

CGA DIRT

2015

Volume 12

Analysis & Recommendations



| Year | Jan | Feb | Mar | Apr |
|-------|-------|-------|-------|-------|
| 2012 | 14383 | 14573 | 17272 | 19182 |
| 2013 | 12966 | 12036 | 14939 | 18212 |
| 2014 | 14108 | 13923 | 18083 | 22173 |
| 2015 | 18584 | 16245 | 23469 | 29457 |
| 2016 | 1994 | 2120 | 2656 | 2577 |
| Total | 62015 | 58897 | 76419 | 91601 |

Released September, 2016

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Dear Damage Prevention Stakeholders,

An all-time high number of event records, more than 363,000, was submitted to DIRT for 2015. As you are about to discover, CGA's analysis and recommendations for 2015 DIRT Report represent several new approaches to data analysis.

Firstly, the Data Reporting & Evaluation Committee worked with a data science consultant to match and weight multiple records pertaining to the same event, most often submitted by two or more companies. This method consolidates the data set to about 79% of its original size and makes the analysis more accurate. However, it complicates comparisons with prior years and makes 2015 somewhat of a "reset" year. For example, damages due to lack of 811 notification appear to be up, at least as a percentage of the traditional root cause pie chart. This may be due to the effects of the new weighting and matching method, as well as more accurate root cause reporting.

In reality, things may be better than the increase in damages due to lack of 811 notification make it appear. Incoming 811 notifications and general awareness of 811 services are up. Total U.S. damages and damages per one call ticket are down. At the same time, housing permits and construction activity are up. Taken together, these are encouraging indicators that damage prevention efforts continue to trend in the right direction, although opportunities for improvement remain.

Secondly, the most exciting feature of this year's report is the introduction of a new [interactive dashboard](#) that allows users to filter the data more granularly by factors contributing to damages: what types of excavators, doing what types of work, with what equipment, what facilities are being damaged, and why? This can lead to more targeted corrective actions. The 2015 DIRT Report highlights some interesting examples of how the dashboard can be used in this manner. In addition, this feature is now accessible from the CGA website, allowing visitors to do their own sorting and analysis. I believe this has the potential to be a game-changer in data-driven damage prevention programs and education.

To obtain the most value from this new feature, I implore stakeholders to continue submitting data to DIRT, and wherever possible to improve the quality of the data submitted. Thank you for your support.

Sincerely,



Robert R. Kipp
President, Common Ground Alliance

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Introduction

The number of events submitted to DIRT for the United States and Canada for 2015 totaled 363,176. Using a newly implemented methodology to identify, match, and weight multiple reports of the same event, this consolidates to 288,346 events, which is still approximately 5% higher than the number reported for 2014 (273,599).

Exhibit 1: Unweighted and weighted events, U.S. and Canada

| Country | Unweighted Events | Weighted Events | Change | % Reduction |
|---------------|-------------------|-----------------|--------|-------------|
| United States | 352,786 | 278,216 | 74,570 | 21.14% |
| Canada | 10,390 | 10,130 | 260 | 2.50% |
| Total | 363,176 | 288,346 | 74,830 | 20.60% |

Additionally, this year's report highlights a new interactive DIRT analysis [tool](#) available on the Common Ground Alliance (CGA) website¹ that allows industry stakeholders to fully immerse themselves in the data and drill down to levels never before available.

Key Takeaways

The increase in DIRT-reported damages in 2015 is only one part of the total picture of underground damage prevention. This year's DIRT Report highlights several key takeaways that demonstrate that despite the increase in damages submitted to DIRT, the industry has improved in several key areas:

- Estimated total U.S. damages decreased 9%, from 349,000 to 317,000
- Incoming locate requests increased 8%, from 30,400,000 to 32,750,000
- Outgoing transmissions decreased 6%, from 217,968,000 to 206,217,000, causing the Transmission/Incoming ratio to go from 7.17 to 6.30²
- Damages per 1000 Transmissions decreased 3.75%, from 1.60 to 1.54
- Call before you dig awareness is up from 44% to 47% (survey taken June 2016)
- Housing permit activity and construction spending on infrastructure, two of the most highly correlated variables to excavation damages, increased 15% and 4% respectively
- A new method to match and weight multiple reports of the same event consolidates the reports by 20.6%, from 363,176 to 288,346

¹ <http://commongroundalliance.com/dirt-2015-interactive-report>

² OCSI data reporting of incoming notices and outgoing transmissions improved substantially in 2015 over 2014. The 217,968,000 outgoing transmissions for 2014 was estimated by extrapolating from a smaller data sample. The decrease to 206,217,000 in 2015 may be partially due to the 2014 estimate being on the high side, and to improved filtering of tickets transmitted to one call center members by reducing tickets for work sites where no buried utilities are present.

Recommendations

1. Target 811 education programs for occupant excavators, landscaping and fencing work, and excavating with hand tools. This need not be limited to these exact combinations. There are also damages by professional contractors doing landscaping or fencing with powered equipment, or using hand tools for other types of work.
2. Promote safe excavation practices by professional excavators once locates are requested and accurately provided.
3. Encourage stakeholder use of the DIRT data dashboard to hone in on factors contributing to damages at the state level. Where applicable, use DIRT data to evaluate 811 notification exemptions.
4. Continue to improve data quality, especially root cause. See examples of incorrect data entry in this report (Exhibit 8 on page 8, and Exhibit 22 on page 20). If you recognize yourself and need assistance, contact CGA staff.

Estimates of U.S. Total Damage and Damages/1,000 One Call Transmissions

The estimate for the total number of damages in the U.S. is developed from a multiple regression model using information from states that appear to have a substantial number of damages reported to DIRT. Substantial reporting was determined by reviewing state regulations and statutes, One Call Systems International (OCSI)³ and U.S. DOT's Pipeline Hazardous Material Safety Administration (PHMSA) state classifications, a survey of state pipeline safety representatives conducted by the Data Reporting and Evaluation Committee in 2014, and a review of the number of events reported to DIRT in each state. Based on this research, for 2015 the team identified 16 states believed to have substantial reporting due to their legislative requirements or to their having an entity such as a PSC (Public Service Commission), PUC (Public Utility Commission), or one call center with a high participation in a Virtual Private Dirt (VPD),⁴ and/or having a high level of stakeholder reporting. These states are Colorado, Connecticut, Georgia, Illinois, Indiana, Kansas, Michigan, Missouri, New Mexico, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia and Washington. Of the 269,081 damage events submitted to DIRT from all U.S. states, 191,302⁵ came from stakeholders in these 16 states.

The variables used in the model include building permits, construction spending put in place, infrastructure spending,⁶ land area, population, and population density.⁷ This analysis suggests that the estimated total number of underground excavation damages in the U.S. in 2015 was approximately 317,000, approximately 9% less than 2014's estimated 349,000 damages.

³OCSI is a CGA 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.

⁴For more information about VPD, go to: <http://www.cga-dirt.com/virtual/VirtualDIRTOverview.pdf>

⁵These numbers exclude near misses and reflect application of the method to match and weight multiple reports of the same event as described in the next section.

⁶Includes construction spending on highway and street, water/wastewater facilities, conservation and development, and power projects.

⁷Sources: US Census Bureau, FMI Construction Forecast.

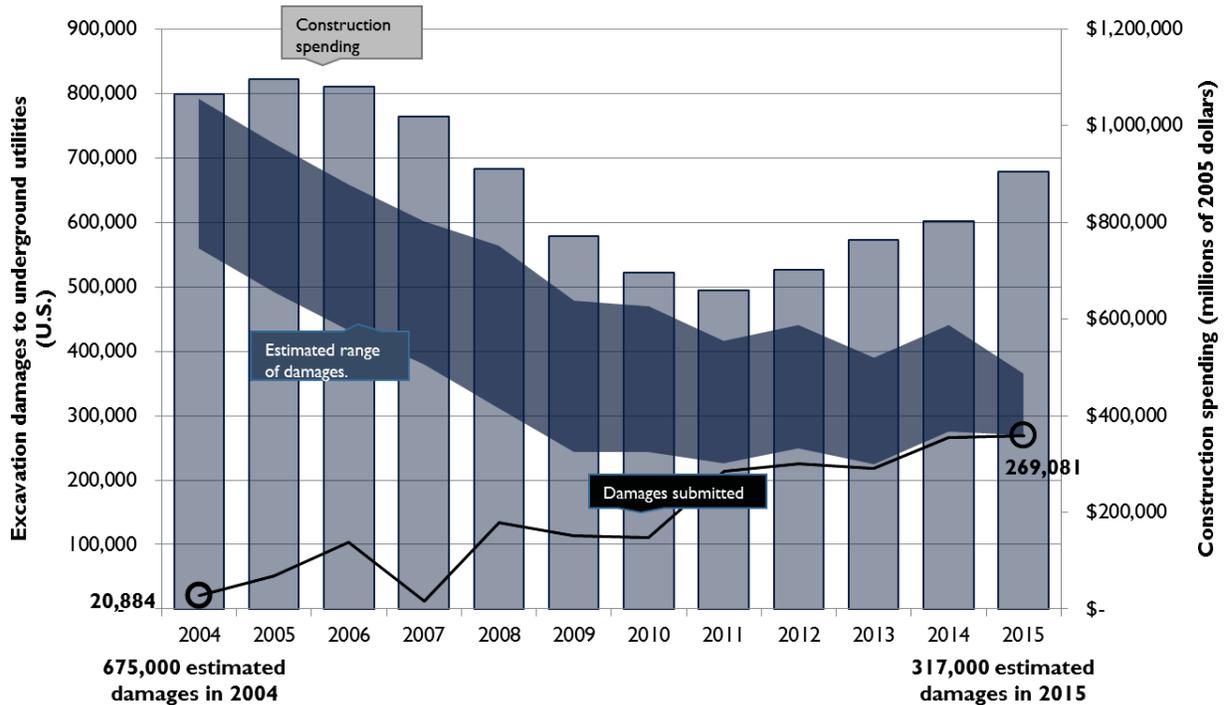
The 2015 estimated rate of damage per 1,000 one call tickets (outgoing transmissions) is calculated as follows:

- Estimate of 2015 total U.S. damages = 317,000
- Total outgoing transmissions based on OCSI data = 206,217,000

$$317,000 / [206,217,000 / 1000] = 1.54$$

This is 4% lower than the 2014 rate (1.60), and 26% lower than the 2013 rate (2.07), indicating continuous improvement.

Exhibit 2: Estimated number of U.S. excavation damages



Because of variations among state laws and one call center policies regarding geographical size and valid duration of one call tickets, care must be taken when comparing state damage rates against each other or against a national figure. For these reasons, this metric may be more useful for an entity such as a state, company, region, association, etc., to measure against itself over time. In addition, since participation in DIRT is voluntary, the degree of stakeholder reporting to DIRT varies among the states. Therefore, DIRT data may not provide a complete picture of damages and damage prevention efforts, particularly in states without substantial-reporting.

Another source of information regarding state damage prevention efforts is the U.S. Department of Transportation’s (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA),⁸ which administers safety regulation over natural gas distribution facilities.

For comparison and also from publicly available PHMSA data,⁹ a damage rate of 3.0 per 1,000 tickets (incoming) can be calculated for U.S. natural gas distribution facilities. This figure is based on mandatory reporting to PHMSA by regulated entities. Therefore, it is more reflective of actual conditions but should not be taken to mean natural gas distribution facilities perform worse than the U.S. as a whole.

Matching and Weighting Multiple Reports of Same Events

Since the early days of DIRT the question has been raised of whether or not multiple stakeholders are submitting reports on the same events (overlapping reports). With the increase in reports in recent years, particularly from locators as the reporting stakeholder, it became apparent that this was probably occurring often enough that it should be factored into the analysis for the annual DIRT Report.

The Data Reporting & Evaluation Committee (DR&EC) retained a data science consultant to develop a methodology to identify and merge multiple DIRT submissions relating to the same event, which was applied for the first time to the 2015 data set. Matching records are grouped into “sets” with each set having a linking identification number. Each record in the set has a “weight” equal to one divided by the number of records in that set.

Exhibit 3A demonstrates how this methodology was applied to several of the fields from DIRT. Each record in set #195119 has a weight of 0.33333, each in set #215278 is 0.5, etc. The sum of weighted values is used in the analysis for this report. For example, there were 104,569 damage reports (excluding near misses) with natural gas as the facility damaged. Applying this method results in a weighted sum of 75,042.22608, which is rounded to 75,042.

Exhibit 3A: Matching and Weighting Method

| Set number | Weight | RPT_STAKEH | DATE_OF_I | ADDRESS | FAC_DAMAGED | FAC_AFFECTED |
|------------|---------|------------|-----------|--------------------------|-------------|--------------|
| 195119 | 0.33333 | NATGAS | 09/08/15 | 1214 ALLENTOWN ROAD | NATGAS | DISTRIBUTION |
| 195119 | 0.33333 | EXCV | 09/08/15 | ALLENTOWN ROAD | UNKNOWN | UNKNOWN |
| 195119 | 0.33333 | LOCA | 09/08/15 | ALLENTOWN ROAD | NATGAS | DISTRIBUTION |
| 215278 | 0.5 | TELC | 09/28/15 | 535 29 ROAD | TELECOM | SERVICEDROP |
| 215278 | 0.5 | LOCA | 09/28/15 | 535 29TH ROAD | TELECOM | DISTRIBUTION |
| 254637 | 0.25 | NATGAS | 11/06/15 | 6341 STONEY VALLEY COURT | NATGAS | SERVICEDROP |
| 254637 | 0.25 | LOCA | 11/06/15 | 6341 STONEY VALLEY COURT | NATGAS | SERVICEDROP |
| 254637 | 0.25 | 1CAL | 11/06/15 | 6341 STONEY VALLEY COURT | NATGAS | SERVICEDROP |
| 254637 | 0.25 | NATGAS | 11/06/15 | 6341 STONE VALLEY COURT. | NATGAS | SERVICEDROP |

⁸ See links for each state to “State Program Performance Metrics” and “Damage Prevention Information” at: <https://primis.phmsa.dot.gov/comm/states.htm?nocache=4754>

⁹ <http://www.phmsa.dot.gov/pipeline/library/data-stats/distribution-transmission-and-gathering-Ing-and-liquid-annual-data>

Note that this method also captures instances where the same submitter may have inadvertently entered the same event more than once (see the two reports from NATGAS in set #254637 in Exhibit 3B). However, multiple stakeholders submitting overlapping reports make up the vast majority of these occurrences.

Exhibit 3B: Matching and Weighting Method¹⁰

| Set number | EXCAVATOR_TYPE | EXCAVATION_TYPE | WORK_PERFORMED | DAMAGE_CAUSE |
|------------|----------------|-----------------|----------------|--------------|
| 195119 | UTILITY | TRENCHER | WATER | EXHANDTOOL |
| 195119 | CONTRACTOR | BACKHOE | UNKNOWN | NOTCOL |
| 195119 | CONTRACTOR | UNKNOWN | WATER | INSUFEX |
| 215278 | UNKNOWN | BACKHOE | ELECTRIC | NOTCOL |
| 215278 | UTILITY | UNKNOWN | ELECTRIC | EXTESTHOLE |
| 254637 | CONTRACTOR | NOTCOLLECTED | TELECOM | INSUFCALL |
| 254637 | CONTRACTOR | BORING | UNKNOWN | INSUFEX |
| 254637 | CONTRACTOR | BORING | TELECOM | NOLOCATEREQ |
| 254637 | NOTCOLLECTED | NOTCOLLECTED | NOTCOLLECTED | INSUFEX |

Note also that events with *Unknown* and *Data Not Collected* are included in the weighted sums, but for most analyses these are filtered out, leaving what are referred to as “known” events. Therefore, with this methodology no data is ignored and no judgment is made as to which record is correct.

There were 363,176 underground damage and near-miss event records submitted for 2015, and after applying the matching and weighting methodology, that figure consolidates to 288,346 as shown in Exhibit 4:

Exhibit 4: Records and sets from matching and weighting method

| Records/Set | Records | Sets |
|-------------|---------|---------|
| 1 | 226,228 | 226,228 |
| 2 | 104,036 | 52,018 |
| 3 | 23,958 | 7,986 |
| 4 | 7,084 | 1,771 |
| 5 | 1,140 | 228 |
| 6 | 516 | 86 |
| 7 | 154 | 22 |
| 8 | 40 | 5 |
| 9 | 9 | 1 |
| 11 | 11 | 1 |
| total | 363,176 | 288,346 |

¹⁰ Exhibits 3A and 3B are examples of actual DIRT output conforming to the bulk File Upload Specification. References to root causes in this report will generally be as they appear on the DIRT Offline Field Form. Appendix 1 shows the root cause abbreviation matches to the Field Form descriptions. This report also typically uses *Notification NOT made* which is synonymous with *NOLOCATEREQ* and *No notification made to the one-call center*.

Exhibit 5 shows the effect this methodology has on the number of reports by reporting stakeholder. In terms of raw numbers, locators had the most overlap with other reporting stakeholders. This is unsurprising, since locators submitted the most reports and are most likely to overlap reporting by another entity such as a facility operator, one call center, or excavator. Setting aside manufacturers (MFGR), one call centers had the largest reduction in terms of percentage, which indicates that in many cases they are overlapping reporting with one or more other entities.

Exhibit 5: Matching and weighting effect on reporting stakeholder events

| Reporting Stakeholder | Unweighted Events | Weighted Events | Change | % Reduction |
|------------------------|-------------------|-----------------|--------|-------------|
| One-Call Center | 26,665 | 14,516 | 12,149 | 45.56% |
| Electric | 4,581 | 3,711 | 840 | 19.00% |
| Engineer/Design | 22 | 18 | 4 | 16.67% |
| Excavator | 18,724 | 12,630 | 6,094 | 32.55% |
| Insurance | 1 | 1 | 0 | 0.00% |
| Liquid Pipe | 432 | 420 | 13 | 2.89% |
| Locator | 222,842 | 188,186 | 34,656 | 15.55% |
| Equipment Manufacturer | 2 | 1 | 1 | 50.00% |
| Natural Gas | 59,717 | 45,107 | 14,640 | 24.47% |
| Private Water | 162 | 145 | 17 | 10.34% |
| Public Works | 1,445 | 1,119 | 326 | 22.57% |
| Railroad | 7 | 5 | 2 | 23.81% |
| State Regulator | 7,349 | 4,861 | 2,488 | 33.85% |
| Road Builder | 120 | 89 | 31 | 25.42% |
| Telecommunications | 20,163 | 16,849 | 3,314 | 16.43% |
| Unknown | 944 | 687 | 257 | 27.21% |
| TOTAL | 363,176 | 288,346 | 74,830 | 20.60% |

Several one call centers take “damage tickets” from excavators and submit these as DIRT reports. The Data Reporting & Evaluation Committee (DR&EC) has been trying to discourage one call centers from listing *One Call Center* as the reporting stakeholder, and in fact the DIRT Users Guide material for answering “Who Is Submitting this Information” states, “*One Call Center: For one call centers that compile data from other parties, such as their membership, for submission to DIRT, the original-source stakeholder group should be used rather than one call center, to allow for more accurate analysis of the original source of the data.*”

The DR&EC is considering removing *One Call Center* as an answer to this question (see **Preview of DIRT Revisions Coming in 2018**). One call centers would still be able to submit reports, and CGA will know they came from one call centers based on the submitters' registration information. But the DR&EC needs the original source of the DIRT information to analyze in conjunction with other DIRT fields. If reports are identified as coming from excavators rather than one call centers, more accurate analysis can be made of the excavator viewpoint on issues important to them such as downtime and root cause.

Events by Known Root Cause Groups¹¹

Exhibit 6 shows the distribution of the major root cause groupings for 2009 through 2015.

Exhibit 6: Root cause groups—known events

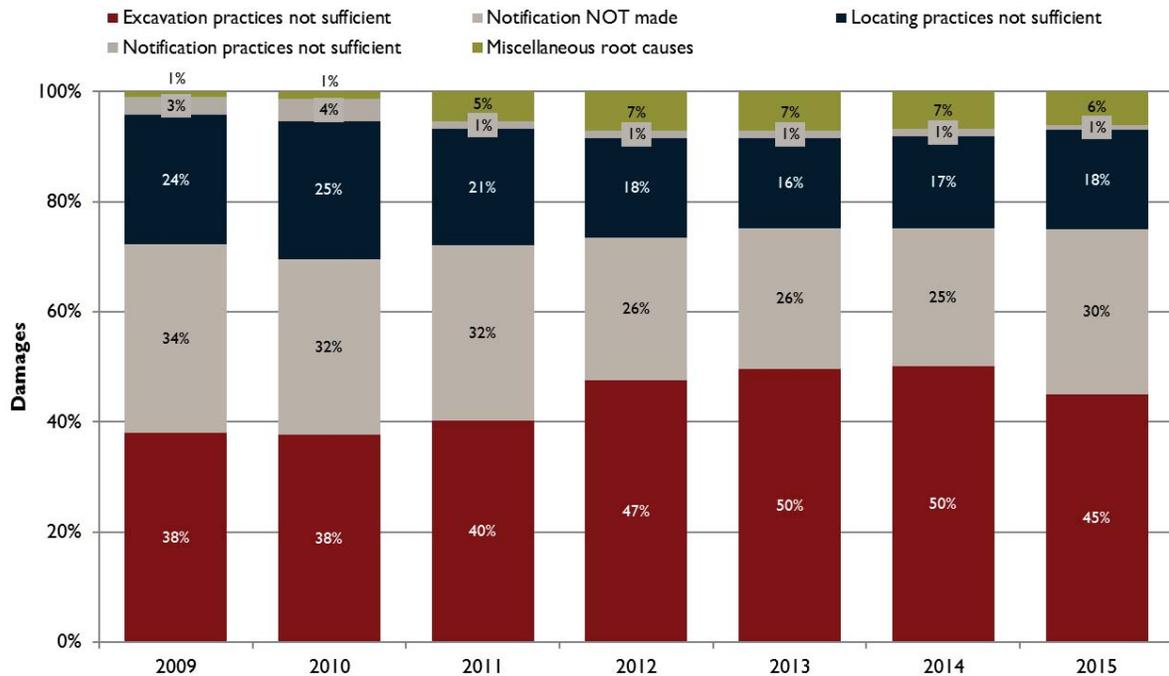
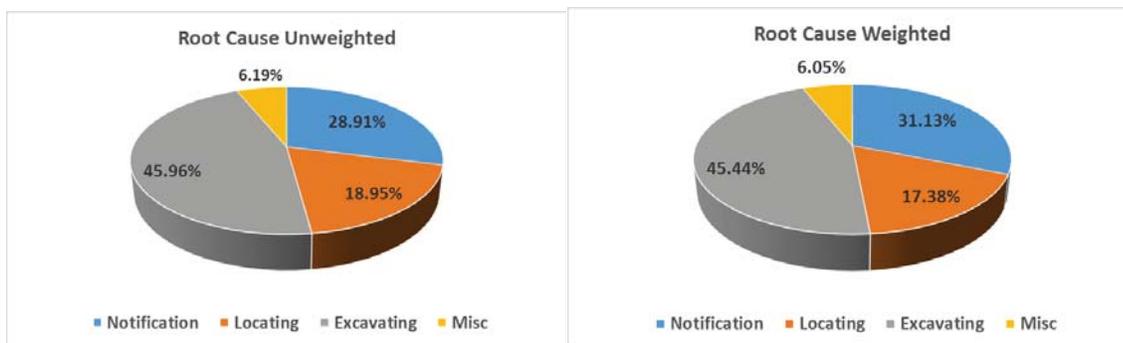


Exhibit 7 shows the distribution of known root cause groups for the original 373,176 unweighted records and the 288,346 weighted records for 2015. The weighting method causes the Notification (combines *Notification NOT Made* and the *Notification practices not sufficient* from Exhibit 6) pie slice to be slightly larger, and *Excavating and Locating Practices* to be slightly smaller. This is likely because the weighting method dilutes the effect of filtering out the reports with root causes of *Data not collected* and *Other*.

Exhibit 7: Unweighted and weighted root cause groups (2015 known events)



¹¹ Appendix 2 shows the groupings used in this report, and on the dashboard, for root cause, excavator type, excavation type, and work performed.

From 2012 through 2014, prior to implementation of the matching and weighing method, damages due to *Notification NOT made* hovered around 25% to 26%. In 2015 such damages appear to be up whether calculated before or after applying the matching and weighing method. Some of this increase may be attributable to more accurate reporting. Exhibit 22 in the Data Quality Index (DQI) section of this report shows some examples of where *Notification Not Made* (NOLOCATEREQ) could be a more accurate choice. Exhibit 8 shows some additional examples of comments from the free-text “damage_other_desc) DIRT field indicating an improper root cause choice. In each case, *Notification Not Made* would have been the proper selection. *Other Insufficient Excavation Practices* (INSUFEX) is an excavation practice, *Facility could not be found or located* (NOTLOCATED) is a locating practice, and *One-Call Center error* (1CALLPRAC) is miscellaneous. To the extent that DIRT submitters make these corrections and choose *Notification Not Made* over the other options, that slice of the pie chart will increase and the others will decrease.

Exhibit 8: Improper root cause selections

| damage_cause | damage_other_desc |
|--------------|------------------------------|
| INSUFEX | DUG BEFORE LOCATE COMPLETE |
| INSUFEX | exempt from calling locates |
| INSUFEX | Expired locate |
| INSUFEX | NOLOCATEREQ |
| INSUFEX | OUT OF SPECIFIED LOCATE AREA |
| NOTLOCATED | No locate request |
| 1CALLPRAC | No locate request |

This raises the question: Have damages due to *Notification NOT made* increased in 2015 compared to the past few years? Several moving targets need to be examined to answer this question. For 2015, one call notification issues are a larger percentage of the root cause pie chart, both unweighted and weighted, compared to 2014. As discussed above, this may be driven by a combination of the matching/weighting effect and more accurate reporting. It is also important to remember that total estimated damages are down approximately 9%, so one call notification issues represent a larger slice of a smaller pie. In terms of raw numbers, for 2014 we estimated that 92,136 U.S. damages were due to one call notifications not made, or made but insufficient or with wrong information provided. For the same figures in 2015 we estimated 91,645 unweighted (less than 2014) and 98,682 weighted (more than 2014). The implementation of the matching and weighting method makes the 2015 data analysis somewhat of a transition or “reset,” so comparison to 2014 data, when the method was not applied, is difficult.

Damages involving occupants, hand tools, landscaping, and fencing all increased in 2015, and as will be seen in the DIRT Dashboard Analysis, these involve high rates of *Notification NOT made*. However, when considering that incoming one call notifications, 811 awareness, and construction activity are all up and total damages are down, it appears that overall damage prevention continues to improve, although opportunities for further improvement remain.

DIRT Dashboard Analysis—Overview of Tableau Dashboard and Analysis Examples

Damage Element Analysis

As noted in the introduction, the 2015 DIRT Report marks the introduction of an [interactive dashboard](#) that allows industry stakeholders to conduct their own analysis on 2015’s reported DIRT damages. This [tool](#) is accessible on the CGA website and contains seven individual dashboards that examine the data through a specific element; e.g., damage characteristics by state, root cause analysis, etc. The visualizations within each dashboard act as a filter to allow users the ability to drill down into the topics that are of most interest to them.

Exhibit 9 provides a screen shot example from the “Damage Cause Analysis” dashboard, without no filters activated. It contains all known data pertinent to each element—damage root cause, excavator type, excavation equipment, and facility damaged. This dashboard shows that 31% of known damages were attributed to *Notification NOT Made* and that telecommunication was the most reported affected facility. In addition, the contractor/developer group had 66.53% of known damages attributed to it, and 50.55% of damages involved backhoe/trenchers.

Exhibit 9: Damage Cause Analysis—no filters activated

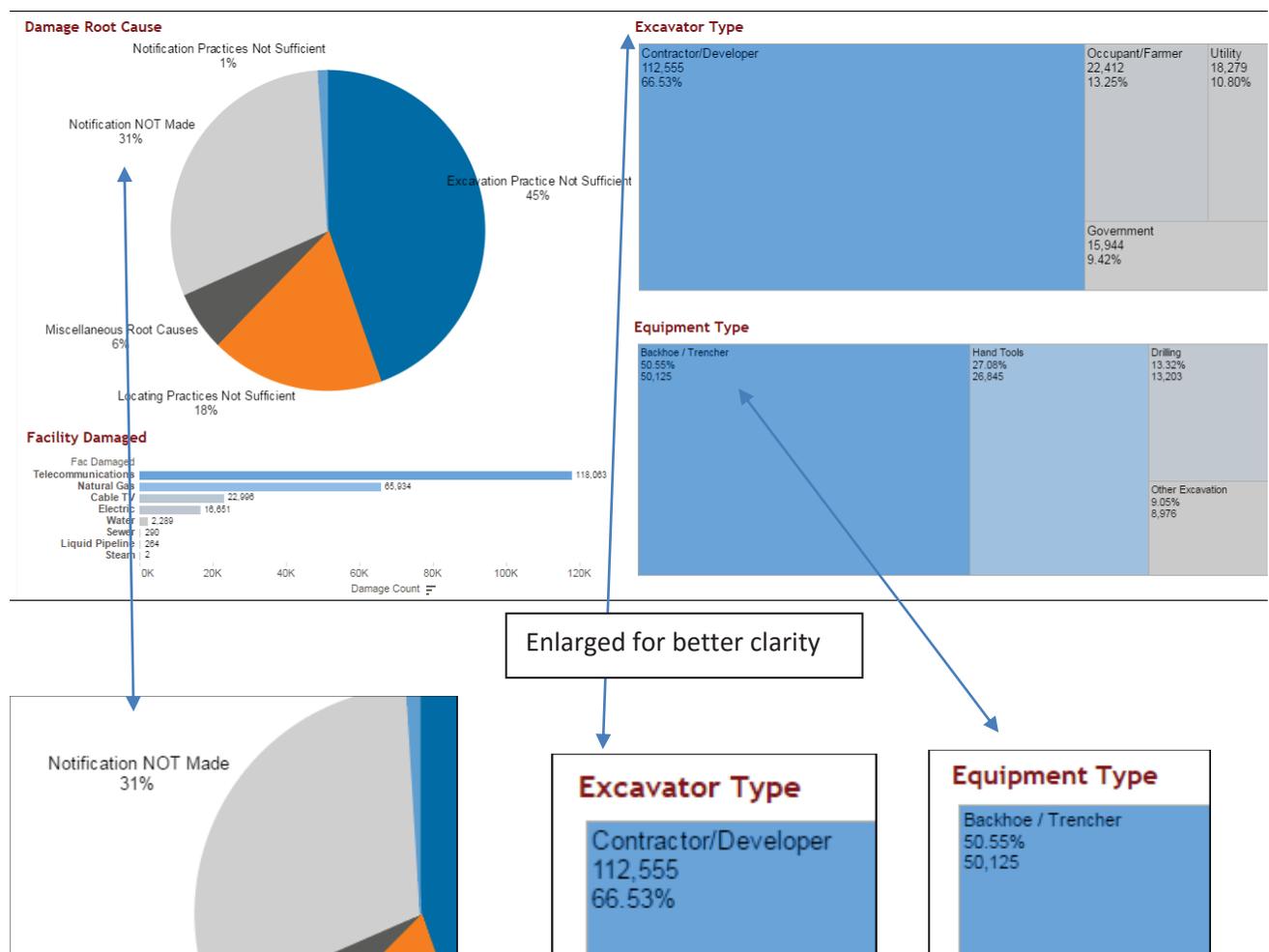


Exhibit 10 demonstrates each data element acts as a filter to the other charts within the dashboard. When the occupant/farmer element is selected (blue arrow), the other elements recalculate to reflect the characteristics involving only occupant/farmers, now 64.15% involving hand tools and only 22.85% involving backhoes/trenchers, and the root cause pie chart recalculates to show 65% due to *Notification NOT Made*.

Exhibit 10: Damage Cause Analysis—Occupant/Farmer filter selected under the Excavator Type chart

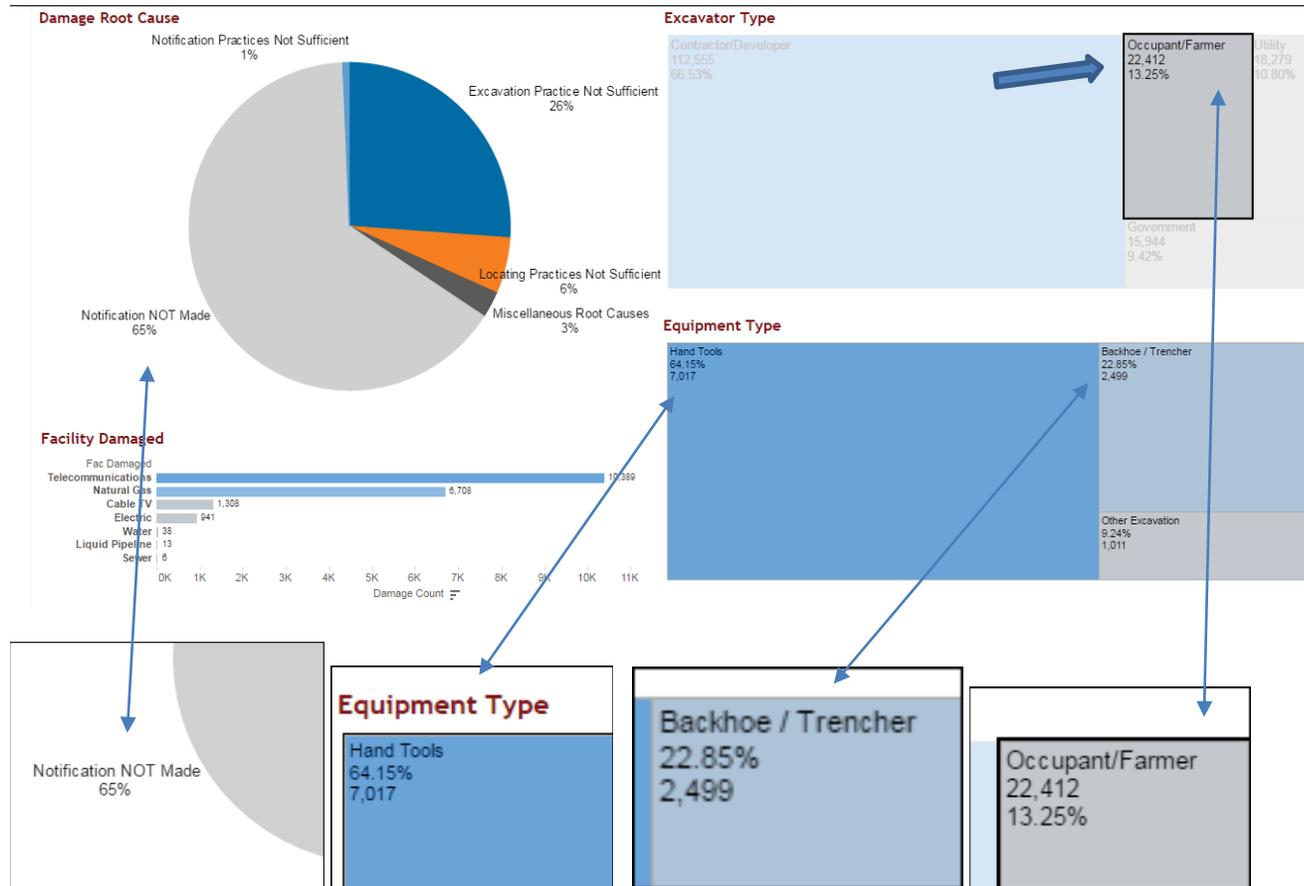
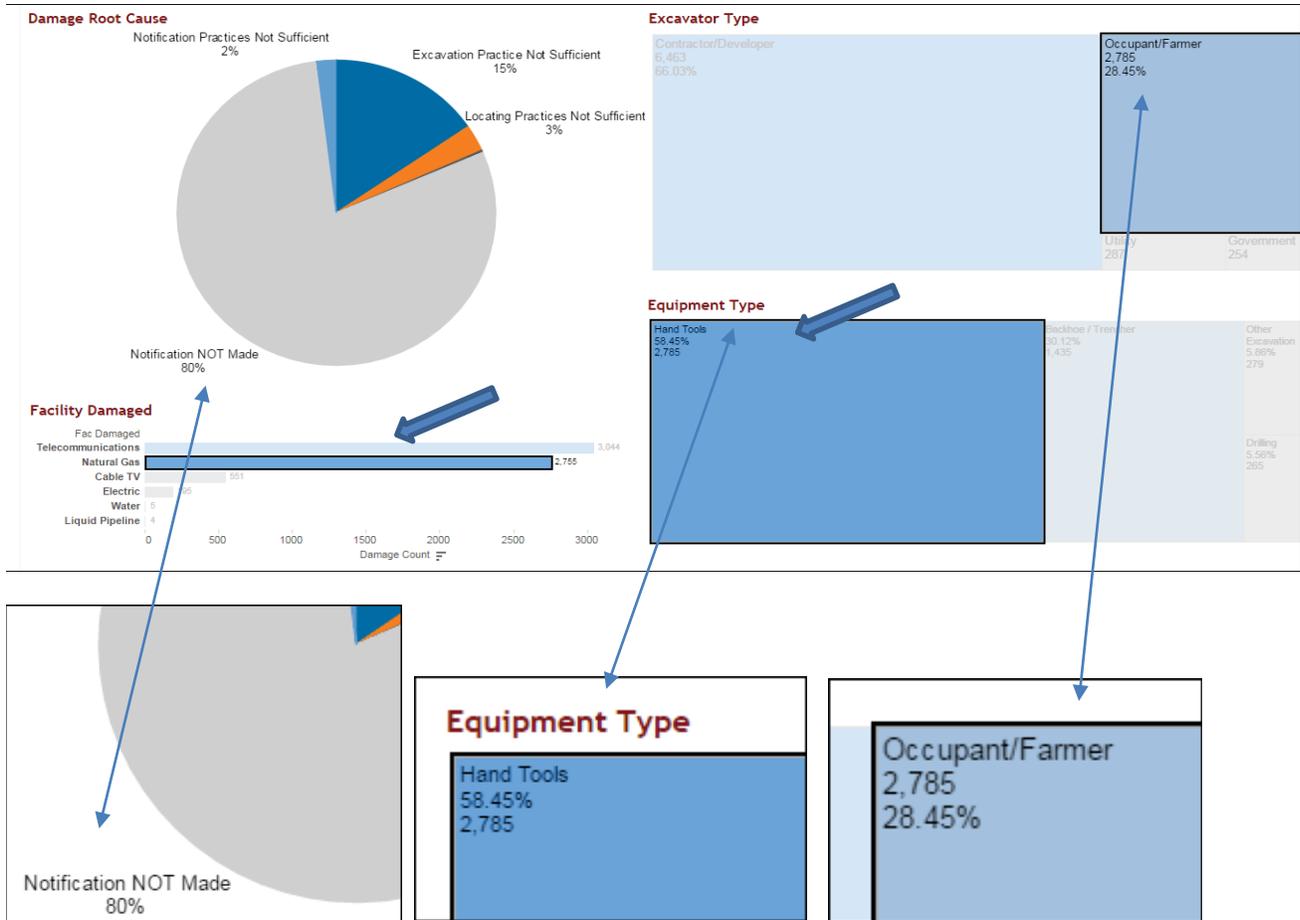


Exhibit 11 depicts how Exhibit 10 recalculates if natural gas is selected as the facility affected and hand tools as the excavation equipment. *Notification NOT Made* becomes 80% of the root cause pie chart.

Exhibit 11: Damage Cause Analysis—Occupant/Farmer, Hand Tools, and Natural Gas filters selected



Work Performed by Excavator Type Analysis

Exhibit 12 is an example of another dashboard from the Tableau data analysis tool. The matrix on the upper left shows damages involving various combinations of work performed and excavator type. With no filtering applied, the combination with the highest percentage is contractor/developers performing sewer/water work. The other elements on this dashboard view are a heat map of the U.S., percentage of damages with or without a locate request, type of excavation equipment, and the top three root causes and facilities damaged.

Exhibit 12: Work performed by Excavator Type Analysis—no filters selected

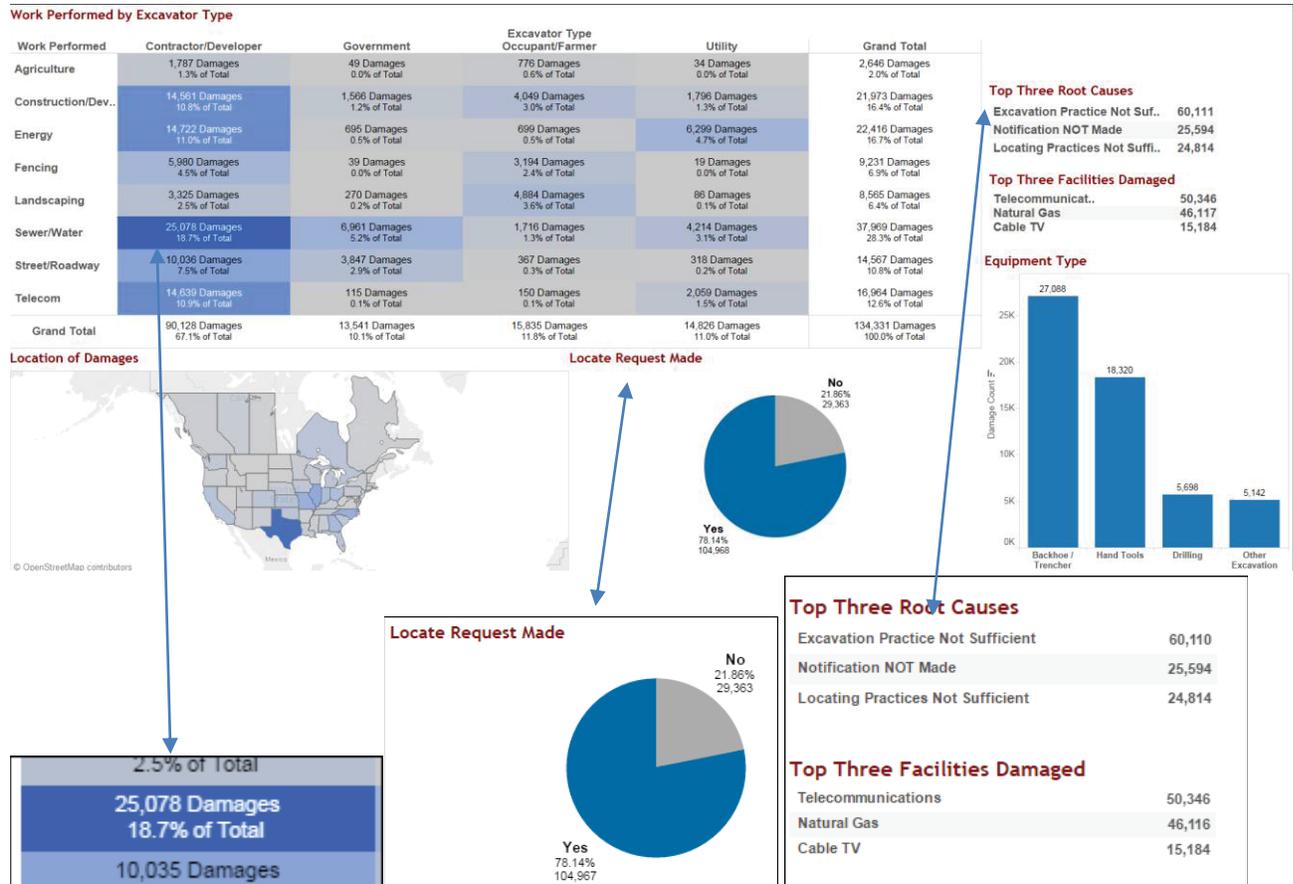


Exhibit 13 then highlights the damage characteristics when focused solely on contractors/developers performing sewer/water work (by clicking on the darkest blue box). This causes the damages with locate requests to increase by approximately 11% and natural gas facilities become the leading damaged facility. Consistent with past DIRT reports, the majority of the damages for the contractor/developer group involve backhoe/trencher and *Excavation Practices Not Sufficient* as the leading root cause group.

Exhibit 13: Work performed by Excavator Type Analysis — Contractor/Developer and Sewer/Water filter selected

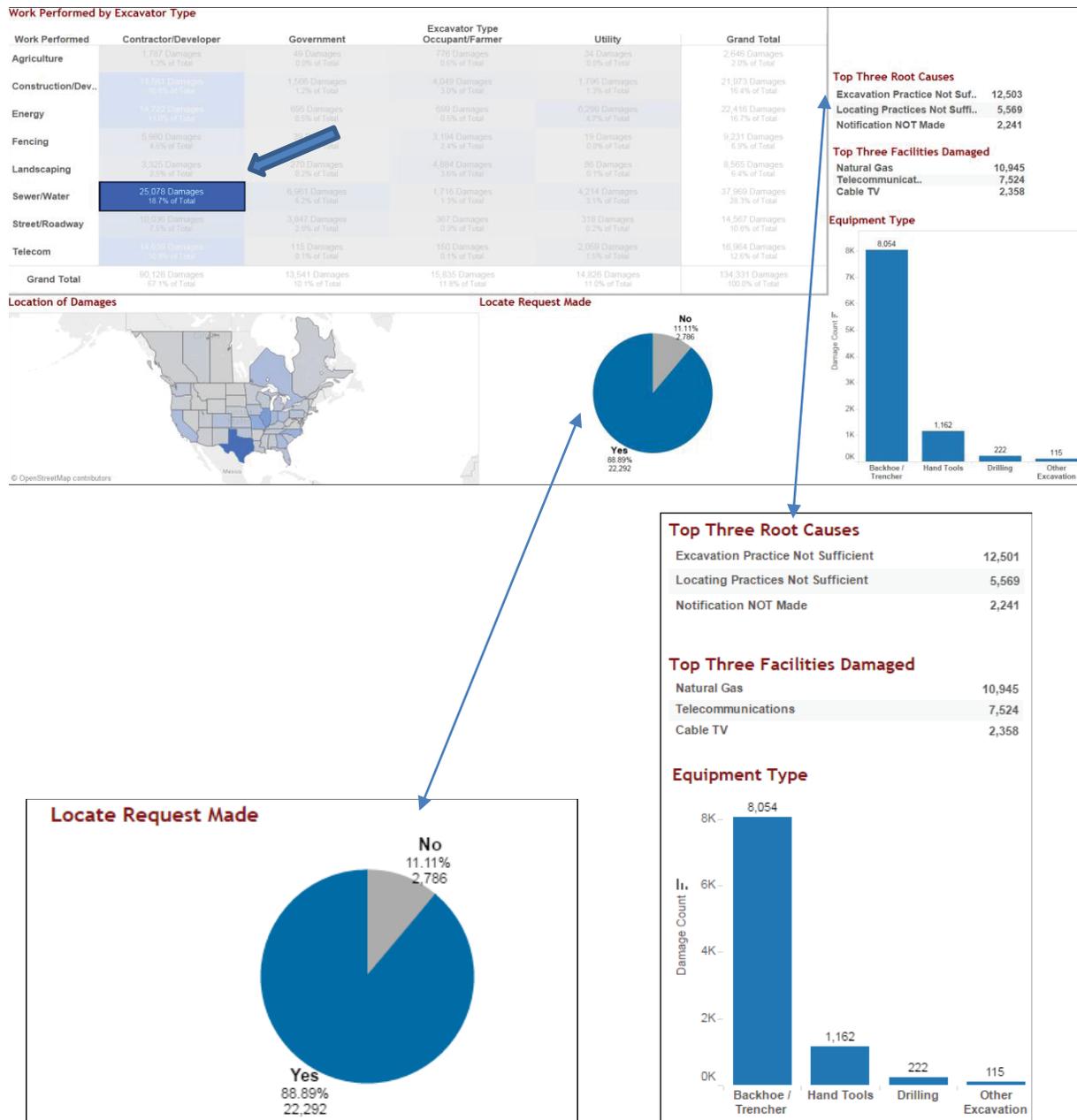
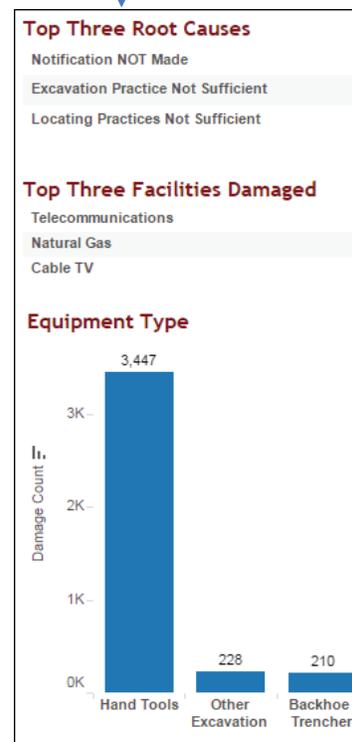
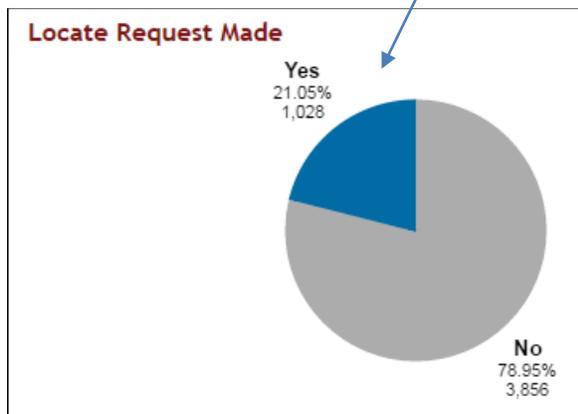
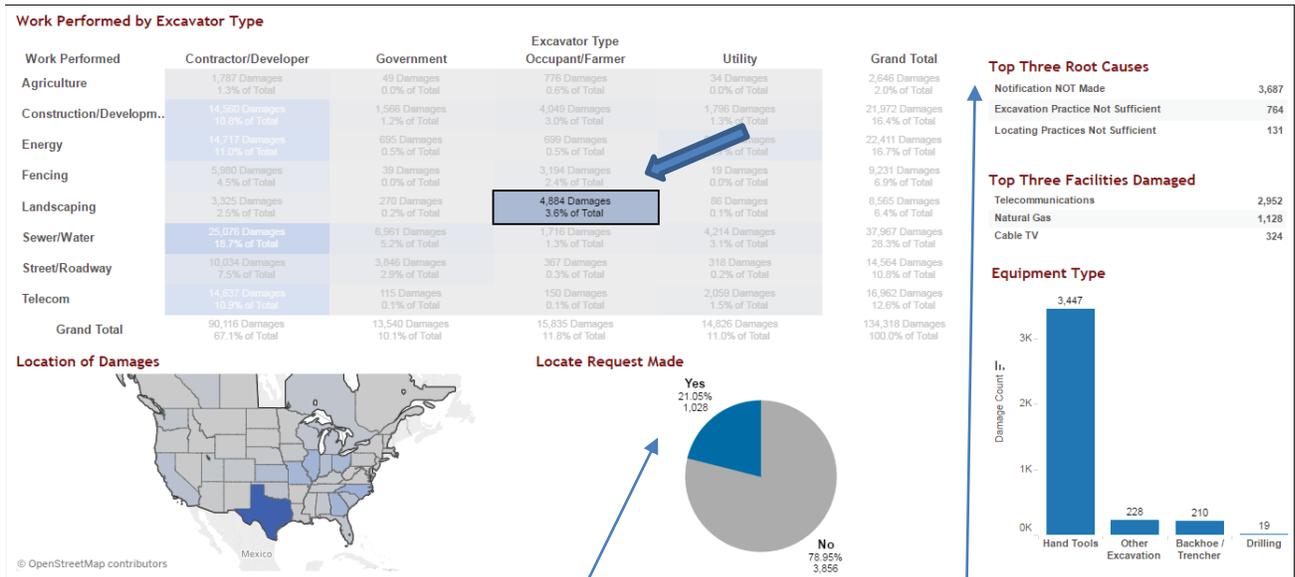


Exhibit 14 shows how the dashboard elements change if the Occupant/Farmer versus Landscaping box is selected. This causes a dramatic difference in the “Locate Request Made” pie chart with “No” increasing to 78.95%, hand tools becoming the leading equipment type, and *Notification NOT Made* becoming the leading root cause.

Exhibit 14: Work performed by Excavator Type Analysis—Occupant/Farmer and Landscaping filter selected



Work Performed by Equipment Type Analysis

In the next dashboard view, the excavator type and equipment used trade places in the upper left and lower right. Here again, any data point from any of the elements can be selected to cause all other elements to recalculate to show the relevant attributes. In the unfiltered analysis (Exhibit 15), the leading combination of work performed and equipment used is sewer/water with backhoe/trencher, and the next is landscaping work with hand tools, followed closely by fencing with hand tools.

Exhibit 15: Work performed by Excavation Type Analysis—no filter selected

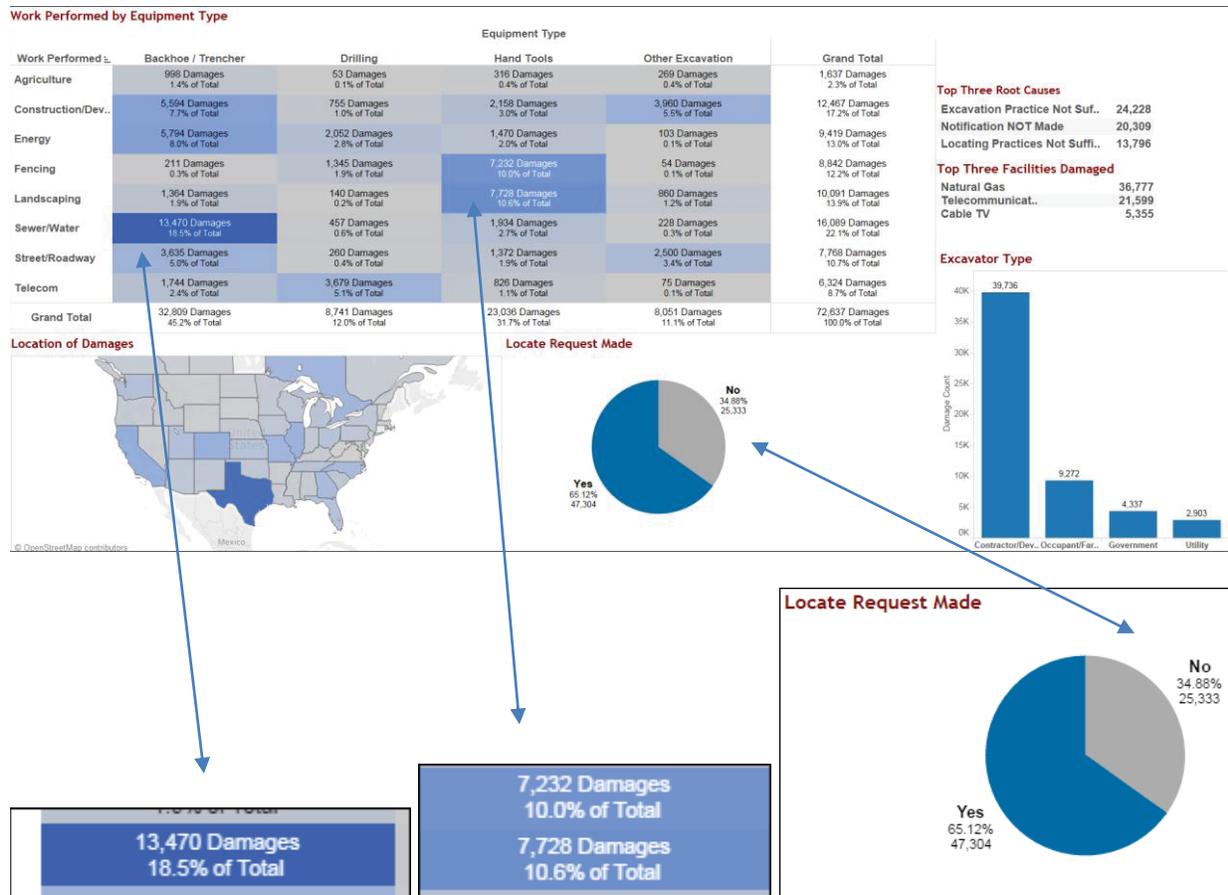
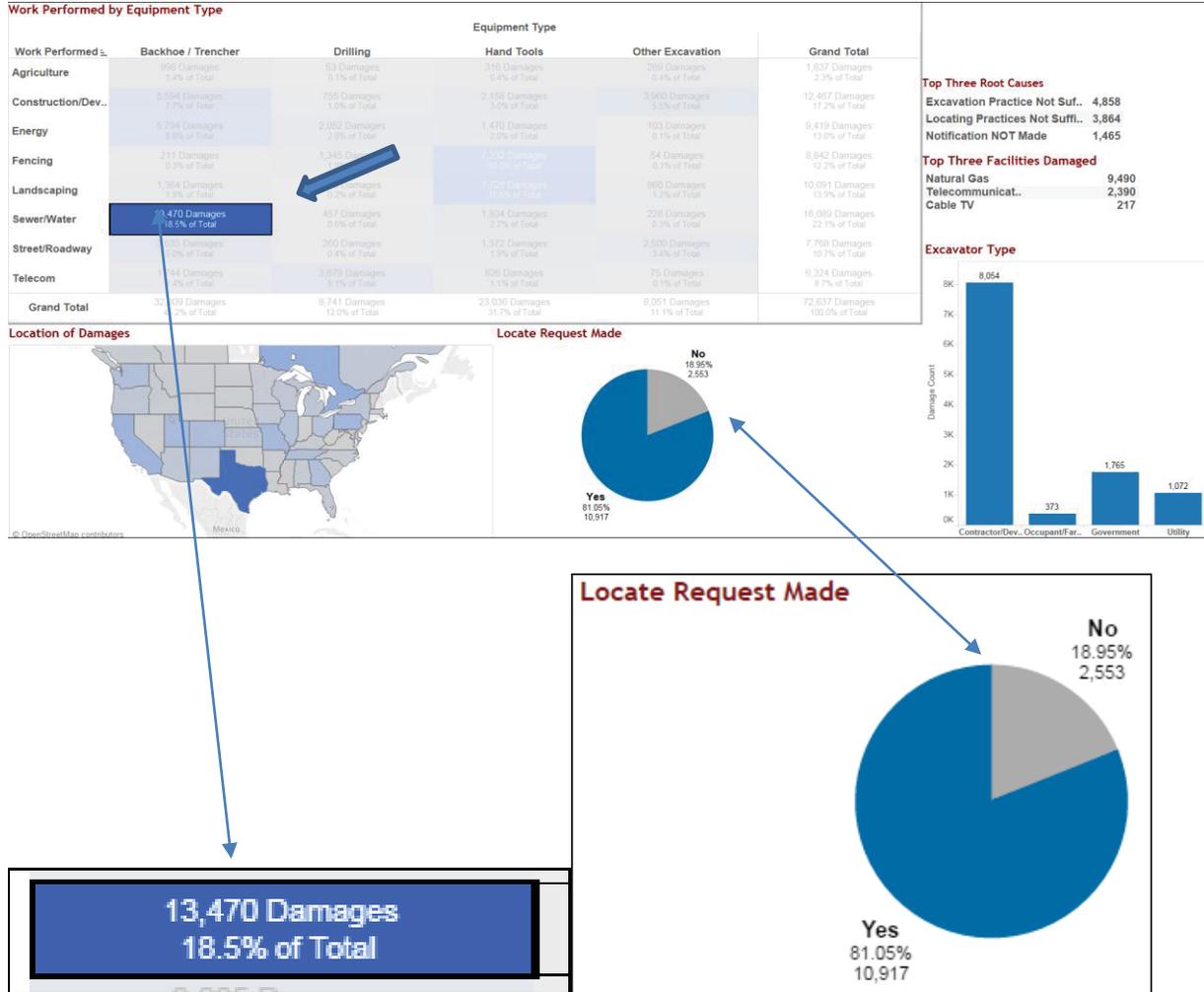


Exhibit 16 illustrates filtering for sewer/water work with backhoe/trencher equipment.

Exhibit 16: Work performed by Excavation Type Analysis—Sewer/Water and Backhoe/Trencher filter selected

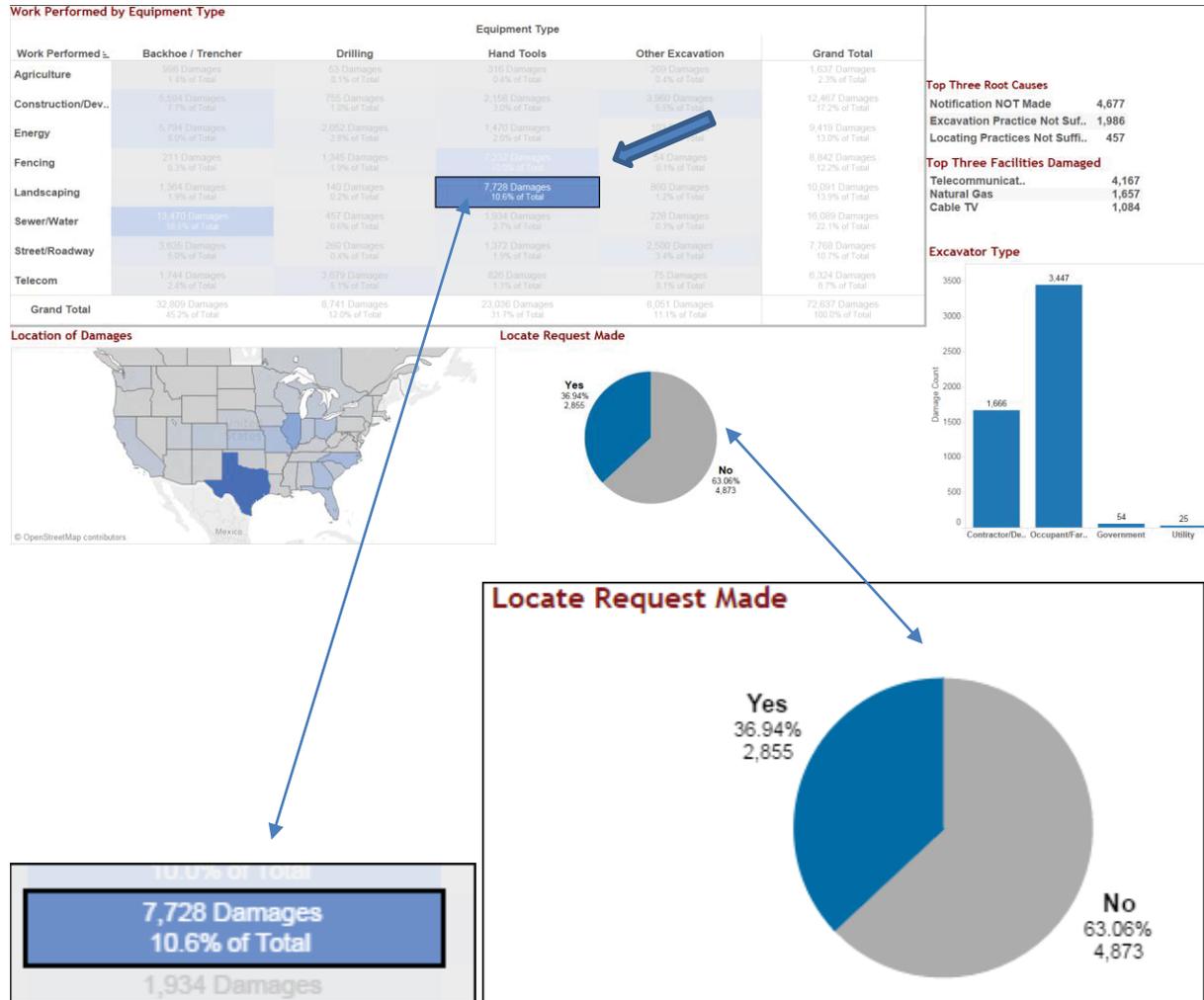


Note: It is also possible to expand any grouping to see its components, and then hover the cursor over another dashboard element and see its details. The example below isolates “water” from “sewer/water” in the “backhoe/trencher” column.



Exhibit 17 illustrates filtering for landscaping work with hand tools.

Exhibit 17: Work performed by Excavation Type Analysis—Landscaping and Hand Tools filter selected



Note how “No” increases dramatically in the Locate Request Made pie chart between Exhibits 16 and 17. As these examples show, this dashboard tool allows for instant analysis of various combinations of DIRT data elements to hone in on the factors contributing to damages: what types of excavators, doing what types of work with what equipment, what facilities are being damaged, and why? This leads to more targeted corrective actions. For example, events involving contractors/developers, water/sewer work, and backhoes/trackhoes show relatively good compliance with one call notification, but improvement in safe excavation practices could have a great impact on reducing damages.

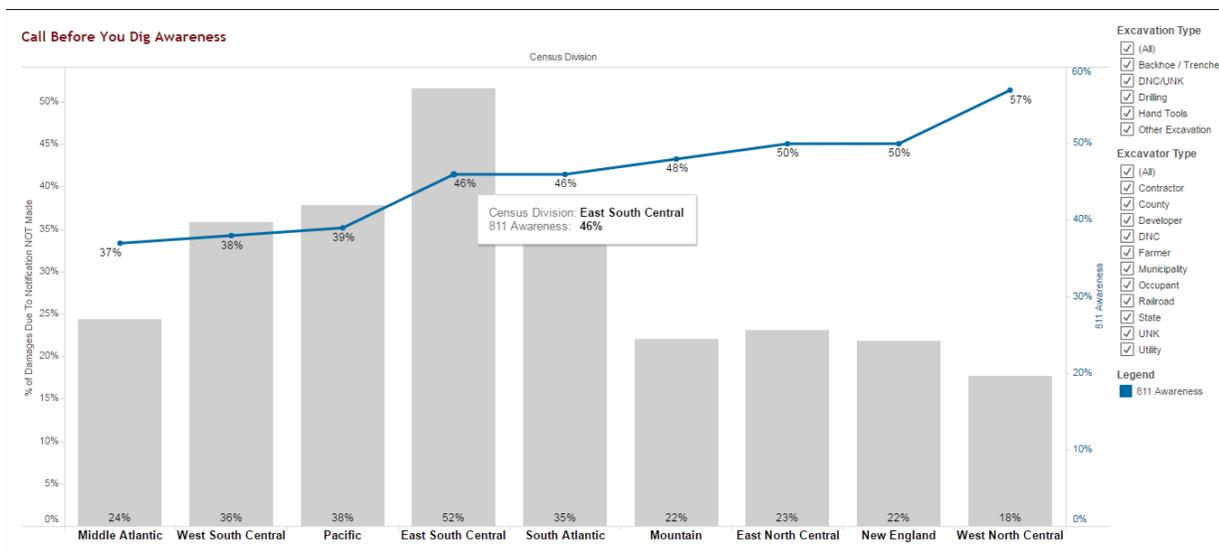
In contrast, events involving occupants/farmers, landscaping, and hand tools are disproportionately caused by lack of one call notification. As noted previously, housing permit activity was up by 15% in 2015 over 2014, so although national data on the extent of landscaping or fencing is not available, it would be reasonable to assume those activities increased along with new home construction and general improvement in the economy (U.S. GDP was up 2.6% in 2015 from 2014). These may be areas for improved 811 awareness.

Among the states there are various exemptions from 811 notification requirements for digging by non-professional excavators and with non-mechanized equipment. One call notification exemptions were discussed in the 2012 and 2013 annual DIRT Reports. In October 2014, PHMSA released “[A Study on the Impact of Excavation Damage on Pipeline Safety](#)”¹² in which exemptions are discussed extensively. In July 2015, PHMSA issued a “Final Rule on Pipeline Safety: Pipeline Damage Prevention Programs,”¹³ that describes how PHMSA will evaluate the effectiveness of state damage prevention enforcement programs, including consideration of exemptions. The dashboard tool can be helpful in analyzing the effects of exemptions.

Call Before You Dig Awareness

Similar to previous DIRT reports, the relationship between call before you dig awareness and percentage of damages attributed to *Notification NOT Made* is again examined and is one of the features of the new dashboard tool. This analysis is conducted at the U.S. Census Division¹⁴ level and uses the 2015 “Call Before You Dig/811 National Awareness Study” conducted for CGA by Povaddo, LLC, to evaluate general (not limited to professional excavators) awareness of call before you dig services. Exhibit 18 shows the results of this analysis for the entire unfiltered data set. The exhibit is sorted left to right by increasing awareness, indicated by the blue line, which remains constant no matter the combination of excavator or equipment type selected. Overall, the observed trend is that as awareness increases, the percentage of damages attributed to *Notification NOT Made* decreases.

Exhibit 18: Call before you dig general awareness and percentage of events attributed to Notification NOT Made by U.S. census division (2015)—no filter



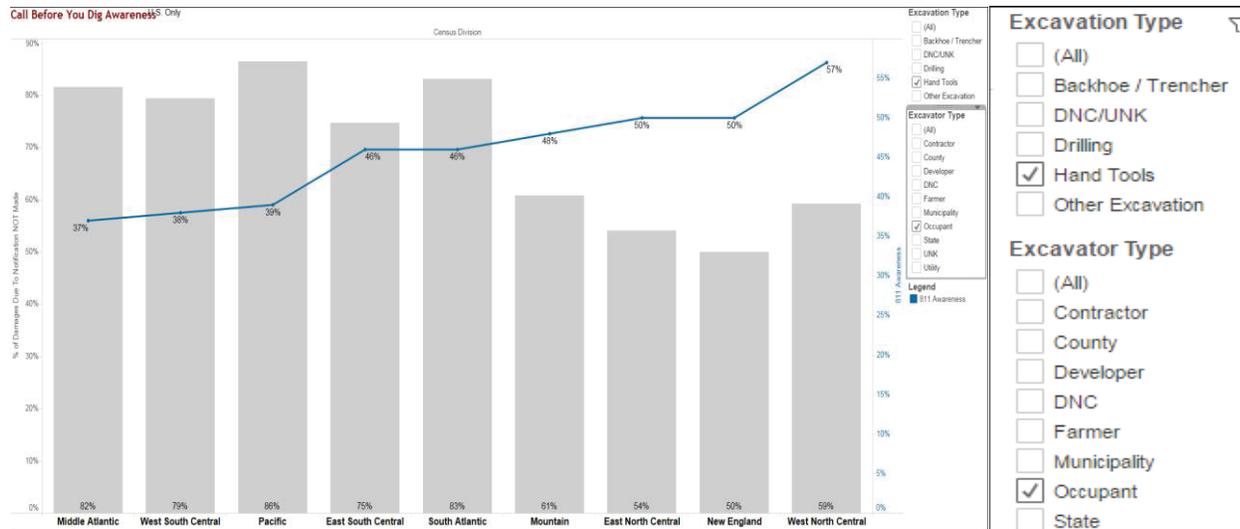
¹² http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/S10_140728_011_F_reduced.pdf

¹³ http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Excavation_Damage_80_FR_43836_Final_Rule.pdf

¹⁴ See https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf for details.

By isolating the excavator type “occupant” and the excavation type “hand tools” as shown in Exhibit 19, the same trend is seen as in Exhibit 18, but the percentages of damages due to *Notification NOT Made* are much higher. This suggests that an increase in awareness for occupants using hand tools could increase their likelihood to call 811, hopefully resulting in fewer damages. However, as discussed in the previous section, exemptions come into play for non-professional excavators and non-mechanized equipment.

Exhibit 19: Call before you dig general awareness and percentage of events attributed to Notification NOT Made by U.S. census division (2015)—Occupant and Hand Tools filter selected



Here are the key findings of the Povaddo survey:

1. Awareness of call before you dig services increased from 44% to 47% (surveys June 2015 and June 2016). Aided recall (asked if 811 sounds familiar?) also increased 4 points since 2015, while unaided recall remains consistent.
2. More than one-third (38%) of respondents say they have seen or heard advertising that promotes the 811 service, a significant increase since 2015. This increase is partially driven by young and urban populations who have historically had lower awareness.
3. Usage of 811 has also increased since 2015, and is currently at the highest level seen to date (12%). An additional 14% of respondents who were not aware of 811 or have not called 811 in the past say they have gone online or called to have their underground utility lines marked.
4. Six in 10 (61%) respondents say in the future they are likely to call 811 before beginning a digging project. Of those planning a future project, nearly 9 in 10 (89%) say they would call. This important finding illustrates that the value of 811 is most recognized by those who need the service.
5. The June 2016 survey finds a slight increase in all measures, potentially driven by the increased exposure to 811 advertising. Engagement with 811 services continues to be driven by those who have done or are planning a future project.

Data Quality Index (DQI)

The Data Quality Index (DQI) measures the completeness of event data submitted to DIRT. Each part within the DIRT form has a relative weight based on the value that it provides to statistical analysis (see Exhibit 20). Each question within each part is also weighted, adding to 100 within the part. Points are subtracted when *Unknown*, *Other*, and *Data Not Collected* are used. The DQI is intended to provide submitters feedback based on measures of the ‘completeness’ and/or ‘quality’ of the data they submit, so that they can identify opportunities to improve.

Exhibit 20: DIRT Parts and DQI relative weights

| Part | Title | Relative Weight |
|-------|------------------------------------|-----------------|
| A | Who is submitting this information | 5 |
| B | Date and location of the event | 12 |
| C | Affected facility information | 12 |
| D | Excavation information | 14 |
| E & F | Notification, locating and marking | 12 |
| G | Excavator downtime | 6 |
| H | Description of damage | 14 |
| I | Description of the root cause | 25 |
| | Total | 100 |

Exhibit 21 shows the 2015 and 2014 DQI by reporting stakeholder. Because the matching and weighting method involves combining records from different reporting stakeholders, it makes more sense to present the DQI scores based on the original unweighted 363,176 records.

Exhibit 21: DQI by reporting stakeholder

| Reporting Stakeholder | DQI 2015 | DQI 2014 | Change |
|------------------------|----------|----------|--------|
| One-Call Center | 45 | 42 | 3 |
| Electric | 65 | 66 | -1 |
| Engineer/Design | 58 | 37 | 21 |
| Excavator | 51 | 41 | 10 |
| Insurance | 80 | NA | NA |
| Liquid Pipe | 77 | 47 | 30 |
| Locator | 71 | 72 | -1 |
| Equipment Manufacturer | 70 | NA | NA |
| Natural Gas | 71 | 68 | 3 |
| Private Water | 84 | 75 | 9 |
| Public Works | 74 | 81 | -7 |
| Railroad | 69 | 77 | -8 |
| State Regulator | 67 | 66 | 1 |
| Road Builder | 67 | 78 | -11 |
| Telecommunications | 53 | 53 | 0 |
| Unknown | 56 | 57 | -1 |
| TOTAL | 67 | 65 | 2 |

The DQI continues to improve incrementally year to year. locators remained virtually the same, and the other two leading submitting stakeholder groups, natural gas and one call centers, each improved by three points.

There is “low-hanging fruit” in the data that would enable reporting stakeholders to improve their DQI scores and make data analysis more accurate and meaningful. Root cause is considered the most important DIRT field for analysis and carries the highest weight.¹⁵ There are many reports with *Other* as the root cause, which causes a DQI point reduction, but that contain comments in the description field (damage_other_desc) that indicate a more specific choice was available. Exhibit 22 table below shows several examples. The first two columns are as entered by DIRT submitters. The last two columns are the better recommended selections.

Exhibit 22: Better alternatives to OTHER as a damage root cause

| damage_cause | damage_other_desc | better_damage_cause | better_damage_cause_abbv |
|--------------|------------------------------------------------|----------------------------------------------------------|--------------------------|
| OTHER | Facility could not be found or located | Facility could not be found or located | NOTFOUND |
| OTHER | Facility markings or location not sufficient | Facility markings or location not sufficient | INSUFMARKING |
| OTHER | Facility owner prints for site were inaccurate | Incorrect facility records/maps | BADMAP |
| OTHER | Working on expired ticket | No Notification made to the one-call center | NOLOCATEREQ |
| OTHER | Wrong City on ticket | Wrong information provided to one-call center | WRONGINFO |
| OTHER | Failure to stay within proposed work area | No Notification made to the one-call center | NOLOCATEREQ |
| OTHER | No locates called in | No Notification made to the one-call center | NOLOCATEREQ |
| OTHER | Contractor dug prior to facilities marked | Notification to one-call center made, but not sufficient | INSUFCALL |

The DIRT Users Guide provides helpful guidance in choosing the appropriate entries. Thus far, the DR&EC has been reluctant to make corrections to the data submitted. This is primarily to respect the data as entered by DIRT submitters. Secondly, “damage_other-desc” is a free-text field with no rules or consistency for how data is entered, making it impractical and time-consuming to review thousands of records. If you recognize yourself in these examples (or in Exhibit 8 previously), please contact CGA Support Staff for advice.

Preview of DIRT Revisions Coming in 2018

The Data Reporting and Evaluation Committee (DR&EC) is performing a comprehensive review of the DIRT form to determine if some questions and/or associated answers should be eliminated, added, consolidated, or revised. The DR&EC reviewed historical data on which questions were answered with high percentages of known values (i.e. high DQI) versus *Unknown/Other* or *Data NOT Collected*, and which answers were frequently or seldom selected. The DR&EC also reviewed user support and feedback tickets and requests for enhancements to DIRT.

Implementation of the revisions is targeted for the beginning of 2018. Several steps need to line up, including software revisions to the online form and bulk-upload specification, recalibration of DQI weights, and Users Guide revisions. Starting at the beginning rather than middle of a calendar year will enable a smoother transition with better data consistency. Significant efforts to prepare and educate the DIRT user community will also be required.

¹⁵ The three lowest scoring reporting stakeholder groups: one call center, excavator, and telecommunications, had root causes of *Data Not Collected* or *Other*, respectively, 84%, 42%, and 79% unweighted; and 81%, 46%, and 77% weighted.

Following are some of the key revisions approved by the DR&EC in June 2016:

- Eliminate “Data not collected” throughout the form.
- Change **Part A** title to “Original Source of Information” and delete “one call center” and “insurance” as options.
- Change **Part B** title to “Type, Date, and Location of Event” and add “underground damage” and “underground near miss” as types of events (in conjunction with removing “Was there damage to a facility?” from Part H).
- Change **Part C** “Sewer (sanitary sewer)” to “sewer” in type of facility affected. Add “N/A exempt” to “Was the facility owner a member of One-Call Center?” Add a new question “Did the event involve a crossbore?” Add a new question on “Depth of Facility.”
- To **Part D**, add “bulldozer” as a type of excavation equipment.
- Change **Part E** title to “Notification and Locating.” Move “Type of Locator” question from Part F to Part E. Add “N/A exempt” to “Was the one call center notified?”
- Delete entire **Part F**, including the questions “Were marks visible in the area of excavation?” and “Were facilities marked correctly?”
- Reduce selections in **Part G** with larger ranges for “cost of downtime.”
- Change **Part H** Title to “Interruption and Restoration.” Reduce selections with larger ranges for “duration of interruption” and “estimated cost of damage.” Eliminate “number of injuries” and “fatalities” questions.

Part I Root Causes

The DR&EC is also considering, but has not yet approved, revisions to some of the root cause selections based on feedback and support questions, apparent areas of confusion, and common free-text comments such as “expired ticket” or “dug outside scope of ticket.” Some of the current root causes are vague and overlapping (e.g., “notification ...made, but not sufficient” versus “wrong info provided to One Call Center” or “Facility could not be found or located” versus “Facility was not located or marked”). The goal is to make Root Causes more descriptive of real-world situations.

Appendices

Appendix 1: Root cause abbreviations and descriptions

| DAMAGE_CAUSE_ABBR | DAMAGE_CAUSE_DESCRIPTION |
|--------------------------|--------------------------------------------------------------|
| n/a | One Call notification practices not sufficient (choose one): |
| NOLOCATEREQ | - - No notification made to the one-call center |
| INSUFCALL | - - Notification to one-call center made but not sufficient |
| WRONGINFO | - - Wrong information provided |
| n/a | Locating practices not sufficient (choose one): |
| NOTFOUND | - - Facility could not be found/located |
| INSUFMARKING | - - Facility marking or location not sufficient |
| NOTLOCATED | - - Facility was not located or marked |
| BADMAP | - - Incorrect facility records/maps |
| INSUFEX | Excavation practices not sufficient |
| EXCLEARANCE | - - Failure to maintain clearance |
| EXMARKS | - - Failure to maintain the marks |
| EXSUPPORT | - - Failure to support exposed facilities |
| EXHANDTOOL | - - Failure to use hand tools where required |
| EXTESTHOLE | - - Failure to verify location by test-hole (pot-holing) |
| EXBACKFILL | - - Improper backfilling |
| CALLCENTER | One-Call notification center error |
| ABANDONED | Abandoned facility |
| DETERIORATED | Deteriorated facility |
| PREVDAMAGE | Previous damage |
| NOTCOL | Data Not Collected |
| OTHER | Other |

Appendix 2: Groupings used in report and dashboard

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 facility, Previous damage |

Excavator Group

| Group | Type of Excavator |
|----------------------|--------------------------|
| Contractor/Developer | Contractor, Developer |
| Government | State, County, Municipal |
| Occupant/Farmer | Occupant, Farmer |
| Utility | Utility |

Excavation Equipment Group

| Group | Type of Excavation Equipment |
|------------------|---------------------------------------------------------------------------------------|
| Backhoe/Trencher | Backhoe, Trackhoe, Trencher |
| Drilling | Auger, Bore, Directional drill, Drill |
| Hand tools | Hand tools, Probe |
| Other | Grader, Scraper, Road milling equipment, Explosives, Vacuum equipment, Farm implement |

Work Performed Group

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

2015 CGA DIRT Analysis & Recommendations

Prepared by:

FMI Corporation

CGA's Data Reporting & Evaluation Committee

