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RL: 96-02-026BT

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file code:	240.0730
subject:	Gauging of Distribution Cables
type:	Recommendation Letter
date:	April 11, 1996
distribution list:	ND0, ND1, ND2, ND5
related letters:	None
other:	None
to:	Assistant Vice Presidents - Network, General Managers - Network
entities:	BellSouth Telecommunications
from:	Shirley L. Veal , Director - OSP Engineering Support Stan C. Thompson, Director - Transmission Engineering Suppor
description:	Provide procedures for gauging distribution cable.

* * *

This letter provides the Outside Plant Engineer procedures for determining the most economical gauge requirements for distribution cables. The impact of deploying new technologies such as Digital Loop Electronics (DLE) and fiber-fed multiplexers should have reduced the demand for 22 gauge cables. However, data collected for 1994 and 1995 indicates that BellSouth placed 6,864 sheath miles of 22 gauge cable at a cost of $40.2 Million (M) in 1994 and 5,892 sheath miles of 22 gauge cable at a cost of $36.5 M in 1995. The costs of the 22 gauge cable placements were 39% and 34% of the total costs for all cable placements by BellSouth in 1994 and 1995, repectively. Assuming 50 percent of the 22 gauge cable placed could have been 24 gauge, the potential

appeal

savings for down gauging would amount to $6.2 M in 1994 and $5.7 M in 1995.

The majority of feeder relief in the local loop is provided via fiber cable and DLE. The distribution copper cables in these areas are administered under the Carrier Serving Area (CSA) concept (Attachment A contains a definition and the gauge requirements for CSAs and Metallic CSAs). CSA design strives for ease of administration and consistent transmission characteristics within the CSA. Maximum loop lengths of 9 to 12 KF in CSAs establish the coarsest gauge of distribution cable needed at 24 gauge. Currently, CSA design is recommended for Distribution Areas (DA) with 100% DLE feeder facilities.

Changes to Gauging Rule

This letter authorizes the use of the Distribution Cable Gauge Selection Chart of Attachment B in place of Resistance design for gauge selection within DAs where the feeder facilities are not presently 100% DLE. This chart is in compliance with CSA design rules. For areas served in part or completely by physical feeder the following additional restrictions will apply:

1. **If an area is served partly or completely by copper without REGs, then gauge selection should not trigger REGs for any existing services.**
2. **If the area is served partly or completely by copper with REGs then the gauge should not violate the 2800 ohm range of the REGs.**

Attachment B contains a chart to aid the engineer with the determination of the proper gauge for proposed distribution cables. The chart is to be used in areas where the feeder facilities are not currently 100% DLE. In constructing the chart, starting with the 27.8 - 37.9 kf band, the assumption was made that the existing portion of the loop was 100% 22 gauge cable. Any existing coarser gauge of cable would have to be included in determining the proper gauge for the new cable. For example, if the existing loops in a cable to be replaced are in the 29.5 kf length range and composed of 27.5 kf of 22 gauge and 2.0 kf of 24 gauge cable, then an additional 2.0 kf section of 24 gauge cable could be placed without further calculations. PLRMS can be used to check loop make-ups and LFACS can be used to check loop make-ups to existing interfaces. Also, BSCAP (BellSouth Cable Analysis Program) is available on all LEIS processors. This program will calculate loss and cable make-up from data provided by the user. Instruction on the use of BSCAP can be found in RL: 90-03-025SV.

Resistance design (1500 ohms) and dB loss limits (8.0 dB for OSP cable only) were used in constructing the chart contained in Attachment B. While resistance design was the predominate factor controlling the last five bands of the chart, the dB loss limit becomes the controlling factor when using 26 gauge cable. For nonloaded 26 gauge cable, the 8.0 dB loss limit is exceeded before reaching the 1500 ohm limit.

Staff comments or questions may be directed to David M. Williams (OSPE) at (205) 977-2613 or Sabrina Calhoun (Transmission) at (205) 977-7698.

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Attachment A

Attachment B

Carrier Serving Areas

A Carrier Serving Area (CSA) is a distinct geographic area capable of being served by one theoretical DLC Remote Terminal site. The initial goal of the CSA concept was to sectionalize a cable route into discrete geographical units (CSAs) so that every customer along the route could be provided with the most restrictive digital service of that time (56 kb/sec DDS) over an unrepeatered facility when all the CSAs were activated. With this planning approach, the entire cable route beyond 12 kf from a central office is segmented into CSAs. When feeder relief is required in the cable route and if it is economical to use a DLC system to provide the relief, the pre-planned RT site and its serving area can be acti vated.

The boundaries of a CSA were determined by the following considerations:

A conservative determination of the maximum unrepeatered transmission range for the worst cas digital service, 56 kb/sec DDS.
The distance that currently available DLC systems could provide acceptable Message Telephone Service on unloaded cable pairs.

Based on these considerations, a CSA cable from the Remote Terminal of the DLC system to the net work interface on the customer's premises must meet the following requirements.

Nonloaded cable only.
Multi-gauge cable is restricted to two gauges (excluding short cable sections used for stubbing or fusing).
Total bridged tap length may not exceed 2.5 kilofeet (kf). No single bridged tap may exceed 2.0 kf.
The amount of 26 gauge cable (used alone or in combination with another gauge cable) may not exceed a total length of 9 kf including bridged tap.
For single gauge or multi-gauge cables containing only 19, 22 or 24 gauge cable, the total cable length including bridged tap may not exceed 12 kf.
The total cable length including bridged tap of a multi-gauge cable that contains 26 gauge cable may not exceed

$$12 - [(3 * L26)/[(9-LBTAP)]$$

where L26 is the total length of 26 gauge cable in the cable (excluding any 26 gauge bridged tap) and LBTAP is the total length of bridged tap in the cable. All lengths are in kilofeet (kf).

Metallic Carrier Serving Area (Metallic CSA)

A metallic CSA is an area surrounding the central office which meets the above CSA distance

require ments. Metallic cable loops that originate at the central office and whose make-ups meet CSA re quirements are considered CSA loops.

Distribution Cable Gauge Selection Chart

(For use in DAs where the feeder facilities are not 100% DLE)

Feeder + Distribution Cable Maximum Loop	Distribution Cable Gauge
0 - 14.6 KF	26 Gauge
14.7 - 27.7 KF	24 Gauge
27.8 - 37.9 KF	<4000 ft 24 Gauge *
38.0 - 43.9 KF	22 Gauge **
44.0 - 66.6 KF	< 4000 ft 24 Gauge *
66.7 KF >	22 Gauge **

Note: Starting with the 27.8 - 37.9 kF band 100% 22 gauge loop make-up is assumed.
Calculations were based on resistance characteristic of cable at 100 degrees Fahrenheit

* Cable placements up to 4,000 feet in length can be placed in these bands without additional calculations. Placements longer than 4,000 feet maybe placed if the maximum loop resistance is calculated and a REG is not triggered or the range of an existing REG is not exceeded.

** Short placements of 24 gauge cables in these sections can be justified with calculation of maximum loop resistance. These placements should not trigger additional REGs nor should they violate the range of any existing REGs.