Electrical Distribution System Assessment

For
Victor Valley College
18422 Bear Valley Road
Victorville, CA 92395

Prepared by
CALPEC Engineering, Inc.
(CALPEC Job No. 176-33a)

25 September, 2012
TABLE OF CONTENTS

I. Purpose ....................................................... Page 1

II. Existing Condition ................................. Page 1

III. New Load Data ................................. Page 2

IV. Analysis ....................................................... Page 4

V. Conclusions ........................................... Page 5

VI. Appendix

Victor Valley College, 2012 Project Map ...... Appendix A
Campus Map (Easy Access) ......................... Appendix B
Electrical Existing Site Plan ....................... Appendix C
Electrical Existing Single Line Diagram ...... Appendix D
I. **Purpose:**

A. The purpose of this Electrical Distribution System assessment is to evaluate existing electrical infrastructure system currently serving Victor Valley College Campus whether it has the capacity to accommodate planned expansion as indicated per-attached Victor Valley College, 2012 Project Plan (Appendix A).

B. In reference to the 2012 Project Plan, there are six new buildings considered in the assessment as follows:

   21,357 Square-Feet single story building to be set northwest of the existing Science Building - 31.
2. New Music Auxiliary Building.
   2,800 Square-Feet one story building situated on the footprint of an existing toilet/service, west of the existing Music Building - 20.
3. One Stop Center Building – Student Services.
   New 7,051 Square-Feet one story addition to the existing Student Services Buildings, located between Student Services Building - 50 and 51, which will interfere with the Switchboard Operator Building – 53. Building -53 may be demolished.
   New 1,500 Square-Feet single story building, to align with the existing Welding Lab. Building - 61.
   New 8,000 Square-Feet single story building, to align with the west wall of existing Automotive Lab. Building - 64.
6. One Stop Center Building - Admin.
   New 3,937 Square-Feet one story addition to Admin. Services -10 building.

C. This assessment is based on the review of as built drawings, studies and reports done by others which are provided to us by the College, in addition to field observation and survey conducted on July 26, 2012.

II. **Existing Condition:**

A. The Victor Valley College campus is mainly served from 4160V, 1200A, 3-phase, 4-wire electrical service switchgear located in the Electrical/Power Plant - 40 (also known as Central Plant). The service is coming from 12 kV Southern California Edison (SCE) underground service feeder, connected thru 2500kVA SCE outdoor pad mounted transformer located east of the Central Plant building, converting from 12kV to 4.16 kV (5kV), 3 phase, 4-wire system. The 5kV Main Service electrical switchgear is provided with 1,200 Amp main load break switch with a 750A current-limiting fuse. The switchgear distribution sections comprises of five - 5kV, 600A switches (load interrupter switches) with 250 A current limiting fuse each, and no spares for future growth.
In reference to Electrical Existing Single Line Diagram (Appendix D), the load interrupter switches are serving the following buildings:
(Refer also to Campus Map (Easy Access) Appendix B for building location)

1. Switch #1 – serving 5kV underground Feeder #1 currently connected to four buildings, i.e.: Music Building-20, Art – 22, Liberal Arts-30 and Health and Public Safety-32.
2. Switch #2 – serving 5kV underground Feeder #2 currently connected to five buildings, i.e.: Advanced Technology-21, Science Building-31, Student Services-52, Performing Arts Center-54 and Counseling & Administration-55.
3. Switch #3 – serving 5kV underground Feeder #3 currently connected to three buildings, i.e.: Library-41, Academic Commons-42 and Student Activities Center-44
4. Switch #4 – serving 5kV underground Feeder #4 currently connected to seven buildings, i.e.: Welding-61, Automotive-64, Construction Technology-65, Lower Portables-66, Adapted PE Center-70, Gym-71 and Weight Room-72.
5. Switch #5 – serving currently connected to 1000 kVA transformer serving the Central Plant.

The underground 5kV Feeder #1 & #2 circling along the west half of the upper campus, and Feeder #3 along the east half of the upper campus with Feeder #4 feeds all buildings on the lower campus which are not served directly by SCE – refer to Electrical Existing Site Plan Appendix C.

The Administration services – 10, Child Development Center – 12, Lower Campus Portables (Humanity Center) and Maintenance Office – 93 are individually served directly from SCE, separately metered, in addition to the 5kV service. As well as the insignificant other SCE meters for Dug-Out and Signage.

B. Photovoltaic System.
In addition, there is a 1.25 Mega-watt DC – photovoltaic panels with tracking system located at the north end of the campus which tie in to the main campus 5kV electrical distribution system thru the 750kVA, 5kV – 480/277, 3-phase, 4-wire substation that serves the Welding Shop-61 as well as Electronics-62.

III. New Load Data:

A. New Building Electrical Power demand calculations.
Based on anticipated connected load of 20 Volt-Amp per-Square-Feet (SF) associated with the planned expansions, the new building load are as follows:

   21,357 x 20 VA = 427.14 kVA
2. New Music Auxiliary Building.
   2,800 x 20 VA = 56 kVA
3. One Stop Center Building – Student Services.
   7,051 x 20 VA = 141 kVA
   1,500 x 20 VA = 30 kVA
   8,000 x 20 VA = 160 kVA
6. One Stop Center Building - Admin.
   3,937 x 20 VA = 78.74 kVA

New buildings anticipated total electrical connected load would be 892.88 kVA.


A review of the existing 5kV service distribution route drawings (Appendix C) and the location of the expansions indicated on the College, 2012 Project Map (Appendix A) revealed that not all of the new buildings can be served from the 5kV underground campus distribution system cost effectively.

Following are feasible method of serving the new buildings from existing campus services:

1. New Science/Health Lab. Building should be served from 5kV Feeder #1 loop thru pull box #6. Propose a new primary selective (Feeder #1 & #2) substation with 500kVA transformer provided.
2. New Music Auxiliary Building should be connected to Music Building-20 existing service. The existing 300kVA substation serving Music Building-20 should be capable of serving additional new building load of 56 kVA.
3. One Stop Center Building–Student Services should be served from previously shown 5kV Feeder #2 serving the Switchboard Operator Building–53, that is going to be demolished. A new 150kVA substation should be adequate to serve this new building. Also, possible to utilize the primary selective substation if Feeder #1 can be extended from pull box #10 to pull box #12, 5kV conductors’ size shall be upgraded accordingly.
4. Welding Lab. Building should be served from 5kV Feeder #4 thru pull box #5L. Propose a new substation with 300kVA transformer, the substation will also serving the new Auto/Diesel Lab. Building.
5. Auto/Diesel Lab. Building should be served from 5kV Feeder #4 thru pull box #5L, refer to the proposed new 300kVA substation indicated above for the Welding Lab. Building.
6. One Stop Center Building - Admin. should be served from existing 400A, 480/277V, 3Ph, 4W distribution system (served by SCE padmount transformer on separate meter) of the Admin Building-10, meter recording verification should be arranged to determine this option viable.
   Should there be no additional spare capacity determined after the demand meter recording result, upgrading the electrical service should be arranged with SCE.

C. Assumptions.

1. The highest peak demand recorded in September 2009 for the 5kV main switchgear meter by campus was 18,000 kW or 1,911kVA with a power
factor of 0.94 (equates to 265A at 5kV) is still relevant considering not any significant expansions done since then. Considering installation of 1.25 Mega-watt DC – photovoltaic system two years ago, which is currently in operation injecting solar power to the 5kV distribution system, the peak demand may logically be reduced, since the peak demand normally occurs during the day time.

2. Existing data from survey recently conducted by P2S in 2010 revealed that 5kV Feeder loads are listed below.

<table>
<thead>
<tr>
<th>Feeder #</th>
<th>Installed Capacity (kVA)</th>
<th>Demand (@25% Installed) (kVA)</th>
<th>Demand (@25% Installed) (Amp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1350</td>
<td>330</td>
<td>50</td>
</tr>
<tr>
<td>#2</td>
<td>3050</td>
<td>770</td>
<td>110</td>
</tr>
<tr>
<td>#3</td>
<td>1510</td>
<td>390</td>
<td>50</td>
</tr>
<tr>
<td>#4</td>
<td>3345</td>
<td>850</td>
<td>120</td>
</tr>
<tr>
<td>#5</td>
<td>1000</td>
<td>250</td>
<td>40</td>
</tr>
</tbody>
</table>

3. In the absence of available metered data, the approximate demands of 25% installed capacity appears to be reasonable, and in concurrence with the industry practice.

IV. **Analysis:**

A. Future Building Power Allocations:

1. The feasible method of servicing new building electrical power described above, the 825kVA (equates to 115A at 5kV) addition load should be allocated to the existing 5kV main switchgear service at the Central Plant.

2. In addition, 100 kVA new load of One Stop Center Building-Admin should be planned for additional capacity to the existing 400Amp, 480/277V, 3-Ph., separately metered SCE service for the Admin Building-10.

B. Electrical Distribution System Capacity Assessment.

1. **Central Plant existing 5kV SCE Service.**
   
   At the 5kV system, if additional new building loads of 115 A is added to highest recorded maximum peak demand of 265A, the total of 380A updated load will be anticipated on the 1200A main switchgear with 750A current limiting fuse.

2. **5kV Feeder #1 new load.**
   
   If new Science/Health Lab. Building load of 500kVA is added to existing Feeder #1 load of 330kVA, the total of 830 kVA updated load will be anticipated; which equates to 115A on 600A current limiting Switch & 250A current limiting fuse.

3. **Music Building-20, existing 300kVA substation new load.**
In the Music Building, in addition to existing 300kVA substation serving 480/277V, 3-Ph distribution system, there is an existing 75 kVA transformer is serving the 208/120V, 3-Ph distribution system. Record as-built drawings indicate Music Building has a 10,000 SF footprint. With an additional 2800 SF new Auxiliary Building, the existing 300kVA substation should be able to serve an estimated of 260kVA connected load for the 12,800 SF buildings (at 20VA/SF).

4. 5kV Feeder #2 new load.
If new One Stop Center Building – Student Services load of 150kVA is added to existing Feeder #2 load of 770kVA, the total of 920 kVA updated load will be anticipated; which equates to 128A on 600A current limiting Switch & 250A current limiting fuse.

5. 5kV Feeder #4 new load.
If new Welding Lab. Building and Auto/Diesel Lab. Building load of 300kVA is added to existing Feeder #4 load of 850kVA, the total of 1150 kVA updated load will be anticipated; which equates to 160A on 600A current limiting Switch & 250A current limiting fuse.

6. 400A, 480/277V, 3PH – SCE service new load (Admin Building-10).
With an additional 3,937SF One Stop Center Building-Admin to the existing 14,442 GSF Admin Building-10 (per-as built record), the updated of 18,379 SF buildings will have an estimated load of 368kVA, equates to 441A at 480V-3PH. Existing 400A electrical service may not be adequate to serve the new building addition, further verification is required to determine if electrical service upgrade necessary.

V. Conclusions:

A. The existing 5kV campus electrical service is adequately sized to support the existing and new planned facilities expansion as indicated on the attached Victor Valley College, 2012 Project Plan (Appendix A). Proposed connection of each new building is delineated on above section III.B, however metered recording of each associated Feeder shall be conducted for validation prior to proceeding with the proposed connection.

B. Feeder size review is excluded on this assessment, existing 5kV feeder conductor sizes shall be evaluated prior to any new building connection execution. Replacement with new larger sizes or new conductors’ extension may be required.

C. The primary selective substation shall be implemented on the new Science/Health Lab. Building and One Stop Center Building -Student Services substations. Feeder #1 and #2 conductors’ ampacity shall be evaluated for possible maximum load if only one feeder can be operated due to temporary de-commission, maintenance or possible fault on one of the feeder.

D. Due to existing infrastructure of only a single Feeder #4 serving all the buildings (not served directly by SCE) in the lower campus (shown on Electrical Existing
Single Line Diagram Appendix D), primary selective implementation to new substation for Welding and Auto/Diesel Lab can be done with installation of new long distance underground conduits and 5kV conductors which eventually will be very costly.

E. The electrical power for One Stop Center Building-Admin may be served from the existing 400A, 480/277V, 3-Ph SCE service if 30 days maximum demand power meter recording indicates available spare capacity (will be determined based on actual maximum demand load recorded).

Request for service upgrade to 600A, 480/277V, 3PH should be arranged with SCE if no spare capacity determined after 30 days demand meter recording obtained.
APPENDIX A

Victor Valley College, 2012 Project Map
Victor Valley College, 2012 Project

New 30' x 50' one story Welding Lab Building (set approximately 20' east of the existing 50' wide Welding Building); new building to align with the existing building east wall. Construction: slab on grade, steel wall and roof framing, corrugated steel walls and roof.

Remodel Existing Welding Lab to correct ventilation. 3,720 GSF / 2,862 ASF

New 80' x 100' one story Auto/Diesel Lab Building (set approximately 10' south of the existing 80' wide Automotive Building); new building to align with the existing building west wall. Construction: slab on grade, steel wall and roof framing, corrugated steel walls and roof.

New buildings (Auto + Welding) = 9,357 GSF / 6,732 ASF

New 350' x 70' single story Science/Health Lab Building (set approx. 20' northwest of the existing Science Building); to match construction of existing science building (slab on grade, CMU walls, steel roof framing); new building to align with and center on the existing building west wall.

New building = 21,357 GSF / 14,950 ASF

New 80' x 100' one story Auto/Diesel Lab Building (set approximately 10' south of the existing 80' wide Automotive Building); new building to align with the existing building west wall. Construction: slab on grade, steel wall and roof framing, corrugated steel walls and roof.

New buildings (Auto + Welding) = 9,357 GSF / 6,732 ASF

Remodel Existing 30' x 50' one story Welding Lab Building (set approximately 20' east of the existing 50' wide Welding Building); new building to align with the existing building east wall. Construction: slab on grade, steel wall and roof framing, corrugated steel walls and roof.

Remodel Existing Welding Lab to correct ventilation. 3,720 GSF / 2,862 ASF

Remodel Existing Music Building 20 -- 10,002 GSF / 8,308 ASF

Victor Valley College, 2012 Project

One Stop Center -- New 30' x 50' one story addition to Building 10; building area 3,937 GSF; Construction to match existing slab on grade, wood frame walls with stucco, and wood roof framing.

Remodel existing Building 10 -- 14,442 GSF / 13,300 ASF

One Stop Center -- New 30' x 50' one story addition to Building 10; building area 3,937 GSF; Construction to match existing slab on grade, wood frame walls with stucco, and wood roof framing.

Remodel existing Building 10 -- 14,442 GSF / 13,300 ASF

Remodel Existing Music Building 20 -- 10,002 GSF / 8,308 ASF

Victor Valley College, 2012 Project
APPENDIX B

Campus Map (Easy Access)
APPENDIX  C

Electrical Existing Site Plan
APPENDIX D

Electrical Existing Single Line Diagram