be encouraged to re-visit submitted reports if or when they have more information at a later date.
2. **Expand Stakeholders.** With nearly all reported events (89.6%) coming from the telecommunications industry every year, the diversity and robustness of the dataset in BC would increase with a greater variety of stakeholders reporting.
3. **Location: address gains in *Vancouver Island*; *Fraser Valley and Coastal BC.*** Reported events in Greater Vancouver plunged in 2016, a positive sign. But while numbers for *Interior* and *Northern* regions have remained fairly steady from 2014-2016, *Vancouver Island* and *Fraser Valley and Coastal BC* have spiked. An emphasis on these locations is a necessary response.
4. **When considering *Natural Gas* infrastructure, focus on *Private Land* and *City Streets.*** The majority of events occurred on the *Private–Land Owner* and *Public–City Street* categories, a trend in all 3 years of data. In practically all reported events, *Natural Gas* facilities were affected, reflecting the membership of BC's One Call program. While still accounting for a plurality of reported events, the number of reported events related to *Hoe/Trencher* excavation work is in decline. Given that more data is missing on excavation equipment in this year's data, it is impossible to know what sort of equipment is involved in more accidents than last year.
5. **Focus on *Contractors* and *Occupants*.** 88% of all damage reports from BC in 2016 were related to these excavator types, both of which have increased in number each year as other types have declined.
6. **Improve notification practices by ensuring contact with One Call center.** 56% of all reported events in BC occurred because no notification of the One Call center occurred. Educating all stakeholders on best practices for informing their employees on use of the One Call service is a natural first step to address this issue.
7. **Consider developing and publicizing a damage-costing model.** Quebec's *Info-Excavation* worked with engineering researchers, stakeholders and first responders to tabulate the cost of damage

events in the province. By their metric, and assuming a similar level of data quality to Quebec, damage events across Western Canada would have cost $661 million, $134 million in BC alone. Creating benchmarks based on analysis of a representative set of real-life events in BC would aid in this regard.


Alberta 2016 DIRT
Data & Analysis
ABCGA
Alberta Common Ground Alliance

Alberta DIRT

This section provides a high-level snapshot of damage statistics related to Alberta's underground infrastructure. The goal of this report is to help improve worker and public safety and to protect underground infrastructure in Alberta. A comprehensive picture of contributing issues is vital to foster a stronger culture of underground safety.

The Alberta Common Ground Alliance (ABCGA) encourages all interested parties to submit their damage reports to the AB Virtual Private DIRT by visiting www.cga-dirt.com. Once registered, users can submit damage information or generate reports on the existing data. This report presents the data collected from the Virtual Private DIRT website in 2016.

The following limitations should be noted with regards to the presentation of the 2016 data:

- While every effort has been made to ensure that the most up to date information is employed in this report, the voluntary nature of DIRT reporting means that it does not include all events that occurred in Alberta in 2016. It is clear that not all stakeholders in Alberta have chosen to report in this edition. The information is statistically relevant for the purposes of a high-level analysis.
- Alberta DIRT is still relatively new and it appears that some operators did not collect information pertaining to certain prescribed DIRT fields. As such, in a number of cases, some fields have not been completed. The ABCGA will continue to improve the quality of data by educating users on what information is most valuable to collect. The addition of an ABCGA controller submission page would increase the usage and the number of required fields.

As a principle, the ABCGA is committed to improving the data collection process.

About the ABCGA

The Alberta Common Ground Alliance is an open membership organization dedicated to improving worker safety, public safety, community safety, protection of the environment and preservation of the integrity of the infrastructure that provides essential goods and services by identifying, validating and promoting the adoption of effective ground disturbance and damage prevention practices.

The prevention of damage to buried facilities has many stakeholders who are mutually dependent upon the successful execution of one another's roles and responsibilities in the overall process. The exchange of accurate and timely information during the damage prevention process combined with a genuine interest by all stakeholders for a successful outcome is critical. Prevention of damage to buried facilities is a responsibility shared among the stakeholders.

What is now the ABCGA was originally formed in the 1970s as the Alberta Utility Location and Coordination Council (AULCC) of the Alberta Chapter of the American Public Works Association and known most recently as the Alberta Damage Prevention Council (ADPC) of the Alberta Chapter of the American Public Works Association. In 2004 it was recognized as a Regional Partner of the Common Ground Alliance. The ABCGA was incorporated as a society in July 2011.

The Ground Disturbance Stakeholders Committee, which was originally established in 1998, became part of the ABCGA in 2006. During its 30+ years of activity, the ABCGA has become recognized as the voice of buried facility damage prevention in Alberta. It provides the 'table' to which issues related to damage prevention may be brought for discussion and resolution among the stakeholders. The ABCGA works with industry stakeholders and regulators to produce stronger, more effective results through cooperation, collaboration and the pursuit of common goals in damage prevention.

The objectives of the ABCGA are:

- To prevent damage from ground disturbance activities by identifying, validating and promoting the adoption of damage prevention best practices among all stakeholders in the buried facility damage prevention process;
- To define and promote recognition and acceptance of the roles, responsibilities and expectations of all the stakeholder groups in the buried facility damage prevention process;
- To establish and maintain minimum program content for ground disturbance training programs;
- To establish and maintain a ground disturbance training program assessment and endorsement process to ensure minimum content consistency and relevance;
- To foster a cooperative approach to the resolution of issues among all the stakeholders in the buried facility damage prevention process;
- To foster a sense of shared responsibility for the prevention of damage to buried facilities;
- To advocate for the development and implementation of fair, reasonable and practical damage prevention regulation that is based on best practices and acceptable to all stakeholder groups;
- To sponsor, promote and participate in public awareness, education and training programs related to the prevention of damage to buried facilities and safe ground disturbance activities;
- To evaluate publications, programs and services that are or may be of interest to members;
- To conduct activities that advance the purposes of the ABCGA and enhance the quality of the services provided to the members;
- To promote membership in the ABCGA and participation in achieving its objectives;
- To establish and maintain liaison with other related interest groups and organizations; and
- To serve as the provincial voice for buried facility damage prevention and ground disturbance training.

Data Analysis

The Alberta 2016 DIRT Report presents a 3-year trend whenever possible, allowing a more sophisticated and in-depth analysis including several new tables and charts. It is also clear from the data that 2016 represents the most comprehensive data set to date. It is difficult to quantitatively assess increase in participation and reporting due to the anonymous nature of the reporting, however, members should be congratulated on the continued commitment and improvement to data reporting.

The information provided in this report is generally organized to match the structure of the Damage Information Reporting Field Form of the AB Virtual Private DIRT. The analysis of the data is organized around the following section headings:

- Part A: Information Providers
- Part B: Date and Location of Events
- Part C: Affected Facilities
- Part D: Excavation Information
- Part E, F, H & G: Notification, Locating and Marking, Excavator Downtime, and Cost of Damage
- Part I: Root Causes

As in previous reports, due to appropriateness of the data and/or data quality, parts H (Excavator Downtime) and G (Cost of damage) are not part of the Alberta 2016 DIRT report.

Part A: Information Providers

In Table 14, columns labelled '2014', '2015', and '2016' give the total number of damage events reported by each stakeholder group in Alberta. The column '2016 %' shows the percentage of the total events for 2016 reported by each stakeholder group. '2015-2016%' and '2014-2016%' show the percentage growth for each stakeholder group from 2015 to 2016 and 2014 to 2016, respectively.

In total, the number of damage reports in 2016 increased by 64.8% over 2015 and by 48.5% over 2014. A large portion of this increase is attributable to the *State Regulator* category, a major presence in 2016 (1043; 23.9%) which had not been recorded in previous years. This change allowed damage events submitted by the Alberta Energy Regulator (AER) to be properly categorized. *Telecommunications* reported almost half of all damage events in 2017, more than doubling its count in 2015 or 2014.

Table 14. Alberta Events by stakeholder group and year-over-year change, 2014-2016

Stakeholder Group	2014	2015	2016	2016 %	2015-2016 %	2014-2016%
Electric	143	170	216	5.0	27.1	51.0
Excavator	5	-	1	0.0	0.0	-80.0
Liquid Pipeline	1086	2	2	0.0	0.0	-99.8
Natural Gas	180	114	340	7.8	198.2	88.9
One-Call Center	350	753	365	8.4	-51.5	4.3
Private Water	9	1	1	0.0	0.0	-88.9
Public Works	-	-	30	0.7	0.0	0.0
State Regulator	-	-	1043	23.9	0.0	0.0
Telecommunications	1015	1029	2159	49.6	109.8	112.7
Unknown/Other	146	575	199	4.6	-65.4	36.3
Total	**2934**	**2644**	**4356**	**100.0**	**64.8**	**48.5**

Figure 10, a comparison of the total number of reports by stakeholder over time, demonstrates how the big increases between 2015 and 2016 in reports submitted by *Telecommunications* and *State Regulator* more than made up for the decline in the *Unknown/Other* and *One-Call Center*. *Liquid Pipeline*, a major factor in 2014, all but disappears in the two following years, while categories like *Excavator* and *Private Water* have been minor factors every year.

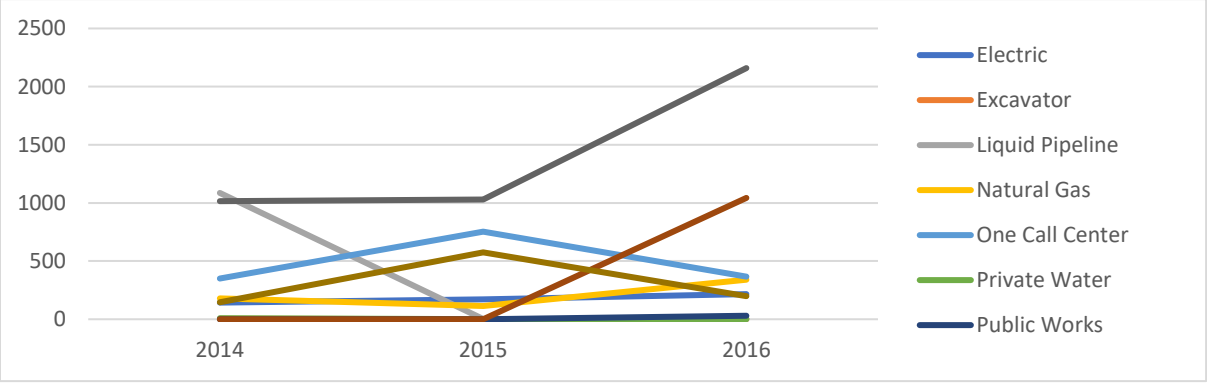


Figure 10: Alberta Events by stakeholder group and year-over-year change, 2014-2016

Part B: Date and Location of Events

In Table 15, columns labelled '2014', '2015', and '2016' give the total number of reported events per month in Alberta. The column '2016 %' shows the percentage of the total events for 2016 that occurred in each month. '2015-2016%' and '2014-2016%' show the percentage growth for each month from 2015 to 2016 and 2014 to 2016, respectively.

The total of 4,356 damage event reports in 2016 in Alberta translates to an average of 363 .0 events per month, a 94.7% increase over the 2015 average of 220.3 and a 45.8% increase over the 2014 average of 244.5 (Table 2). Each month of 2016 was the record-highest month for the 3-year period.

Table 15: Alberta events per month, 2014-2016

Month	2014	2015	2016	2016 %	2015-2016%	2014-2016 %
Jan.	119	88	125	2.9	42.0	5.0
Feb.	121	63	152	3.5	141.3	25.6
Mar.	141	131	189	4.3	44.3	34.0
Apr.	172	191	295	6.8	54.5	71.5
May	217	313	426	9.8	36.1	96.3
Jun.	293	325	603	13.8	85.5	105.
Jul.	377	361	485	11.1	34.3	28.6
Aug.	351	368	561	12.9	52.4	59.8
Sep.	342	339	534	12.3	57.5	56.1
Oct.	357	320	424	9.7	32.5	18.8
Nov.	275	82	370	8.5	351.2	34.5
Dec.	169	63	192	4.4	204.8	13.6
Total	**2,934**	**2,644**	**4,356**	**100.0**	**64.8**	**48.5**
Avg.	244.5	220.3	363.0	8.3	94.7	45.8

The summer months are consistently the highest for reported events (Figure 11), and the months for which the increases in 2016 were the most pronounced. The fires in Fort McMurray and the subsequent reconstruction may have been a contributing factor to this. In contrast, the winter months from January to March were the most consistent months from year to year. 2015, with the least events of the 3 years, witnessed unusually few events in November and December as compared to 2014 and 2016. The highest-ever month was June 2016 with 603 reported events, while the lowest was December 2015.

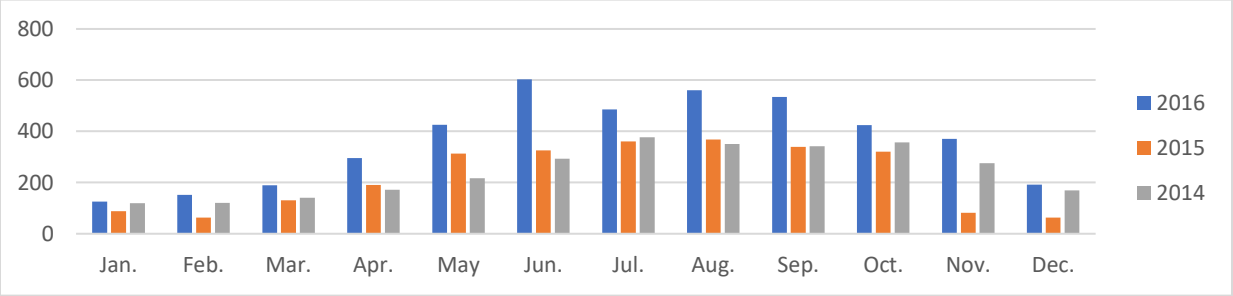


Figure 11: Alberta events per month, 2014-2016

Table 16 provides the distribution of reported damage events by region within Alberta from 2014 to 2016. As the 1-year change column shows, the increase from 2015 to 2016 was very unequally distributed, with *Edmonton* region skyrocketing over 400% from 360 events in 2015 to over 1800 in 2016.

Within the region of *Edmonton* in 2016, 1217 events occurred in the municipal region of Leduc alone (the municipality accounted for 27.9% of the provincial total). *North* region's decreases relative to 2014 are likely a result of the economic downturn, while the increase compared to 2015 is likely due to the fires at Fort McMurray.

Table 16: Events by Alberta region, 2014-2016

Region	2014	2015	2016	2016%	2015-2016%	2014-2016%
Calgary	612	1016	1000	23.0	-1.6	63.4
Central	348	696	1048	24.1	50.6	201.1
Edmonton	972	360	1824	41.9	406.7	87.7
North	723	254	341	7.8	34.3	-52.8
South	279	318	143	3.3	-55.0	-48.7
Total	**2934**	**2644**	**4356**	**100.0**	**64.8**	**48.5**

Figure 12 below shows how the distribution of events has evolved in each region. *Central* has seen a consistent increase from 2014-2016; *North* and *South* have remained relatively small and consistent; while *Calgary* has remained consistent in the past two years.

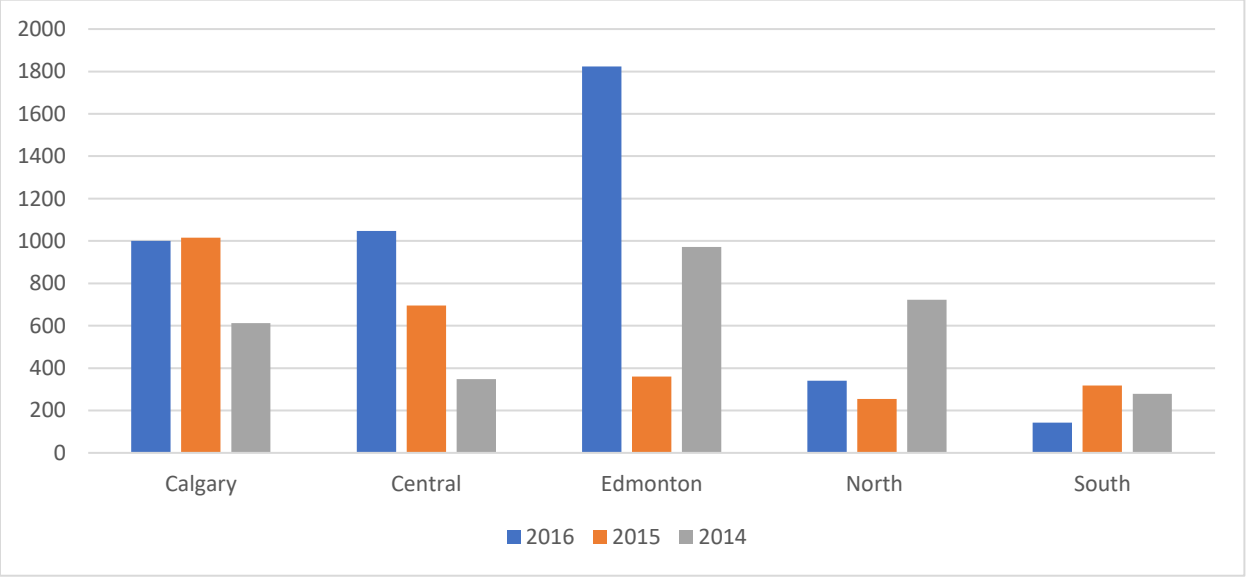


Figure 12: Events by Alberta region, 2014-2016

Table 17 shows the distribution of reported events among land types in Alberta from 2014-2016. *Private-Business* (21.8%, after a 15-fold year-over-year increase) and *Private Easement* (24.9%) were the largest categories in 2016. *Private-Land Owner*, the largest land type category in 2014 and 2015, plunged by half last year. *Railroad* came online as a relevant category for the first time in 2016 due to increased telecom

participation (up 109.8%; see Table 1). In rural areas, telecom wires often run alongside or below railroad tracks.

Table 17. Alberta events by land type (right of way), 2014-2016

Land Type	2014	2015	2016	2016%	2015-2016%	2014-2016%
Data Not Collected	110	3	3	0.1	0.0	-97.3
Dedicated Public Utility Easement	147	267	365	8.4	36.7	148.3
Federal Land	614	35	406	9.3	1060.0	-33.9
Pipeline	34	247	451	10.4	82.6	1226.5
Power/Transmission Line	7	-	75	1.7	0.0	971.4
Private - Business	53	59	950	21.8	1510.2	1692.5
Private - Land Owner	621	735	333	7.6	-54.7	-46.4
Private Easement	414	364	1083	24.9	197.5	161.6
Public - City Street	444	504	309	7.1	-38.7	-30.4
Public - County Road	261	209	114	2.6	-45.5	-56.3
Public - Other	108	88	48	1.1	-45.5	-55.6
Public - Highway	45	36	5	0.1	-86.1	-88.9
Railroad	1	1	215	4.9	21400.0	21400.0
Unknown/Other	75	96	3	0.1	-96.9	-96.0
Total	**2934**	**2,644**	**4357**	**100.0**	**64.8**	**48.5**

The radar map in Figure 13 below shows in which land types reported events tend to occur. The differences between 2016 compared to previous years are clear: more events on *Private Easement* and *Private-Business* land, fewer on *Private-Land Owner*. Still, privately-owned lands of various types tend to experience far more reported events than public lands (with the exception of public streets).

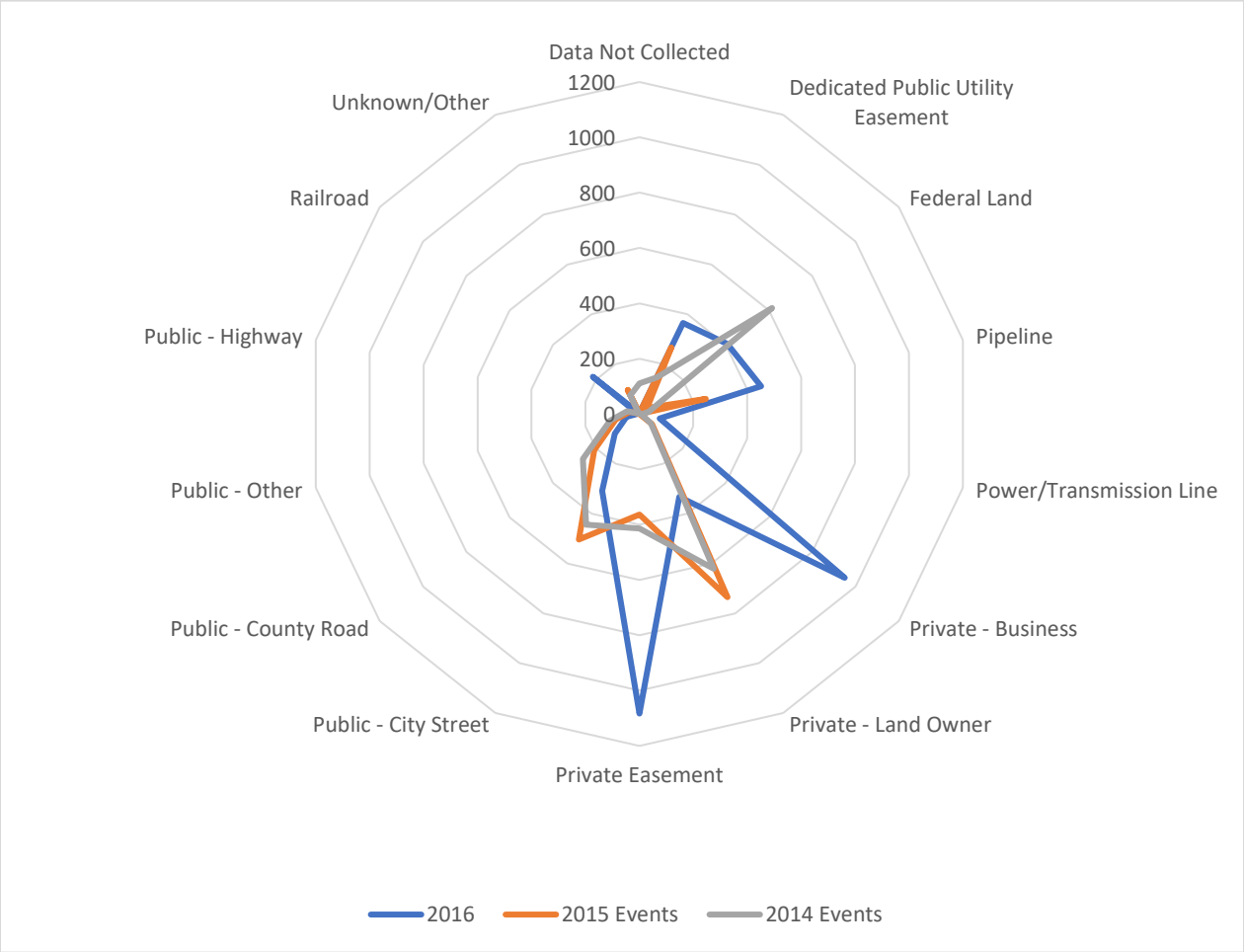


Figure 13: Alberta events by land type, radar map, 2014-2016

Part C: Affected Facilities

Table 18 below compares the types of facilities damaged in Alberta from 2014-2016. New in 2016 was *Cable TV*, accounting for 9% of last year's reported events. *Electric* and *Liquid Pipeline* declined significantly in terms of damaged facilities in 2016 compared to previous years, while the increase in total numbers was primarily allotted to the *Water* category (up to almost 2000 events in 2016 from 21 in 2015). *Federal Land* decreased in part due to less oil work occurring on Federal lease sites, while the increase in *Private* land types may be due to more reporting from Edmonton and Red Deer.

Table 18: Alberta events by facility affected, 2014-2016

Facility Damaged	2014	2015	2016	2016%	2015-2016%	2014-2016%
Cable TV	-	-	394	9.0	0.0	0.0
Electric	144	157	5	0.1	-96.8	-96.5
Liquid Pipeline	624	154	-	0.0	-100.0	-100.0
Natural Gas	599	954	900	20.7	-5.7	50.3
Sewer (Sanitary/Storm)	1	4	58	1.3	1350.0	5700.0
Steam	4	1	-	0.0	-100.0	-100.0
Telecommunications	1,025	1045	207	4.8	-80.2	-79.8
Unknown/Other	251	308	813	18.7	164.0	223.9
Water	286	21	1979	45.4	9323.8	592.0
Total	**2934**	**2644**	**4356**	**100.0**	**64.8**	**48.5**

Of the most-frequently damaged facility types, only *Natural Gas* was consistent year-over-year (Figure 10). Figure 14 demonstrates the extent to which the type of facility damaged varies immensely on an annual basis.

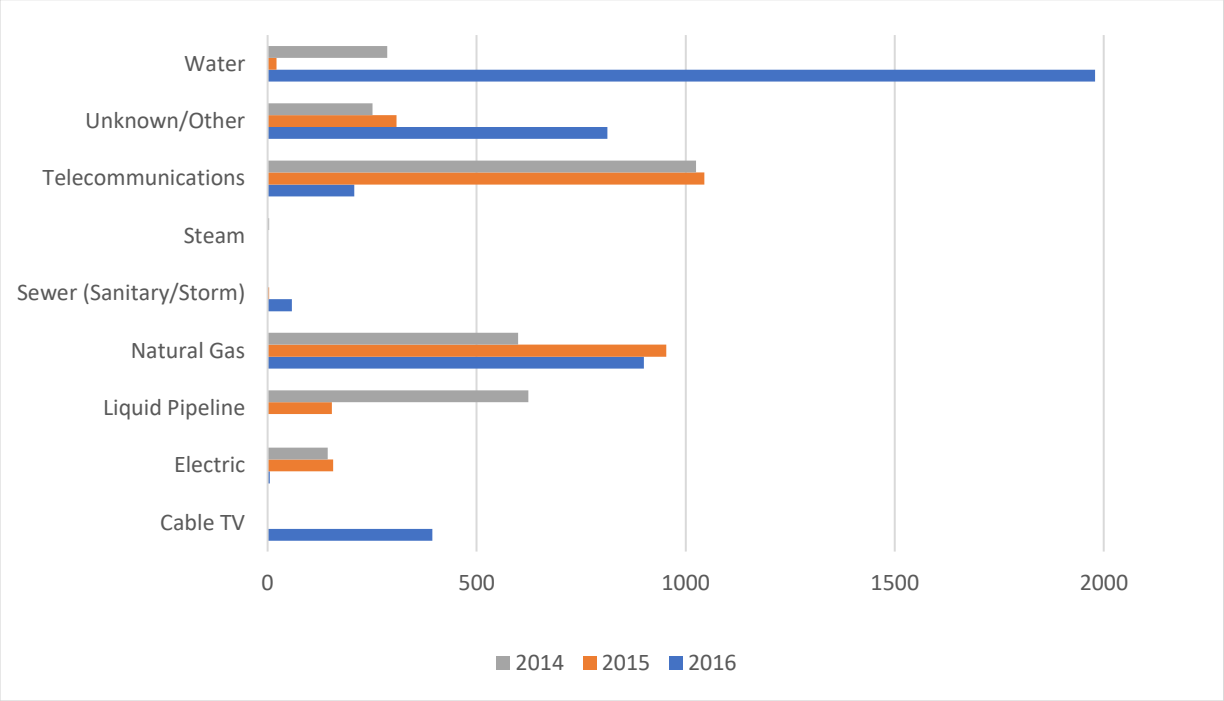


Figure 14: Alberta Events by Facility Operation Type, 2014-2016.

Part D: Excavation Information

Among the events associated with a known excavation equipment type in 2016, *Hoe/Trenchers* represented the majority of the reported events (11.3%), followed by *Drilling*, *Hand Tools*, and *Vacuum Equipment* in descending order (Table 19 below). Virtually every category of equipment has increased over both a 1- and 2-year comparison.

Table 19: Alberta events by excavation equipment type, 2014-2016

Equipment Type	2014	2015	2016	2016%	2015-2016%	2014-2016%
Hoe/Trencher	303	444	512	11.3	15.32	68.98
Hand Tools	58	103	106	2.3	2.91	82.76
Drilling	100	196	223	4.9	13.78	123.00
Vacuum Equipment	5	15	40	0.9	166.67	700.00
Unknown/Other	1363	1512	2387	52.6	57.87	75.13
Data Not Collected	1105	374	1088	24.0	190.91	-1.54
Total	**2934**	**2644**	**4356**	**96.0**	**64.75**	**48.47**

Figure 15 shows how little meaningful data has been captured about excavation equipment in all three years of the DIRT report. Combined, the *Unknown/Other* and *Data Not Collected* categories represent over 75% of the damage reports submitted, while the chart below shows that the year-over-year growth from 2015 to 2016 was almost entirely in these categories. Increasing the volume of reports with fields for which data has not been collected has a negative effect on DQI.

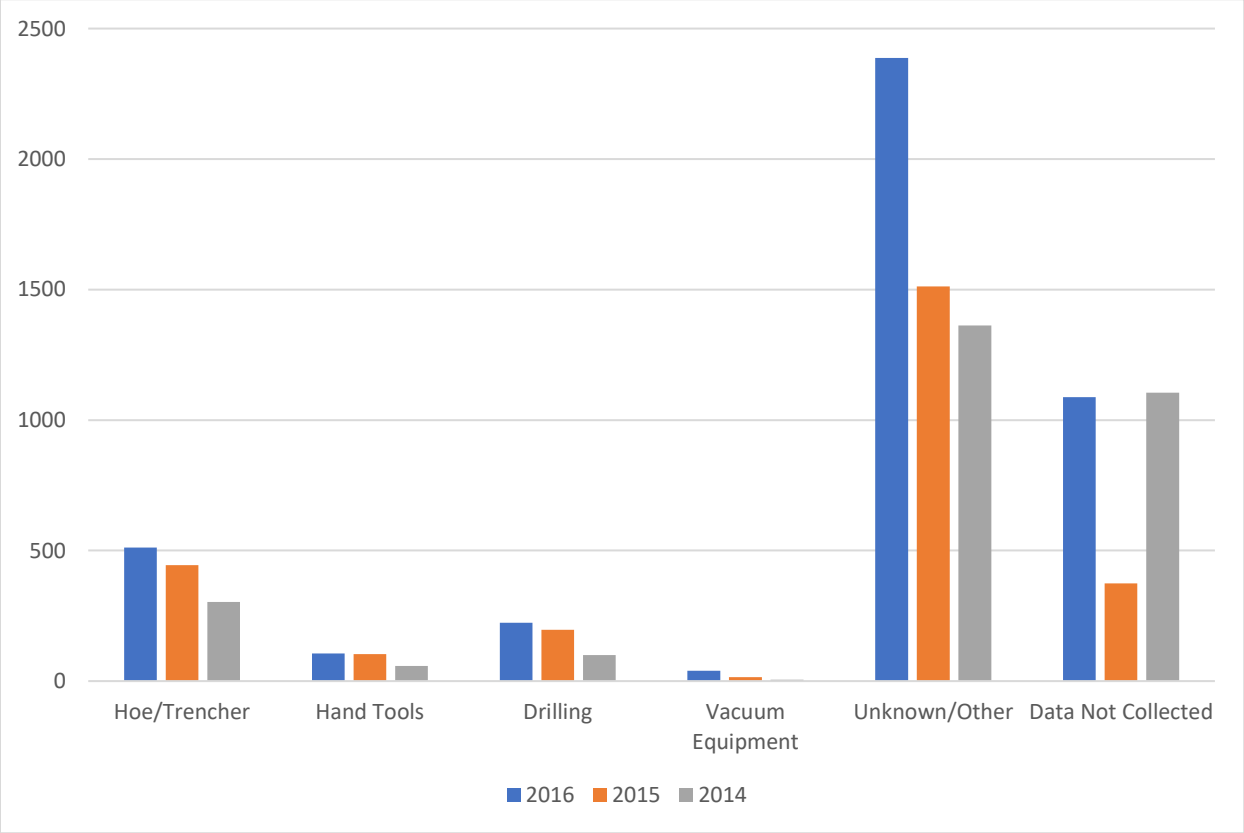


Figure 15: Alberta events by excavation equipment type, 2014-2016

Table 20 below shows the number of reported events by excavator type for 2014-2016. In 2016, *Contractor*—the largest reporters of damage events—increased almost 40%, a 3-year trend.

A downgrade in data accuracy was also visible, as *Data Not Collected* responses almost tripled in number, from 356 (14.6%) in 2015 to 1064 (24.4%) in 2016. Notably, 100% of *State Regulator*-supplied damage reports did not enter this data.

Table 20. Alberta events by excavator type, 2014-2016

Excavator	2014	2015	2016	2016%	2015-2016%	2014-2016%
Contractor	1,160	1,517	2120	48.7	39.7	82.8
County	30	386	60	1.4	-84.5	100.0
Data Not Collected	1,107	356	1064	24.4	198.9	-3.9
Developer	6	1	12	0.3	1100.0	100.0
Farmer	17	36	20	0.5	-44.4	17.6
Municipality	26	10	34	0.8	240.0	30.8
Occupant	267	7	362	8.3	5071.4	35.6
State	-	-	1	0.0	0.0	0.0
Total	**2,934**	**2644**	**4356**	**100.0**	**64.8**	**48.5**

Two categories, *Utility* and *Occupant*, returned to relevance in 2016 after big decreases from 2014 to 2015 (Figure 16). After a spike in 2015, *County* fell back toward its 2014 number. And three categories—*Municipality, Farmer,* and *Developer* continue to play a marginal role year after year.

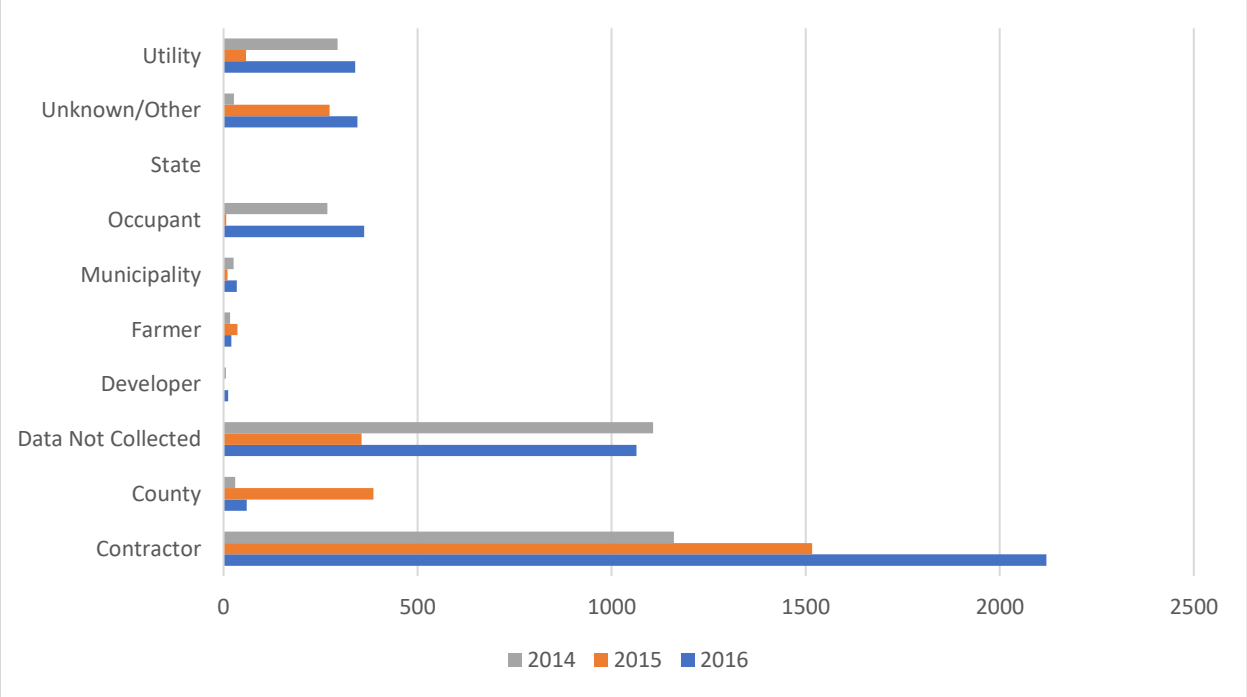


Figure 16: Alberta events by excavator type, 2014-2016

Table 21 displays reported events for the type of work performed in Alberta in 2014-2016. *Street* (1711; 39.3%) and *Construction/Development* (1797; 41.3%) together accounted for more than four-fifths of all the reported events in 2016. Both variables were many times higher in 2016 than they were in either of the previous years.

Table 21: Alberta events by work performed, 2014-2016

Work Performed	2014	2015	2016	2016%	2015-2016%	2014-2016%
Agriculture	12	17	61	1.4	258.8	408.3
Construction/Dev.	183	221	1797	41.3	713.1	882.0
Data Not Collected	1306	622	9	0.2	-98.6	-99.3
Energy/Telecom.	292	417	423	9.7	1.4	44.9
Landscaping/Fencing	181	307	285	6.5	-7.2	57.5
Street	239	309	1711	39.3	453.7	615.9
Unknown/Other	396	372	22	0.5	-94.1	-94.4
Water	325	379	49	1.1	-87.1	-84.9
Total	**2934**	**2644**	**4356**	**100.0**	**64.8**	**48.5**

Data quality in this section improved significantly in 2016, as *Data Not Collected* plunged to a mere 9 events (0.2% of the distribution) from 622 in 2015 and 1306 in 2014. *Water* and *Unknown/Other* both saw declines of more than 80% in 2016 as compared to either of the previous years. Finally, *Landscaping/Fencing* and *Energy/Telecommunications* have continued to remain steady over the 3-year period (Figure 17).

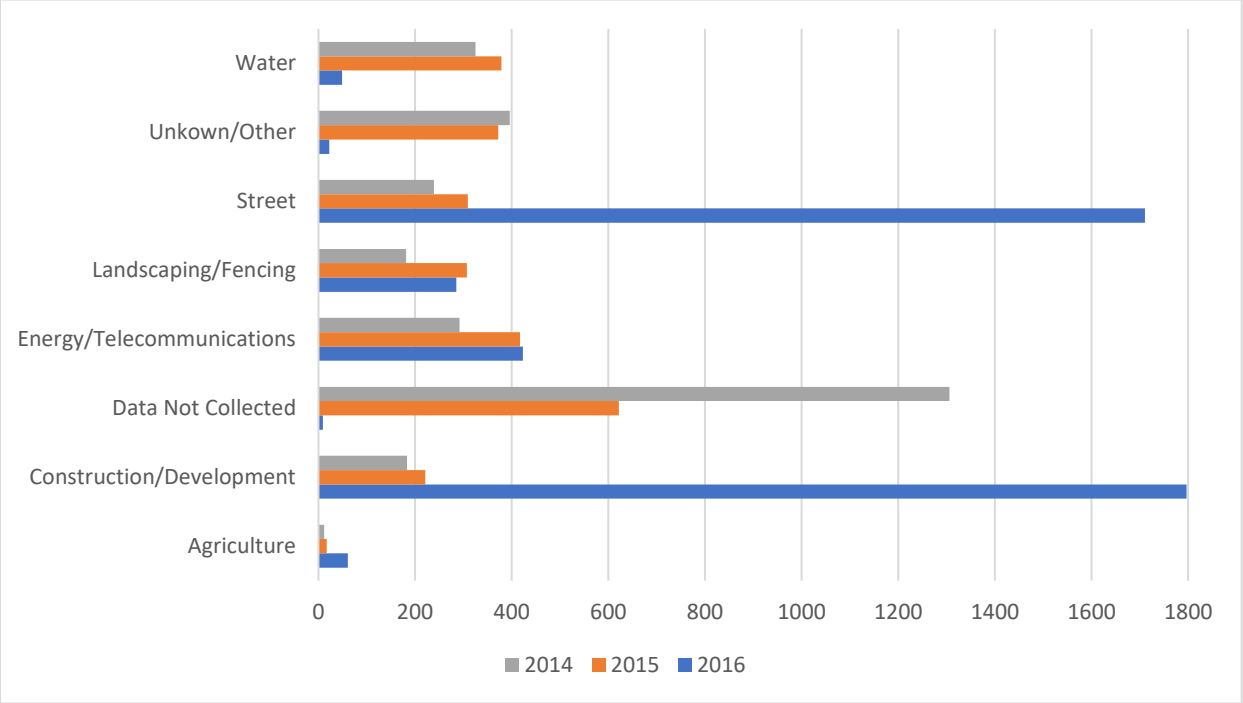


Figure 17: Alberta events by work performed, 2014-2016

Part E, F, G & H: Notification, Locating and Marking, and Excavator Downtime, and Cost of Damage

There were 4356 damage events reported in Alberta in 2016, a 64.8% increase over 2015 and a 48.5% increase over 2014 (Table 22 below). In contrast, the total number of locate requests remained remarkably similar between the 3 years, varying less than 5% overall. Similarly, the number of notifications varied less than 20% amid much larger variation in the number of reported events.

Although the ratio of damage to locate requests therefore increased by 68.4% over 2015, this may be caused by greater participation rate in DIRT in Alberta in 2016.

Table 22. Alberta One-Call notifications, locates, and damage ratios, 2014-2016

One-Call Notification	2014	2015	2016	2015-2016%	2014-2016%
Number of D. Events	2934	2644	4356	64.8	48.5
Number of Locates	416,429	410548	403,870	-1.6	-3.0
Damages/1000 Locates	7.0	6.4	10.78	68.4	54.0
Notifications:Locates	4.5	4.7	4	-14.9	-11.1
Number of Notifications	1,889,150	1,947,324	1,615,067	-17.1	-14.5
Reported events:1000 Notif.	1.6	1.4	2.7	92.9	68.8

Table 23 below presents the incidence of service interruptions among reported events in Alberta in 2016, the first year that service interruptions are presented as part of the DIRT report. In Alberta, 20.7% of all reported events led to some sort of service interruption, while the occurrence of a service interruption was listed as *Unknown* for 64.5% of all reported events.

Table 23: Alberta events by service interruption occurrence, 2016

Service Interruption	2016	2016%
Yes	901	20.7
No	469	10.8
Unknown	2809	64.5
Data Not Collected	177	4.1
Total	4356	100.0

Part I: Root Causes

Table 24 provides damage event records by root cause category. The 65% overall increase since 2015 was divided among all four categories, with the fastest-growing group *Miscellaneous Root Cause* at 72% higher than 2015 and 17% higher than 2014, and the slowest-growing group *One Call Practices Not Sufficient* at 39% more than 2015 and more than triple 2014.

Table 24: Alberta events by root cause, 2014-2016

Damage by Root Cause Category	2014	2015	2016	2016 %	2015-2016%	2014-2016%
One Call Practices Not Sufficient	100	299	415	9.5	38.8	315.0
Locating Practices Not Sufficient	416	404	687	15.8	70.1	65.1
Excavation Practices Not Sufficient	130	386	580	13.3	50.3	346.2
Miscellaneous Root Cause	2,288	1,555	2,674	61.4	72.0	16.9
Total	**2,934**	**2,644**	**4,356**	**100.0%**	**64.8**	**48.5**

Figure 18 below provides a simpler way to look at the 2- and 3-year trend for the root cause subcategories. Over 3 years, there has been gentle growth in reported events due to the insufficiency of *One Call Practices, Locating Practices*, and *Excavation Practices,* while *Miscellaneous Root Cause* has been consistently more significant and more volatile. For instance, the decrease in overall events from 2014-2015 (from 2,934 to 2,644, or about 10%) was almost entirely accounted for by the decrease in *Miscellaneous*. 2016 brought a huge increase in *Miscellaneous* events due to *Data Not Collected* entries, discussed in more detail below.

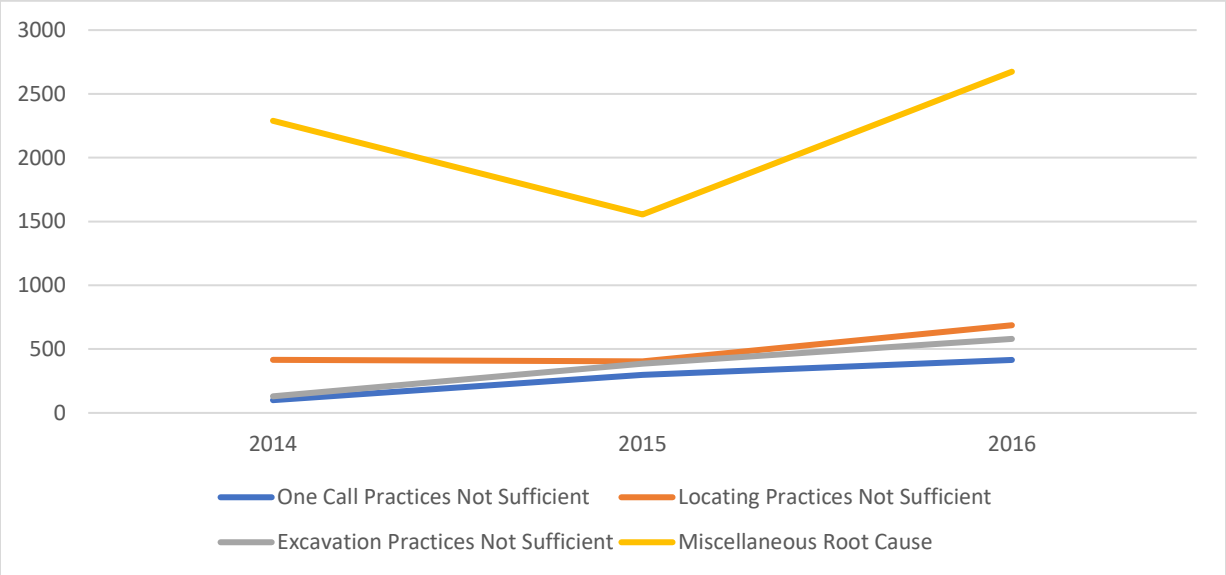


Figure 18: Alberta events by root cause category, 2014-2016

Figure 19 examines the most important causes within each root cause category to identify more specific areas where efforts may be targeted.

Note that data on root cause was not collected for over half of the total reported events in 2016. As in the previous years' reports *Data Not Collected* is grouped with the *Miscellaneous* root cause category in Table 24 and Figure 18 above (Appendix B contains a complete list of each root cause and how it falls into the

broader categories). *Facility was not located or marked*, *Excavation practices not sufficient* (without additional detail), and *No notification made to the one-call center* each accounted for about 10% of the events in 2016.

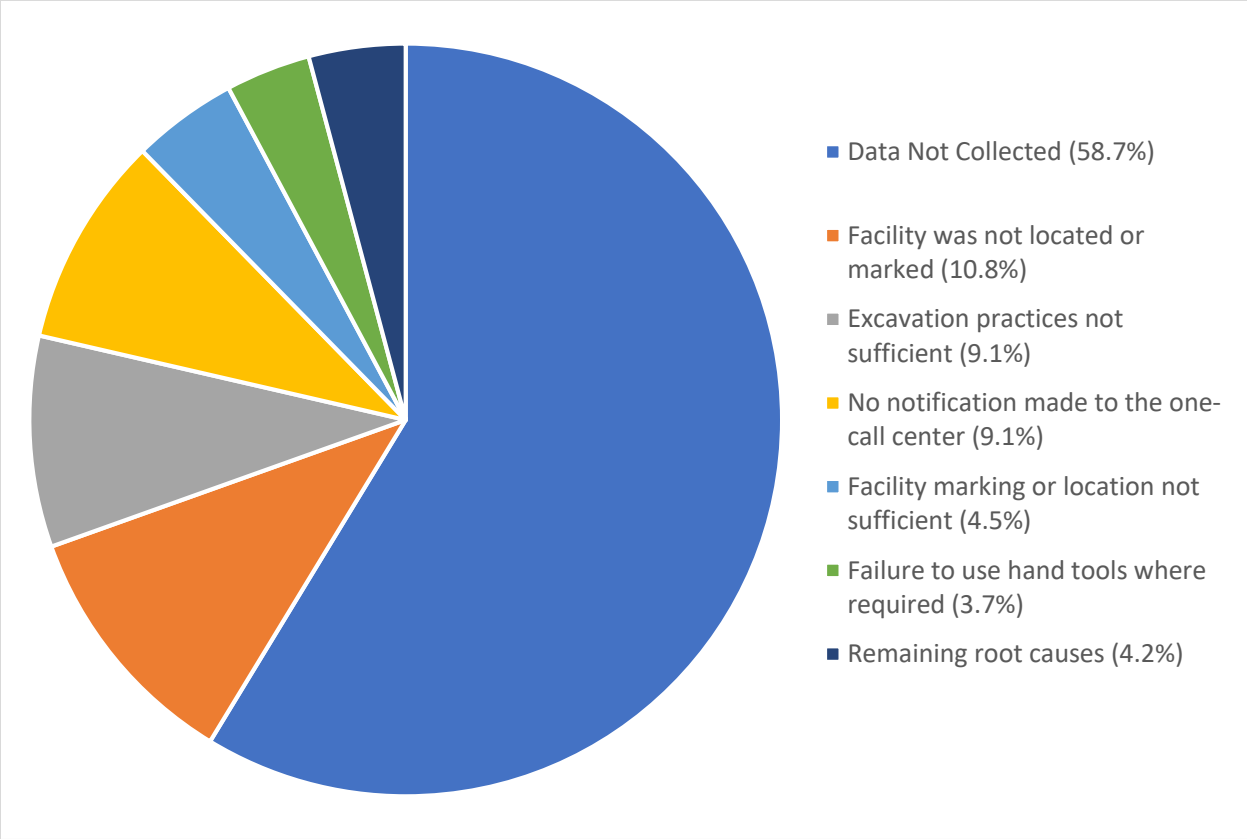


Figure 19: Reported events by root cause subcategory, 2014-2016

Data Quality

The Data Quality Index (DQI) consists of the evaluation of each of the 4356 damage records submitted in Alberta in 2016. It is divided into 8 categories (A, B, C, D, EF, G, H, and I) representing each portion of the DIRT reporting form. Each individual form has a percentile score for each category, as well as an overall score for the entire form. These scores can then be averaged across all forms for each category.

In previous years the DIRT report would organize the percentile DQI scores into quintiles and compare the relative number of each form that fell into each quintile, per form section. New in the 2016 report, average scores for each form section have been calculated for 2014, 2015 and 2016. We believe this approach offers greater clarity and insight.

Table 25 shows that average DQI decreased 4.6% overall between 2015 and 2016, amid a huge increase in damage reports, while remaining 5.7% higher than its 2014 average. The most important decline in DQI was seen in Part D (Excavation Information), which was 25.4% lower than in the previous year.

Table 25: Average DQI per DIRT form section, 2014-2016

DQI Averages	2014	2015	2016	2015-2016%	2014-2016%
Part A	100	100	100	0	0
Part B	77.1	74.4	69.4	-7.2	-10.0
Part C	71.6	77.6	79.3	2.1	10.8
Part D	40.1	59.2	47.2	-25.4	17.6
Part EF	80.3	71.4	67.8	-5.3	-15.6
Part G	43.4	35.4	44.0	19.7	1.5
Part H	9.3	6.3	9.2	31.5	-0.4
Part I	26.0	42.5	39.7	-7.1	52.6
Overall Average	**48.6**	**53.8**	**51.4**	**-4.6**	**5.7**

Figure 20 offers a visual comparison of the average DQI per DIRT form section per year. In addition to a year-over-year decline in Part D, a 2-year trend of decline in Part B and Part EF as well as smaller one-year decline in Part I are visible. Meanwhile, Part C, Part G, and Part H have all improved.

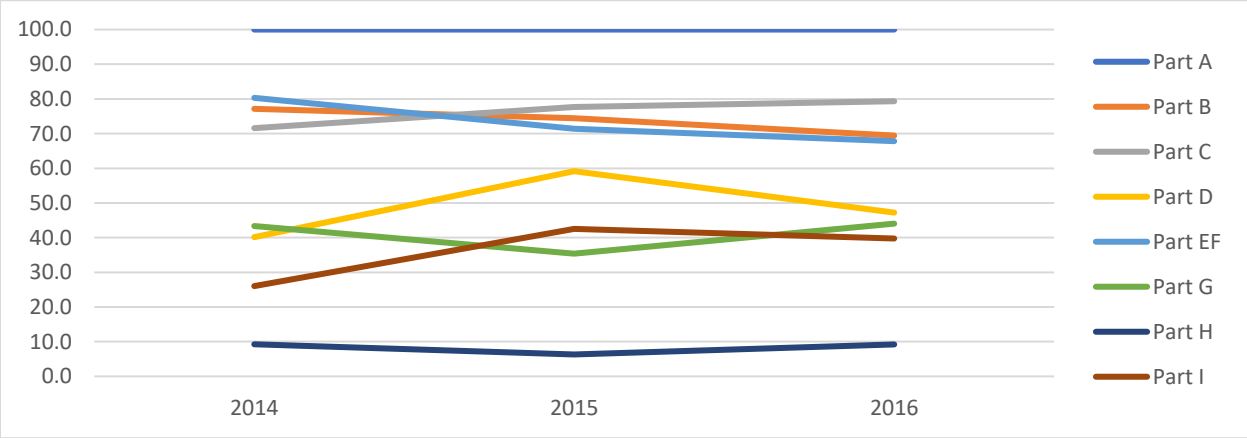


Figure 20. Average DQI per DIRT form section, 2014-2016

Recommendations

The following recommendations are intended to enhance industry efforts to reduce damage events and standardize the data collection process. Based on the analysis of the 2016 DIRT data, the recommendations are:

1. **Continue efforts to improve data quality**
    a. **Focus on increasing the DQI of Part D.** The decline in data quality between 2015 and 2016 as compared to the improvement between 2014 and 2015 should be addressed, particularly with new stakeholders as they become used to using the DIRT system.
    b. **Continue to encourage stakeholders to use DIRT.** By encouraging DIRT use among existing members, the entire reporting framework becomes more robust and useful to all.
    c. **Encourage stakeholders to re-visit reports.** To increase data quality and cut down on the number of "Data not collected" entries across several DIRT form sections, stakeholders should be encouraged to re-visit submitted reports if or when they have more information at a later date.
2. **Season: Focus on summer, fall**. The increase in reported events over 2015 was mostly distributed over the summer and autumn months of the year (June, July, August, September, and November). As the total number of events increases, the distribution of events becomes more concentrated in summer. Thus, efforts to reduce damage events should take into account seasonal activity and seasonal workers.
3. **Location: Address surge in Edmonton Region.** The Edmonton Region's four-fold increase in reported events and significant increases in Central and North Alberta is notable against the plateau in numbers of events in South Alberta and Calgary. Efforts to reduce damage events should address the skyrocketing number of incidents in Edmonton, while taking note of any successful efforts to halt the proliferation of damage events in Alberta's southern areas.
4. **Land Type: Focus on privately-held land; note success in reducing road construction-related damage.** Reducing the number of events that occur on privately-held land remains the primary challenge in 2016. Focus should be on land held by private businesses, a category that jumped by an order of magnitude from 50-60 events per year in 2014-2015 to 950 events in 2016. Events on private easement lands and in pipeline areas have also increased. However, among most public land types, the picture is brighter. The 30-40% reduction in number of events on city streets over previous years signifies an important area of success, especially amidst major growth in the total number of events. County roads, highways, and other public land types all witnessed reductions of 40-80%, suggesting that efforts involving these categories may have been successful. Finally, the growth in number of events on federal and railroad lands should be investigated.
5. **Excavator: Focus on Contractors.** As the excavator type involved in almost half of all reported events and with strong year-over-year growth, Contractors are an obvious choice for education or outreach programs concerning best practices.
6. **Work performed: Focus on construction/development, street-related work.** Major improvement in the quality of data on type of work performed is noticeable in the 2016 data set, in which the "data not collected" answer category is down to just 9 events (0.2%) from 622 in

2015 and 1305 in 2014. Two types of work performed account for 80% of all reported events: construction/development and street-related work, indicating that programs should be targeted to workers in construction and street maintenance trades.

7. **Root Cause: Focus on encouraging existing and new stakeholders to complete Part I.** Although Part I is an optional section, it offers invaluable insight by identifying the root cause of the damage event. Increasing the participation rate, which is currently under 50%, would greatly help understand how to reduce damage events even as new stakeholders join the ABCGA.
1. **Consider developing and publicizing a cost assessment** per incident of reported damage. By the metric of Quebec's Info-Excavation, 2016 damages across all of Western Canada cost $661 million, if DQI were similar to that of Quebec, or $460 million in Alberta alone. A thorough cost analysis of a representative set of real-life events in Alberta to create benchmarks would be a good place to start.

Saskatchewan 2016 DIRT Data & Analysis

SCGA™
Saskatchewan Common Ground Alliance

Saskatchewan DIRT

This report provides a high-level snapshot of damage statics related to Saskatchewan's underground infrastructure. The goal of this report is to help improve worker safety, public safety and to protect underground infrastructure in SK. A comprehensive picture of contributing issues is vital to foster a stronger culture of underground safety.

This report utilizes information collected using the Common Ground Alliance (CGA) USA's Damage Information Reporting Tool (DIRT). The Saskatchewan Common Ground Alliance (SCGA) encourages all interested parties to submit their damage reports to the SK Virtual Private DIRT by visiting www.cga-dirt.com. Once registered, users can submit damage information or generate reports on the existing data. This report presents the data collected from the Virtual Private DIRT website 2014-2016.

About the SCGA

The Saskatchewan Common Ground Alliance (SCGA), through shared responsibility among all key stakeholders, is committed to enhancing public and worker safety while reducing damage to buried facilities. The Common Ground Alliance is a member-driven association dedicated to ensuring public safety, environmental protection, and the integrity of services by developing and promoting effective damage prevention practices, which we refer to collectively as Best Practices. Promoting a spirit of shared responsibility, the CGA welcomes all stakeholders who would like to be a part of the identification and promotion of best practices. In recent years, the CGA has established itself as the leading organization in North America through shared responsibility among all stakeholders. The CGA currently has seven Regional Partnerships throughout Canada including British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec and the Maritimes.

In order to successfully develop and promote effective damage prevention practices, any persons or companies who may be involved in ground disturbance activities such as excavators, locators, road builders, electric, telecommunications, oil, gas, water, One-Call, public works, regulators, fencing contractors, landowners, engineering and design are encouraged to participate.

The underground facility network in Saskatchewan is growing and as a result the stakes are higher for employers and workers as buried facilities become increasingly congested. Stakeholders in the underground community include excavators, locators, planners, and facility owners. To date, there has been tremendous effort given to enhancing the safety of various underground operations focusing on both facility and worker protection by a number of individual groups. The CGA will give Saskatchewan the opportunity to play a part in a new collective approach to damage prevention and worker safety in the province. Following the lead of many jurisdictions across North America, several key employers in Saskatchewan have been looking for ways to collectively renew and enhance our approach to damage prevention and underground worker safety in the province through the creation and promotion of Best Practices.

Understanding the value of a collective approach, Saskatchewan industry partners committed to adopt the model established in most North American jurisdictions. 2015 marked the first year that the full DIRT

dataset was available. 2016 marks the first full year-over-year comparison, with a three-year comparison available for sections A, E, and I.

Data Analysis

The Saskatchewan 2016 DIRT Report presents a 3-year trend whenever possible, allowing a more sophisticated and in-depth analysis including several new tables and charts. It is also clear from the data that 2016 represents the most comprehensive data set to date. It is difficult to quantitatively assess increase in participation and reporting due to the anonymous nature of the reporting, however, members should be congratulated on the continued commitment and improvement to data reporting.

The information provided in this report is generally organized to match the structure of the Damage Information Reporting Field Form. Data for Saskatchewan are provided by the main public utility companies of SaskEnergy (natural gas), SaskPower (electricity), and SaskTel (telephone). In 2016, the number of damage reports totalled 632, down 19.8% from 788 in 2015. The analysis of the data is organized around the following section headings:

- Part A: Information Providers
- Part B: Date and Location of Events
- Part C: Affected Facilities
- Part D: Excavation Information
- Part E, F, H & G: Notification, Locating and Marking, Excavator Downtime, and Cost of Damage
- Part I: Root Causes

Part A: Information Providers

In Table 26, columns labelled '2014', '2015', and '2016' give the total number of damage events reported by each stakeholder group in BC. The column '2016%' shows the percentage of the total events for 2016 reported by each stakeholder group. '2015-2016%' and '2014-2016%' show the percentage growth for each stakeholder group from 2015 to 2016 and 2014 to 2016, respectively.

With an overall decline of 19.8% in the number of damage reports in 2016 compared to 2015, numbers for all stakeholder groups fell except *Electric*, which grew 15.1% year-over-year to become the second-biggest stakeholder by number of damage reports after *Telecommunications*, which recorded 275 events in 2016 after a year-over-year decline of 31.6%.

Table 26. Saskatchewan events by stakeholder group, 2014-2016

Stakeholder Group	2014	2015	2016	2016%	2015-2016%	2014-2016 %
Electric	195	191	220	34.8	15.2	12.8
Excavator			1	0.2	0.0	0.0
Liquid Pipeline	-	17	6	0.9	-64.7	0.0
Natural Gas	180	176	130	20.6	-26.1	-27.8
Telecommunications	307	402	275	43.5	-31.6	-10.4
Unknown/Other	-	2	-	-	0.0	0.0
Total	**682**	**788**	**632**	**100.0**	**-19.8**	**-7.3**

Figure 21 offers a visual representation of Table 1. There, we see how the three categories of *Electric, Natural Gas*, and *Telecommunications* are responsible for reporting the large majority of reported events every year, with *Excavator, Liquid Pipeline*, and *Unknown/Other* responsible for almost none.

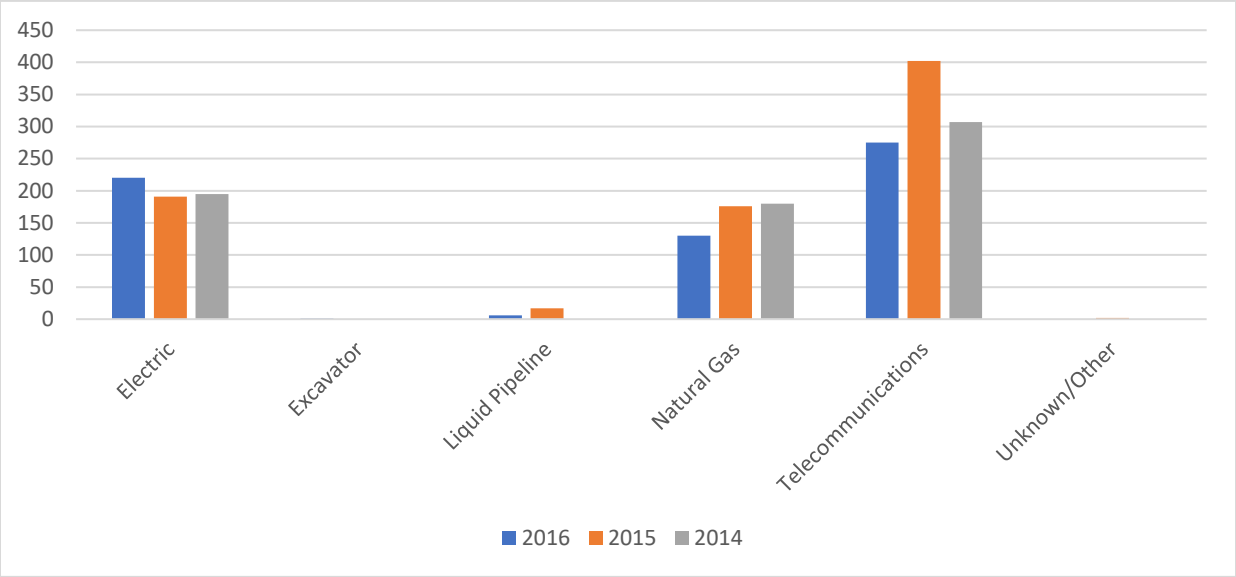


Figure 21: Saskatchewan events by stakeholder group, 2014-2016

Part B: Date and Location of Events

In Table 27, columns labelled '2015' and '2016' give the total number of reported events per month in Saskatchewan for those years. The column '2016 %' shows the percentage of the total events for 2016 that occurred in each month. '2015-2016%' shows the percentage growth for each month from 2015 to 2016.

The total of 632 damage events reported in 2016 represents an average of 52.7 events/month, down 19.8% from 2015 which had an average of 65.7 events/month.

Table 27: Saskatchewan events by month, 2015-2016

Month	2015	2016	2016%	2015-2016%
January	23	17	2.7	-26.1
February	18	16	2.5	-11.1
March	33	27	4.3	-18.2
April	35	42	6.6	20.0
May	102	62	9.8	-39.2
June	109	79	12.5	-27.5
July	94	60	9.5	-36.2
August	94	87	13.8	-7.4
September	89	82	13.0	-7.9
October	88	60	9.5	-31.8
November	81	71	11.2	-12.3
December	22	29	4.6	31.8
Total	**788**	**632**	**100.0**	**-19.8**
Avg.	65.7	52.7	8.3	-19.8

Figure 22 demonstrates the actual distribution of event reports over the year. As in 2015, the peak season for reported damage events extended from May to November, with the most number of events (87) reported in August.

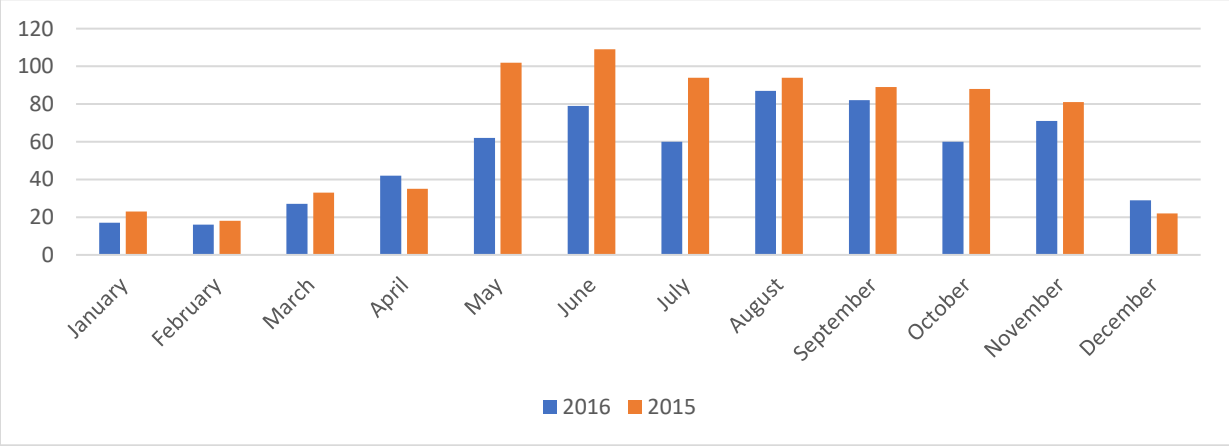


Figure 22: Saskatchewan events by month, 2015-2016

Table 28 shows the distribution of reported damage events across Saskatchewan by region. Saskatoon, where a large proportion of reported events occurred in 2015, saw a decline of an order of magnitude (-214), in addition to smaller decreases in Regina and Yorkton. Meanwhile, increases relative to 2015 occurred in Battleford (+45), Estevan (+72), Kindersley (+64), Moose Jaw (+27), and Weyburn (+83).

Table 28: Events by Saskatchewan region, 2015-2016

County	2015	2016	2016%	2015-2016%
SK-Battleford	0	45	7.1	-
SK-Estevan	2	74	11.7	3600.0
SK-Kindersley	9	73	11.6	711.1
SK-Moose Jaw	24	51	8.1	112.5
SK-North Battleford	48	7	1.1	-85.4
SK-Prince Albert	129	134	21.2	3.9
SK-Regina	166	105	16.6	-36.8
SK-Saskatoon	224	10	1.6	-95.5
SK-Swift Current	69	1	0.2	-98.6
SK-Weyburn	41	124	19.6	202.4
SK-Yorkton	76	8	1.3	-89.5
Total	**788**	**632**	**100.0**	**-19.8**

Figure 23 shows how events in 2016 were much more widely dispersed across the province, despite the overall decline in number of events. *Battleford*, *Estevan*, and *Kindersley* all had less than 10 reported events in 2015, while in 2016 they each accounted for between 7 and 12% of the year's total.

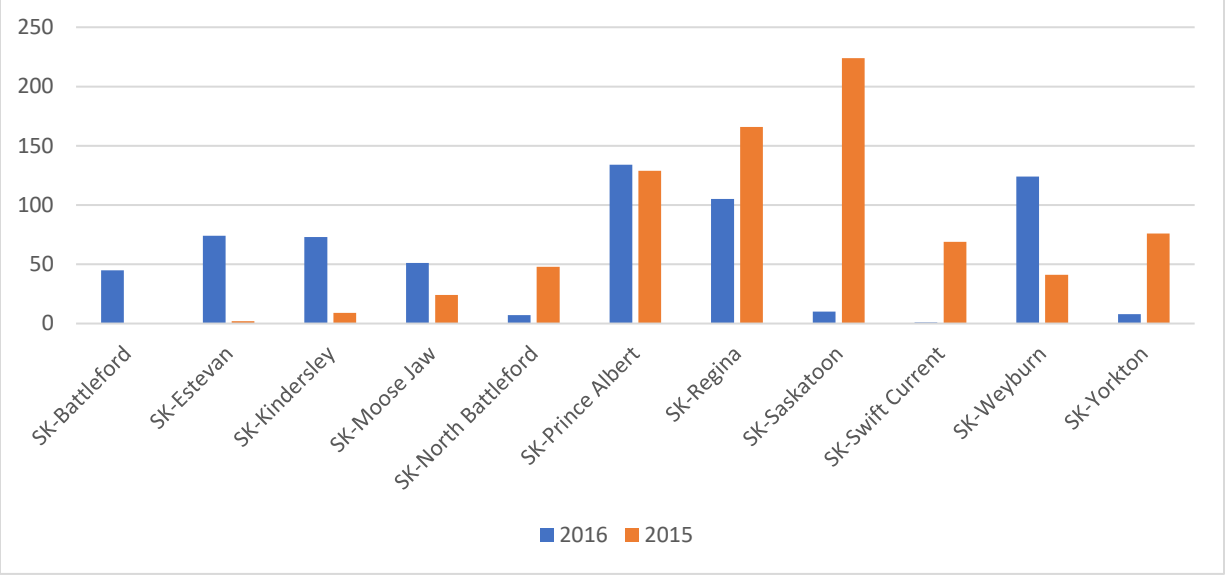


Figure 23: Saskatchewan events by region in 2016

The distribution of reported events according to land type in 2016 (Table 29) was concentrated in *Private–Land Owner* (34.2%) and *Data Not Collected* (31.8%) categories. *Unknown/Other* (9.8%) occupies a significant portion of the distribution, and *Public–County Road* comes a distant fourth (5.8%).

Table 29: Saskatchewan events by land type, 2015-2016

Land Type	2015	2016	2016 %	2015-2016%
Data Not Collected	200	201	31.8	0.5
Dedicated Public Utility Easement	12	4	0.6	-0.7
Federal Land	17	15	2.4	-11.8
Pipeline	12	3	0.5	-75.0
Power/Transmission Line	0	1	0.2	-
Private - Business	16	22	3.5	37.5
Private - Land Owner	304	216	34.2	-28.9
Private Easement	7	8	1.3	14.3
Public - City Street	29	26	4.1	-10.3
Public - County Road	46	19	3.0	-58.7
Public – Interstate Highway	0	5	0.8	-
Public - Other	1	45	7.1	4400.0
Public - State Highway	18	5	0.8	-72.2
Railroad	0	0	0.0	-
Unknown/Other	126	62	9.8	-50.8
Total	**788**	**632**	**100.0**	**-19.8**

Figure 24 shows that even amid the reduction in events from 2015 to 2016, the *Data Not Collected* category grew slightly. This leads to a lower DQI (data quality index), as undefined responses, especially at over 30% of a distribution, cast doubt on the importance of the relationships shown within the known entries.

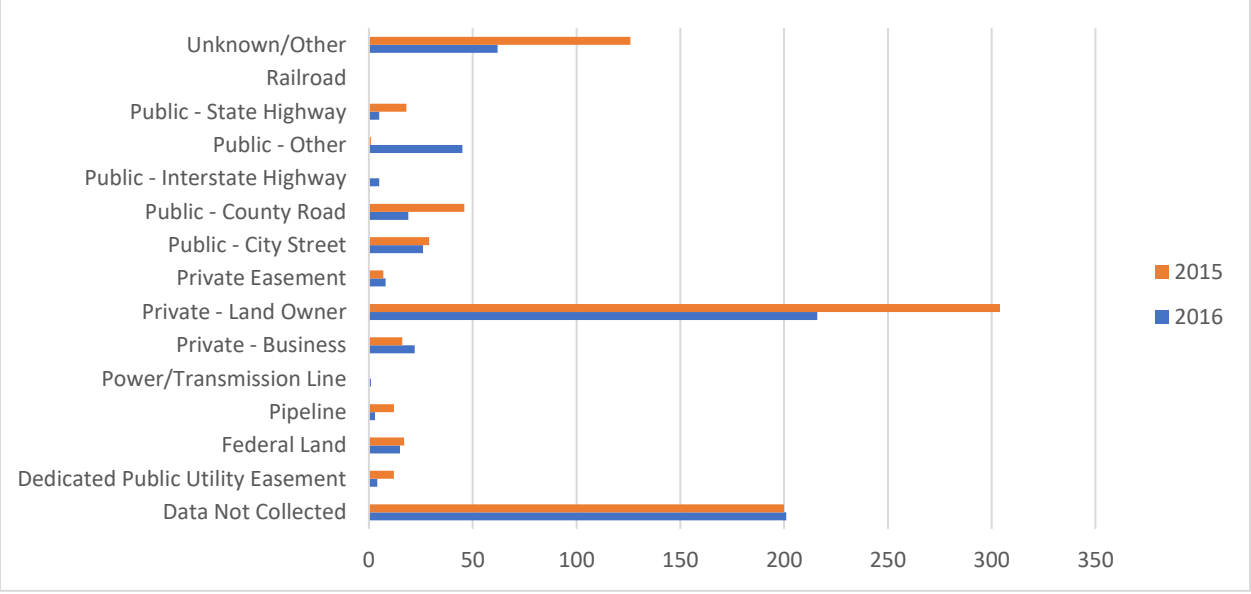


Figure 24: Saskatchewan events by land type, 2015-2016

Part C: Affected Facilities

Table 30: Saskatchewan events by affected facility, 2014-2016

Facility Damaged	2015	2016	2016%	2015-2016%
Electric	197	220	34.8	11.7
Liquid Pipeline	12	6	0.9	-50.0
Natural Gas	176	131	20.7	-25.6
Telecommunications	403	275	43.5	-31.8
Total	**788**	**632**	**100**	**-19.8**

As shown above in Table 30, total events by facility affected in 2016 was *Telecommunications* (275 events, or 43.5%%), followed by *Electric* (220 events, or 34.8%) and *Natural Gas* (131 events, or 20.7%). Below, Figure 25 shows the decline in *Natural Gas* as a stakeholder category, while other categories increased or decreased less dramatically, and *Liquid Pipeline* remained negligible for both years of reporting.

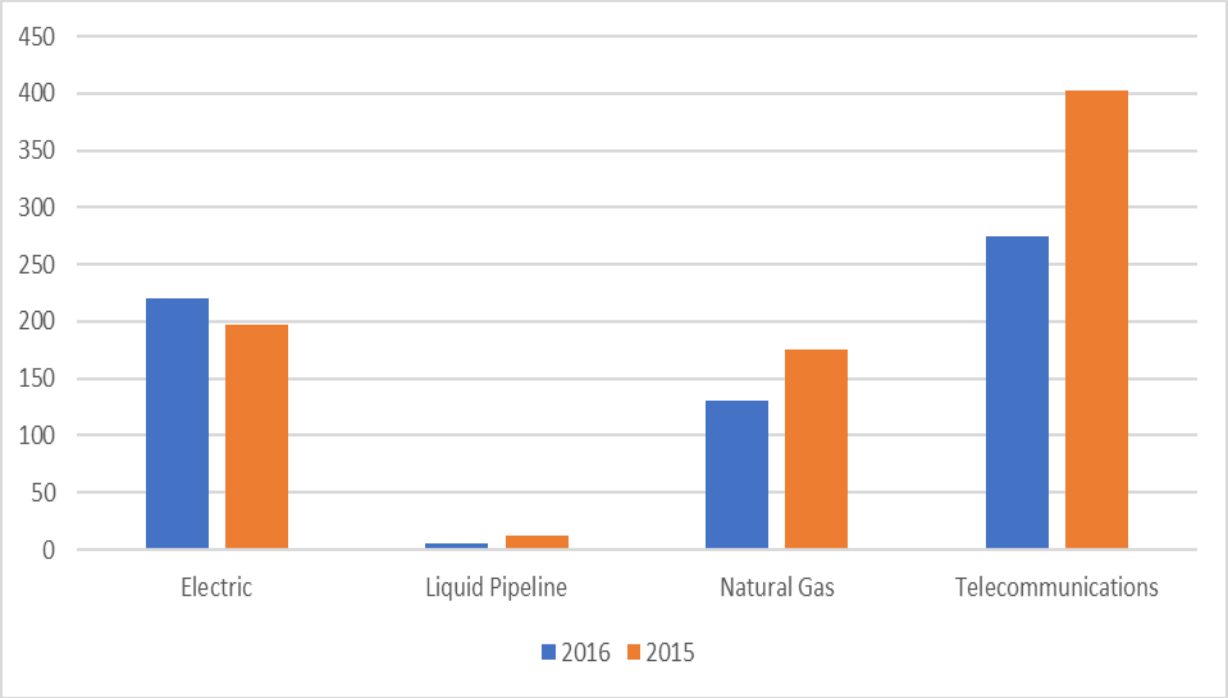


Figure 25: Saskatchewan events by affected facility, 2015-2016

Part D: Excavation Information

Among the events associated with a known excavation equipment type (Table 31), *Hoe/Trencher* was most frequently listed as the equipment involved, with 273 events, a decline of 30.7% compared to 2015. The categories of both *Unknown/Other* (86, or 13.6%) and *Data Not Collected* (198, or 31.3%) make up much of the rest, except for 58 events (9.2%) associated with *Drilling*. In general, the 2016 data resembles the 2015 data with fewer events overall (Figure 26).

Table 31: Saskatchewan events by excavation equipment type, 2015-2016

Equipment type	2015	2016	2016%	2015-2016%
Hoe/Trencher	394	273	43.2	-30.7
Hand Tools	9	14	2.2	55.6
Drilling	62	58	9.2	-6.5
Vacuum Equipment	0	3	0.5	-
Unknown/Other	101	86	13.6	-14.9
Data not collected	222	198	31.3	-10.8
Total	**788**	**632**	**100.0**	**-19.8**

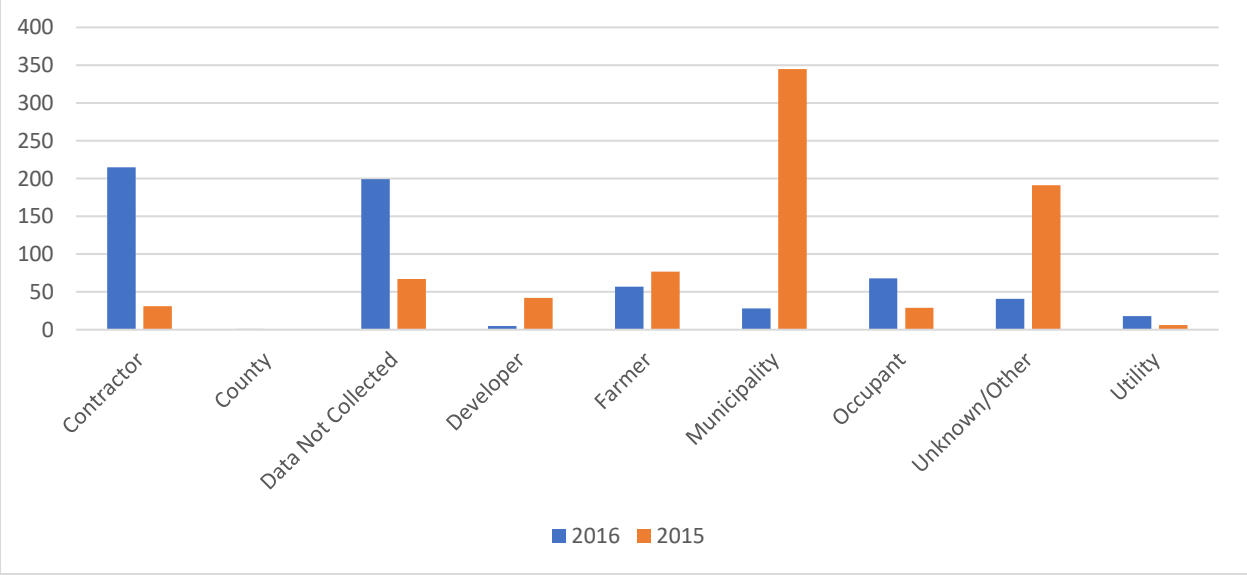


Figure 26: Saskatchewan events by excavator equipment type

Table 32 below shows the volume of events by excavator type for 2016. In 2016, a plurality of events were associated with the *Contractor* excavator type (215; 34.0%) or else were *Data Not Collected* (199; 31.5%). *Occupant*, *Farmer*, and *Unknown/Other* each accounted for between 6% and 11% of the 2016 distribution.

Table 32: Saskatchewan events by excavator type

Excavator Type	2015	2016	2016 %	2015-2016%
Contractor	31	215	34.0	593.5
County	0	1	0.2	-
Data Not Collected	67	199	31.5	197.0
Developer	42	5	0.8	-88.1
Farmer	77	57	9.0	-26.0
Municipality	345	28	4.4	-91.9
Occupant	29	68	10.8	134.5
Unknown/Other	191	41	6.5	-78.5
Utility	6	18	2.8	200.0
Total	**788**	**632**	**100.0**	**-19.8**

In Figure 27, it becomes clear the extent to which the range of excavator types in 2016 has little in common with the previous year. While *Municipality* (345) contributed a large proportion of 2015's 788 events, followed by *Unknown/Other*, these groupings contributed relatively little to 2016. Similarly, *Contractor* and *Data Not Collected* rose by 593.5% and 197.0%, year-over-year.

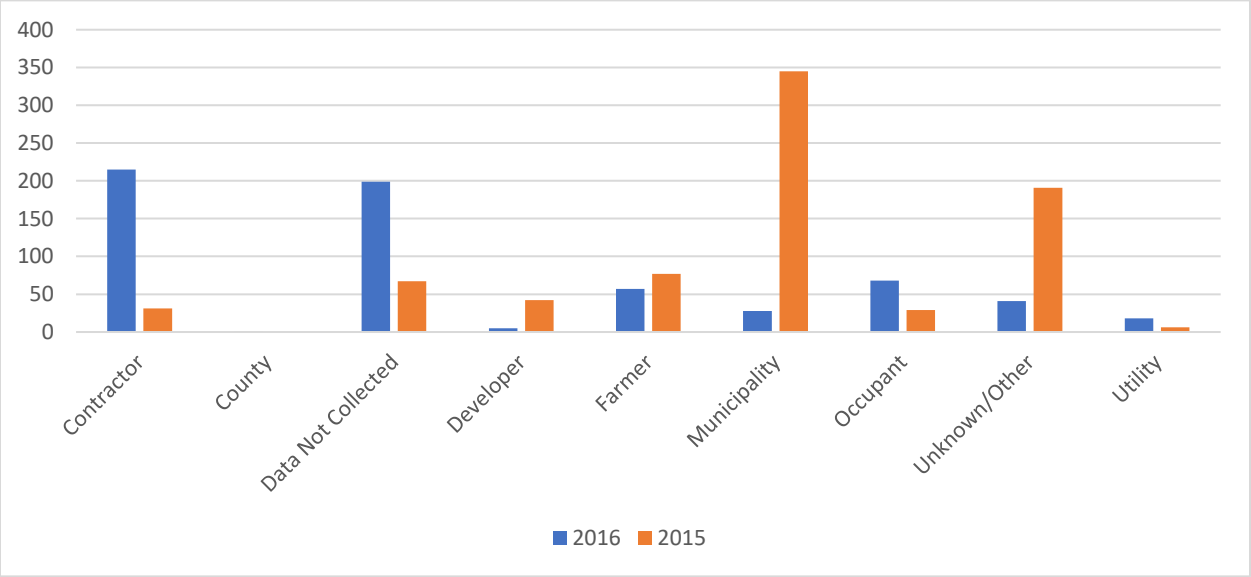


Figure 27: Saskatchewan events by excavator type, 2015-2016

Table 33 lists the volume of reported events in 2015 and 2016 by the category of work performed. With 241 events (30.6%), *Water* was the most common category, followed by *Street* (183, or 23.2%) and then *Energy/Telecommunications* (12.7%), with 222 events for which no data was collected (28.2%).

Table 33: Saskatchewan events by work performed

Work Performed	2015	2016	2016%	2015-2016%
Water	241	61	9.7	-74.7
Energy/Telecommunications	100	85	13.4	-15.0
Construction/Development	57	104	16.5	82.5
Street	183	30	4.7	-83.6
Landscaping/Fencing	11	49	7.8	345.5
Agriculture	70	30	4.7	-57.1
Unknown/Other	4	72	11.4	1700.0
Data not collected	122	201	31.8	64.8
Total	**788**	**632**	**100.0**	**-19.8**

In Figure 28, we see how *Water* and *Street* have increased significantly over the previous year, while *Data Not Collected* has actually decreased and *Energy/Telecommunications* has increased only slightly. Again, Saskatchewan's data is quite different from one year to the next.

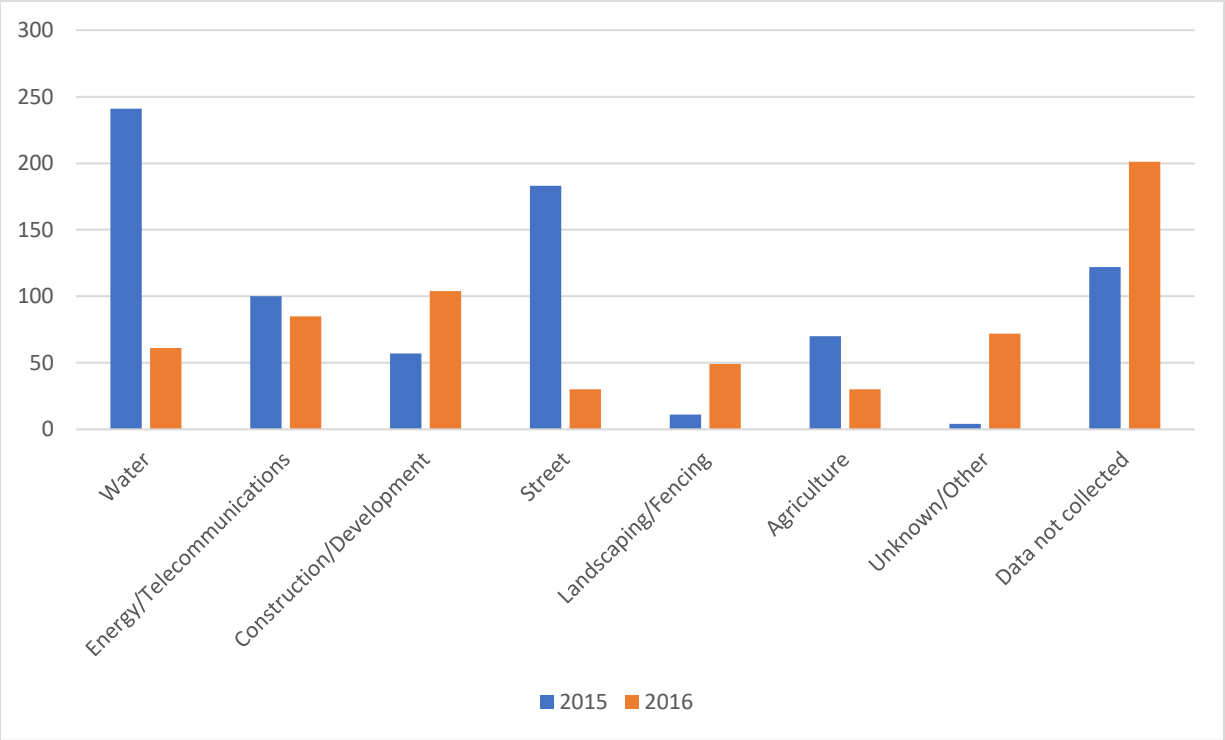


Figure 28: Saskatchewan events by work performed

Part E, F, G & H: Notification, Locating and Marking, Excavator Downtime, and Cost of Damage

Part D, E, F, and G account for excavation type, notification, locating and marking, and excavator downtime. As is stated above, there were 632 reported events reported in SK in 2016, down 19.8% from 2015. Table 34 contains statistics on reported events, locate requests, the number of notifications, and the calculated ratios of reported events to 1,000 locates and reported events to 1,000 notifications. In 2016, there were 130,622 locate requests and 385,795 notifications to Saskatchewan One-Call members, yielding a ratio of 3.0 notifications per locate request. The ratio of reported events per 1,000 locates was 4.8, and there was a ratio of 1.6 reported events per 1,000 notifications.

Table 34. One-Call notifications, locates, and damage ratios

One-Call Notification	2014	2015	2016	2015-2016 %	2014-2016%
Number of D. Events	682	788	632	-19.8%	-7.9
Number of Locates	137,427	141,964	130,622	-7.9%	-5.2
Damages/1000 Locates	5	5.6	4.8	-64.8%	-138.1
Notifications:Locates	2.6	5.4	3.0	-42.9%	13.3
Number of Notifications	356,733	768,501	385,795	-49.7%	7.5
Reported events:1000 Notif.	1.9	1.0	1.6	+60.0%	-18.8

Table 35 below presents the incidence of service interruptions among reported events in Saskatchewan in 2016, the first year that service interruptions are presented as part of the DIRT report. In Saskatchewan, 61.1% of all reported events led to some sort of service interruption, while data was not collected for 31.3% of all reported events.

Table 35: Saskatchewan events by service interruption occurrence, 2016

Service Interruption	2016	2016%
Yes	386	61.1
No	48	7.6
Data Not Collected	198	31.3
Total	632	100.0

Part I: Root Causes

The volume of reported events by root cause is summarized in Table 36 below. The primary root cause of reported damage events in Saskatchewan in 2015 was *Locating Practices Not Sufficient* with 403, or 51.1% of all events. This stands in contrast to 2016, when *Excavation Practices Not Sufficient* was the primary root cause.

Table 36: Saskatchewan events by root cause

Damage by Root Cause	2016 Events	2015 %	2015 Events	2015 %
One-Call Practices Not Sufficient	171	27.1%	58	7.4%
Locating Practices Not Sufficient	167	26.4%	403	51.1%
Excavation Practices Not Sufficient	253	40.0%	313	39.7%
Miscellaneous Root Cause	41	6.5%	14	1.8%
Total	632	100.0%	788	100.0%

Figure 29, the pie chart below, analyzes root cause in terms of subcategory (at greater precision than in Table 9) in order to identify more specific areas that may be targeted.

Figure 29 shows that *No notification made to one-call center* (26.9%), *Excavation practices not sufficient* (21.8%), and *Failure to maintain clearance* (15.8%) were the main drivers of reported events in Saskatchewan in 2016.

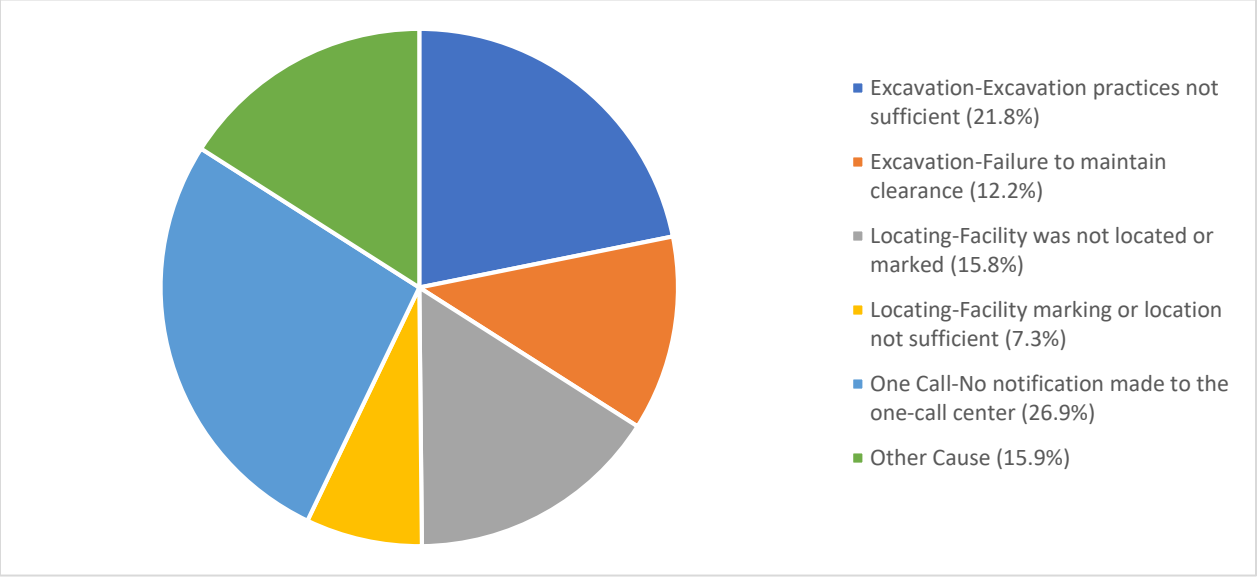


Figure 29: Saskatchewan events by root cause subcategory

Data Quality

The Data Quality Index (DQI) consists of the evaluation of each of the 632 damage records submitted in Saskatchewan in 2016. It is divided into 8 categories (A, B, C, D, EF, G, H, and I) representing each portion of the DIRT reporting form. Each individual form has a percentile score for each category, as well as an overall score for the entire form. These scores can then be averaged across all forms for each category.

In previous years the DIRT report would organize the percentile DQI scores into quintiles and compare the relative number of each form that fell into each quintile, per form section. New in the 2016 report, average scores for each form section have been calculated for 2015 and 2016. We believe this approach offers greater clarity and insight.

Table 37: Average DQI per DIRT form section, Saskatchewan, 2015-2016

DQI Averages	2015	2016	2015-2016%
Part A	100.0	100.0	0
Part B	41.4	38.3	-7.5
Part C	78.2	90.2	15.3
Part D	68.1	60.3	-11.5
Part EF	81.9	79.9	-2.4
Part G	11.9	33.0	177.3
Part H	63.7	63.2	-0.8
Part I	98.6	95.0	-3.7
Overall Average	**73.0**	**73.0**	0.0

Table 38 above shows how, although the overall average DQI per damage report submitted remained exactly 73.0, the year-over-year change varied widely between DIRT form sections. Part G's (Excavator Downtime) percentile score tripled to 33 from just under 12; part D (Excavator Information) decreased 11.5% and Part C (Affected Facility) improved 15.3% to a healthy DQI of 90.2. Other sections, such as section A, EF, H, and I remained more or less the same.

Recommendations

The following recommendations are intended to enhance industry efforts to reduce damage events and standardize the data collection process. Based on the analysis of the 2015 DIRT data, the recommendations are:

1. **Continue efforts to improve data Quality**
    a. **Focus on increasing the DQI of Part D.** The decline in data quality between 2015 and 2016 should be addressed.
    b. **Continue to encourage stakeholders to use DIRT.** By encouraging DIRT use among existing members, the entire reporting framework becomes more robust and useful to all.
    c. **Encourage stakeholders to re-visit reports.** To increase data quality and cut down on the number of "Data not collected" entries across several DIRT form sections, stakeholders should be encouraged to re-visit submitted reports if or when they have more information at a later date.
    d. **Attract more stakeholders to the BC DIRT framework.** With nearly all of reported events coming from the telecommunications industry every year, the diversity and robustness of the dataset in BC would increase with a greater variety of stakeholders reporting.
2. **Expand stakeholders**. Although more stakeholders reported in 2016 than in previous years, three stakeholder types (Electric, Natural Gas, and Telecommunications) accounted for almost 99% of all damage reports in 2016. Continuing efforts to expand this base will improve the breadth and quality of DIRT data in Saskatchewan.
3. **Location: Focus on Prince Albert, Weyburn, Kindersley and Estevan.** While Prince Albert has maintained well over 100 reported events in both years with data (2015 and 2016), Weyburn, Kindersley and Estevan are newly important locations at which to focus on reducing the incidence of underground infrastructure damage. Each has increased more than 200% year-over-year.
4. **Land Type: Focus on Private Land:** Private-Land Owner was the outstanding known land type for volume of reported events in 2016, with 216 events accounting for 34.2% of all events that year. No other known land type accounted for more than 50 of the year's 632 events.
5. **Equipment type: Focus on Hoe/Trencher.** Although the number of reported events associated with Hoe/Trencher work was down 30.7% compared to 2015, it remains the largest known category of equipment. Hoe/Trencher equipment was involved in 273 reported events, 43.2% of the 2016 total.
6. **Excavator: Focus on Contractor.** Contractors were involved in 34% (215) of all reported events in 2016, a big increase over the 31 events they were involved in in 2015.
7. **Work Performed: Focus on Construction/Development.** Construction work was responsible for 16.5% of reported events in 2016 with 104 instances.
8. **Notification: Encourage stakeholders to call; Improve Excavation Practices.** Over a quarter (26.9%) of reported events occurred without a call to the One Call centre. Ensuring that stakeholder's employees and contractors can and do call before digging is a clear way to reduce the incidence of damage events. Among reported events associated with excavation practice problems, 21.8% were marked with the generic "Excavation practices not sufficient" subcategory

and a further 12.2% were due to a failure to maintain clearance. Combined, over a third of reported events were related to poor excavation practices, indicating a second focus area for next year.

Appendix A: British Columbia Category Groupings

Geographic Area

Group	Administrative Region
Greater Vancouver	Greater Vancouver
Fraser Valley and Coastal BC	Central Kootenay, Fraser Valley, Powell River, Sunshine Coast
Interior	Cariboo, Central Okanagan, Columbia-Shuswap, East Kootenay, Kootenay Boundary, North Okanagan, Okanagan-Similkameen, Squamish-Lillooet, Thompson-Nicola
Northern	Fraser-Fort George, Northern Rockies, Peace River
Vancouver Island	Alberni-Clayquot, Capital, Comox-Strathcona, Cowichan Valley, Nanaimo

Excavator Grouping

Group	Type of Excavator
Contractor	Contractor
County	County
Data Not Collected	Data Not Collected
Developer	Developer
Farmer	Farmer
Municipality	Municipality
Occupant	Occupant
Unknown/Other	Unknown/Other
Utility	Utility

Excavation Equipment Grouping

Group	Type of Equipment
Hoe/Trencher	Backhoe, Trackhoe, Trencher
Hand Tools	Hand Tools, Probe
Drilling	Auger, Bore, Directional Drill, Drill
Vacuum Equipment	Vacuum Equipment
Other	Farm Implement, Grader, Scraper, Road Milling Equipment, Explosives

Work Performed

Group	Type of Work
Water	Sewer, Water
Energy/Telecommunications	Natural gas, Electric, Steam, Liquid Pipe, Telecom, Cable TV
Construction/Development	Construction, Site Development, Grading, Drainage, Driveway, Demolition, Engineering, Railroad, Waterway
Street	Roadwork, Curb/Sidewalk, Storm drainage, Milling, Pole, Traffic Signals/Signs, Streetlight, Public Transit
Landscaping/Fencing	Landscaping, Fencing
Agriculture	Agriculture, Irrigation

Root Cause

Group	Root Cause
Excavation Practices Not Sufficient	Failure to maintain clearance, Failure to support exposed facilities, Failure to use hand tools where required, Failure to test hole (pot-hole), Improper backfill practices, Failure to maintain marks
One-Call Practices Not Sufficient	No notification made to One-Call centre, Notification made but not sufficient, Wrong information provided
Locating Practices Not Sufficient	Incorrect facility records/maps, Marking or location not sufficient, Facility not located or marked, Facility could not be found or located
Misc. Root Cause	Abandoned, One-Call centre error, Deteriorated, Previous Damage

Appendix B: Alberta Category Groupings

Geographic Area

Group	County
Edmonton	Barrhead, Westlock, Thorhild, Smoky Lake, St Paul, Bonnyville, Lac St Anne, Sturgeon, Lamont, Strathcona, Two Hills, Minburn, Vermillion, Brazeau, Parkland, Leduc, Wetaskiwin, Camrose, Beaver
Calgary	Bighorn, Mountain View, Kneehill, Starland, Special Area 2, 3 and 4, Kananaskis Country, Foothills, Rocky View, Wheatland
North	Mackenzie, Wood Buffalo, Northern Lights, Clear Hills, East Peace, Saddle Hills, Birch Hills, Smoky River, Big Lakes, Lesser Slave, Athabasca, Lakeland, Greenview, Woodlands
Central	Yellowhead, Clearwater, Ponoka, Lacombe, Stettler, Flagstaff, Wainright, Paint Earth, Provost, Red Deer
South	Newell, Pincher Creek, Willow Creek, Lethbridge, Taber, Cardston, Warner, 40 Mile

Excavator Grouping

Group	Type of Excavator
Contractor	Contractor
County	County
Data Not Collected	Data Not Collected
Developer	Developer
Farmer	Farmer
Municipality	Municipality
Occupant	Occupant
Unknown/Other	Unknown/Other
Utility	Utility

Excavation Equipment Grouping

Group	Type of Equipment
Hoe/Trencher	Backhoe, Trackhoe, Trencher
Hand Tools	Hand Tools, Probe
Drilling	Auger, Bore, Directional Drill, Drill
Vacuum Equipment	Vacuum Equipment
Unknown/Other	Farm Implement, Grader, Scraper, Road Milling Equipment, Explosives

Work Performed

Group	Type of Work
Water	Sewer, Water
Energy/Telecommunications	Natural gas, Electric, Steam, Liquid Pipe, Telecom, Cable TV
Construction/Development	Construction, Site Development, Grading, Drainage, Driveway, Demolition, Engineering, Railroad, Waterway
Street	Roadwork, Curb/Sidewalk, Storm drainage, Milling, Pole, Traffic Signals/Signs, Streetlight, Public Transit
Landscaping/Fencing	Landscaping, Fencing
Agriculture	Agriculture, Irrigation
Unknown/Other	Unknown/Other

Root Cause

Group	Root Cause
Excavation Practices Not Sufficient	"Excavation practices not sufficient", Failure to maintain clearance, Failure to support exposed facilities, Failure to use hand tools where required, Failure to test hole (pot-hole), Improper backfill practices, Failure to maintain marks
One-Call Practices Not Sufficient	No notification made to One-Call centre, Notification made but not sufficient, Wrong information provided
Locating Practices Not Sufficient	Incorrect facility records/maps, Marking or location not sufficient, Facility not located or marked, Facility could not be found or located
Misc. Root Cause	Abandoned, One-Call notification centre error, Deteriorated, Previous Damage, Other

Appendix C: Saskatchewan Category Groupings

Geographic Area

Group	County
Saskatoon	N/A
North Battleford	
Swift Current	
Regina	
Weyburn	
Prince Albert	
Yorkton	
Moose Jaw	
Kindersley	
Estevan	

Excavator Grouping

Group	Type of Excavator
Contractor	Contractor
County	County
Data Not Collected	Data Not Collected
Developer	Developer
Farmer	Farmer
Municipality	Municipality
Occupant	Occupant
Unknown/Other	Unknown/Other
Utility	Utility

Excavation Equipment Grouping

Group	Type of Equipment
Hoe/Trencher	Backhoe, Trackhoe, Trencher
Hand Tools	Hand Tools, Probe
Drilling	Auger, Bore, Directional Drill, Drill
Vacuum Equipment	Vacuum Equipment
Unknown/Other	Farm Implement, Grader, Scraper, Road Milling Equipment, Explosives

Work Performed

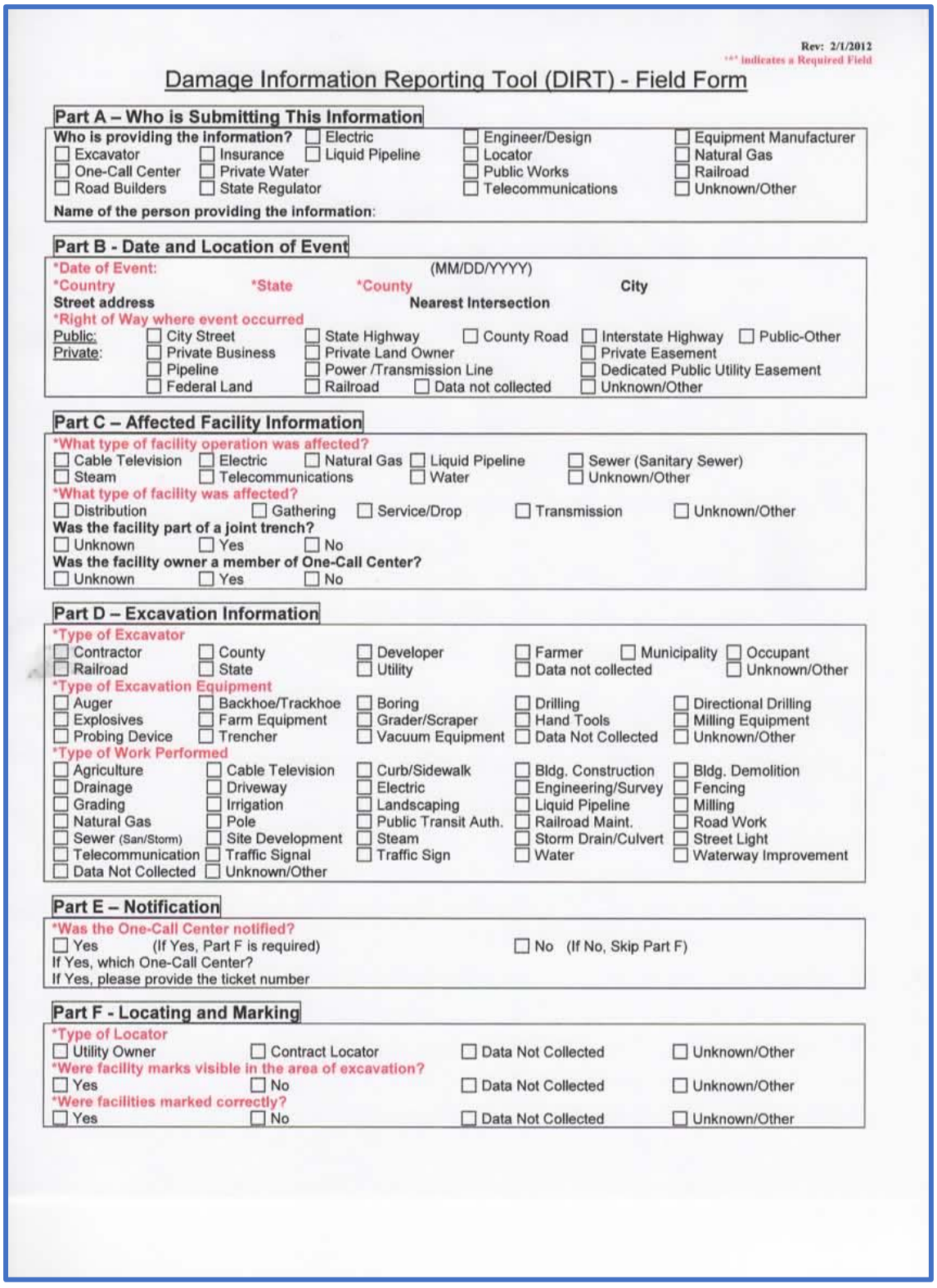
Group	Type of Work
Water	Sewer, Water
Energy/Telecommunications	Natural gas, Electric, Steam, Liquid Pipe, Telecom, Cable TV
Construction/Development	Construction, Site Development, Grading, Drainage, Driveway, Demolition, Engineering, Railroad, Waterway
Street	Roadwork, Curb/Sidewalk, Storm drainage, Milling, Pole, Traffic Signals/Signs, Streetlight, Public Transit
Landscaping/Fencing	Landscaping, Fencing
Agriculture	Agriculture, Irrigation
Unknown/Other	Unknown/Other

Root Cause

Group	Root Cause
Excavation Practices Not Sufficient	Failure to maintain clearance, Failure to support exposed facilities, Failure to use hand tools where required, Failure to test hole (pot-hole), Improper backfill practices, Failure to maintain marks

One-Call Practices Not Sufficient	No notification made to One-Call centre, Notification made but not sufficient, Wrong information provided
Locating Practices Not Sufficient	Incorrect facility records/maps, Marking or location not sufficient, Facility not located or marked, Facility could not be found or located
Misc. Root Cause	Abandoned, One-Call centre error, Deteriorated, Previous Damage, Data Not Collected

Appendix C: Damage Information Reporting Field Form



Rev: 2/1/2012
"*" Indicates a Required Field

Damage Information Reporting Tool (DIRT) - Field Form

Part A – Who is Submitting This Information

Who is providing the information?

☐ Electric ☐ Engineer/Design ☐ Equipment Manufacturer
☐ Excavator ☐ Insurance ☐ Liquid Pipeline ☐ Locator ☐ Natural Gas
☐ One-Call Center ☐ Private Water ☐ Public Works ☐ Railroad
☐ Road Builders ☐ State Regulator ☐ Telecommunications ☐ Unknown/Other

Name of the person providing the information:

Part B - Date and Location of Event

*Date of Event: (MM/DD/YYYY)
*Country *State *County City
Street address **Nearest Intersection**
*Right of Way where event occurred
Public: ☐ City Street ☐ State Highway ☐ County Road ☐ Interstate Highway ☐ Public-Other
Private: ☐ Private Business ☐ Private Land Owner ☐ Private Easement
☐ Pipeline ☐ Power /Transmission Line ☐ Dedicated Public Utility Easement
☐ Federal Land ☐ Railroad ☐ Data not collected ☐ Unknown/Other

Part C – Affected Facility Information

*What type of facility operation was affected?
☐ Cable Television ☐ Electric ☐ Natural Gas ☐ Liquid Pipeline ☐ Sewer (Sanitary Sewer)
☐ Steam ☐ Telecommunications ☐ Water ☐ Unknown/Other
*What type of facility was affected?
☐ Distribution ☐ Gathering ☐ Service/Drop ☐ Transmission ☐ Unknown/Other
Was the facility part of a joint trench?
☐ Unknown ☐ Yes ☐ No
Was the facility owner a member of One-Call Center?
☐ Unknown ☐ Yes ☐ No

Part D – Excavation Information

*Type of Excavator
☐ Contractor ☐ County ☐ Developer ☐ Farmer ☐ Municipality ☐ Occupant
☐ Railroad ☐ State ☐ Utility ☐ Data not collected ☐ Unknown/Other
*Type of Excavation Equipment
☐ Auger ☐ Backhoe/Trackhoe ☐ Boring ☐ Drilling ☐ Directional Drilling
☐ Explosives ☐ Farm Equipment ☐ Grader/Scraper ☐ Hand Tools ☐ Milling Equipment
☐ Probing Device ☐ Trencher ☐ Vacuum Equipment ☐ Data Not Collected ☐ Unknown/Other
*Type of Work Performed
☐ Agriculture ☐ Cable Television ☐ Curb/Sidewalk ☐ Bldg. Construction ☐ Bldg. Demolition
☐ Drainage ☐ Driveway ☐ Electric ☐ Engineering/Survey ☐ Fencing
☐ Grading ☐ Irrigation ☐ Landscaping ☐ Liquid Pipeline ☐ Milling
☐ Natural Gas ☐ Pole ☐ Public Transit Auth. ☐ Railroad Maint. ☐ Road Work
☐ Sewer (San/Storm) ☐ Site Development ☐ Steam ☐ Storm Drain/Culvert ☐ Street Light
☐ Telecommunication ☐ Traffic Signal ☐ Traffic Sign ☐ Water ☐ Waterway Improvement
☐ Data Not Collected ☐ Unknown/Other

Part E – Notification

*Was the One-Call Center notified?
☐ Yes (If Yes, Part F is required) ☐ No (If No, Skip Part F)
If Yes, which One-Call Center?
If Yes, please provide the ticket number

Part F - Locating and Marking

*Type of Locator
☐ Utility Owner ☐ Contract Locator ☐ Data Not Collected ☐ Unknown/Other
*Were facility marks visible in the area of excavation?
☐ Yes ☐ No ☐ Data Not Collected ☐ Unknown/Other
*Were facilities marked correctly?
☐ Yes ☐ No ☐ Data Not Collected ☐ Unknown/Other

Rev: 2/1/2012
'*' indicates a Required Field

Part G – Excavator Downtime

Did Excavator incur down time?
☐ Yes ☐ No

If yes, how much time?
☐ Unknown ☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 or more hours Exact Value _____

Estimated cost of down time?
☐ Unknown ☐ $0 ☐ $1 to 500 ☐ $501 to 1,000 ☐ $1,001 to 2,500 ☐ $2,501 to 5,000
☐ $5,001 to 25,000 ☐ $25,001 to 50,000 ☐ $50,001 and over Exact Value _____

Part H – Description of Damage

*Was there damage to a facility?
☐ Yes ☐ No (i.e. near miss)

*Did the damage cause an interruption in service?
☐ Yes ☐ No ☐ Data Not Collected ☐ Unknown/Other

If yes, duration of interruption
☐ Unknown ☐ Less than 1 hour ☐ 1 to 2 hrs ☐ 2 to 4 hrs ☐ 4 to 8 hrs ☐ 8 to 12 hrs ☐ 12 to 24 hrs
☐ 1 to 2 days ☐ 2 to 3 days ☐ 3 or more days ☐ Data Not Collected Exact Value _____

Approximately how many customers were affected?
☐ Unknown ☐ 0 ☐ 1 ☐ 2 to 10 ☐ 11 to 50 ☐ 51 or more Exact Value _____

Estimated cost of damage / repair/restoration
☐ Unknown ☐ $0 ☐ $1 to 500 ☐ $501 to 1,000 ☐ $1,001 to 2,500 ☐ $2,501 to 5,000
☐ $5,001 to 25,000 ☐ $25,001 to 50,000 ☐ $50,001 and over Exact Value _____

Number of people injured
☐ Unknown ☐ 0 ☐ 1 ☐ 2 to 9 ☐ 10 to 19 ☐ 20 to 49 ☐ 50 to 99
☐ 100 or more Exact Value _____

Number of fatalities
☐ Unknown ☐ 0 ☐ 1 ☐ 2 to 9 ☐ 10 to 19 ☐ 20 to 49 ☐ 50 to 99
☐ 100 or more Exact Value _____

*Part I – Description of the Root Cause *Please choose one

One-Call Notification Practices Not Sufficient
☐ No notification made to the One-Call Center
☐ Notification to one-call center made, but not sufficient
☐ Wrong information provided to One Call Center

Excavation Practices Not Sufficient
☐ Failure to maintain marks
☐ Failure to support exposed facilities
☐ Failure to use hand tools where required
☐ Failure to test-hole (pot-hole)
☐ Improper backfilling practices
☐ Failure to maintain clearance
☐ Other insufficient excavation practices

Locating Practices Not Sufficient
☐ Facility could not be found or located
☐ Facility marking or location not sufficient
☐ Facility was not located or marked
☐ Incorrect facility records/maps

Miscellaneous Root Causes
☐ One-Call Center error
☐ Abandoned facility
☐ Deteriorated facility
☐ Previous damage
☐ Data Not Collected
☐ Other

Part J – Additional Comments

Visit DIRT at www.cga-dirt.com

If any questions, contact lphillips@digline.com

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August 2017