

PROCEDURE MANUAL II
for the
Determination of Quality of Telephone Service

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Public Utilities Commission of Ohio

by

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APPENDIX

Introduction

The purposes that are accomplished by the PUCO inspections and tests of services provided by Ohio telephone companies are listed below in rank order beginning with most important:

- To provide data and assessment concerning the quality of telephone services to be used as staff input to rate cases.
- To encourage a regimen of providing good service in the system.
- To be responsive to public need.
- To identify incidences of noncompliance with PUCO A.0.227.

In the past, inspections have been designed to determine the quality of services provided to the subscribers of individual central offices. This led to checking each central office for all criteria in A.0.227 that can be reasonably tested. If several offices in a metropolitan area are tested and inspected and then the results averaged or summarized for that area, then the conclusions about compliance in the area with respect to each quality of service criteria is dependent upon the single sample of central offices chosen for inspection. It is better to achieve independent estimates of quality of service provided in a metro area relative to each different A.0.227 criteria when it is practical to do so. This is accomplished by redesigning the inspection procedures so that they are oriented toward a determination of quality of service provided in the metro exchange area rather than quality of service provided by individual offices. Furthermore, the philosophy of using a random sample of offices in metro areas dictates the idea of making inferences about the entire metro area rather than about each office in the area.

Due to the goals of the Compliance Division and the reasons stated above the inspection procedures that follow have been designed to assess quality of service for metropolitan area subscribers. The major changes from previous procedures are:

1. In general an office will not be inspected as thoroughly for its performance relative to all criteria in A.0.227 as in the past. Instead, the A.0.227 criteria will be separated into groups of criteria and different sampling and inspection procedures

will be applied to each group. In general then, one will not expect to inspect an office for all criteria.

2. The customer survey will be conducted independently of area inspections by Customer Services personnel.
3. Test calls over interoffice and E.A.S. trunking will be made only over very select trunk groups, and the trunk connections to offices will no longer be recorded except on a metro wide basis by Customer Services personnel.

Step Procedures for Planning a Metro Area Inspection

1. Customer Services personnel should first conduct a subscriber survey and obtain the interoffice trunk traffic data according to Procedure Manual I.
2. Special inspections or follow up action on unresolved subscriber problems may be scheduled. This is a discretionary action of management and a separate function from the regular area inspection.
3. Based on the trunk traffic data and exception reports identify the three interoffice call connections that appear most likely to fail the 95% call completion criteria (i.e. more than 5% blockage).
4. Select two independent groups of n (see appendix) office exchanges randomly from those in the metropolitan area. Each group member should be selected randomly without replacement, but total replacement should occur between groups. The two groups will be inspected or tested in the following two areas.
 - a) One group of offices will be tested for their dial tone response time and intraoffice call completion percentage.
 - b) Another group will receive a visual inspection to determine adequacy and uniformity of maintenance programs.
5. When necessary, inform the telephone company which offices have been identified in steps 3 and 4a and request the assignment of 16 telephone numbers in each of these offices for purposes of connecting the central office analyzer. If possible, avoid identifying the offices selected for visual inspection to the telephone company.
6. Request that the PUCO inspectors be given access to the line cards at all area repair centers and to records of new phone installations and regrades at the Business Office.
7. Schedule inspectors into and out of the various offices in such a way as to make good use of inspector time. Since the analyzer hookup time is dependent upon the availability of telephone personnel at least one day should be allowed for this activity so that other inspection activities should be scheduled for the inspection during that delay time.

Metropolitan Telephone Service Investigation Procedure

The following instructions were prepared to furnish the staff members of the Public Utilities Commission with a broad coverage of items which would fit most situations and assist in forming conclusions, as to the service adequacy or inadequacy, in a uniform manner.

In the course of investigations, the Commission staff will note appropriate data on the various inspection forms, for the information and use of the Commission and the telephone companies.

Since different procedures will be required for checking different aspects of quality of service in different central offices or exchanges, the procedures are separated and grouped according to type of inspection. The location for each type of inspection will be designated ahead of time.

General Procedures

1. For any office entered regardless of the type of tests or inspection that is to be performed there the following additional steps should always be performed.
 - a) Check on the cleanliness of the office, adequate lighting, fire hazards, and unsafe working conditions.
 - b) Inspect to make certain that the office is equipped for emergency A.C. power supply. Make certain equipment is serviceable.
 - c) Inspect the battery supply for proper fluid level, for corrosion, and for close terminals.
2. Any travel to and from offices and between offices should double as outside plant inspection time. It is therefore not necessary to take the most direct routes in each case and all boundaries of central office area of coverage should be ignored unless there is also a change in company when the boundary is crossed. The following steps apply to the outside plant inspection:
 - a) Observe cable construction checking for loose spinning wire, slickers, and tree conditions.
 - b) Drop wire from the pole to subscriber residence will be checked for tree condition as well as proper protection against lightning and clearance over roadway and subscriber premise.
 - c) Improperly set poles.
 - d) Broken guywires.
 - e) Broken or missing poles.

- f) Terminal lids open or missing.
- g) Improperly dressed lead drop wires at terminals.
- h) Proper clearances on all outside facilities with power company facilities.
- i) Installation of cable terminals to eliminate excessive number of drop wires paralleling cable.
- j) Check underground cable pedestals in their general condition.
- k) The open wire circuitry will be checked for the following:
 - (1) Proper sagging.
 - (2) Rusted condition of the wire.
 - (3) Tree conditions.
 - (4) Broken or deteriorated poles.
 - (5) Improperly positioned or damaged cross-arms.
 - (6) Broken pins.
 - (7) Broken insulators or floating insulators.
 - (8) Improper transpositions which would cause A.C. hum.
 - (9) Unusual number of sleeves in open wire.

Procedures For Test Calling

Intraoffice and Administrative Service Test Calls

Intraoffice test calls will be made using the central office analyzer. While the analyzer cycles automatically, manual test calls to repair service and other administrative services should be made. For the following step procedures the analyzer should be hooked to 16 lines with telephone numbers for each (If more than one prefix is used in the office, the 16 lines should include at least one to each prefix):

1. Prepare a list of the test numbers to be called in the testing sequence. Each number will be called no more than 25 times before testing the next number on the list. When the list is exhausted the process is continued by returning to the first number on the list.
2. Set the rate of test calls so that the automatic cycling will produce 180 test calls per hour. The time lost in resetting the machine after every 25 calls will reduce the number of test calls to a rate of 150 to 160 per hour.
3. For each block of 25 test calls record
 - a. Time of day the block of calls was started and the time of day stopped.
 - b. Number of failures by type.
 - c. Number of calls attempted.
 - d. The telephone number called.

4. Follow these testing procedures in order to obtain two eight hour working days' worth of data.
5. Compute the following percentages for dial tone (DT) performance.
 - a. % successful DT on total calls for both days.
 - b. % successful DT on total calls for each hour of each day.
 - c. % successful DT on total calls for each test number for all hours and both days.
 - d. The average over the two days of the lowest percentages of each day computed in b.
6. In general the following values for items computed in step 5 can be expected from a system providing adequate service:
 - a. 5a should be at least 99.9 percent
 - b. 5b should be at least 97 percent
 - c. 5c should be at least 99.9 percent
 - d. 5d should be at least 97 percent.
7. For each block of test calls made subtract from the number of failures and from the number of attempts the number that failed because the dial tone took longer than 3 seconds. Use the new number of failures and attempts to do the calculation in Step 8.
8. Compute the following completion percentages:
 - a. percent completion on total calls for both days
 - b. percent completion on total calls for each hour of each day
 - c. percent completion on total calls for each test number for all hours and both days.
 - d. the average over the two days of the lowest percentage of each day computed in b.
9. In general the following values for items computed in Step 8 can be expected from a system providing adequate intraoffice service:
 - a. 8a should be at least 98 to 99 percent
 - b. 8b should be at least 90 percent
 - c. 8c should be at least 98 to 99 percent
 - d. 8d should be at least 90 percent.
10. After estimating the total number of days required to complete all analyzer testing in the metropolitan area, manual test calls will be made to the facilities listed below (the number of such calls is given in parentheses):
 - a. Repair Service (150)
 - b. Toll Operator (150)
 - c. Information (150)
 - d. Intercept Service (150)

For each test call a PUCO issued stop watch should be used to measure the time interval from the first ring until the operator is ready to service the call. This should include time after the call has been acknowledged if it is placed on hold. These calls should be made during the automatic cycle phase of the analyzer, should be rotated among the various services and the

sample sizer should be spread over the total number of days testing is done in the metro area.

11. For each manual test call the following should be recorded:
 - a. Answer time
 - b. Inspection judgment of quality of transmission (GOOD, FAIR, POOR)
 - c. Inspector's judgment of the courtesy and helpfulness of the operator (GOOD, FAIR, POOR).

When the operators have indicated their readiness to service the call, most calls may be terminated by the inspector by saying, "Thank you, this was a test call." However, the inspector should have a list of hypothetical situations to periodically present to the operator before terminating the call in order to form a better opinion in item c.

12. Compute the average answer time for each type of service and a general average for all services.
13. See (NRRRI Final Report) for a discussion of the possible interpretations of the statistical values computed in Steps 5 and 8 especially when compared with the values in Steps 6 and 9.

Analyzer Trunk Tests

Trunk tests will be made only between selected points determined after studying the trunking data gathered by the Customer Services personnel. The points selected are those expected to provide the worst service in the metro area, therefore, if they test satisfactory then one may conclude that all trunking in the metro area is satisfactory. If they test unsatisfactory then additional points may be selected and tests ordered so as to determine the extent of the problem. For each test, a test number will be provided and one or two busy hours identified. Then follow these steps:

1. Set analyzer to 180 calls per hour rate.
2. Perform the test calls only during the busy hours previously identified and on two separate days.
3. Record all results separately for each hour the tests are made.
4. Compute the percent completed for each hour.
5. Average the percents completed during the worst hour of the first day with that for the worst hour of the second day.
6. The average computed in 5 should be 95% or better if the trunk is satisfactory. If it is marginal, an additional day's data may be warranted.

An alternative method to using the pre-identified busy hour to schedule test calls is to follow the steps of the intraoffice test call procedures given earlier except that only one test number is needed for all tests of one trunking arrangement.

Step Procedures for Visual Inspections

Visual inspections are to be performed at several randomly selected central offices in each metropolitan area. The purpose of these inspections is to provide an overall assessment of the serviceability of the office equipment as a result of its age and condition. The inspector should record all shortcomings observed in the office equipment and then assign a rating (GOOD, FAIR, POOR) that pertains only to the apparent condition of the equipment.

A list (not exhaustive) of checks that may be used as a guide is given below. When sampling individual pieces of equipment for inspection a systematic plan should be used such as checking every 5th connector shelf or every other linefinder group, for example.

1. Check for an excessive amount of busied out equipment.
2. Check the main distributing frame for unsoldered or improperly soldered connections.
3. Inspect solder connections on the D.T.A.
4. Check switch for defective wipers, cords, worn contacts, worn banks, and proper lubrication.
5. Check the primary and auxiliary ringing equipment.
6. If the Central Office inspected is a toll center; check all operator positions as to busied out cord pairs, worn cord pairs, and burnt out lamps.
7. Include the General Instruction Step 1 as part of the visual inspection and consider the results as part of the total evaluation.

Maintenance Center and Business Office Inspection

The main purpose of this inspection is to determine the trouble report rate per 100 subscribers per month and to determine that troubles, especially outages, are cleared within 24 hours. To do this the inspector may make his judgment based on a review of the center's procedures and

based upon the company's summaries of trouble reports (often computerized). Periodically the inspector should acquire his own summary from a maintenance center by systematically sampling line cards as per the following steps:

1. Line cards are usually stored in tub files containing in the neighborhood of 100,000 line cards for the larger metropolitan area. Select line cards systematically by taking those that are spaced at regular intervals so that a sample of 200 will be uniformly spread over the entire file.
2. From each card record the telephone number prefix and whether or not trouble had been reported in the most recent month.
3. For those with trouble reported determine if the trouble was an outage. Compare the date received with the date cleared and record the time interval.
4. Ask about the records for work in progress to determine if any had been reported more than 24 hours earlier.
5. From the data collected above for all maintenance centers in a metropolitan area, compute the area wide average rate of trouble reports per 100 subscribers/month. This average is a weighted average computed as in the following example:

Maintenance Center	# Subscribers Covered	Trouble Report Rate/100
North	135,000	7.2
South	165,000	5.0
East	97,000	6.1
West	225,000	6.8
Total	622,000	

Then the weighted average would be,

$$6.3 = \frac{7.2(135,000) + 5(165,000) + 6.1(97,000) + 6.8(225,000)}{622,000}$$

6. Visit the business office and in a fashion similar to the steps above, systematically sample their records to determine the lengths of time between requests for installations or regrades and the time the requested work is complete. A sample need not always be taken if the company's management summaries show the desired data. The important thing is that the inspector feel confident in the information he receives.

Subscriber Complaints

Investigators from time to time will be assigned to investigate individual subscriber service complaints assigned from the Commission Office. Procedures will be as follows:

1. Contact subscriber first to ascertain specifics.
2. Check phone instruments and make test calls from same.
3. Check all outside plant facilities, as well as Central Office equipment associated with the line.
4. A record of this subscriber's line card should be investigated to determine past history of trouble reported on this line.
5. Contact Commercial Manager of Plant Manager and advise him of your findings and inform him of whatever action is necessary to correct the problem.
6. Follow up contact with subscriber to insure that the service problem has been corrected.
7. Submit a written report to the Commission office for case file.

APPENDIX- RANDOM SELECTION OF CENTRAL OFFICES

Random Selection of Central Offices

Two alternative methods of selecting central offices are given in this appendix. Also, a discussion of sample sizes and their rationale is given.

Alternative 1: This procedure is a manual procedure and consists of simply writing the code for each central office in the metropolitan area being inspected on a slip of paper, mixing all slips together in a container and then withdrawing, without looking, n (sample size) slips from the container. For a second independent sample, record the sample just drawn, replace the slips drawn back into the container, mix and then repeat the process described above for the second sample.

Alternative 2: The above procedures may be easily computerized especially since all central offices are already input to generate materials to assist in subscriber surveys and trunk data collection activities. Therefore, a by-product of those programs could be several lists of independently generated samples of central offices.

Sample Sizes

Sample sizes are usually determined by deciding upon the accuracy and confidence one would like to have in estimating something about a population such as proportion of central offices providing less than adequate service according to some particular criteria. However, the data gathered during these inspections will have multiple purposes and be summarized in many ways other than to make inferences about metro areas. Therefore, the sample sizes are based as much on practical consideration as they are on statistical consideration. When a random sample of exchanges in a metropolitan area is needed for locating the analyzer tests and a second sample for the visual inspections it is recommended that $1/3$ of all exchanges in the area be in the sample (round up to the nearest integer). It is anticipated that this will

make it possible to inspect metro areas at least once a year and when the second and third inspections are planned the sample could be taken in such a way as to preclude the officer checked in each prior year. Thus in three years a 100% sample for both types of inspections will have been inspected. By accomplishing this in three years it may be reasonable to assume that the first sample has experienced no significant change in quality during the whole period. This assumption naturally becomes less reasonable if more time passes.

According to the step procedures for test calls and a sample size of 1/3 the population, an area the size of Columbus could be tested in less than one man month. If no problems are encountered it is estimated that a second inspector could do the visual inspections, visit the maintenance center and check the business office simultaneously with the test calling program. Thus, a two man team should be able to complete Columbus in one month. This means that a two man team should be able to cover the ten largest metropolitan areas in Ohio in one year if the recommended sample size is used and no unusual circumstances are encountered. Of course, this does not count the advance work of the Customer Services team in conducting the survey and collecting trunk traffic data. Thus a 1/3 sample size is sufficiently large to make statistical inferences about metropolitan areas but small enough to allow data to be gathered in all parts of the state within a reasonable time frame.