COMPUTED STRUCTURAL RETURN LOSSES IN THE ECHO RANGE

EXCHANGE AREA FACILITIES

FACILITY TYPE		REFERENCE DEVIATION OF LOAD SPACING (PERCENT)										
		1	2	3	4	5	6	7	8	10	12	15
16	H175	24.0	22.4	20.5	18.9	17.3	16.0	14.8	13.7	12.0	10.4	8.6
19LC	"	26.1	24.5	22.6	21.0	19.4	18.1	16.9	15.8	14.1	12.5	10.7
16	H135	26.8	25.2	23.3	21.7	20.1	18.8	17.6	16.5	14.8	13.2	11.4
19LC	"	28.9	27.3	25.4	23.8	22.2	20.9	19.7	18.6	16.9	15.3	13.5
19HC	"	26.9	25.3	23.4	21.8	20.2	18.9	17.7	16.6	14.9	13.3	11.5
22	"	29.5	27.9	26.0	24.4	22.8	21.5	20.3	19.2	17.5	15.9	14.1
16	H88	30.2	28.6	26.7	25.1	23.5	22.2	21.0	19.9	18.2	16.6	14.8
19LC	"	32.5	30.9	29.0	27.4	25.8	24.5	23.3	22.2	20.5	18.9	17.1
19HC	"	31.4	29.8	27.9	26.3	24.7	23.4	22.2	21.1	19.4	17.8	16.0
22	"	33.8	32.2	30.3	28.7	27.1	25.8	24.6	23.5	21.8	20.2	18.4
24	"	34.8	33.2	31.3	29.7	28.1	26.8	25.6	24.5	22.8	21.2	19.4
26	"	36.5	34.9	33.0	31.4	29.8	28.5	27.3	26.2	24.5	22.9	21.1
16	H44	34.7	33.1	31.2	29.6	28.0	26.7	25.5	24.4	22.7	21.1	19.3
19LC	"	37.1	35.5	33.6	32.0	30.4	29.1	27.9	26.8	25.1	23.5	21.7
19HC	"	36.4	34.8	32.9	31.3	29.7	28.4	27.2	26.1	24.4	22.8	21.0
22	"	38.6	37.0	35.1	33.5	31.9	30.6	29.4	28.3	26.6	25.0	23.2
24	"	39.6	38.0	36.1	34.5	32.9	31.6	30.4	29.3	27.6	26.0	24.2
26	"	41.0	39.4	37.5	35.9	34.3	33.0	31.8	30.7	29.0	27.4	25.6
16	B88	28.3	27.4	26.1	24.8	23.5	22.4	21.3	20.3	18.6	17.2	15.4
19LC	"	30.9	30.0	28.7	27.4	26.1	25.0	23.9	22.9	21.2	19.8	18.0
19HC	"	29.9	29.0	27.7	26.4	25.1	24.0	22.9	21.9	20.2	18.8	17.0
22	"	31.7	30.8	29.5	28.2	26.9	25.8	24.7	23.7	22.0	20.6	18.8
24	"	32.9	32.0	30.7	29.4	28.1	27.0	25.9	24.9	23.2	21.8	20.0
26	"	34.9	34.0	32.7	31.4	30.1	29.0	27.9	26.9	25.2	23.8	22.0
16	B135	26.4	25.5	24.2	22.9	21.6	20.5	19.4	18.4	16.7	15.3	13.5
19LC	"	27.5	26.6	25.3	24.0	22.7	21.6	20.5	19.5	17.8	16.4	14.6
19HC	"	26.6	25.7	24.4	23.1	21.8	20.7	19.6	18.6	16.9	15.5	13.7
22	"	28.7	27.8	26.5	25.2	23.9	22.8	21.7	20.7	19.0	17.6	15.8
16	B175	24.6	23.7	22.4	21.1	19.8	18.7	17.6	16.6	14.9	13.5	11.7
19LC	"	26.2	25.3	24.0	22.7	21.4	20.3	19.2	18.2	16.5	15.1	13.3
16	M88	31.1	29.0	26.8	25.0	23.3	21.9	20.7	19.6	17.7	16.2	14.3
19LC	"	33.3	31.2	29.0	27.2	25.5	24.1	22.9	21.8	19.9	18.4	16.5
19HC	"	31.3	29.2	27.0	25.2	23.5	22.1	20.9	19.8	17.9	16.4	14.5
22	"	33.6	31.5	29.3	27.5	25.8	24.4	23.2	22.1	20.2	18.7	16.8
24	"	34.3	32.2	30.0	28.2	26.5	25.1	23.9	22.8	20.9	19.4	17.5
19LC	D88	31.3	29.8	28.3	26.8	25.4	24.1	23.0	21.9	20.2	18.7	16.9
19HC	"	30.4	28.9	27.4	25.9	24.5	23.2	22.1	21.0	19.3	17.8	16.0
22	"	33.1	31.6	30.1	28.6	27.2	25.9	24.8	23.7	22.0	20.5	18.7
24	"	34.2	32.7	31.2	29.7	28.3	27.0	25.9	24.8	23.1	21.6	19.8
26	"	35.8	34.3	32.8	31.3	29.9	28.6	27.5	26.4	24.7	23.2	21.4

Note 1: The designation HC indicates cable with a capacitance of 0.075 mf per mile or greater and LC indicates cable with a capacitance less than 0.075 mf per mile.

Note 2: Structural return losses in the echo range for trunk groups in the same cable usually conform pretty closely to the so-called normal distribution, and have a standard deviation of roughly 2 db. Each figure in the table may be considered as the average, or 50% point, of a distribution of this kind.

Note 3: The figures in the table are for long lengths of facilities. For lengths less than about 8 db, the corrections given in Section 304-403-101 may be applied.

Note 4: The echo range is assumed to be from 500 to 2500 cps. Return-loss computations are based on the ratio of returned power, or echo power, to power that would be transmitted into a perfect line (no echo) from a matching source. To simplify the computations, the transmitted power is considered to be uniformly distributed over the frequency range 500 to 2500 cps. The choice of this range is based on limited study of the influence of various parts of the audio range on echo effects. Further study may show that some other range is preferable or that other-than-uniform distribution of transmitted power should be assumed, or both.

Note 5: H_L, the standard deviation of loading coil inductance for these exchange area facilities, is considered to be 1% of the nominal inductance. H_C, the standard deviation of loading section capacitance, is calculated as follows (with aid of figures from AB23.191, Issue 2, Part 6):

Standard deviation on reel	= 5.22%
Standard deviation in duct assuming same ratio "in duct" to "on reel" as for toll cable.	= 6.54%
Average reel length	= 750 Feet
Standard deviation in H loading section (8 reels)	= $\frac{6.54}{\sqrt{8}}$ = 2.31%
Standard deviation in B loading section (4 reels)	= $\frac{6.54}{\sqrt{4}}$ = 3.27%

The tabular values reflect a small increase allowed because the controls applied in manufacturing cable and loading coils tend to prevent the return losses from following the normal law indefinitely downward at the poor end of the distribution.