

TRUNK TRANSMISSION MAINTENANCE INDEX

LOSS COMPONENT

GENERAL DESCRIPTION

1. GENERAL

1.01 This section describes the loss component of the Trunk Transmission Maintenance Index (TTMI). The loss component provides a measure of the performance in keeping trunk losses at or near their design values. The sources of information for this component are routine loss maintenance measurements. This section is reissued to include the text of the addendum (Issue 1), to make minor changes in the text, and to include comments on the TTMI Mechanized Summary Procedure. The changes are indicated by marginal arrows.

◆ **1.02** Section 301-121-300 furnishes the index tables which the System uses to rate loss maintenance performance. It also describes application of the index tables and weighting of components. Section 301-121-500 provides manual summary procedures required for computation of the loss component index. These procedures are performed mechanically for companies using the TTMI Mechanized Summary Procedure. The mechanized procedure is covered in Sections 301-124-100 and 301-124-110.◆

1.03 The loss component is based on comparison of actual measurements with System requirements. Local requirements not in agreement with the statements in System practices do not apply.

1.04 The source of information for this component is the routine measurement program conducted in accordance with Section 660-430-010 and associated sections.

2. SCOPE OF THE LOSS COMPONENT

2.01 The loss component of the Trunk Transmission Maintenance Index covers *all* message trunks, both local and toll, which have gain devices and/or make use of outside plant facilities. Local trunks

of all types are weighted equally with toll connecting and intertoll trunks. Intercept, information, and repair service trunks are also included. Only intrabuilding trunks without gain devices are excluded.

2.02 For rating purposes the trunks are divided into two groups. The frequency of measurement depends on the type of facility used, and the maximum intervals for manual tests should be as specified below:

◆ **Group 1**—Trunks making use of carrier channels or equipped with other than "E" type repeaters—should be measured at least quarterly.

Group 2—Trunks equipped with "E" type repeaters should be measured at least every six months.

Trunks using outside plant facilities and having no gain devices should be measured at least annually.

2.03 The performance in control of loss in Group 1 trunks is determined as follows:

SUBCOMPONENT	WEIGHTING %	SATISFACTORY RANGE
1. Percent Deviations Exceeding ± 0.7 dB	45	26.6 to 32.0%
2. Percent Deviation Exceeding ± 1.7 dB	45	2.8 to 5.5%◆
3. Percent Trunks Measured	10	96 to 98%

2.04 The performance in control of loss in Group 2 trunks is determined as follows:

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SUBCOMPONENT	WEIGHTING %	SATISFACTORY RANGE
1. Percent Deviations Exceeding ± 0.7 dB	90	7.8 to 14.5%
2. Percent Trunks Measured	10	96 to 98 %

2.05 The plan provides for the summary of measurements and rating of performance at the end of each quarter. Since some types of trunks are measured at more or less frequent intervals than others, provision is made to weight the data to obtain the proper combined results. These instructions are found in Section 301-121-500.

2.06 The plan does not directly reflect corrective measures taken when trunk losses are found to have excessive deviations. Good maintenance programs will be reflected, however, in the trend of the performance rating over several quarters.

3. LOSS VARIATIONS

3.01 Measured trunk losses can vary from design values for several reasons:

- Failure to meet the design requirement exactly at the beginning of service.
- Variations in test power sources and accuracies of measuring sets.
- Effects of environmental changes such as temperature or humidity changes.
- Aging and deterioration of components.
- Workman—caused errors.
- Automatic switching of amplifiers, radio channels, etc.

If any one of the above factors could be eliminated, the other factors would still remain. It is impossible to completely eliminate any of the factors, but they can be controlled by maintenance effort.

3.02 If too little maintenance work is done, the variations will get large enough to affect service. Testing alone will not improve performance. The component index plan is designed to indicate

whether proper and adequate maintenance is being applied.

3.03 Since the losses of trunks are varying slightly at all times due to aging and environmental effects, some deviation is always expected and a single measurement of loss is therefore not indicative of the quality of maintenance. Many measurements must be taken and summarized to determine the quality of maintenance. When many loss deviations are summarized they approximate a normal distribution curve.

3.04 Fig. 1 shows distributions of loss deviations for a group of trunks using carrier facilities and a group of trunks equipped with E-type repeaters. Since the E repeaters and trunks without gain devices tend to be more stable than the more complex carrier systems and 4-wire repeaters, the spread of loss deviations is not so great, and the spread can be controlled with less maintenance effort. The component plan recognizes this difference by providing separate index tables for each type of facility.

3.05 The distribution of loss deviations can be indicated by determining a few points on the distribution curve. The points on the distribution curve for carrier-equipped and similar trunks are located at ± 0.7 dB and ± 1.7 dB variation, as shown in Fig. 1.

3.06 If the reference points are fixed, good maintenance will tend to reduce the percent of deviations exceeding the reference points, and poor maintenance will allow the percentages to increase. The index tables establish the percentages expected when the maintenance effort is satisfactory.

3.07 In the foregoing discussion, it was assumed that the average loss deviation was zero. This is usually not the case. The average deviation can be either positive or negative. Fig. 2 shows several distribution curves to illustrate the effect of positive average deviation. With average deviation of zero, the percent deviations exceeding -0.7 dB tends to be equal to those exceeding $+0.7$ dB. When the average shifts slightly in the positive direction, the percent deviations exceeding -0.7 dB tends to decrease while those exceeding $+0.7$ dB increase, but the total deviations exceeding ± 0.7 dB is relatively unchanged. When the average shifts substantially in the positive direction, the percent deviations exceeding $+0.7$ dB increases

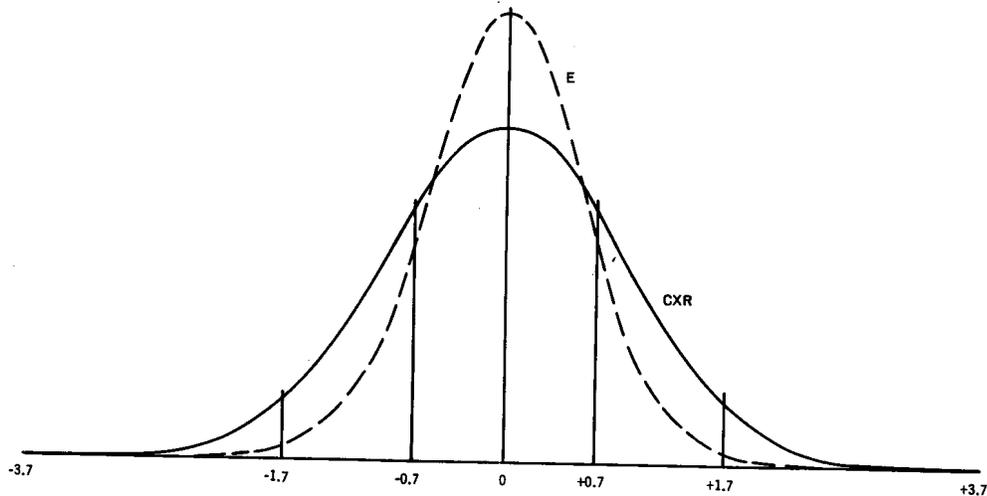


Fig. 1—Distribution of Loss Deviations In Trunks

very rapidly, and the total deviations exceeding ± 0.7 dB increases. Thus, a substantial average deviation results in lowering the performance rating, while a small average deviation has no significant effect. For example, assume a distribution of measurements with no bias and 31.7% of measurements exceeding ± 0.7 dB. A bias of 0.1 dB will increase the percentage to 32.2%, but a bias of 0.5 dB will produce a result of 43.1%.

4. ACCURACY OF THE COMPONENT

4.01 When computed quarterly, area results are based on a large volume of measurements and have a high degree of statistical accuracy. Quarterly variations of 0.5 index point or less are not particularly significant, however. It is more important to observe the trend and insure that

results are remaining somewhere in the 96 to 98 range.

4.02 When results are computed for smaller administrative units, such as divisions or districts, the inherent statistical accuracy of the results is not significantly reduced. Results will tend to vary more, however, and may be more heavily influenced by large offices or large trunk routes. Quarterly variations of 1.0 index point or less is normal in most cases. The general trend becomes more significant, and quarterly variations are not so important unless they continue in the same direction for two or three quarters.

4.03 The range of statistical error tends to increase as the number of measurements decrease. As the number of measurements gets small, say

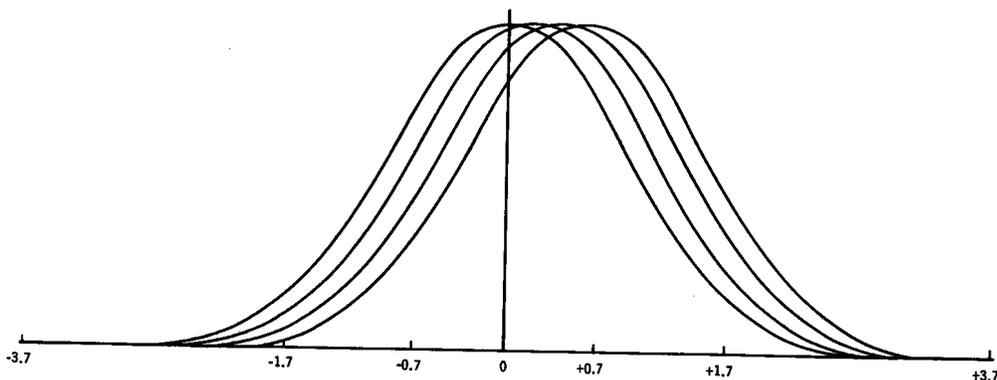


Fig. 2—Effect of Change of Average Loss Deviation

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500 or less, the index must be used with much greater caution, and more attention should be given to analysis of the basic data when analyzing results.

5. APPLICATION

5.01 The loss component of the Trunk Transmission Maintenance Index is designed to be applied on an *area* basis. While the index tables can be applied to results for smaller administrative units, greater variation of performance should be expected.

5.02 When area results are unsatisfactory or trending downward, it may be desirable to apply the index tables to smaller administrative units to detect possible weak spots. When this is done, as the measurement base becomes smaller,

more reliance should be placed on trends and on analysis of the basic data.

5.03 At the individual office level, it should be expected that results can be affected by equipment vintage and design and seasonal variations as well as maintenance effort. Thus, some offices may maintain a trend at the 96 level only with great effort, while others may easily reach the 98 level. In some cases, analysis of the basic data may show poor results to be due to a concentration of old, relatively unstable plant. Thus, the index table, when applied to small units, may be highly accurate when considered from a service standpoint and yet provide an unfair picture of the maintenance effort.