

**TOT 2B/2C North to South Study Plan  
2007 Summer  
(WECC Paths 35, 78 & 79)**

**Submitted to**

**Colorado Coordinated Planning Group  
And  
Rocky Mountain Subregion of the WECC OTCPC**

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**Prepared by**

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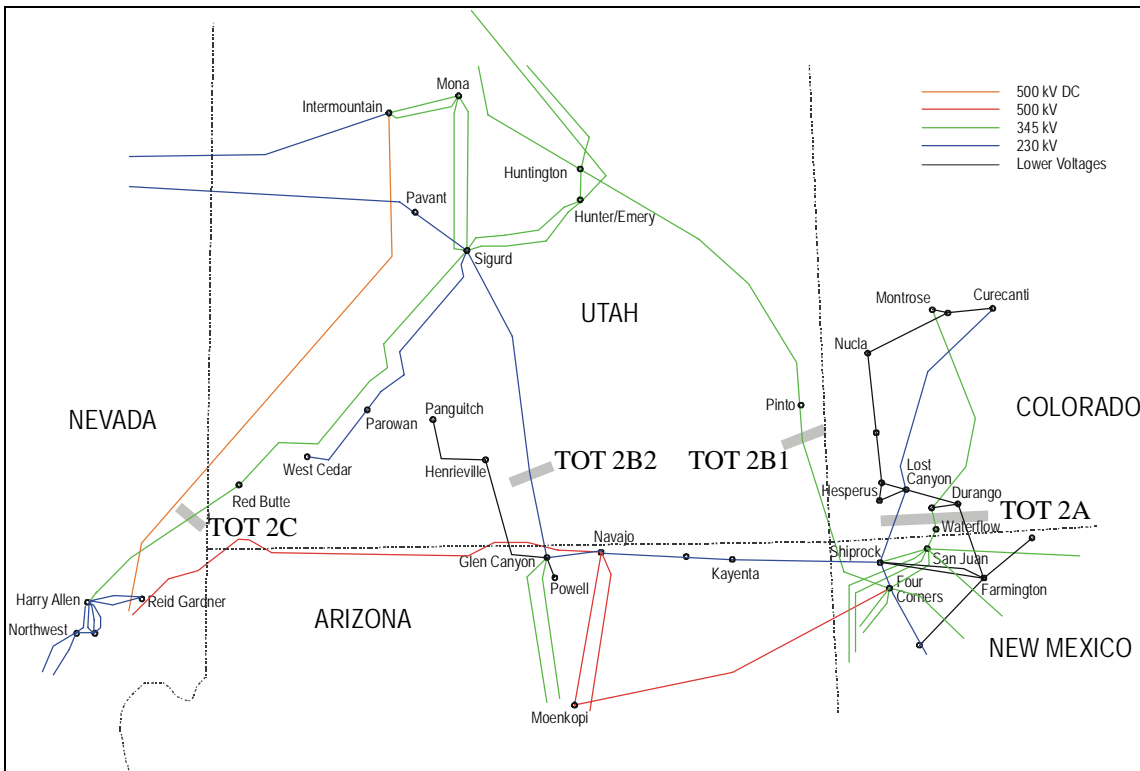
**I. Introduction**

This study will determine the TOT 2B/2C north to south operating limits for the 2007 summer season. On-peak summer operating conditions with varying Utah area load levels will be studied to develop applicable operating limits.

**II. Path Description**

TOT 2B, owned by PacifiCorp (PAC), is comprised of the Pinto-Four Corners 345 kV (TOT 2B1) and the Sigurd-Glen Canyon 230 kV (TOT 2B2) lines. TOT 2C, owned by PAC and the Nevada Power company (NEVP), consists of the Red Butte-Harry Allen 345 kV line. Figure 1 provides a geographical map detailing where the lines and substations are located. The assigned WECC path numbers are 35 for TOT 2C, 78 for TOT 2B1 and 79 for TOT 2B2.

The maximum TOT 2B1 rating is 560 MW from north to south based on steady-state Pinto area voltages and normal thermal limits of the Pinto phase shifting transformers. The maximum TOT 2B2 rating is 250 MW from north to south based on steady-state normal thermal limit of the Sigurd phase shifting transformer. The maximum established TOT 2C rating is 300 MW from north to south based on the previous rating studies. The limiting TOT 2B/2C outages are single contingency (N-1) outages of the Huntington-Pinto, Pinto-Four Corners, and Sigurd-Red Butte 345 kV lines.



**Figure 1**

### **III. Methodology**

The cases for this study will be developed from the WECC 2007 HS3 operating case. Studies will examine several combinations of Pinto and Red Butte area loads and flows on the Pinto-Four Corners and Red Butte-Harry Allen 345 kV lines to define the TOT 2B1 versus TOT 2C transfer capability nomogram. Sensitivity studies will include a 5% increase in Pinto-Four Corners and Red Butte-Harry Allen 345 kV flows.

### **IV. Study Criteria**

The WECC Reliability Criteria for Transmission System Planning will apply. An exception to the criteria will be for post transient N-1 outages, where the minimum and maximum acceptable voltages in the Pinto load area will be in the range of 0.90 to 1.10 pu at the Abajo, Moab and Pinto 69 kV and Hatch 12.5 kV load buses.

### **V. Study Assumptions**

The following assumptions will be applied in the studies:

- The 2007 projected Red Butte load is 340 MW with local area generation. The operation of this generation is generally based on economics and some of the generation may not be on-line during peak load conditions. Studies will include a range of load levels for the Red Butte load.
- The St. George SVC has a continuous rating of -35 to +100 MVAR but is generally operated with a steady-state range of -15/+20 MVAR. Within the steady-state range, the SVC will maintain the St. George 138 kV substation voltage between 1.0 and 1.03 pu (typically 1.0 pu during heavy load conditions and 1.03 pu during light load conditions) by switching reactive devices at Red Butte and St. George to minimize the SVC output and maintain desired voltages at Red Butte and St. George substations. The SVC continuous rating outside of the steady-state range is reserved for outage conditions.
- The emergency ratings of the Pinto and Sigurd phase shifting transformers are 125% of the continuous rating based on the safe operating limits of the LTCs for reducing the loading on the transformers.

### **VII. Remedial Actions**

The Huntington generator tripping RAS will not be used in determining the TOT 2B/2C operating limits. The Huntington RAS is presently triggered by the loss of the Huntington-Pinto or Pinto-Four Corners 345 kV line. Given the simultaneous relationship between TOT 2B1 and TOT 2C, the Huntington RAS is expected to provide very little improvement in the nomogram relationship as the loss of the Sigurd-Red Butte 345 kV line is expected to be the limiting outage. If study results support this expectation, this RAS will be disabled for the 2007 summer operating season.

### **VIII. Interaction With Other Paths**

In the power flow cases for this study, the transfers on the Intermountain Power Project 500 kV bi-pole DC (IPPDC) line and the southern Colorado TOT 2A transmission system will be modeled at their rating limits to determine the simultaneous limitations with the TOT 2B/2C transmission system. The IPPDC line is rated at 1920 MW with the associated Intermountain Power Generating Station (IPGS) generator tripping, and the TOT 2A transmission system is rated between 550 and 690 MW, depending upon local area generation and load.

### **IX. Post Transient Outage Simulations**

The following single and double contingency outages will be studied for all nomogram points.

### **N-1 Outages**

1. Loss of Huntington-Pinto 345 kV line with shunt reactive device switching at Pinto, but without Huntington generator tripping.
2. Loss of Pinto-Four Corners 345 kV line with shunt reactive device switching at Pinto, but without Huntington generator tripping.
3. Loss of Sigurd-Glen Canyon 230 kV line.
4. Loss of Sigurd-Red Butte 345 kV line
5. Loss of Red Butte-Harry Allen 345 kV line.
6. Loss of the Montrose-Hesperus 345 kV line.

### **N-2 Outages**

1. Loss of the Huntington-Pinto and Huntington-Spanish Fork 345 kV lines (common breaker failure).
2. Loss of the Pinto-Huntington and Pinto-Four Corners 345 kV lines (common breaker failure).
3. Loss of the Red Butte-Sigurd and Red Butte-Harry Allen 345 kV lines (common breaker failure).
4. Loss of the IPPDC line with IPGS unit tripping.
5. Loss of two Palo Verde units.

### **X. Dynamic Simulations**

The following outages will be studied for several critical nomogram points.

1. Huntington 345 kV 3 phase fault with loss of the Huntington-Pinto 345 kV line.
2. Pinto 345 kV 3 phase fault with loss of the Pinto-Four Corners 345 kV line.
3. Sigurd 345 kV 3 phase fault with loss of the Sigurd-Red Butte 345 kV line.
4. Red Butte 345 kV 3 phase fault with loss of the Red Butte-Harry Allen 345 kV line.
5. Huntington 345 kV single line to ground fault with delayed clearing and loss of the Huntington-Pinto and Huntington-Spanish Fork 345 kV lines.
6. Loss of the IPPDC line with IPGS unit tripping.
7. Loss of two Palo Verde units.

### **XI. Answers to Specific OTCPC Questions**

1. The last comprehensive OTC studies approved by the OTCPC for these paths were done in 1999. A nomogram defined the simultaneous OTCs for the three paths.
2. The purpose of this study is to update the simultaneous nomogram.
3. Minor changes to the simultaneous nomogram are expected.
4. Thermal and post-transient voltages are the limiting OTC factors.
5. The summer season is the most restrictive season due to local area loads.
6. The study assumptions will be similar to past studies.
7. This will be a comprehensive study.