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New Construction/Reconductor 69KV Transmission Line

PROJECT PLAN

Contents

1 Introduction

1.1 Project statement

Analyze the economic and system viability for reconductoring or new construction of an existing transmission line to meet growing load demand.

1.2 PURPOSE

The current transmission line does not meet the growing load needs, if the line is not improved, some customers will not have power.

1.3 Goals

1. Deliver a viable, robust, and complete design for each option.

2. Learn from being involved in a major design process.

3. Learn about and research power systems topics that we do not know, but need for the project.

2 Deliverables

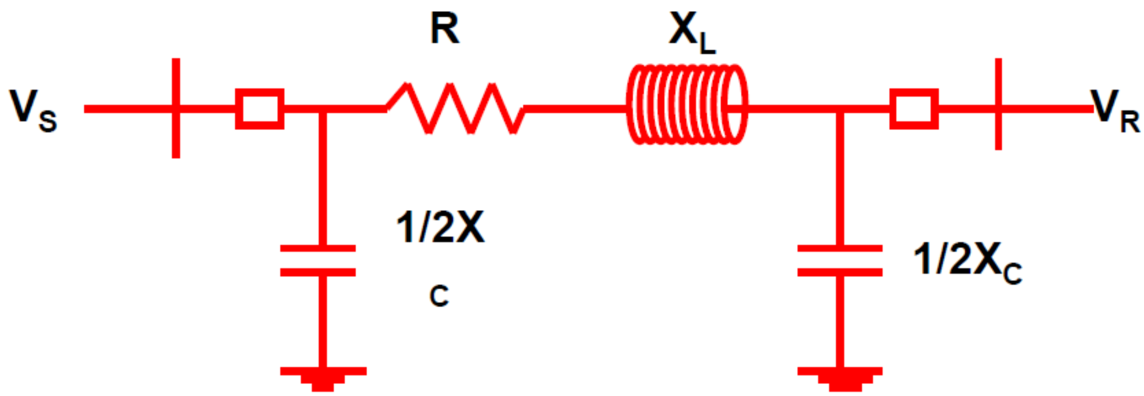
In order to meet the goals outlined in the introduction, the project give these specification:

- Create economic plan with a cost benefit analysis of four type of conductors (T2, ACSR, AAAC, and ACSS).
- Create sag/tension charts for each conductor.
- Construction plan (next semester deliverable)
- List of equipment required for construction.
- Structure design with material list
- Propose reconductoring line 98 and have an engineering analysis plane done.
- Pole loading with different conductor.
- Budget report.

3 Design

3.1 Proposed System Block diagram

- **Transmission Line Model:**



- R, XL,XC depends on :
  - Length of transmission Line
  - Types of conductor (spacing , cross-sectional area)

Xc is equally distributed along the line

- **Type of conductors**

- AAAC (All Aluminum-Alloy Conductor.)
- **ACSR (Aluminum Conductor. Steel Reinforced)**
- **ACSS (Aluminum Conductor, Steel Supported.)**
- **Motion resistant conductor**
- T-2
  - i) **ACSR/T-2(Aluminum Conductor Steel-Reinforced Concentric-Lay-Stranded Twisted Pair)**
  - ii) **AAC/T-2 (All-Aluminum 1350 Conductor Concentric-Lay-Stranded Twisted Pair)**

- **Poles and materials**
    - Select new poles based on the type of conductor.
    - Location of poles (not equal distance).
    - Material and equipment required for installing poles and conductor.

3.3 Assessment of Proposed methods

- **Determine a route planning area**

  We determine start and end points and develop a broad route-planning area based on opportunities and constraints on the landscape.

- **Determine the cost based on different type of conductors and poles.**

  Using different conductors and poles require different material and equipment, that will impact the cost of the construction plan. The cost analysis will determine the best way to achieve the project goal.

3.4 Validation

Basically, this project is based on mounts of calculations in distinct perspective, and so far, we don't have any software suggested from the client for this project. Therefor the major task for this part is that we can only convince our client with our calculations on pole loading, sag/tension calculation, etc. recently we find a software called Osmose O-Calc Pro 5.2, we really think this software will help us in this period.

4 Project Requirements/Specifications

4.1 FUNCTIONAL

The technical requirement:

- The new line must at least supply 89 MVA.
- Economic analysis based on different conductor.
- Materials and equipment.

4.2 NON-FUNCTIONAL

- Consideration of new locations for poles in case of changed surrounding environment.
- Different properties of pole.
- Budget and phase consideration.

4.3 STANDARDS

For types of conductors we are using National Electric Code (NEC).

For types of poles we are using IEEE.

5 Challenges

The biggest challenge is going to be choosing the proper type of poles and where to place them for each type of conductor. Another significant challenge will be based on the distribution line that shares the poles with the transmission line and whether or not there will need to be new poles for that line. There are some construction constraints with the pole locations that will need to be solved based on the terrain conditions in some areas.

6 Timeline

6.1 First Semester

<table>
<tr><th>Week</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td rowspan="4">Research</td><td colspan="4">Research on conductor types</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Read through materials given by client</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">Research on poles</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Research on calculation methods</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">Analysis of materials</td><td></td><td colspan="4">Analyze materials from the client</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="5">Develop different combinations of conductor and methods</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Fit in parameters into calculation formula</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="4">Calculate the costs according to research and materials</td></tr>
<tr><td>Evaluation</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Evaluate combinations and finalize a plan</td></tr>
</table>

6.2 Second Semester

<table>
<tr><th>Week</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td rowspan="4">Design</td><td colspan="4">Carry out the actual design for all combinations</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">Develop the calculated parameters for all combinations</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">Calculate the economic budgets to all combinations</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="4">Construction notations according to Musctine situation</td></tr>
</table>

<table>
<tr><th>Week</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th></tr>
<tr><td>Communicate</td><td colspan="6">Communicate with client and adjust construction plan</td><td></td><td></td></tr>
<tr><td>Document</td><td></td><td colspan="5">Compose the construction plan into real document</td><td></td><td></td></tr>
<tr><td rowspan="2">Presentation</td><td></td><td></td><td></td><td></td><td colspan="3">Prepare a presentation</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
</table>

7 Conclusions

Our goals are to analyze each type of conductor, and create a chart of the electrical and economic benefits for each. We also need to create a design for the pole placement for the transmission line based on each conductor types and the poles locations pf any new distribution poles needed.

8 References

1. Transmission Line Reference Book: Wind-Induced Conductor Motion,Electric Power Research Institute, Palo Alto, CA, 2006.
2. P. Hagedorn, On the computation of damped wind-excited vibrations of overhead transmission lines, Journal of Sound and Vibration.83 (2)(1982) 253-271.
3. J-Power Systems. Gtacsr (gap-type thermal-resistant aluminum alloy steel reinforced) & gztacsr (gap-type super-thermal-resistant aluminum alloy steel reinforced) specifications. J-Power Systems.
4. M.J. Rider, I. de J.Silva, R. Romero, A.V. Garcia, and C.A. Murari. Transmission network expansion planning in full open market considering security constraints. In Power Tech, 2005 IEEE Russia, pages 1{6, 2005}.
5. U.S. Department of Energy. 20% wind energy by 2030: Increasing wind contribution to the us energy supply, July 2008.

6. Hong Fan, Haozhong Cheng, Zhiwei Ying, Fengqing Jiang, and Fangdi Shi. Transmission system expansion planning based on stochastic chance constrained programming with security constraints. In Electric Utility Deregulation and Restructuring and Power Technologies, 2008. DRPT 2008. Third International Conference on, pages 909{914, 2008.

9 Appendices

I. AAAC

Conductor Data

Code Word	Size (KCMIL)	Stranding	Diameter (ins.)		Weight Per 1000 Feet (lbs.)	Rated Strength (lbs.)	Resistance OHMS/1000ft.		Allowable Ampacity+ (Amps)	ACSR With Equivalent Diameter	
			Individual Wires	Complete Cable			DC @ 20°C	AC @ 75°C		Size	Stranding (Al/Stl)
Flint	740.8	37	.1415	.9900	690.8	24400	.0272	.0327	790	636.0	26/7

II. ACSR

Conductor Data

Code Word	Size (AWG or KCMIL)	Stranding (Al/Stl)	Diameter (inches)			Weight Per 1000ft (lbs.)			Rated Strength (lbs.)	Resistance OHMS/1000ft.		Allowable Ampacity+ (Amps)
			AL	Steel	Complete Cable	AL	Steel	Total		DC @ 20°C	AC @ 75°C	
Kingbird	636.0	18/1	.1880	.1880	.9400	597.2	93.6	690.8	15700	.0270	.0332	773
Swift	636.0	36/1	.1329	.1329	.9300	596.0	47.0	643.0	13690	.0271	.0334	769

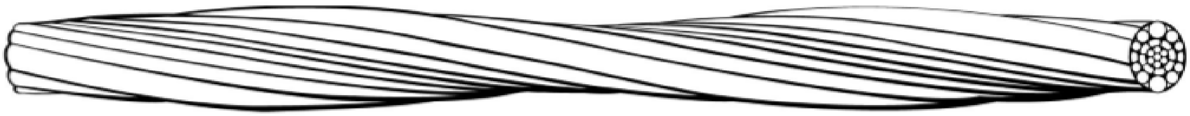
Rook	636.0	24/7	.1628	.1085	.9770	600.0	219.2	819.2	22600	.0268	.0330	784
Grosbeak	636.0	26/7	.1564	.1216	.9900	600.0	275.2	875.2	25200	.0267	.0328	789
Scoter	636.0	30/7	.1456	.1456	1.0190	600.0	395.0	995.0	30400	.0256	.0325	798
Egret	636.0	30/19	.1456	.0874	1.0190	600.0	386.0	987.0	31500	.0266	.0326	798

III. ACSS

Conductor Data

Code Word	**Size (KCMIL)**	**Stranding**	**Diameter (ins.)**		**Weight Per 1000 Feet (lbs.)**	**Rated Strength (lbs.)**	**Resistance OHMS/1000ft.**		**Ampacity at 200C**
			Individual Wires	**Complete Cable**			**DC @ 20°C**	**AC @ 75°C**	
Partridge	266.8	26/7	0.2363	0.642	366.8	8880	0.0619	0.0761	812
Junco	266.8	30/7	0.2829	0.660	417.4	11700	0.0615	0.0756	822

IV. Motion resistant conductor

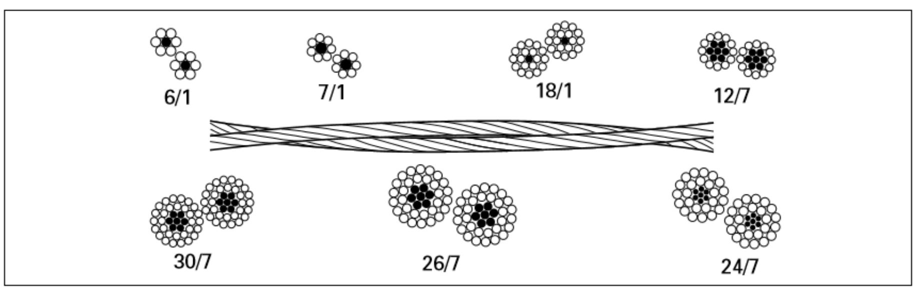


Conductor Data

Code Word	Size(AWG)	Area(sq.inches)		Steel stranding	Conductor ellipse dimeters (inches)		Weight per 1000 ft (Lbs.)	R/1000 ft		Rated Strength	Ampacity
		Al	total		major	minor		DC@ 20C	AC@ 75C		
Linnet/MR	795	0.6247	0.7264	7x0.136	1.302	0.879	1093	0.0213	0.0263	31500	908

V. T-2

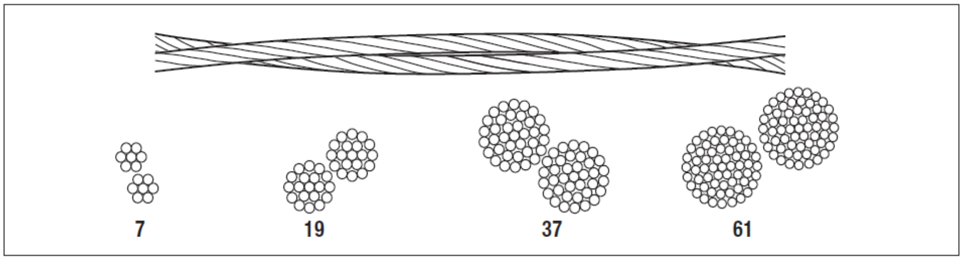
5.1 ACSR/T-2(Aluminum Conductor Steel-Reinforced Concentric-Lay-Stranded Twisted Pair)



Conductor Data

Code Word	**Size (KCMIL)**	**Stranding**	**Diameter (ins.)**	**Weight Per 1000 Feet (lbs.)**	**Rated Strength (lbs.)**	**Resistance OHMS/1000ft.**		**Ampacity at 75 C**
Ostrich	600		. 1.114	825	24400	.0283	.0348	790
Merlin	672		1.119	730	17400	0.0255	.0315	830

5.2 AAC/T-2 (All-Aluminum 1350 Conductor Concentric-Lay-Stranded Twisted Pair)



Code Word	Size (KCMIL)	Stranding	Diameter (ins.)	Weight Per 1000 Feet (lbs.)	Rated Strength (lbs.)	Resistance OHMS/1000ft.		Ampacity at 75 C
Tulip	672.8		1.089	631	12800	.0257	.0317	820
Daffodil	700		1.111	656	14200	.0247	.0305	840