DIRT
Damage Information Reporting Tool

2013
Analysis & Recommendations

Volume 10

CGA
Common Ground Alliance

811

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CGA™
Common Ground Alliance

Dear Damage Prevention Stakeholders,

The founders of CGA knew that the only effective way to create best practices, educational campaigns, technologies, and laws was to ensure they were implemented in reaction to data and not because of anecdotes or "hunches."

Nearly a decade has passed since the first Damage Information Reporting Tool (DIRT) Report was released, and we've seen significant growth during that time. Annual submissions have grown ten-fold, and the 2013 DIRT Report features submissions from more sources than ever before.

The Data Reporting and Evaluation Committee spent hundreds of volunteer hours during the past year requesting, collecting, analyzing, and reporting on data submitted in 2013, making this the most comprehensive report to date.

There is plenty of encouraging news in this report, starting with the finding that **damages are down by approximately 5% compared to last year.** With incoming tickets up 8% year over year and construction spending also up, this is a very encouraging statistic. The committee also examined the connection between events and 1) ticket life and 2) tolerance zone size, providing stakeholders with data that could help guide future legislative efforts.

Many data fields remain consistent, confirming our confidence in those conclusions while also challenging our industry to not be satisfied with remaining at these plateaus. The percentage of events attributed to "no notification made" remained at about **25%** of all reported incidents. The report again confirms that a locate request made to a one call center results in the excavation occurring without incident over **99%** of the time. Our goal for these percentages should continue to be 0% and 100%, respectively.

But how do we get there? There are **three reasons** people don't request a locate:

- They don't know that the service exists,
- they choose not to use the service,
- or they are exempt (or think they are) from having to request a locate.

I challenge all stakeholders to examine their public awareness programs, any exemptions to one call laws, and their enforcement mechanisms to determine if any of these need changes or improvements to help reduce "no call" events, which in turn will reduce damages, injuries, and fatalities.

The data collected for the annual DIRT Report can continue to improve, as well. If your organization did not submit data for the 2013 DIRT Report, I hope you'll consider submitting it for the 2014 Report. And if you always submit, please be sure to complete as many data fields as possible. This applies to the One Call Systems International (OCSI) data also, because the Committee continues to find innovative ways to integrate the OSCI and DIRT data.

More data and better data will produce better analysis and conclusions, which will lead to the right programs and legislation that can produce the improvement we all seek. Thank you for your support.

Sincerely,

Robert Kipp
CGA President

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Table of Contents

Introduction

The Damage Information Reporting Tool (DIRT) is the result of the efforts of the Common Ground Alliance (CGA), through its Data Reporting & Evaluation Committee (DR&EC or Committee), to gather meaningful data regarding the occurrence of facility 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 factors leading to events.

CGA's primary purpose is the promotion of safe underground excavation practices and the prevention of damages, of which DIRT serves an important role. While DIRT itself does not have the capabilities to prevent underground excavation damages, it is a unique industry asset because it can identify opportunities to do so. Additionally, DIRT is able to measure the effectiveness of potential excavation and locating training programs and outreach efforts. Therefore, this report will be useful in developing educational programs and/or best practices that will aid in the prevention of future underground excavation damages.

This annual DIRT report provides a summary and analysis of the submitted events occurring during the year 2013. For 2013, 224,616 events were submitted, approximately 8,000 less than were submitted for 2012. It is positive to note that this 3.5% reduction in events is not the result of lower industry participation; instead the opposite is true. 2013 saw an overall 10% increase in the number of locate requests being made. Combined, these figures demonstrate the importance of participation, and it is the hopes of the CGA that this reporting trend continues.

As in prior years, the Committee reviewed the data collected for all of the DIRT elements. While not all of this information is included in this report, it is published and available online at http://www.damagereporting.org/annual.

Reported Events and Total Damages Estimate

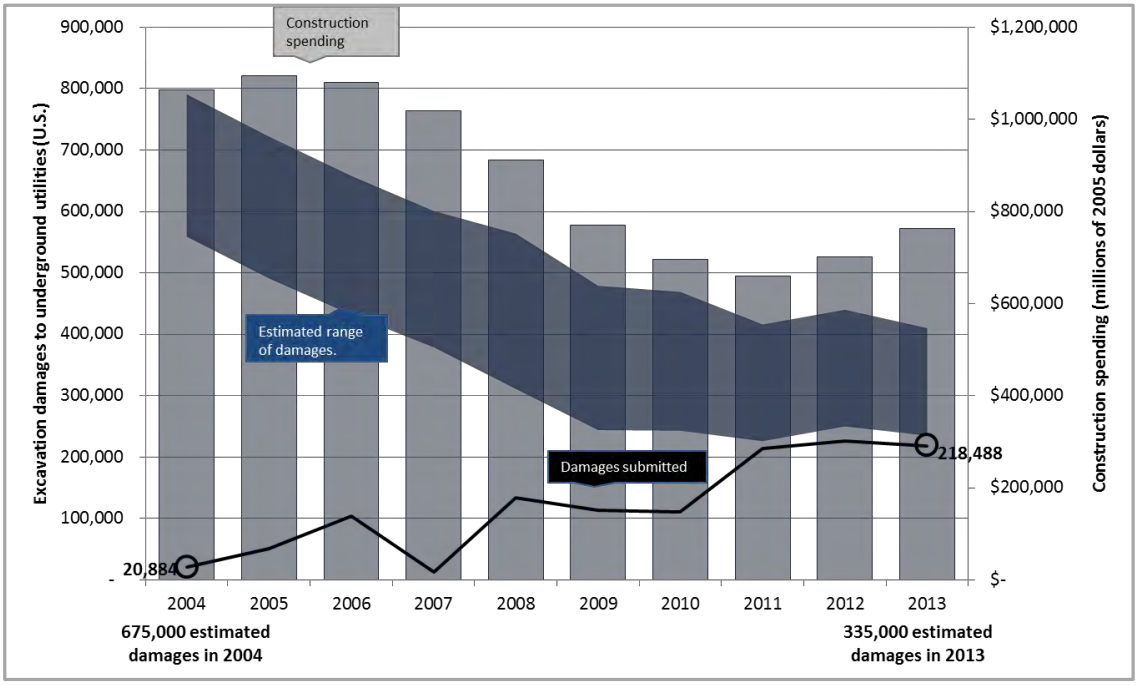
The number of events submitted to DIRT in 2013 totals 224,616 (for Canada and the U.S.). This is 8,101 fewer events than were reported in 2012.

The estimate for the total number of damages occurring in the U.S. is developed from a linear regression model using information from states that seemed to have a substantial number of damages reported. Substantial reporting was determined by reviewing state regulations and statutes, OCSI (One Call Systems International)[1] and PHMSA (Pipeline Hazardous Material Safety Administration) state classifications, a survey of state pipeline safety representatives conducted by the Committee, and a review of the number of events reported to DIRT in each state. Based on this research, the team identified 16 states believed to have substantial reporting due to their legislative requirements and/or an entity such as a PSC (Public Service Commission), PUC (Public Utility Commission) or one call center with a Virtual Private Dirt (VPD)[2] that submits data to DIRT. These states submitted 138,659 of the 218,488 total events submitted to DIRT from all U.S. states (6,128 events were near misses where no facilities were damaged)[3]. These states are Colorado, Connecticut, Georgia, Illinois, Indiana, Kansas, Michigan, New Mexico, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia, Washington and Wyoming.

The variables used in the model include building permits, construction spending put in place, infrastructure, land area, population, and population density. This analysis suggests that the estimated total number of underground excavation damages is approximately 335,000 (see Exhibit 1). The 2013 estimate represents a decrease from the estimated 350,000 damages of 2012. For states where both 2012 and 2013 one call center data is available, there was an 8% increase in the total number of locate requests received in 2013. In addition, construction spending put in place increased in 2013 by approximately 7.4%. All else being equal, a higher number of damages would be expected based on these two variables. Therefore, the decrease for 2013 may suggest actual improvement and that efforts to promote safer practices are indeed leading to fewer damages.

[1] OCSI is a CGA sub-committee comprised of one call center representatives and other industry professionals whose mission is to promote facility damage prevention and infrastructure protection through education, guidance and assistance to one call centers internationally.
[2] For more information about VPD, go to: http://www.cga-dirt.com/virtual/VirtualDIRTOverview.pdf
[3] Events identified as near misses were excluded from this report's analyses.

Exhibit 1: Estimated number of total underground utility damages resulting from excavation (U.S.)



As first introduced in the 2010 DIRT report, the damages per 1,000 locate requests may be a more compelling measurement of underground excavation damage prevention efforts. Using data from 38 one call centers that had available information for incoming notifications and damages for 2013, a rate of 8.78 damages per 1,000 locate requests is calculated.

However, one of the weaknesses of this analysis is that although it uses data from locations where incoming notification volume is available, not all of these locations have what the Committee considers "substantial" reporting of damages, and therefore the data necessary for an accurate calculation is not present. In addition, the denominator for this metric is incoming notifications to the one call center, and each incoming notification can result in multiple outgoing transmissions sent to member facility operators; such as gas, electric, telephone, sewer, water, cable TV, etc. Since there is potential for multiple facilities to be damaged on the same locate request, each individual facility operator represents an opportunity for a damage to occur. Therefore, a more meaningful way to calculate a damage rate is to use outgoing transmissions to the facility operators. This would provide a value similar to the value an individual operator using this metric would experience, since an outgoing transmission from the one call center is an incoming locate request for each facility operator. This realization, coupled with improved data from OCSI on incoming notifications and outgoing transmission volumes, allows us to calculate this measure more simply and directly by using the available data on a national scale, as follows:

- Estimate of 2013 total U.S. damages = 335,000
- Total incoming notifications for 2013 for the 40 U.S. one call centers reporting to OCSI = 22,201,183
- Using the same methodology to calculate the estimated total U.S. damages, and extrapolating from the 22,201,183 above, estimated total U.S. 2013 locate requests = 28,000,000
- From OCSI U.S. locations that reported both outgoing transmissions and incoming notifications, the ratio = 5.78

  Assuming that ratio remains valid for the non-reporting U.S. OCSI locations,

335,000 / [(28,000,000 * 5.78) / 1000] = 2.07 damages per 1,000 outgoing transmissions

It is important to keep in mind that locate request criteria vary from state to state. Requirements for submitting locate requests, such as length or size of the excavation (e.g., a city block, 1 mile, or from county line to county line, etc.), life of the ticket (e.g., 14 business days, 30 calendar days, indefinite), and notification exemptions, will affect how many locate requests may be submitted in a particular state.

For these reasons, users of the metric need to keep in mind how the number is derived when attempting comparisons, whether they be state vs. state, operator vs. operator, or state vs. operator. However, the metric remains valuable as a means for states and operators to measure their own "Damages per 1,000 locate requests" data in a year-over-year basis to ensure that improvement is being made.

Underground Damage Prevention Analysis

During any excavation project, there are three major opportunities to minimize the likelihood of damage to underground facilities.

1. Requesting that the underground facilities be located in the area to be excavated, typically by contacting 811

2. Correctly marking the underground facilities (i.e., fulfilling the locate request)

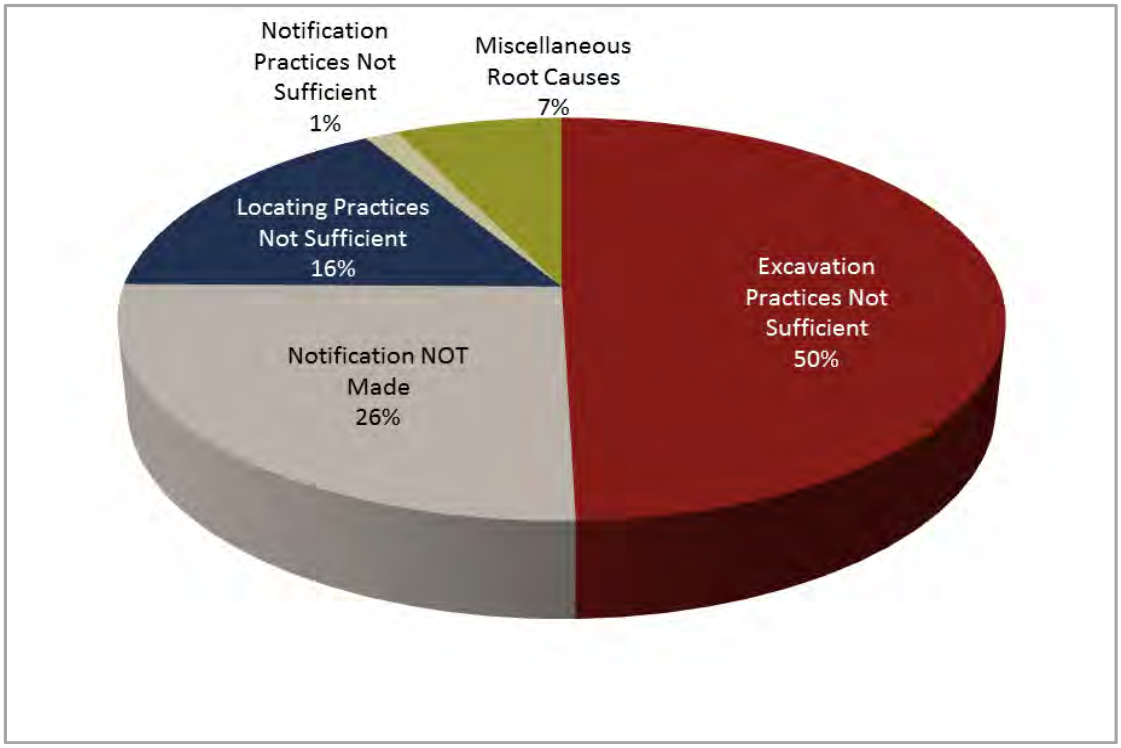
3. Employing proper excavation techniques given the site characteristics and conditions (e.g., maintaining clearance, maintaining marks, supporting exposed facilities, using hand tools when appropriate)

The DIRT damage root cause groups reflect these three major points of opportunity, and the analysis of additional data elements provides insights to the more common attributes associated with each damage root cause group. This results in the ability to more effectively direct efforts and resources that will most reduce the likelihood of future excavation damages to underground facilities.

A damage root cause was reported for slightly more than 73% of all events submitted to DIRT for 2013. The traditional categorization of these damage root cause groups aligns with the three major points of

opportunity described above and accounts for 92% of the reported damage root causes (see Exhibit 2). *Excavation practices not sufficient* was the most common damage root cause group reported in 2013 (50% of known events).

Exhibit 2: Distribution of known events by root cause group[4]



Excavation practices not sufficient damage root cause group increased as a percentage of all damage root cause groups. A concurrent decrease in the percentage of events attributed to the *Notification NOT made* and *Locating practices not sufficient* damage root cause groups has occurred over the past four years. This does not necessarily suggest worsening excavation practices; more likely, greater public awareness concerning the importance of submitting locate requests and improved facility marking techniques led to this natural outcome. For example, 74% of events that included facility damages were preceded by a locate request in 2013. Ideally, this percentage should eventually reach 100%, which could potentially eliminate *Notification NOT made* as a reported damage root cause.

1) <u>Was a locate request made prior to excavation?</u>

Submitting a locate request continues to prove the most effective means of preventing underground excavation damages. Recent annual DIRT reports have noted that less than 1% of underground

[4] Events that included facility damages (Part H).

excavations preceded by a locate request result in damages. This year, we reaffirm that statement, but arrive at a new method that we believe is more valid, based on a more complete dataset.

By examining 15 states[5] that are considered to have "substantial reporting" and available OCSI data on outgoing transmissions, we calculate that damages with a locate request divided by transmissions equals 0.12 %.

By using the available national data described above in conjunction with Exhibit 2, we calculate

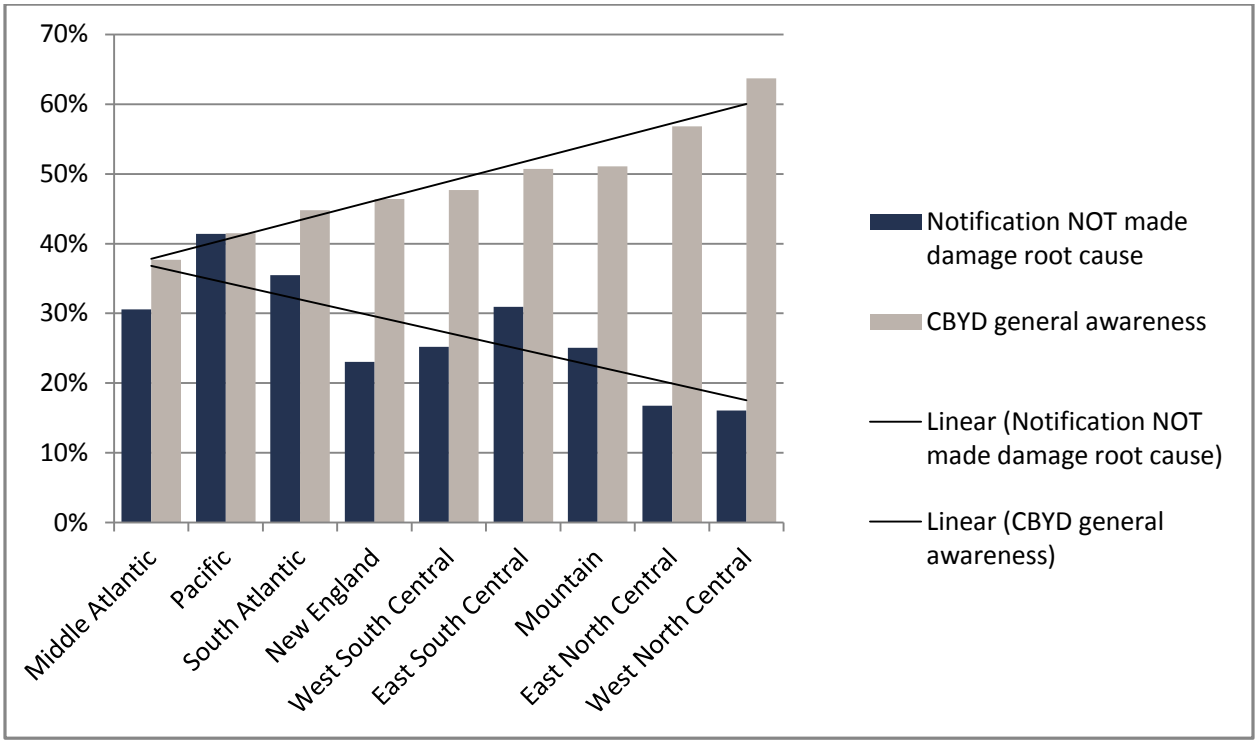
- 26% notification not made + 1% notification not sufficient = 27%
- 335,000 * 0.27 = 90,450 damages without a locate request
- Damages with a locate request = 335,000 – 90,450 = 244,550
- Outgoing transmissions = incoming * (outgoing/incoming ratio) = 28,000,000 * 5.78 = 161,840,000
- Damages with a locate request over total U.S. outgoing transmissions = 244,550 / 161,840,000 = 0.15%

Using outgoing transmissions is the equivalent of saying that an excavator making one call to 811 is on average actually notifying approximately 6 underground facility operators, and there's 0.15% chance of damaging any one of them–i.e., 0.15% chance of damaging the natural gas facility, 0.15 % chance of damaging the communications facility, etc. However, the statement that 1% of underground excavations preceded by a locate request result in damages remains valid if just incoming notices are used: 244,550 / 28,000,000 = .0087 = 0.87%. This is equivalent to saying that by making one call to 811, there is a 0.87% chance of damages occurring to one of the facility operators in the project area. In other words, by contacting 811, the excavator has less than a 1% chance of being involved in a damage event.

A survey conducted by Common Ground Alliance in 2013 identified "Call Before You Dig" general awareness by the nine U.S. census divisions. Awareness ranged from a low of 42.1% in the Northeast to a high of 60.3% in the Midwest. Generally speaking, as awareness increases, the percentage of events attributed to *Notification NOT made* decreases (see Exhibit 3).

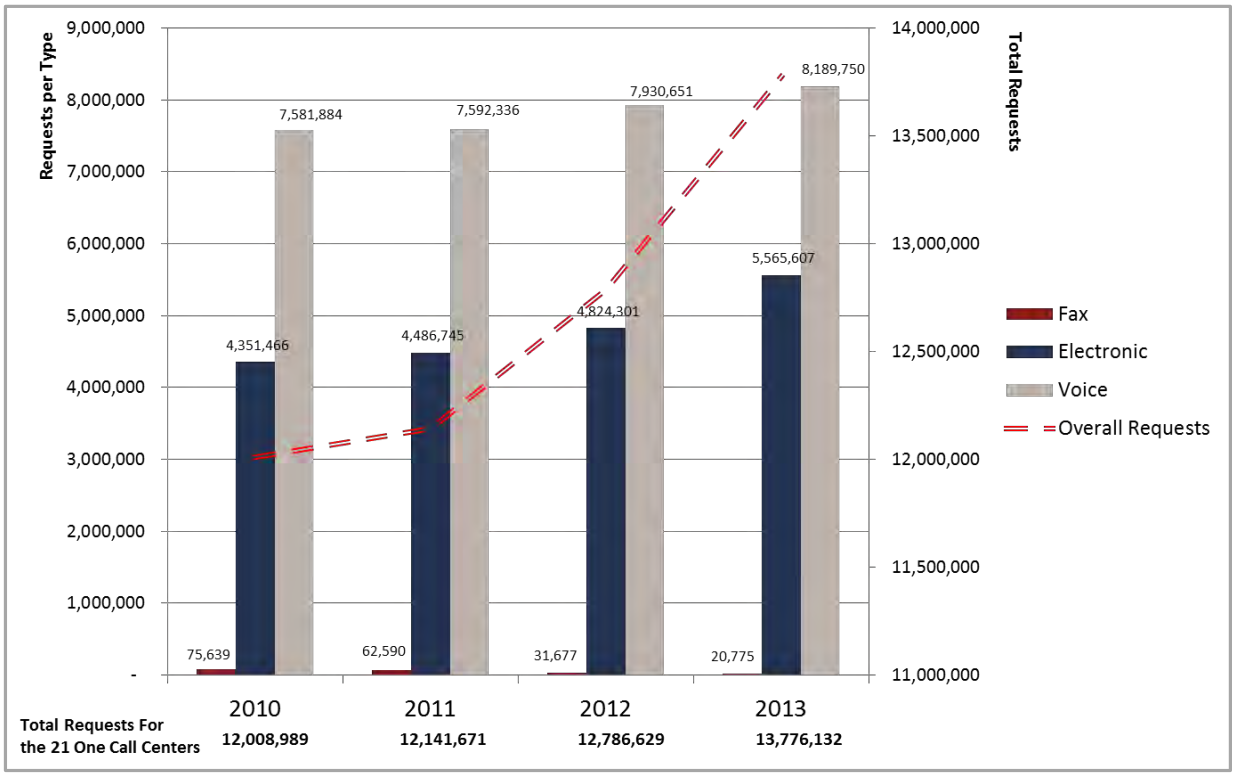
[5] Of the 16 "substantial reporting" states, one did not provide information for outgoing transmissions. As a result, only 15 "substantial reporting" states were used for analyses involving outgoing transmissions.

Exhibit 3: Comparison of "Call Before You Dig" (CBYD) general awareness and percentage of events attributed to the Notification NOT made *damage root cause by U.S. census division (2013)*



Over the past 4 years, there have been 21 one call centers that have consistently had locate request information submitted to OCSI. For these 21 one call centers, a positive trend can be seen in the amount of incoming locate requests made prior to excavation. As seen in Exhibit 4, total incoming requests for these one call centers has increased by approximately 14.7% from 2010 to 2013. During this time frame, requests made by fax have decreased 72.5% from 2010, and fax requests account for only 0.15% of all requests made in 2013. Conversely, during this period electronic requests have increased 28%. In 2013, electronic requests make up approximately 40.4% of all requests, a significant increase from 36.2% in 2011. It would appear based off this analysis that the trend in incoming locate requests is shifting toward electronic request methods and away from traditional voice and fax methods. This can further be observed through the decrease in voice requests as a percentage of total requests from 2011 to 2013 – 63.1% vs. 59.4%.

Exhibit 4: OCSI incoming requests from 2010—2013, by type, for 21 one call centers where comparison is possible for all years, including breakdown by request type[6]



The percentage of underground excavation damages that were not preceded by a locate request varies by excavator group as illustrated in Exhibit 5. Occupants and farmers were the least likely to notify a one call center prior to underground excavation in 2013; two-thirds (66%) of damages involving this excavator group were not preceded by a locate request. In addition, occupant/farmer was the only excavator group for which *Notification NOT made* represented more than half of the damage root causes reported (66%).

[6] The estimate of 28 million incoming notifications used above in the estimate of total U.S. damages was extrapolated from 40 one call locations that provided data for 2013. Exhibit 4 uses 21 one call centers that provided data for all years 2010—2013, which is why the numbers are lower.

Exhibit 5: Locate request by excavator group[7]

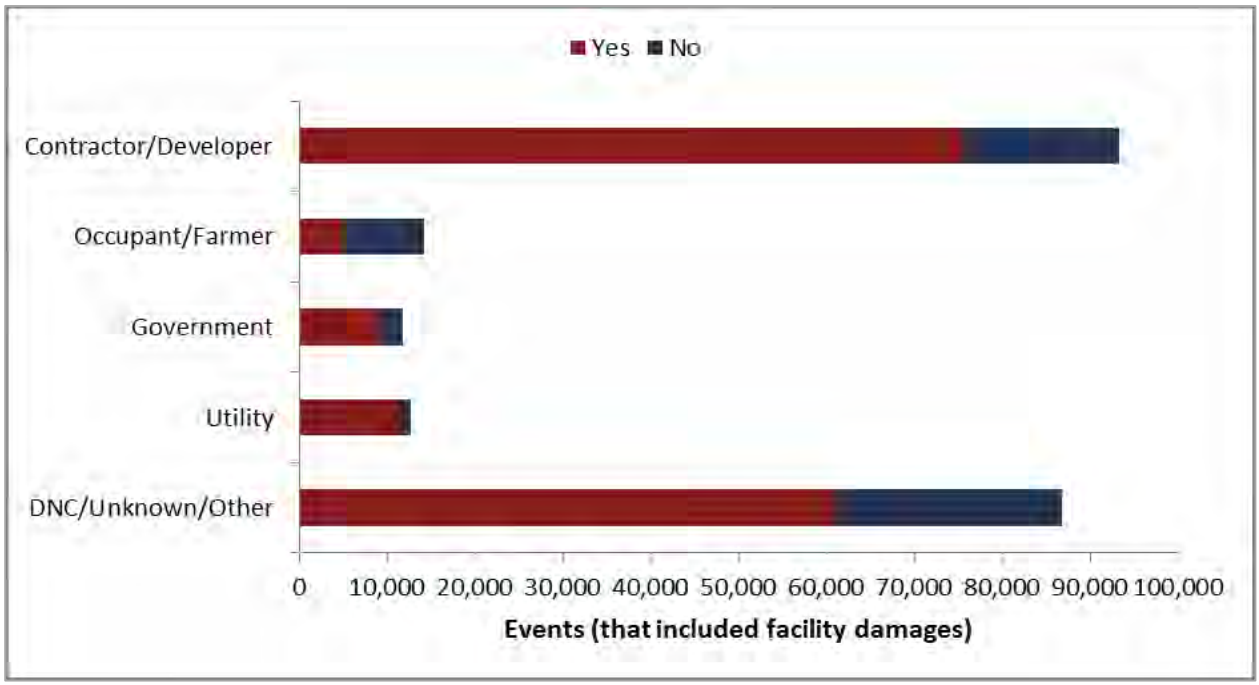
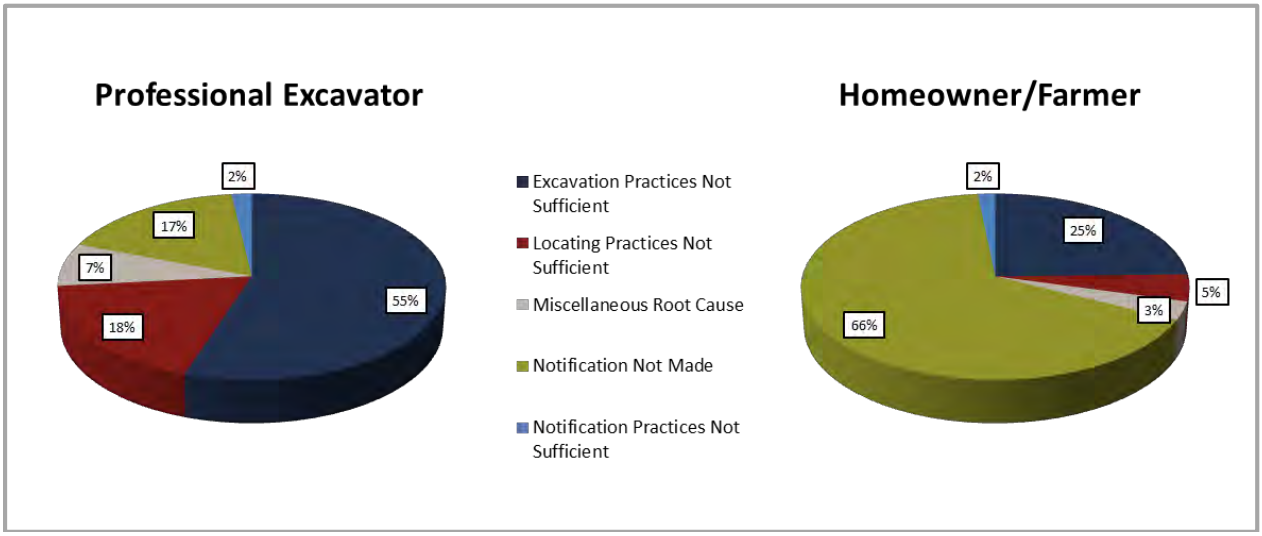


Exhibit 6: Known damage root cause comparison for professional excavators vs. homeowner/farmer excavators



[7] Appendix 1 contains the lists of groupings used in this report.

2) Was the facility properly marked?

The damage root cause group *Locating Practices Not Sufficient* is made up of several root causes. These include *Facility could not be found or located*; *Facility marking or location not sufficient*; *Facility was not located or marked*; and *Incorrect facility records/maps*. *Facility Marking or Location Not Sufficient* was the most commonly reported subgrouping (63%), followed by *Facility not located or marked* (24%). Of the events that included facility damages, and for which a locate request was made and the damage root cause group was reported as *Locating Practices Not Sufficient*, the majority (65%) had visible but incorrect markings, and 35% had markings not visible (possibly not made at all).

3) Was the site properly excavated?

Insufficient excavation practices were the leading root cause of damage to underground facilities reported to DIRT for 2013 (comprising 50% of known root cause groups selected). The majority of events under the root cause group *Excavation Practices Not Sufficient* (85.6%) lack a detailed description of the cause for insufficiency (see Exhibit 7).

Exhibit 7: Distribution of root causes for group "Excavation Practices Not Sufficient" (known events)

	Number of events	Percentage of events
Excavation Practices Not Sufficient	**82,248**	
Other excavation practices not sufficient	70,435	85.6%
Hand tools not used	4,743	5.8%
Clearance not maintained	4,293	5.2%
Marks not maintained	1,690	2.1%
Test hole not used to verify	651	0.8%
Exposed facility not supported	370	0.4%
Backfilling improper	66	0.1%

The next two most-reported damage root causes for the *Excavation practices not sufficient* group were *Hand tools not used where required* and *Clearance not maintained*.

When the damages for which *Excavation practices not sufficient* was the reported root cause are segmented by the excavation information provided in Part D, the most common characteristics of damages to underground facilities are revealed (see Exhibits 8 and 9). The pattern for the past three DIRT data sets—that most underground excavation damages involved contractors and developers using backhoes/trenchers while performing sewer/water construction—persists for the 2013 DIRT data set.

It is important to note that even though a particular excavation characteristic may occur more often, it does not mean that it results in a greater probability of damages. For example, Exhibit 6 indicates that the contractor/developer excavator group is involved in more events not preceded by a locate request than the occupant/farmer group. However, because of the difference in the volume of events between the two groups, a higher percentage of the occupant/farmer group events were not preceded by a locate request (66% vs. 19%).

Exhibit 8: Segmentation of "Excavation Practices Not Sufficient" root cause by excavator and excavation equipment type for known events (Part D)

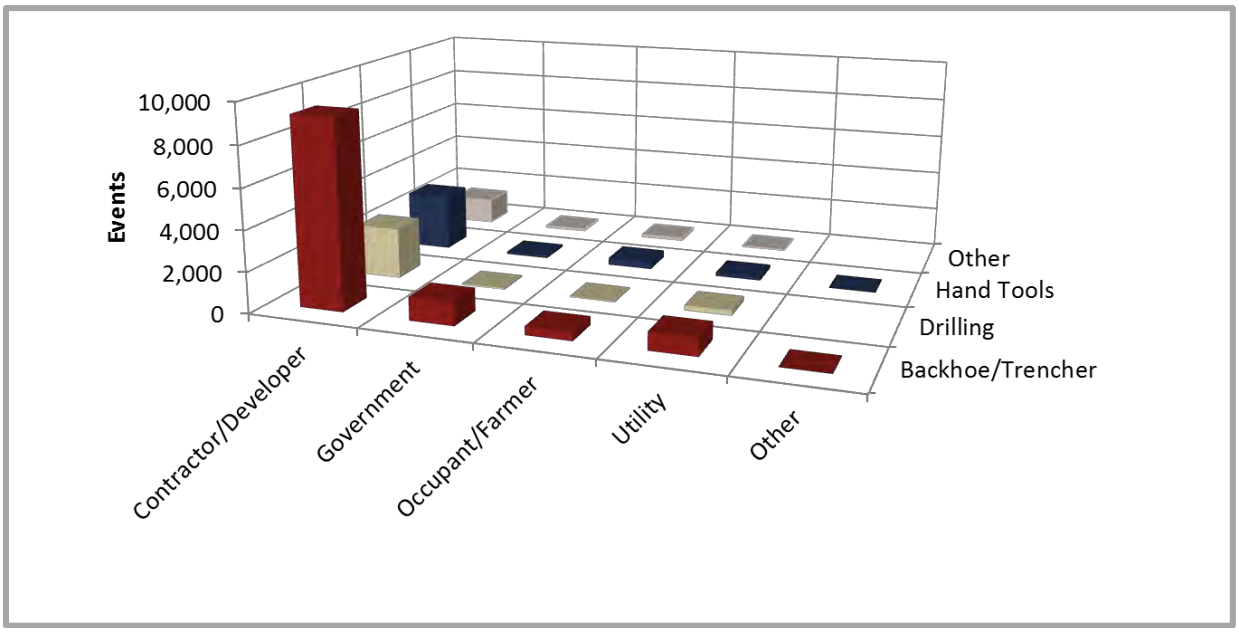
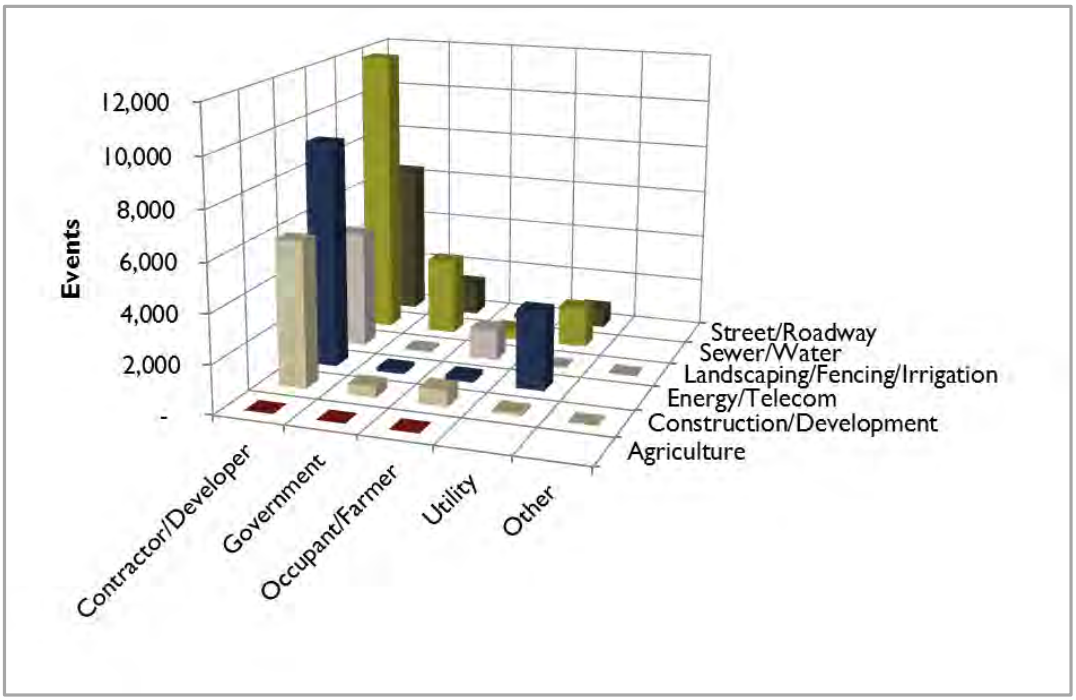


Exhibit 9: Segmentation of "Excavation Practices Not Sufficient" root cause by excavator type and work performed for known events (Part D)



Select Data Element Results

Part A: Who is submitting this information?

Locator, natural gas, telecommunications, and one call center are the reporting stakeholder groups for 95% of events submitted for 2013. The locator reporting stakeholder group submitted the most events for the third year in a row with 120,130 (53.6% of total).

Exhibit 10: Change in number of events submitted by reporting stakeholder

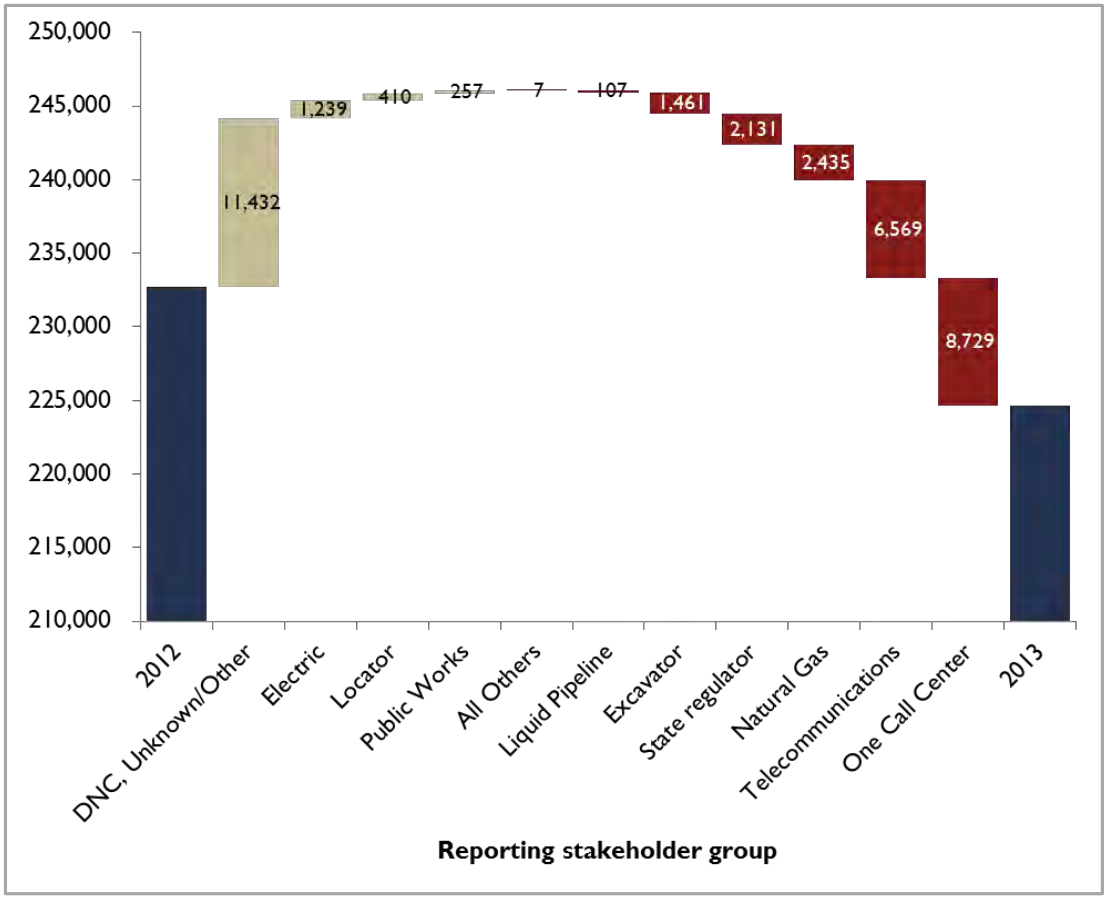
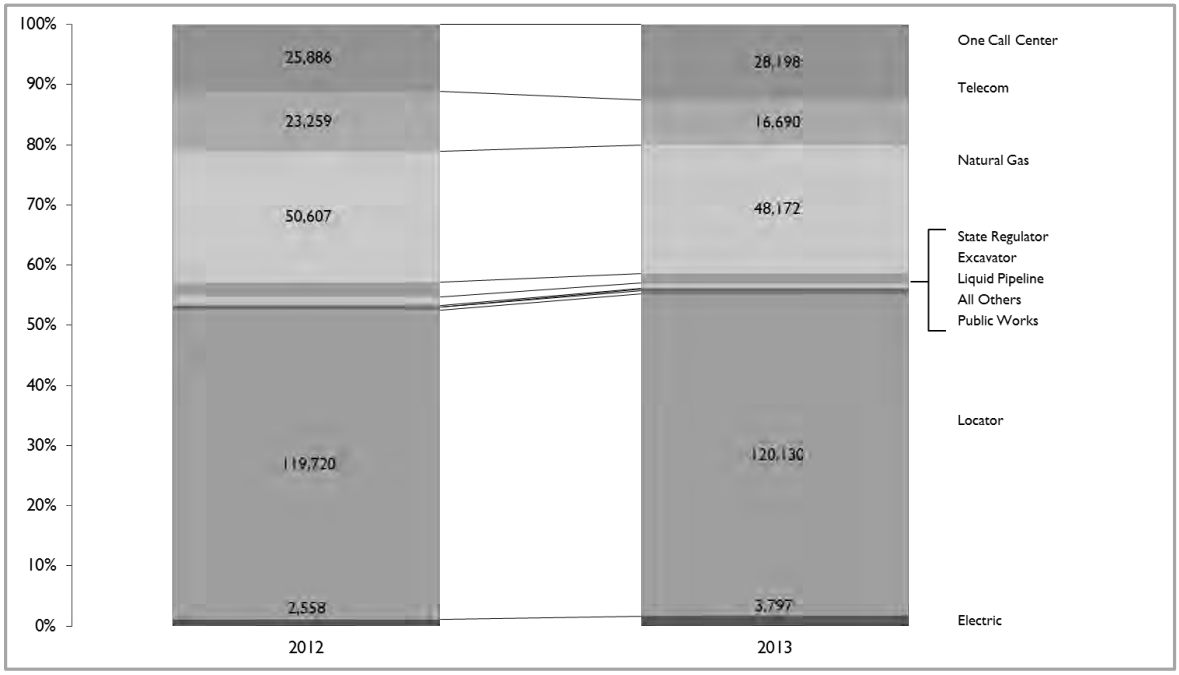


Exhibit 11: Distribution of events by reporting stakeholder group



Part B: Date and location of the event

This data element includes the date of the event and the type of right-of-way (ROW). As may be expected, the number of events increases in the spring and decreases in the winter, reflecting the typical construction season (see Exhibit 12). Nearly 40% of the reported events occurred in public city street ROW (see Exhibit 13). This percentage has increased from the near 30% of 2012, even though the number decreased by over 1,000. This is most likely attributed to the increased number of respondents that categorized the type of ROW instead of labeling as *Other*.

Exhibit 12: Month in which the event occurred

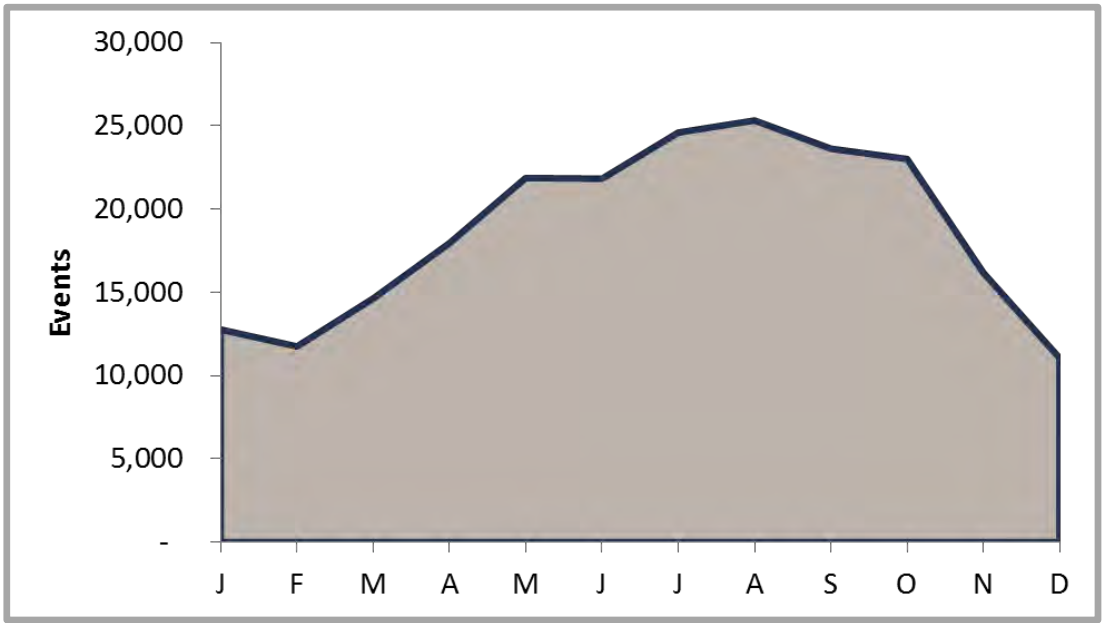
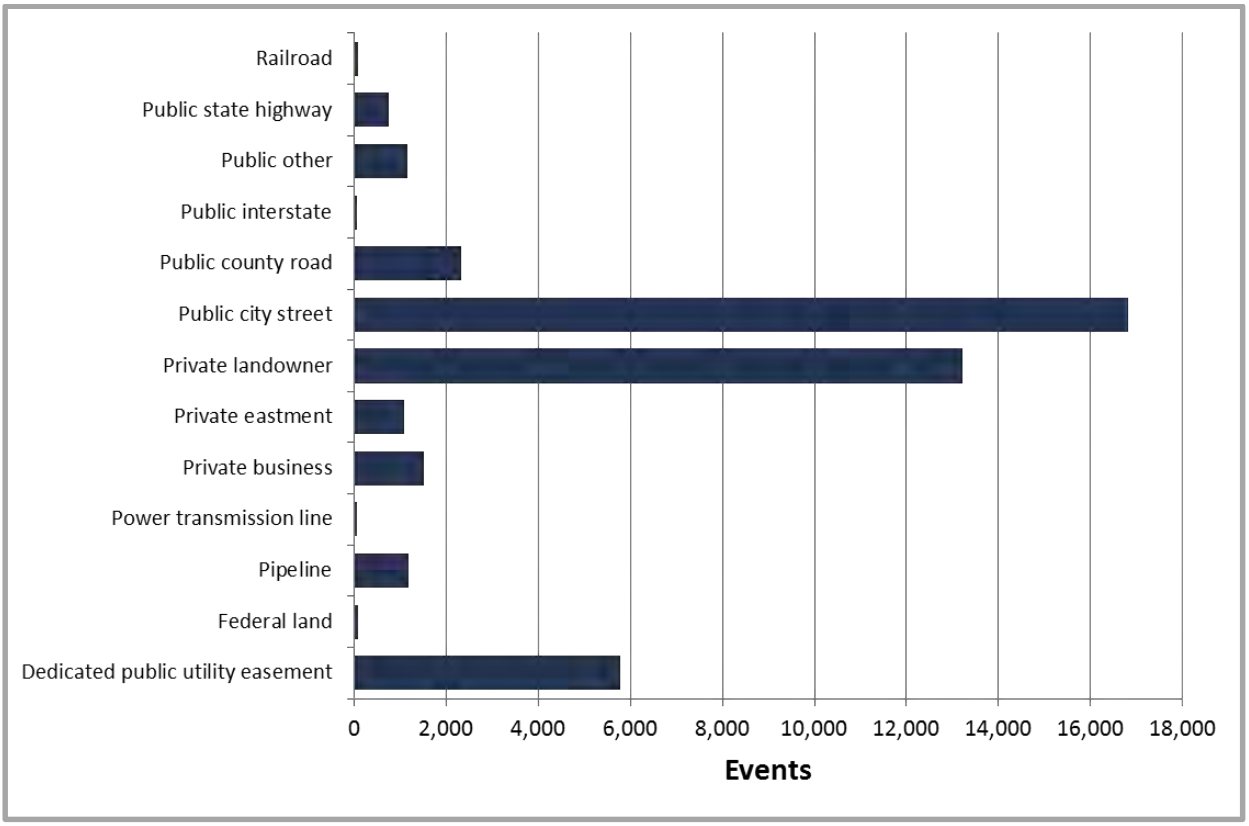


Exhibit 13: ROW in which the event occurred (excludes Data Not Collected)

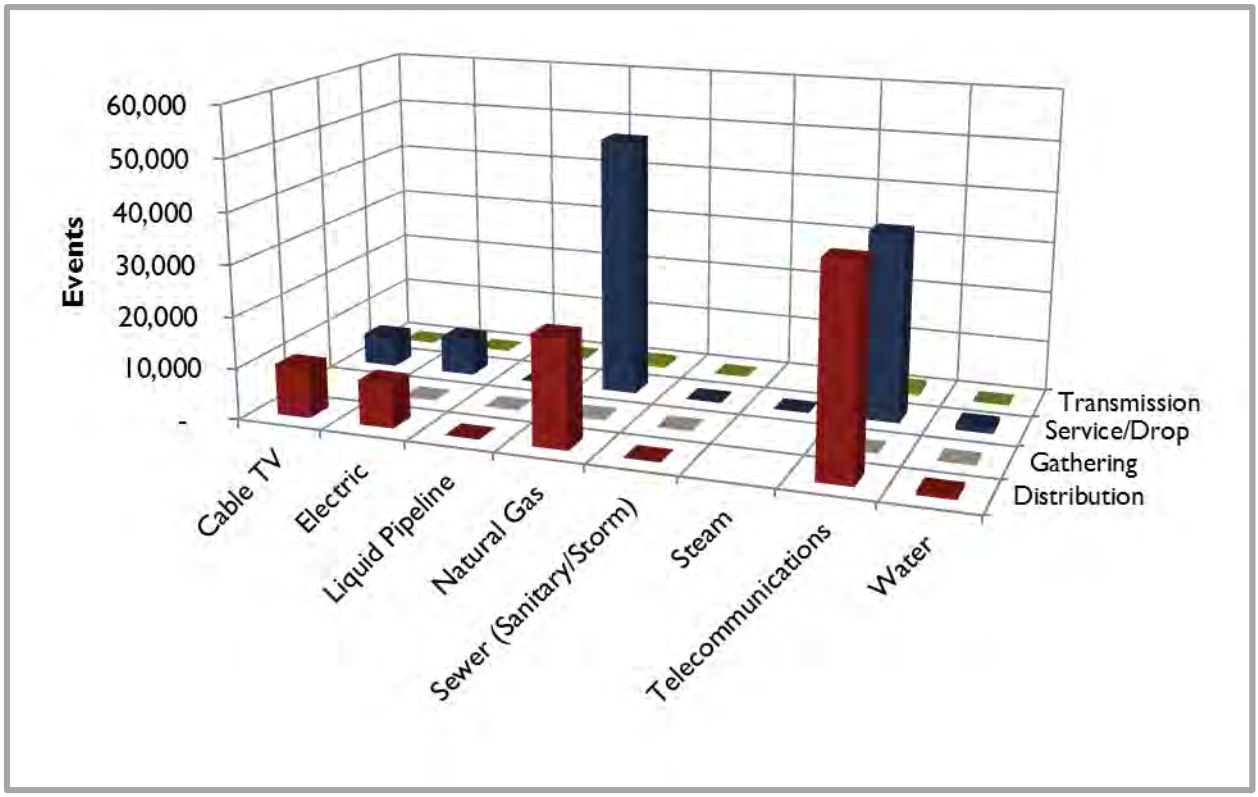


Part C: Affected facility information

This data element includes the type of facility operation affected (e.g., Cable TV, Natural Gas, Water); the type of facility affected (e.g., Distribution, Transmission); whether it was a joint trench; and if the owner of the facility is a one call member. Natural Gas and Telecommunications utilities bore the most damages, representing more than 80% of the known events (39% Natural Gas and 42% Telecommunications).

Similar to 2011 and 2012, nearly 99% of the facilities affected in 2013 (known data) were reported as Service/Drop or Distribution (see Exhibit 14). A little more than half of the facilities affected in 2013 (known data) were reported as Service/Drop (55%).

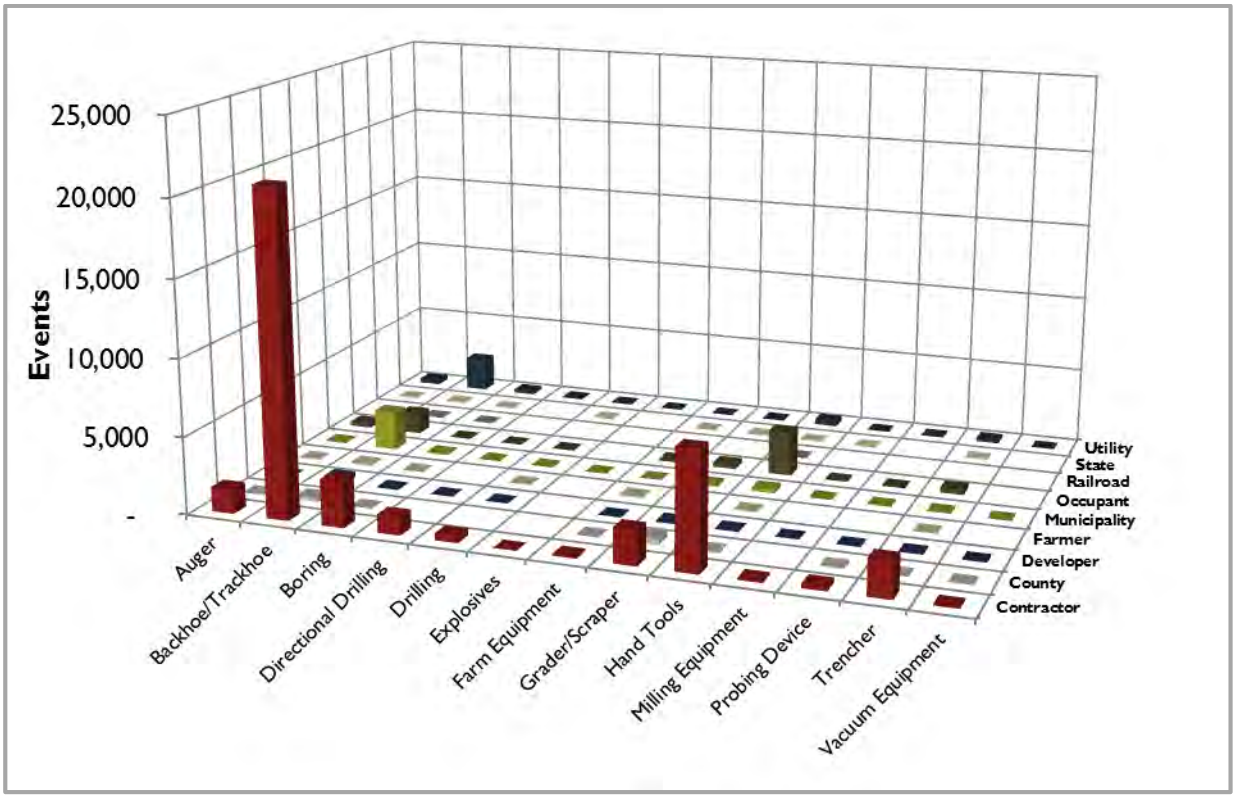
Exhibit 14: Events segmented by facility operation and type of facility affected (excludes Unknown/Other responses)



Part D: Excavation information

This data element includes the type of excavator, type of work performed, and type of excavation work involved in the event. This is one of the most critical components of the DIRT data set, because it identifies the "who" and the "how" related to excavation damages. The Underground Damage Prevention Analysis section of this report addresses this data element in additional detail and suggests that the greatest number of damages involve contractors and developers using backhoes/trackhoes while performing sewer and water excavation when *Excavation practices not sufficient* was the root cause. Backhoes/trackhoes in use by the Contractor excavator group were also involved in the majority of damages (known events) regardless of root cause (see Exhibit 15).

Exhibit 15: Distribution of events by type of excavator and type of excavation equipment (excludes Data Not Collected, Other, and Unknown responses)



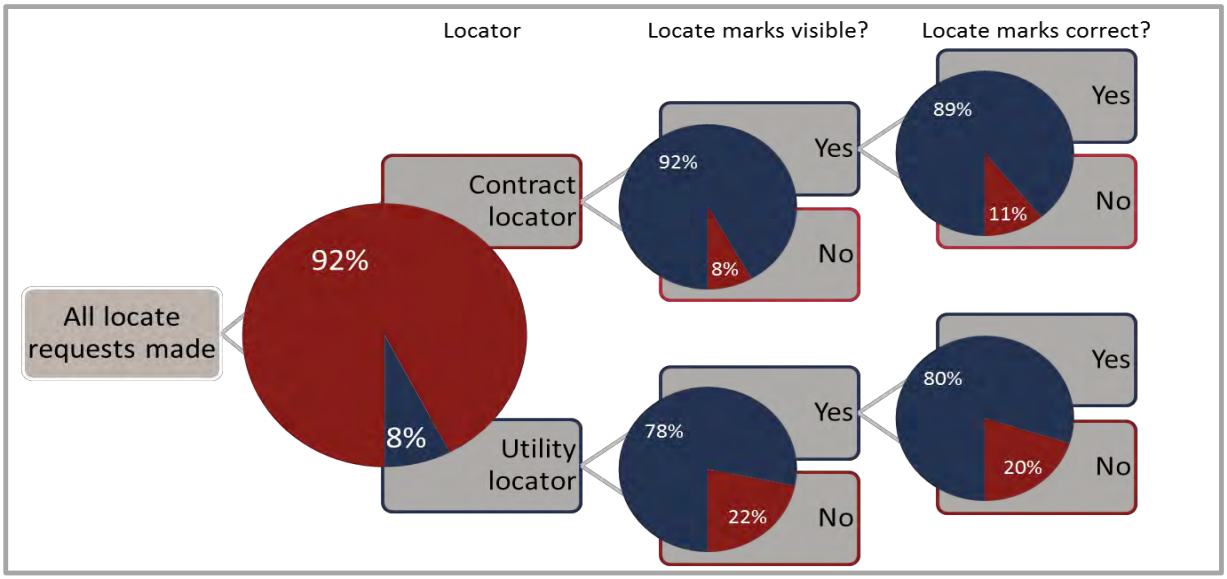
Part E: Notification

Requesting the location of underground utilities prior to excavation is a proven method for preventing damage. In 2013, 73.6% of the events submitted included notification made to a one call center, which remains consistent with the 73.3% in 2012.

Part F: Locating and marking

Contract locators continue to fulfill the majority of locate requests, representing more than 90% of submitted events in 2013 (see Exhibit 16). The locating and marking performance of contract locators in 2013 is essentially unchanged compared to 2012 (based on reported DIRT data), with the percentage of marks that are 1) visible and 2) correct being 92% and 89% respectively. The locating and marking performance of utility locators in 2013 is also essentially unchanged compared to 2012, although still below that of contract locators.

Exhibit 16: Site marking characteristics by locator (known events)



Part G: Excavator downtime

This data element reports whether excavator downtime was incurred as well as its duration and cost. A large majority of reported events do not include this data (approximately 88%). Of the 26,524 events that included responses to excavator downtime incurred (i.e., response of yes or no), one-third were affirmative.

When excavator downtime was experienced, for the majority of events it was one to two hours in duration (see Exhibit 17). This duration of downtime occurred predominately in the $1–$500 range, but was also a significant portion of the $501–$1,000 range. As would be expected, the longer duration downtimes generally were more expensive as can be seen in the $5,001–$25,000 range. In this range, 2 to 3 hour downtime was the prevailing range with a small percentage being greater than 3 hours. Exhibit 18 illustrates that the lengthiest downtimes were associated with liquid pipeline facilities, electric facilities, and natural gas facilities. The majority of events reported for water facilities shifted from <1 hour to 1–2 hours while downtime for events reported for cable television facilities decreased.

Exhibit 17: Distribution of events experiencing excavator downtime by cost and duration

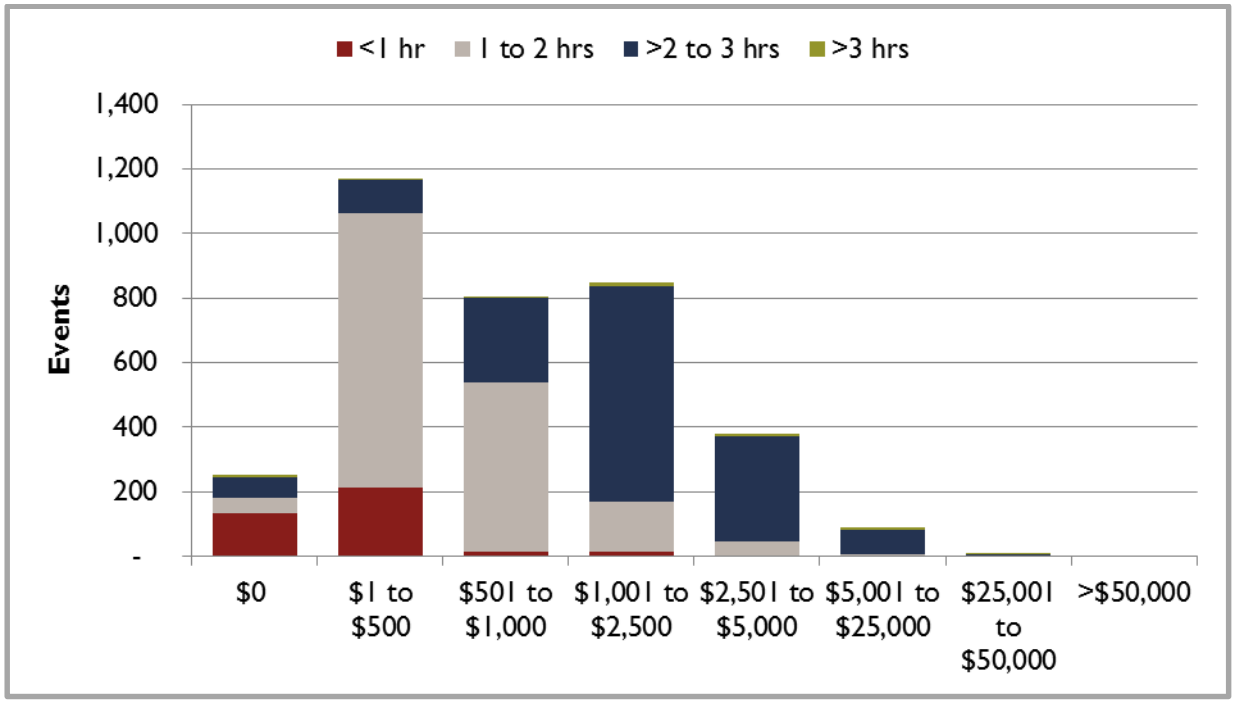
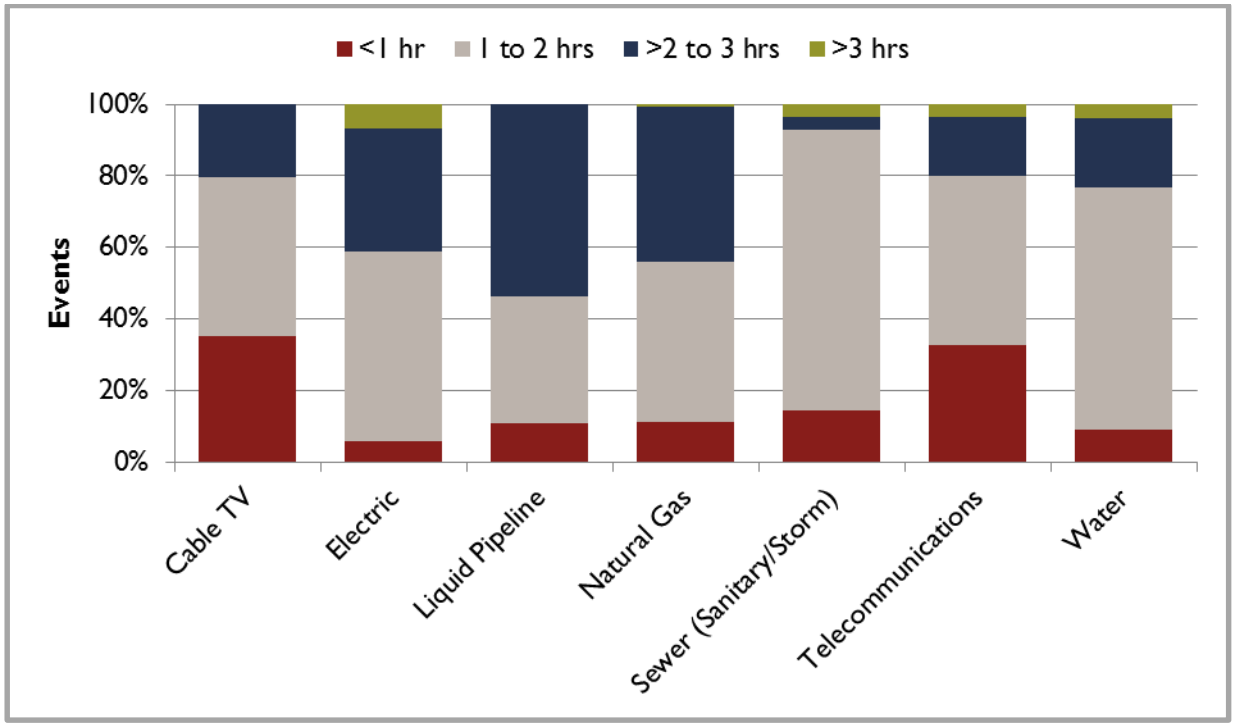


Exhibit 18: Distribution of events experiencing excavator downtime by facility damaged and duration



Part H: Description of damage

This data element indicates if damage was incurred and provides details regarding a service interruption if applicable. The results of this analysis can be summarized as follows.

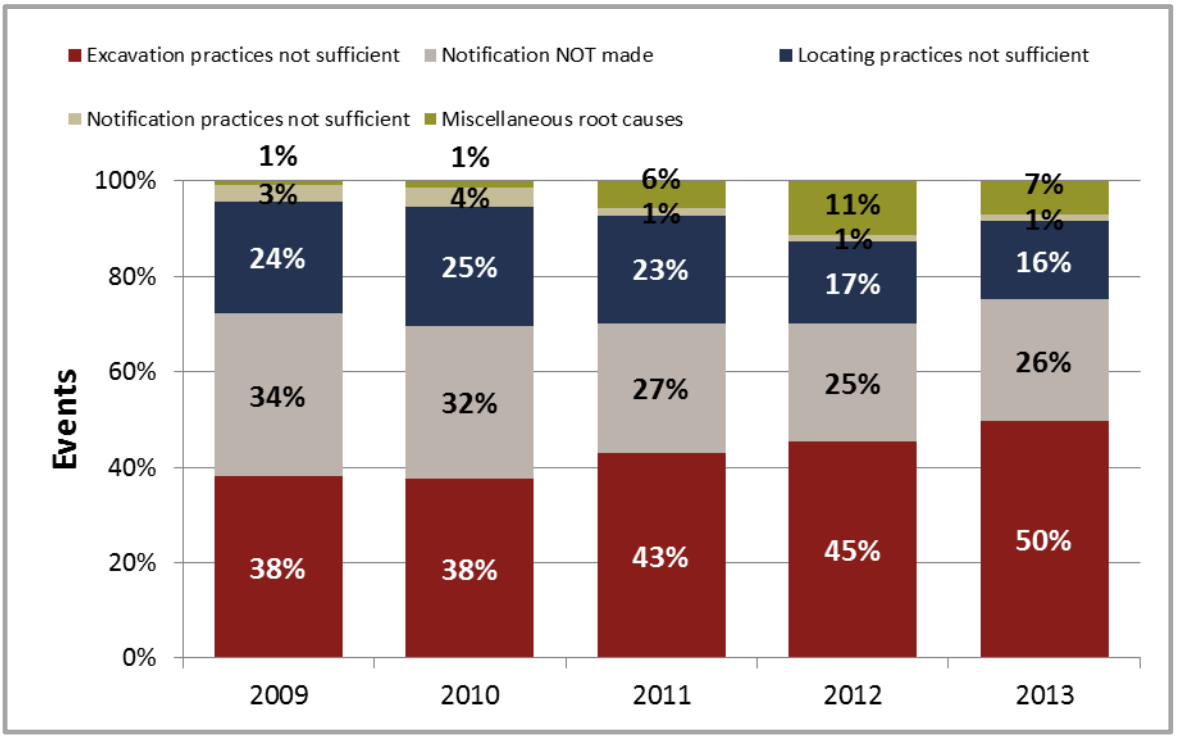
- 97% of events submitted in 2013 experienced facility damages.
- 76% of these facility damages have known data regarding service interruption.
- Of the known facility damages that included data about service interruptions, the majority (81%) did experience service interruption.
    - 94% experienced service interruptions lasting less than 24 hours. The largest group was between 0 and 8 hours with 80% of the interruptions. Of the known service interruptions, 42% came from natural gas and 48% came from telecommunications.
    - 91% affected zero (33%) to one customer (58%)[8]
    - 87% incurred costs of $2,500 or less.

Part I: Description of the root cause

A damage root cause was reported for 77% of all events submitted to DIRT in 2013, approximately the same as in 2012. Prior to 2013, the percentage of events attributed to the damage root causes *Notification NOT made* and *Locating practices not sufficient* steadily declined (see Exhibit 19). While *Locating practices not sufficient* continues to decline, this year shows that a slightly greater percentage is allocated to *Notification NOT made* than in 2012. However, even though the percentage has increased, the actual number of reports indicating the root cause as *Notification NOT made* has decreased by 4% since 2012. *Excavation practices not sufficient* continues to increase in percentage as well as the actual number of events, although this is not to say that excavating practices are becoming sloppier and more likely to result in damages. This increase may stem from the lower amount of *Data not collected* and the lowering numbers of *Miscellaneous* and *Other* root causes as reports are becoming progressively more accurate and defined.

[8] An interruption is described as a deviation from normal operating capabilities; as such, zero customers can be affected by an interruption of services.

Exhibit 19: Distribution of known events by root cause group (2009–2013)

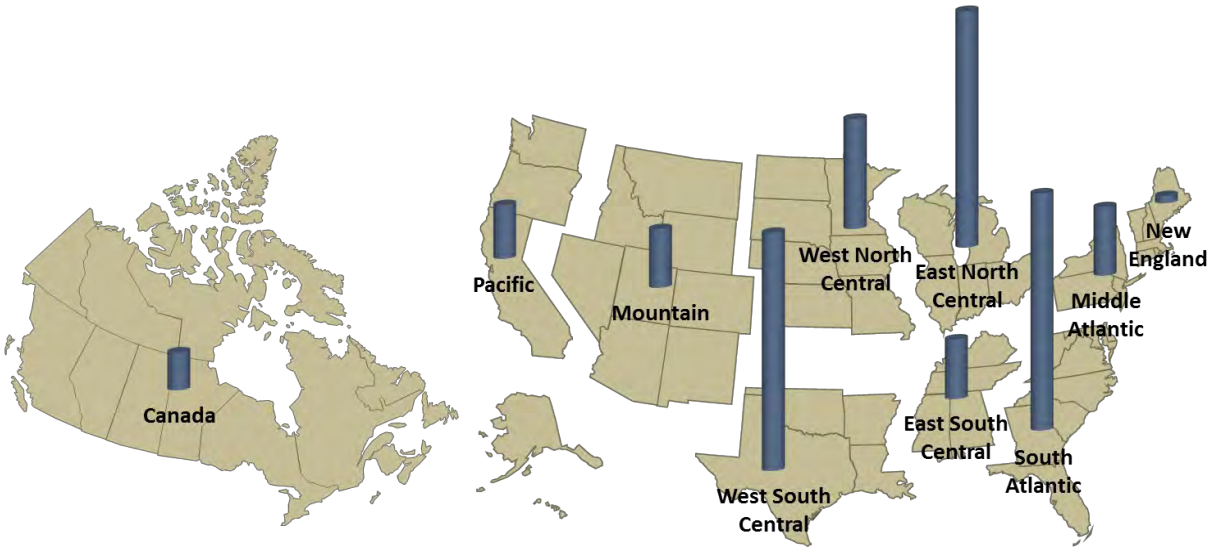


Regional Data Comparisons

Events submitted to DIRT include the state or province of occurrence. In previous DIRT reports, regional data comparisons were reported according to the eight One Call Systems International (OCSI) regions. With increasing DIRT participation and the subsequent volume of events submitted, it is possible to make more regional comparisons. It was therefore decided to make the 2013 regional data comparisons by the nine U.S. census divisions and Canada (increasing the number of regions compared from 8 to 10). The ability to develop more localized damage prevention recommendations that result from the analysis of event data and information for smaller regions has great benefit. However, this change also introduces opportunities to include other government and published statistics that are often reported by census division.

The greatest numbers of events reported to DIRT in 2013 were from the East North Central, South Atlantic and West South Central U.S. census divisions (as illustrated in Exhibit 20 below). These three divisions account for nearly two-thirds of the total.

Exhibit 20: Distribution of events by division[9]

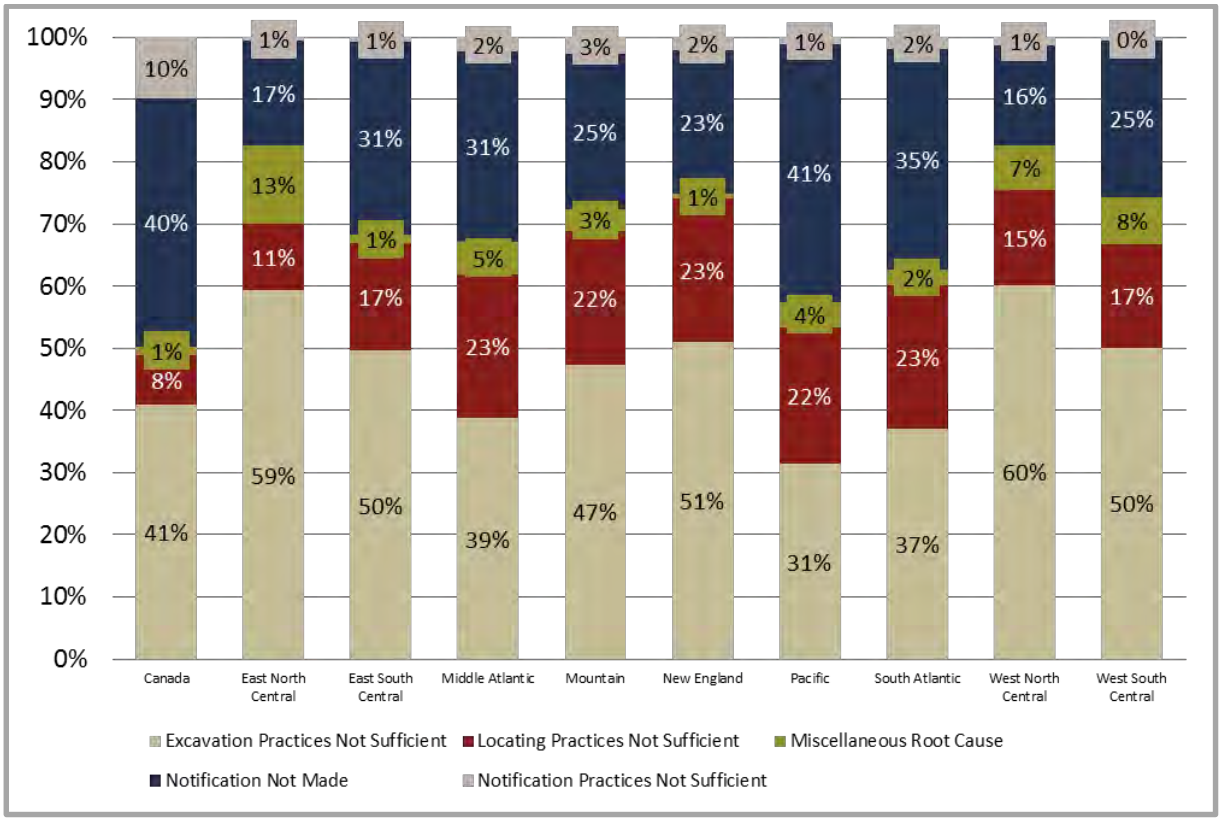


Census Division	Number of Events	Percentage of Total Events
Canada	7,557	3.46%
East North Central	46,611	21.33%
East South Central	10,405	4.76%
Middle Atlantic	12,600	5.77%
Mountain	15,476	7.08%
New England	1,158	0.53%
Pacific	13,728	6.28%
South Atlantic	43,524	19.92%
West North Central	24,022	10.99%
West South Central	43,407	19.87%

[9] Canada and U.S. census divisions

Exhibit 21 illustrates the distribution of damage root causes by division. Meaningful differences are apparent and may suggest the need to develop underground excavation damage prevention best practices specific to some geographies.

Exhibit 21: Distribution of known events by root cause by division



An examination of the circumstances and common characteristics of events by division reveals some variations for the type of excavator, excavation equipment, and work performed. These are illustrated in Exhibits 22, 23, and 24 (Part D).

Exhibit 22: Distribution of known events by division and excavator type

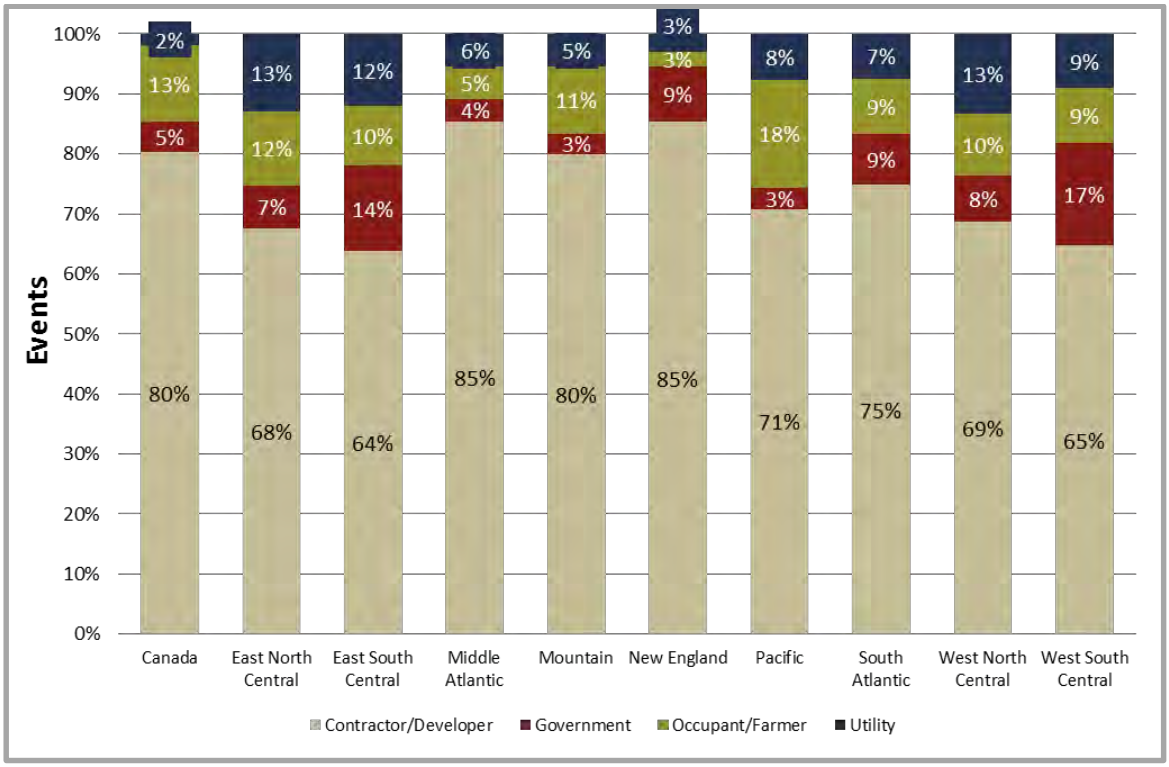


Exhibit 23: Distribution of known events by division and excavation equipment type

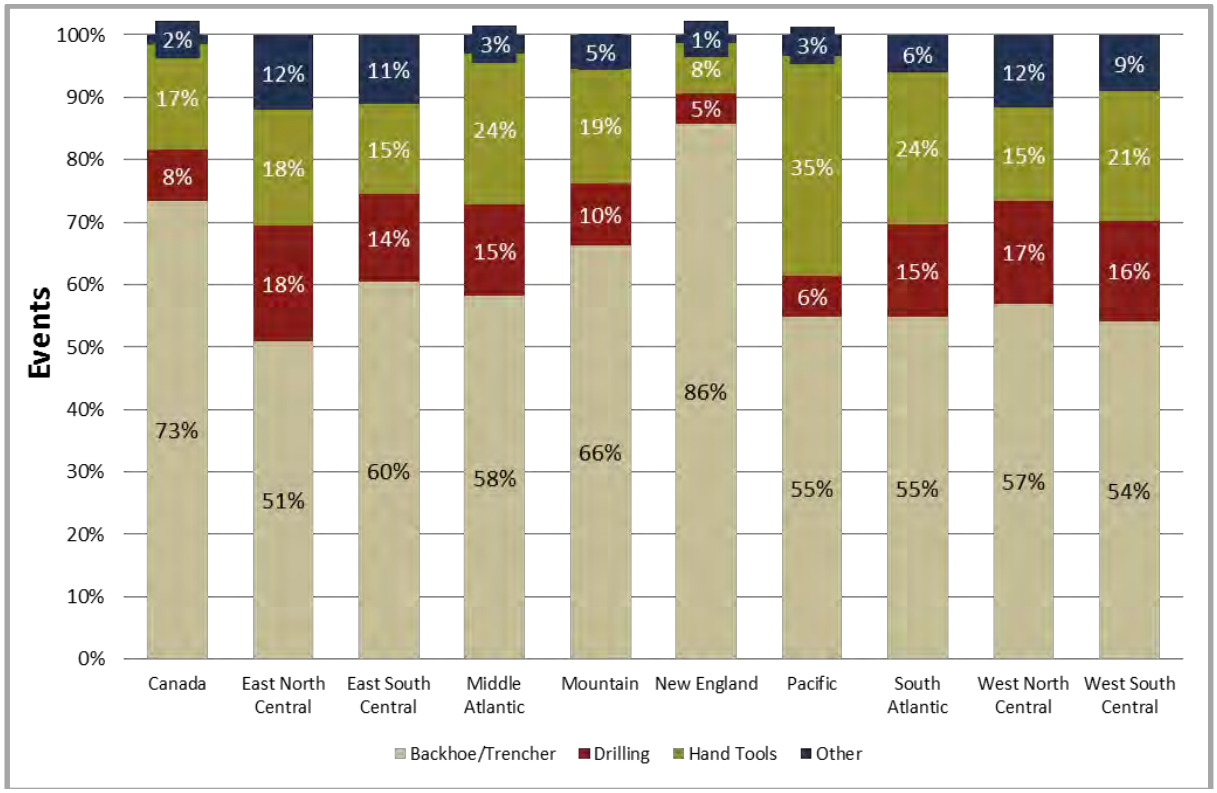
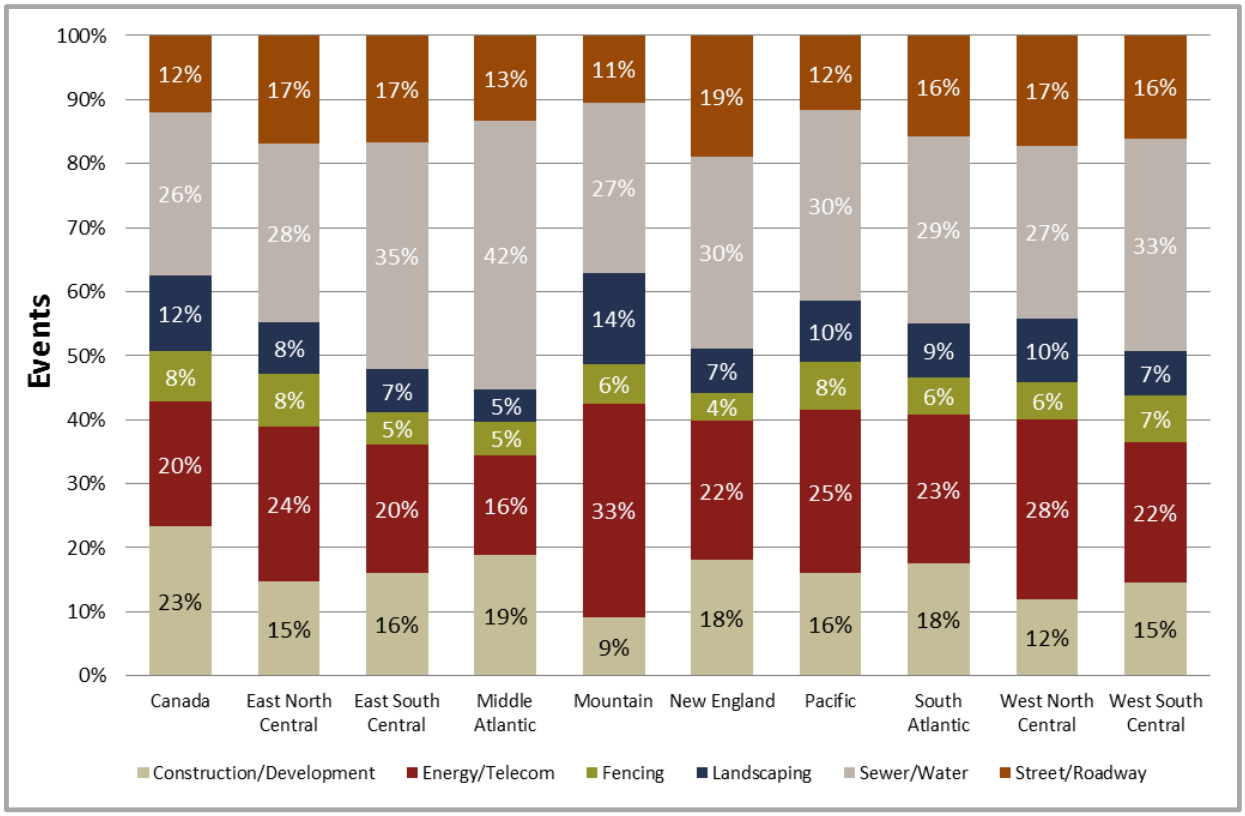


Exhibit 24: Distribution of known events by division and work performed



Additional Analyses

For the 2013 report, the Committee selected two issues on which to conduct additional detailed analyses. These additional detailed analyses are intended to understand the relationships between damages to underground utilities resulting from excavation and 1) ticket life and 2) tolerance zones. Furthermore, these additional detailed analyses demonstrate the enhanced opportunities now available to the Common Ground Alliance to develop new insights and best practices by incorporating data and information not specifically captured by DIRT. Some readers will recall that this began last year with the analysis of notification exemptions. This is made possible by the large number of damages reported to DIRT. Based on the current total damages estimate, it is possible that DIRT now captures about two-thirds of the total number of damages that occur in a given year.

Tolerance Zone

The CGA Best Practices Appendix A defines Tolerance Zone as "the space in which a line or facility is located, and in which special care is to be taken," and Best Practices 5-19 and 5-20 describe specific practices of how the concept is used to avoid damages. A review of state laws and statutes finds that all U.S. states employ the concept, although some have different terms such as "approximate location" of the buried utility or "extra caution zone" for excavators. Exhibit 25 below depicts a 24-inch tolerance zone. There are 24 states with an 18-inch tolerance zone and 26 with a 24-inch tolerance zone.

Exhibit 25: Tolerance zone example

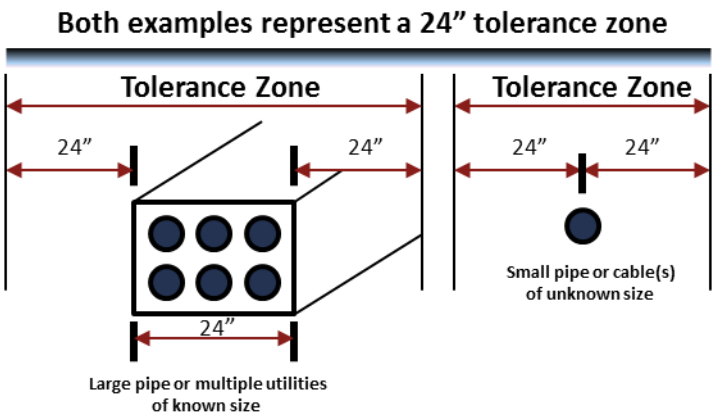


Exhibit 26 depicts the DIRT event data organized by major root cause groupings from states with 18 and 24-inch tolerance zones.

Exhibit 26: Root cause damages by tolerance zone

Damage Root Cause	18"	24"	Total	18"	24"
Excavation Practices Not Sufficient	43,908	33,651	77,559	51.74%	49.97%
Locating Practices Not Sufficient	12,932	13,273	26,205	15.24%	19.71%
Miscellaneous Root Cause	7,546	3,573	11,119	8.89%	5.31%
Notification Not Made/ Not Sufficient	20,478	16,846	37,324	24.13%	25.02%
Totals	84,864	67,343	152,207	100.00%	100.00%

The notification practices seem to be worse and the miscellaneous root causes better in the 24-inch tolerance zone states, but these may be a coincidence or based on other factors besides the size of the tolerance zone. For a tolerance zone to exist, the marks must be present, which implies that a one call notification was made. Therefore, the critical issues pertaining to tolerance zones are how accurate the marks are and how carefully excavation is performed in close proximity to the marked facilities, and it therefore makes sense to isolate just the excavating and locating practices, as shown in Exhibit 27.

Exhibit 27: Isolated root cause damages distributed by tolerance zone

Damage Root Cause	18"	24"	18"	24"	Delta
Excavation Practices Not Sufficient	43,908	33,651	77.25%	71.71%	5.53%
Locating Practices Not Sufficient	12,932	13,273	22.75%	28.29%	-5.53%
Total	56,840	46,924	100%	100%	

This data shows that as the tolerance zone increases, the excavation practices improve and the locating practices drop off. One possible explanation is that with the larger tolerance zone, excavators take more care to avoid damaging buried facilities. Similarly, with the smaller 18-inch tolerance zone, locators may take more care to ensure accurate mark-outs. The damage rate per 1,000 outgoing transmissions is lower among those states with 24-inch tolerance zones (1.20)[10] than those with 18-inch tolerance zones (1.33), which is logical considering that *Excavation practices not sufficient* are the largest grouping (50%) of the known events by root cause group (see Exhibit 2).

Life-of-Ticket

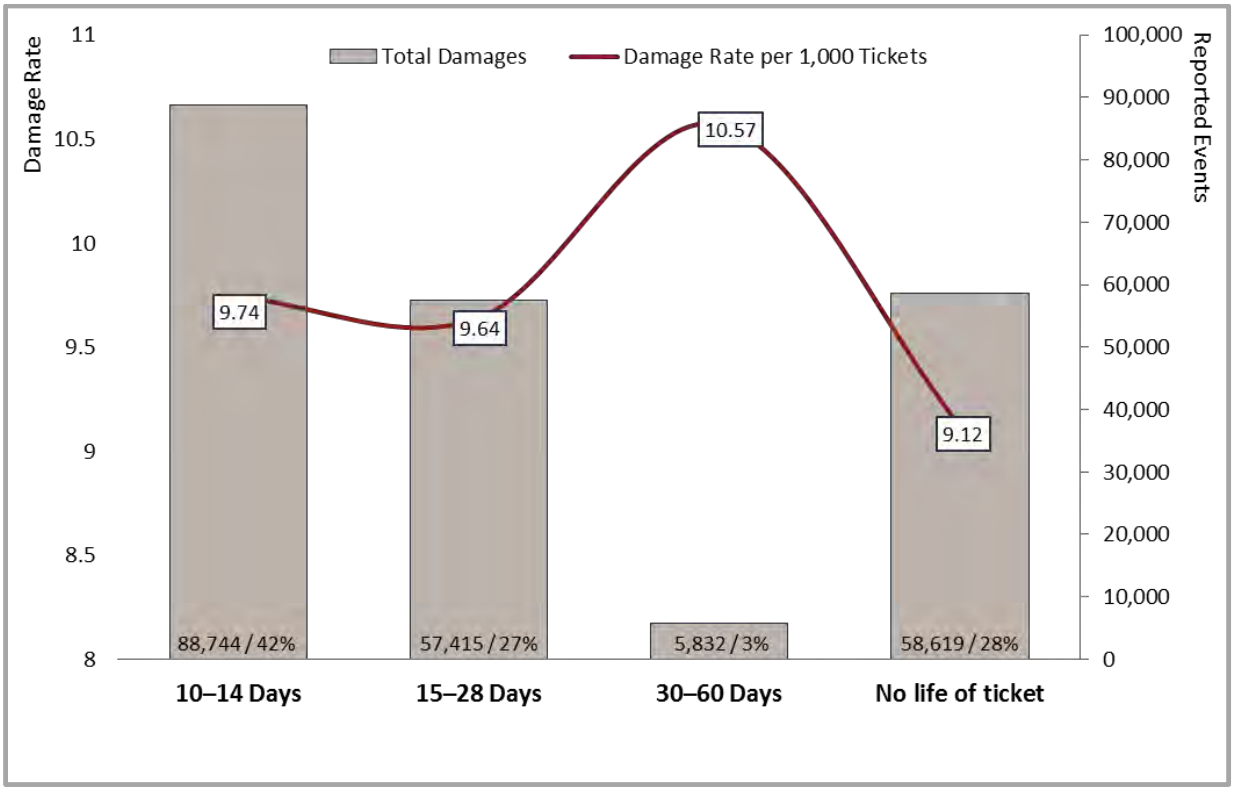
Life-of-ticket refers to the length of time a one call notification remains valid. If the excavation work continues beyond the life-of-ticket the excavator is required to renotify the One Call Center in order for the marks to be refreshed (see CGA Best Practice 5-23).

For this analysis, ticket life is expressed as 10 to 14 days, 15 to 28 days, 30 to 60 days or no ticket life. Forty-eight states were included in the investigation of ticket life and other characteristics of the relationships between ticket life and damages to underground utilities resulting from excavation. See Exhibit 28 for a breakdown of the number of states within each category, as well as the damages and damage rate associated with each.

Multiple analyses and data comparisons were made to determine the impact of ticket life on damages to underground utilities resulting from excavation (both frequency of damage and characteristics thereof). Using data from 35 states where information is available for a damage rate comparison, it appears that the damage rate increases beyond a 14-day life-of-ticket.

[10] In this Additional Analysis section of the report, damage rates are calculated using outgoing one call center transmissions, consistent with the methodology used earlier to calculate the national damage rate. However, it is important to keep in mind that the damage numbers used in the numerator here include data from states not considered "substantial-reporting" states. Therefore, the damage rates in this section are under-estimates, and are not directly comparable to the national damage rate estimate. However, the Committee believes the damage estimates used here remain useful for making relative comparisons within each individual Additional Analysis topic.

Exhibit 28: Distribution of damages by ticket life and number of states within each category



As can be seen in Exhibit 29, the distribution of root damage causes throughout each life-of-ticket category, as well as all reported damages, is fairly consistent except for the 30–60 day life-of-ticket category. In this category, a significant shift of root cause distribution occurs, and *Locating practices not sufficient* emerges as a more significant damage root cause than in the other categories.

In conjunction with this, the question of whether or not marks were visible and correct (DIRT Part F) was examined, with the following results: damages attributed to locator marks not being visible increase during the 15–28 day life-of-ticket category, and the same is true for damages linked to locator marks being incorrect. See Exhibit 30 for further details.

Exhibit 29: Comparison of root cause damage distribution by ticket life group and all reported damages

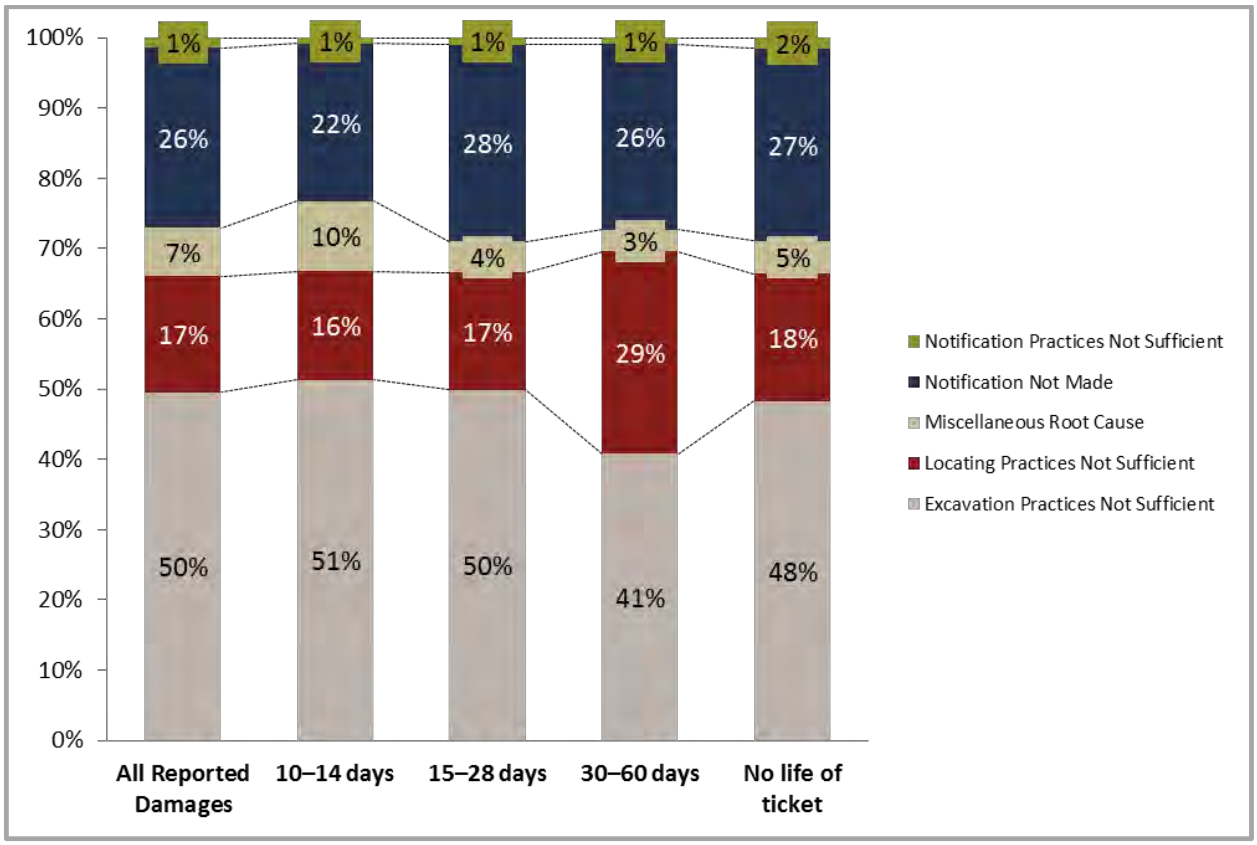


Exhibit 30: Distribution of damages attributed to locator marks being visible or correct by life-of-ticket group

	Marks Visible		Marks Correct	
Life of Ticket	No	Yes	No	Yes
10–14 Days	8%	92%	21%	79%
15–28 Days	22%	78%	40%	60%
30–60 Days	22%	78%	41%	59%
No Life of Ticket	10%	90%	26%	74%

The data suggests that as ticket life increases, marks become less visible. Regarding whether or not marks are accurate, it is not likely that marks start out accurate in the early stages of a project and become less so over time. They are either accurate, or not, at the time they are made. The data shows that as ticket life increases, marks not accurate and marks not visible also increase in Part F, but it is important to keep in mind that Part F in DIRT is not the same as Root Cause (Part I). A possible reason for these findings is that as ticket life increases, the marks degrade or get lost, and damages then become attributed to locating practices.

It is significant to note that when looking at the 30–60 day life-of-ticket category, a significant shift occurs in the subsegments for the l*ocating practices not sufficient* root cause. Here, there is a

noteworthy increase in damages attributed to *facility could not be located* (see Exhibit 31). One possible reason is that excavation projects that extend for a month or more are often in areas with older infrastructure, such as cast iron gas piping, plastic piping without tracer wire, concrete or clay sewer and water facilities, etc., that are very difficult to pick up with conventional locating equipment. In addition, tickets in this category are "project size" and are often built over the course of several months. Communication gaps between contractor and locating professionals can lead to misinterpretations.[11]

Records and maps of these older buried facilities are often of poorer quality, which may lead to damages being attributed to inability to locate or to incorrect maps/records.

Exhibit 31: Damage distribution for the subsegments contained within the Locating practices not sufficient root cause among the four life-of-ticket categories

	Incorrect Facility Records/ Maps	Facility Marking or Location Not Sufficient	Facility Was Not Located or Marked	Facility Could Not Be Found	Facility Could Not Be Located
10–14 Days	5%	63%	1%	7%	24%
15–28 Days	8%	65%	1%	7%	20%
30–60 Days	10%	46%	0%	4%	40%
None	11%	60%	0%	4%	26%

Exhibit 32: Damage distribution for the subsegments contained within the excavating practices not sufficient root cause among the four life-of-ticket categories

	Failure to Maintain Clearance	Failure to Use Hand Tools Where Required	Failure to Maintain Marks	Failure to Verify Location by Test Hole
10–14 Days	5%	3%	1%	0%
15–28 Days	8%	7%	1%	1%
30–60 Days	8%	22%	7%	3%
None	3%	6%	4%	1%

As discussed above in the Tolerance Zone analysis, there is a close interaction between accuracy of marks and careful excavation practices. Several of the subsegments within the *Excavation practices not sufficient* root cause group are dependent on the existence of the facility marks, particularly Failure to Maintain Clearance, Failure to Use Hand Tools Where Required, Failure to Verify Location by Test Hole, and Failure to Maintain Marks.

The data indicates that damages attributed to each of these root causes increase with ticket life. This is likely because as the marks deteriorate and become less visible, the tolerance zones become less well

[11] Readers should also keep in mind that the 30- to 60-day data is based on a much smaller sample of records compared to the other ticket-life categories.

defined, and it becomes more difficult to maintain the necessary clearances, or determine where test holes and use of hand tools are required. Of course, marks must remain present and visible in order to be maintained. One interesting observation is that states with no life-of-ticket have smaller percentages of damages attributed to these root causes than states with 30- to 60-day ticket lives. The damage rate per thousand tickets also decreases relative to the 15–28 and 30–60 day states, but remains higher than the 10–15 days states. This may be because the states with no set ticket life emphasize calling for marks to be refreshed when necessary, rather than at any set timeframe. To reduce damages, states with extended ticket lives could consider emphasizing requirements to maintain the marks (see CGA Best Practice 5-17) and the excavating practices that are tied to the tolerance zone. Locators may also want to explore ways to make markings more robust so that they will survive the life of the ticket (see CGA Best Practice 4-8).

Effects of Regulations

The effects of state regulations had been studied in previous DIRT reports. For example, last year's report on 2012 data examined notification exceptions for certain types of excavation activities, and noted that states with 5 or more notice exemptions had a higher rate of damages per 1,000 locate requests (7.33)[12] than states with less than 5 notice exemptions. In addition to the discussions above of tolerance zones and life-of-ticket, included here is a high-level snapshot of some state regulations and/ or practices that seem to have a notable effect on damage rates.

Exhibit 33: Damage rate per 1,000 transmissions by whether a state does (Yes) or does not (No) have regulations or notification exceptions[13]

	Damage Rate per 1,000 Transmissions			Number of States	
Regulation	Yes	No	Rate Variance	Yes	No
Exemptions for Landscaping	1.84	1.26	0.58	1	34
Exemptions for Minor Routine Road Maintenance	1.45	1.16	0.29	9	26
Civil Penalties/ Fines	1.26	1.44	0.18	32	3
Hand Dig Clause	1.22	1.58	0.36	29	6
Mandatory Pre-Mark	0.96	1.43	0.47	15	20
Excavator Permits Issued	0.62	1.35	0.73	6	29

[12] Using incoming calls to the one call center rather than outgoing transmissions in the denominator.
[13] OCSI information was used to determine whether a state has the listed regulation, and to calculate the damage rate per 1,000 locate requests. Outgoing transmissions are used here as the denominator. The one state with Exemptions for Landscaping is a substantial-reporting state.

The following is the OCSI User's Guide description of these regulations:

- **Exemptions for Landscaping**—Does the legislation in your jurisdiction exempt landscaping activities from any or all of the provisions of the legislation?

- **Exemptions for Minor Routine Road Maintenance**—Does the legislation in your jurisdiction exempt minor routine road maintenance activities from any or all of the provisions of the legislation?

- **Civil Penalties/Fines?** —Does the legislation in your jurisdiction include the provision for civil penalties or fines for non-compliance with the legislation?

- **Hand Dig Clause**—Does the legislation in your jurisdiction require the exposure of underground facilities using nondestructive techniques acceptable to the owner/operator of an underground facility before mechanical excavation equipment may be used within a specified distance of the locate marks?

- **Mandatory Premark**—Does the legislation in your jurisdiction require a ground disturber to pre-mark the limits of a proposed ground disturbance before requesting locates?

- **Excavator Permits Issued**—Does the legislation in your jurisdiction require a ground disturber to obtain a formal permit before undertaking a ground disturbance? The source of the permit is immaterial. In many jurisdictions municipalities have an excavation permit system.

As seen in Exhibit 33, those states that have the listed notification exceptions have higher damage rates than those that do not. As such, it would then be a reasonable assumption that removing these notification exceptions may have a positive impact on a state's overall damage. The opposite is seen for states with civil penalties, hand-dig clauses, mandatory premarking and excavator permits. These regulations appear to have a positive effect on a state's damage rate and further implementation by states may improve overall damage rates by limiting damages. The Committee may examine these in more detail in future reports.

Data Quality Index Indications

The Data Quality Index (DQI) measures the completeness of event data submitted to DIRT. Data that is complete (i.e., information is provided for all fields) receives a score of 100%. As illustrated by Exhibit 34 [*Share of 2013 data element using Data Not Collected (DNC), Other, or Unknown]*, 55% of the data are missing only six of the twenty fields or less. In other words, 55% of the reported events have a DQI of 70% or higher. This represents continued improvement in the reduction of incomplete event data.

Exhibit 34: Share of 2013 data element using DNC, Other, or Unknown

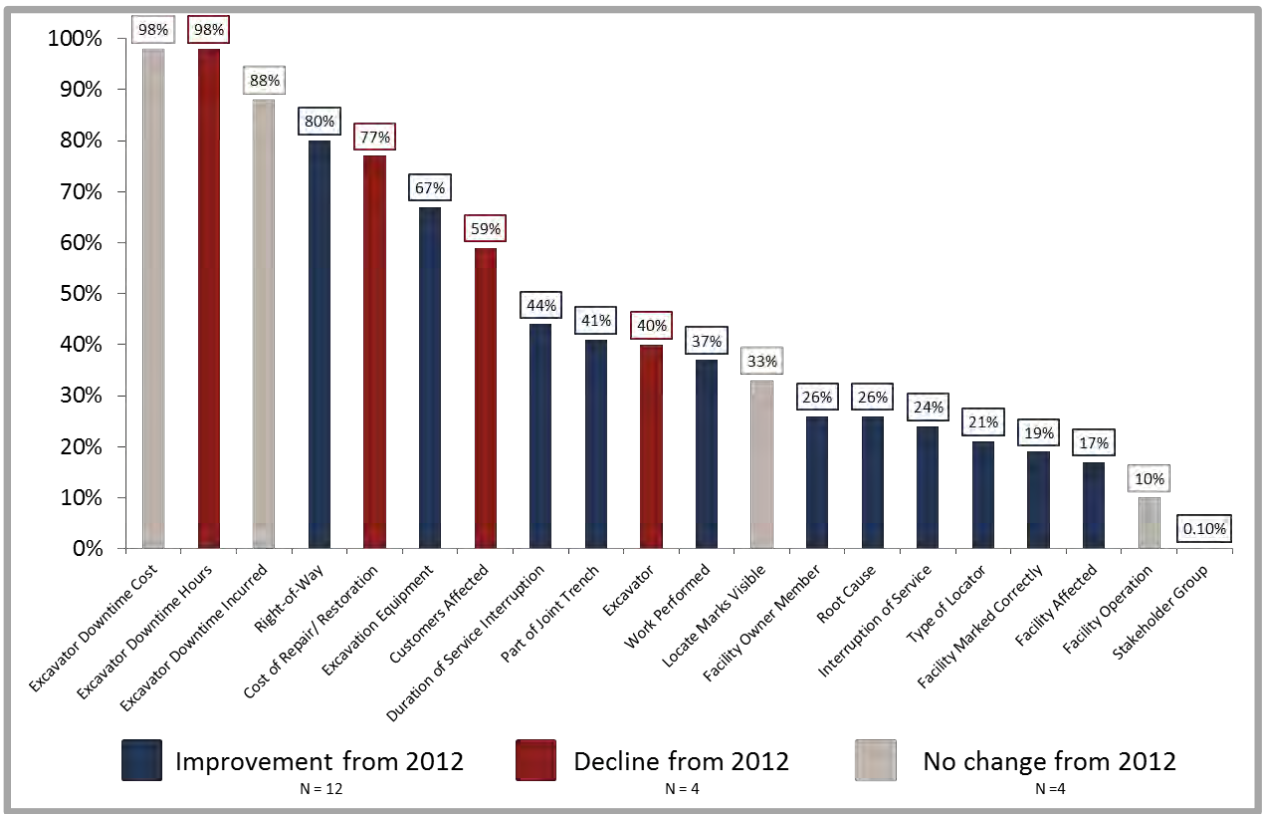
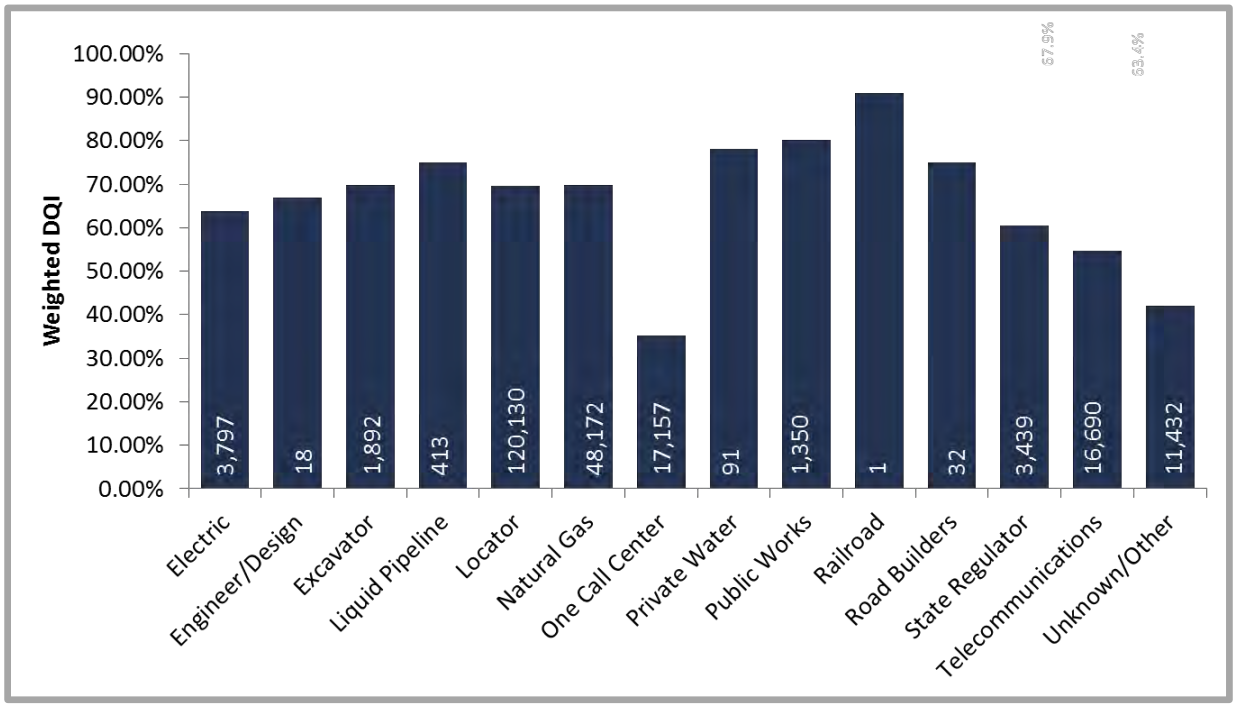


Exhibit 35: DQI by reporting stakeholder group



Appendices

Appendix 1: Lists of groupings used in this report

Excavator Group

Group	Type of Excavator
Contractor/Developer	Contractor, developer
Occupant/Farmer	Occupant, farmer
Utility	Utility
Government	State, county, municipal
Other	Railroad

Excavation Equipment Group

Group	Type of Excavation Equipment
Backhoe/Trencher	Backhoe, track hoe, trencher
Hand tools	Hand tools, probe
Drilling	Auger, bore, directional drill, drill
Other	Grader, scraper, road milling equipment, explosives, Vacuum equipment, farm implement

Work Performed Group

Group	Type of Work Performed
Sewer/Water	Sewer, Water
Energy/Telecom	Natural Gas, electric, steam, liquid pipe, telecommunication, cable TV
Construction/ Development	Construction, site development, grading, drainage, driveway, demolition, engineering, railroad, waterway
Street/Roadway	Roadwork, curb/sidewalk, storm drainage, milling, pole, traffic signals, traffic signs, streetlight, public transit
Landscaping	Landscaping
Fencing	Fencing
Agriculture	Agriculture

Root Cause Group

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, excavation practices not sufficient (other)
Notification NOT made	No notification made to one call center
Locating practices not sufficient	Incorrect facility records/maps, facility marking or location not sufficient, facility was not located or marked, facility could not be found or located
Notification practices not sufficient	Notification of one call center made but not sufficient, wrong information provided to one call center
Miscellaneous root cause	Abandoned, one call center error, deteriorated, previous damage

2013 CGA DIRT
Analysis & Recommendations

Prepared by:

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CGA's Data Reporting & Evaluation Committee

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