Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19a:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

> (A) SCE's response to ALT-4 indicates an ampacity of 2,170 amps for a single 1590 ACSR conductor. We note that the manufacturer's rating for 1590 ACSR is 1,354 amps at 75o C. Please provide both the normal and emergency rated ampacity that SCE uses for 1590 ACSR and 1033.5 ACSR specifying the conductor temperature for these ratings. Also, indicate whether the existing lines in the corridor utilizing 1033.5 ACSR conductor are designed for each of these conductor types and operating temperatures.

Response to Question ALT-19a:

The normal and emergency-rated ampacity values for all conductor types discussed in Data Request Questions No. ALT-18 and ALT-19 are reflected in the attachment titled "Calculated Conductor Ampacity.pdf." These values reflect SCE's standard parameters, which are slightly different than the parameters that are typically used by manufacturers when applying IEEE Standard 738-2006, resulting in slightly greater ampacity values for all conductors than what are typically advertised by the manufacturers.

Please refer to SCE's response to Data Request Question No. ALT-18.A, attachment titled "Summary Conductor Evaluations.pdf" that also includes the analysis for the existing single-conductor 1033.5 kcmil ACSR. In summary, approximately 71 spans (43%) would violate the SCE ground clearance design requirements, with similar solutions as described in SCE's response to Data Request Question No. ALT-18.A. From a structure loading perspective, approximately 22 (13%) of the structures would be overloaded in some form or another, primarily the deadend (41%) and tangent (7%) types, with no angle structures experiencing overload conditions. Typical solutions for these conditions would also be similar to those described in SCE's response to Data Request Question No. ALT-18.A.

		CONDUCTOR TYPE																									
		Double-bundled Curlew 1033.5 kcmil ACSR			Single-conductor Lapwing 1590 kcmil ACSR			Single-conductor Drake 795 ACCR			Single-conductor Bittern 1272 ACCR			Double-bundled Dove 557 ACCR			Double-bundled Drake 795 ACCR			Double-bundled Curlew 1033 ACCR	
		Temp	Amps		Temp	Amps		Temp	Amps		Temp	Amps		Temp	Amps		Temp	Amps		Temp	Amps
CALCULATED AMPACITY	NORMAL	194 F	2480		194 F	1615		410 F	1902		410 F	2425		410 F	3005		410 F	3804		410 F	4355
	EMERGENCY	275 F	3340		275 F	2180		464 F	2037		464 F	2602		464 F	3214		464 F	4074		464 F	4668

Note: Ampacity values calculated here reflect SCE standard parameters, which are different than typical manufacturers' calculations using IEEE Standard 738-2006.

For Reference (Temperature Conversions):

167 F = 75 C
194 F = 135 C
275 F = 135 C
410 F = 210 C
464F = 240 C

Last updated on 1/30/2015

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19b.1:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(B) Please address the following:

1. Describe any general concerns about the use of ACCR in the SCE system.

Response to Question ALT-19b.1:

SCE's general concerns about the use of ACCR in the SCE system remain similar to those provided in SCE's response to Data Request Question No. ALT-5, which reiterated the conclusions drawn for a similar composite conductor alternative in the Final EIR/EIS for the Devers-Palo Verde No. 2 Transmission Line Project. Those prior responses indicated that due to the recent introduction of this type of conductor (i.e., first installed 10 years ago in 2005 by Excel Energy) and the niche applications where the use of ACCR appears to best fit (e.g., typically selected spans with higher seasonal load levels, long obstacle crossings, restricted access locations, etc.), there is still little tangible experience with long term maintenance costs and other operability issues related to ACCR conductor. This limited experience base increases the risks associated with the selection of such a conductor for a large-scale, critical project such as the WOD Upgrade Project. SCE continues to evaluate other future smaller-scale transmission line construction projects whose conditions might be more appropriate for the potential application of ACCR conductors in order to become more familiar with the materials and associated construction impacts over time.

For this Project, an evaluation was performed to compare anticipated WOD corridor ratings, annual energy losses, and system power flow impacts for the various ACCR conductor configurations listed in Data Request Questions No. ALT-18 and ALT-19, using the specific line lengths and projected loads for the circuits that make up the WOD corridor. Please see the attachment titled "WOD Conductor Comparisons.pdf" that contains the full analysis.

This analysis shows that out of all of the alternative conductor configurations listed in Data Request Questions No. ALT-18 and ALT-19, only the double-bundled Drake 795 ACCR and double-bundled Curlew 1033 ACCR conductor alternatives mathematically result in corridor capacities similar to the double-bundled Lapwing 1590 ACSR used for the Proposed Project (see sheet 1 of the attachment). However, because the overall system resistance for those two ACCR conductors are significantly greater than the Proposed Project's selected conductor type, those two ACCR conductor types result in proportionally more annual energy losses (see sheet 2 of the attachment). These greater annual energy losses reflect a reduction in overall system efficiency in comparison to the Proposed Project due to the use of these alternate conductors. The analysis also concluded that while there could be some significant power flow and voltage regulation concerns with the use of some of the other ACCR alternatives, there would be no such impacts resulting from the use of either the double-bundled Drake 795 ACCR or the double-bundled Curlew 1033 ACCR conductor alternatives when compared to the Proposed Project (see sheet 3 of the attachment).

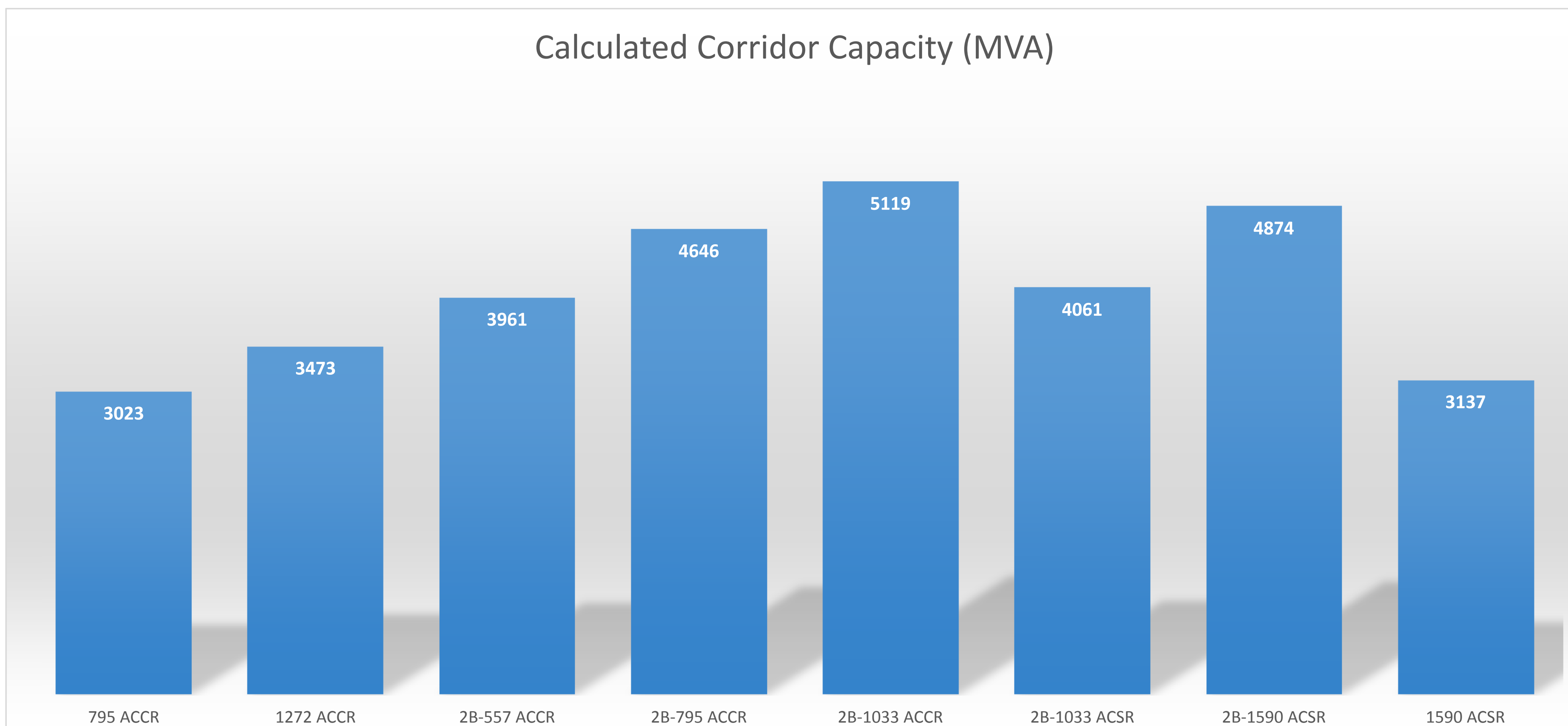
In addition to the analysis summarized above, SCE has general concerns that there may be other electrical, organizational, and right of way impacts resulting from the use of non-SCE standard conductors that have not been thoroughly studied. Such impacts may include, but are not limited to: different weight versus diameter characteristics of alternative conductors that could create altered right-of-way blowout profiles; different corona noise characteristics of the alternative conductors than what has been previously evaluated; maintaining emergency stock of alternative conductors, including the appropriate hardware and tools required to support operations and maintenance; a limited number of suppliers for ACCR; and the need for training of SCE personnel on any unique construction and maintenance techniques.

To change from the Proposed Project to any ACCR alternative for the WOD Upgrade Project at this time would significantly delay the Project's operating date because it would result in changes to the tower placement designs and all related access and stub roads, structure construction work areas, and site grading activities, as well as impacting material procurement and other critical path schedule activities. While SCE is not able to conduct a rigorous analysis of all potential schedule impacts as part of this response, based on the limited available information related to the extent of the overall scope for a project alternative utilizing an ACCR conductor option, it is reasonable to expect that the overall project schedule would be extended by at least 12-24 months.

West Of Devers Alternative Conductors: Corridor Capacity Comparison

Conductor Name	Conductor Type	Normal Rating (Amps)	Emergency Rating (Amps)	Normal Rating (MVA) = Amps (Normal) x Voltage x √3	Emergency Rating (MVA) = Amps (Emergency) x Voltage x √3	WOD calculated Corridor capacity (MVA) = Emergency capability of two lines + capacity provided by generation tripping	Capacity Comparison (Alternative Capacity - (2B-1590) capacity)
Drake^	795 ACCR	1902	2037	758	811	3023	-1851
Bittern^	1272 ACCR	2425	2602	966	1037	3473	-1401
Dove^	2B-557 ACCR	3005	3214	1197	1280	3961	-913
Drake^	2B-795 ACCR	3804	4074	1515	1623	4646	-228
Curlew^	2B-1033 ACCR	4355	4668	1735	1860	5119	+245
Curlew~	2B-1033 ACSR	2480	3340	988	1331	4061	-813
Lapwing~	**2B-1590 ACSR**	**3230**	**4360**	**1287**	**1737**	**4874**	**0**
Lapwing~	1590 ACSR	1615	2180	643	868	3137	-1737

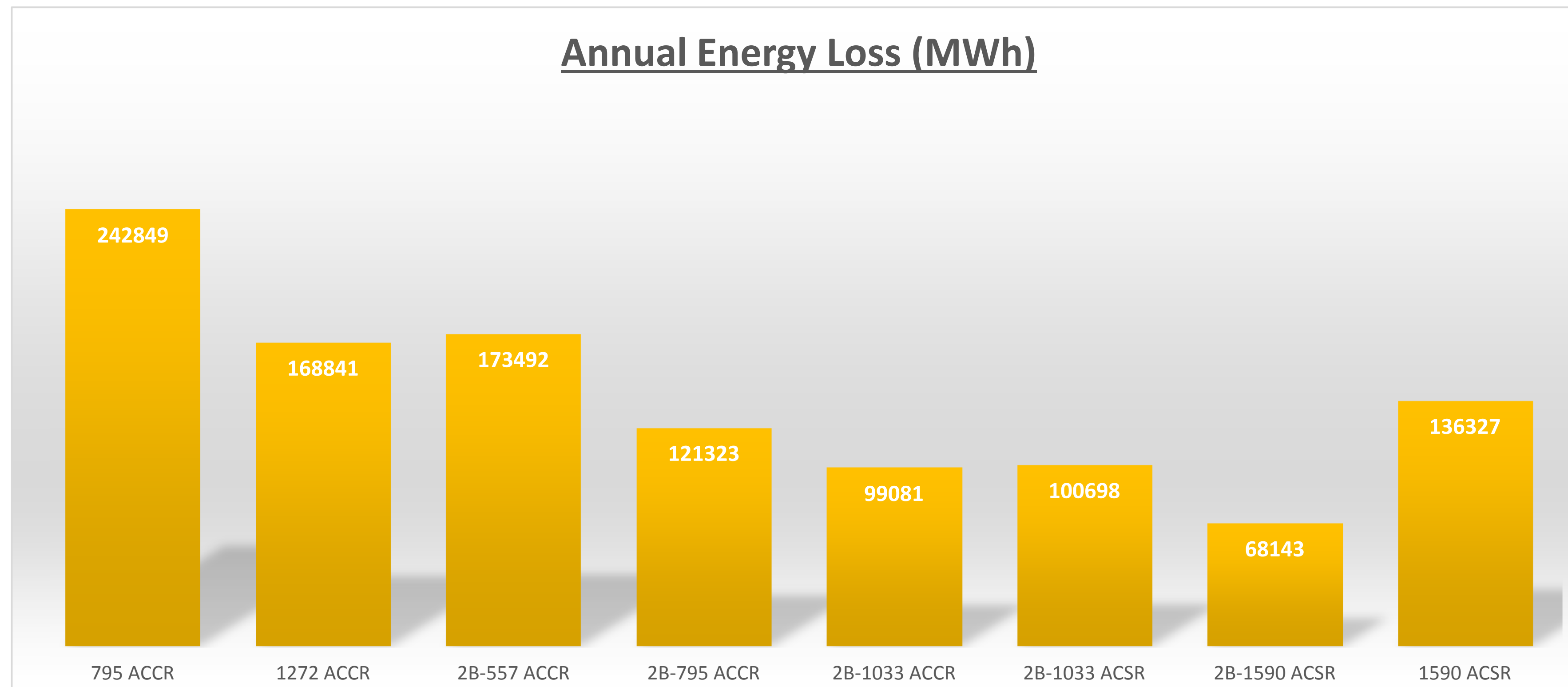
^ Source: http://m.3m.com/wps/portal/3M/en_US/EMD_ACCR_Mobile/ACCR_Home/Properties/
~ Source: Internal SCE Data base



West of Devers Alternative Conductors: Energy Loss Comparison

Conductor Name	Conductor Type	$R_{50°C}$ (Ω/mi) [1]	Devers - El Casco	El Casco - San Bernardino	Devers - San Bernardino	Devers - Vista No.1	Devers - Vista No.2	Combined
			$R=R_{50°C}$ (Ω/mi)x30(mi)	$R=R_{50°C}$ (Ω/mi)x14(mi)	$R=R_{50°C}$ (Ω/mi)x43(mi)	$R=R_{50°C}$ (Ω/mi)x45(mi)	$R=R_{50°C}$ (Ω/mi)x45(mi)	$R_{(\Omega)\text{Total Impedance}}$
Drake^	795 ACCR	0.1201	3.603	1.6814	5.1643	5.4045	5.4045	21.2577
Bittern^	1272 ACCR	0.0835	2.505	1.169	3.5905	3.7575	3.7575	14.7795
Dove^	2B-557 ACCR	0.0858	2.574	1.2012	3.6894	3.861	3.861	15.1866
Drake^	2B-795 ACCR	0.0600	1.8	0.84	2.58	2.7	2.7	10.62
Curlew^	2B-1033 ACCR	0.0490	1.47	0.686	2.107	2.205	2.205	8.673
Curlew~	2B-1033 ACSR	0.0498	1.494	0.6972	2.1414	2.241	2.241	8.8146
Lapwing~	**2B-1590 ACSR**	**0.0337**	**1.011**	**0.4718**	**1.4491**	**1.5165**	**1.5165**	**5.9649**
Lapwing~	1590 ACSR	0.0674	2.0226	0.94388	2.89906	3.0339	3.0339	11.93334

Conductor Name	Load Current (amps) [2]	P_{loss} (MW) = $I^2 \times R$	E_{loss} (MWh/year) = P_{loss} x 8760 h/year x Loading Factor (LF) [3]
Drake^	1615	55.4	242849
Bittern^	1615	38.5	168841
Dove^	1615	39.6	173492
Drake^	1615	27.7	121323
Curlew^	1615	22.6	99081
Curlew~	1615	23.0	100698
Lapwing~	**1615**	**15.6**	**68143**
Lapwing~	1615	31.1	136327



^ Source: http://m.3m.com/wps/portal/3M/en_US/EMD_ACCR_Mobile/ACCR_Home/Properties/

~ Source: Internal SCE Data base

[1] This study assumes a constant impedance at 50 degrees C

[2] This study assumes a constant current of 1615 Amps/line based on the lowest studied conductor rating (1C-1590 ACSR)

[3] This study assumes a Loading Factor of 0.5.

West of Devers Alternative Conductors: Power Flow Impact Comparison

Conductor Name	Conductor Type	Normal Rating (Amps)	Emergency Rating (Amps)	Normal Rating (MVA) = Amps (Normal) x Voltage x √3	Emergency Rating (MVA) = Amps (Emergency) x Voltage x √3	WOD calculated Corridor capacity (MVA) = Emergency capability of two lines + capacity provided by generation tripping	Power Flow Impact
Drake^	795 ACCR	1902	2037	758	811	3023	Would limit the system transfer capability to meet the current queue need; Voltage support would be required at the receiving end to maintain the Voltage within operational limits; Overload on SCE-MWD tie breaker under the loss of Devers - Valley 500kV T/Ls
Bittern^	1272 ACCR	2425	2602	966	1037	3473	Would limit the system transfer capability to meet the current queue need; Voltage support would be required at the receiving end to maintain the Voltage within operational limits; Stability concerns under the loss of Devers - Valley 500kV T/Ls
Dove^	2B-557 ACCR	3005	3214	1197	1280	3961	Provides less corridor capacity
Drake^	2B-795 ACCR	3804	4074	1515	1623	4646	Provides less corridor capacity
Curlew^	2B-1033 ACCR	4355	4668	1735	1860	5119	
Curlew~	2B-1033 ACSR	2480	3340	988	1331	4061	Provides less corridor capacity
Lapwing~	**2B-1590 ACSR**	**3230**	**4360**	**1287**	**1737**	**4874**	**Proposed Project - Meets all identified project criteria**
Lapwing~	1590 ACSR	1615	2180	643	868	3137	Would limit the system transfer capability to meet the current queue need; Voltage support would be required; Overload was observed on SCE-MWD tie breaker and the WOD lines under the loss of Devers - Valley 500kV T/Ls

Revised on 1/26/2015

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19b.2:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing

1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(B) Please address the following:

2. Describe any concerns about the use of two circuits of ACCR in the following configurations for the WOD system in particular:
   - Single-conductor Drake 795 ACCR (Rated Ampacity: 1,691 A per circuit).
   - Single-conductor Bittern 1272 ACCR (Rated Ampacity: 2,162 A per circuit).
   - Double-bundled Dove 557 ACCR (Rated Ampacity: 1,332 A per conductor double-bundled to achieve 2,664 A per circuit).
   - Double-bundled Drake 795 ACCR (Rated Ampacity: 1,691 A per conductor double-bundled to achieve 3,382 A per circuit).
   - Double-bundled Curlew 1033 ACCR (Rated Ampacity: 1,939 A per conductor double-bundled to achieve 3,878 A per circuit).

Response to Question ALT-19b.2:

For the purpose of responding to this data request question, two separate lengths of the existing double-circuit towers were evaluated as 'representative spans' – an approximately 13.5-mile segment from the west side of the West of Devers-Interim reactor station to Malki Road and an approximately 5-mile segment from the San Bernardino Junction to Vista Substation. The two applicable wind-loading design conditions (12 PSF and 18 PSF, respectively) were then applied to the existing towers in the study areas for each of the two requested conductor configurations to compare the possible results. The eastern study area is representative of the typical SCE tower family (W-series) found in Segments 3 through 6, while the western study area is representative of the typical SCE tower family (N-O-P-Q-series) found in Segments 1 and 2. The summarized results of the 'representative structures' in the two study areas were then extrapolated to obtain approximated results for the remaining 30 miles of line across the length of the Project. And while the text of this data request question specifically referenced issues related to structure capacities, the analysis also includes the evaluation of conductor sag at maximum-rated temperature to determine if there would be any ground clearance issues that would have to be addressed as well. Please see the attachment titled "Summary Conductor Evaluations.pdf" that contains the full analysis.

For the single-conductor Drake 795 ACCR option, approximately 9 spans (6%) of the 165 spans that make up the full line length would violate the SCE ground clearance design requirements (32 feet total, which includes the 30-foot requirement identified in GO 95,Table 1, Column F, Cases 3 and 4, plus a 2 foot design buffer). The most likely solutions for these situations range from structure replacements with taller structures or intersetting structures somewhere in between the existing structures, if possible. From a structure loading perspective, approximately 50 (30%) of the structures would be overloaded in some form or another, primarily the deadend (71%) and angle (33%) types, with approximately 17% of the tangent structures experiencing overload conditions. Typical solutions for these conditions could range from the simple (i.e., adding redundant members to the tower design) to the very complex (i.e., complete tower replacement).

For the single-conductor Bittern 1272 ACCR option, approximately 71 spans, or 43%, of the 165 spans would violate GO 95 ground clearance requirements, with similar solutions as described above. From a structure loading perspective, approximately 52 (31%) of the structures would be overloaded in some form or another, primarily the deadend (71%) and angle (33%) types, with approximately 20% of the angle structures experiencing overload conditions. Typical solutions for these conditions would also be similar to those described above.

For the double-bundled Dove 557 kcmil ACCR option, approximately 16 spans (10%) would violate the SCE ground clearance design requirements, with similar solutions as described above. From a structure loading perspective, approximately 54 (33%) of the structures would be overloaded in some form or another, primarily the deadend (71%) and angle (33%) types, with approximately 20% of the tangent structures experiencing overload conditions. Typical solutions for these conditions would also be similar to those described above.

For the double-bundled Drake 795 kcmil ACCR option, approximately 14 spans (8%) would violate the SCE ground clearance design requirements, with similar solutions as described above. From a structure loading perspective, approximately 74 (45%) of the structures would be overloaded in some form or another, primarily the deadend (82%) and angle (78%) types, with approximately 30% of the tangent structures experiencing overload conditions. Typical solutions for these conditions would also be similar to those described above.

For the double-bundled Curlew 1033 kcmil ACCR option, approximately 73 (44%) would violate the SCE ground clearance design requirements, with similar solutions as described above. From a structure loading perspective, approximately 93 (56%) of the structures would be overloaded in some form or another, primarily the angle (89%) and deadend (82%) types, with approximately 46% of the tangent structures experiencing overload conditions. Typical solutions for these conditions would also be similar to those described above.

In summary, as identified from the analysis of representative spans, the use of two circuits of any ACCR alternative would still require a combination of additional structures to be installed and structures to be replaced or reinforced in order to remedy conflicts with ground clearance or structure overloads. A change, at this time, from the Proposed Project to any ACCR alternative for the WOD Upgrade Project would significantly delay the Project’s operating date because it would result in changes to the tower placement designs and all related access and stub roads, structure construction work areas, and site grading activities. This modification would also impact material procurement and other critical path schedule activities. While SCE is not able to conduct a rigorous analysis of all potential schedule impacts as part of this response, due to limited available information related to the extent of the overall scope for a project alternative utilizing an ACCR conductor option, it is reasonable to expect that the overall project schedule would be extended by at least 12-24 months.

CONDUCTOR TYPE

STUDY AREAS = 13.5 MILES (12PSF WIND) & 5 MILES (18PSF WIND)

EVALUATED/STUDIED		Double-bundled 1033.5 kcmil ACSR		Single-conductor 1590 kcmil ACSR		Single-conductor Drake 795 ACCR		Single-conductor Bittern 1272 ACCR		Double-bundled Dove 557 ACCR		Double-bundled Drake 795 ACCR		Double-bundled Curlew 1033 ACCR		Existing Single 1033.5 kcmil ACSR	
		OPERATING TEMPERATURE															
		275 DEG F		275 DEG F		464 DEG F		464 DEG F		464 DEG F		464 DEG F		464 DEG F		275 DEG F	
SPANS ENCROACHING BELOW 32'-VERTICAL GROUND CLEARANCE	# OF SPANS	VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS	
		COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%
	72	35	49%	42	58%	4	6%	31	43%	7	10%	6	8%	32	44%	31	43%
STRUCTURE TYPES	# OF STR.	STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD	
		COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%
TANGENT (WC/NE/O)	46	21	46%	9	20%	8	17%	9	20%	10	22%	14	30%	21	46%	3	7%
ANGLE (WB/WF)	9	8	89%	1	11%	3	33%	3	33%	3	33%	7	78%	8	89%	0	0%
DEADEND (WY/P/Q)	17	14	82%	12	71%	12	71%	12	71%	12	71%	14	82%	14	82%	7	41%
Total	72	43	60%	22	31%	23	32%	24	33%	25	35%	35	49%	43	60%	10	14%

EXISTING TRANSMISSION LINE = 45 MILES OF DOUBLE-CIRCUIT 220kV STEEL LATTICE TOWER

ANTICIPATED/POTENTIAL		Double-bundled 1033.5 kcmil ACSR		Single-conductor 1590 kcmil ACSR		Single-conductor Drake 795 ACCR		Single-conductor Bittern 1272 ACCR		Double-bundled Dove 557 ACCR		Double-bundled Drake 795 ACCR		Double-bundled Curlew 1033 ACCR		Existing Single 1033.5 kcmil ACSR	
		OPERATING TEMPERATURE															
		275 DEG F		275 DEG F		464 DEG F		464 DEG F		464 DEG F		464 DEG F		464 DEG F		275 DEG F	
SPANS ENCROACHING BELOW 32'-VERTICAL GROUND CLEARANCE	# OF SPANS	VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS		VIOLATIONS	
		COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%
	165	80	49%	96	58%	9	6%	71	43%	16	10%	14	8%	73	44%	71	43%
STRUCTURE TYPES	# OF STR.	STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD		STRUCTURE OVERLOAD	
		COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%	COUNT	%
TANGENT (WC/NE/O)	119	54	46%	23	20%	21	17%	23	20%	26	22%	36	30%	54	46%	8	7%
ANGLE (WB/WF)	11	10	89%	1	11%	4	33%	4	33%	4	33%	9	78%	10	89%	0	0%
DEADEND (WY/P/Q)	35	29	82%	25	71%	25	71%	25	71%	25	71%	29	82%	29	82%	14	41%
Total	165	93	56%	49	30%	50	30%	52	31%	55	33%	74	45%	93	56%	22	13%

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19c.1:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(C) Please provide the following information:

1. Provide a list of the ruling spans for the existing double-circuit line.

Response to Question ALT-19c.1:

The requested ruling span information is incorporated into the Sag/Ten reports attached in SCE’s responses to Data Request Questions No. ALT-18.C and ALT-19.C.2.b.

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19c.2a:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(C) Please provide the following information:

2. Provide Sag/Ten charts for the set of ruling spans identified in response to (C)(1) above for the existing line, and for the conductor types listed in (a) and (b) below. For the Sag/Ten information that SCE develops, use SCE standard conditions. For the HTLS conductors, also include high temperatures for normal and emergency conditions (210 degrees and 240 degrees)
    a. SCE standard conductors (1033.5 and 1590 kcmil ACSR);

Response to Question ALT-19c.2a:

The requested Sag/Ten reports for these two conductor types are included in SCE’s response to Data Request Question No. ALT-18.C.

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19c.2b:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(C) Please provide the following information:

2. Provide Sag/Ten charts for the set of ruling spans identified in response to (C)(1) above for the existing line, and for the conductor types listed in (a) and (b) below. For the Sag/Ten information that SCE develops, use SCE standard conditions. For the HTLS conductors, also include high temperatures for normal and emergency conditions (210 degrees and 240 degrees)
   b. Each of the 5 types of HTLS conductors identified in item (B).

Response to Question ALT-19c.2b:

The requested Sag/Ten reports are attached as requested.

Note 1: These reports include the information for 33 separate ruling spans that cover the full extent of the existing lines from just west of the West of Devers-Interim reactor station to Vista Substation (i.e., Segments 2 through 6), which is more than just the two study areas described in SCE's response to Data Request Question No. ALT-18.A, but do not include the spans from the San Bernardino Junction to San Bernardino Substation (i.e., Segment 1).

Note 2: Only four attachments are included, instead of the five requested, because the Sag/Ten report for single-conductor Drake 795 ACCR and the double-bundled Drake 795 ACCR contain the same results.

Southwire SAG10™

1/27/2015

SCE

DATA REQUEST 10-ALT19
SAG/TENSION TABLE - BITTERN 1272 ACCR (3M)

Conductor: 1272.0 Kcmil 51/19 Stranding ACCR "BITTERN" (Custom SAG10 Cable Data)

Area = 1.0750 Sq. in Diameter = 1.350 in Weight = 1.325 lb/ft RTS = 38500 lb
Data from Chart No. 4-1000 (Custom SAG10 Cable Data)
English Units
Limits and Outputs in Average Tensions.

Span = 1165.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	20.21	13462	20.21	13462
25.0	0.00	0.00	0.00	1.325	18.64	12069	18.26	12320*
60.0	0.00	0.00	0.00	1.325	21.38	10530	20.23	11124
410.0	0.00	0.00	0.00	1.325	35.73	6316	35.73	6316
464.0	0.00	0.00	0.00	1.325	36.72	6146	36.72	6146

* Design Condition

Span = 1428.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	30.35	13475	30.35	13475*
25.0	0.00	0.00	0.00	1.325	28.54	11851	28.00	12080
60.0	0.00	0.00	0.00	1.325	31.68	10683	30.38	11139
410.0	0.00	0.00	0.00	1.325	48.67	6972	48.67	6972
464.0	0.00	0.00	0.00	1.325	49.79	6816	49.79	6816

* Design Condition

Span = 4119.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	255.99	13475	255.99	13475*
25.0	0.00	0.00	0.00	1.325	253.58	11250	252.46	11298

60.0	0.00	0.00	0.00	1.325	257.76	11073	256.02	11145
410.0	0.00	0.00	0.00	1.325	288.68	9926	288.68	9926
464.0	0.00	0.00	0.00	1.325	290.58	9863	290.58	9863

* Design Condition

Span = 1656.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	40.85	13475	40.85	13475*
25.0	0.00	0.00	0.00	1.325	38.89	11706	38.22	11908
60.0	0.00	0.00	0.00	1.325	42.27	10773	40.87	11140
410.0	0.00	0.00	0.00	1.325	61.30	7450	61.30	7450
464.0	0.00	0.00	0.00	1.325	62.53	7305	62.53	7305

* Design Condition

Span = 1384.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	28.51	13475	28.51	13475*
25.0	0.00	0.00	0.00	1.325	26.73	11885	26.22	12118
60.0	0.00	0.00	0.00	1.325	29.81	10663	28.53	11139
410.0	0.00	0.00	0.00	1.325	46.38	6871	46.38	6871
464.0	0.00	0.00	0.00	1.325	47.48	6713	47.48	6713

* Design Condition

Span = 1263.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	23.74	13475	23.74	13475*
25.0	0.00	0.00	0.00	1.325	22.07	11987	21.62	12233
60.0	0.00	0.00	0.00	1.325	24.96	10600	23.75	11138
410.0	0.00	0.00	0.00	1.325	40.34	6577	40.34	6577
464.0	0.00	0.00	0.00	1.325	41.38	6412	41.38	6412

* Design Condition

Span = 1434.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	30.61	13475	30.61	13475*
25.0	0.00	0.00	0.00	1.325	28.80	11847	28.25	12075

60.0	0.00	0.00	0.00	1.325	31.94	10686	30.63	11139
410.0	0.00	0.00	0.00	1.325	48.98	6986	48.98	6986
464.0	0.00	0.00	0.00	1.325	50.11	6830	50.11	6830

* Design Condition

Span = 1630.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	39.57	13475	39.57	13475*
25.0	0.00	0.00	0.00	1.325	37.63	11721	36.98	11926
60.0	0.00	0.00	0.00	1.325	40.98	10764	39.59	11140
410.0	0.00	0.00	0.00	1.325	59.79	7399	59.79	7399
464.0	0.00	0.00	0.00	1.325	61.01	7253	61.01	7253

* Design Condition

Span = 1596.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	37.93	13475	37.93	13475*
25.0	0.00	0.00	0.00	1.325	36.01	11740	35.38	11949
60.0	0.00	0.00	0.00	1.325	39.33	10752	37.96	11140
410.0	0.00	0.00	0.00	1.325	57.85	7331	57.85	7331
464.0	0.00	0.00	0.00	1.325	59.05	7184	59.05	7184

* Design Condition

Span = 1568.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	36.61	13475	36.61	13475*
25.0	0.00	0.00	0.00	1.325	34.70	11757	34.08	11970
60.0	0.00	0.00	0.00	1.325	38.00	10742	36.63	11140
410.0	0.00	0.00	0.00	1.325	56.27	7274	56.27	7274
464.0	0.00	0.00	0.00	1.325	57.46	7125	57.46	7125

* Design Condition

Span = 1286.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	24.61	13475	24.61	13475*
25.0	0.00	0.00	0.00	1.325	22.92	11966	22.46	12210

60.0	0.00	0.00	0.00	1.325	25.85	10612	24.63	11138
410.0	0.00	0.00	0.00	1.325	41.46	6634	41.46	6634
464.0	0.00	0.00	0.00	1.325	42.51	6471	42.51	6471

* Design Condition

Span = 1328.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	26.25	13475	26.25	13475*
25.0	0.00	0.00	0.00	1.325	24.52	11930	24.03	12170
60.0	0.00	0.00	0.00	1.325	27.51	10635	26.27	11138
410.0	0.00	0.00	0.00	1.325	43.54	6738	43.54	6738
464.0	0.00	0.00	0.00	1.325	44.62	6577	44.62	6577

* Design Condition

Span = 1557.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	36.10	13475	36.10	13475*
25.0	0.00	0.00	0.00	1.325	34.20	11764	33.58	11978
60.0	0.00	0.00	0.00	1.325	37.48	10737	36.12	11140
410.0	0.00	0.00	0.00	1.325	55.65	7252	55.65	7252
464.0	0.00	0.00	0.00	1.325	56.84	7102	56.84	7102

* Design Condition

Span = 1544.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	35.50	13475	35.50	13475*
25.0	0.00	0.00	0.00	1.325	33.60	11772	33.00	11988
60.0	0.00	0.00	0.00	1.325	36.87	10732	35.52	11140
410.0	0.00	0.00	0.00	1.325	54.93	7225	54.93	7225
464.0	0.00	0.00	0.00	1.325	56.11	7074	56.11	7074

* Design Condition

Span = 1823.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	49.53	13475	49.53	13475*
25.0	0.00	0.00	0.00	1.325	47.48	11624	46.75	11806

60.0	0.00	0.00	0.00	1.325	51.01	10825	49.55	11141
410.0	0.00	0.00	0.00	1.325	71.39	7757	71.39	7757
464.0	0.00	0.00	0.00	1.325	72.69	7620	72.69	7620

* Design Condition

Span = 1792.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	47.85	13475	47.85	13475*
25.0	0.00	0.00	0.00	1.325	45.82	11638	45.10	11823
60.0	0.00	0.00	0.00	1.325	49.32	10816	47.88	11141
410.0	0.00	0.00	0.00	1.325	69.47	7703	69.47	7703
464.0	0.00	0.00	0.00	1.325	70.75	7564	70.75	7564

* Design Condition

Span = 1868.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	52.01	13475	52.01	13475*
25.0	0.00	0.00	0.00	1.325	49.94	11605	49.19	11781
60.0	0.00	0.00	0.00	1.325	53.50	10837	52.03	11141
410.0	0.00	0.00	0.00	1.325	74.24	7834	74.24	7834
464.0	0.00	0.00	0.00	1.325	75.55	7699	75.55	7699

* Design Condition

Span = 1874.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	52.34	13475	52.34	13475*
25.0	0.00	0.00	0.00	1.325	50.28	11602	49.52	11778
60.0	0.00	0.00	0.00	1.325	53.84	10839	52.37	11141
410.0	0.00	0.00	0.00	1.325	74.62	7844	74.62	7844
464.0	0.00	0.00	0.00	1.325	75.94	7710	75.94	7710

* Design Condition

Span = 1609.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	38.56	13475	38.56	13475*
25.0	0.00	0.00	0.00	1.325	36.62	11733	35.98	11940

60.0	0.00	0.00	0.00	1.325	39.96	10757	38.58	11140
410.0	0.00	0.00	0.00	1.325	58.59	7358	58.59	7358
464.0	0.00	0.00	0.00	1.325	59.80	7210	59.80	7210

* Design Condition

Span = 527.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	4.38	12710	4.38	12710
25.0	0.00	0.00	0.00	1.325	3.78	12167	3.73	12320*
60.0	0.00	0.00	0.00	1.325	4.96	9279	4.44	10370
410.0	0.00	0.00	0.00	1.325	11.72	3931	11.72	3932
464.0	0.00	0.00	0.00	1.325	12.32	3742	12.32	3742

* Design Condition

Span = 1477.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	32.48	13475	32.48	13475*
25.0	0.00	0.00	0.00	1.325	30.63	11816	30.06	12040
60.0	0.00	0.00	0.00	1.325	33.82	10705	32.50	11139
410.0	0.00	0.00	0.00	1.325	51.27	7081	51.27	7081
464.0	0.00	0.00	0.00	1.325	52.42	6928	52.42	6928

* Design Condition

Span = 853.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	11.12	13113	11.12	13113
25.0	0.00	0.00	0.00	1.325	9.98	12086	9.79	12320*
60.0	0.00	0.00	0.00	1.325	12.06	10003	11.18	10788
410.0	0.00	0.00	0.00	1.325	22.85	5290	22.85	5290
464.0	0.00	0.00	0.00	1.325	23.66	5108	23.66	5108

* Design Condition

Span = 1199.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	21.39	13475	21.39	13475*
25.0	0.00	0.00	0.00	1.325	19.78	12048	19.38	12298
60.0	0.00	0.00	0.00	1.325	22.58	10562	21.41	11137

410.0	0.00	0.00	0.00	1.325	37.29	6410	37.29	6410
464.0	0.00	0.00	0.00	1.325	38.30	6242	38.30	6242

* Design Condition

Span = 2222.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	73.68	13475	73.68	13475*
25.0	0.00	0.00	0.00	1.325	71.50	11485	70.63	11625
60.0	0.00	0.00	0.00	1.325	75.27	10914	73.71	11143
410.0	0.00	0.00	0.00	1.325	98.47	8370	98.47	8370
464.0	0.00	0.00	0.00	1.325	99.92	8250	99.92	8250

* Design Condition

Span = 1045.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	16.41	13335	16.41	13335
25.0	0.00	0.00	0.00	1.325	15.00	12070	14.69	12320*
60.0	0.00	0.00	0.00	1.325	17.50	10346	16.45	11005
410.0	0.00	0.00	0.00	1.325	30.52	5946	30.52	5946
464.0	0.00	0.00	0.00	1.325	31.45	5772	31.45	5772

* Design Condition

Span = 1313.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	25.65	13475	25.65	13475*
25.0	0.00	0.00	0.00	1.325	23.94	11943	23.47	12184
60.0	0.00	0.00	0.00	1.325	26.91	10627	25.67	11138
410.0	0.00	0.00	0.00	1.325	42.79	6701	42.79	6701
464.0	0.00	0.00	0.00	1.325	43.86	6539	43.86	6539

* Design Condition

Span = 665.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	6.88	12881	6.88	12881
25.0	0.00	0.00	0.00	1.325	6.04	12123	5.95	12320*
60.0	0.00	0.00	0.00	1.325	7.63	9607	6.94	10551

410.0	0.00	0.00	0.00	1.325	16.13	4550	16.13	4551
464.0	0.00	0.00	0.00	1.325	16.83	4363	16.83	4364

* Design Condition

Span = 1145.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	19.55	13441	19.55	13441
25.0	0.00	0.00	0.00	1.325	18.01	12069	17.64	12320*
60.0	0.00	0.00	0.00	1.325	20.70	10501	19.58	11105
410.0	0.00	0.00	0.00	1.325	34.84	6256	34.84	6256
464.0	0.00	0.00	0.00	1.325	35.82	6086	35.82	6086

* Design Condition

Span = 972.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	14.29	13253	14.29	13253
25.0	0.00	0.00	0.00	1.325	12.97	12073	12.71	12320*
60.0	0.00	0.00	0.00	1.325	15.32	10223	14.33	10926
410.0	0.00	0.00	0.00	1.325	27.51	5707	27.51	5707
464.0	0.00	0.00	0.00	1.325	28.39	5530	28.39	5530

* Design Condition

Span = 972.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	14.29	13253	14.29	13253
25.0	0.00	0.00	0.00	1.325	12.97	12073	12.71	12320*
60.0	0.00	0.00	0.00	1.325	15.32	10223	14.33	10926
410.0	0.00	0.00	0.00	1.325	27.51	5707	27.51	5707
464.0	0.00	0.00	0.00	1.325	28.39	5530	28.39	5530

* Design Condition

Span = 962.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	14.01	13242	14.01	13242
25.0	0.00	0.00	0.00	1.325	12.70	12074	12.45	12320*
60.0	0.00	0.00	0.00	1.325	15.03	10205	14.06	10915
410.0	0.00	0.00	0.00	1.325	27.10	5673	27.10	5673

464.0	0.00	0.00	0.00	1.325	27.98	5496	27.98	5496

* Design Condition

Span = 674.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	7.06	12892	7.06	12892
25.0	0.00	0.00	0.00	1.325	6.21	12121	6.11	12320*
60.0	0.00	0.00	0.00	1.325	7.82	9627	7.13	10563
410.0	0.00	0.00	0.00	1.325	16.44	4588	16.44	4588
464.0	0.00	0.00	0.00	1.325	17.14	4401	17.14	4402

* Design Condition

Span = 356.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.602	2.03	12519	2.03	12519
25.0	0.00	0.00	0.00	1.325	1.72	12233	1.70	12320*
60.0	0.00	0.00	0.00	1.325	2.37	8851	2.07	10156
410.0	0.00	0.00	0.00	1.325	6.91	3043	6.91	3043
464.0	0.00	0.00	0.00	1.325	7.37	2854	7.37	2854

* Design Condition

Southwire SAG10™

1/27/2015

SCE

DATA REQUEST 10-ALT19
SAG/TENSION TABLE - CURLEW 1033 ACCR (3M)

Conductor: *1036.0 Kcmil 54/19 Stranding ACCR "CURLEW" (*SAG10 Conductor Designation)

Area = 0.9170 Sq. in   Diameter = 1.247 in   Weight = 1.134 lb/ft   RTS = 35600 lb
Data from Chart No. 4-1100
English Units
Limits and Outputs in Average Tensions.

Span = 1165.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	19.90	12000	19.90	12000*
25.0	0.00	0.00	0.00	1.134	18.12	10625	17.73	10860
60.0	0.00	0.00	0.00	1.134	20.78	9270	19.64	9807
410.0	0.00	0.00	0.00	1.134	34.25	5637	34.25	5637
464.0	0.00	0.00	0.00	1.134	35.29	5471	35.29	5471

* Design Condition

Span = 1428.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	29.92	12000	29.92	12000*
25.0	0.00	0.00	0.00	1.134	27.86	10391	27.30	10605
60.0	0.00	0.00	0.00	1.134	30.92	9366	29.61	9779
410.0	0.00	0.00	0.00	1.134	46.76	6209	46.76	6209
464.0	0.00	0.00	0.00	1.134	47.94	6057	47.94	6057

* Design Condition

Span = 4119.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	252.23	12000	252.23	12000*
25.0	0.00	0.00	0.00	1.134	249.48	9782	248.32	9826
60.0	0.00	0.00	0.00	1.134	253.56	9629	251.77	9695

410.0	0.00	0.00	0.00	1.134	281.34	8708	281.34	8708
464.0	0.00	0.00	0.00	1.134	283.31	8650	283.31	8650

* Design Condition

Span = 1656.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	40.26	12000	40.26	12000*
25.0	0.00	0.00	0.00	1.134	38.03	10243	37.34	10432
60.0	0.00	0.00	0.00	1.134	41.34	9427	39.92	9761
410.0	0.00	0.00	0.00	1.134	58.99	6623	58.99	6623
464.0	0.00	0.00	0.00	1.134	60.28	6483	60.28	6483

* Design Condition

Span = 1384.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	28.10	12000	28.10	12000*
25.0	0.00	0.00	0.00	1.134	26.08	10425	25.55	10643
60.0	0.00	0.00	0.00	1.134	29.08	9352	27.80	9783
410.0	0.00	0.00	0.00	1.134	44.55	6121	44.55	6121
464.0	0.00	0.00	0.00	1.134	45.71	5966	45.71	5966

* Design Condition

Span = 1263.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	23.40	12000	23.40	12000*
25.0	0.00	0.00	0.00	1.134	21.50	10528	21.04	10758
60.0	0.00	0.00	0.00	1.134	24.32	9310	23.11	9795
410.0	0.00	0.00	0.00	1.134	38.71	5863	38.71	5863
464.0	0.00	0.00	0.00	1.134	39.81	5702	39.81	5702

* Design Condition

Span = 1434.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	30.17	12000	30.17	12000*
25.0	0.00	0.00	0.00	1.134	28.11	10386	27.54	10599
60.0	0.00	0.00	0.00	1.134	31.17	9368	29.86	9778
410.0	0.00	0.00	0.00	1.134	47.06	6220	47.06	6220

464.0	0.00	0.00	0.00	1.134	48.25	6069	48.25	6069

* Design Condition

Span = 1630.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	39.00	12000	39.00	12000*
25.0	0.00	0.00	0.00	1.134	36.79	10258	36.11	10449
60.0	0.00	0.00	0.00	1.134	40.07	9421	38.67	9762
410.0	0.00	0.00	0.00	1.134	57.53	6579	57.53	6579
464.0	0.00	0.00	0.00	1.134	58.81	6438	58.81	6438

* Design Condition

Span = 1596.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	37.39	12000	37.39	12000*
25.0	0.00	0.00	0.00	1.134	35.20	10278	34.54	10473
60.0	0.00	0.00	0.00	1.134	38.45	9413	37.06	9765
410.0	0.00	0.00	0.00	1.134	55.64	6521	55.64	6521
464.0	0.00	0.00	0.00	1.134	56.91	6377	56.91	6377

* Design Condition

Span = 1568.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	36.09	12000	36.09	12000*
25.0	0.00	0.00	0.00	1.134	33.92	10295	33.27	10493
60.0	0.00	0.00	0.00	1.134	37.14	9406	35.76	9767
410.0	0.00	0.00	0.00	1.134	54.11	6471	54.11	6471
464.0	0.00	0.00	0.00	1.134	55.36	6326	55.36	6326

* Design Condition

Span = 1286.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	24.26	12000	24.26	12000*
25.0	0.00	0.00	0.00	1.134	22.34	10508	21.86	10735
60.0	0.00	0.00	0.00	1.134	25.20	9318	23.97	9793
410.0	0.00	0.00	0.00	1.134	39.79	5914	39.79	5914
464.0	0.00	0.00	0.00	1.134	40.90	5754	40.90	5754

* Design Condition

Span = 1328.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.406	25.87	12000	25.87	12000*
25.0	0.00	0.00	0.00	1.134	23.91	10471	23.40	10694
60.0	0.00	0.00	0.00	1.134	26.83	9334	25.58	9789
410.0	0.00	0.00	0.00	1.134	41.80	6004	41.80	6004
464.0	0.00	0.00	0.00	1.134	42.93	5847	42.93	5847

* Design Condition

Span = 1557.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.406	35.58	12000	35.58	12000*
25.0	0.00	0.00	0.00	1.134	33.42	10302	32.78	10502
60.0	0.00	0.00	0.00	1.134	36.63	9403	35.25	9768
410.0	0.00	0.00	0.00	1.134	53.52	6451	53.52	6451
464.0	0.00	0.00	0.00	1.134	54.76	6306	54.76	6306

* Design Condition

Span = 1544.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.406	34.99	12000	34.99	12000*
25.0	0.00	0.00	0.00	1.134	32.83	10310	32.20	10511
60.0	0.00	0.00	0.00	1.134	36.03	9399	34.66	9769
410.0	0.00	0.00	0.00	1.134	52.82	6428	52.82	6428
464.0	0.00	0.00	0.00	1.134	54.06	6282	54.06	6282

* Design Condition

Span = 1823.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.406	48.82	12000	48.82	12000*
25.0	0.00	0.00	0.00	1.134	46.49	10160	45.72	10329
60.0	0.00	0.00	0.00	1.134	49.94	9462	48.45	9750
410.0	0.00	0.00	0.00	1.134	68.78	6888	68.78	6888
464.0	0.00	0.00	0.00	1.134	70.15	6756	70.15	6756

* Design Condition

Span = 1792.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	47.16	12000	47.16	12000*
25.0	0.00	0.00	0.00	1.134	44.85	10174	44.10	10347
60.0	0.00	0.00	0.00	1.134	48.28	9456	46.81	9752
410.0	0.00	0.00	0.00	1.134	66.91	6841	66.91	6841
464.0	0.00	0.00	0.00	1.134	68.26	6707	68.26	6707

* Design Condition

Span = 1868.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	51.26	12000	51.26	12000*
25.0	0.00	0.00	0.00	1.134	48.91	10140	48.13	10305
60.0	0.00	0.00	0.00	1.134	52.39	9470	50.90	9747
410.0	0.00	0.00	0.00	1.134	71.54	6954	71.54	6954
464.0	0.00	0.00	0.00	1.134	72.93	6824	72.93	6824

* Design Condition

Span = 1874.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	51.59	12000	51.59	12000*
25.0	0.00	0.00	0.00	1.134	49.24	10138	48.45	10302
60.0	0.00	0.00	0.00	1.134	52.73	9471	51.23	9747
410.0	0.00	0.00	0.00	1.134	71.92	6963	71.92	6963
464.0	0.00	0.00	0.00	1.134	73.30	6833	73.30	6833

* Design Condition

Span = 1609.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	38.00	12000	38.00	12000*
25.0	0.00	0.00	0.00	1.134	35.80	10270	35.14	10464
60.0	0.00	0.00	0.00	1.134	39.07	9416	37.67	9764
410.0	0.00	0.00	0.00	1.134	56.36	6543	56.36	6543
464.0	0.00	0.00	0.00	1.134	57.63	6400	57.63	6400

* Design Condition

Span = 527.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	4.15	11754	4.15	11754
25.0	0.00	0.00	0.00	1.134	3.50	11255	3.46	11392*
60.0	0.00	0.00	0.00	1.134	4.56	8645	4.08	9656
410.0	0.00	0.00	0.00	1.134	10.99	3590	10.98	3590
464.0	0.00	0.00	0.00	1.134	11.61	3396	11.61	3396

* Design Condition

Span = 1477.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	32.01	12000	32.01	12000*
25.0	0.00	0.00	0.00	1.134	29.91	10355	29.32	10564
60.0	0.00	0.00	0.00	1.134	33.03	9381	31.69	9775
410.0	0.00	0.00	0.00	1.134	49.28	6304	49.28	6304
464.0	0.00	0.00	0.00	1.134	50.48	6154	50.48	6154

* Design Condition

Span = 853.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	10.66	12000	10.66	12000*
25.0	0.00	0.00	0.00	1.134	9.37	11015	9.18	11237
60.0	0.00	0.00	0.00	1.134	11.34	9105	10.48	9850
410.0	0.00	0.00	0.00	1.134	21.58	4792	21.58	4793
464.0	0.00	0.00	0.00	1.134	22.44	4609	22.44	4610

* Design Condition

Span = 1199.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	21.08	12000	21.08	12000*
25.0	0.00	0.00	0.00	1.134	19.26	10590	18.85	10824
60.0	0.00	0.00	0.00	1.134	21.98	9285	20.81	9803
410.0	0.00	0.00	0.00	1.134	35.77	5718	35.77	5718
464.0	0.00	0.00	0.00	1.134	36.83	5553	36.83	5553

* Design Condition

Span = 2222.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	72.62	12000	72.62	12000*
25.0	0.00	0.00	0.00	1.134	70.13	10019	69.23	10149
60.0	0.00	0.00	0.00	1.134	73.82	9522	72.23	9730
410.0	0.00	0.00	0.00	1.134	95.12	7412	95.12	7412
464.0	0.00	0.00	0.00	1.134	96.63	7297	96.63	7297

* Design Condition

Span = 1045.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	16.01	12000	16.01	12000*
25.0	0.00	0.00	0.00	1.134	14.40	10760	14.09	10997
60.0	0.00	0.00	0.00	1.134	16.82	9214	15.77	9822
410.0	0.00	0.00	0.00	1.134	29.10	5337	29.10	5337
464.0	0.00	0.00	0.00	1.134	30.07	5164	30.07	5164

* Design Condition

Span = 1313.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	25.29	12000	25.29	12000*
25.0	0.00	0.00	0.00	1.134	23.34	10484	22.85	10709
60.0	0.00	0.00	0.00	1.134	26.24	9328	25.00	9790
410.0	0.00	0.00	0.00	1.134	41.08	5972	41.08	5972
464.0	0.00	0.00	0.00	1.134	42.20	5814	42.20	5814

* Design Condition

Span = 665.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	6.52	11917	6.52	11917
25.0	0.00	0.00	0.00	1.134	5.59	11211	5.50	11392*
60.0	0.00	0.00	0.00	1.134	7.05	8902	6.40	9798
410.0	0.00	0.00	0.00	1.134	15.14	4150	15.13	4152
464.0	0.00	0.00	0.00	1.134	15.87	3960	15.86	3961

* Design Condition

Span = 1145.0 Feet

Special Load Zone

Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	19.22	12000	19.22	12000*
25.0	0.00	0.00	0.00	1.134	17.47	10646	17.09	10882
60.0	0.00	0.00	0.00	1.134	20.09	9261	18.97	9809
410.0	0.00	0.00	0.00	1.134	33.36	5589	33.36	5589
464.0	0.00	0.00	0.00	1.134	34.40	5422	34.40	5422

* Design Condition

Span = 972.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	13.85	12000	13.85	12000*
25.0	0.00	0.00	0.00	1.134	12.35	10852	12.09	11086
60.0	0.00	0.00	0.00	1.134	14.61	9176	13.63	9832
410.0	0.00	0.00	0.00	1.134	26.13	5140	26.13	5140
464.0	0.00	0.00	0.00	1.134	27.07	4963	27.07	4963

* Design Condition

Span = 972.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	13.85	12000	13.85	12000*
25.0	0.00	0.00	0.00	1.134	12.35	10852	12.09	11086
60.0	0.00	0.00	0.00	1.134	14.61	9176	13.63	9832
410.0	0.00	0.00	0.00	1.134	26.13	5140	26.13	5140
464.0	0.00	0.00	0.00	1.134	27.07	4963	27.07	4963

* Design Condition

Span = 962.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.406	13.57	12000	13.57	12000*
25.0	0.00	0.00	0.00	1.134	12.08	10865	11.83	11098
60.0	0.00	0.00	0.00	1.134	14.32	9170	13.35	9834
410.0	0.00	0.00	0.00	1.134	25.74	5112	25.74	5112
464.0	0.00	0.00	0.00	1.134	26.67	4935	26.66	4935

* Design Condition

Span = 674.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.406	6.70	11927	6.70	11927
25.0	0.00	0.00	0.00	1.134	5.75	11209	5.65	11392*
60.0	0.00	0.00	0.00	1.134	7.22	8918	6.57	9807
410.0	0.00	0.00	0.00	1.134	15.42	4185	15.42	4186
464.0	0.00	0.00	0.00	1.134	16.16	3994	16.15	3995

* Design Condition

Span = 356.0 Feet　　Special Load Zone
Creep is NOT a Factor　　Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.406	1.92	11574	1.92	11574
25.0	0.00	0.00	0.00	1.134	1.59	11316	1.58	11392*
60.0	0.00	0.00	0.00	1.134	2.16	8325	1.89	9494
410.0	0.00	0.00	0.00	1.134	6.46	2785	6.46	2785
464.0	0.00	0.00	0.00	1.134	6.94	2591	6.94	2591

* Design Condition

Southwire SAG10™

1/27/2015

SCE

DATA REQUEST 10-ALT19
SAG/TENSION TABLE - DOVE 557 ACCR (3M)

Conductor: *573.0 Kcmil 26/ 7 Stranding ACCR "DOVE" (*SAG10 Conductor Designation)

Area = 0.5240 Sq. in Diameter = 0.941 in Weight = 0.650 lb/ft RTS = 23100 lb
Data from Chart No. 4-1200
English Units
Limits and Outputs in Average Tensions.

Span = 1165.0 Feet Special Load Zone
Creep is NOT a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	18.98	8085	18.98	8085*
25.0	0.00	0.00	0.00	0.650	16.14	6837	15.59	7078
60.0	0.00	0.00	0.00	0.650	18.73	5893	17.39	6347
410.0	0.00	0.00	0.00	0.650	32.26	3429	32.26	3429
464.0	0.00	0.00	0.00	0.650	33.36	3316	33.36	3317

* Design Condition

Span = 1428.0 Feet Special Load Zone
Creep is NOT a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	28.53	8085	28.53	8085*
25.0	0.00	0.00	0.00	0.650	25.18	6587	24.34	6814
60.0	0.00	0.00	0.00	0.650	28.24	5875	26.61	6234
410.0	0.00	0.00	0.00	0.650	44.13	3769	44.13	3769
464.0	0.00	0.00	0.00	0.650	45.37	3666	45.37	3666

* Design Condition

Span = 4119.0 Feet Special Load Zone
Creep is NOT a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	240.18	8085	240.18	8085*
25.0	0.00	0.00	0.00	0.650	235.61	5927	233.74	5974
60.0	0.00	0.00	0.00	0.650	239.80	5827	237.32	5886

410.0	0.00	0.00	0.00	0.650	267.08	5248	267.08	5248
464.0	0.00	0.00	0.00	0.650	269.15	5209	269.15	5209

* Design Condition

Span = 1656.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	38.38	8085	38.38	8085*
25.0	0.00	0.00	0.00	0.650	34.73	6427	33.66	6630
60.0	0.00	0.00	0.00	0.650	38.08	5864	36.26	6157
410.0	0.00	0.00	0.00	0.650	55.74	4015	55.74	4015
464.0	0.00	0.00	0.00	0.650	57.10	3921	57.10	3921

* Design Condition

Span = 1384.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	26.79	8085	26.79	8085*
25.0	0.00	0.00	0.00	0.650	23.52	6624	22.73	6855
60.0	0.00	0.00	0.00	0.650	26.52	5878	24.93	6251
410.0	0.00	0.00	0.00	0.650	42.03	3717	42.03	3717
464.0	0.00	0.00	0.00	0.650	43.25	3612	43.25	3612

* Design Condition

Span = 1263.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	22.31	8085	22.31	8085*
25.0	0.00	0.00	0.00	0.650	19.26	6735	18.60	6974
60.0	0.00	0.00	0.00	0.650	22.05	5886	20.59	6302
410.0	0.00	0.00	0.00	0.650	36.49	3564	36.49	3564
464.0	0.00	0.00	0.00	0.650	37.65	3455	37.65	3455

* Design Condition

Span = 1434.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	28.77	8085	28.77	8085*
25.0	0.00	0.00	0.00	0.650	25.42	6582	24.57	6809
60.0	0.00	0.00	0.00	0.650	28.48	5875	26.85	6232
410.0	0.00	0.00	0.00	0.650	44.42	3776	44.42	3776

464.0	0.00	0.00	0.00	0.650	45.67	3673	45.67	3673

* Design Condition

Span = 1630.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	37.18	8085	37.18	8085*
25.0	0.00	0.00	0.00	0.650	33.56	6443	32.52	6649
60.0	0.00	0.00	0.00	0.650	36.88	5865	35.08	6165
410.0	0.00	0.00	0.00	0.650	54.35	3989	54.35	3989
464.0	0.00	0.00	0.00	0.650	55.70	3894	55.70	3894

* Design Condition

Span = 1596.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	35.65	8085	35.65	8085*
25.0	0.00	0.00	0.00	0.650	32.06	6465	31.06	6674
60.0	0.00	0.00	0.00	0.650	35.35	5866	33.57	6176
410.0	0.00	0.00	0.00	0.650	52.57	3954	52.57	3954
464.0	0.00	0.00	0.00	0.650	53.90	3858	53.90	3858

* Design Condition

Span = 1568.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	34.40	8085	34.40	8085*
25.0	0.00	0.00	0.00	0.650	30.86	6484	29.88	6696
60.0	0.00	0.00	0.00	0.650	34.11	5868	32.35	6185
410.0	0.00	0.00	0.00	0.650	51.11	3925	51.11	3925
464.0	0.00	0.00	0.00	0.650	52.43	3827	52.43	3827

* Design Condition

Span = 1286.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	23.13	8085	23.13	8085*
25.0	0.00	0.00	0.00	0.650	20.04	6712	19.35	6950
60.0	0.00	0.00	0.00	0.650	22.87	5884	21.38	6291
410.0	0.00	0.00	0.00	0.650	37.52	3594	37.52	3594
464.0	0.00	0.00	0.00	0.650	38.69	3486	38.69	3486

* Design Condition

Span = 1328.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	24.66	8085	24.66	8085*
25.0	0.00	0.00	0.00	0.650	21.50	6673	20.76	6909
60.0	0.00	0.00	0.00	0.650	24.40	5881	22.87	6274
410.0	0.00	0.00	0.00	0.650	39.42	3647	39.42	3647
464.0	0.00	0.00	0.00	0.650	40.62	3541	40.62	3541

* Design Condition

Span = 1557.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	33.92	8085	33.92	8085*
25.0	0.00	0.00	0.00	0.650	30.39	6491	29.42	6705
60.0	0.00	0.00	0.00	0.650	33.63	5868	31.88	6188
410.0	0.00	0.00	0.00	0.650	50.55	3913	50.55	3913
464.0	0.00	0.00	0.00	0.650	51.86	3815	51.86	3815

* Design Condition

Span = 1544.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	33.36	8085	33.36	8085*
25.0	0.00	0.00	0.00	0.650	29.84	6500	28.88	6715
60.0	0.00	0.00	0.00	0.650	33.06	5869	31.33	6193
410.0	0.00	0.00	0.00	0.650	49.88	3899	49.88	3899
464.0	0.00	0.00	0.00	0.650	51.19	3801	51.19	3801

* Design Condition

Span = 1823.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	46.54	8085	46.54	8085*
25.0	0.00	0.00	0.00	0.650	42.71	6337	41.51	6519
60.0	0.00	0.00	0.00	0.650	46.22	5857	44.28	6112
410.0	0.00	0.00	0.00	0.650	65.04	4173	65.04	4173
464.0	0.00	0.00	0.00	0.650	66.48	4083	66.48	4083

* Design Condition

Span = 1792.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	44.96	8085	44.96	8085*
25.0	0.00	0.00	0.00	0.650	41.16	6352	39.99	6538
60.0	0.00	0.00	0.00	0.650	44.65	5858	42.73	6120
410.0	0.00	0.00	0.00	0.650	63.27	4145	63.27	4145
464.0	0.00	0.00	0.00	0.650	64.69	4054	64.69	4054

* Design Condition

Span = 1868.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	48.87	8085	48.87	8085*
25.0	0.00	0.00	0.00	0.650	45.00	6315	43.77	6492
60.0	0.00	0.00	0.00	0.650	48.55	5856	46.59	6101
410.0	0.00	0.00	0.00	0.650	67.67	4212	67.67	4212
464.0	0.00	0.00	0.00	0.650	69.12	4124	69.12	4124

* Design Condition

Span = 1874.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	49.18	8085	49.18	8085*
25.0	0.00	0.00	0.00	0.650	45.31	6312	44.07	6489
60.0	0.00	0.00	0.00	0.650	48.86	5856	46.90	6100
410.0	0.00	0.00	0.00	0.650	68.02	4217	68.02	4217
464.0	0.00	0.00	0.00	0.650	69.48	4129	69.48	4129

* Design Condition

Span = 1609.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	36.23	8085	36.23	8085*
25.0	0.00	0.00	0.00	0.650	32.63	6457	31.61	6664
60.0	0.00	0.00	0.00	0.650	35.93	5866	34.14	6172
410.0	0.00	0.00	0.00	0.650	53.25	3968	53.25	3968
464.0	0.00	0.00	0.00	0.650	54.58	3871	54.58	3871

* Design Condition

Span = 527.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	4.07	7699	4.07	7699
25.0	0.00	0.00	0.00	0.650	3.10	7271	3.05	7392*
60.0	0.00	0.00	0.00	0.650	4.03	5600	3.59	6293
410.0	0.00	0.00	0.00	0.650	10.48	2156	10.46	2161
464.0	0.00	0.00	0.00	0.650	11.14	2029	11.11	2034

* Design Condition

Span = 1477.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	30.52	8085	30.52	8085*
25.0	0.00	0.00	0.00	0.650	27.10	6549	26.21	6771
60.0	0.00	0.00	0.00	0.650	30.23	5872	28.56	6216
410.0	0.00	0.00	0.00	0.650	46.52	3825	46.52	3825
464.0	0.00	0.00	0.00	0.650	47.79	3724	47.79	3724

* Design Condition

Span = 853.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	10.22	8040	10.22	8040
25.0	0.00	0.00	0.00	0.650	8.24	7181	8.00	7392*
60.0	0.00	0.00	0.00	0.650	10.06	5883	9.14	6468
410.0	0.00	0.00	0.00	0.650	20.34	2913	20.32	2917
464.0	0.00	0.00	0.00	0.650	21.24	2790	21.22	2793

* Design Condition

Span = 1199.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	20.10	8085	20.10	8085*
25.0	0.00	0.00	0.00	0.650	17.19	6800	16.60	7042
60.0	0.00	0.00	0.00	0.650	19.85	5890	18.47	6331
410.0	0.00	0.00	0.00	0.650	33.70	3477	33.70	3477
464.0	0.00	0.00	0.00	0.650	34.83	3365	34.82	3366

* Design Condition

Span = 2222.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	69.22	8085	69.22	8085*
25.0	0.00	0.00	0.00	0.650	65.11	6183	63.66	6322
60.0	0.00	0.00	0.00	0.650	68.88	5846	66.75	6031
410.0	0.00	0.00	0.00	0.650	90.07	4483	90.07	4483
464.0	0.00	0.00	0.00	0.650	91.66	4406	91.66	4406

* Design Condition

Span = 1045.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	15.26	8085	15.26	8085*
25.0	0.00	0.00	0.00	0.650	12.73	6977	12.31	7215
60.0	0.00	0.00	0.00	0.650	15.04	5903	13.86	6408
410.0	0.00	0.00	0.00	0.650	27.38	3249	27.37	3250
464.0	0.00	0.00	0.00	0.650	28.42	3132	28.40	3133

* Design Condition

Span = 1313.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	24.11	8085	24.11	8085*
25.0	0.00	0.00	0.00	0.650	20.97	6687	20.25	6923
60.0	0.00	0.00	0.00	0.650	23.84	5882	22.33	6280
410.0	0.00	0.00	0.00	0.650	38.74	3628	38.74	3628
464.0	0.00	0.00	0.00	0.650	39.92	3522	39.92	3522

* Design Condition

Span = 665.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	6.37	7840	6.37	7840
25.0	0.00	0.00	0.00	0.650	4.97	7228	4.86	7392*
60.0	0.00	0.00	0.00	0.650	6.28	5720	5.65	6366
410.0	0.00	0.00	0.00	0.650	14.40	2499	14.38	2504
464.0	0.00	0.00	0.00	0.650	15.17	2373	15.14	2378

* Design Condition

Span = 1145.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	18.33	8085	18.33	8085*
25.0	0.00	0.00	0.00	0.650	15.54	6859	15.01	7101
60.0	0.00	0.00	0.00	0.650	18.09	5895	16.77	6357
410.0	0.00	0.00	0.00	0.650	31.42	3400	31.42	3401
464.0	0.00	0.00	0.00	0.650	32.52	3286	32.51	3287

* Design Condition

Span = 972.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	13.20	8085	13.20	8085*
25.0	0.00	0.00	0.00	0.650	10.86	7069	10.52	7301
60.0	0.00	0.00	0.00	0.650	13.00	5910	11.91	6447
410.0	0.00	0.00	0.00	0.650	24.58	3131	24.56	3133
464.0	0.00	0.00	0.00	0.650	25.57	3011	25.54	3013

* Design Condition

Span = 972.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	13.20	8085	13.20	8085*
25.0	0.00	0.00	0.00	0.650	10.86	7069	10.52	7301
60.0	0.00	0.00	0.00	0.650	13.00	5910	11.91	6447
410.0	0.00	0.00	0.00	0.650	24.58	3131	24.56	3133
464.0	0.00	0.00	0.00	0.650	25.57	3011	25.54	3013

* Design Condition

Span = 962.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	0.903	12.93	8085	12.93	8085*
25.0	0.00	0.00	0.00	0.650	10.62	7082	10.29	7312
60.0	0.00	0.00	0.00	0.650	12.73	5911	11.66	6453
410.0	0.00	0.00	0.00	0.650	24.20	3114	24.19	3117
464.0	0.00	0.00	0.00	0.650	25.18	2994	25.16	2996

* Design Condition

Span = 674.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	6.54	7849	6.54	7849
25.0	0.00	0.00	0.00	0.650	5.11	7225	4.99	7392*
60.0	0.00	0.00	0.00	0.650	6.45	5728	5.80	6370
410.0	0.00	0.00	0.00	0.650	14.67	2521	14.65	2525
464.0	0.00	0.00	0.00	0.650	15.45	2395	15.42	2399

* Design Condition

Span = 356.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	0.903	1.90	7545	1.90	7545
25.0	0.00	0.00	0.00	0.650	1.41	7327	1.39	7392*
60.0	0.00	0.00	0.00	0.650	1.89	5463	1.66	6214
410.0	0.00	0.00	0.00	0.650	6.18	1669	6.16	1674
464.0	0.00	0.00	0.00	0.650	6.68	1543	6.67	1547

* Design Condition

Southwire SAG10™

1/27/2015

SCE

DATA REQUEST 10-ALT19

SAG/TENSION TABLE - DRAKE 795 ACCR (3M)

Conductor: *824.0 Kcmil 26/19 Stranding ACCR "DRAKE" (*SAG10 Conductor Designation)

Area = 0.7510 Sq. in   Diameter = 1.128 in   Weight = 0.930 lb/ft   RTS = 32200 lb
Data from Chart No. 4-1300
English Units
Limits and Outputs in Average Tensions.

Span = 1165.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	18.02	11270	18.02	11270*
25.0	0.00	0.00	0.00	0.930	15.87	9950	15.46	10213
60.0	0.00	0.00	0.00	0.930	18.41	8577	17.18	9194
410.0	0.00	0.00	0.00	0.930	31.40	5040	31.39	5041
464.0	0.00	0.00	0.00	0.930	32.52	4866	32.51	4868

* Design Condition

Span = 1428.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	27.09	11270	27.09	11270*
25.0	0.00	0.00	0.00	0.930	24.53	9677	23.90	9932
60.0	0.00	0.00	0.00	0.930	27.55	8618	26.06	9108
410.0	0.00	0.00	0.00	0.930	42.87	5550	42.87	5550
464.0	0.00	0.00	0.00	0.930	44.14	5392	44.14	5392

* Design Condition

Span = 4119.0 Feet   Special Load Zone
Creep is NOT a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	227.82	11270	227.82	11270*
25.0	0.00	0.00	0.00	0.930	224.16	8903	222.63	8963
60.0	0.00	0.00	0.00	0.930	228.46	8739	226.19	8825

410.0	0.00	0.00	0.00	0.930	255.77	7830	255.77	7830
464.0	0.00	0.00	0.00	0.930	257.92	7767	257.92	7767

* Design Condition

Span = 1656.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	36.45	11270	36.45	11270*
25.0	0.00	0.00	0.00	0.930	33.62	9498	32.82	9730
60.0	0.00	0.00	0.00	0.930	36.95	8645	35.29	9049
410.0	0.00	0.00	0.00	0.930	54.06	5922	54.06	5922
464.0	0.00	0.00	0.00	0.930	55.45	5775	55.45	5775

* Design Condition

Span = 1384.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	25.44	11270	25.44	11270*
25.0	0.00	0.00	0.00	0.930	22.94	9718	22.35	9975
60.0	0.00	0.00	0.00	0.930	25.89	8612	24.44	9121
410.0	0.00	0.00	0.00	0.930	40.84	5471	40.84	5471
464.0	0.00	0.00	0.00	0.930	42.09	5310	42.09	5310

* Design Condition

Span = 1263.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	21.18	11270	21.18	11270*
25.0	0.00	0.00	0.00	0.930	18.86	9840	18.37	10102
60.0	0.00	0.00	0.00	0.930	21.60	8594	20.27	9160
410.0	0.00	0.00	0.00	0.930	35.49	5242	35.49	5242
464.0	0.00	0.00	0.00	0.930	36.67	5074	36.67	5075

* Design Condition

Span = 1434.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	27.32	11270	27.32	11270*
25.0	0.00	0.00	0.00	0.930	24.75	9672	24.11	9926
60.0	0.00	0.00	0.00	0.930	27.78	8619	26.29	9107
410.0	0.00	0.00	0.00	0.930	43.15	5561	43.15	5561

464.0	0.00	0.00	0.00	0.930	44.42	5402	44.42	5402

* Design Condition

Span = 1630.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	35.31	11270	35.31	11270*
25.0	0.00	0.00	0.00	0.930	32.51	9516	31.72	9751
60.0	0.00	0.00	0.00	0.930	35.81	8643	34.17	9055
410.0	0.00	0.00	0.00	0.930	52.73	5882	52.73	5882
464.0	0.00	0.00	0.00	0.930	54.10	5734	54.10	5734

* Design Condition

Span = 1596.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	33.85	11270	33.85	11270*
25.0	0.00	0.00	0.00	0.930	31.09	9540	30.32	9779
60.0	0.00	0.00	0.00	0.930	34.34	8639	32.73	9063
410.0	0.00	0.00	0.00	0.930	51.00	5830	51.00	5830
464.0	0.00	0.00	0.00	0.930	52.36	5680	52.36	5680

* Design Condition

Span = 1568.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	32.67	11270	32.67	11270*
25.0	0.00	0.00	0.00	0.930	29.94	9561	29.20	9803
60.0	0.00	0.00	0.00	0.930	33.16	8636	31.56	9071
410.0	0.00	0.00	0.00	0.930	49.60	5785	49.60	5785
464.0	0.00	0.00	0.00	0.930	50.95	5634	50.95	5634

* Design Condition

Span = 1286.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	21.96	11270	21.96	11270*
25.0	0.00	0.00	0.00	0.930	19.61	9815	19.09	10077
60.0	0.00	0.00	0.00	0.930	22.39	8598	21.03	9152
410.0	0.00	0.00	0.00	0.930	36.48	5287	36.48	5287
464.0	0.00	0.00	0.00	0.930	37.68	5120	37.67	5121

*   Design Condition

Span = 1328.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.196	23.42	11270	23.42	11270*
25.0	0.00	0.00	0.00	0.930	21.00	9772	20.45	10033
60.0	0.00	0.00	0.00	0.930	23.86	8604	22.46	9139
410.0	0.00	0.00	0.00	0.930	38.32	5368	38.32	5368
464.0	0.00	0.00	0.00	0.930	39.54	5204	39.54	5204

*   Design Condition

Span = 1557.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.196	32.21	11270	32.21	11270*
25.0	0.00	0.00	0.00	0.930	29.49	9570	28.76	9812
60.0	0.00	0.00	0.00	0.930	32.70	8635	31.11	9073
410.0	0.00	0.00	0.00	0.930	49.06	5767	49.06	5767
464.0	0.00	0.00	0.00	0.930	50.39	5616	50.39	5616

*   Design Condition

Span = 1544.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.196	31.68	11270	31.68	11270*
25.0	0.00	0.00	0.00	0.930	28.97	9580	28.25	9824
60.0	0.00	0.00	0.00	0.930	32.16	8633	30.58	9077
410.0	0.00	0.00	0.00	0.930	48.42	5746	48.42	5746
464.0	0.00	0.00	0.00	0.930	49.75	5594	49.75	5594

*   Design Condition

Span = 1823.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
25.0	0.00	8.00	0.00	1.196	44.19	11270	44.19	11270*
25.0	0.00	0.00	0.00	0.930	41.21	9394	40.29	9607
60.0	0.00	0.00	0.00	0.930	44.71	8661	42.96	9013
410.0	0.00	0.00	0.00	0.930	63.01	6160	63.01	6160
464.0	0.00	0.00	0.00	0.930	64.48	6022	64.48	6022

*   Design Condition

Span = 1792.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	42.70	11270	42.70	11270*
25.0	0.00	0.00	0.00	0.930	39.74	9411	38.85	9628
60.0	0.00	0.00	0.00	0.930	43.22	8658	41.48	9020
410.0	0.00	0.00	0.00	0.930	61.30	6118	61.30	6118
464.0	0.00	0.00	0.00	0.930	62.76	5978	62.76	5978

* Design Condition

Span = 1868.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	46.40	11270	46.40	11270*
25.0	0.00	0.00	0.00	0.930	43.39	9369	42.44	9577
60.0	0.00	0.00	0.00	0.930	46.93	8665	45.15	9005
410.0	0.00	0.00	0.00	0.930	65.54	6220	65.54	6220
464.0	0.00	0.00	0.00	0.930	67.02	6084	67.02	6084

* Design Condition

Span = 1874.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	46.70	11270	46.70	11270*
25.0	0.00	0.00	0.00	0.930	43.68	9366	42.74	9573
60.0	0.00	0.00	0.00	0.930	47.23	8666	45.45	9004
410.0	0.00	0.00	0.00	0.930	65.88	6228	65.88	6228
464.0	0.00	0.00	0.00	0.930	67.37	6092	67.37	6092

* Design Condition

Span = 1609.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	34.41	11270	34.41	11270*
25.0	0.00	0.00	0.00	0.930	31.63	9531	30.86	9768
60.0	0.00	0.00	0.00	0.930	34.90	8640	33.27	9060
410.0	0.00	0.00	0.00	0.930	51.66	5850	51.66	5850
464.0	0.00	0.00	0.00	0.930	53.02	5701	53.02	5701

* Design Condition

Span = 527.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	3.91	10633	3.91	10633
25.0	0.00	0.00	0.00	0.930	3.17	10174	3.13	10304*
60.0	0.00	0.00	0.00	0.930	4.12	7834	3.67	8796
410.0	0.00	0.00	0.00	0.930	10.30	3141	10.28	3144
464.0	0.00	0.00	0.00	0.930	10.96	2950	10.95	2953

* Design Condition

Span = 1477.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	28.98	11270	28.98	11270*
25.0	0.00	0.00	0.00	0.930	26.36	9635	25.69	9885
60.0	0.00	0.00	0.00	0.930	29.45	8625	27.92	9095
410.0	0.00	0.00	0.00	0.930	45.17	5635	45.17	5635
464.0	0.00	0.00	0.00	0.930	46.47	5479	46.47	5479

* Design Condition

Span = 853.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	9.89	11004	9.89	11004
25.0	0.00	0.00	0.00	0.930	8.39	10080	8.21	10304*
60.0	0.00	0.00	0.00	0.930	10.22	8278	9.35	9048
410.0	0.00	0.00	0.00	0.930	20.05	4228	20.03	4232
464.0	0.00	0.00	0.00	0.930	20.97	4043	20.95	4047

* Design Condition

Span = 1199.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	19.09	11270	19.09	11270*
25.0	0.00	0.00	0.00	0.930	16.88	9911	16.44	10174
60.0	0.00	0.00	0.00	0.930	19.49	8583	18.22	9182
410.0	0.00	0.00	0.00	0.930	32.79	5112	32.79	5112
464.0	0.00	0.00	0.00	0.930	33.94	4940	33.93	4941

* Design Condition

Span = 2222.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	65.72	11270	65.72	11270*
25.0	0.00	0.00	0.00	0.930	62.49	9214	61.36	9382
60.0	0.00	0.00	0.00	0.930	66.29	8689	64.36	8948
410.0	0.00	0.00	0.00	0.930	87.04	6635	87.04	6635
464.0	0.00	0.00	0.00	0.930	88.67	6514	88.67	6514

* Design Condition

Span = 1045.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	14.56	11223	14.56	11223
25.0	0.00	0.00	0.00	0.930	12.64	10049	12.33	10304*
60.0	0.00	0.00	0.00	0.930	14.92	8513	13.82	9192
410.0	0.00	0.00	0.00	0.930	26.74	4760	26.73	4762
464.0	0.00	0.00	0.00	0.930	27.79	4581	27.77	4584

* Design Condition

Span = 1313.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	22.90	11270	22.90	11270*
25.0	0.00	0.00	0.00	0.930	20.50	9787	19.96	10049
60.0	0.00	0.00	0.00	0.930	23.33	8602	21.94	9143
410.0	0.00	0.00	0.00	0.930	37.66	5339	37.66	5339
464.0	0.00	0.00	0.00	0.930	38.87	5174	38.87	5174

* Design Condition

Span = 665.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	6.13	10786	6.13	10786
25.0	0.00	0.00	0.00	0.930	5.08	10129	4.99	10304*
60.0	0.00	0.00	0.00	0.930	6.41	8026	5.78	8901
410.0	0.00	0.00	0.00	0.930	14.17	3634	14.16	3638
464.0	0.00	0.00	0.00	0.930	14.95	3445	14.94	3449

* Design Condition

Span = 1145.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	17.41	11270	17.41	11270*
25.0	0.00	0.00	0.00	0.930	15.29	9974	14.90	10236
60.0	0.00	0.00	0.00	0.930	17.79	8573	16.58	9201
410.0	0.00	0.00	0.00	0.930	30.59	4997	30.58	4998
464.0	0.00	0.00	0.00	0.930	31.70	4822	31.69	4824

* Design Condition

Span = 972.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	12.69	11141	12.69	11141
25.0	0.00	0.00	0.00	0.930	10.92	10059	10.66	10304*
60.0	0.00	0.00	0.00	0.930	13.04	8427	12.03	9138
410.0	0.00	0.00	0.00	0.930	24.12	4566	24.10	4568
464.0	0.00	0.00	0.00	0.930	25.12	4384	25.10	4388

* Design Condition

Span = 972.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	12.69	11141	12.69	11141
25.0	0.00	0.00	0.00	0.930	10.92	10059	10.66	10304*
60.0	0.00	0.00	0.00	0.930	13.04	8427	12.03	9138
410.0	0.00	0.00	0.00	0.930	24.12	4566	24.10	4568
464.0	0.00	0.00	0.00	0.930	25.12	4384	25.10	4388

* Design Condition

Span = 962.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	12.44	11129	12.44	11129
25.0	0.00	0.00	0.00	0.930	10.70	10060	10.45	10304*
60.0	0.00	0.00	0.00	0.930	12.79	8415	11.79	9131
410.0	0.00	0.00	0.00	0.930	23.76	4538	23.75	4541
464.0	0.00	0.00	0.00	0.930	24.76	4357	24.74	4360

* Design Condition

Span = 674.0 Feet — Special Load Zone
Creep is NOT a Factor — Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	6.29	10797	6.29	10797
25.0	0.00	0.00	0.00	0.930	5.22	10127	5.13	10304*
60.0	0.00	0.00	0.00	0.930	6.57	8039	5.93	8908
410.0	0.00	0.00	0.00	0.930	14.44	3665	14.42	3669
464.0	0.00	0.00	0.00	0.930	15.22	3476	15.21	3480

* Design Condition

Span = 356.0 Feet
Creep is NOT a Factor

Special Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
25.0	0.00	8.00	0.00	1.196	1.81	10468	1.81	10468
25.0	0.00	0.00	0.00	0.930	1.44	10234	1.43	10304*
60.0	0.00	0.00	0.00	0.930	1.94	7607	1.70	8680
410.0	0.00	0.00	0.00	0.930	6.05	2437	6.05	2438
464.0	0.00	0.00	0.00	0.930	6.57	2246	6.57	2247

* Design Condition

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19d:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)[1]

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(D) Please describe specific concerns, if any, about the interconnection of ACCR conductors into existing substations.

Response to Question ALT-19d:

There are no specific concerns about interconnecting ACCR conductors into existing substations. SCE typically separates the design efforts between the Transmission elements and the Substation elements at the deadend rack. Because the use of high-temperature low-sag (HTLS) conductors is not necessary to connect the equipment within the substation line position, SCE expects that the use of any selected ACCR conductors would terminate at the deadend racks and that connecting hardware would be sufficiently available to connect those conductors to the standard substation conductors/hardware that is rated for similar ampacity.

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19e.1a:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(E) For SCE's standard double-circuit tower family please provide the following:

1. For angle and deadend structures, provide the maximum design line tension at each phase attachment point.
    a. Stipulate whether these tensions are factored working loads or un-factored loads.

Response to Question ALT-19e.1a:

The maximum design line tensions for SCE's standard double-circuit tower families are provided in the attachment titled "Existing Tower Loading Diagrams_Trees.pdf." The W-series towers are typical for those structures found in Segments 3 through 6, while the N-O-P-Q-series towers are found in Segments 1 and 2.

The tensions provided in this table are un-factored.

WODUP Project
Existing Tower Loading Diagrams/Trees

TOWER TYPE	WY Tower - DEADEND		WC Tower - TANGENT </= 2.5°/ANGLE >2.5°		WB Tower - TANGENT </=2.5°/ANGLE >2.5°		WF Tower - ANGLE </=20 °	P Tower - DEADEND 52°		Q Tower - DEADEND 100°		O Tower - TANGENT		N/NE Tower - TANGENT </=2.5°	
LOADING CASE	Case 1	Case 2	Case 1	Case 2 (Note 1)	Case 1	Case 2 (Note 2)	Case 1	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2 (Note 3)	Case 1	Case 2 (Note 4)
ALLOWABLE LOADS, per phase (LBS.)	**CONDUCTOR**														
Longitudinal	24,000	21,600	0	16,000	0	16,000	0	12,000	10,800	12,000	7,700	0	8,000	0	8,000
Transverse	1,700	12,300	4,400	2,750	4,400	2,200	10,000	830	6,000	830	9,750	1,400	700	2,800	1,400
Vertical	6,800	6,800	9,000	5,500	9,000	5,000	9,000	1,750	1,750	1,750	1,750	2,400	1,200	3,000	1,600
ALLOWABLE LOADS, (LBS.)	**OVERHEAD GROUNDWIRE**														
Longitudinal	8,000	7,200	8,000	0	8,000	0	0	8,000	7,200	8,000	5,200	0	8,000	0	8,000
Transverse	500	4,000	875	1,400	700	1,400	3,300	330	3,800	330	6,300	800	400	1,400	700
Vertical	1,200	1,200	1,500	2,400	1,200	2,400	2,400	500	500	500	500	800	400	1,000	500

NOTES:
1-Loadings on one (1) phase only. Remaining phases not to exceed conductor loads in Case 1.
2-Loadings for two (2) phases only. Remaining phases not to exceed conductor loads in Case 1.
3-Loadings on one (1) phase or groundwire only. Remaining phases not to exceed conductor loads in Case 1.
4-Loadings for two (2) phases or groundwire only. Remaining phases not to exceed conductor loads in Case 1.

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19e.1b:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE’s response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the “Drake 795”-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE’s concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 “Curlew” ACCR has essentially the same diameter as 1033 “Curlew” ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project’s objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(E) For SCE's standard double-circuit tower family please provide the following:

1. For angle and deadend structures, provide the maximum design line tension at each phase attachment point.
    b. Indicate standard load factors used by SCE for structure loads.

Response to Question ALT-19e.1b:

SCE uses a value of 1.5 as a standard loading factor for steel structures.

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19e.2a:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(E) For SCE’s standard double-circuit tower family please provide the following:

2. For tangent structures, provide the maximum lateral wind design load in pounds at each phase attachment point.
    a. Stipulate if these loads are working loads or un-factored loads.

Response to Question ALT-19e.2a:

The information for tangent structures is provided in the attachment included in SCE’s response to Data Request Question No. ALT-19.E.1.a.

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19e.2b:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(E) For SCE's standard double-circuit tower family please provide the following:

2. For tangent structures, provide the maximum lateral wind design load in pounds at each phase attachment point.
    b. Indicate standard load factors used by SCE for structure loads.

Response to Question ALT-19e.2b:

SCE uses a value of 1.5 as a standard loading factor for steel structures.

Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-10

To: ENERGY DIVISION
Prepared by: Scott Lacy, P.E.
Title: Project Engineer
Dated: 12/05/2014

Question ALT-19f:

Follow-up to ALT-4 (Data Request No. 5, regarding potential use of Aluminum Conductor Composite Reinforced [ACCR]): SCE's response to ALT-4 provided the requested line sag and tension characteristics (Sag/Ten charts) for the "Drake 795"-sized ACSS and ACCR. We note that the response showed that the emergency-rating ampacity for these conductors is less than that of the proposed 1590 ACSR conductor. We recognize SCE's concerns about the potential reduced capacity of alternative technologies.

Background. High Temperature Low Sag (HTLS) options exist to the proposed 1590 ACSR conductors; these HTLS conductors are commercially available and need to be explored further for feasibility. HTLS conductors are a proven and accepted technology in the electric utility industry for upgrading capacity in existing corridors and on existing structures as well as for new line construction. Since HTLS conductors can normally operate at much higher temperatures it is possible to greatly increase power transfer capacity when compared to an equivalent ACSR type of conductor while maintaining clearances due to the low sag nature of HTLS conductors. For example ACCR conductor was first commercially installed in the United States in 2005 by Excel Energy and since that time it has been used domestically by multiple utilities such as Western Area Power Administration, Arizona Public Service, Silicon Valley Power, Alabama Power and Platte River Authority at voltages up to 230 kV and for critical generation tie lines. This type conductor is also used internationally by utilities like British Columbia Transmission Corporation and Shangai Power.

Because a high-performance conductor has less weight and lower thermal expansion, resulting in less sag for an equivalent strength and durability as ACSR conductor, an alternative conductor may be able to partially satisfy project objectives and simultaneously avoid the need to rebuild towers in the corridor. For example, 1033 "Curlew" ACCR has essentially the same diameter as 1033 "Curlew" ACSR, it weighs about 15% less but has a rated power transfer capacity that is 85% higher than ACSR.

Composite reinforced conductors are available in configurations and sizes that appear to achieve much if not all of the Proposed Project's objectives, especially if composite conductors are double-bundled. To avoid the impacts of rebuilding existing towers, using a high-performance conductor in lieu of the existing 1033.5 kcmil ACSR on the existing double-circuit 220 kV towers within the corridor appears to be feasible and warrants closer analysis.

Using these lighter-weight conductors on the existing double-circuit towers would increase the capacity of the circuits and postpone the impacts of rebuilding the towers as proposed. The

weight of the Drake 795 ACCR per linear-foot is about 70 percent as heavy as the existing 1033.5 kcmil ACSR used in the corridor. (ACSR and ACCR Weights and capacities derived from vendor technical properties fact sheets. Rated ampacity at 75o C for ACSR and 210o C for ACCR.)1

Data Requests. Please answer the following additional questions regarding the potential use of ACCR.

(F) For the existing line, identify whether the design with the existing conductor and structure combination meets the “new” SCE standard for wind loading of 18 psf. Provide this response for tangent, angle and deadend structures. If not identify at what span length and/or tension the existing conductor and structure combination exceeds the design limit.

Response to Question ALT-19f:

Please reference SCE’s response to Data Request Questions No. ALT-19.A and ALT-18.A.