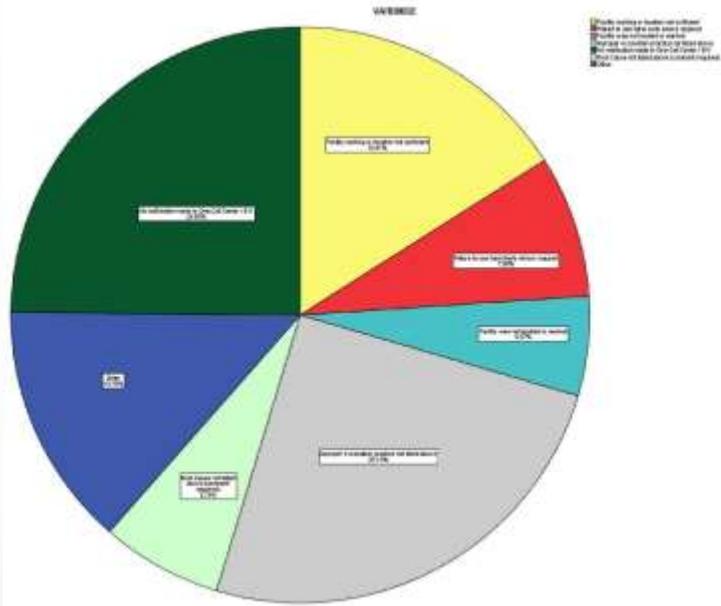




# 2019 WESTERN REGIONAL GAS CONFERENCE



## *North Carolina Damages Analysis:*

*Use of Comprehensive Data Analysis for Process Improvement*



# *North Carolina Damages Analysis:*

*Use of Comprehensive Data Analysis for Process Improvement*

Introductions

Project Background

Measurement: Why? What? What Next?

The Research Study

Conducting a Valid Survey

Results and Recommendations

Wrap up

# *Introductions*

Louis Panzer

WRGC old timer  
NC 811 Executive Director, 8 years  
Previously at Arizona 811  
Long time data enthusiast  
Committed to Shared Responsibility



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## *Introductions – North Carolina State Facts*

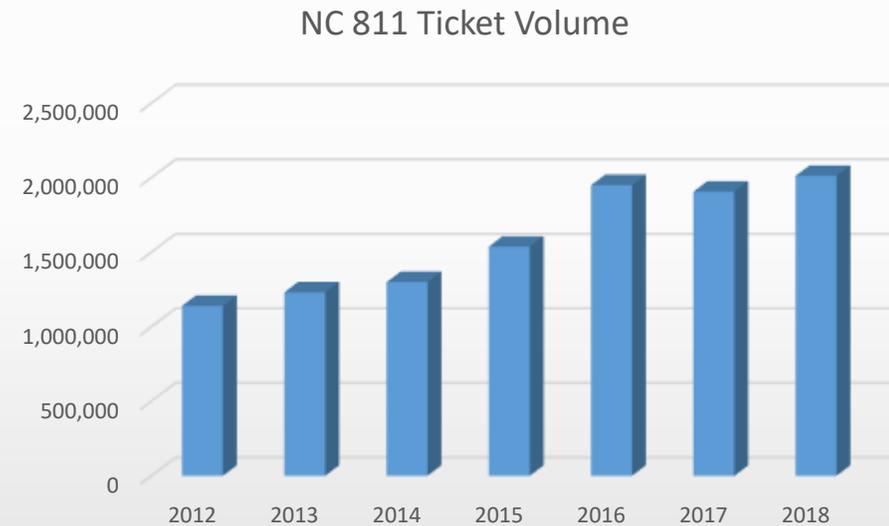
### Volume:

2012: 1,139,860

2018: 2,012,022

### Miles of roadway:

The NC Department of Transportation has more than 80,000 miles of highways. (Texas is the only state that has more.)





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## Project Background

- NC 811 created the first SuperMega Spreadsheet™ in 2013.
- 2012 data, by county, was input into the sheet, including:
  - Basic census population numbers
  - Ticket and transmission volumes
  - Positive Response Codes
  - Damages per thousand transmissions and tickets
  - “Failure to Call” root cause
  - Percentages of online ticket creation use
  - First time caller percentages and survey data
  - Education specifics – numbers of people reached
  - UCC attendance

The screenshot displays a Microsoft Excel spreadsheet titled "2019 SuperMega Spreadsheet with Specifics (1) (Workbook) - Excel". The interface shows the ribbon with tabs for File, Home, Insert, Page Layout, Formulas, Data, Review, and View. The spreadsheet contains a large table with columns for years (2013, 2014, 2014 CATV, 2014 Natural Gas, 2014 Telecommunications, 2014 Electric, 2015, 2015 Extra) and various data points. The table is color-coded with green, blue, and red headers. The bottom of the screen shows the Windows taskbar with the time 9:21 AM on 2/1/2019.



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## *Project Background (cont.)*

- NC 811 created the first SuperMega Spreadsheet™ in 2013.
- Data was analyzed manually by yours truly.
- Covered the first 2 quarters in 2012 vs. 2013
- A written report was issued discussing the findings.





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## *Project Background (cont.)*

- Since then, a sheet and a report was generated every year since.
- The sheet itself was modified to include facility specific detailed damage information.
- In 2018, NC 811 engaged Dr. Al-Bayati to perform more robust statistical analysis on the data.
- Additional support to the findings was added by conducting surveys of excavators, both professional and first time callers.



*Less flashy: more meaty*



# 2019 WESTERN REGIONAL GAS CONFERENCE



## Project Background (cont.)

- Since then, a sheet and a report was generated every year since.
- The sheet itself was modified to include facility specific detailed damage information.
- In 2018, NC 811 engaged Dr. Al-Bayati to perform more robust statistical analysis on the data.
- 3 published articles to date
- Additional support to the findings was added by conducting surveys of excavators, both professional and first time callers.

### Reducing Damages to Underground Infrastructure: Performance Evaluation of One-Call Notification Program

Ahmed Jalil Al-Bayati, Ph.D., P.E., M.ASCE<sup>1</sup>; Louis Panzer<sup>2</sup>; and Ali Karakhan<sup>3</sup>

**Abstract:** Reducing damages to underground utilities is one of the primary goals of construction stakeholders. The societal and economic impacts of such damages are substantial. To minimize potential damages to underground utilities, one-call notification programs have been created to coordinate efforts that aim to locate utilities before excavating. One-call centers are distributed throughout the United States and have been collecting damages data for years. However, few, if any, studies have evaluated the overall process of one-call centers and whether their services are adequately designed and efficiently delivered to utility owners and excavators. Thus, the present study aims to fill this gap in practice by investigating underground utility damages and evaluating the overall process. To achieve the aim of the study, two methods of data collection were adopted. Damage data from the state of North Carolina in 2017 were obtained to examine trends and frequencies of damages. In addition, a survey was developed and used to evaluate the overall process of one-call centers and identify deficiencies. Among other findings, the results suggest that damages to telecommunication and television (Teh/TV) lines are more frequent than other types of damages and that, overall, Teh/TV contractors are the primary contributors to most damages. The study also reveals that locate time is the most deficient component in the locating process. Findings from the present study are expected to help construction stakeholders and state agencies improve the locating process and management of underground utilities. DOI: 10.1061/(ASCE)SC:1943-5576.0000441. © 2019 American Society of Civil Engineers.

#### Introduction

There were an estimated 450,000 occurrences of damages to underground utility networks in the United States in 2017, according to the Common Ground Alliance (CGA 2017). The estimated damages have experienced a consistent increase since 2015 (i.e., 378,000 damage reports in 2015, 416,000 damage reports in 2016, and 479,000 damage reports in 2017). The reported damages often happen to the following underground utilities, in descending order of incidence: telecommunication and television (Teh/TV), natural gas, electricity, and water (Al-Bayati and Panzer 2019). According to Nelson et al. (2012), more than 38 million miles of underground utilities exist in the United States, and this number is growing every day. These dense utility networks are responsible for the well-being and continued economic strength of the United States. Yet damages to underground utilities are still a major concern (Trenold and Kanan 2012), due mostly to the inaccuracy of identifying the exact location of these utilities (Young et al. 2016; UNDOT 2018). If the location of utilities is not accurately identified, then each excavation activity has the potential to cause damage to underground utilities. As for the social and economic impact of these damages on the public, they can influence

design and construction operations negatively, leading to delayed schedules and increased cost. Accordingly, damages to underground utilities cost society roughly \$1.5 billion (DRE 2016). Furthermore, these damages could result in significant food and medical crises. For example, an explosion caused by a damaged gas line killed 1 person and injured 11 others in Canton, IL, in 2016.

One-call notification is a program initiated in the 1970s to coordinate communication between excavators and operators of underground facilities. The one-call center is generally a free service for excavators to inform underground utility owners of any called-in excavation activities that can affect their underground facilities. More formalized recognition was established through 1996's Transportation Equity Act for the 21st Century to reduce unintentional damage to underground utilities (TEA-21 1998). According to the act, accidental damages can cause significant disruption to public services such as hospitals and electrical power and are a leading cause of hazardous liquid pipeline accidents (Kellers and Bensch 2006). Accordingly, the act encourages states to establish one-call notification systems to serve as the connection between excavators and utility owners (i.e., operators) to mark underground utilities to prevent damages. TEA-21 established a 2-year program that provides grants for states that have a one-call notification system meeting the minimum standards to enhance the overall process. In March 2015, the Federal Communications Commission (FCC) granted three-digit dialing (8-1-1), creating a universal number in the United States for the coordination of locating services for underground utilities. Currently, all states across the nation have their own 811 notification center to help excavators and operators coordinate digging underground safely. In addition, each state has its own regulations that require all individuals and entities (i.e., excavators) to call in and report information before excavating. The regulations vary from state to state (Table 1 illustrates some of the differences between states).

It is important to realize that a one-call center can only notify the utility owners who are members of the one-call center. This means

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Note. This manuscript was submitted for review on December 18, 2018; approved on April 3, 2019; published online on June 24, 2019. Discussion period open until November 24, 2019; separate discussions must be submitted for individual papers. This paper is part of the *Practice Periodicals on Structural Design and Construction*, © ASCE, ISSN 1944-0680.

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Peer review Journal article



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## *Measurement: Why? What? What Next?*

- Let's start with the Why...
  - Without measuring, how can you know if improvements are being made?
  - This is true for everything we do and almost every task can be quantified to objectively determine whether the results confirm progress is being made.
  - The trick is determining the next question: the "What should be measured?"



*Too meaty: less meaty*



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## *Measurement: Why? What? What Next?*

- And now the “What?”
  - The obvious metric we are focused on as a measure of improvement is not waist size or weight. It is the reduction in damages.
  - In 2013 we decided to put everything we had into the bowl. This was primarily because we couldn't be sure what efforts were making the most impact in moving the needle.



*Everything we could think of...*

# *In addition to SMS data...we like our data like we like our oysters: raw.*

- Incidents data including number, stakeholder group, facility owner, facility damaged, work type, failure to call, etc.
- Tickets and transmissions numbers ( NC 811 and CGA).
- Number of positive response codes such as code 999, code 32, etc.
- Number and location of funded educational methods such as billboards and fuel tanks as well as “eyes on” calculation method.
- 3-hour notices
- First-time caller survey data survey data.
- Causes of damages (other than failure to call) as having been reported to NC811.
- The time (duration in hours or days) between the ticket creation time and positive response time; Not sure if this doable.





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## *Measurement: Why? What? What Next?*

### What Next?

- Over the years we made some conclusions about the data we had accumulated. But this method was more observational than statistically tested.
- In 2018 we established a relationship with WCU to perform analysis of the data accumulated.
- Our goal was to evaluate the data we had in an objective, statistically validated way.
- It was time to put the data under the microscope.





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## *The Research Study*

- Engaged into a contract with WCU.
- Original agreement included the use of SAS (“Statistical Analysis System”) to identify correlations and confirm whether the results were considered valid using mathematical modelling.
- What does it mean to perform a valid study of the data?





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## *The Research Study*

- In addition to the raw data analysis, surveys were conducted with first time users and professional excavators.
- 985 responses were received from homeowners, 450 from professionals.
- Questions were designed to measure satisfaction with overall process, including NC 811.
- We wanted to know their experience: from the call itself to the response time by locators as well as whether any damages occurred during their excavation.





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## *Results and Recommendations*

WHO is reporting data is extremely important.

Bias isn't always intentional.

In some cases, the way the data that is put into the system is based on an understanding of the law itself.

In this case, NC 811 damage data was more heavily supplied by excavators than locators.

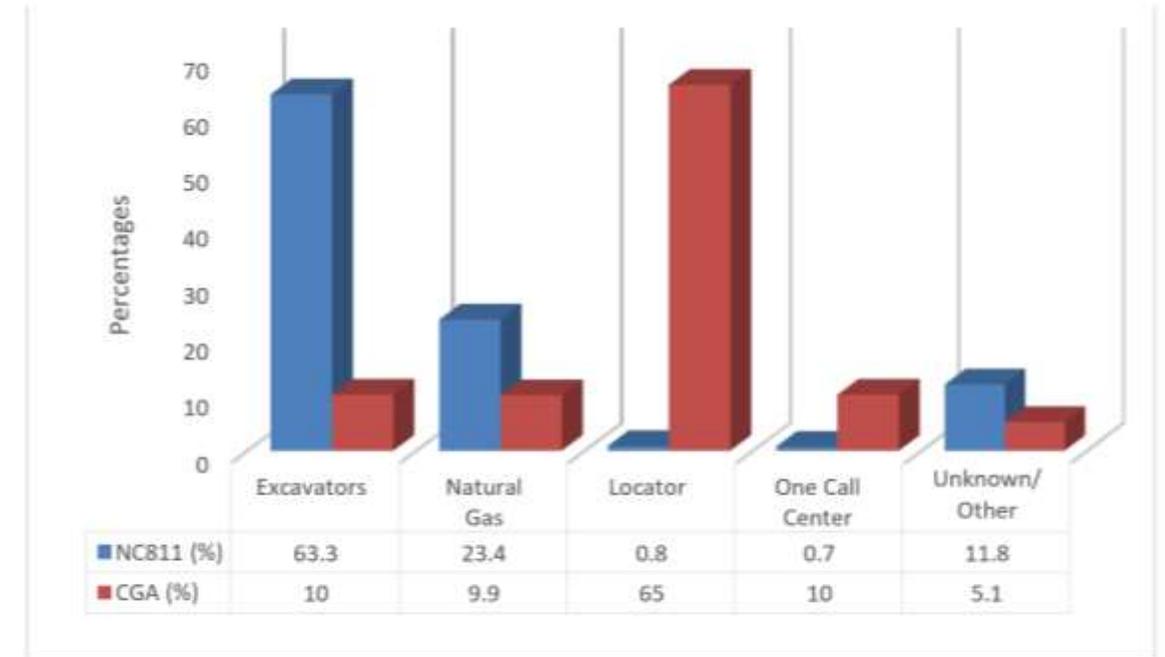


Figure 2. Damages Reported by Stakeholders



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## *Results and Recommendations*

When “unknown” root cause data is removed, the results indicated a difference between what CGA DIRT reports and what NC 811 reports.

Remember, data is provided without being vetted by investigation.

The root cause of locating practices in NC is validated by additional positive response and survey data.

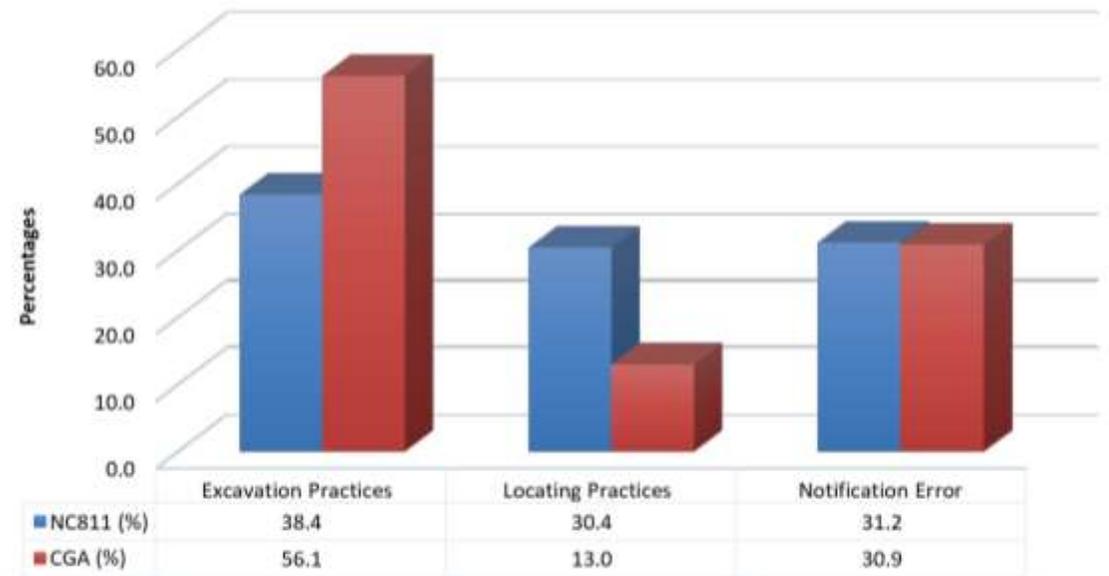


Figure 4. The Percentages of Root Causes without Unknown Data (NC811 Vs. CGA)



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## *Results and Recommendations*

Contrary to data reported through DIRT, NC 811 data reflects that marking accuracy and visibility is more often correct when performed by the utility owners themselves vs. the contract locators.

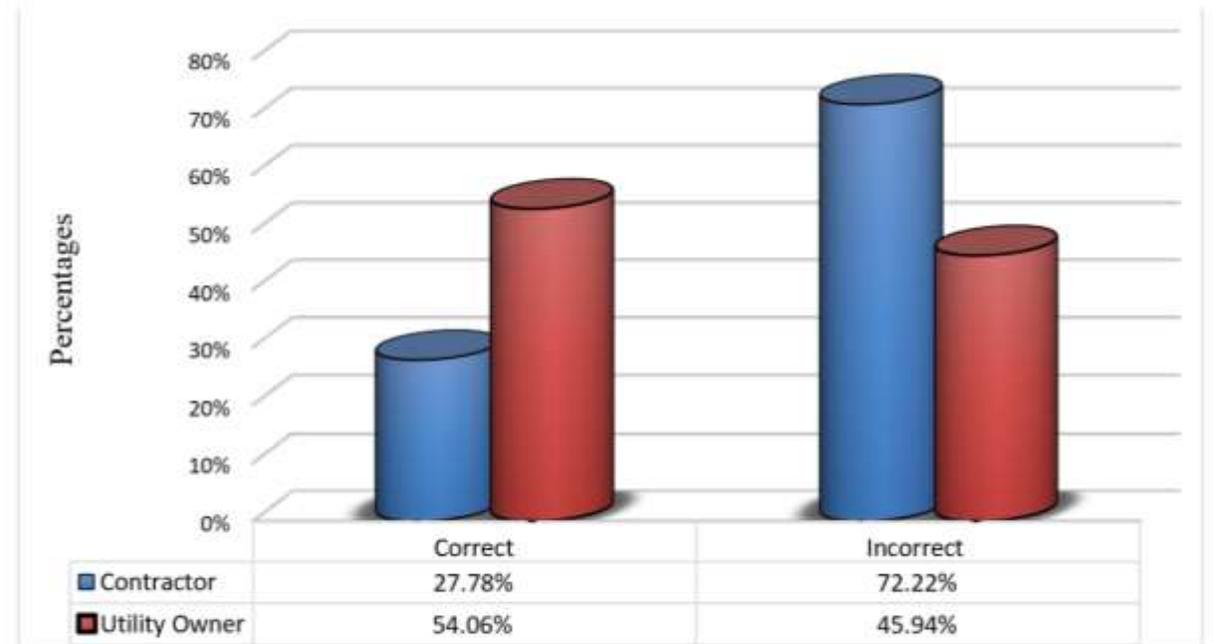


Figure 5. Marks Accuracy by Locating Party



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## *Results and Recommendations*

Examining the “employer type” in the damage data illustrates the fact that Utility Owners, conducting work, were reported to have the highest incidents of damage to telecommunication facilities.

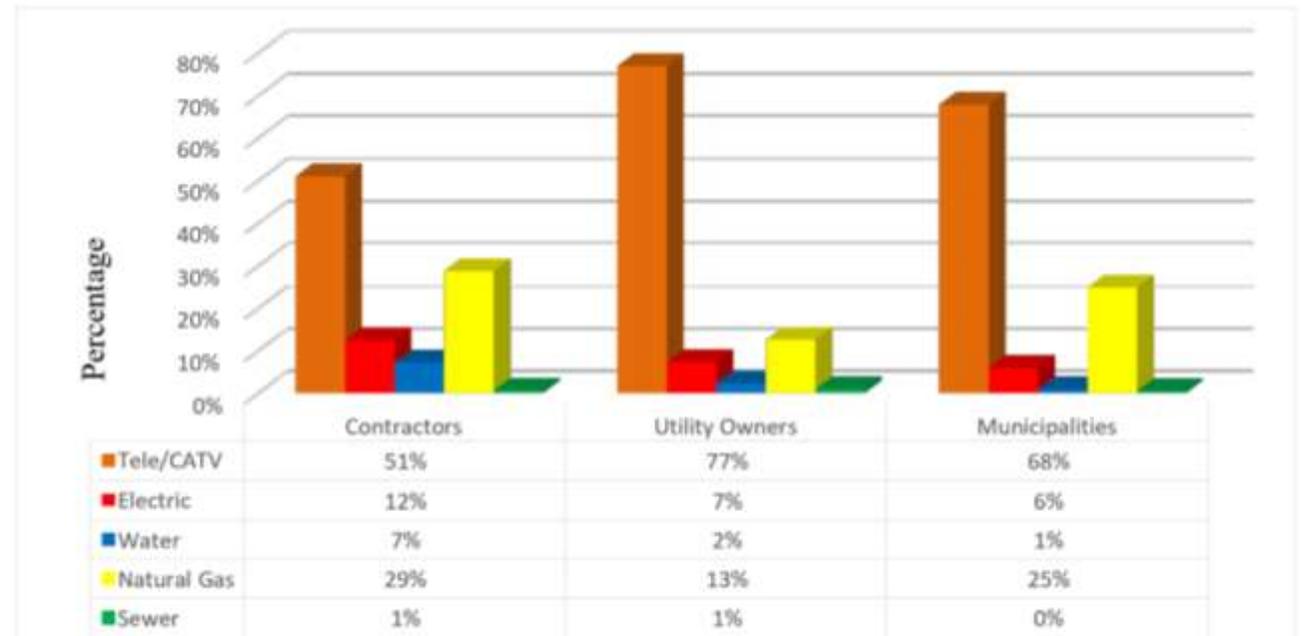


Figure 7. Damages to Underground Utilities per Employer Type



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## *Results and Recommendations*

This chart illustrates the work type of Telecom/CATV was the leading type contributing to damages, followed by Water, Construction then Natural Gas.

Construction contributed the second highest amount of damages to natural gas.

Telecom/CATV work produced the highest amount of damage to Telecom/CATV facilities.

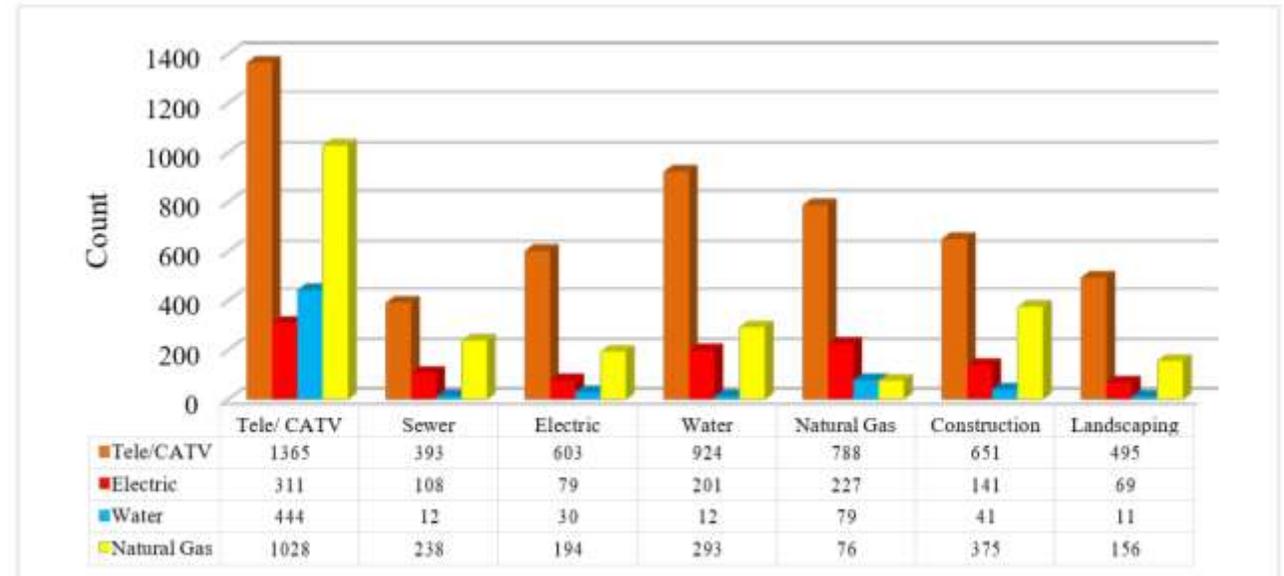


Figure 9. Damager per Work Type



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## *Results and Recommendations*

“No Locate” damages reported by work type. These highlight educational opportunities within these groups

- Landscaping (25%)
- Construction (23%)
- Telecom/CATV (22.6%)
- Water installation/repair (11%)





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## *Results and Recommendations*

When asked how these first time users know about calling, their results surprised us to some degree.

Media was considered TV, radio and Internet.

Billboard, at 33%, reinforced that method.

Print took a distant third.

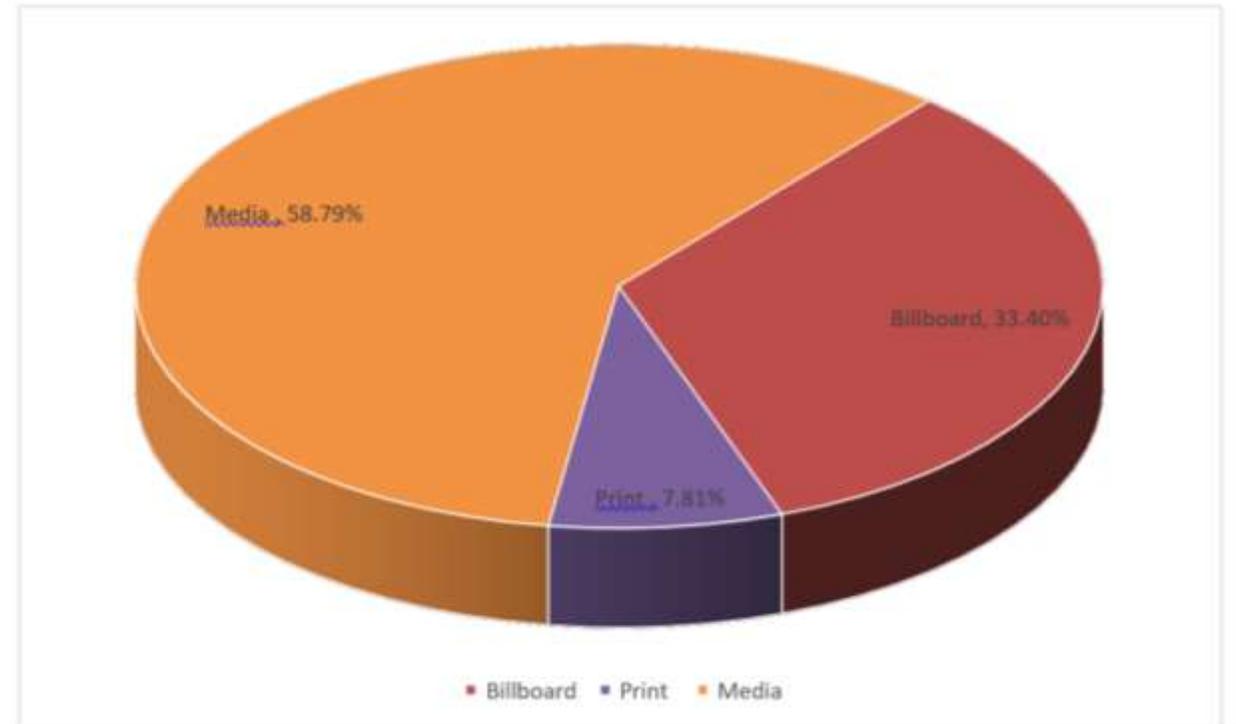


Figure 16. Most Effective Education Methods



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## Results and Recommendations

What is a 999 code?

What is a 3 hour notice?

Analyzing the raw data brought to light a disparity between 3 hour notice and 999 codes in Durham.

The recommendation is training. But...

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)

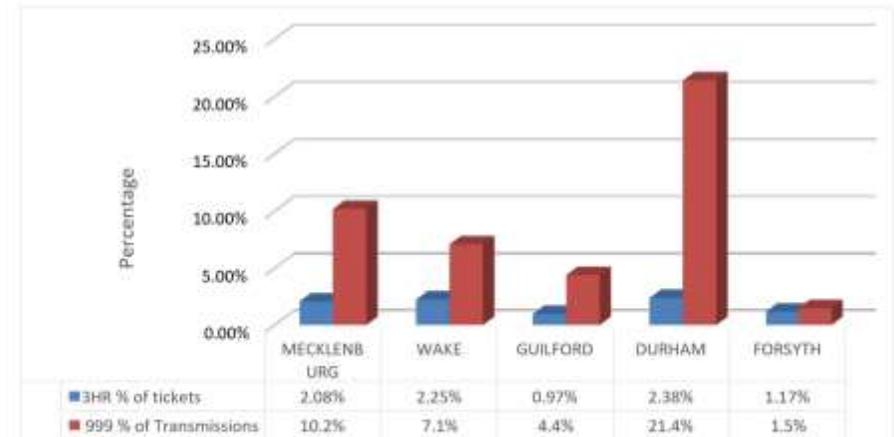


Figure 10. The Percentages of 3Hr Notices and Code 999



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## *Results and Recommendations*

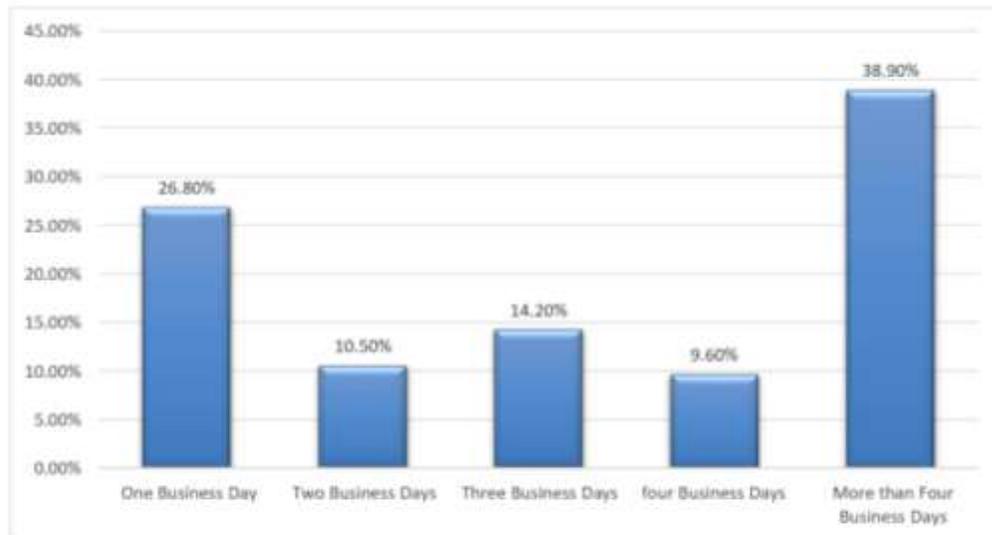


Figure 11. The Number of Days Needed for Positive Responses in 2017

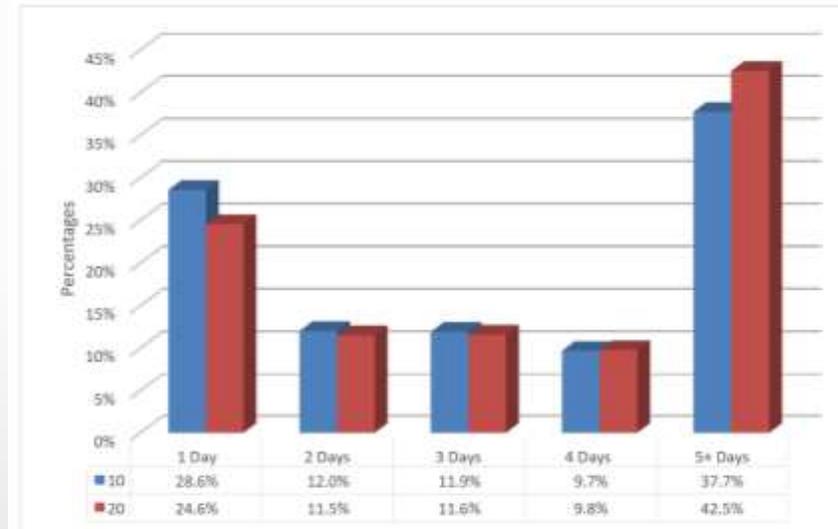


Figure 12. The Number of Days Needed for Locating in 2017

Survey Results verified data received through positive response with actual personal experiences



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## *Results and Recommendations*

Survey results from the first time users.  
They were happy with NC 811.  
Good with overall process, locator professionalism and accuracy.  
Not so much with completion time.

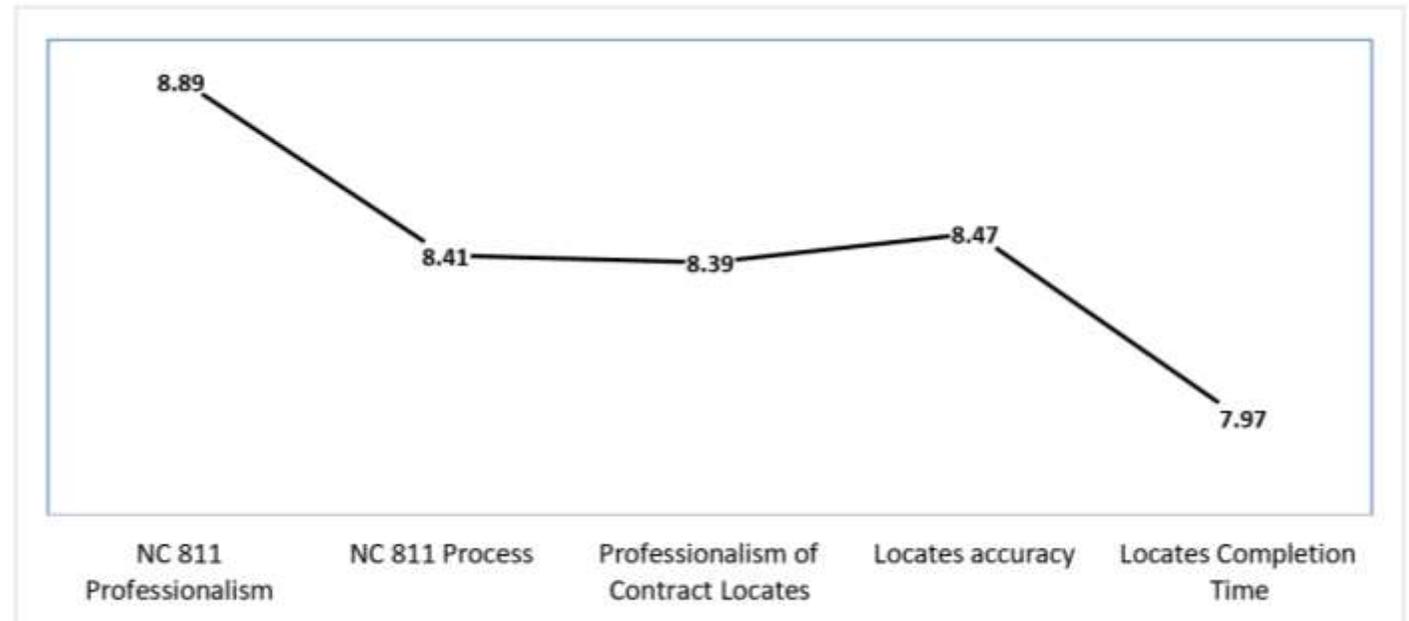


Figure 14. The Average Quality based on Participants' Experience



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## *North Carolina Damages Analysis: Wrap Up*

- Bias exists and is inherent in any one method of data gathering.
- Having multiple data gathering, analysis methods and sources is critical.
- When outcomes are reinforced they should be taken seriously.
- Correcting flaws in the process can be done through education but ONLY when the audience that is a contributor to the flaw is known.
- Utility Companies can benefit from a top down review of these issues and conclusions.
- Continuous measurement will help to determine if the education methods and audience reached resulted in a reduction in damages.



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*QUESTIONS?*



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Research can be found at:  
<https://www.nc811.org/education.html>