Exhibit No.:	
Issue(s):	Project Design
Witness:	David Endorf, P.E.
Sponsoring Party:	Ameren Transmission Company of Illinois
Type of Exhibit:	Direct Testimony
Case No.:	EA-2015-0146
Date Testimony Prepared:	May 29, 2015

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. EA-2015-0146

DIRECT TESTIMONY

OF

DAVID ENDORF, P.E.

ON

BEHALF OF

AMEREN TRANSMISSION COMPANY OF ILLINOIS

St. Louis, Missouri
May 2015

TABLE OF CONTENTS

I. INTRODUCTION AND WITNESS QUALIFICATIONS 1

II. PURPOSE AND SCOPE 2

III. DESIGN CONSIDERATIONS 3

IV. RIGHT-OF-WAY WIDTH 5

V. CONCLUSION 7

DIRECT TESTIMONY

OF

DAVID ENDORF, P.E.

CASE NO. EA-2015-0146

I. INTRODUCTION AND WITNESS QUALIFICATIONS

Q. Please state your name, business address and present position.

A. My name is David Endorf, and my business address is 1901 Chouteau Avenue, St. Louis, Missouri 63103. I am employed by Ameren Services Company ("Ameren Services") as a Principal Engineer in the Transmission Performance Management and Engineering Department.

Q. Please summarize your professional experience and educational background.

A. I have a Bachelor of Science degree in Civil Engineering from Valparaiso University. I have a Master of Science degree in Civil Engineering from the University of Missouri – Rolla. I am a registered Professional Engineer in Missouri and Illinois. I have transmission line experience including project design and management of both small and large projects at voltages from 138,000 volts to 345,000 volts. I currently serve as a member on the American Society of Civil Engineers Standards Committee. I am a member of both the Institute of Electrical and Electronic Engineers and the American Society of Civil Engineers.

Q. What are your duties and responsibilities in your present position?

A. My duties include designing transmission line projects for the operating companies to which Ameren Services provides support, including Ameren Transmission Company of Illinois ("ATXI") and other Ameren Corporation subsidiaries such as Ameren Illinois Company and Union Electric Company, d/b/a Ameren Missouri. These duties include

assisting with the selection of line routes that balance cost effectiveness and environmental impacts, and ensuring line design meets National Electrical Safety Code ("NESC") requirements. While the scope of the projects vary, each one includes the following elements: the design of the transmission structures that are to be used on the transmission line, selection of transmission hardware, development of technical drawings, materials procurement, coordinating the scheduling of outages, coordination of field surveying work and cooperation with other departments within Ameren Services (real estate, vegetation management, environmental services and other engineering groups), resolution of issues during construction, performance of the final inspection and turning the line over to operations to place in service. One of my primary responsibilities at present is to serve as an engineer for the Mark Twain Project, the subject of this Application, which means that I will be designing approximately 95 miles of new 345-kV transmission line and an approximately 2.2-mile, 161-kV connector transmission line between Ameren Missouri's existing Adair Substation and ATXI's new Zachary Substation.

II. PURPOSE AND SCOPE

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide information regarding the design of the proposed Mark Twain transmission project.

Q. Are you sponsoring any schedules in support of your direct testimony?

A. Yes. I am sponsoring **Schedule DE-01**, a drawing of a typical tangent steel pole structure for the 345-kV transmission line. I am also sponsoring **Schedule DE-02**, a drawing of a typical tangent pole steel structure for the 161-kV transmission line, and **Schedule DE-03**, a drawing depicting the site design of the Zachary Substation.

III. DESIGN CONSIDERATIONS

Q. Please provide a technical description of the proposed Mark Twain Project.

A. The proposed line will be a 345-kV, overhead transmission line approximately 95 miles long. The route for the primary transmission line consists of two portions, from ATXI's Maywood Switching Station located near Palmyra to the new Zachary Substation near Kirksville, and from the Zachary Substation north to a connection point at the Iowa state line. In addition, the Project includes construction of a 2.2-mile, 161-kV transmission line from the Zachary Substation, which is also to be constructed for the transmission Project, to an existing substation near Adair.

ATXI will construct the proposed single-circuit 345-kV transmission line using single-shaft, self-supported steel poles on concrete foundations. Pole heights will range from approximately 90 feet to 130 feet above ground. The steel pole structures will be set on top of a concrete pier foundation that will be about seven to ten feet in diameter. **Schedule DE-01** shows a drawing of a typical tangent steel pole structure for the 345-kV transmission line. Typical spans will be approximately 850 feet. The transmission line will require a 150-foot wide easement for right-of-way.

Each phase for the 345-kV line will be bundled Cardinal ACSS conductor. One shield wire will be 7#7 AW, and the second shield wire will be a fiber optic ground wire. The structure types will consist of tangents, running angles, and dead-ends. The line will be designed to meet or exceed the requirements of the NESC and, accordingly, the requirements at 4 CSR 240-18.010.

Q. Will there be any above-ground fixtures located on agricultural land other than support structures and conductors?

A. No.

Q. Will ATXI place any guy wires and anchors along right-of-way lines or land division lines?

A. No. All proposed structures will be self-supporting steel poles with concrete foundations and will not require any guy wires.

Q. Please provide a general description of the proposed Zachary Substation and facilities.

A. The 23-acre substation, designed by the Ameren Substation Design Team, will consist of a 345-kV and a 161-kV switchyard connected by a power transformer. The substation will include two relay control enclosures, six circuit breakers, voltage and current sensing transformers, and a shunt reactor for voltage stability. The substation yard will be fully enclosed by chain-link fencing and only accessible by authorized personnel. **Schedule DE-03** depicts the substation design for the Zachary Substation.

Q. Please provide a technical description of the proposed 161-kV transmission line that will connect the Zachary Substation with the Adair Substation.

A. The proposed 161-kV transmission line from the Zachary Substation to the Adair Substation will be approximately 2.2 miles long. ATXI will construct the proposed double-circuit 161-kV transmission line using single-shaft, self-supported steel poles on concrete foundations. Pole heights will range from approximately 70 to 100 feet above ground. These steel pole structures will be set on top of a concrete pier foundation that will be about seven to ten feet in diameter. **Schedule DE-02** shows a drawing of a typical tangent steel pole structure to be used for the 161-kV transmission line. Typical spans will be approximately 600 feet. The transmission line will require a 100-foot wide easement for right-of-way.

Each phase for the double circuit 161-kV line will be a single 1192 Grackle ACSS conductor. Both shield wires will be fiber optic ground wires. The structure types will consist of tangents, running angles, and dead-ends. The line will be designed to meet or exceed the requirements of NESC and, accordingly, the requirements at 4 CSR 240-18.010.

Q. Did ATXI evaluate the conceptual design impacts of the proposed Mark Twain Project?

A. Yes. ATXI retained a consultant, Burns & McDonnell Engineering, Inc. ("Burns & McDonnell") to help develop route siting criteria, prepare a route siting analysis, and work with various stakeholders and the public to obtain their input into that process. The ATXI project team worked with Burns & McDonnell in the route selection process, which addressed land use impacts, environmental, cultural and historical resource concerns, and other routing criteria, including the engineering and constructability of the Project. The results of the route selection process are discussed in more detail in Mr. Christopher Wood's direct testimony.

IV. RIGHT-OF-WAY WIDTH

Q. You have stated that a 150-foot right-of-way easement will be required to construct the 345-kV portion of the Mark Twain Project transmission line. Please describe why a 150-foot easement is required.

A. The 150-foot wide easement is required to provide adequate clearance from the 345-kV transmission line conductors to the edge of the right-of-way for operational and maintenance purposes.

Q. Is the 150-foot easement the minimum easement required?

A. Yes. The 150-foot easement will provide adequate NESC clearances from the conductor to a building on the edge of the right-of-way (Rule 234C.1). The 150-foot easement is

the minimum easement that will provide the necessary clearance to trees or vegetation at the edge of the right-of-way. Maintenance of this clearance is necessary for the safe operation of the line.

Q. Does ATXI have the necessary easements to construct the Mark Twain Project?

A. Not yet. ATXI witness Douglas Brown will address the acquisition of the permanent easements. ATXI has acquired the property for the proposed Zachary Substation.

Q. In addition to the permanent utility easements, will ATXI require construction easements to construct the Mark Twain Project transmission line?

A. Generally, the permanent easement obtained by ATXI will provide sufficient area for construction of the transmission line. During the installation of the wires, the construction contractor may need to set up equipment outside the permanent right-of-way. Depending on the particular circumstances, there may be a need to obtain a temporary construction easement.

Q. Does ATXI anticipate installing its transmission support structures along the centerline of the easement?

A. Yes.

Q. When the electric line parallels other electric transmission lines, will ATXI require a narrower easement?

A. No, ATXI will still require a 150-foot easement width; however, where the transmission line parallels other facilities, ATXI will seek to acquire an overlapping easement so as to reduce the total easement width impacting a given property.

Q. Will the 161-kV connector line between the Zachary Substation and the Adair Substation also require a 150-foot wide permanent easement?

A. No. The 161-kV line will require a 100-foot wide permanent easement. Similar to the construction of the 345-kV transmission line, the construction contractor may need to set up equipment outside the 100-foot wide right-of-way. Depending on where this might occur, there may be a need to obtain a temporary construction easement.

V. CONCLUSION

Q. What is the status of the final technical design for the Mark Twain Project?

A. Now that the final route has been selected, the technical design of the Project has begun. We anticipate having a final design for the project complete by late fall 2015.

Q. Does this conclude your direct testimony?

A. Yes, it does.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Ameren Transmission Company of Illinois for Other Relief or, in the Alternative, a Certificate of Public Convenience and Necessity Authorizing it to Construct, Install, Own, Operate, Maintain and Otherwise Control and Manage a 345,000-volt Electric Transmission Line from Palmyra, Missouri, to the Iowa Border and an Associated Substation Near Kirksville, Missouri.	)))))))	File No. EA-2015-0146

AFFIDAVIT OF DAVID ENDORF

STATE OF MISSOURI)
) **ss**
CITY OF ST. LOUIS)

David Endorf, being first duly sworn on his oath, states:

1. My name is David Endorf. I work in St. Louis, Missouri, and I am employed by Ameren Services Company.

2. Attached hereto and made a part hereof for all purposes is my Direct Testimony on behalf of Ameren Transmission Company of Illinois consisting of 7 pages, and Schedule(s) DE-01, DE-02, DE-03 all of which have been prepared in written form for introduction into evidence in the above-referenced docket.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

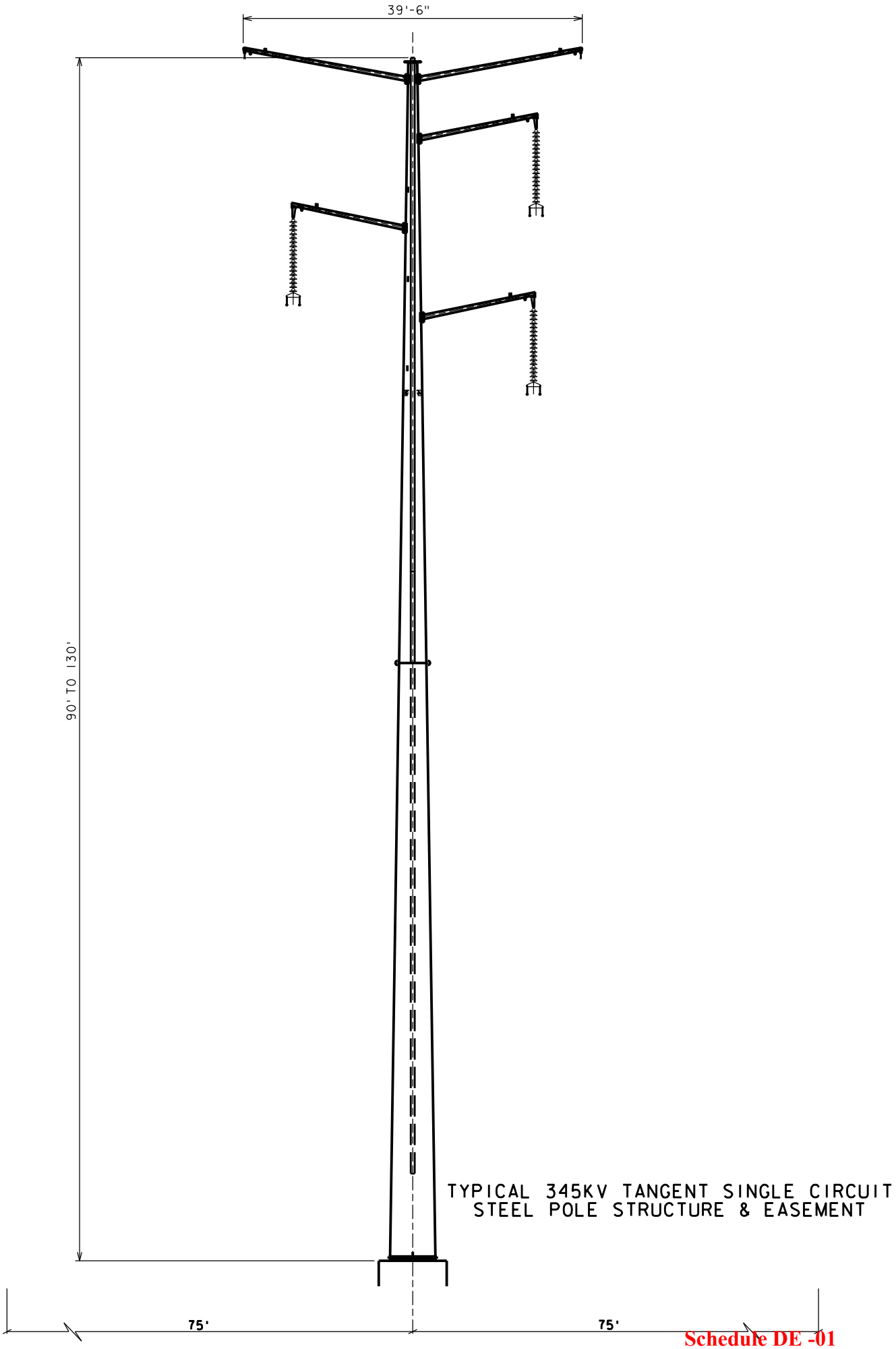
David Endorf

Subscribed and sworn to before me this 26th day of May, 2015.

Notary Public

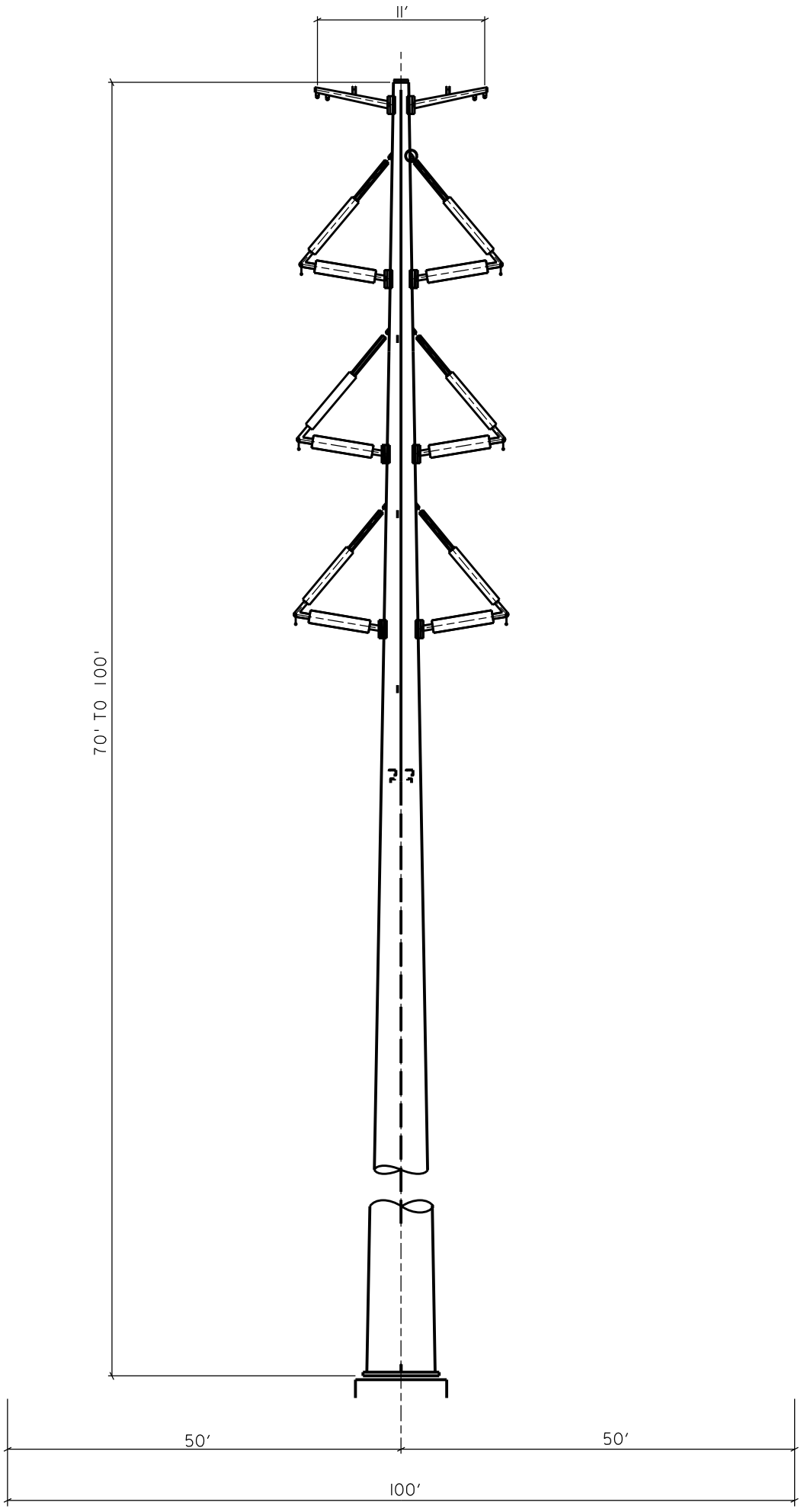
My commission expires:

BECKIE J. EAVES
Notary Public - Notary Seal
State of Missouri
Commissioned for St. Louis City
My Commission Expires: February 21, 2018
Commission Number: 14938572



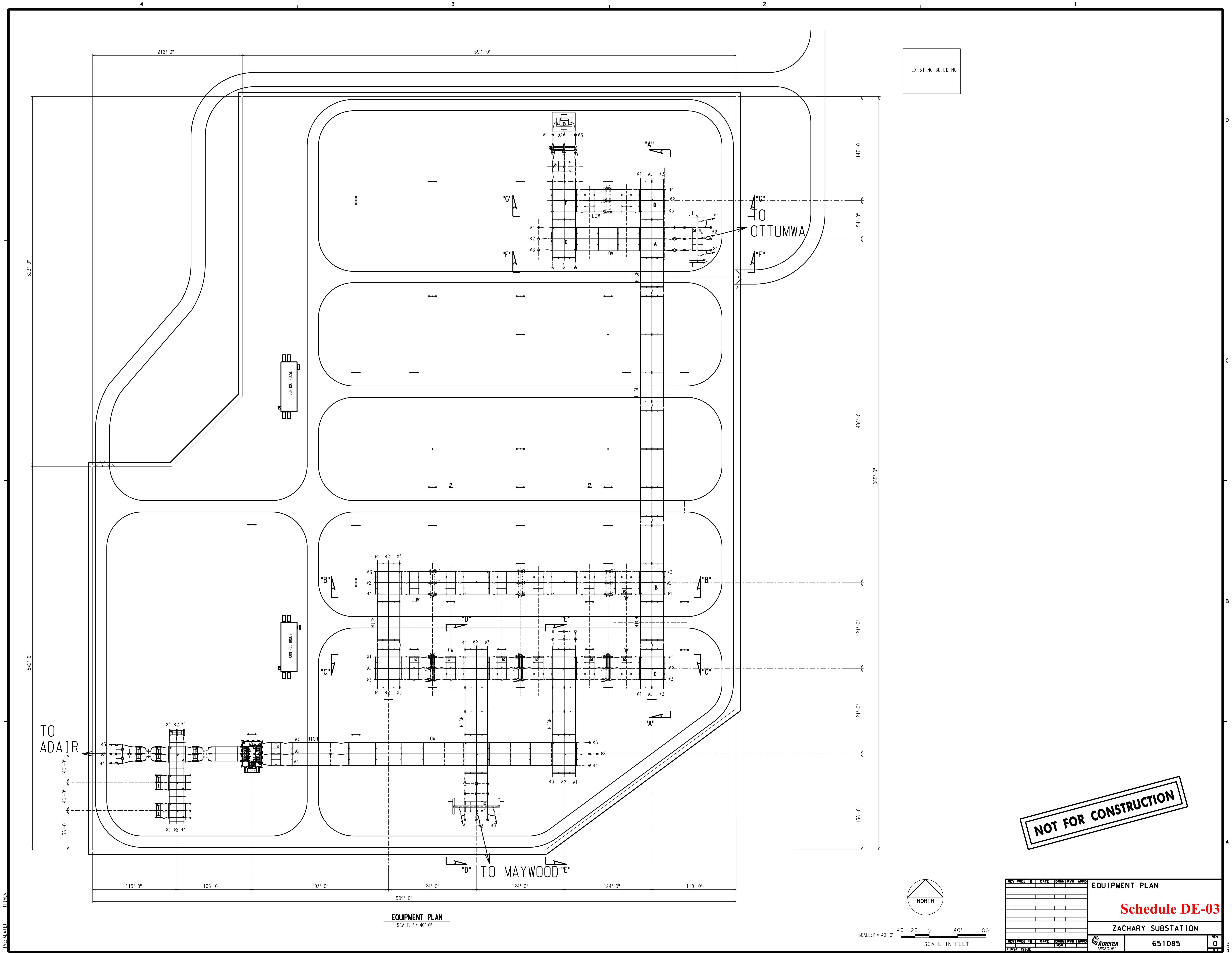
TYPICAL 345KV TANGENT SINGLE CIRCUIT
STEEL POLE STRUCTURE & EASEMENT

Schedule DE -01



TYPICAL 161KV TANGENT DOUBLE CIRCUIT
STEEL POLE STRUCTURE & EASEMENT

Schedule DE-02



EQUIPMENT PLAN

Schedule DE-03

ZACHARY SUBSTATION

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FIRST ISSUE

Ameren MISSOURI