DRAFT
WestConnect Proposal for Funding SWAT SCWG Impedance Map Development

by

Members of the SWAT SCWG

on

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The Southwest Area Transmission (SWAT) Short Circuit Working Group (SCWG) began in January of 2006. At the first meeting, the group decided that one of the products of the working group would be a set of impedance maps representing all of the SWAT members systems to the level modeled in the annual SWAT short circuit operating case. At subsequent meetings, the group refined the format for a common set of impedance maps and how the maps should be developed. Part of the development plan included a request for funding from WestConnect for the development of these maps. As a response to the request, in May of 2006 WestConnect requested a proposal for the project that would include background, scope of work, schedule of activities, management of the work, deliverables, and estimated cost. This document is the requested proposal that was developed by the SWAT SCWG.

Background

The SWAT SCWG members are: APS, SRP, WAPA DSW, TEP/Unisource, SWTC, IID, EPE, PNM, NPC/SPPC, and SWRTA. In the past, most of these utilities maintained independent sets of impedance maps which showed impedance representations used in short circuit calculations. Due to the effects of the interconnections with each other, these maps were usually shared among the utilities for accurate short circuit calculations. As the SWAT system grew, it became more interconnected and as a result, many of the impedance maps created duplication of effort and information. Therefore, the SWAT SCWG decided that it would be more efficient to generate a single set of common impedance maps for use in future short circuit and system planning studies. In recent years, the impedance maps have not been updated by many SWAT members due to lack of available resources, increased work loads, and other priorities. Because of this, the SWAT SCWG decided that the best way to develop a set of common impedance maps would be through funding a single member of SWAT or hiring an outside consultant if none of the members had the resources to develop the maps.

Scope of Work

The group decided that prior to developing a set of common impedance maps, it would develop the current system operating case. Therefore, the person that develops the maps should use the Aspen or CAPE short circuit program database to obtain the required information for the impedance maps. All of the items to be placed on the maps, including equivalents, will be in the combined operating base case. The person that develops the set of common impedance maps would do so in AutoCad.

In addition to generating an initial set of impedance maps, updates of the maps would be required in subsequent years. It is envisioned by the group that there will need to be at least 3 iterations to develop all of the required information such as mutual coupling. Some of the items in the attachment to this proposal may also change for subsequent updates. For the subsequent annual updates, each utility will supply a copy of the current drawings with new items to be added marked in red and items to be removed marked in green.

Schedule of Activities

The current operating case is being developed by the SWAT SCWG. It is anticipated that this work will be completed within the next 12 months. Therefore, the SWAT SCWG would like to have work on the impedance maps begin no later than July of 2007. The SWAT SCWG will supply the case in either Aspen or CAPE format to develop the maps. The impedance maps should be generated within 6 months of the July 2007.

Management of the Work

A technical contact for each SWAT member will be supplied to answer any questions that may arise. A single person from the SWAT SCWG will be selected as the primary contact and project manager.

Deliverables

The deliverables to the SWAT SCWG should include 1 black and white hard copy of the impedance maps in D size format (22 inches high and 34 inches wide) and 1 set of 3 hole punched 11 inch by 17 inch drawings. The text in the 11 inch by 17 inch drawings should be clear enough to read the details by a person with 20/20 vision without the need for a magnifying glass. The arrangement of the drawings should be broken down by company as much as possible on individual sheets. An index should be included on the first page indicating the sheet number for each substation. The drawings should also be supplied to each SWAT member in AutoCad (.dwg) format on a CD in editable form.

Estimated Cost of Work

An RFP will have to be generated and sent out to each SWAT member and a set of consultants before a cost estimate can be determined. The SWAT SCWG will supply any details needed for the RFP.

Attachment

SWAT SC Working Group
Map Item List

Case

1) Positive and zero sequence data on maps for all elements
2) Positive sequence data above elements and lines
3) Zero sequence data below elements and lines
4) Data on horizontal lines and elements only
5) Impedance per unit values on 100 MVA base
6) A legend showing symbols
7) Maps in black and white
8) Dashed lines to show ownership boundaries. Owner acronym label to be placed on each side of boundary. If multiple owners or different owners and operators, ownership shown for company responsible for updating the part of the system in the annual short circuit operating case.

Buses

1) Name
2) Longer more descriptive name than in the WECC PSLF case
3) kV value
4) Do not change bus numbers to WECC, but continue using numbers used today

Lines

1) Do not show shunt admittance
2) Show DC Converter Stations as a diode with the anode on the AC side and the cathode on the DC side

Mutually Coupled Lines

1) Lines with mutual coupling on separate drawings showing mutual coupling between line segments

Series Compensated Lines

1) Capacitor symbol
2) Reactance above symbol
3) A box with diagonal upward right angle line for gap or MOV protection
4) Open switch if there is a bypass even if it is a breaker

Breakers

1) Do not show normally closed breakers
2) Show normally open breakers or switches as an open switch with "NO" above it

Equivalents

1) A circle with "EQ" is symbol
2) A line from the circle to the bus with positive sequence equivalent impedance above line and zero sequence equivalent impedance below the line

Transformers

1) 100 MVA base and not transformer base
2) Voltage in pu calculation is bus voltage and not tested voltage
3) Number identifiers placed above parallel transformers and optional for other transformers
4) Test voltage between windings
5) P,S,T used to indicate primary, secondary, and tertiary on 3 winding tranformers
6) Impedance in R+jX form if resistance is available
7) Y grounded symbols used for grounded windings
8) All transformers with a tertiary winding show tertiary
9) Phase shift when phase shift other than the IEEE Standard for phase shift is used
10) Delta or Wye symbol next to each winding based on winding configuration
11) IEC (European) Symbol
12) Grounding impedance shown as a resistor, an inductor, or a box grounded with impedance next to it in ohms and a j shown before impedance if it is reactive grounding
13) Do not show any information on LTCs
14) All 3 winding transformers shown as a single 3 winding transformer model and no star representations

Phase Shifters

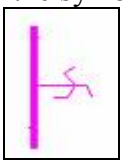
1) Symbol is a circle with an upward right angled arrow through it
2) Bypass switch if it is available

Regulators

1) Do not show the regulators on the maps

Zig Zag Transformers

1) Show symbol when actual zig zag
2) Use the symbol below



Auto Transformers

1) Indicate with an A above the transformer symbol if it is known to be an autotransformer

Generators

1) Symbol is a sine wave in a circle
2) Unit number placed above the circle
3) Negative sequence data also if available
4) Positive and then negative sequence data above line to generator.
5) Zero sequence data below the line to generator
6) Resistance on map if available
7) R+jX is the form for data
8) 100 MVA base and not generator base
9) Voltage in pu calculation is bus voltage and not tested voltage
10) An indication of some type for generators that have a converter interface to grid
11) Saturated reactance
12) Subtransient reactance
13) Synchronous reactance if available
14) Resistance if it is known
15) Do not place transient reactance on maps
16) Grounding impedance when an individual company wants to place it on maps

Motors

1) Symbol is circle with an M in it
2) Straight line connecting the circle to the bus
3) Positive sequence above line and zero sequence below line
4) Other items for April meeting

Shunt Reactors

1) Do not show shunt reactors

Shunt Capacitors

1) Do not show shunt capacitors

Switchable Shunts

1) Do not show switchable shunts