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AUSLEY MCMULLEN
ATTORNEYS AND COUNSELORS AT LAW

123 SOUTH CALHOUN STREET
P.O. BOX 391 (ZIP 32302)
TALLAHASSEE, FLORIDA 32301
(850) 224-9115 FAX (850) 222-7560

May 2, 2016

VIA: ELECTRONIC FILING

Ms. Carlotta S. Stauffer
Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Re: Tampa Electric Company's 2016-2018 Storm Hardening Plan

Dear Ms. Stauffer:

Pursuant to Rule 25-6.0342, Florida Administrative Code, attached for filing on behalf of Tampa Electric Company is its Petition for Commission approval of its Storm Hardening Plan.

Thank you for your assistance in connection with this matter, and please feel free to contact me should you have any questions.

Sincerely,

James D. Beasley

JDB/pp
Attachment

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition to Approve Tampa Electric Company's Rule 25-6.0342 Storm Hardening Plan.	)))	DOCKET NO. ________ FILED: May 2, 2016

PETITION

1. Petitioner, Tampa Electric Company ("Tampa Electric" or "the company"), is an investor-owned utility subject to the jurisdiction of the Commission under Chapter 366, Florida Statutes. Tampa Electric's general offices are located at 702 North Franklin Street, Tampa, Florida 33601.

2. All notices, pleadings and other communications required to be served on petitioner should be delivered to:

James D. Beasley
jbeasley@ausley.com
J. Jeffry Wahlen
jwahlen@ausley.com
Ashley M. Daniels
adaniels@ausley.com
Ausley McMullen
Post Office Box 391
Tallahassee, FL 32302
(850) 224-9115
(850) 222-7560 (fax)

Paula K. Brown
regdept@tecoenergy.com
Manager, Regulatory Coordination
Tampa Electric Company
Post Office Box 111
Tampa, FL 33601
(813) 228-1444
(813) 228-1770 (fax)

3. Rule 25-6.0342, Florida Administrative Code, requires investor-owned electric utilities in Florida to file a Storm Hardening Plan with the Florida Public Service Commission ("FPSC") on or before May 7, 2007 and every three years thereafter as a matter of course. Rule 25-6.0342 specifies what must be included in utility storm hardening plans, and Tampa Electric has tracked those rule provisions in its 2016-2018 Storm Hardening Plan which is attached hereto as Exhibit "A".

4. Pursuant to Rule 25-6.0342, Tampa Electric hereby submits this petition for approval of its 2016-2018 Storm Hardening Plan.

5. Tampa Electric is not aware of any disputed issues of material fact in connection with the matters addressed in this petition.

WHEREFORE, Tampa Electric respectfully requests that the Commission enter an order granting this petition and approving Tampa Electric's 2016-2018 Storm Hardening Plan attached hereto as Exhibit "A".

DATED this 2nd day of May, 2016.

Respectfully submitted,

JAMES D. BEASLEY
J. JEFFRY WAHLEN
ASHLEY M. DANIELS
Ausley McMullen
Post Office Box 391
Tallahassee, FL 32302
(850) 224-9115

ATTORNEYS FOR TAMPA ELECTRIC COMPANY

EXHIBIT A

TECO
TAMPA ELECTRIC

2016–2018
Storm Hardening Plan

Filed: May 2, 2016

Tampa Electric's 2016-2018 Storm Hardening Plan

Executive Summary

Tampa Electric's 2016-2018 Storm Hardening Plan is an important part of the company's multi-pronged approach to enhance the reliability of the overhead and underground electrical transmission and distribution facilities as well as to reduce restoration costs and outage times in a prudent, practical and cost-effective manner.

Tampa Electric's 2016-2018 Storm Hardening Plan will be the fourth three-year storm hardening plan since Order No. PSC-07-0043-FOF-EU was issued by the Florida Public Service Commission ("FPSC") on January 16, 2007 requiring utilities to file storm hardening plans. Tampa Electric has developed this plan to ensure conformance to this Order and will continue the hardening practices found in the company's prior storm hardening plans approved by the FPSC. This plan contains a description of the company's construction standards, policies, practices and procedures. This plan also describes the company's deployment strategy to achieve the plan's objectives, which include the costs and benefits expected, the benefits and impacts to joint users and outlines the company's pole attachment standards and procedures for joint users.

Table of Contents

Tampa Electric’s Service Area:

Tampa Electric’s Service Area covers approximately 2,000 square miles in West Central Florida, including all of Hillsborough County and parts of Polk, Pasco and Pinellas Counties as shown in Figure 1 below. Tampa Electric provides service to 724,911 retail electric customers as of January 1, 2016. Tampa Electric’s transmission system consists of approximately 1,300 miles of overhead facilities, 25,400 poles and structures and 14 miles of underground facilities. The company’s distribution system consists of approximately 6,300 circuit miles of overhead facilities, 404,000 poles and 5,100 circuit miles of underground facilities. Tampa Electric also has approximately 339,000 authorized joint user attachments on the company’s transmission and distribution poles.

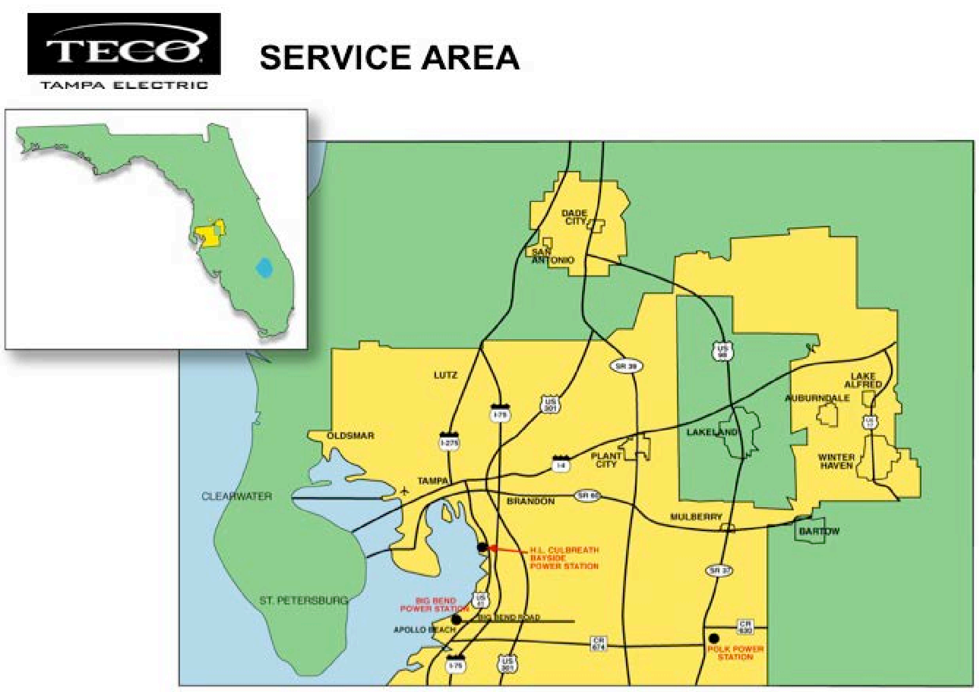


Figure 1: Tampa Electric’s Service Area

References:

The following resources are referenced in this plan:

a) 2012 National Electrical Safety Code
b) National Hurricane Center Database
c) Florida State Building Code
d) Hillsborough County Wind Maps
e) Tampa Electric's 2006 Storm Implementation Plan
f) Distribution Engineering Technical Manual
g) Standard Electrical Service Requirements
h) General Rules and Specifications
i) General Rules and Specifications Underground
j) Approved Materials Catalog
k) Hillsborough County Flood Hazard Maps

Acronyms and Definitions:

AAAC: All aluminum alloy conductor ("AAAC").

ACSR: Aluminum conductor, steel reinforced ("ACSR"). A conductor that is constructed of a stranded steel core that carries the mechanical load and layers of stranded aluminum surrounding the core that carries the current.

AMC: Approved Material Catalog ("AMC") provides a listing of the approved material that can be used for the construction of Tampa Electric's electrical facilities.

ANSI: American National Standards Institute ("ANSI") which provides the generally accepted industry standard pruning practices for the management of trees, shrubs and other woody plants.

ASCE: American Society of Civil Engineers ("ASCE") provides criteria and regional boundaries for wind loading on buildings and other structures.

CCA: Chromated copper arsenate ("CCA") is a chemical wood preservative used in pressure treated wood to protect wood from rotting due to insects and microbial agents.

Circuit miles: The geographic miles of facilities as measured along each individual circuit. In a two circuit configuration the circuit miles length would be count each individual circuits length (i.e., it would be twice as long as the number of pole or wire miles)

DETM: Distribution Engineering Technical Manual ("DETM") provides Tampa Electric's corporate and service area personnel with the policies, procedures and technical data related to the design of distribution facilities owned and operated by the Company.

Distribution: Tampa Electric service facilities consisting of primary and secondary conductor, service laterals, transformers and necessary accessories and appurtenances for the furnishing of electrical power at utilization voltage. Tampa Electric's distribution system has a uniform 13.2 kV primary voltage at three phase.

DOD: Distribution Outage Database ("DOD") is the database used to house and track electric system reliability data by Tampa Electric.

EEI: Edison Electric Institute (“EEI”)

EMS: Energy Management System (“EMS”) is the computer system used by Tampa Electric to monitor, control and increase the performance of the electric system.

EOC: Emergency Operations Centers (“EOC”) are centralized locations to coordinate city activities during an emergency or special event.

ESCC: Electric Sub-Sector Coordinating Council (“ESCC”) is responsible for facilitating and supporting the coordination of sub-sector wide, policy-related activities and initiatives designed to improve the reliability and resilience of the electricity sub-sector, including physical and cyber security infrastructure and emergency preparedness of the nation’s electricity sub-sector.

ETR: Estimated Time of Restoration (“ETR”) is the time Tampa Electric expects it will take to restore power after an outage.

FDEM: Florida Division of Emergency Management (“FDEM”) plans for and respond to both natural and man-made disasters to ensure that Florida is prepared to respond, recover and mitigate against their impacts.

FEMA: Federal Emergency Management Agency (“FEMA”) is the federal agency under the U.S. Department of Homeland Security responsible for coordinating the federal response to natural and man-made disasters within the United States.

Flood Zones: Zones identified within flood hazard maps developed and published by County organizations and FEMA.

GIS: Geographic Information System ("GIS") is a computer system and database that is used for storing, updating and mapping information about Tampa Electric's transmission, substation and distribution facilities.

GR&S-OH: General Rules and Specification – Overhead ("GR&S-OH") provides Tampa Electric's general rules and specifications for the construction of overhead facilities.

GR&S-UG: General Rules and Specification – Underground ("GR&S-UG") provides Tampa Electric's general rules and specifications for the construction of underground facilities.

Joint Users: Any known or unknown third party attacher or entity that has placed any facility on a Tampa Electric owned pole. Facilities may include but are not limited to cables, messenger wires, catenary support wires, equipment boxes, grounding wires or lugs, brackets, guys, etc.

kV: Kilovolt ("kV") is a measure of voltage level on an electrical system expressed in thousands of volts.

LMS: Local Mitigation Strategy ("LMS") is a plan developed by the county to reduce and or eliminate the risks associated with natural and man-made hazards.

mph: Miles per hour (“mph”) is a measurement for wind speeds when considering construction standards due to projected wind loading on electric system facilities.

NESC: National Electrical Safety Code (“NESC”), which is published by the Institute of Electrical and Electronic Engineers and sets the ground rules for practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment. It contains the basic provisions that are considered necessary for the safety of employees and the public under the specified conditions.

NFPA: National Fire Protection Association (“NFPA”) provides NFPA 1600 which is the standard on disaster/emergency management and Business Continuity/Continuity of Operations Programs.

NJUNS: National Joint Utilities Notification System (“NJUNS”) is a non-profit utility consortium designed to improve joint use communication. The software is an internet based service that allows Tampa Electric to communicate and track workflow regarding joint utility ventures such as joint pole administration, joint trench coordination, oversize load move coordination and large project notification. The web address of the program is www.njuns.com

OMS: Outage Management System ("OMS") is a computer system used by Tampa Electric to assist in the restoration of power. The OMS provides more accurate outage analysis and facilitates faster response to any level of outages.

PoleForeman: A software program for classing utility poles, analyzing pole loading, calculating guy wire tensions and performing joint use analysis to help assure compliance with the NESC.

PDRP: Post-Disaster Redevelopment Plan ("PDRP"), which is developed and published by Hillsborough County and is a requirement of all Florida coastal counties and identifies how a community will redevelop and recover long-term after a disaster.

PURC: Public Utility Research Center ("PURC") is located at the University of Florida and is a research and training center used to provide collaborative research on storm hardening topics.

ROW: Right of Way ("ROW") is a strip of land that Tampa Electric uses to construct, maintain or repair the company's electric power lines. Tampa Electric follows the Florida Administrative Code 25-6.0341 for the location of the company's electric power lines.

RTU: a remote terminal unit ("RTU") is an electronic device that allows for the control and reporting data of an electrical system device through communication.

SESR: Standard Electrical Service Requirements (“SESR”) provides Tampa Electric’s information to customers and their agents the requirements to receive electrical service from Tampa Electric.

SETM: Substation Engineering Technical Manual (“SETM”) provides Tampa Electric’s corporate and service area personnel with the policies, procedures and technical data related to the design of substation facilities owned and operated by the company.

SPIDAMin: A software program that provides spatial asset and project administration and management.

T&D: Transmission and Distribution (“T&D”).

Transmission: The network of Tampa Electric high voltage lines and associated equipment, typically ranging from 69 kV to 230 kV, which are used to move electrical power from generating resources to load centers where it is transformed to a lower primary distribution voltage for distribution customers.

Vaults: An isolated ventilated enclosure for electrical equipment with fire-resistant walls, ceiling and floor which personnel may enter and in which transformers and switching equipment are installed, operated and maintained.

Wind Zones: Areas of defined wind speeds as shown on maps contained in the ASCE 7-10 and as incorporated in the Florida Building Codes.

Storm Hardening Plan Initiatives:

Initiative 1: Four-year Vegetation Management

Tampa Electric's Vegetation Management Program incorporates a balanced approach to electrical safety and reliability while adhering to the ANSI A300 pruning standards. The company manages approximately 6,300 circuit miles of overhead distribution facilities and 1,300 circuit miles of overhead transmission facilities over five counties within Florida. Tampa Electric’s current vegetation management plans call for trimming the company’s distribution system on a four-year cycle, approved by the Commission in Docket No. 120038-EI, Order No. PSC 12-0303-PAA-EI, issued June 12, 2012. The plan allows for the flexibility to change circuit prioritization utilizing the company's reliability based methodology.

The incremental cost of this initiative is estimated to be $9,600,000 annually.

Initiative 2: Joint Use Pole Attachments Audit

Tampa Electric will continue to conduct comprehensive loading analyses to ensure the company’s poles, with joint use attachments, are not overloaded and meet the NESC or Tampa Electric Standards, whichever is more stringent. These loading analyses are a direct effort to lessen storm related issues on poles with joint use attachments. All current joint use agreements require attaching entities to apply for and gain permission to make attachments to Tampa Electric's poles. Once the application is received, an engineering assessment of every pole where attachments are being proposed will have a comprehensive loading analysis performed. If the loading analysis determines that additional support is necessary, all upgrades will be made prior to notifying the joint use attacher that their construction is ready for attachments.

Tampa Electric's audit of joint use attachments is an important step in documenting all pole attachments. A critical component of the audit is finding pole attachments that the company is not aware of. If an unauthorized attachment is found, the company can perform a comprehensive pole loading analysis to ensure the pole is not overloaded and ensuring that all safety, reliability, capacity and engineering requirement are met.

The necessity for the audit arises due to the significant wind loading and stress that pole attachments can have on a pole and the fact that some attachments are made without notice or prior engineering.

Tampa Electric's incremental annual cost of this initiative is estimated to be $0 due to the cost for the comprehensive pole loading analysis being currently entirely paid for by the requesting third party attacher.

Initiative 3: Transmission Structure Inspection Program

Tampa Electric's transmission system has a history of strong reliability performance. This performance is in large part due to the multi-pronged inspection approach the company has applied to the system. The approach includes the eight-year above ground structure inspection cycle, eight-year ground line wood and non-wood inspection cycle, annual ground patrol, annual aerial infrared patrol, annual substation inspection cycle and the pre-climb inspection requirement. Tampa Electric will continue these inspections and will also continue the company’s ongoing efforts to monitor and evaluate the appropriateness of its transmission structure inspection program to ensure that any cost-effective storm hardening or reliability opportunities found are taken advantage of.

The incremental cost of this initiative is estimated to be $1,900,000 annually.

Initiative 4: Hardening of Existing Transmission Structures

Tampa Electric has over 25,400 transmission poles and structures with approximately 1,300 circuit miles of transmission facilities. Of these transmission structures, approximately 32 percent are supported with wood poles. Tampa Electric will continue hardening the existing transmission system in a prudent and cost-effective manner utilizing the company’s inspection and maintenance program to systematically replace these existing wood structures with non-wood structures. Tampa Electric builds all new transmission line construction projects, system rebuilds and line relocations with non-wood structures that meet or exceed NESC Grade B Code requirements. The company will also continue to replace insulators that have deteriorated over time with new polymer insulators.

This initiative is still consistent with Tampa Electric’s practice of storm hardening transmission structures. There are no incremental costs associated with this activity.

Initiative 5: Geographic Information System

Tampa Electric's GIS will continue to serve as the foundational database for all transmission, substation and distribution facilities. Development and improvement of the GIS continues. All new computing technology requests and new initiatives are evaluated with a goal to eliminate redundant, exclusive and difficult to update databases as well as to place emphasis on full integration with Tampa Electric's business processes. These evaluations further cement GIS as the foundational database for Tampa Electric's facilities.

Tampa Electric will continue ongoing activities to improve the functionality and ease of use of the GIS for the company's GIS users. Two examples of these ongoing activities include the GIS User's Group, which meets to review, evaluate and recommend enhancements for implementation. The second ongoing activity is the annual publication of the Tampa Electric GIS Annual Report.

There are no incremental costs associated with this activity.

Initiative 6: Post-Storm Data Collection

Tampa Electric has implemented a formal process to randomly sample system damage following a major weather event in a statistically significant manner. This information will be used to perform forensic analysis in an attempt to categorize the root cause of equipment failure. From these reports, recommendations and possible changes will be made regarding engineering, equipment and construction standards and specifications. A hired third party of data collection specialists will patrol a representative sample of the damaged areas of the electric system following a major storm event and perform the data collection process. At a minimum, the following types of information will be collected:

- Pole/Structure - type of damage, size and type of pole, and likely cause of damage
- Conductor - type of damage, conductor type and size, and likely cause of damage
- Equipment - type of damage, overhead or underground, size, and likely cause of damage
- Hardware - type of damage, size and likely cause of damage

Third party engineering personnel will perform the forensic analysis of a representative sample of the data obtained to evaluate the root cause of failure and assess future preventive measures where possible and practical. This will include evaluating the type of material used, the type of construction and the environment where the damage occurred including existing vegetation and elevations. Changes will be recommended and implemented if more effective solutions are identified by the analysis team.

The incremental cost of this initiative is estimated to be approximately $113,000 per storm and will depend on the severity of the storm and extent of system damage.

Initiative 7: Outage Data - Overhead and Underground Systems

Tampa Electric tracks and stores the company's outage data for overhead and underground systems in a single database called the DOD. The DOD is linked to and receives outage data from the company's EMS and OMS. The DOD tracks outage records according to cause and equipment type and is capable of supporting the following functionality:

- Centralized capture of outage related data
- Analysis and clean-up of outage-related data
- Maintenance and adjustment to distribution outage database data
- Automatic Generation and distribution of canned reliability reports
- Generating ad hoc operational and managerial reports

The DOD is further programmed to distinguish between overhead and underground systems and is specifically designed to generate distribution service reliability reports that comply with Rule 25-6.0455, Florida Administrative Code.

In addition to the DOD and supporting processes to ensure that outage data for the company's overhead and underground systems are analyzed for accurate performance, the company also has established processes in place for collecting post-storm data and performing forensic analysis to ensure the performance of Tampa Electric's overhead and underground systems are correctly assessed.

The incremental cost of this initiative is estimated to be approximately $100,000 per storm.

Initiative 8: Increase Coordination with Local Governments

Tampa Electric representatives will continue to focus on maintaining existing vital governmental contacts and participating on disaster recovery committees to collaborate in planning, protection, response, recovery and mitigation efforts. Tampa Electric will participate with local and municipal government agencies within its service area, as well as the FDEM, in planning and facilitating joint storm exercises. In addition, Tampa Electric will continue to be involved in improving emergency response to vulnerable populations.

The incremental cost of this initiative is estimated to be $0 annually.

Initiative 9: Collaborative Research

Tampa Electric will continue the company's participation in collaborative research effort with the Florida's other investor-owned electric utilities, several municipals and cooperatives to further the development of storm resilient electric utility infrastructure and technologies that reduce storm restoration costs and outages to customers.

This collaborative research is being facilitated by the PURC at the University of Florida. A steering committee comprised of one member from each of the participating utilities is providing the direction for research initiatives. Tampa Electric signed an extension of the memorandum of understanding with PURC in December 2015 for three years which will set this collaborative research to continue during this proposed three-year storm hardening plan.

The incremental cost of this initiative will be determined by the extent and duration of collaborative research projects that are directed to be conducted.

Initiative 10: Disaster Preparedness and Recovery Plan

Tampa Electric will continue to be active in many ongoing activities to support the restoration of the system before, during and after storm activation. For the next three-year period, the company intends to lead or support disaster preparedness and recovery plan activities such as planning, training and working with other electric utilities to continually refine and improve the company’s ability to respond quickly and efficiently in any restoration situation.

Tampa Electric’s Emergency Management plans address all hazards, including extreme weather events and are reviewed annually. Tampa Electric follows the policy set by TECO Energy for Emergency Management and Business Continuity which delineates responsibilities at the employee, company and community levels. Tampa Electric will continue in leadership or active participant roles in the following local and national preparedness groups:

- PDRP
- EEI
- ESCC
- NFPA 1600 Committee
- LMS
- Vulnerable Population committees

Tampa Electric will also continue to plan, participate in, and conduct internal and external preparedness exercises, collaborating with government emergency management agencies, at the local, state and federal levels.

In late 2015, a Manager of Emergency Management was selected in Tampa Electric’s Energy Delivery Department to focus full time on the response plans of the company. This position will be responsible for ensuring Energy Delivery is effectively prepared to respond to storms and other emergency events that can disrupt service to customers. Working with other utilities and utility trade association committees, this position will bring new technology and best practices to Tampa Electric and shepherd their implementation and integration into Tampa Electric’s emergency response plans.

Tampa Electric is in the process of implementing a common roster for use when forces are deployed to another utility or when outside resources are requested to assist the company in restoration efforts. The common roster will standardize the collection of crew member information to facilitate the tracking of personnel and equipment during a restoration effort.

Tampa Electric is also participating with other electric utilities nationwide on the development and implementation of a software platform to automate and facilitate the requesting of and responding to requests for outside crews to assist in the event of a restoration event. The platform will allow transparency in the allocation of resources when multiple utilities are impacted by large scale storms or events and provide more detailed records of the process.

In 2015, part two of the review of Energy Delivery's emergency restoration project was completed. In 2014, Energy Delivery engaged the services of an outside consulting firm to perform a review of Energy Delivery's emergency restoration process. The consultant made a total of 17 recommendations in their review of the emergency restoration process. The review for Energy Delivery consisted of two parts with a potential third part. Part one involved securing outside restoration resources which was completed in 2014. Part two involved the review of the emergency restoration plan which was completed in 2015. Part three is the potential evaluation of alternatives for hardening the T&D system and formulating a multi-year plan for the Distribution System. At this time, Tampa Electric has decided to not engage the consultant for part three.

Beginning in 2016, the consultant's recommendations will be evaluated for implementation into Energy Delivery restoration plans. Tampa Electric projects that by June 2017, a Damage Assessment system software tool will be implemented, which will automate the back office input, tracking, reporting and dispatching of restoration work.

The incremental cost of this initiative is estimated to be $275,000 annually.

National Electrical Safety Code Compliance

Tampa Electric’s construction standards and policies meet or exceed all minimum NESC Rule requirements.

Extreme Wind Loading Standards

NESC Rule 250, which addresses pole loading requirements in the United States, is divided into three loading districts; Heavy, Medium and Light (see Figure 2 below). Tampa Electric’s service area is located in the Light loading district, which assumes no ice buildup and a wind pressure rating of nine pounds per square foot. The nine pound wind corresponds to approximately 60 mph. The Light loading district wind speed corresponds to a wind pressure of more than twice that in the Heavy or Medium districts due to the strong (non-linear) dependence of the wind force on wind speed (i.e., the wind pressure is proportional to the square of the wind speed). Another part of the NESC Rule 250 requires safety loading factors applied to the calculated wind forces to provide a conservative margin of safety when selecting appropriate pole sizes. A safety loading factor of 2.06:1 is applied to Grade C construction and 3.85:1 is applied to Grade B construction. The effective wind speed of Grade B new construction is approximately 116 mph. According to the NESC, Grade B wind loading criteria must be applied when constructing facilities less than 60 feet in height when crossing railroads, bridges and highways.

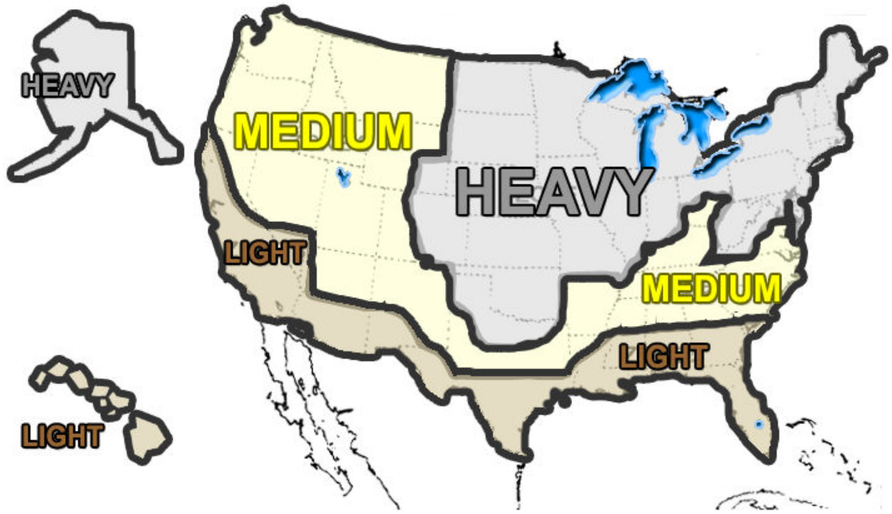


Figure 2: NESC General loading map of United States with respect to loading of overhead lines.

The NESC also specifies an extreme wind pole loading criteria for all facilities constructed that are 60 feet in height or greater. The NESC provides a wind loading map that indicates the wind speed criteria for each area of the country. These same criteria and regional boundaries, developed by the ASCE, are utilized by the state of Florida and Hillsborough County for building code requirements. Tampa Electric’s service territory is divided into two wind regions (see Figure 3 below). The western half is in the 120 mph zone and the eastern half is in the 110 mph zone.

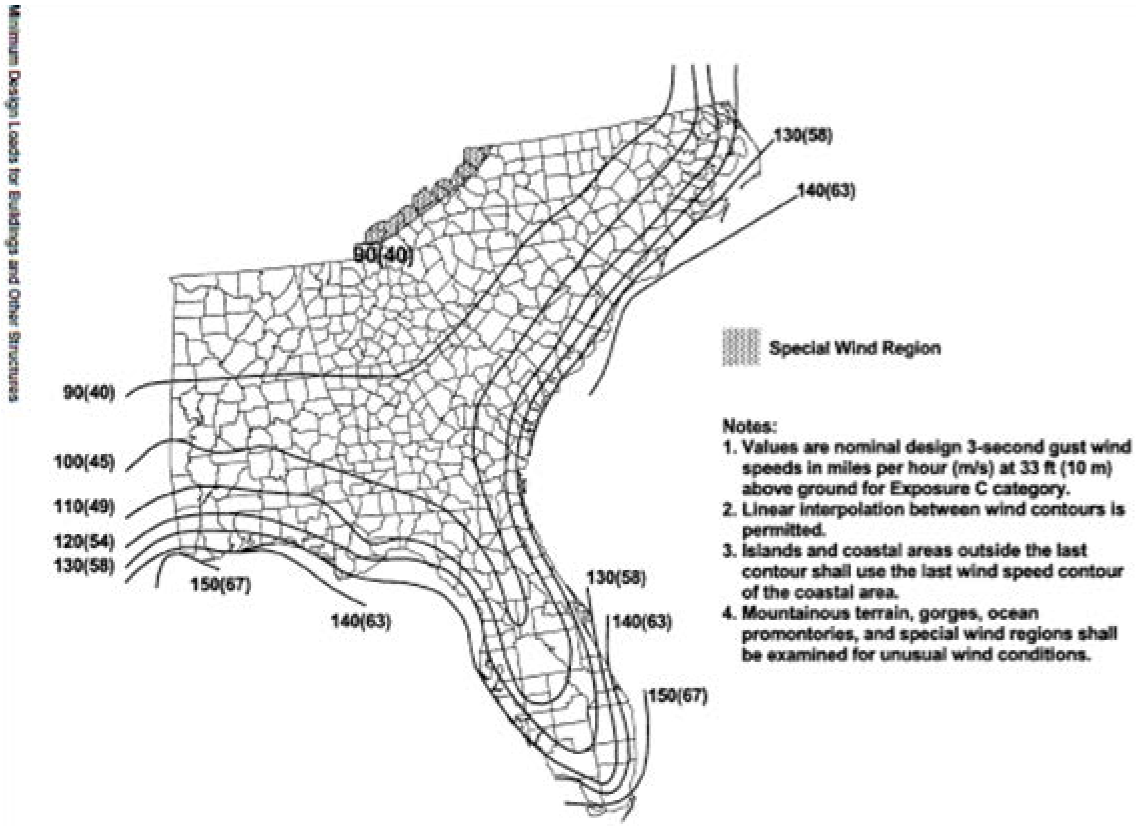


Figure 3: ASCE 7-05 Eastern Gulf of Mexico and Southeastern U.S. Hurricane Coastline

Construction Standards, Policies, Practices and Procedures

Design Philosophy

The basis of Tampa Electric’s construction standards, policies, practices and procedures is the NESC Grade B-Light. From this foundation, the company’s philosophy is to implement safe, reliable and cost-effective service to the company’s customers.

Experience with Major Storm Events

Tampa Electric has been fortunate to not have a major storm event impact the company’s service territory in many years. However, mutual assistance trips have afforded Tampa Electric’s restoration crews opportunities to gain invaluable restoration knowledge and experience in restoring service after a major storm event. This knowledge includes the importance of conducting an expedient and accurate damage assessment immediately after the storm has past. The mutual assistance trips have also provided insight on the importance of providing customers accurate ETR. Also, hurricane Sandy exposed how vulnerable coastal regions are to the significant damaging effects of storm surge and the significant effort required to restore a system that has been impacted. These experiences and industry best practices have been discussed, analyzed and used to improve Tampa Electric’s storm response plan.

Table 1 below provides the details of named storms affecting Tampa Electric’s service area since 1960. The data is from the National Hurricane Center database.

Table 1: Named Storms Affecting Tampa Electric Service Area since 1960			
Year	**Storm Name**	**Size** [1]	**Wind Speed** [2]
1960	Donna	Cat 3	115
1995	Erin	TS	57
2004	Charley	Cat 2	86
2004	Francis	Cat 1	63
2004	Jeanne	Cat 1	63
2005	Dennis	TS	43
2005	Wilma	TS	44
2006	Alberto	TS	45
2007	Barry	TS	31
2012	Debby	TS	53
2012	Isaac	TS	36
2013	Andrea	TS	47

Note 1: Maximum category when the storm passed through the Tampa Electric service area.
Note 2: Maximum sustained surface wind speed measured in miles per hour when the storm passed through the Tampa Electric service area.

Distribution

This section of the plan builds upon the design philosophy discussed above and provides an overview of the design criteria, construction standards and practices applicable to all new distribution facilities. This section also presents a broad discussion of distribution materials and structure types utilized.

Tampa Electric has developed and maintains a DETM which provides corporate and field personnel the policies, procedures and technical data related to the design of distribution facilities owned and operated by the company. Information contained in this manual along with the SESR, GR&S-OH, GR&S-UG and AMC, provide guidelines for designing, constructing and maintaining Tampa Electric's distribution system.

Overhead System

Voltage

Tampa Electric's primary distribution system operates at a uniform 13.2 kV at three phase. Secondary voltage is provided in conjunction with the primary distribution system.

Clearances

Primary voltage conductors are located in the power space on the pole which is the upper most portion of the pole as defined by the NESC. Secondary and service conductors along with the neutral are located approximately six feet lower than the primary conductors. Joint attachers are located in the communication space on the pole which is at a minimum 40 inches below the neutral cable or Tampa Electric's communication cable. For typical clearances applicable to joint use attachments see Attachment A.

Pole Loading

Tampa Electric utilizes NESC construction Grade B loading criteria as the basis for the company's construction standard for all new construction, major planned work, expansions, rebuilds and relocations on the overhead distribution system. As described above, the safety factors considered in the NESC construction Grade B criteria provide for a system that is 87 percent stronger than the NESC construction Grade C criteria which results in a robust design that the company’s experience has shown to provide safe, reliable and cost-effective service. This standard exceeds the minimum requirement of the NESC, which requires distribution poles to be designed to construction Grade C. While the NESC has requirements related to extreme wind conditions, these requirements are only for structures over 60 feet in height and rarely apply to distribution structures.

Tampa Electric’s experience continues to show that there is no substantial evidence that building distribution structures to extreme wind construction grades will prevent damage from falling trees, tree limbs and flying debris during major storm events. Tampa Electric has concluded from the company’s storm restoration experience and historical hurricane exposure that Grade B construction, which will withstand an effective wind speed between 116 mph (new construction) and 95 mph (at replacement), is the most cost-effective and reliable standard for the company’s service area.

Materials

There are several types of poles that are used for distribution structures. Tampa Electric’s distribution system consists of wood, concrete, steel, ductile iron and fiberglass poles. The standard for all new distribution construction is CCA treated wood poles.

The company’s standard conductor for circuit feeders is 336 kcmil ACSR with a 2/0 AAAC neutral. Conductor sizes utilized for distribution laterals (overhead takeoffs from feeders) may either be #2, 2/0 or 4/0 AAAC with some older existing facilities containing #6 copper conductor.

Construction Types

Proper configuration selection is emphasized for safety, maintenance and economics. The existing line configuration is typically maintained on multi-phase line extensions. Customer requests for alternative distribution pole and construction types will be considered and if agreed upon, the customer(s) requesting would incur the incremental expense from standard service.

Triangular line configuration using fiberglass brackets is the preferred construction standard. It is the most economical to install and is particularly suited to situations involving restrictive ROW, easements and clearances. Because of its narrow profile, it is also preferred for locations with numerous trees. Other construction types that may be used include vertical, modified vertical and wood, or fiberglass cross arms.

Pole Loading Compliance

Tampa Electric will continue to use “PoleForeman,” a pole loading software program to assure that Tampa Electric is in compliance with all NESC loading requirements and company construction standards. The program utilizes the company’s construction standards with templates to model each pole and assist company distribution design technicians. The technician inputs the appropriate template, conductor, pole size and class, which the program uses to determine all loads on the pole. The program applies the loads to the structure and calculates the resulting stresses as a percent utilization of the pole.

Underground Facilities

Standard Design

Tampa Electric's standard underground distribution system consists of normally looped circuits operating at 13.2 kV three-phase or 7.6 kV single-phase primary voltages. The standard cable is 15 kV strand-filled jacketed tree-retardant cross-linked polyethylene insulated aluminum cable with a copper concentric neutral. Tampa Electric's standard is to place all underground distribution cables in a conduit system buried at depths of 24 to 36 inches from the ground surface to the top of the conduit.

Network Service

Tampa Electric has several types of underground services with associated facilities. One is standard underground service that is used in residential subdivisions and commercial areas, which are described above. Another is network service, which provides a higher level of reliability and operating flexibility.

Tampa Electric employs two types of network service. The first type is an integrated secondary grid network that serves the high-density load area in downtown Tampa. The second type is spot network systems that also serves high-density load in the downtown Tampa network area.

The network systems provide redundant circuit feeds from a two transformer substation and thus are designed to maintain service during a first contingency outage. The network systems are also designed to resist water intrusion and the equipment is located in vaults, some of which are below-grade. However, the customer-owned electrical panels are not necessarily waterproof and will likely be severely impacted by saltwater intrusion. This will possibly delay power restoration in the event of a major storm with storm surge into downtown Tampa.

Construction Standards in Coastal Areas

Tampa Electric's service area is partially bounded by Tampa Bay and has approximately 60 square miles of land in the Flood Zone 1 designated area as defined in Hillsborough County's Hazard Flood Maps and approximately 2.5 square miles of land in the Oldsmar area in the Flood Zone 1 designated area as defined in Pinellas County's Hazard Flood Maps. Along these coastal areas there is increased risk of storm surge, flooding and saltwater contamination. Since 2008, the company's standard is that new underground distribution facilities (padmounted transformers, switchgear and load break cabinets) shall be of stainless steel or aluminum construction and bolted to the concrete pad. Upgrading the material from mild steel to stainless steel or aluminum makes it more durable and typically extends equipment life after saltwater contamination. While utilizing stainless steel or aluminum has significant benefits to storm hardening, the equipment is not waterproof and may require cleaning following a flooding event prior to re-energizing.

Since 2004, all primary switchgear has been specified using 100 percent stainless steel enclosures, and since 2008 all padmounted transformers have been specified using 100 percent stainless steel enclosures to reduce the corrosive effects from salt spray, effluent irrigation spray and to help harden the equipment against the corrosive effects of a saltwater storm surge.

Procedures Following Flooding Events

The company has considered two flooding event scenarios that could occur in these flood prone areas. The first scenario is a flooding event where a less severe storm surge of up to five feet occurs during a Category 1 hurricane. In most cases, and depending on the level of water, there may not be any load to serve immediately; however, the buildings, houses, etc., will probably still be standing but they may not be habitable.

The second scenario, a much more catastrophic event, would be a Category 3 hurricane or greater with a storm surge of 12 feet or greater producing high crushing water, sand and debris. In this event, the company anticipates everything in the storm surge’s path would be moved or buried, as was the case in the aftermath of Hurricane Ivan in Gulf Power’s utility system. The result was no load to serve for an extended period of time after the storm surge. In light of this experience, Tampa Electric has concluded that it is not practical or cost-effective to attempt to design an underground system that can withstand such an extreme event.

Tampa Electric recognizes there is a significant chance that some equipment may become submerged or flooded during a storm. Although specific locations and the severity of flooding cannot be pre-determined, Tampa Electric may choose to de-energize portions of the company’s system before the storm impacts the area if it is in the public’s best interest and can be done safely. Tampa Electric will also de-energize portions of the company’s system if directed by the appropriate governing authorities. Prior to re-energizing flooded switchgear and padmounted transformers, the underground equipment will be visually inspected and cleaned with fresh water if saltwater intrusion has occurred. The switchgear fuses will be replaced if the flood levels exceeded the height of the fused barrels. All meters that have been submerged will be replaced prior to re-energizing. If a replacement is not immediately available, the customer’s meter may be bypassed. The service can be re-energized after the customer requests it and only after the water has receded and the meter socket and main disconnect have been visually inspected. Tampa Electric’s inspection jurisdiction is limited to the meter, meter socket and main disconnect.

Major storms can cause damage to customer-owned equipment as well, such as pipe mast, switchgear or meter sockets. In this case, Tampa Electric will notify the affected customer that service cannot be restored until the customer secures the services of an electrical contractor to make the appropriate repairs, and those repairs are inspected by the governing agency.

Location of Facilities

Tampa Electric’s policy as stated in the DETM is to ensure that the route for new lines is located within the ROW or an electric utility easement. New residential lines shall be front lot construction and truck accessible. Commercial lines may be rear lot construction, but they must be truck accessible. This approach facilitates efficient access during installation and maintenance of the facilities.

Prior to 1970 and this policy being instituted, some distribution facilities were constructed in rear lot easements. Occasionally communities or homeowner associations make inquiries regarding the relocation of overhead facilities from rear lot locations to the front of customer’s properties. Tampa Electric evaluates each inquiry on a case-by-case basis for feasibility, practicality and cost-effectiveness. The following considerations are given for locating and relocating lines:

- Storm Hardening
- ROW
- Permits and Easements
- Intersections
- Field conditions
- Required construction including costs
- Environmental impact and permit requirements
- Property lines
- Future growth support
- Future construction plans
- Vegetation management changes

Critical Infrastructure

Tampa Electric, in conjunction with local government emergency management, has identified the company’s critical facilities and associated circuits feeding loads which are deemed necessary for business continuity and continuity of government. As such, critical community facilities are identified based on being most critical to the overall health of the community, including public health, safety or the national or global economy. Such facilities include hospitals, emergency shelters, master pumping stations, wastewater plants, major communications facilities, flood control structures, electric and gas utilities, EOC, as well as main police and fire stations, and others. The circuits serving these facilities have the highest restoration priority level. Tampa Electric has hardened several circuits which feed some of the most critical customers on the company’s system to extreme wind criteria. Opportunities to harden specific circuits of the distribution system based upon feeding critical customers for NESC extreme wind loading requirements will continue to be evaluated.

Overhead to Underground Conversions

Tampa Electric will continue to evaluate community, governmental agency and homeowner association requests to convert existing overhead power lines to underground. Each inquiry will be evaluated on a case by case basis for feasibility, practicality and cost impact. Consideration will be given to conversion costs, ROW availability for underground facilities, physical constraints, maintenance costs, additional customer cost associated with service main conversion from overhead to underground, Joint Users impact cost, scheduling and coordination.

Tampa Electric developed Table 2 below to illustrate the benefits and drawbacks associated with both overhead and underground electric service as compared to each other.

Table 2 - Summary of Benefits and Drawbacks of Overhead and Underground Electric Service			
Overhead		**Underground**	
Benefits	**Drawbacks**	**Benefits**	**Drawbacks**
Lower cost to install and maintain	More power outages primarily due to trees coming in contact	Better aesthetics	Difficult and longer to trouble shoot outages
Easier to restore and locate faults	Higher exposure due to wind impact	Lower exposure to high winds and reduced outages due to animals	More costly to restore/repair outages (four times)[1]
Shorter duration of power outages	Accidental contacts from antennas and aluminum gutter installations	No tree trimming expense	More exposure due to storm surge or flooding
More operational flexibility, e.g., adding transformer, tapping lateral	More exposure to outage causes due to location in traffic areas, roadways, easements	Property values tend to be higher	More costly to install and maintain. Up to ten times the cost of new overhead power line[2] and higher cost upgrading existing underground facilities due to expansion
Longer life expectancy and better reliability late in life	Poor aesthetics	Lower risk of electrocutions due to antennas and aluminum gutter installations	Lower reliability late in life[1]

Note 1: From the North Carolina Utilities Commission, November 2003, Feasibility of Placing Electric Distribution Facilities Underground

Note 2: From the Edison Electric Institute, 2004, *Out of Sight, Out of Mind, A study on the costs and benefits of undergrounding overhead lines.*

Transmission

This section of the plan provides an overview of design considerations and references when performing a transmission structure analysis for new and existing facilities. This section is a broad discussion of transmission structure types, foundation design and design criteria.

Transmission Structures

Voltage levels

Tampa Electric's transmission system consists of circuits operating at 230 kV, 138 kV and 69 kV. These circuits consist of a minimum of three phase conductors and (usually) a static wire (ground). Additional facilities may exist or be incorporated in the design of a transmission structure. These include additional transmission conductors, optical ground wire, communication conductors, distribution conductors and an assortment of wire attachments by joint users.

Material types

Tampa Electric's transmission system consists of wood, concrete, aluminum, steel and composite supporting structures. Since 1991, Tampa Electric has adopted a standard that all new construction, line relocations and maintenance replacements will use pre-stressed spun concrete, steel or composite pole structures. Past practices included wood pole, aluminum and lattice steel structure design. Pre-stressed spun concrete, tubular steel and composite poles are now the preferred structure material types that are being installed when replacing structures as part of Tampa Electric’s system hardening plan and maintenance.

Configuration Types

There are multiple transmission structure configurations utilized. Pre-stressed spun concrete poles and tubular steel poles are utilized in single or multiple pole configurations. The advent of pre-stressed spun concrete and tubular steel poles has permitted a more cost-effective, lower maintenance and higher strength option.

The configurations will vary widely when considering the many variables associated with transmission facilities. Some of these variables are:

- Number of circuits
- Conductor size
- Structure strength
- Span length
- Soil conditions
- ROW width
- Potential permitting requirements
- Utilization of adjacent land
- Environmental impacts
- Electric and magnetic field criteria
- Aesthetics
- Economics and cost–effectiveness
- Community input

Single pre-stressed spun concrete or tubular steel structure configurations have proven to be the most economical and maintainable choice given the work environment and constraints encountered while engineering and constructing transmission facilities.

Prior to pre-stressed spun concrete and tubular steel technology, typical structure configurations commonly consisted of single wood pole or multiple wood pole structures, lattice aluminum H-frames and lattice steel towers.

Foundations

Direct embedment is the preferred foundation type utilized for pre-stressed spun concrete, tubular steel or composite structures. A direct embedded foundation typically has a specified depth and diameter. The direct embedded foundation also requires that a segment of the superstructure to be embedded below ground, acting as part of the foundation, along with natural soil, crushed rock or concrete backfill.

When a structure location requires it, Tampa Electric uses an industry accepted program for foundation design. Soil borings are collected or standard penetration tests are conducted to compile the appropriate soil data for foundation analysis.

Design Criteria

There are two types of methodologies used to analyze pole strength. Tampa Electric uses the ultimate strength analysis for all wood and non-wood structures. However, it is acceptable and often recommended to use the working stress method for wood poles.

Tampa Electric designs and specifies all transmission facilities in accordance with the latest version of the NESC. All designs address NESC extreme wind and Grade B construction at a minimum. The extreme wind loads are applied to all attachments on the transmission structure regardless of attachment height.

Tampa Electric’s service area is largely within the 100 to 120 mph extreme wind contours referenced in the NESC. For design consistency, the 120 mph wind standard is applied on all 69 kV structures throughout the service area. In addition, a 133 mph wind standard is applied to all 138 kV and 230 kV structures throughout Tampa Electric’s service area. The 133 mph wind standard exceeds the NESC requirements for extreme wind loading. This standard was adopted when Tampa Electric commissioned the first 230 kV line in the company’s service area. Tampa Electric continues to support the 133 mph wind standard as the best practice for 138 kV and 230 kV line construction.

Since the inception of the NESC extreme wind standard, it has been applied to Tampa Electric transmission facilities. Tampa Electric historically has applied the 133 mph wind standard to 230 kV facilities and in some cases an even higher wind speed has been applied when the company determined that the circuit would be very difficult to restore. An example of this higher wind standard is when the company replaced the transmission structures crossing the Alafia River. For these structures, a 150 mph wind standard was used.

Substation

Tampa Electric has developed and maintains a SETM which provides the company's personnel with the policies, procedures and technical date to the design of substation facilities owned and operated by the company. Information contained in the SETM along with the SESR, GR&S-OH, GR&S-UG and AMC, provide guidelines for designing, constructing and maintaining Tampa Electric's substation facilities.

Tampa Electric designs, constructs and maintains transmission and distribution substations and switchyards ranging from 13.2 kV to 230 kV. This includes performing siting studies, physical design, grading and drainage, foundation design, layout and design of control buildings, structure design and analysis, protection and control systems, and preparation of complete specifications for material, equipment and construction. The company currently has 216 substations.

Design Philosophy

Wind Strength Requirements

Tampa Electric designs the company's substations in accordance with the latest approved version of the NESC. Currently, all distribution substation structures are designed to withstand a wind load of 120 mph.

All 230 kV generation facilities and 230 kV transmission stations, current design standards call for terminal line structures to withstand 133 mph wind loading along with the line tension of the transmission circuit.

The design standards summarized above meet the NESC loading criteria for extreme wind, Grade B construction. As previously stated, Tampa Electric's service area is within the 100 to 120 mph extreme wind contours referenced in the NESC.

Equipment Elevations

Equipment elevations are carefully evaluated when building on existing sites or when selecting future sites in the Flood Zone 1 designated area. Information on past flooding in localized areas and potential future storm surge levels are evaluated. Most equipment is built on steel supports and is above expected flood levels. Some equipment such as transformers can be submerged up to the point of attached cabinets and controls. Therefore, the major focus is on the elevation and water resistance of the control cabinets and related equipment. The sites and/or equipment are elevated based on the overall site permitting that must be done with the governmental and environmental agencies while taking into consideration the surrounding area.

Protection

Animal protection covers are installed on all new 13 kV bushings, lightning arrestors, switches and leads. This helps prevent outages caused by animals and will also reduce damage from debris that may get inside the substation during a major storm event. Tampa Electric uses circuit switchers instead of fuses or ground switches on new and upgraded transformer installations. This design will clear a fault faster which minimizes damage and greatly reduces restoration time.

Flood Zones

Flood zones are carefully evaluated when building on existing sites or when selecting future sites. The company will continue to review existing sites in the Flood Zone 1 designated area. The major focus will be on the elevation and water resistance of control cabinets and related equipment. Prudent modifications will be made. Consideration will be given to whether there will be load to be served in the area of the substation immediately after a storm and if any load can be served from adjacent substations that are outside the flooded area.

Other

When transformers are added to an existing substation or a transformer is upgraded, existing fences are removed and new fences are installed to meet or exceed current NESC wind and height standards. At the same time, animal protection covers are installed on all 13 kV bushings, lightning arrestors, switches and leads. This helps prevent damage from debris that gets inside the substation. This type of work will occur on an average of three substations per year based on current plans.

Construction Standards

In distribution substations, new designs utilize structures that are of a galvanized tubular steel design. The tallest structure is approximately 24 feet above grade, with the majority of the structures and equipment being below 17 feet. Distribution feeder circuits are designed to exit the substation via underground cables installed inside six-inch conduit.

In 230 kV substations and 69 kV switching stations, control buildings are used to house protection relays, communication equipment, RTU monitoring equipment and substation battery systems. Previous construction methods used concrete block construction with poured concrete columns and concrete roof panels, which are designed to withstand winds of 120 mph without any damage to the building or the equipment housed inside. Control buildings currently being installed are pre-fabricated metal buildings designed for 150 mph wind loading. Tampa Electric installs eight-foot tall perimeter chain link fences designed to 120 mph or walls designed to 125 mph. This provides additional protection from wind-blown debris. Tampa Electric has determined that this fencing standard is most effective in blocking debris and exceeds county codes.

Deployment Strategy

Tampa Electric's 2016-2018 Storm Hardening Plan's deployment strategy will enhance system reliability and reduce storm restoration costs through the continuation of several core components of the company's previous storm hardening plans. The deployment strategy includes the continuation of:

- The implementation of the enhanced construction standards outlined above for all new transmission, distribution and substation facilities.
- The various maintenance programs that will strengthen and upgrade the system to current standards.
- All specific ongoing storm hardening initiatives.
- The evaluation of the construction programs piloting the extreme wind loading standard for select targeted distribution facilities serving critical infrastructure within the company's service territory.

Construction Standards

The transmission, distribution and substation design and construction standards described above are in effect and apply to all new facilities as well as all rebuilds, relocations and maintenance.

A majority of new distribution facilities Tampa Electric constructs each year are placed underground, however the company has averaged approximately 67 miles of new overhead distribution construction over the past few years which includes reconductoring, line extensions and new circuits/feeders over the last few years. Additionally, Tampa Electric plans to construct, rerate or rebuild approximately 90 miles of overhead transmission, of various transmission voltages, during the 2016-2018 time period.

Maintenance Programs

Vegetation Management

Tampa Electric’s Vegetation Management Program provides a balanced approach to vegetation management and currently calls for a four-year tree trim cycle, which will improve the quality of line clearance while increasing system reliability related to system hardening activities. Tampa Electric began ramping up the company’s vegetation management program at the end of 2005, with an emphasis on critical trimming needed in areas identified by the company’s reliability based methodology. The company’s Vegetation Management Program utilizes the ANSI A300 standards which are implemented through Tampa Electric’s Transmission and Distribution Line Clearance Specifications. This comprehensive document covers specifications related to operations, notification guidelines, tree trimming and removal, chemical application, targeted completion dates, overtime and non-compliance.

Distribution Maintenance

Wood Pole Inspection/Replacement Program

Tampa Electric's Wood Pole Groundline Inspection Program is part of a comprehensive program initiated by the FPSC for Florida investor-owned electric utilities to harden the electric system against severe weather and unauthorized and unnoticed non-electric pole attachments which affect the loadings on poles.

This inspection program complies with Order No. PSC-06-0144-PAA-EI, issued February 27, 2006 in Docket No. 060078-EI which requires each investor-owned electric utility to implement an inspection program of its wooden transmission and distribution poles on an eight-year cycle based on the requirements of the NESC. This program provides a systematic identification of poles that require repair, reinforcement or replacement to meet strength requirements of the NESC.

The wood pole inspections will be conducted on a substation circuit basis with a goal of inspecting the entire wood pole population every eight years. The 2016-2018 groundline pole inspections program goals/targets include approximately 43,000 annual distribution pole inspections.

Tampa Electric will conduct a pole loading analysis and data collection on poles having joint users attachments with a cable equal to or greater than one-half inch in diameter. The analysis will ensure that the condition of the pole meets the requirements in Table 261-1A of the NESC and Tampa Electric Construction Standards.

Tampa Electric’s Groundline Inspections Program strategy takes a balanced approach and has produced excellent results in a cost-effective manner. The future inspections coupled with the company’s pole replacement program will ultimately harden Tampa Electric’s transmission and distribution systems.

Transmission Maintenance

The Tampa Electric transmission system inspection program identifies potential system problems along the entire transmission circuit by analyzing the structural conditions at the groundline, above ground and the conductor spans. The inspection program is a multi-pronged approach. The inspection cycles are one or eight years depending on the goals or requirements of the inspection activity. Formal inspection activities included in the program are groundline inspection, ground patrol, aerial infrared patrol, above ground inspection and substation inspections. The ground patrol, aerial infrared patrol and substation inspections are performed on one-year cycles, the above ground and the groundline inspections are performed on an eight-year cycle. This conforms with the company's petition that was approved by the Commission which changed the above ground inspection cycle from a six-year to an eight-year cycle in Docket No. 140122-EI, Order No. PSC-14-0684-PAA-EI and confirmed in Order No. PSC-15-0017-CO-EI. Additionally, pre-climb inspections are performed prior to commencing work on any structure.

Groundline Inspection

Tampa Electric has implemented a groundline inspection program that complies with the Commission's order requiring groundline inspection of wooden transmission structures. In addition, Tampa Electric has included provisions in the groundline inspection program to identify deficiencies with non-wood structures. Groundline inspections are performed on an eight-year cycle. Each year approximately 12.5 percent of all transmission structures are scheduled for inspection. These inspections will also include a wind load analysis that will be performed on the structures where joint user attachments are present. In 2015, Tampa Electric identified a scheduling opportunity that would benefit overall reliability. This scheduling opportunity enabled the company to perform all of the groundline inspections scheduled for 2016 in the last quarter of 2015. Because of this early completion of groundline inspections, no groundline inspections are planned for 2016. However, inspections will begin again in 2017. For 2017 and 2018, the company plans to perform approximately 3,200 groundline inspections each year.

Ground Patrol

The ground patrol is a visual inspection for deficiencies including poles, insulators, switches, conductors, static wire and grounding provisions, cross arms, guying, hardware and encroachment. The ground patrol will include identification of vegetation encroachment as well as all circuit deficiencies. All transmission circuits are patrolled by ground at least once each year.

Aerial Infrared Patrol

The aerial infrared patrol is planned annually on the entire transmission system. It is performed by helicopter with a contractor specializing in thermographic power line inspections and a company employee serving as navigator and observer. This inspection identifies areas of concern that are not readily identifiable by normal visual methods as well as splices and other connections that are heating abnormally and may result in premature failure of the component. This inspection also identifies obvious system deficiencies such as broken cross arms and visibly damaged poles. Since many of these structures are on limited access ROW, this aerial inspection provides a frequent review of the entire transmission system and helps identify potential reliability issues in a timely manner.

Above Ground Inspection

Above ground inspections are performed on transmission structures on an eight-year cycle; therefore, each year approximately 12.5 percent or one-eighth of transmission structures are inspected. This inspection is typically performed by a contractor specializing in above ground power pole inspections and may be performed by climbers, bucket truck or helicopter. The above ground inspection is a comprehensive inspection that includes assessment of poles, insulators, switches, conductors, static wire, grounding provisions, cross arms, guying, hardware and encroachment issues. This program provides a detailed review of the above ground condition of the pole and the associated hardware on the structure. Annual above ground inspections are planned on approximately 3,200 structures comprising 24 circuits. This is in line with the company's petition that changed the above ground inspection cycle from a six-year cycle to an eight-year cycle which was approved in Docket 140122-EI, Order No. PSC-14-0684-PAA-EI and confirmed by Consummating Order No. PSC-15-0017-CO-EI.

Pre-Climb Inspections

While not a part of the formal inspection program outlined above, Tampa Electric crews are required to inspect poles prior to climbing. As part of these inspections, the employee is required to visually inspect each pole prior to climbing and sound each pole with a hammer if deemed necessary. These pre-climbing inspections serve to provide an additional integrity check of poles prior to the employee ascending the pole and may also result in the identification of any structural deterioration issues.

Reporting

Standardized reports are provided for each of the formal inspections. Deficiencies identified during the inspections are entered into a database. This maintenance database is used to prioritize and manage required remediation. Deficiencies identified during the pre-climb inspections are assessed by the on-site crew and reported to supervisory personnel for determination of next steps.

Pole Replacements

Tampa Electric is hardening the existing transmission system in a prudent, cost-effective manner utilizing its inspection and maintenance program to systematically replace wood structures with non-wood structures. The standard for transmission new construction is either steel or concrete exclusively. The company has approximately 25,400 transmission poles and structures with wood poles accounting for approximately 8,200 of the total.

In 2016, it is estimated that Tampa Electric will harden 600 transmission structures. This includes 500 structure replacements with steel or concrete poles and 100 sets of insulators replaced with polymer insulators. The 2016 hardening goals were developed using historical failure rates scaled to the increased inspection cycles. It is anticipated that 2017 and 2018 will have similar amounts of replacements.

Substation Maintenance

Tampa Electric performs inspections of distribution substations annually and inspections of transmission substations quarterly. The substation inspections include visual inspection of the substation fence, equipment, structures, control buildings and the integrity of grounding system for all equipment and structures.

Other Storm Hardening Initiatives:

- **Downtown Network:** The Tampa downtown network is a small area of dense loads comprised mostly of high-rise office buildings. This area is considered critical infrastructure because of the high concentration of business and governmental buildings in the area. The types of businesses include a telecommunications switching center, banking, city and county governmental offices, federal and county courthouses, as well as approximately 2,500 hotel rooms and 6.5 million square feet of office space. The company's Marion Street substation serves the downtown network with six underground distribution circuits.

  The downtown network consists of 361 manholes and 56 network vaults. Most vaults contain two network transformers and two network protectors. The typical elevation in the downtown area is 12 feet or greater; however, there are a few areas with lower elevation. In these areas, there are a total of eight below-grade vaults, two of which have flooding tendencies. Although network protectors are designed to be resistant to water intrusion, Tampa Electric will inspect and test approximately eight network protectors per year in the 12 eight below-grade low-lying vaults. If leaks are found, all the pertinent gaskets will be replaced. In addition, Tampa Electric has an effective network disaster recovery plan in place to safely and efficiently recover the downtown network in the event of total power loss. This network disaster recovery plan is reviewed and updated on an annual basis.

- **Overhead to Underground Conversion of Interstate Highway Crossings:** This activity focuses on hardening limited access highway crossings which will prevent the hindrance of first responders, emergency vehicles and others due to fallen distribution lines blocking traffic. The restoration of downed overhead power lines over interstate highways can be lengthy because of heavy traffic congestion. Tampa Electric’s current preferred construction standard requires all distribution line interstate crossings to be underground. All remaining overhead crossings will be converted to underground as construction and maintenance activities present opportunities.

- **Submersible Padmount Switchgear:** In 2015, Tampa Electric began using submersible padmount switchgear to harden the underground system. This switchgear is designed to withstand intrusion from water, including salt-water, while remaining in service. This gear will be specifically used for those critical customers in areas where storm surge is expected to have a significant impact, or those areas where the environment has caused live front switchgear to fail prematurely. The switchgear has been deployed in locations serving the Tampa International Airport and the Downtown Network. There are current plans to install the switchgear at some hospitals served by Tampa Electric, including Tampa General Hospital. Tampa Electric's plans to deploy the submersible gear for all new critical customers and to retrofit switchgear serving critical loads as scheduling permits.

- **Tampa General Hospital:** Tampa General Hospital is the only level I trauma center in Tampa and contains just over 1,000 beds. It is one of only three hospitals in Florida with a Burn Center. The hospital is located on Davis Island which could experience a significant storm surge event in a major storm. Tampa Electric and the hospital are engaged in discussions about storm hardening measures to harden and protect their electrical infrastructure. There are plans to replace three existing switchgear with submersible switchgear. Plans are also being developed to relocate the primary feeds attached to the bridge that connects the hospital to the mainland and placing them under the channel adjacent to the hospital. Tampa Electric will continue to engage the hospital on cost-effective and prudent measures to ensure that the electrical system serving the hospital is as robust and storm hardened as feasible.

Prior Tampa Electric Storm Hardening Projects

Tampa Electric has performed storm hardening of several specific portions of the company's electric system to ensure that the services these areas provide customers during and after a storm remain intact. Examples of these storm hardening projects are:

- **Tampa International Airport:** Tampa International Airport, prior to the project, was completely served by six underground distribution circuits that were fed from a single substation. Tampa Electric has completed the project to split the service to feed the airport from two different substations. The new distribution configuration also allows the airport to be fed 100 percent from either substation should a fault occur. The area of the airport and its close proximity to the bay makes it susceptible to a storm surge. The new substation feeding the airport is further inland and at a higher elevation than the initial single substation.

- **City of Tampa–Tippin Water Treatment Plant:** In 2013, Tampa Electric hardened the two circuits that fed the water treatment plant. Each of these circuits was hardened by converting a portion of the circuit from overhead to underground. Additionally, all of the poles on each circuit that were not undergrounded were upgraded and hardened. As a reliability improvement, animal protection was installed on both affected substations which feed these two circuits and at the same time Tampa Electric replaced the circuit breakers and associated relays on the two circuits.

- **Extreme Wind Pilot Program:** Tampa Electric's 2007-2009 Storm Hardening Plan strategy for piloting the extreme wind loading construction criteria on distribution facilities focused on the system infrastructure serving two critical customers. These customers included a local hospital designated as a Level 2 Trauma Center and the Port of Tampa gasoline tank storage area. The company has completed the extreme wind loading enhancements to the infrastructure serving the hospital and the Port of Tampa. The circuits feeding the hospital and the Port of Tampa were rebuilt to meet extreme wind loading. Their performance will be closely monitored during and after hurricane events and compared to the performance of other circuits in the same area built to the current standard. Tampa Electric is not proposing any further pilot hardening projects until the performance of the existing projects has been evaluated under storm conditions.

- **Port of Tampa**: The Port of Tampa is a critical facility as it serves 10 petroleum distribution customers that deliver 40 percent of the gasoline in the state of Florida. Approximately six miles of transmission and distribution feeder were rebuilt to meet extreme wind requirements.

- **Saint Joseph's Hospital**: While there are several hospitals in Tampa Electric's service territory that are considered critical customers, Saint Joseph's Hospital was chosen for this pilot program because of its Level 2 Trauma Center status, central location, high elevation and the cost-effectiveness of the hardening activities. The distribution feeder serving the hospital is approximately one-mile in length and was rebuilt to meet extreme wind requirements.

2016-2018 Deployment and Costs

($ in thousands)

Project	2016	2017	2018
Transmission Circuit	1,000	4,000	1,500
Transmission pole inspections	164	226	231
Transmission above ground	0	336	345
Transmission pole	14,682	6,846	6,901
Distribution pole inspections	500	1,680	1,722
Distribution pole	27,488	27,509	27,531
Pole reinforcements	50	50	50
Substation enhancements	512	525	538
Vegetation management	9,398	9,633	9,874
Total	$55,437	$54,606	$48,692

Joint Users/Third Part Attacher Benefits and Impacts

Tampa Electric’s 2016–2018 Storm Hardening Plan is expected to provide benefit to all Joint Users and have minimal impact on Joint Users attached to the company’s system. The largest impacts will come from the increased pole inspections, which includes a pole loading analysis.

Pole loading calculations will be conducted as part of the pole inspection program on any joint use pole with an attachment of one-half inch in diameter cable or greater. This will ensure that each pole is not overloaded. Any pole that fails a preliminary stress test will be flagged and a comprehensive pole loading analysis will be conducted to determine if the pole is in fact overloaded. If the pole is overloaded, Tampa Electric will determine which attachment is actually causing the overload. If the pole is overloaded, the pole will be replaced and the attaching entities will be notified via NJUNS of the need to transfer their attachments to the new pole.

Tampa Electric will continue conducting a comprehensive pole loading analysis where necessary and evaluate when to initiate the next system wide pole attachment audit. The purpose of this attachment audit is to identify the location of each pole, the facilities attached and to obtain verification that such attachments are pursuant to a current joint use agreement. Costs of this audit will be shared by all attaching entities. Following the audit, if any unauthorized attachments are found, Tampa Electric will true-up its pole attachment count and back bill to the last audit unless the pole attachment owner can provide documentation of an approved permit authorizing the attachment. Unauthorized attachment fees may also be assessed for any attachments not previously approved. Additionally, the pole attachment owner will be responsible to pay for a complete engineering study and for any corrective action required to meet NESC and/or Tampa Electric construction standard requirements.

Attachment Standards and Procedures

Tampa Electric has approximately 339,000 Joint User attachments on transmission and distribution poles throughout the company's service territory. This includes attachments made by telecommunications companies, cable TV companies and governmental entities. This section of the plan outlines the standards, procedures and policies that must be adhered to by all Joint Users attaching entities.

Access to Tampa Electric Poles

Access to Tampa Electric poles is granted only to those companies who have an attachment agreement with the company. The licensee must also secure any necessary permit, consent, or certification from state, county or municipal authorities or private property owners prior to attaching. If an attaching entity does not currently have an agreement with Tampa Electric, it is necessary to contact the company's Joint Use Department. (see Attachment B for the company's contact information).

Permit Application Procedure

Prior to permit application submittal, the licensee should take the time to review its attachment agreement with Tampa Electric, including the Tampa Electric construction standards as outlined in Construction Standards, Policies, Practices and Procedures as outlined in Bates stamped pages 22 through 41 of this 2016-2018 Storm Hardening Plan.

Licensees will manage their online account and communicate with Tampa Electric in a paperless format. Prior to attaching, applicant shall log onto Tampa Electric's online application, SPIDAMin (www.spidamin.com), to select all new attachment requests or overlashing to existing attachments requests on Tampa Electric owned distribution and transmission poles. SPIDAMin will provide permit communication between Tampa Electric and the applicant. Tampa Electric also utilizes the NJUNS to notify parties of requested actions. NJUNS notifications and information can also be accessed through SPIDAMin.

No access will be granted for attachment to any poles that are specifically used for private and street lighting systems without the consent of the leasing party or entity and Tampa Electric. Access to transmission poles is not mandated by the Telecommunications Act of 1996 and is typically not granted due to excessive make ready construction costs. It is recommended that the licensee should avoid permitting to attach to transmission poles whenever possible. A complete engineering study for transmission facilities may take much longer than the 45 days it takes for distribution pole access.

Permit Application Documentation

Licensee's completed permit application shall also include the documentation listed below. Additionally, a deposit may be required for the engineering study and any make ready construction activities. Omission of any required documentation below may result in the rejection of licensee's permit application delaying the permit approval. Including the online submission of the application identifying proposed activities to Tampa Electric structures, the following documentation is also required:

- Legible map showing entire route highlighted, along with identification to correlate poles on map to poles selected in SPIDAMin. Files must be uploaded to SPIDAMin at the time of submission or the application may be rejected.
- When selecting structures, engineering properties of proposed attachments or alterations selected must be included.
- Larger projects must be divided into multiple applications. Structures in a submission must be related by a common proximity route unless the application is for service drop attachment type only.
- Deposit fee in the amount of $200.00 per pole. (This may be based on credit worthiness and/or contract terms and conditions)

Permit Engineering Study Review

Once Tampa Electric has received and accepted licensee's completed permit application, the company will review the proposed pole attachments and conduct a complete engineering study to ensure compliance of the NESC and Tampa Electric's construction standards. This study will include a structural loading and a clearance analysis on each pole. This study may take up to 45 days to complete for distribution poles and typically longer for transmission poles. Therefore, permit applications should be submitted a minimum of 90 days in advance of the expected installation date and an additional 45 days for make ready construction involving transmission. For joint use parties, Tampa Electric will determine whether joint use is excluded on any pole application within 10 days.

Make Ready

Construction Not Required

If the results of the engineering study find no existing or proposed violations with the NESC and Tampa Electric construction standards, the company will return a signed copy of licensee's permit request (see Attachment C) approving the installation of the proposed attachments. The licensee has 120 days from the approved permit date to complete attachment construction.

Construction Required by Tampa Electric

If it is determined that make ready construction by Tampa Electric is necessary to accommodate the proposed attachments, the company will notify licensee in writing of the required work along with an estimate of the construction costs. Upon licensee's acceptance of the estimate and submittal of any additional payments over and beyond the initial deposit, Tampa Electric will schedule and complete the required make ready work. Upon completion of the make ready construction, Tampa Electric will return a signed copy of licensee's permit request (see Attachment C) approving the installation of the proposed attachments. The licensee has 120 days from the approved permit date to complete attachment construction.

Construction Required by Existing Joint Users

If it is determined that make ready construction by a Joint Users is necessary (lower or raise attachments) to accommodate the proposed attachments, Tampa Electric will notify licensee via the NJUNS describing the re-arrangement work required. This system is used by Tampa Electric to communicate with its pole attachment licensees of the need to perform work. The licensee must contact the responsible Joint Users directly to negotiate work schedules and/or costs. Upon completion of this work, Tampa Electric shall be notified via the completion of the NJUNS ticket which will prompt the company to schedule an inspection to confirm all make ready construction has been completed. Once approved, Tampa Electric will return a signed copy of Licensee's permit request (see Attachment C) approving the installation of the proposed attachments. The licensee has 120 days from the approved permit date to complete attachment construction.

Tampa Electric Post Make Ready Construction Inspection Process

Upon completion of licensee's attachment installation, Tampa Electric will perform a post inspection of licensee's construction. If Tampa Electric finds licensee's construction to meet all NESC and Tampa Electric standards, the company will authorize the installation, close the job and reconcile the final costs.

Code Violations

If the company finds any violations of Tampa Electric construction standards, licensee will be notified via NJUNS to make immediate corrections. The licensee will be given 30 days to correct the violations before Tampa Electric will schedule a second post inspection. If licensee fails the second post inspection, Tampa Electric will complete the work for licensee at licensee's expense. Repeated failure to correct any code violations within the 30 day time period may result in suspension of future attachment rights.

National Joint Utility Notification System

NJUNS is an electronic notification tool used to notify licensee of any code violations found during the post inspection process. The use of this tool is paid for by Tampa Electric and does not cost licensee anything to use. The licensee will be required to communicate with Tampa Electric via this tool regarding all permit applications per its attachment agreement. Prior to submitting any permit application, licensee must have created an NJUNS account. Additionally, as part of its normal construction process, Tampa Electric will use NJUNS to notify licensees of the need to perform cable or equipment transfers when poles are being replaced or are being relocated. The licensee should contact Tampa Electric for assistance if necessary.

Permit Closeout and Final Billing

Upon completion of licensee's permit application, Tampa Electric will complete the final billing within 60 days of the completion date. Tampa Electric will reconcile the estimated pre-paid costs and the actual incurred costs. Tampa Electric will issue a refund check for any over payments or an invoice for any additional monies owed to the company. The invoice will include the total costs of the engineering conducted to process licensee's permit application and any construction costs due to make ready.

Pole Inspection Program

Pursuant to FPSC Order No. PSC-06-0144-PAA-EI (eight-year pole inspection requirement), Tampa Electric will conduct an inspection of all poles on the company’s system on an eight-year cycle. Additionally, stress calculations will be conducted on any joint use pole to ensure that each pole is not overloaded or approaching overloading for instances not already addressed by Order No. PSC-06-0144-PAA-EI. Any pole that fails a preliminary stress test will be flagged and a comprehensive pole loading analysis will be conducted to determine two things. First is to confirm whether or not the pole is in fact overloaded. Second is to determine which attachment is actually causing the overload condition to exist. If the responsible party is a Joint User that has not permitted with Tampa Electric to be on that pole, Tampa Electric will notify said party. The Joint Users will have the choice to either remove their attachment(s) or pay for the cost of corrective action. Corrective action will typically require either a pole replacement or the installation of an Osmose extended steel truss.

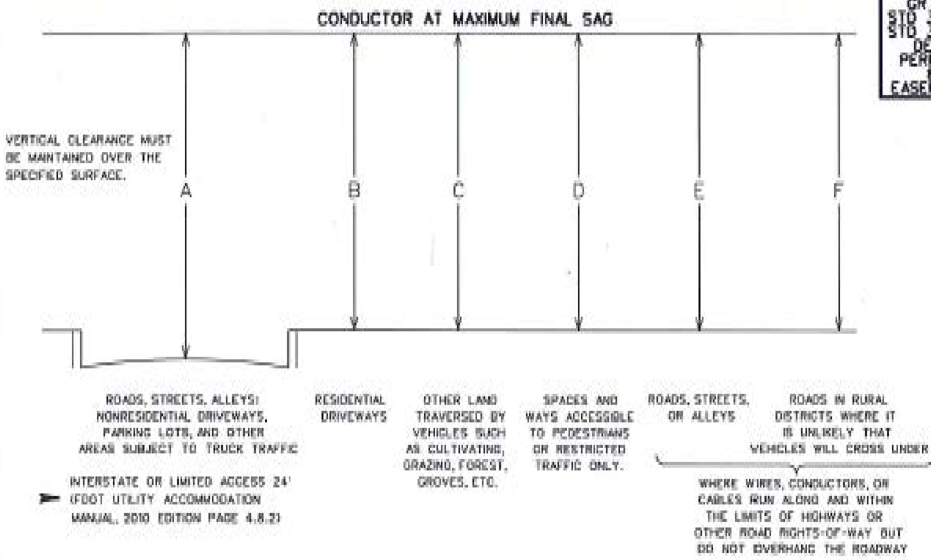
Joint Use Pole Attachment Audit

Pursuant to FPSC Order No. PSC-06-0351-PAA-EI, Tampa Electric will conduct an audit of all pole attachments on an eight-year cycle at a minimum. The last joint use pole attachment audit was completed in 2014. The purpose of this audit of joint use attachments is to identify the location of each pole and the facilities attached and verification that such attachments are pursuant to a current joint use agreement. The cost of this audit is shared among all attaching entities. Tampa Electric tags and identifies all pole locations using a geographical positioning system. If any unauthorized attachments are found, Tampa Electric reserves the right to true-up its pole attachment count and back bill to the last audit unless licensee can provide documentation of an approved permit authorizing the attachment (see Attachment C).

Unauthorized attachment fees will also be assessed for any attachments not previously approved. Additionally, licensee will be responsible to pay for a complete engineering study and for any corrective action required to meet Tampa Electric construction standards.

Attachment A

REFERENCES
GR & S
STD 3-1
STD 3-13
DETM
PERMITS
&
EASEMENTS



(VOLTAGES ARE PHASE-TO-GROUND FOR EFFECTIVELY GROUNDED CIRCUITS AND THOSE OTHER CIRCUITS WHERE ALL GROUND FAULTS ARE CLEARED BY PROMPTLY DE-ENERGIZING THE FAULTED SECTION, BOTH INITIALLY AND FOLLOWING SUBSEQUENT BREAKER OPERATIONS.)

※ CLEARANCE CODE (SEE ABOVE ILLUSTRATION.)	INSULATED COMMUNICATION CONDUCTORS AND CABLE; MESSENGERS; SURGE-PROTECTION WIRES; GROUNDED GUYS; UNGROUNDED GUYS EXPOSED TO 0 TO 300V; NEUTRAL CONDUCTORS MEETING RULE 230E1; SUPPLY CABLES MEETING RULE 230C1 (FT)	NON INSULATED COMMUNICATION CONDUCTORS; SUPPLY CABLES OF 0 TO 750 V MEETING RULES 230C2 OR 230C3 (FT)	SUPPLY CABLES OVER 750 V MEETING RULES 230C2 OR 230C3; OPEN SUPPLY CONDUCTORS, 0 TO 750 V; UNGROUNDED GUYS EXPOSED TO OVER 300 V TO 750 V (FT)	OPEN SUPPLY CONDUCTORS, OVER 750 V TO 22kV; UNGROUNDED GUYS EXPOSED TO 750 V TO 22kV (FT)	OPEN SUPPLY CONDUCTORS ABOVE 22KV (SEE NOTE 2)
A	18.0	18.0	18.0	18.5	SEE NOTE 2
B	15.5	16.0 ①	16.5 ①	18.5	
C	15.5	16.0 ③	16.5	18.5 ③	
D	9.5	12.0 ①	12.5 ①	14.5	
E	15.5	16.0	16.5	18.5	
F	13.5	14.0	14.5	16.5	

※ THE CLEARANCES REQUIRED BY THE UTILITY ACCOMMODATION GUIDE (DEPARTMENT OF TRANSPORTATION), CITY, COUNTY OR MUNICIPAL AUTHORITY SHALL GOVERN WHERE MORE CONSERVATIVE.

NOTES:

① WHERE THE HEIGHT OF A RESIDENTIAL BUILDING OR OTHER INSTALLATION DOES NOT PERMIT SERVICE DROPS TO MEET THESE VALUES, THE CLEARANCES MAY BE REDUCED TO THE FOLLOWING (REF. 2007 NESC, TABLE 232-1, NOTE 7&8):

	B	D
INSULATED SERVICE DROPS 300V OR LESS TO GROUND	12.5	10.5
INSULATED DRIP LOOPS OF SERVICE DROPS 300V TO GROUND	10.5	10.5
SERVICE DROPS LESS THAN 150V TO GROUND	12.0	10.0
INSULATED DRIP LOOPS OF SERVICE DROPS 150V TO GROUND	10.0	10.0
INSULATED COMMUNICATION SERVICE DROPS	11.5	—

COLUMN "B" APPLIES TO RESIDENTIAL DRIVEWAYS AND COLUMN "D" APPLIES TO SPACES ACCESSIBLE TO PEDESTRIAN TRAFFIC ONLY.

2. THE TRANSMISSION ENGINEERING DEPARTMENT SHOULD BE CONSULTED FOR CLEARANCE CONSIDERATIONS INVOLVING VOLTAGES EXCEEDING 22KV TO GROUND

③ SEE SPEC. 3-13 FOR CLEARANCE REQUIREMENTS IN GROVES.

REF. 2012 NESC 232

◄ DENOTES LATEST REVISION

NO.	CK'D	DATE	REVISION
7	TOB	7-19-12	REVISED TO SHOW FDOT ACCOMMODATION MANUAL 2010
6	TOB	3-15-12	REVISED TO MEET 2012 NESC CODE
5	TOB	9-15-11	PROPOSED IEEE NESC TIA WAS REJECTED
4	TOB	5-19-11	DELETE NOTE 1 & TABLE, ADD CLARITY TO DIAGRAM

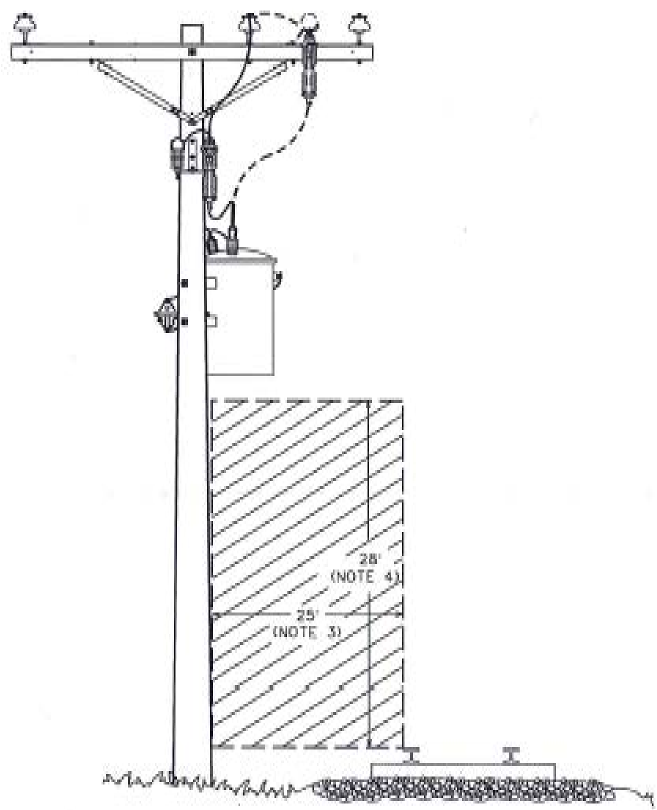
MGR. STD'S
APPR. DATE 7-19-12
SUPERSEDES 3-4/3-15-12

VERTICAL CLEARANCE OVER AND ADJACENT TO ROADS, DRIVEWAYS AND OTHER LAND AREAS

3-4

TAMPA ELECTRIC CO. STANDARDS | GENERAL RULES & SPECIFICATIONS

REFERENCES
GR & S STD 3-21



NOTES:

1. CROSSING REQUIREMENTS OF RAILROADS IN OUR SERVICE AREA EXCEED AND SHALL TAKE PRECEDENT OVER NESC CODE REQUIREMENTS. CROSSING PERMITS AND APPROVAL MUST BE OBTAINED FROM THE RAILROAD INVOLVED. CONTACT PERMITS SECTION. SEE STANDARD 3-21.

2. THE TRANSMISSION ENGINEERING DEPARTMENT SHOULD BE CONSULTED FOR CLEARANCE CONSIDERATIONS INVOLVING VOLTAGES EXCEEDING 15kV TO GROUND.

➤ 3. WHEN INSIDE CSX's RIGHT OF WAY A MINIMUM 25' HORIZONTAL CLEARANCE IS REQUIRED TO SUPPORTING STRUCTURES, SUPPORT ARMS, ANCHOR GUYS AND ATTACHED EQUIPMENT LESS THAN 28' ABOVE THE NEAREST TRACK. REFERENCE CSX TRANSPORTATION DESIGN & CONSTRUCTION STANDARD SPECIFICATION, PLATE V REVISED 9/15/03. WHEN OUTSIDE CSX's RIGHT OF WAY, 2012 NESC 231C MINIMUM HORIZONTAL CLEARANCE IS 12'.

➤ 4. WHEN INSIDE CSX's RIGHT OF WAY A MINIMUM 28' VERTICAL CLEARANCE IS REQUIRED FROM THE LOWEST TEC WIRE, CONDUCTOR OR ALL CABLES (SUPPLY OR COMMUNICATIONS). WHEN OUTSIDE CSX's RIGHT OF WAY, 2012 NESC 231C MINIMUM VERTICAL CLEARANCE IS 22'.

➤ DENOTES LATEST REVISION

NO.	CK'D	DATE	REVISION
8			
7	TOB	3-15-12	REVISED TO MEET 2012 NESC CODE, REV. NOTES 3 & 4
6	TOB	5-19-11	REVISED NOTES 3 & 4
5	CRM	3-19-09	CHANGE OUT SMALL BRACES TO LARGE BRACES

VERTICAL AND HORIZONTAL CLEARANCES FROM RAILROAD TRACKS

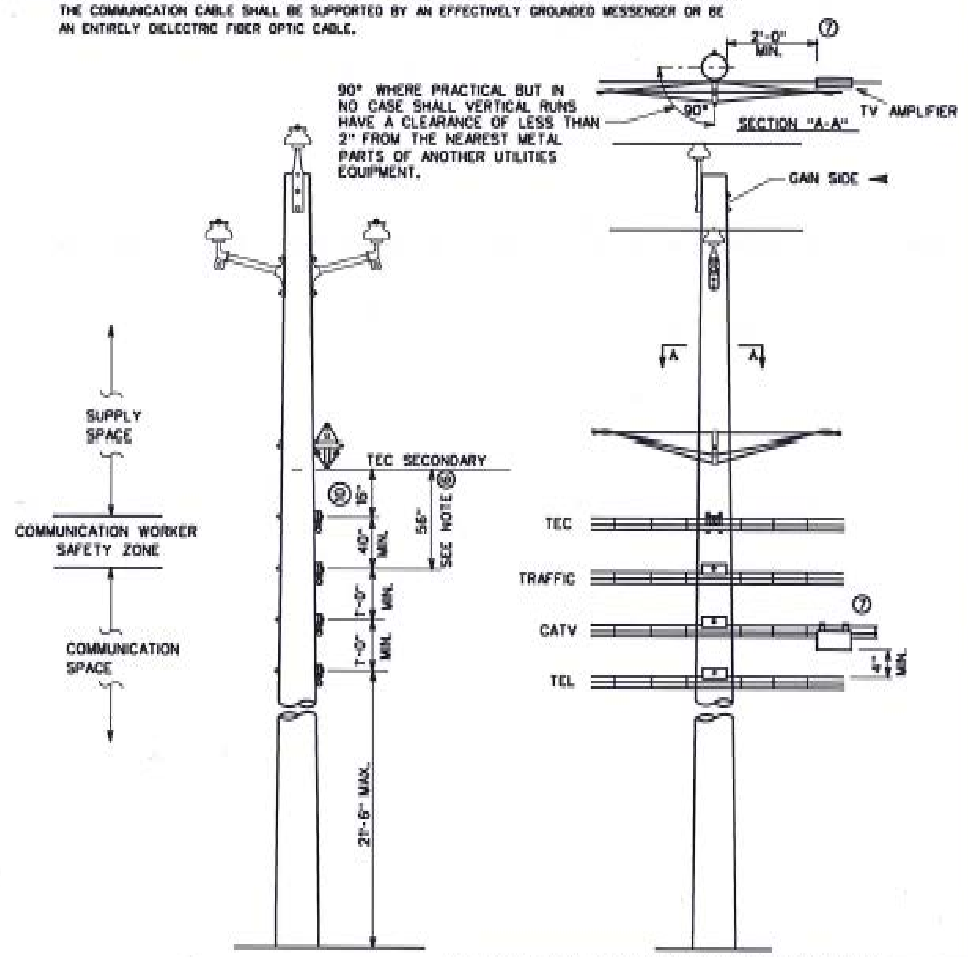
MGR. STD'S
APPR. DATE 3-15-12
SUPERSEDES 3-5/5-19-11

TAMPA ELECTRIC CO. STANDARDS | GENERAL RULES & SPECIFICATIONS | 3-5

REFERENCES
GR&S SEC. 8

NOTES:

1. CABLE CLEARANCE MEASUREMENTS SHALL BE TAKEN FROM THE HIGHEST COMMUNICATION CABLE TO THE LOWEST CABLE/CONDUCTOR IN THE SUPPLY SPACE. GROUND CLEARANCE MEASUREMENTS SHALL BE TAKEN FROM THE LOWEST CABLE TO GROUND.
2. THE CATV CABLE ELEVATION MAY BE LOWER WHEN APPROVED BY THE TELEPHONE COMPANY.
3. ELEVATIONS MAY BE LOWERED IF CODE CLEARANCE PERMITS AND UPON THE MUTUAL AGREEMENT OF ALL CABLE OWNERS.
4. ALL COMMUNICATION VERTICAL RUNS OF ALL TYPES SHALL BE PROTECTED AS PER NESC.
5. ► REFER TO 2012 NESC 235 C (2) (b) (1) (a) FOR SAG RELATED CLEARANCES.
6. IF TEC COMMUNICATION CABLE IS NOT PRESENT, THE MINIMUM 40" DIMENSION IS ALLOWED (SEE NOTE 5 FOR DETAILS).
7. ALL CATV EQUIPMENT (SUCH AS AMPLIFIERS, SERVICE DROPS, ETC.) SHALL BE PLACED NO LESS THAN 2'-0" FROM OUTER EDGE OF POLE.
8. ALL GROUNDING AND OVERCURRENT PROTECTION SHALL BE PER APPLICABLE CODES.
9. TEC COMMUNICATIONS CABLE, CATV CABLE, TEL CABLE, AND TRAFFIC CONTROL CABLE, SHALL BE MOUNTED ON THE SAME SIDE OF POLE AS TEC SECONDARY.
10. WHEN THE CONDUCTOR DIRECTLY ABOVE A COMMUNICATION WIRE IN THE SUPPLY SPACE IS A NEUTRAL (NEUTRAL ONLY), THEN THE CLEARANCE MAY BE REDUCED WITH APPROVAL FROM DISTRIBUTION SERVICES. THE COMMUNICATION CABLE SHALL BE SUPPORTED BY AN EFFECTIVELY GROUNDED MESSENGER OR BE AN ENTIRELY DIELECTRIC FIBER OPTIC CABLE.



► REF. 2012 NESC 235

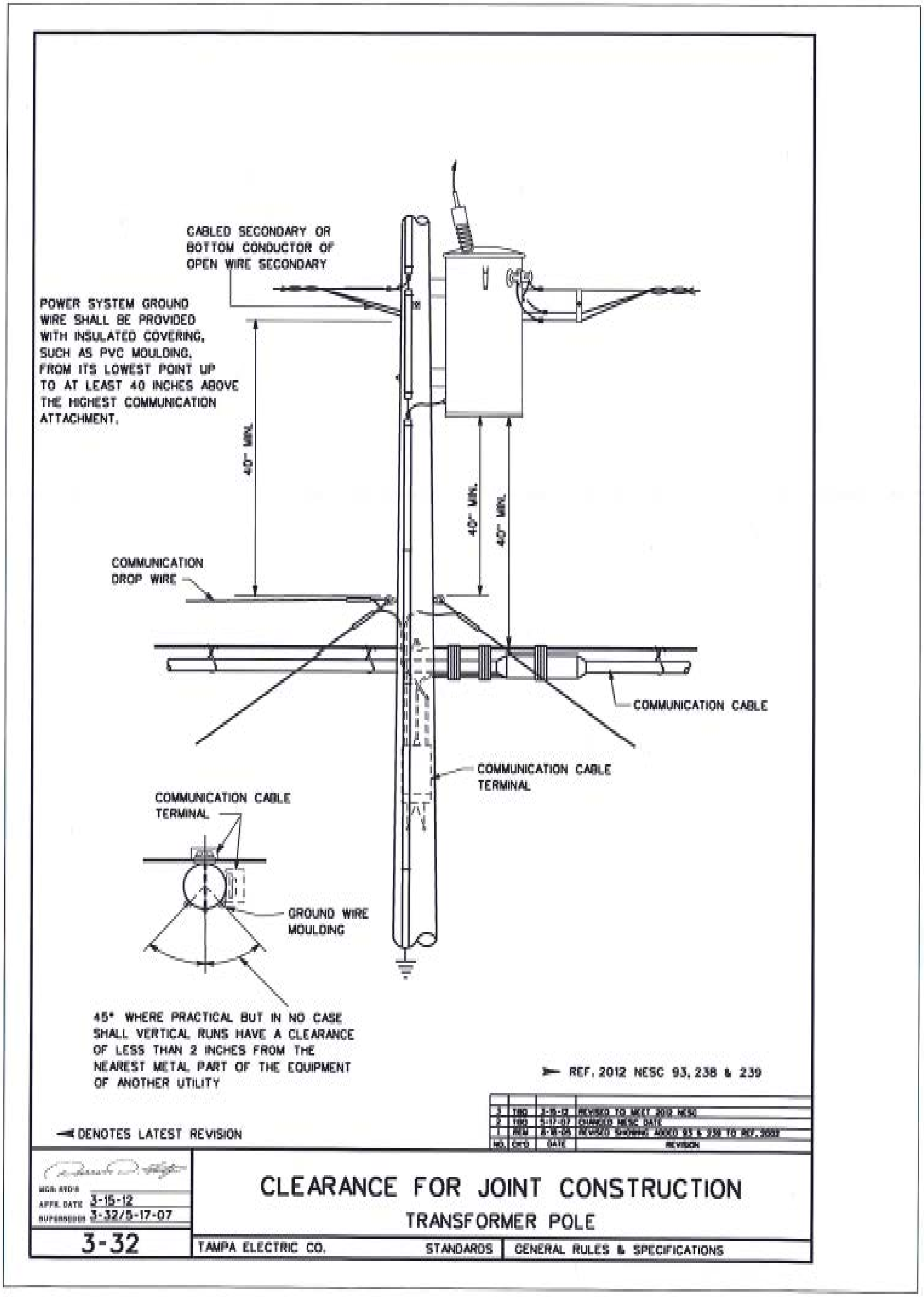
◄ DENOTES LATEST REVISION

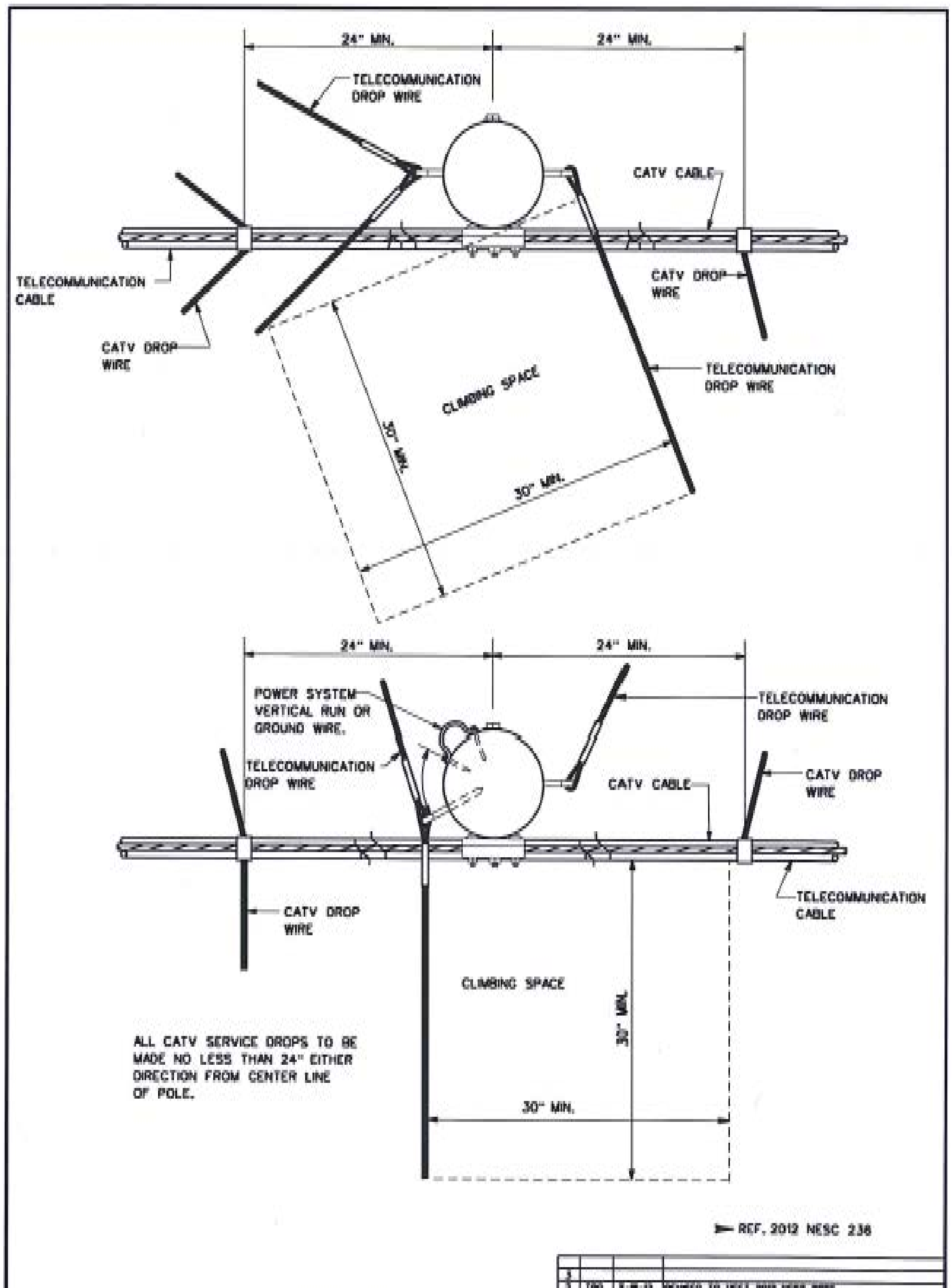
NO.	CK'D	DATE	REVISION
6	TOO	3-15-12	REVISED TO MEET 2012 NESC CODE, NOTE 5
5	CRM	3-17-11	ADDED GAIN DIRECTION
4	TOO	5-17-07	CHANGED NESC DATE REV. NOTES 5 & 6
3	REM	10-20-05	REVISED TO MEET 2002 NESC

CLEARANCE FOR JOINT CONSTRUCTION

APPR. DATE 3-15-12
SUPERSEDES 3-31/3-17-11

TAMPA ELECTRIC CO. STANDARDS | GENERAL RULES & SPECIFICATIONS | 3-31


CABLED SECONDARY OR BOTTOM CONDUCTOR OF OPEN WIRE SECONDARY
POWER SYSTEM GROUND WIRE SHALL BE PROVIDED WITH INSULATED COVERING, SUCH AS PVC MOULDING, FROM ITS LOWEST POINT UP TO AT LEAST 40 INCHES ABOVE THE HIGHEST COMMUNICATION ATTACHMENT.
40" MIN.
40" MIN.
40" MIN.
COMMUNICATION DROP WIRE
COMMUNICATION CABLE
COMMUNICATION CABLE TERMINAL
COMMUNICATION CABLE TERMINAL
GROUND WIRE MOULDING
45° WHERE PRACTICAL BUT IN NO CASE SHALL VERTICAL RUNS HAVE A CLEARANCE OF LESS THAN 2 INCHES FROM THE NEAREST METAL PART OF THE EQUIPMENT OF ANOTHER UTILITY
REF. 2012 NESC 93, 238 & 239
DENOTES LATEST REVISION
NO. CHKD DATE REVISION
APPR. DATE 3-15-12
SUPERSEDES 3-32/5-17-07
3-32
CLEARANCE FOR JOINT CONSTRUCTION
TRANSFORMER POLE
TAMPA ELECTRIC CO.
STANDARDS
GENERAL RULES & SPECIFICATIONS



► REF. 2012 NESC 236

◄ DENOTES LATEST REVISION

NO.	CK'D	DATE	REVISION
3			
2	TBO	3-15-12	REVISED TO MEET 2012 NESC CODE
1	TBO	5-17-07	CHANGED NESC DATE, DELETE NOTE ON 3" BETWEEN BOLTS

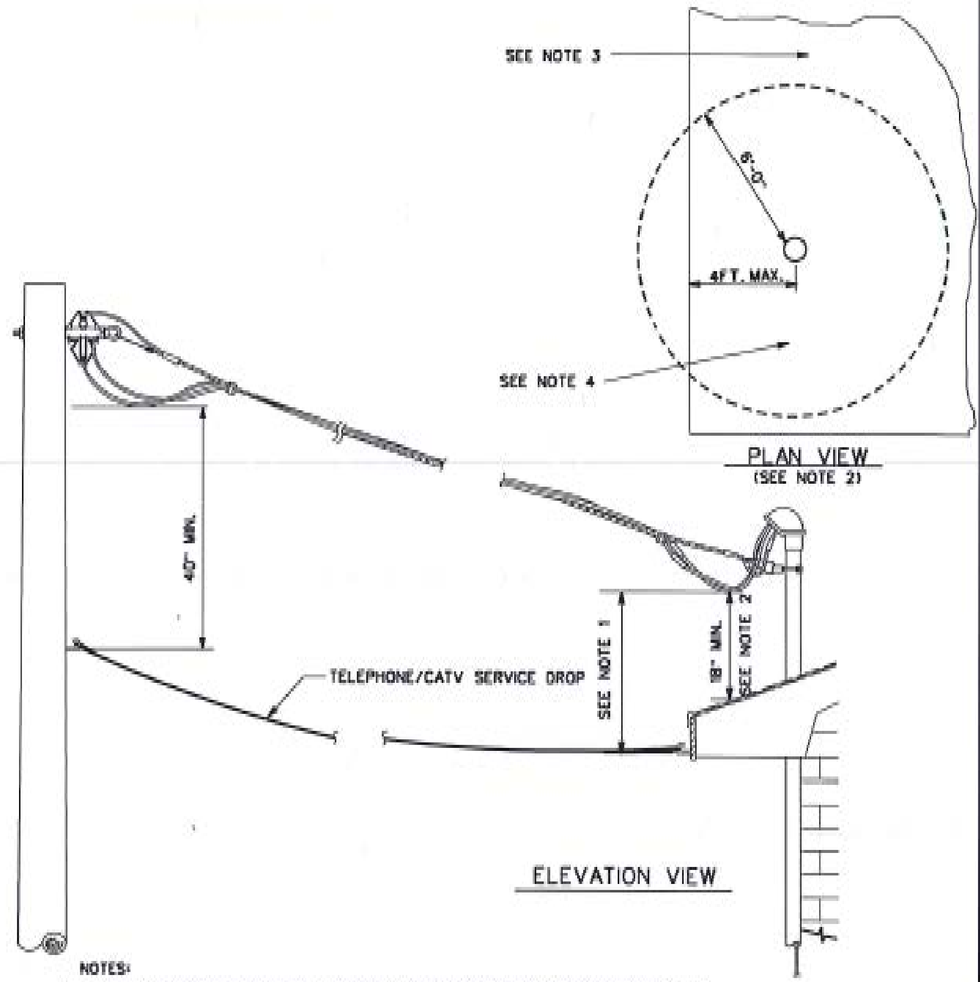
CLIMBING SPACE

THROUGH TELEPHONE AND CATV DROP WIRES

MGR. STD'S
APPR. DATE 3-15-12
SUPERSEDES 3-33/5-17-07

TAMPA ELECTRIC CO. STANDARDS | GENERAL RULES & SPECIFICATIONS

3-33



NOTES:

1. SUPPLY SERVICE DROPS OF 0 TO 750 VOLTS, RUNNING ABOVE AND PARALLEL TO COMMUNICATION SERVICE DROPS, MAY HAVE A CLEARANCE OF NOT LESS THAN 12 INCHES AT ANY POINT IN THE SPAN. THIS INCLUDES THE POINT OF ATTACHMENT TO THE BUILDING OR STRUCTURE BEING SERVED, PROVIDED THAT THE NON-GROUNDED CONDUCTORS ARE INSULATED AND THAT THE CLEARANCE, AS OTHERWISE REQUIRED BY RULE 235C1d EXCEPTION 3 (2012 NESC), IS MAINTAINED BETWEEN THE TWO SERVICE DROPS AT THE POLE.
2. REF. 2012 NESC FIG. 234-2 (RULE 234C3d1b, 2012 NESC).
3. MAINTAIN NOT LESS THAN 3'-0" VERTICAL CLEARANCE ABOVE ROOF OUTSIDE 6'-0" RADIUS FROM THE SERVICE MAST (RULE 234C3d1a, 2012 NESC).
4. MAINTAIN NOT LESS THAN 18" VERTICAL CLEARANCE ABOVE ROOF WITHIN 6'-0" RADIUS FROM THE SERVICE MAST.
5. FOR READILY ACCESSIBLE ROOF, SERVICE DROP CONDUCTORS (ATTACHED TO BUILDING), INCLUDING DRIP LOOPS SHALL HAVE A VERTICAL CLEARANCE NOT LESS THAN 10' FROM THE HIGHEST POINT OF ROOFS, BALCONIES, PORCHES OR ATTACHED DECKS OVER WHICH THEY PASS (RULE 234CEd1, 2012 NESC).
6. SUPPLY SERVICE DROPS OF 0 TO 750 VOLTS, INCLUDING DRIP LOOPS SHALL HAVE A MINIMUM OF 3 FT. CLEARANCE IN ANY DIRECTION FROM WINDOWS, DOORS, PORCHES, FIRE ESCAPES OR SIMILAR LOCATIONS.

◄ DENOTES LATEST REVISION

NO.	CK'D	DATE	REVISION
5	TRO	3-15-12	REVISED TO MEET 2012 NESC CODE & NOTES 1, 2, 3 & 5
4	TRO	2-18-10	REVISED NOTE 5, ADD NOTE 6 & EYE NUT AT SPREADER
3	TRO	5-21-09	REVISED NOTES 1, 2, & 3, ADD NOTE 5, REVISED TITLE BLK
2	TRO	5-17-07	REVISED NOTES 1 & 2 TO SHOW CHANGED NESC DATE

MGR. STD'S

APPR. DATE 3-15-12

SUPERSEDES 3-34/2-18-10

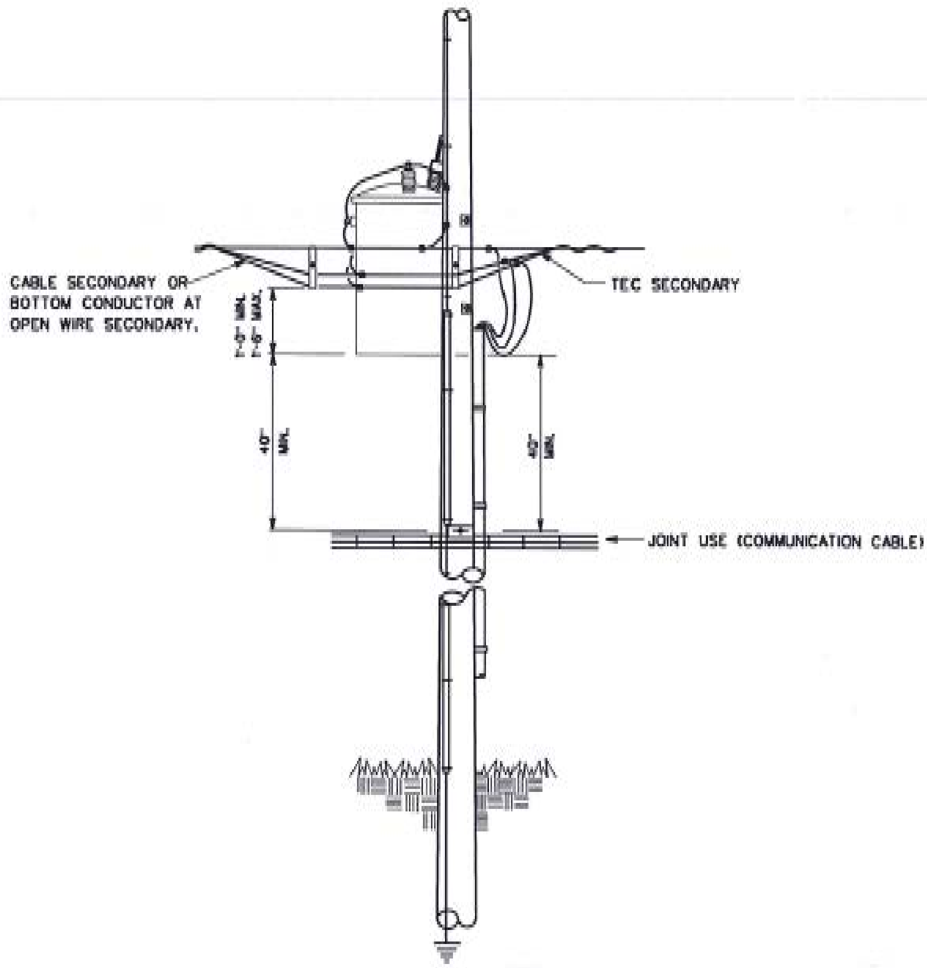
CLEARANCES FOR JOINT USE CONSTRUCTION & SUPPLY SERVICES

3-34

TAMPA ELECTRIC CO. STANDARDS | GENERAL RULES & SPECIFICATIONS

NOTE:

1. CABLE CLEARANCE MEASUREMENTS SHALL BE TAKEN FROM THE HIGHEST COMMUNICATION CABLE TO THE LOWEST CABLE/CONDUCTOR IN THE SUPPLY SPACE. GROUND CLEARANCE MEASUREMENTS SHALL BE TAKEN FROM THE LOWEST CABLE TO GROUND.



REF. 2012 NESC 235 & 238

DENOTES LATEST REVISION

NO.	CK'D	DATE	REVISION
4	TOB	3-15-12	REVISED TO MEET 2012 NESC CODE
3	TOB	7-26-07	UPDATED THE NESC TO THE 2007 CODE
2	RKM	8-18-05	REVISED NOTE 1
1	SAW	7-22-04	REMOVAL UNDERGROUND CONDUIT, TITLE BLOCK

CLEARANCE FROM SERVICE RISER TO JOINT USE ATTACHMENT

MGR. STD'S

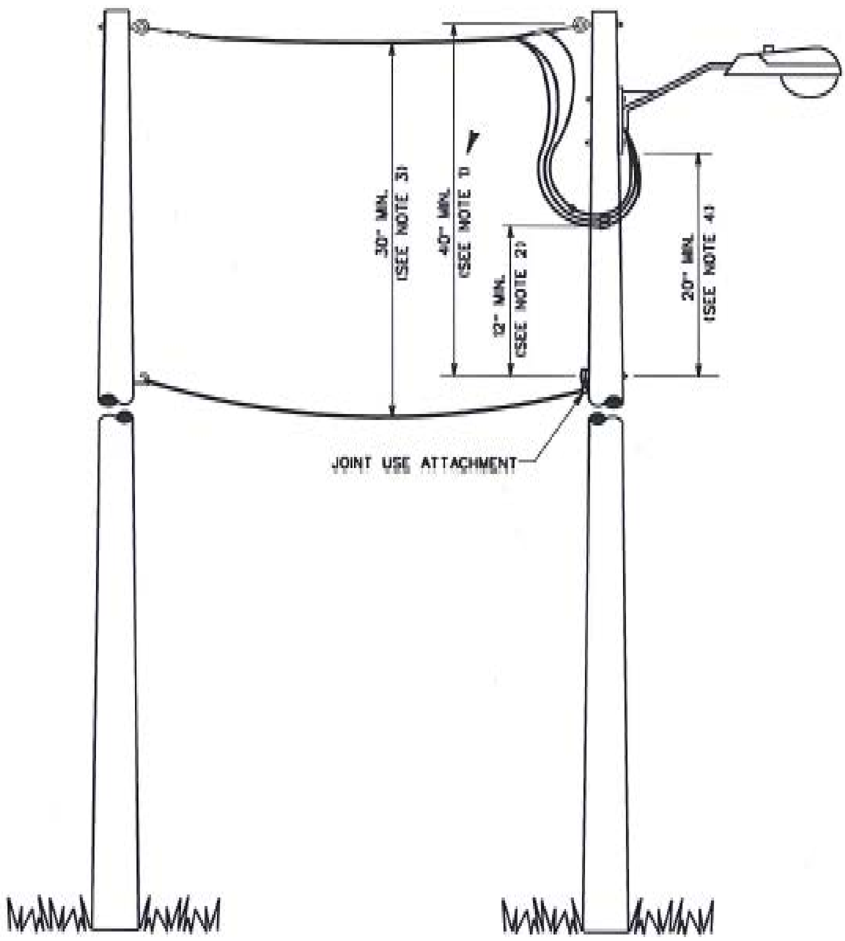
APPR. DATE 3-15-12

SUPERSEDES 3-35/7-26-07

TAMPA ELECTRIC CO. STANDARDS | GENERAL RULES & SPECIFICATIONS | 3-35

NOTES:

1. THE SERVICE TO A LIGHT REQUIRES A 40" CLEARANCE TO THE TELECOMMUNICATION CABLES AT SUPPORT. (NESC TABLE 235-5)
2. THE DRIP LOOP REQUIRES A 12" CLEARANCE TO THE JOINT USE ATTACHMENT, UNLESS THE SERVICE IS IN A CONDUIT THAT EXTENDS AT LEAST 2" BEYOND THE LOOP, THEN THE 12" CAN BE REDUCED TO 3". (NESC 238D)
3. A MINIMUM 30" CLEARANCE BETWEEN THE LOWEST POINT OF THE SAG OF THE SERVICE AND THE HIGHEST TELECOMMUNICATION CABLE BELOW IS REQUIRED. (NESC TABLE 235-6)
4. A MINIMUM 20" CLEARANCE BETWEEN THE LIGHT BRACKET TO THE MESSENGER CARRYING THE TELECOMMUNICATION CABLES IS REQUIRED. (NESC TABLE 238-2)



REF. 2012 NESC 238C, 238D AND 235C

DENOTES LATEST REVISION

NO.	CK'D	DATE	REVISION
6	TOB	3-15-12	REVISED TO MEET 2012 NESC CODE, & ALL NOTES
5	CRM	7-22-10	CHANGE OUT DRIVE HOOK TO EYEBOLT
4	TOB	7-26-07	UPDATED NESC TO THE 2007 CODE
3	TOB	7-26-07	REVISED DRAWING, NOTES 2, 3 & 4, AND DIMENSIONS

MGR STD'D

APPR. DATE 3-15-12

SUPERSEDES 3-36/7-22-10

3-36

CLEARANCE FROM LIGHTS TO JOINT USE ATTACHMENT

TAMPA ELECTRIC CO. STANDARDS GENERAL RULES & SPECIFICATIONS

Attachment B

Authorized Representatives:

Tampa Electric Company
Paul Allen
Manager, Project Management
P.O. Box 111
Tampa, FL 33601
Phone: 813-228-0295

Tampa Electric Company
George Cox
Supervisor of Construction Services
P.O. Box 111
Tampa, FL 33601
Phone: 813-228-3115

Attachment C

TECO ENERGY TAMPA ELECTRIC COMPANY	**Exhibit A** Date:	**Check All That Apply** (X) CATV ( ) Phone/Telecommunications ( ) Traffic

Licensee Company Nam			
Permit Address:	(street name and number)	Cable Type:	
Permit Number:	(licensee's uniquie permit ID)	Cable Size:	
Total # of Poles:		Cable Weight:	
(Maximum 100 Poles)		Messenger Size:	
Submitted by:		Messenger Weight	
Phone #:			
Email Address:			

***Attachment Types**

( ) N=New
( ) O=Overlash
( ) R=Rebuild
(X) S=Service
( ) W=Remove/Wreck Out

				For TECO Use Only			
Licensee Pole ID Number	**Pole Number (gln or atn)**	**Transmission or Distribution Pole (T or D)**	***Licensee Attachment Type**	****Change Flag Legend**	**Scheduled Work to be Completed Before Proposed Can Attach Licensee is Responsible for Notifying and Coordinating all 3rd Party Work**	**Work Complete**	**Attachment Count**
(ID to	(10 digit GLN preferred						
correlate	if none, then note the						
poles on	6 digit asset tag #)						
map)							

****Change Flag Legend**		**Exhibit A**	**Tampa Electric Use Only:**
D=Delete	TECO Tracking #:		Date Work to be Completed
A=Added Pole	Internal Order #:	( ) Authorization to Attac Date:	Approved By:
F=Foreign Owned Pole	Date Permit Received:	( ) Attachment in Violatic Date:	Printed Name:
	Licensee Desired Construction D	( ) Final Permit	Title: