Special Purpose Transmission Conductors

In addition to considering different sizes and strandings of standard conductors, the line designer may also want to consider the use of a number of non-standard conductors if their special properties offer sufficient advantage in a particular line design situation. The main types of special conductors include “self-damping conductor” (SDC), “aluminum conductor steel supported” (ACSS), “trapezoidal wire conductor” (TW - a conductor having aluminum strands with a trapezoidal shape rather than round), or “T2” conductor consisting of two sub conductors twisted about one another with a lay length of about 3 meters. Special conductors may be more economic, offer increased reliability, or provide a unique solution to an otherwise impossible design problem.

SDC - "Self-damping conductor"

Manufactured with a conventional stranded steel core, this conductor’s innermost layers of aluminum (and usually the outer layers) consist of trapezoidal strands sized such that a gap exists between the steel core and the innermost layer, even with the conductor under full tension. Under vibration, the steel core and the aluminum layers vibrate with different frequencies and impact damping results. This impact damping is sufficient to keep any Aeolian vibration to a low level. The use of trapezoidal strands also results in reduced conductor diameter for a given AC resistance per mile [km].

The major advantages are:

- High self-damping allows the use of higher unloaded tension levels resulting in reduced maximum sag and thus reduced structure height and/or fewer structures per mile [km].
- Reduced diameter for a given AC resistance yields reduced structure transverse wind and ice loading.

The major disadvantages are:

- There may be increased installation and clipping costs.
- The conductor design always requires the use of a steel core even in light loading areas.

TW – “Trapezoidal Wire”

This conductor is essentially similar to SDC conductor except that the gap between the layers is essentially eliminated. TW may also be manufactured without a steel core. It has none of SDC's self-damping properties but it presents a diameter, which is approximately 10% less than a standard ACSR conductor of the same AC resistance whereas SDC is only 5% less.

Table **Error! No text of specified style in document.**-1 - Comparison of AAC with AAC/TW

alternatives

Conductor Description	Diameter (in)	dc Resistance @20C (A/1000 ft)
Arbutus AAC	1.026 (100%)	0.0217 (100%)
Arbutus/TW	0.919 (89.5%)	0.0217 (100%)
Rainier/TW	1.00 (97.4%)	0.0188 (86.6%)

T2 - "Twisted 2 Conductor"

The conductor consists of two standard conductors twisted about one another with a twist length of approximately 3 meters. The conductor crossection is a rotating "figure-8". The sub conductors can be any type of standard conductor.

The major advantages are:

- The amplitude and frequency of occurrence of large amplitude "ice-galloping" motions are reduced or eliminated.
- The non-round shape of this conductor reduces the amplitude of aeolian vibration and the accompanying fatigue inducing strains near clamps. As a result, T2 conductor can be installed to higher tension levels and reduced sags.

The major disadvantages are:

- The non-round crossection yields wind and ice loadings which are about 11% higher than standard conductor of the same AC resistance per mile.
- The installation of, and hardware for this conductor, can be somewhat more expensive than standard conductor.

ACSS - "Aluminum Conductor Steel Supported"

This conductor appears to be similar to standard ACSR but the aluminum strands are fully annealed. Annealing the aluminum strands reduces the composite conductor strength but, after installation, permanent elongation of the aluminum strands results in a much larger percentage of the conductor tension being carried in the steel core than is true for standard ACSR. This in turn yields reduced composite thermal elongation and increased self-damping.

The major advantages of ACSS are as follows:

- Since the aluminum strands are "dead-soft" to begin with, the conductor may be operated at temperatures in excess of 200oC without loss of strength.

- Since the tension in the aluminum strands is normally low, the conductor's self-damping of Aeolian vibration is high and it may be installed at high unloaded tension levels without the need for separate Stockbridge dampers.

The major disadvantages of ACSS are:

- In areas experiencing heavy ice load, the reduced strength of this conductor relative to standard ACSR may make it less desirable.
- The softness of the annealed aluminum strands and the possible need for pre-stressing prior to clipping and sagging may raise installation costs.