

**Preliminary Data Analysis Report – 2017**

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NC 811

## **811 Call Before You Dig**

Excavation activities in the United States must be reported, before work starts, to a notification center (commonly known as a “one call” center). This service was established to protect excavators and underground utilities from third-party damages. A one-call center may be defined as an entity that administers the system through which a person can notify owners/operators of lines or facilities in advance of proposed excavations. In North Carolina, employers/excavators are required by law to report planned excavation activities to North Carolina 811 (NC 811). NC 811 then notifies the utilities of a potential conflict, allowing the utilities to identify their underground utilities within the excavation’s boundaries. The following are laws that govern excavation activities:

1. North Carolina General Statutes (NC-GS), chapter 87 – Excavators

- a. Article 8A – Underground Utility Safety and Damage Prevention Act.

Excavator responsibilities (87-122): “Before commencing any excavation or demolition operation, the person responsible for the excavation or demolition shall provide or cause to be provided notice to the Notification Center of his or her intent to excavate or demolish.” Furthermore, NC-GS. 87 -120 (d) requires that any person that intends to excavate in the state of North Carolina to notify NC 811 at least three business days from the day of excavation.

2. North Carolina General Statutes (NC-GS), chapter 95 – Department of Labor and Labor Regulations

- a. Article 16 - Occupational Safety and Health Act of North Carolina (OSHA NC).

1926.651 (b) (2): “Utility companies or owners shall be contacted within established local response times, advised of the proposed work, and asked to

establish the location of the utility underground installations before the start of actual excavation.”

Accordingly, two of North Carolina’s general statutes require at least a three working days notification before the proposed commencement of excavation. Otherwise, employers may be cited by OSHA NC or violators of the Act can be cited through a complaint process to the Underground Damage Prevention Review Board. When damage happens to underground utilities, North Carolina’s Underground Utility Safety and Damage Prevention Act requires the excavator to immediately contact the Notification Center (i.e., NC 811) and the facility operator/owner, if known, to report the location and nature of the damage. Therefore, the employers of excavators must provide the required time and training to his/her excavator(s) to ensure compliance. It is the employer’s responsibility to provide all required resources to ensure both NC 811, and the facility operator, have been notified.

### **Number of damages reported in 2017**

This report provides preliminary trends of collected damages in 2017 in the state of North Carolina. Per damage reports collected by NC 811, there were 11,160 reported damages to the state’s underground utilities in 2017 which is less than the reported damages in 2016 by 4,011 damages. However, the number of damages reported by Common Ground Alliance (CGA), a national member-driven association of 1,700 individuals, organizations and sponsors, for 2017 is higher. CGA reported 23,203 damages in North Carolina, creating a difference of 12034 damages reported by the two groups. Figure 1 shows the differences in the number of damages reported to NC 811 and CGA and the difference between them. Most of the difference occurred within Tele/CATV damages.

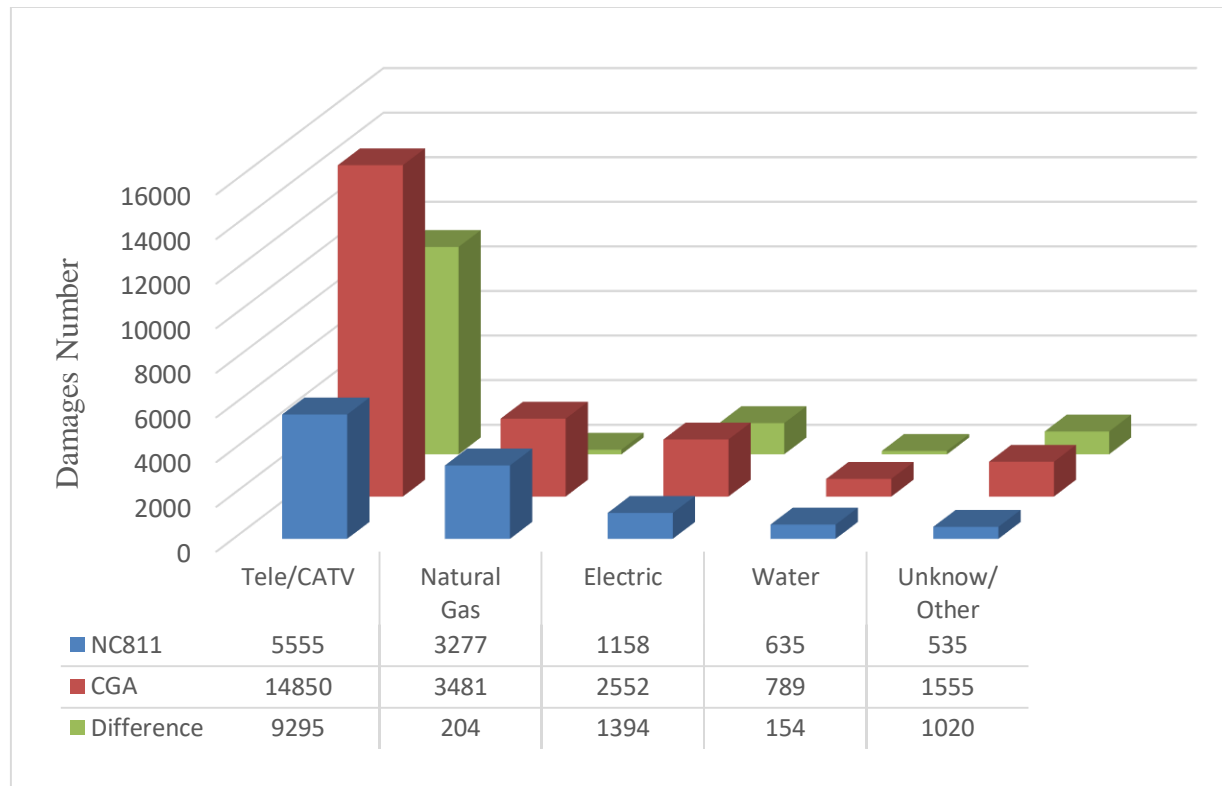


Figure 1. The Number of Damages Reported (NC 811 Vs. CGA)

The damage information is reported to CGA and NC811 by stakeholders (i.e., the source of information). Figure 2 summarizes 2017 damages by stakeholders for CGA and NC811. It is obvious that the locators represent the highest source of information for CGA while excavators represent the highest source of information for NC811. Accordingly, the difference in the number of damages could be a result of the fact that locators in North Carolina, who contribute more than 60% of the damage data to CGA DIRT CGA damages, do not grant access to NC 811 when damages are reported. This difference in reported damages illustrates the fact that many excavators are failing to report the damages directly to NC 811 as required by North Carolina General Statutes (87-126), which requires the excavators to notify NC 811 as soon as damages occur.

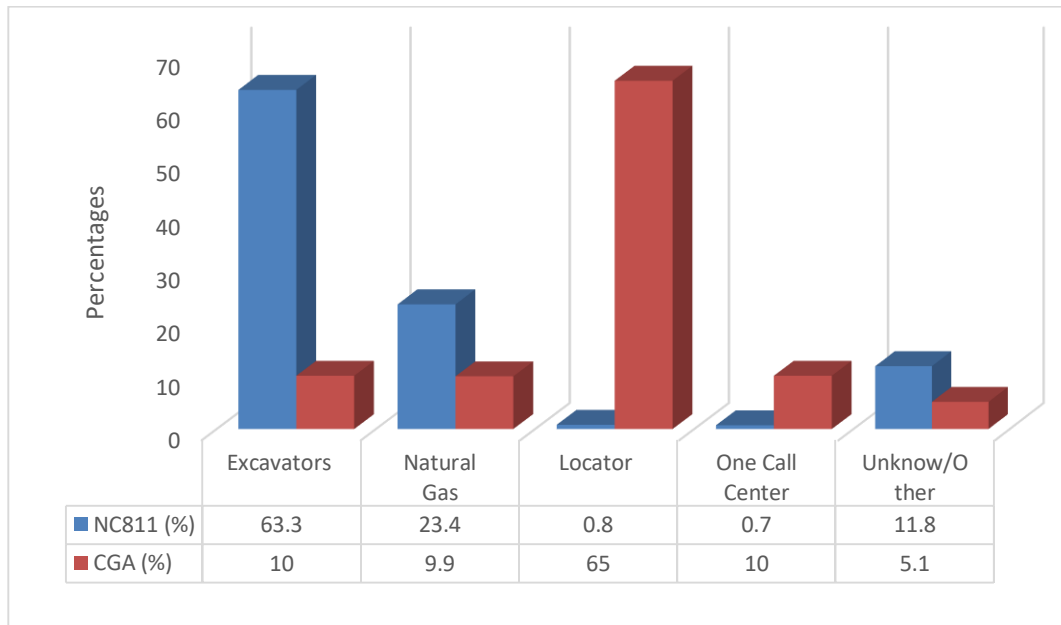


Figure 2. Damages Reported by Stakeholders

### The Cause of Damages

The damages' causes that reported to NC811 and CGA will be discussed in this section.

The main reported causes are:

1. "Excavation practices insufficient" which may include failure to use hand tools when needed, failure to maintain clearness, failure to protect/shore underground facilities, and improper backfilling practices.
2. "Locating practices insufficient" which may include underground utilities that have not been located, marks faded or not maintained, and incorrect marks.
3. Notification error which may include failure to notify one-call center/811 and provide wrong information to one-call center/811
4. Unknown/other.

Figure 3 summarizes the percentages of causes of 2017 damages based on information provided to NC811 and CGA. It is obvious that NC811 dataset does not provide enough information since 78.3% damages causes are unknown. Investigating the data without the unknown/other inputs reveals an inconsistency in the order of the causes, see Figure 4. The CGA data indicates that excavation practices are the major cause of damages to underground utilities followed by notification error and locating practices respectively. However, the NC811 data reported by excavators indicates that locating practices is the second cause of damages instead of the third cause in order as CGA data suggests. Accordingly, locating practices have more contribution to damages to underground utilities versus failing to notify NC811. It is important to notice these causes are based on stakeholders' subjective opinions. Therefore, this difference could be a result due the fact excavators are the main source of information to NC811, while contractor locators are the main source of information to CGA. Therefore, it would be beneficial to have a unified investigation form or process that collects necessary information with a strategy to identify causes objectively.

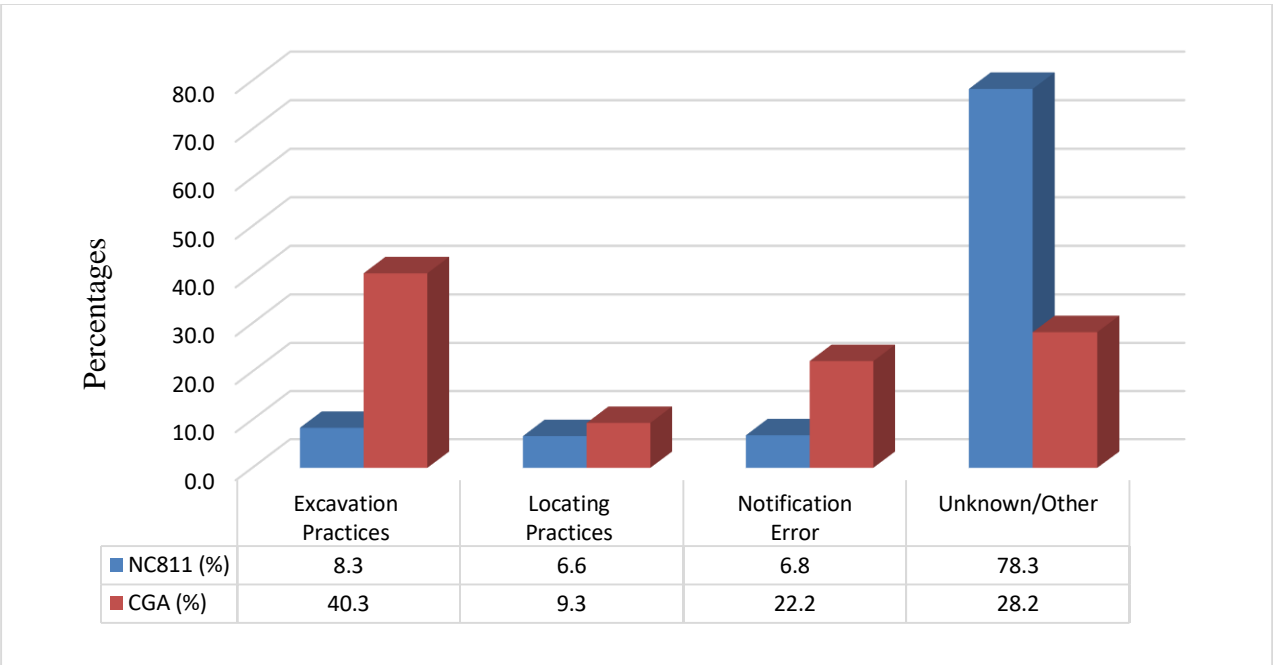


Figure 3. The Percentages of Root Causes (NC811 Vs. CGA)

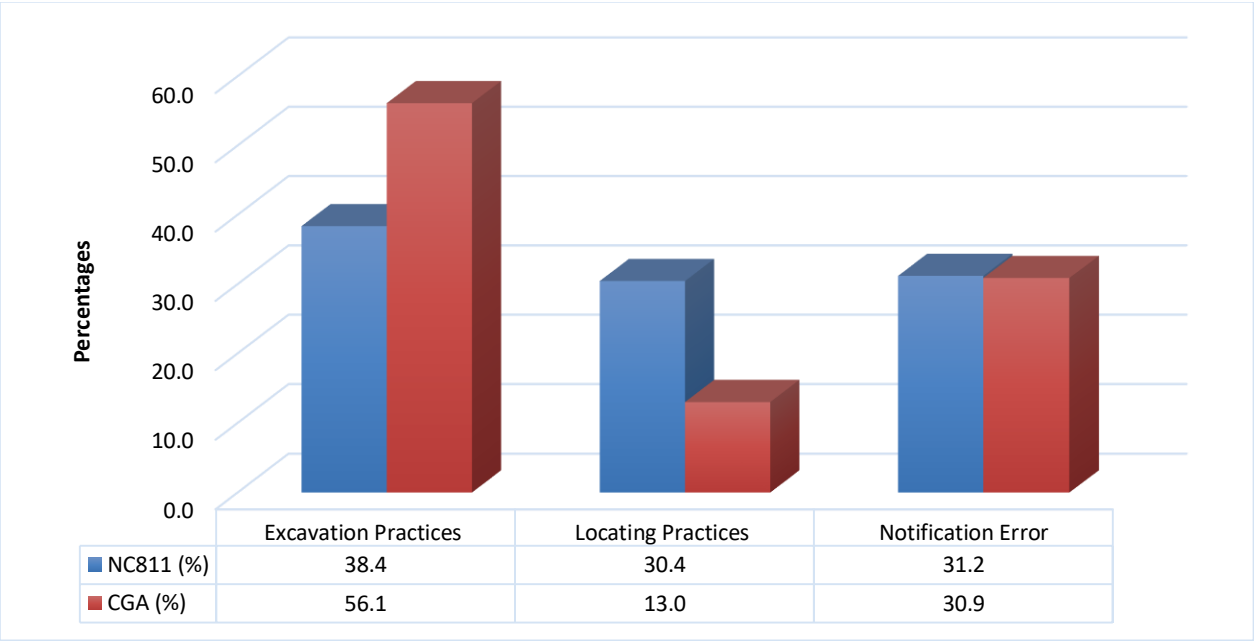


Figure 4. The Percentages of Root Causes without Unknow Data (NC811 Vs. CGA)

## **Locate Visibility & Accuracy**

The visibility and accuracy of locating marks (i.e., locating practices) contribute to the number of damages. Therefore, investigating the accuracy and visibility of locating marks is a crucial step in reducing damages to underground utilities. This section will discuss the visibility and accuracy of locating services in the state of North Carolina. The proportions of unknown status of the accuracy and visibility of locating marks were 37.2% for marks visibility and 36.3% for marks accuracy. With the unknown data excluded, the known data within the study sample suggested that 58.7% (i.e., 4144) of locating marks were visible while only 31.2% (i.e., 2217) were accurate (i.e., correct). Accordingly, there is a need to investigate the reason behind this low percentage of accuracy further. Also, there is a need to improve the marks' visibility and/or educate excavators about the reporting of destroyed marks which would result in a new ticket and opportunity for the locator to refresh existing marks.

A careful examination of the known data regarding marks accuracy suggests that locate contractors are more likely to provide inaccurate marks than utility owners, see Figure 5. Figure 5 suggests that there is a higher probability of 26% to deliver correct marks when using a utility owner to locate underground utilities. Similarly, the known data regarding marks visibility suggests that utility owner locator are more likely by about 10% to have provided visible marks than locate contractors, see Figure 6. Again, this finding could be a result of the fact that excavators are the main source of information about damages to NC811 (i.e., 63.3%). Excavators report that the percentage of marks visibility is 56.85% and the accuracy of them is only 25.29%. However, there is currently no acceptable method to evaluate this information. Therefore, the overall results indicate a crucial need to adopt an objective method to investigate the damages causes.



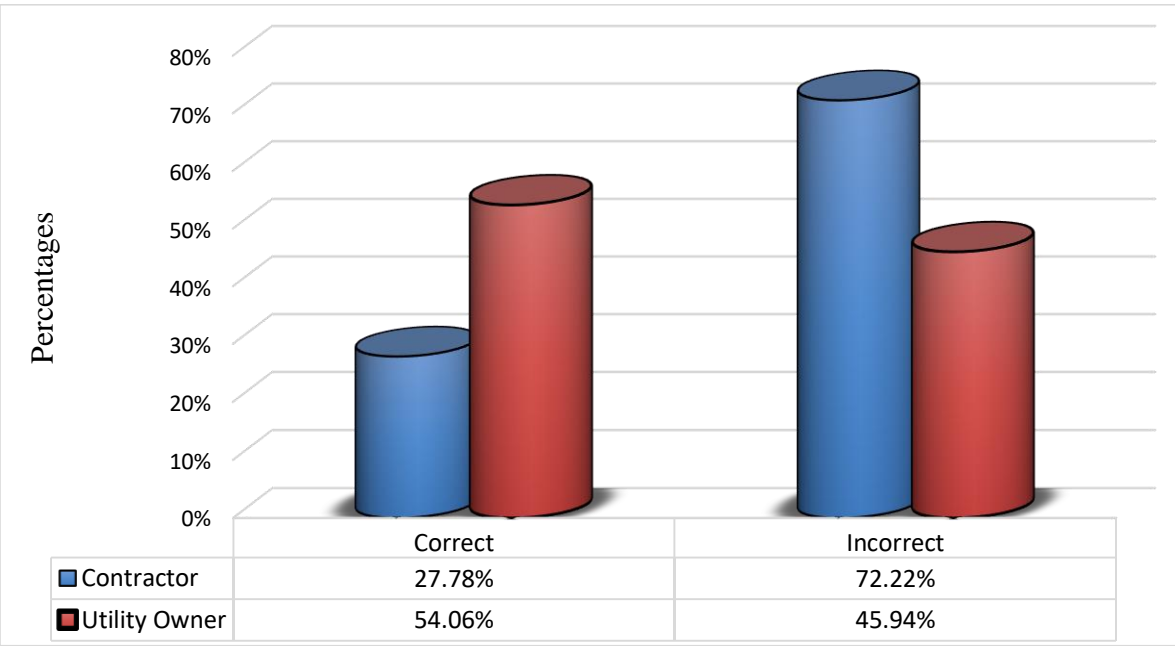


Figure 5. Marks Accuracy by Locating Party

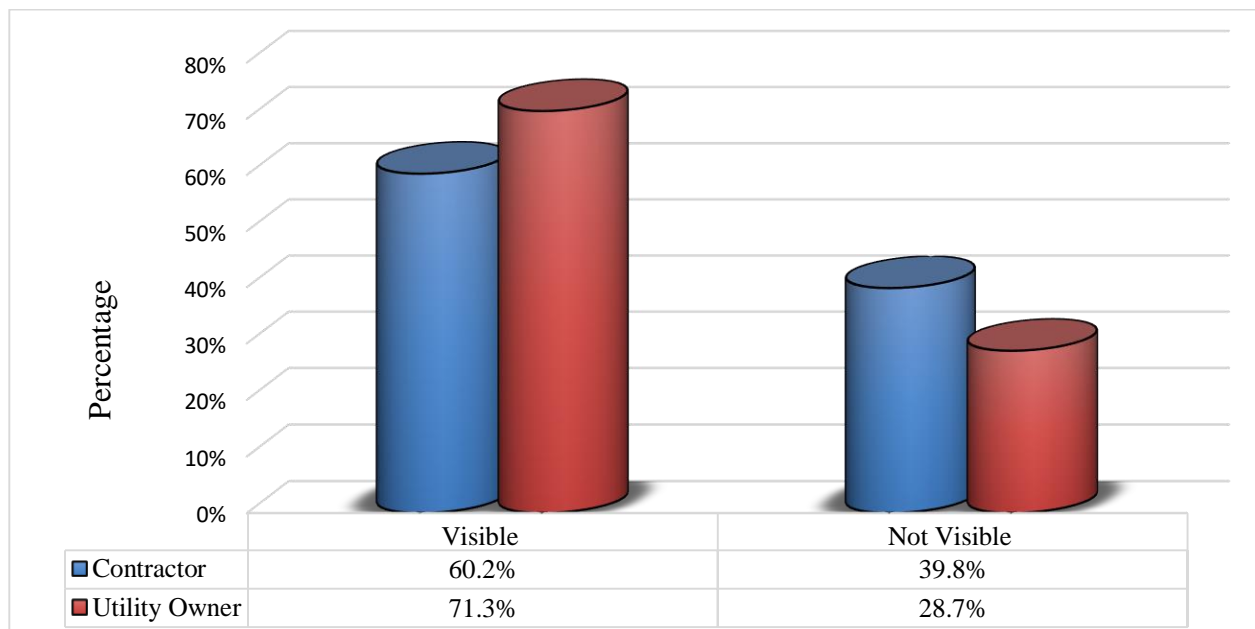
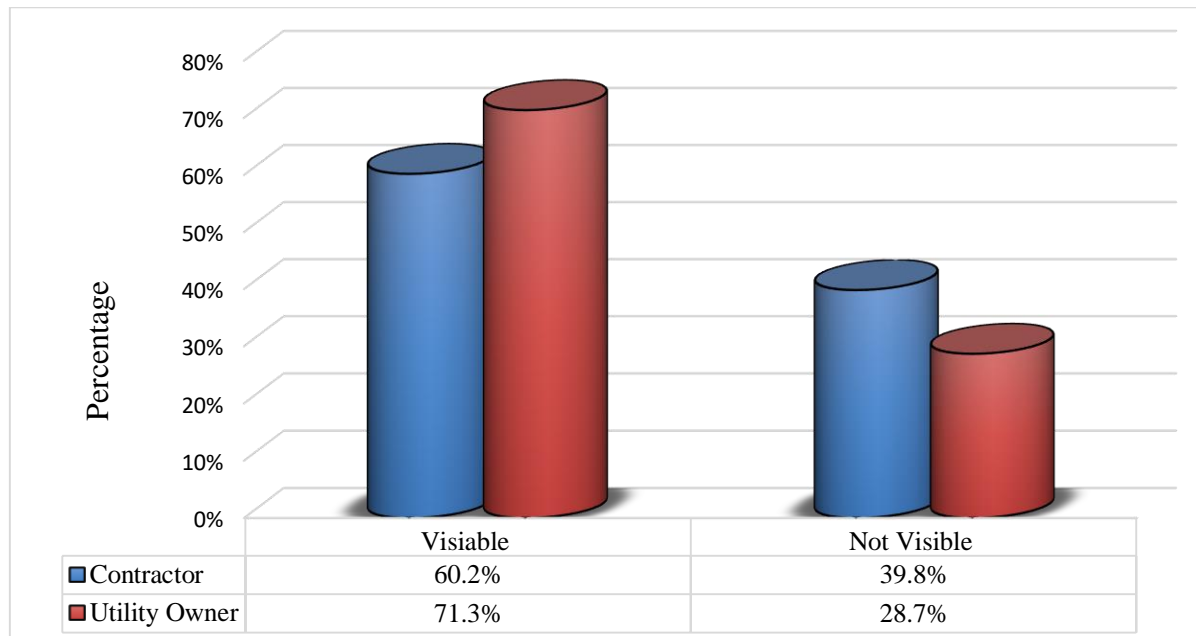


Figure 6. Marks Visibility by Locating Party

## General Trends

For the remainder of this report, the discussion will deal exclusively with the NC 811's collected data and will not consider the difference reported by CGA. It is expected to provide accurate trends of damages using NC 811 data since a trend could be captured through a random

representative sample.

### ***Locate Request Analysis***

One of the NC811 goals is to ensure that all excavators call before they dig to allow for the marking of underground utilities which could help in turn reduce the overall damages. The NC811 2017 dataset shows that 2169 damages (i.e.,19.4%) were not associated with a locate request. This percentage is less than 2016's no located percentage which was 21.56 % (i.e., 3,271 damages). Accordingly, this could indicate that there is an improvement in overall awareness about NC811.

Furthermore, the examination of no locate requests indicates that most of the cases occurred in Mecklenburg (23.10%) followed by Wake County (17.38%), Durham County (5.53%), and Guilford County (4.52%) Respectively. Comparing these percentages with 2016's percentages also shows an overall decrease in no locate request among these counties except Guilford county, see Table 1. However, the overall results also indicate that the education efforts regarding NC811 and its services should be focused on these counties. NC 811 education comes in a variety of methods such as advertisement (e.g., billboards and television advertisement), onsite training by NC 811 educators, and online (i.e., PIPES Plus).

Table 1. No Locate Request by Major Counties (2016 Vs. 2017)

County	Mecklenburg	Wake	Durham	Guilford
2017	23.10%	17.38%	5.53%	4.52%
2016	28.12%	18.52%	6.14%	4.49%

Note: Counties with less than 4.1% of no locate requests in 2017 are not presented

Examining the “no locate” requests data by work performed indicates that high percentages of no locate requests were found in landscaping (25.15%), construction (23.08%), telecommunication/CATV installation and repair (22.59%) and water installation and repair

(i.e.,10.9%). Accordingly, this finding highlights the specific sectors that NC 811 needs to target through education and training.

### ***Damages Per County***

The NC 811 damages per county show that the highest percentages (i.e., more than 4%) of reported damages occurred in Mecklenburg County (26.09%), followed by Wake County (19.87%), Durham County (5.39%), and Guilford County (4.36%). This is expected as these counties also reflect most of the excavations taking place in the state. Excavation work increased significantly in Mecklenburg, Wake, and Durham since Google and AT&T chose these counties to be outfitted with fiber internet service back in 2015. Accordingly, thousands of miles of fiber had been installed in 2015-2016. As that work slowed down we can see that, when comparing the 2017 high percentages of damages per county with 2016 percentages, a decrease occurred in most counties except Guilford County, see Table 2. Accordingly, the data show an increase in reported damages in Guilford County, as well as an increase in “no locate request” which suggests that there is a need to investigate how it is possible to improve NC811 use by excavators in this county.

Table 2. Damages Percentages by Major Counties (2016 Vs. 2017)

County	Mecklenburg	Wake	Durham	Guilford
2017	26.09%	19.87%	5.39%	4.36%
2016	33.35%	21.46%	6.62%	3.96%

Note: Counties with less than 4% of damages in 2017 are not presented

### ***Employer Type***

An excavator is a person engaged in excavation or demolition. There are also several

types of employers, such as contractors and utility owners, who may hire excavators to perform an excavation. Contractors caused the most damage to underground utilities (78.7%), followed by municipalities (6.33%) and utility owners (4.07%).(here is where you should include a chart because it is interesting that utility owners only being 4% have such a high rate of damage to telecom. Why? It is a question worth exploring...) Employers who caused less than 3% of damages have been excluded for further discussion. Figure 7 illustrates the damages to underground utilities per the major three employers who caused the most damages (89.1%). The overall results show consistency in damages' percentage across the major employers. However, it seems that utility owners cause a higher percentage of the reported damages to Tele/CATV underground utilities during excavation than contractors or municipalities. It bears noting that 50% of 78% of total damages reported are caused by contractors, the majority of which are installing the telecom.

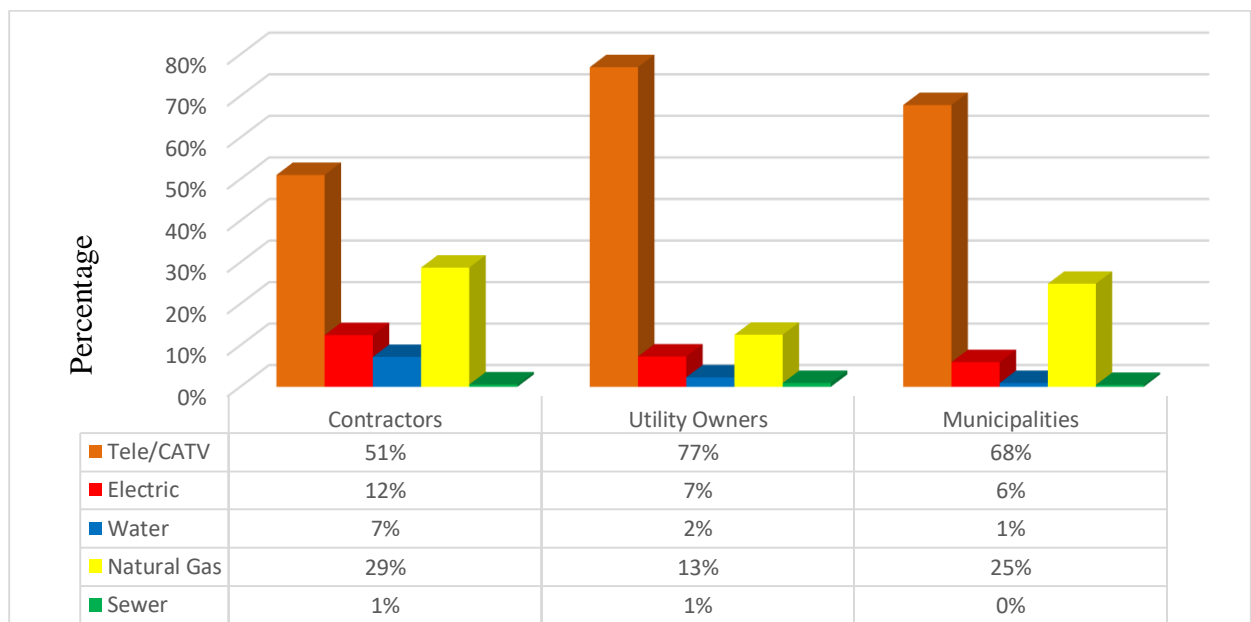


Figure 7. Damages to Underground Utilities per Employer Type

Turning attention to the type or classification of a facility, Figure 8 illustrates the affected

service types due to the damages. The service types could be classified as transmission, distribution, and service lines. Transmission lines are carrying the service, such as electricity, clean water and natural gas to distribution lines that are then carrying services to the customers through the service lines. The overall data indicated a consistency in affected service types across the major employers. The service types that could be affected based on known data are distribution lines, service lines, and transmission lines respectively. It is also clear that the damages to transmission lines represent a very small percentage. Transmission lines are deeper and well-marked in private rights-of-way (ROW).

The transmission lines that are not in private ROWs are usually along busy roads, not in neighborhoods. Also, Transmission Integrity Management has required that pipeline personnel to be present during excavation to satisfy the Pipeline and Hazardous Materials Safety Administration (PHMSA). Although no such guidelines direct electric or telecom, the risk of injury and potential cost of disruption make these items a high priority for the owners to protect.

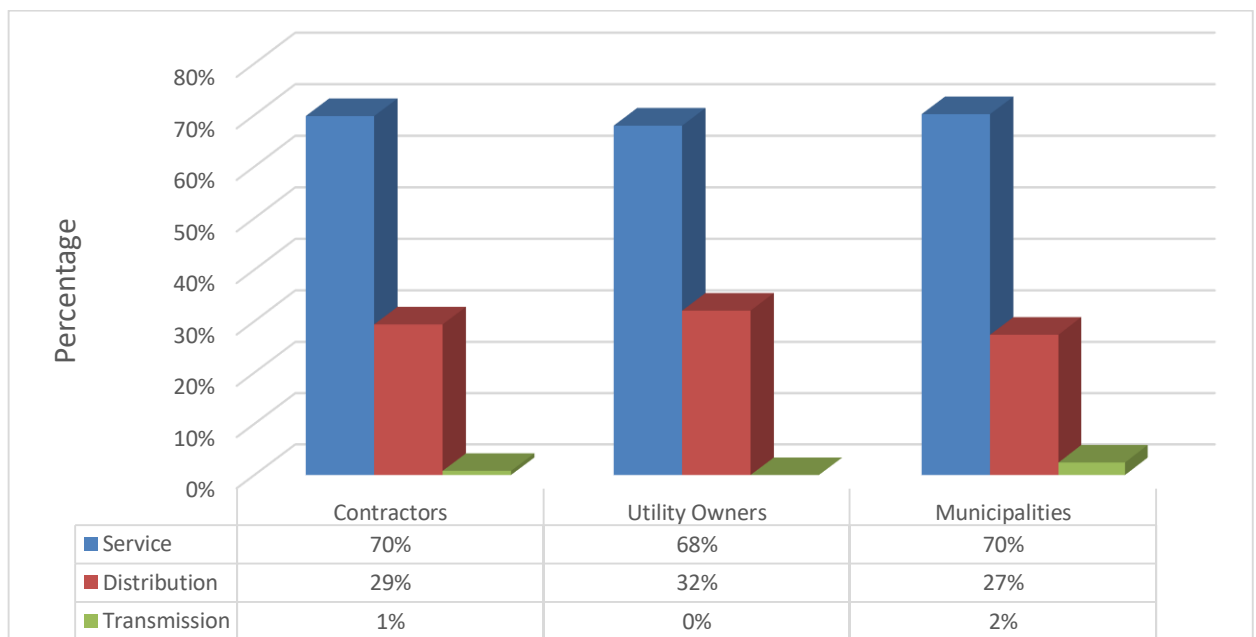


Figure 8. The Affected Services per Type of Employer

## Societal Impact of Damages

This section tries to answer the following question: **How much did damage to underground utilities cost North Carolina in 2017?** This report adopted the costs that have been reported in the DIRT 2016 report. Table 3 illustrates the total number of damages within investigated categories and their total social impact cost. The resulted estimate cost of damages in only natural gas, electrical, and Tele/CATV is \$41,849, 616. However, it is important to notice that this estimation does not include the additional reported damages through. Accordingly, the total estimation cost to society would be \$77,986,265 when include additional damages through CGA DIRT.

**Table 3.** Costs of Known Damages by Facility Damaged in North Carolina – 2017

Facility	Avg. Cost per Damage	# Damages	2016 Cost	Percentage
Natural gas	\$5,914.05	3277	\$19,380,341.85	46.3%
Telecom/CA	\$3,022.24	5555	\$16,788,543.20	40.1%
Electric	\$4,905.64	1158	\$5,680,731.12	13.6%
Total			\$41,849,616.17	

## Damages by Work Type

This section investigates damages per work type to reveal if there is a type of work that contributes more than others to underground utility damages. Figure 9 illustrates damages per work type. The illustration suggests that most of the damages happened while conducting Tele/CATV work (i.e., 29%) followed by water work (i.e., 14%), construction work (i.e., 12%), and natural gas work (i.e., 11%). The illustration also indicates that higher percentages of natural gas damages happened while working on Tele/CATV work and construction.

The contribution of Tele/CATV is interesting, and somehow unexpected since the depth of the Tele/CATV work should be less than other utilities. Accordingly, the probability of damaging utilities other than Tele/CATV should be less likely. However, the increase use of horizontal directional drilling (HDD) could explain the high contribution of Tele/CATV. In recent years,

HDD has become the method of choice for installing new underground utilities due to its minimal impact to surface area and competitive cost. Accordingly, using HDD to install Tele/CATV may place them deeper than customarily expected which may lead to conflicts with existing lines and a higher rate of underground damages.

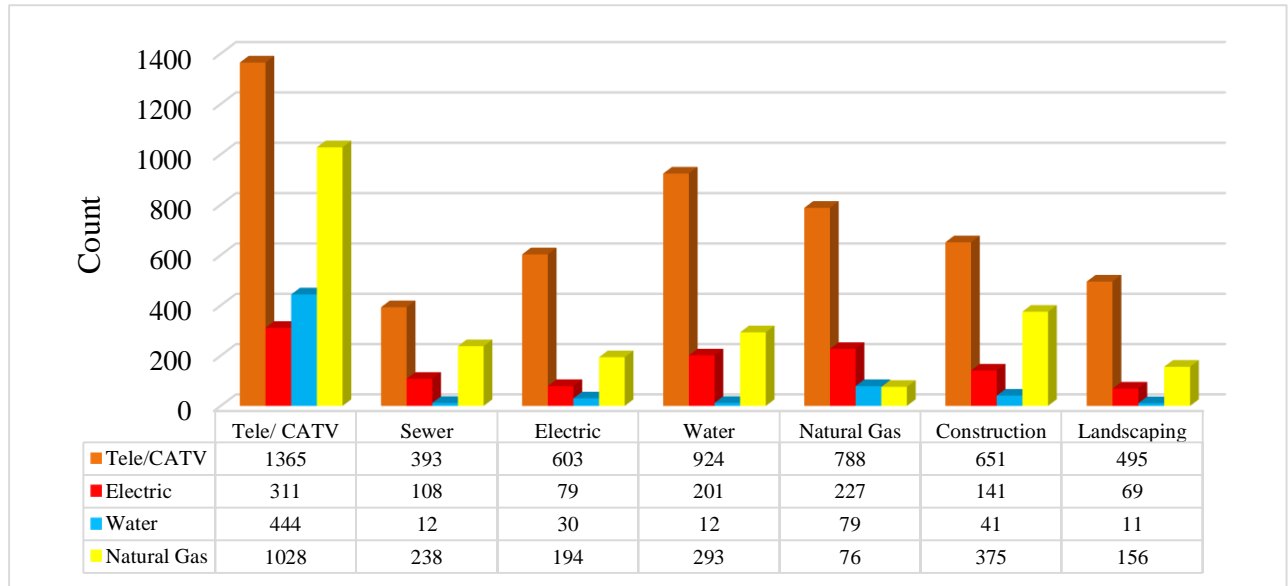


Figure 9. Damager per Work Type

### Three Hour Notices and Code 999

When an excavator finds evidence of unmarked underground facilities at a site, after waiting the three full days, an excavator can put in a three-hour notice (3Hr) request. The presence of three-hour notices typically means something was done incorrectly during the process of locating or there was no response from the utility owners within the three full business days. If utility owners do not respond by the required time (i.e., three full business days), response code 999 will be assigned to the ticket. Out of the 100 counties in the state of North Carolina, 55.2% (i.e., 4,229,215) of the 2017 transmissions have been placed in the following five counties: Mecklenburg, Wake, Guilford, Durham, and Forsyth, see Table 4. Also, the percentages of the 3Hr notices and code 999 in these five counties represent 57.9% and 48.4% of the total count of



the 3Hr notices and code 999 respectively. Comparing the overall number of 3Hr and Code 999 in these five major counties indicates that 3Hr notice is not fully utilized. For example, the percentage of 999 codes per transmissions in Mecklenburg County was 10.2% while the percentage of 3Hr notices per tickets was only 2.08% in the same county. This may suggest that a high percentage of not completed locates have not been followed by 3 Hr notices, see Figure 10. Durham county seems to have the lowest percentage of 3Hr notices when comparing it to the percentage of code 999.

Table 4. The Count and Percentage of Transmissions and Tickets

County	Transmissions (%)	Tickets (%)
Mecklenburg	1804028 (22.3)	317369(16.6)
Wake	1344797 (16.6)	282032 (14.8)
Guilford	454160 (5.6)	97892 (5.1)
Durham	355230 (4.4)	73657 (3.9)
Forsyth	271000 (3.3)	67990 (3.6)

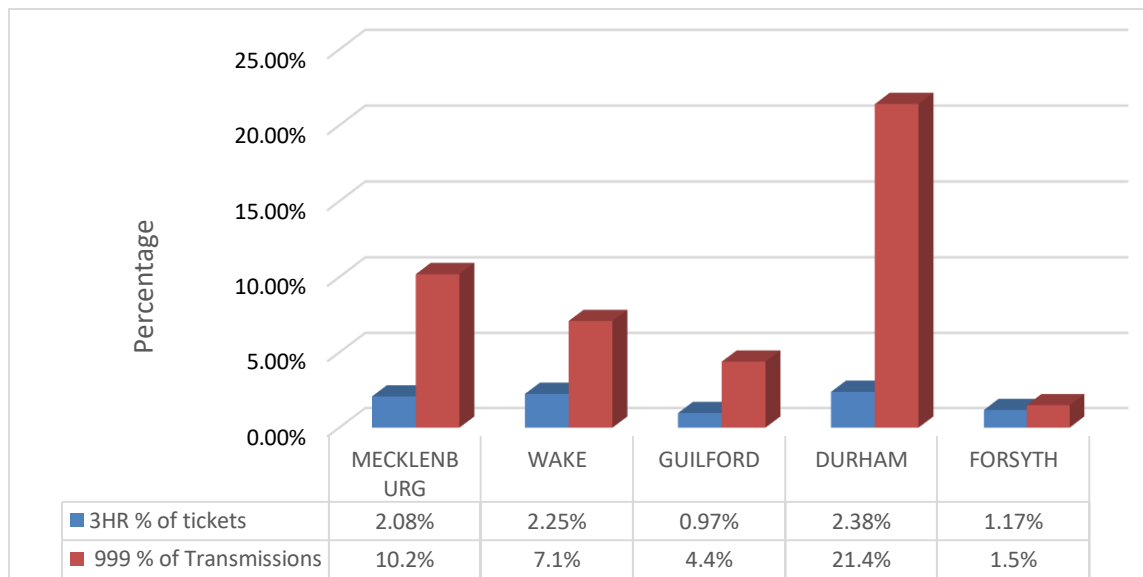


Figure 10. The Percentages of 3Hr Notices and Code 999

The other important observation from the Figure 10 is that the percentage of Code 999 in Durham County is the highest (i.e., 21.4%) followed by Mecklenburg county (i.e., 10.19%) and Wake county (i.e., 7%). These percentages suggest a high shortage in locators in these three counties, especially Durham county. Thus, this finding may indicate that there is a vital need to hire more locators in these counties. Furthermore, high rate of Code 999 could be a result to low participation by utility owners in Durham County. This will help reduce the loss of time for the excavator, as well as reduce the number of damages that occur due to unfulfilled transmissions.

### **Positive Responses Trends**

Positive Response is a means for the members of North Carolina 811 to provide information regarding the of a location request to the excavator. The most frequent positive responses during 2017 were code 10 ( 153,494; 33.8%), followed by code 20 (150,892; 33.3%), code 80 (35,621; 7.8%), code 999 (28,759; 6.3%), and code 60 ( 28,214; 6.2%). The meaning of most frequent codes is presented in Table 5. The various number of days that have been needed to provide positive responses in 2017 are presented in Figure 11. The results indicate that 48.5% of positive responses have required more than the regulatory period which is three business days. Investigating the time needed to mark the proposed excavation (i.e., Code 10 and Code 20) shows a similar trend, see Figure 12. Accordingly, there is need to further investigate the causes that lead to not fulfilling the regulatory time.

Table 5. The Most Frequent Codes and their Meaning

Code	Meaning
Code 10	No conflict, the utility is outside of the stated work area
Code 20	Marked
Code 80	Member's Master Contractor is responsible for locating facilities
Code 999	Member has not responded by the required time
Code 60	Locator and excavator agreed and documented marking schedule

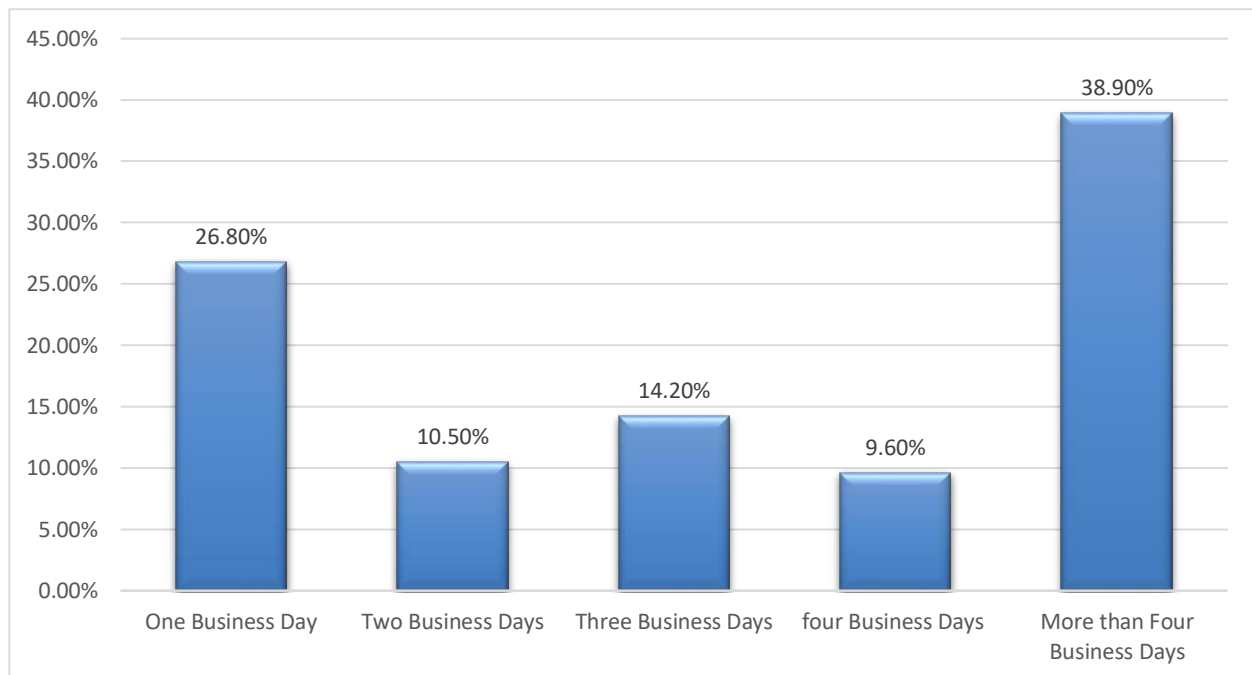


Figure 11. The Number of Days Needed for Positive Responses in 2017

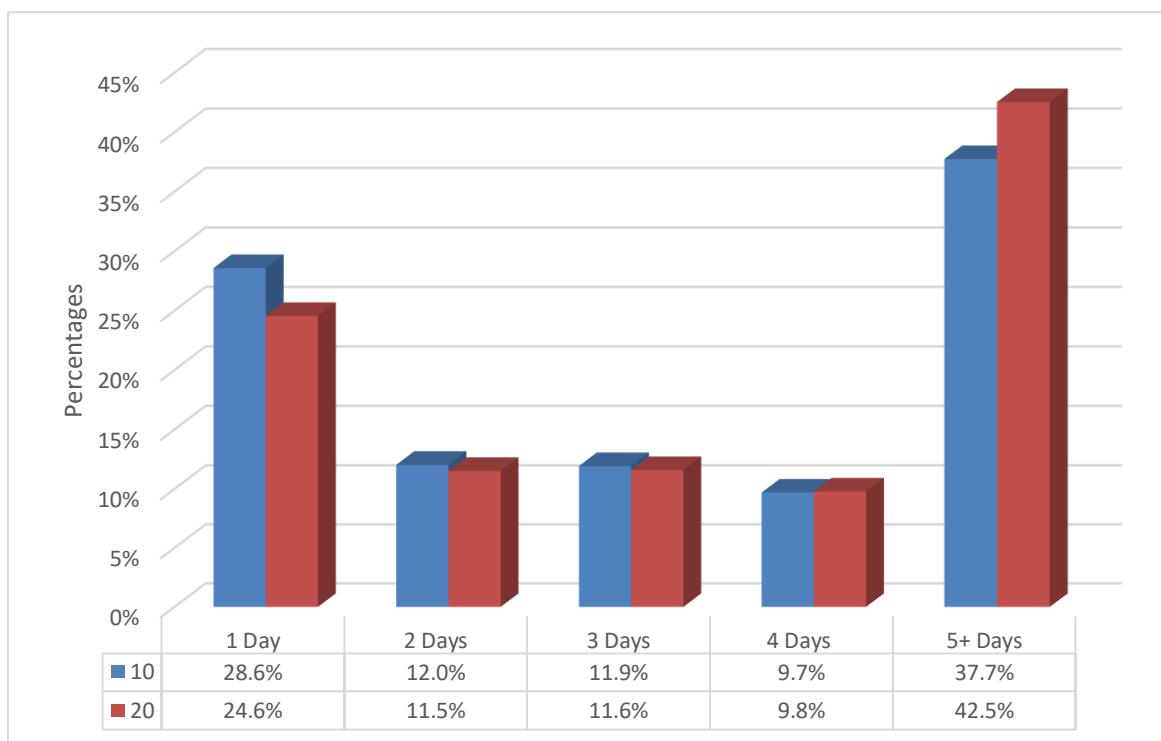


Figure 12. The Number of Days Needed for Locating in 2017

## Follow up Survey Report

A survey to assess the NC811's customer experience was administered over the month of September, and by the end of the month, 958 responses had been received. The survey targets first-time callers to assess their experience with the NC811 process and overall locating time and accuracy. Accordingly, seven hundred and seven (73.8%) first-time callers have participated which means 251(26.2%) from the study sample are not first-time callers. Figure 13 illustrates the frequency of contacting NC811 by participants who are not first-time callers. In addition, most of participant were homeowners (753; 78.65%), followed by construction practitioners (75; 7.83 %), agriculture practitioners (18; 1.9%), manufacturing (10; 1.0%), and others (102; 10.6%).

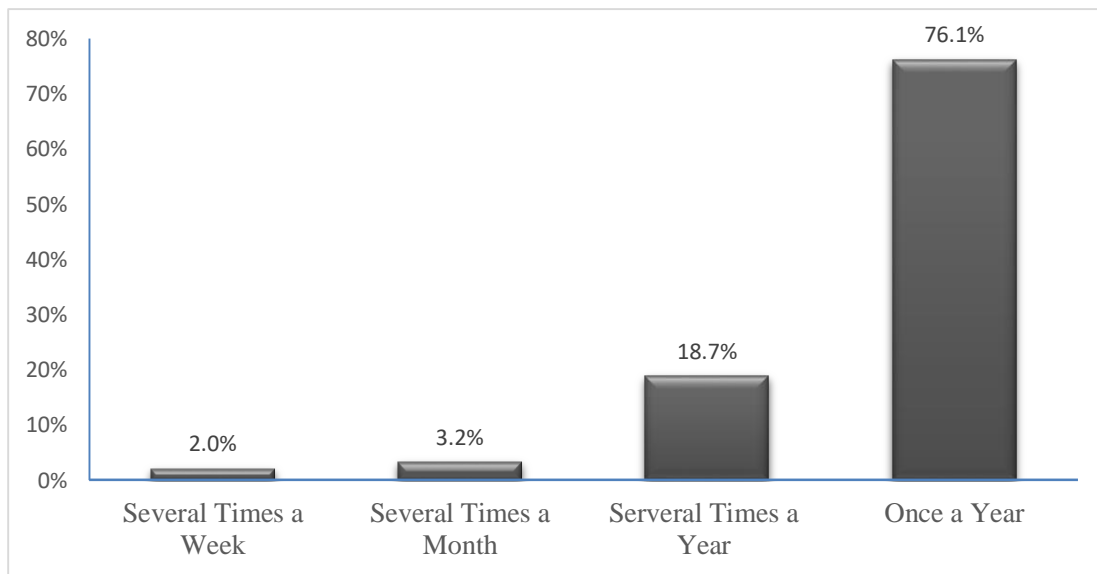


Figure 12. The Frequency of Contacting NC 811

## Findings

Overall, participants seem to be satisfied with the easiness of placing tickets. Almost 94% of those surveyed stated that their experience with NC811 was easy. Also, the locating accuracy seems to satisfy the individuals who participated in the study since 87.9% of them stated that the

locating marks were accurate. The participants have experienced 73 (7.62%) damages due to their activities. The 7.62% would be considered high if we applied it the number of tickets in 2017. There were 1,906,148 tickets in 2017 which would have translated to 145,248 damages.

However, it seems the utility owners and/or locators often are unable to complete the locating within the specified time which is three business days. Figure 14 illustrates the number of days that was needed to locate underground utilities based on participant's experience. The results indicate that 37.7% of participants stated that the locating service was not fulfilled within the specified three business days. This finding matches the 2017 data that have been discussed previously in this report. Furthermore, the results indicate that many participants have used the incorrect method to check the locating status. Individuals who place a ticket with NC811 should be sure all underground utilities have been marked by checking with NC811 using phone calls, website, or emails. **However, the results indicate that 62.73% of participants have only checked the excavation area to check the locating status.** Checking the excavation area alone does not provide enough information for an excavator to know if all utilities had been onsite.

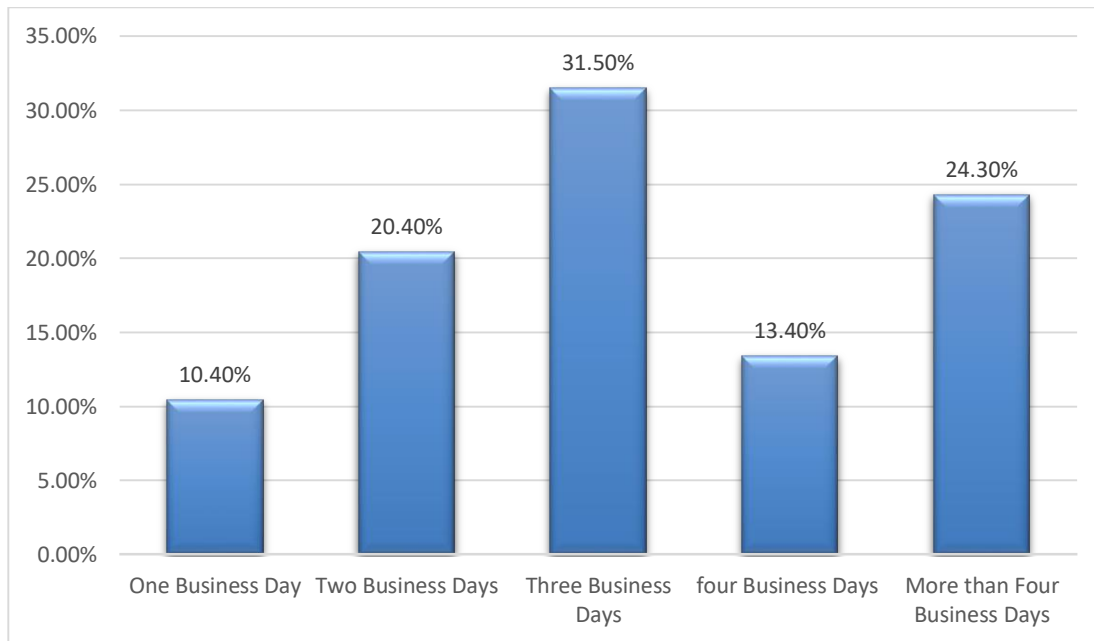


Figure 13. The Locates Time based on Participants' Experience

### ***The Quality of Services Provided***

This section will assess the quality of the process and professionalism of NC 811 and the accuracy, completion time, and professionalism of locates. An ANOVA test between the five aspects reveals that the mean of professionalism of NC 811 is statistically significantly different from other aspects, see Figure 15. This finding indicates that participants believe the NC 811 professionalism is better than other aspects. Thus, the results suggest that the professionalism of NC 811 in handling the requests is better than the experience of the entire "Call before you dig" process. Each component of the process may require further investigation to identify the deficiencies in the process in order to take the proper corrective actions. The results do highlight certain aspects of the process itself. For example, the accuracy of locates is statically significantly better than the professionalism of utility locators and completion time. Furthermore, the completion time of locates scores the lowest when compared to the professionalism and accuracy

of utility locators.

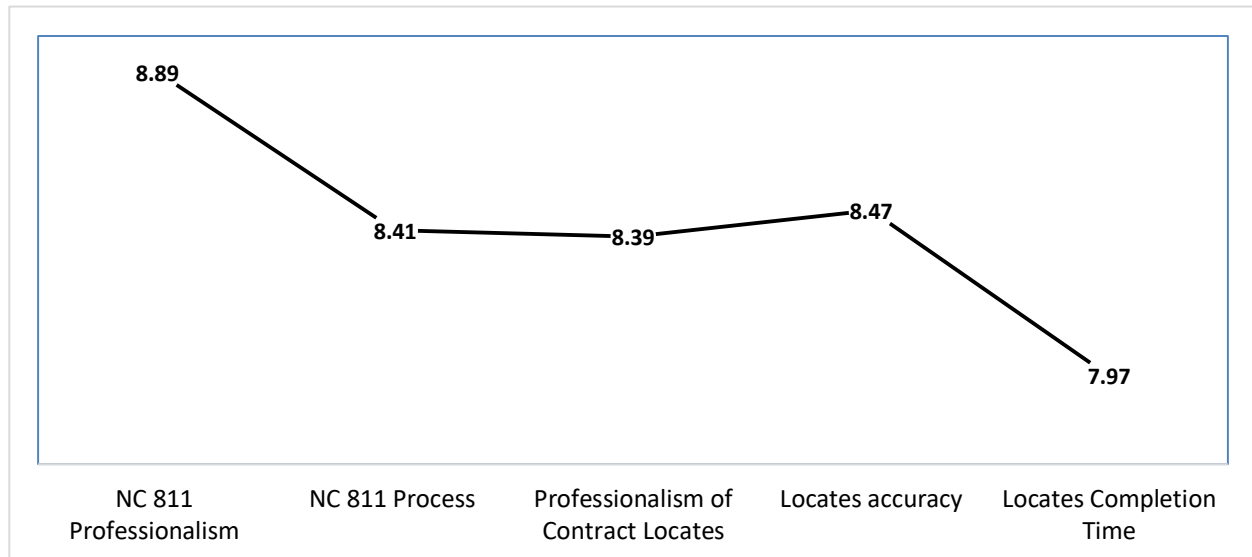


Figure 14. The Average Quality based on Participants' Experience

### ***NC 811 Education Efforts***

North Carolina 811 works hard to educate the citizens of North Carolina about the call before you dig service. The education efforts come in different format such as billboards, TV and radio advertisements. Figure 16 illustrates the most effective methods of education based on the opinions of the 512 individuals. Accordingly, media which includes television, radio, and internet advertisement represents the most effective method of education with a share equals 58.8%, followed by billboard 33.4% and print (7.81%). Print includes magazine, phonebook, and utility bills.

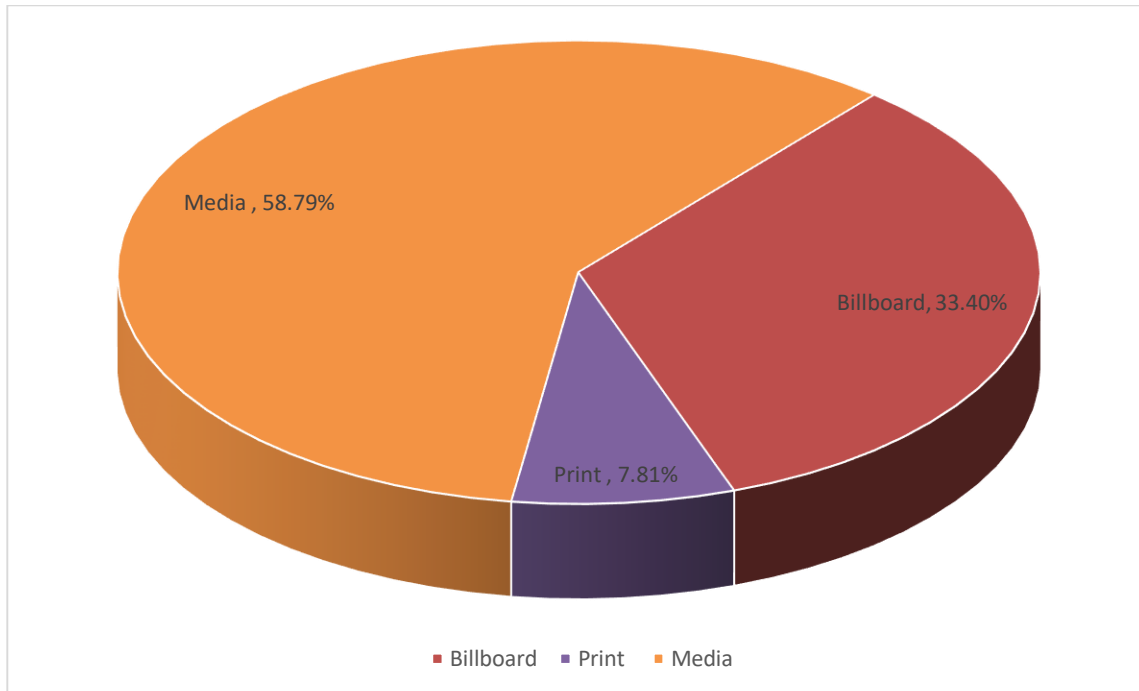


Figure 16. Most Effective Education Methods

These results can help shape future education efforts to address specific methods, audiences and messages. The results also illustrate the specific areas that may benefit from increased educational efforts.

### ***Conclusions***

Combining the results discovered from the raw ticket and positive response data with the survey results supports the fact that locates performed after the 3 full business days is a significant issue. Excavators that wait the three full days and receive incomplete markings are forced to request a 3 hour notice which many times goes unfulfilled within the timeframe. Excavators are encouraged to wait longer, especially when there are indications of an underground conflict, however the law allows them to proceed with care if the operators have not performed their legal duties to mark. A follow up to this report that would be helpful to understanding the impact on damages would be to tie reported damages to specific ticket information, including positive response compliance rates.

Another important finding is that a large percentage of survey respondents indicated that they determined locate status solely through a physical site check after the 3 full days and not through use of the positive response as required by law. Increased educational efforts about the importance and legal requirement of checking positive response by the excavator will be helpful in changing behavior.



Use of billboards to raise awareness of the necessity to notify NC 811 prior to digging is proving to be a measurably reliable means to increase participation. Billboards accompanied by radio, television and social media efforts carry a significant amount of the reported methods driving first time callers to use the system.

Additional research into the 3 hour tickets would be helpful to understand why, in Durham County for example, excavators are underutilizing the ability to request a 3 hour response after an incomplete three day response.

Costs to all parties are significant when measuring damage impacts. It is interesting to note that the largest number of damages seem to be to telecommunications by contractors performing work to install or repair telecommunications. An improved coordination between the construction of new facility and protection of existing facilities could provide a meaningful reduction in reported damages.

Finally, the results point out the importance of bias recognition in the root causes reported by stakeholders. National reporting suggests a higher percentage of excavation related root cause while the data in North Carolina suggests that timely locates are more likely at fault. That conclusion is reinforced from the survey results which do not carry the same reporting bias that might be inherent in national or regional reporting.

Conclusions suggest that specific targeted education delivered to utility owners, contractors and municipalities in geographic areas of high reported damages can help to raise awareness and hopefully correct behavior.