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September 28, 1998

## FCC RELEASES REPORT ON QUALITY OF SERVICE

The FCC has released a report entitled "Quality of Service for the Local Operating Companies Aggregated to the Holding Company Level."

This report updates a previous report issued in March 1996 and summarizes data submitted by the Bell Operating Companies, the GTE companies, and the Sprint companies on their quality of service. The report includes data reflecting full year results for 1995, 1996, and 1997.

This report is available in the reference room maintained by the Common Carrier Bureau at 2000 M Street, N.W., Room 575. Copies may be purchased by calling International Transcription Service, Inc. (ITS) at (202) 857-3800. The report can also be downloaded [file name: qual97.zip] from the FCC-State Link internet site, which can be reached through a link from the Common Carrier Bureau home page (<http://www.fcc.gov/ccb/stats>) on the World Wide Web. The report can also be downloaded from the FCC-State Link bulletin board at (202) 418-0241.

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# QUALITY OF SERVICE FOR THE LOCAL OPERATING COMANIES AGGREGATED TO THE HOLDING COMPANY LEVEL

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## Introduction

This report summarizes various kinds of service quality data filed by local exchange telephone companies through 1997.<sup>1</sup> The Federal Communications Commission (FCC or Commission) does not impose service quality standards, *per se*, on communications common carriers. Rather, the Commission annually monitors carrier-submitted data and publishes this report in order to document customer-initiated trouble reports and company reactions. This report publicizes information about company performance and, specifically, statistics about company responsiveness to network failures and associated consumer complaints. We include, in the tables following the text of this report, company comparison data about various service parameters including installation, maintenance, switch downtime, and trunk blocking, along with associated customer perception data.

As with previous service quality reports, this report indicates areas where there is room for carrier improvement. Further, as expanding services and technology choices cause users to place ever greater demands on the network, it will be critically important to maintain our monitoring effort to help ensure high levels of network performance and reliability in the future.

## Background

At the end of 1983, anticipating AT&T's imminent divestiture of its local operating companies, the Commission directed the Common Carrier Bureau to establish a monitoring program that would provide a basis for detecting adverse trends in network service quality. Throughout 1985, the Bureau modified the service quality reporting requirements to reduce unnecessary paperwork and to ensure that needed information would be provided in a more uniform format. The data were received semiannually, typically in March and August, and formed the basis for FCC summary reports published in June 1990 and July 1991.

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<sup>1</sup> This report is a follow-up to a report released March 22, 1996 (mimeo number 60268), which covered data through the third quarter of 1995.

With the implementation of price-cap regulation for certain local exchange carriers, the Commission made several major changes to the service quality monitoring program beginning with reports filed in 1991. First, the Commission expanded the class of companies filing reports to include non-Bell carriers subject to price-cap regulation.<sup>2</sup> Second, the Commission included service quality reports as part of the Automated Reporting Management Information System (ARMIS).<sup>3</sup> Third, the Commission ordered significant changes to the kinds of data reported.<sup>4</sup> Following these developments, the Commission released service quality summary reports in February 1993, March 1994, and March 1996. Thereafter and pursuant to requirements in the Telecommunications Act of 1996<sup>5</sup> the Commission reduced the frequency of the filed data from quarterly to annual submissions.<sup>6</sup> In May 1997 relevant definitions were clarified further and these changes have been reflected

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<sup>2</sup> See *Policy and Rules Concerning Rates for Dominant Carriers*, Second Report and Order, 5 FCC Rcd 6786, 6827-31 (1990) (*LEC Price Cap Order*) (establishing the current service quality monitoring program and incorporating the service quality reports into the ARMIS program), Erratum, 5 FCC Rcd 7664 (Com. Car. Bur. 1990), *modified on recon.*, 6 FCC Rcd 2637 (1991); *aff'd sub nom.*, *Nat'l Rural Telecom Ass'n v. FCC*, 988 F.2d 174 (D.C.Cir. 1993).

<sup>3</sup> *LEC Price Cap Order*, 5 FCC Rcd 6786, 6827-30. The ARMIS database includes a variety of financial and infrastructure company mechanized reports in addition to the quality-of-service reports. Most data are available disaggregated to a study area or state level.

<sup>4</sup> *LEC Price Cap Order*, 5 FCC Rcd 6786, 6827-30; *See Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 6 FCC Rcd 2974 (Com. Car. Bur. 1991) (*Service Quality Order*), *reconsideration* 6 FCC Rcd 7462 (Com. Car. Bur. 1991). Previously the Common Carrier Bureau had collected data on five basic service quality measurements from the Bell Operating Companies. These were customer satisfaction levels, dial tone delay, transmission quality, on time service orders, and percentage of call blocking due to equipment failure.

<sup>5</sup> Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996 Act).

<sup>6</sup> Orders implementing filing frequency and other reporting requirement changes associated with implementation of the Telecommunications Act of 1996 are as follows: *Implementation of the Telecommunications Act of 1996: Reform of Filing Requirements and Carrier Classifications*, Order and Notice of Proposed Rulemaking, 11 FCC Rcd 11716 (rel. Sep. 12, 1996); *Revision of ARMIS Quarterly Report (FCC Report 43-01) et al.*, Order, 11 FCC Rcd 22508 (Com. Car. Bur., rel. Dec. 17, 1996); *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 12 FCC Rcd 8115 (rel. May 30, 1997); *Revision of ARMIS Annual Summary Report (FCC Report 43-01) et al.*, Order, 12 FCC Rcd 21831 (Com. Car. Bur., rel. Dec. 16, 1997).

starting with data covering the 1997 calendar year.<sup>7</sup> This is the first report summarizing data from annual submissions.

## Overview

The introduction of new technologies to the network has resulted in a greater concentration of telephone traffic on a smaller number of higher capacity switches and facilities. Outages on those facilities, although infrequent, could have serious consequences. Examples of such outages include AT&T switching system failures and other switching failures in the operating areas of Bell Atlantic and Pacific Telesis during 1990 and 1991.

While the latest reporting period generally indicates fewer complaints per million access lines than for the previous period, the data suggest that some companies may still have problems with increasing complaint levels or the absolute number of customer complaints.<sup>8</sup> In examining historical data it often appears that where complaints have increased some other measured parameter has also been adversely affected, for example, items relating to installation and maintenance (such as trouble reports, outage levels, and installation and repair intervals).<sup>9</sup> At the same time, delays on the customer end (i.e. delays in filing complaints) and in company response times mean that overall customer satisfaction levels and other measurements do not necessarily correlate with the number of reported complaints. Nevertheless, it is our experience that, overall, complaint levels are a sensitive

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<sup>7</sup> See *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 12 FCC Rcd 8115 (rel. May 30, 1997).

<sup>8</sup> Factors that could contribute to higher complaint levels are the delayed impact of capital investment or the presence of localized problems, and at least in some cases may suggest a need to more effectively deal with human resource and customer relations issues. Although technology and capital investment can address many quality of service issues, ultimately the quality of service provided is a significant function of human resources, a fact which is easily overlooked. Effective use of new technology will increasingly require that the companies effectively manage their human resources and address the human issues in providing service. See Gross Capital Expenditure data in ARMIS 43-07 reports (row 540) which shows evidence of increased capital investment by a number of companies in 1996.

<sup>9</sup> Installation and maintenance data associated with interexchange carrier access services is provided separately from data associated with end users.

indicator of company service quality and that increases in complaint levels can be correlated to discrete problem areas. Thus continuing increases in complaint levels for more than one annual reporting period are of greatest concern.

In our last summary report we surmised that increasing customer complaint levels, could be attributed, in part, to unexpected access line growth, downsizing and consolidation efforts within the companies. Data for 1995 through 1997 suggest that not all companies have experienced the same problems and that responses to problems have varied by company.

### Data Presented in this Report

The source data used in preparing this report are available on the FCC-State Link electronic bulletin board system (BBS) operated by the Industry Analysis Division of the Common Carrier Bureau. The electronic bulletin board can be reached by dialing (202) 418-0241. The data are also available from ITS, Inc., at (202) 857-3800. Selected paper filings are available in the Common Carrier Bureau public reference room at 2000 M Street, N.W., Room 575, Washington, D.C. 20554.

The BBS files are posted in compressed format in order to group files and to conserve space but they can be easily decompressed on a personal computer by using a program posted on the board. There is a separate file within each compressed file for each study area, usually a state or portion of a state. A second posted file can be used to view the raw service quality data as a spreadsheet table with appropriate titles and annotations.<sup>10</sup>

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<sup>10</sup> The bulletin board operates from a standard personal computer presently equipped to handle data transfers of up to 14,400 baud. The compressed files comprising the ARMIS 43-05 and 43-06 reports contain the raw data from which this paper was prepared. They are typically about 15 kilobytes, but typically range in size from several thousand bytes for companies operating in a few states to sizes exceeding 80 kilobytes for companies operating in numerous states or study areas. A viewer file "QVIEW2.ZIP" can be downloaded to view the raw data filed prior to 1994, and a similar viewer file "QVIEW5.ZIP" can be downloaded to view data starting with 1994. Included in the archive are a template viewer for 1994 and 1995 data and a newly created executable viewer which converts datasets to a form with annotations and data labels. The executable viewers are in more than one version, one of which handles pre-1996 data. Also available for downloading is a generic decompressing program "PCUNZP.COM."

The data presented in this report summarize ARMIS 43-05 and 43-06 carrier filings and reflect changes in the filing frequency from quarterly to annually along with certain changes to the filing definitions. Other changes affecting the definitions and further modifying filing requirements have resulted in additional reporting requirements that have affected the format of these filed data submissions. Although many of the changes are minor and clarify the definitions, added caution should be exercised in analyzing time series data.

One of the most obvious changes is the elimination of the overall customer satisfaction levels reported previously in ARMIS 43-06 reports, beginning with data filed in 1997.<sup>11</sup> The tables accompanying this report highlight the key data now received. Tables include data from each major holding company: the regional Bell companies, GTE (including Contel), and Sprint.<sup>12</sup> These tables also reflect corrections for previously filed data as made by the companies.

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<sup>11</sup> While customer perception surveys tend to be the most visible measures of service quality, there are a number of significant pitfalls in relying solely on this kind of data. First, there are differences in customer perception in different parts of the country and procedural variation among companies and over time in developing the data. Second, general frustration or stress levels in the population can be targeted and translated into poorer overall perception levels for the same service quality. Finally, not all perception measures are of equal statistical validity because some of the companies use very small sample sizes, particularly with business customers. In our last report we noted significant declines in sample sizes of residence and small business customers for several companies, including US West, Southwestern Bell, and BellSouth. Southwestern Bell reported, for example, that new sample sizes increase confidence ranges from plus or minus 0.2% to plus or minus 0.4% with a 95% confidence, but significantly reduce survey cost. Sample size information is thus included in this report along with the customer perception results. Other problems with this information reflect underlying changes in company procedures used to collect customer perception data and reporting changes. These and other changes make it impossible to properly relate current measurements to the previous data series. The current data reflecting customer dissatisfaction levels are provided directly as a composite of company filed study area data in which composite percentages were calculated as a weighted average of individual study area percentages. Starting with 1997 data, the companies were no longer required to file data on overall customer perception levels.

<sup>12</sup> In February 1992, United Telecommunications Inc. became Sprint Corporation [Local Division]; and in March 1993, Sprint Corporation acquired Centel Corporation. Although Bell Atlantic and NYNEX merged in August 1997, the tables continue to reflect the merged entities separately. Similarly, SBC and Pacific Telesis facilities are shown separately despite the merger of the two entities in April 1997.



The data items summarized in the tables largely contain raw data measurements that are not scaled by company indexing processes. This removes a degree of procedural variation among companies. For example, companies file a fairly extensive amount of raw data about switching outages, including outage durations and number of lines affected.

The data summarized in this report contain sums, or weighted averages, of data reported by states or study areas and may be useful in assessing overall trends. Where information is reported in terms of percentages or average time intervals, data presented here are based on a composite of individual study area data that is calculated by weighting the percentage or time interval figures. For example, we weight the percent of commitments met by the corresponding number of orders provided in the filed data.<sup>13</sup>

The items contained in the tables that cover data for 1995, 1996 and 1997, respectively, are summarized below. Installation, maintenance and customer complaint data are shown in Tables 1(a), 2(a), and 3(a) and switch downtime and trunk servicing data are shown in Tables 1(b), 2(b), and 3(b). Installation and maintenance data are presented separately for services provided to end users and for interexchange carrier access facilities. Outage data categorized by cause are shown in Tables 1(c), 2(c), and 3(c). Customer perception data are contained in Tables 1(d), 2(d), and 3(d) and the associated survey sample sizes are contained in Tables 1(e), 2(e), and 3(e).

This summary report has attempted to display data elements that are roughly comparable for the three years covered by this report. More detailed information on the raw data from which this report has been developed is contained in the raw

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<sup>13</sup> Company composite data were typically recalculated on a consistent basis from study area data, as a number of company supplied composites could not be confirmed. Although the companies have prepared their own company rollups, we have discovered various inconsistencies or inaccuracies in some of these company-prepared composites. We have therefore weighted data involving percentages or time intervals in order to arrive at the more consistent composite data shown in the tables and expect that the companies will want to review their procedures for preparing composites. Parameters used for weighting in this report were appropriate for the composite being calculated and were based on the raw data filed by the carriers but are not necessarily shown in the tables. For example, we calculate composite installation interval data by summing the individual study area results multiplied by the number of installation orders reported for each study area and then dividing the result by the total number of orders.

data sets that can be examined using spreadsheet viewers that are maintained on the electronic BBS described above. In addition, complete data descriptions are available in the Commission Orders referenced above.<sup>14</sup> The row numbers and columns associated with the raw source data in the ARMIS 43-05 report are included in the descriptions below.<sup>15</sup>

#### 1. Percent of Installation Commitments Met

Percent of installations that were met by the date promised by the company to the customer. It is presented separately for residential and business customers' local service (row 132, columns f and i or af and ai, respectively) and access services provided to carriers (row 112, columns a and c or aa and ac).

#### 2. Average Installation Interval (in days)

Average interval (in days) between the installation service order and completion of installation. It is shown separately for access services provided to carriers (row 114, column a and c or aa and ac) and for

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<sup>14</sup> See footnote 6, *supra*.

<sup>15</sup> For rows 110-121 in the raw machine readable data sets, column a or aa is the first column; for rows 130 to 151, column d or ad is the first column; for rows 180 to 190, column k or ak is the first column; for rows 200 to 214, column n or an is the first column; for rows 220 to 319 and 333-500, column t is the first column; and for rows 320 to 332, column aa or da is the first column. The companies also file printed copies of their submissions where rows 110-121 are designated as Table I, rows 130-170 are designated as Table II, rows 180-190 are designated as Table III, rows 200-214 are designated as Table IV, rows 220-319 and 333-500 are designated as Table IV-A, and rows 320-332 are designated as Table V. Note that some of the row numbers in the data such as rows 142, 143 and 160 do not appear in numerical order. In addition to definitional wording changes, most of which are minor, rows 111, 131, 160 and 170 (missed installations for customer reasons and subsequent trouble reports) have been added with the 1997 data; however, not all companies have populated the added rows. Many column designations have also been changed and most column labels are now preceded by the letter "a". The reader should note that there are variations in numbers of switches and access lines in the various ARMIS reports that may lead to inconsistencies when comparing data sources; however, these variations are not believed to be significant enough to alter the observations made in this report. Because the entire row and column descriptions and definitions for each year in question are too voluminous to reproduce here, the reader should refer to the relevant Commission Order referenced in a prior footnote describing requirements for the specific data year of interest.

residential and business customers' local service (row 134, columns f and i or af and ai, respectively). Data on intervals for missed installations (rows 113 and 133) were replaced by average interval described above.

### 3. Average Repair Interval

Average time (in hours) for the company to repair access lines and includes subcategories for switched access, high-speed special access, and all special access. Only data for switched and special access services provided to carriers are presented. (See row 121, column a and c or aa and ac.)

### 4. Initial Trouble Reports per Thousand Access Lines

Calculated as the total count of trouble reports reported as "initial trouble reports," divided by the number of access lines in thousands. (Note that multiple calls within a 30 day period associated with the same problem are counted once, and the number of access lines reported and used in the calculation is the total number of access lines divided by 1,000.) This item is subcategorized by Metropolitan Statistical Areas (MSA) (the sum of row 141, column d or ad and row 141, column g or ag divided by the sum of row 140, column d or ad and row 140, column g or ag); non-MSA (the sum of row 141, column e or ae and row 141, column h or ah divided by the sum of row 140, column e or ae and row 140, column h or ah); residence (row 141, column f or af divided by row 140, column f or af); and business (row 141, column i divided by row 140, column i or ai). Note that access lines for data filed in 1997 was requested in whole numbers, but was requested in thousands for prior years.

### 5. Found or Verified Troubles per Thousand Access Lines

Calculated as described in item 4, above. Represents the number of trouble reports in which the company identified a problem (row 141, column j or aj less row 143, column j or aj divided by row 140, column j or aj).

## 6. Repeat Troubles as a percent of Initial Trouble Reports

Calculated as the number of trouble reports that recur, or remain unresolved, within 30 days of the initial trouble report, divided by the number of initial trouble reports as described above (row 142, column j or aj divided by row 141, column j or aj). Provides a measure of the effectiveness of the company in resolving troubles at the outset. Subcategorized by MSA, non-MSA, residence, and business. (Also refer to the section of this report entitled "Observations, Notes and Data Qualifications.")

## 7. Complaints per Million Access Lines

The number of residential and business customer complaints, per million access lines, reported to state or federal regulatory bodies during the reporting period. (Total residence complaints are calculated as the sum of row 331, column aa and row 332, column aa; total business complaints are calculated as the sum of row 321, column aa or da and row 322, column aa or da).

## 8. Number of Access Lines, Trunk Groups and Switches

The count of in-service access lines (row 140, column j or aj), trunk groups (row 180, column k or ak), and switches (the sum of row 200, column n or an and row 201, column n or an or the sum of row 210, column n or an through row 214, column n or an). Trunk groups only include common trunk groups between Local Exchange Carrier (LEC) access tandems and LEC end offices. Access lines were reported in thousands in pre 1997 data submissions. Starting with 1997 data submissions access line data was requested in whole numbers. Data for 1995 was annualized as the average of quarterly data.

## 9. Switches with Downtime

Number of network switches experiencing downtime and the percentage of the total number of company network switches experiencing downtime (row 210, column o or ao through row 214,

column o or ao or the sum of row 200, column o or ao and row 201, column o or ao).

#### 10. Average Switch Downtime in Seconds per Switch

Total switch downtime divided by the total number of company network switches indicates the average switch downtime in seconds per switch. Shown for all occurrences (the sum of row 200, column p or ap and row 201, column p or ap, multiplied by 60 and divided by the sum of row 200, column n or an and row 201, column n or an) and for unscheduled occurrences greater than 2 minutes (data derived from rows 220 through 319 and rows 333 through 500, columns t through z in the source data divided by the sum of rows 200 and 201, column n or an ).

#### 11. Unscheduled Downtime Over 2 Minutes per Occurrence

Number of occurrences of more than 2 minutes duration that were unscheduled, the number of occurrences per million access lines, the average number of minutes per occurrence, the average number of lines affected per occurrence, the average number of line-minutes per occurrence in thousands, and the outage line-minutes per access line. For each outage, the number of lines affected was multiplied by the duration of the outage to provide the line-minutes of outage. The resulting sum of these data represents total outage line-minutes. This number was divided by the total number of access lines to provide line-minutes-per-access-line, and, by the number of occurrences, to provide the line-minutes-per-occurrence. This categorizes the normalized magnitude of the outage in two ways and provides a realistic means to compare the impact of such outages between companies. A separate table is provided for each company showing the number of outages and outage line-minutes by cause. (These items are derived from data in rows 220 through 319 and 333 through 500, columns t through z, in the source data).

## 12. Scheduled Downtime Over 2 Minutes per Occurrence

Determined as in item 11, above, except that it consists of scheduled occurrences. (These items are derived from data contained on rows 220 through 319, and rows 333 through 500, columns t through z, in the source data).

## 13. Percent of Trunk Groups Meeting Design Objectives

This data item provides the percentage of trunk groups exceeding an industry standard for blocking over the reporting interval (the sum of rows 189 and 190, column k, divided by row 180, column k for 1995 data and the sum of rows 189 and 190, column ak divided by row 180 column ak starting with 1996 data). The trunk groups measured and reported are interexchange access facilities. These represent only a small portion of the total trunk groups in service.

### Observations, Analytical Notes, and Methodological Qualifications

Overall, we caution readers to be aware of potential methodological shortcomings and inconsistencies associated with use of the service quality data presented in this report. First, carriers periodically revise submitted data as problems are discovered and data presented here may contain errors or may not reflect the latest updates. Second, although the data are subject to an initial screening by Commission staff and certain problems may have been corrected in carrier-submitted revised filings, there are still potential flaws in the data that will only become apparent when users subject the data to further analysis or compare it with data from other sources.<sup>16</sup>

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<sup>16</sup> For example, small variations between GTE prepared composites and those that we calculated independently appear to have been caused by inclusion or exclusion of data from study areas such as Micronesia (GTMC) and Alaska (GTAK). We also note that GTE data available to us for the early quarters of 1995 was missing at least 2 study areas that appear to account for discrepancies in the composites for that year.

Third, Commission staff have recalculated holding company totals or data composites and these might not match company-filed totals or composites.<sup>17</sup> This is primarily due to calculation variations regarding, *e.g.*, percentages or average intervals that require weighting in the calculations. In the case of some of the data sets presented in earlier reports but not continued in this report, carriers have updated earlier filings numerous times. In a few isolated instances the most recent update could not be used or required minor adjustment. The data presented here typically reflect data updates filed with the Industry Analysis Division as of June 1998. We therefore caution the reader that some of the problems that may be discovered in connection with the data presented here resulted from differences in aggregation methodologies, data irregularities, or data revisions that either could not be used or were not available in time for use in this Report.<sup>18</sup>

Fourth, outage measurements should be considered in context. For example, the average number of lines affected per event would tend to favor a company with a larger number of smaller or remote switches with lower line counts per switch, while the average outage duration might favor a company with larger switches. Thus, using the average number of lines per event measurement, one 25,000 line switch that is out of service for five minutes would appear to have a greater service impact than ten 2,500 line switches that are out of service for five minutes. That

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<sup>17</sup> Recent Commission orders have modified definitions in the data collection process in an attempt to remove perceived ambiguities. We note, however, that because this report contains many items whose composites are calculated as weighted sums or averages, we have recalculated company composites for this report to improve consistency and we have pointed out general cautions in using the data. We expect that this will be useful to the companies in their review of internal processes associated with calculation of composites and may enable us to use company calculated composites in the future.

<sup>18</sup> Note that 1995 data has been annualized and items such as switching entities and access lines represent the average of the reported quantities over the 4 quarters of 1995. We have noted in some cases that total access lines as reported in the last column of row 140 does not agree with the sum of the first column entry of rows 320 and 330. Variations in access line and switch counts may affect normalized outage data reported in the tables. In some instances irregularities inherent in the underlying data at the study area level or the use of datasets prior to the latest version for this summary report may have resulted in other undetected errors in the calculated composites. In a few instances we have received revised diskettes without version number changes or have not received copies of the most recent revisions in time for inclusion in this report. Typically data revisions do not involve all study areas. In at least one case revised data had a data irregularity that made it unusable.

is why we present a grouping of outage measurements that include the outage line-minutes per event and per 1,000 access lines. We have also added the number of outages per switch as another metric for measuring a company's performance.

Fifth, we have identified some erroneous or incomplete company responses. Some of these deficiencies were corrected prior to preparation of this report, including one error that apparently resulted from an improper reading of the instructions or from otherwise misunderstanding the definitions. This error related to the new requirement that access lines now be provided in whole numbers rather than in thousands. Modifications to the definitions or changes in their interpretation may in some cases affect the ability to perform time series analysis. In addition, data revisions reflecting corrections or omissions have not necessarily been provided retroactively. Some of the errors may be in the process of correction or may not be evident until one performs further analysis with the data.

Notwithstanding these qualifications, we expect this report will promote company responsiveness and, thereby, assist in the elimination of errors that were not identified by earlier screenings or that can only be identified by the companies themselves. Therefore, except in the calculation of company composites, we have not, in most cases, deleted or adjusted data. It is expected that the process of data correction will continue as problems are further identified and corrected.

We also note the following specific caveat: responding to trouble reports is a process that can be affected by various externalities such as adverse weather conditions. Also, response times seem to be affected by such factors as company size and other company specific characteristics or factors.<sup>19</sup> As a result, we advise the reader to remember that slower responsiveness to problems in service quality should not be confused with a lack of responsiveness.

This report presents data that reflect several different ways of measuring switch outages, including line-minutes-per-access line and line-minutes-per-event. Outage line-minutes is a measure that combines both duration and number of lines affected

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<sup>19</sup> SBC, for example, had reported a high level of customer trouble reports for the fourth quarter of 1994 and attributed this to severe weather and flooding in Texas during the period. Similarly, Pacific Telesis attributed high first quarter 1995 trouble reports to weather-related problems. While the reduced frequency of data now filed reduces the number of data points available for trend analysis, it also smooths out the effects of seasonal and weather related problems.



in a single parameter. We derived this parameter from the raw data by simply multiplying the number of lines involved in each outage by the duration of the outage, summing the resulting values and dividing the sum by the total number of access lines or events. Because outage measurements tend to exhibit more variability than other measurements, we have shown in the tables several ways of presenting the results. Improvements in responding to outages by some of the reporting companies may be associated with efforts to improve switch reliability, including working with manufacturers to replace poorly performing switches and to improve performance of existing ones.<sup>20</sup>

Because performance within any single data category may vary widely over time, evaluating a given company's performance by looking at a single measurement may be misleading, especially considering that long lead times might be needed to correct certain problems or that corrections might already be underway. On the other hand, problems that are observed in several service quality measurement categories could also reflect overall service deterioration. We believe that customer complaint and perception levels should be viewed in the context of other measures of performance. However, we have found that it is practically impossible to ascertain whether changes in aggregate customer complaint levels result from developments in a single problem area or reflect a perception of a wider ranging set of problems. For these reasons and because data is now filed annually rather than quarterly we recommend the use of both trend and pattern analysis of the data.

Most measurements do not exhibit a consistent pattern of changes between 1995 and 1997. In at least one case there is a consistent increase in customer complaints and customer dissatisfaction over this period.<sup>21</sup> In fact, some companies which in

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<sup>20</sup> GTE representatives met with the staff to express concerns about presentation of its outage data in this Report, asserting that the raw number of outages taken out of context would result in GTE appearing worse than other companies due to the large number of small and remote switches in its territory. The use of a menu of data elements as a description of outage performance actually tends to portray performance more equitably for all companies and reduces reporting bias that would tend to result from a more limited description of the data.

<sup>21</sup> Ameritech for example does exhibit continued increases in residential complaints per million access lines and in the percentage of customers dissatisfied; however, there does appear to be improvement in other measurements that may lead to improvement in future customer satisfaction levels. Further steps may be required to avoid future increases in customer complaints and dissatisfaction levels.

previous reports had registered service indicator declines have shown improvements that might, at least in part, be related to significant increases in gross capital expenditures.<sup>22</sup> Recent Bell Atlantic data for New York and New England (formerly NYNEX) disclose capital expenditure increases and register concurrent improvement in some service quality measures. This illustrates the lag in addressing the causes of historically reported service quality declines.

Finally, one of the measurements for which service quality data is collected is the number of service affecting troubles reported by customers. Because of the various classifications of trouble reports, the Commission's May 1997 Order addressed problems relating to subtleties in the definitions associated with the terms "initial" and "repeat" trouble reports.<sup>23</sup> This and other issues were addressed in an October 1993 Order modifying filing requirements and were the subject of further clarification and expansion in subsequent orders leading to the reporting of a new category of recurring trouble reports.<sup>24</sup>

All of these reflections and observations essentially relate to the issue of maintaining the necessary continuity of data measurement. While an attempt has been made to preserve continuity up to this point, detection of errors and changes in reporting requirements that are deemed necessary to deal with price-cap and other requirements will introduce discontinuities into certain time series data or eliminate certain items of data entirely.

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<sup>22</sup> See Infrastructure data in 1996 ARMIS 43-07 filings (row 540). In 1995 GTE and SBC reported the largest gains in ISDN-capable switches. See Federal Communications Commission, Industry Analysis Division, *Infrastructure of the Local Operating Companies Aggregated to the Holding Company Level*, released March 13, 1997 (mimeo 72687).

<sup>23</sup> This issue was discussed in the last report on service quality and was addressed in recent Commission orders. See *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 12 FCC Rcd 8115, 8133 (rel. May 30, 1997); *Revision of ARMIS Annual Summary Report (FCC Report 43-01) et al.*, Order, 12 FCC Rcd 21831, 21835 (Com. Car. Bur., rel. Dec. 16, 1997). See also Federal Communications Commission, Industry Analysis Division, *Quality-of-Service for the Local Operating Companies Aggregated to the Holding Company Level*, released March 22, 1996 (mimeo 60268) for further discussion.

<sup>24</sup> See *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 8 FCC Rcd 7474, ¶ 26 and attachments (1993). See also *Revision of ARMIS Annual Summary Report (FCC Report 43-01) et al.*, 12 FCC Rcd 21831 (introducing reporting of "subsequent" troubles).

In addition, changes in technology have compelled changes in measurements required to adequately monitor service quality.<sup>25</sup> Compounding this problem is the fact that the companies themselves periodically wish to change their internal measurement procedures from which regulatory data are drawn, adding difficulty to long-term measurement.<sup>26</sup> In some cases procedural changes in the data measurement and collection process may be subtle enough so that they are not immediately noticeable in the data. Significant changes in company procedures, however, usually result in noticeable and abrupt changes in data levels. It appears that at least some of these changes are not reported to the Commission. These factors tend to limit the number of years of data available to track service quality trends and will affect the frequency and availability of summary reports that are prepared by the Commission. Although the Commission has made every effort to standardize and rationalize data reporting over the years, given the number of changes to the reporting regimes and predictable future changes, one should not assume exact comparability on all measurements for data sets as they are presented year by year.

It is our experience that service reliability data is, by its nature, subject to a greater volatility than other types of company data. As a general rule, one should be cautious about interpreting individual measurements until one develops a sense of what the data measurements disclose about company performance.

This report is available in the Common Carrier Bureau's Public Reference Room, 2000 M Street, N.W., Room 575, Washington, D.C. 20554. For more information, contact Jonathan Kraushaar at (202) 418-0947 or (202) 418-0940.

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<sup>25</sup> For example there is presently a lack of information on digital transmission characteristics particularly with respect to performance of high speed data modems used on analog lines. This lack of information and associated customer confusion may contribute to adverse customer perceptions. Furthermore, adequate public information on the performance of analog loops in terms of their performance when used with a data modem could provide a stimulus for the proliferation of digital and fiber subscriber loops.

<sup>26</sup> For those interested in trending customer perception data in this Report with that available in prior Reports it should be noted that Bell Atlantic, for example, reported changes to its customer perception surveys that were reflected in its post-1990 data, and Pacific Telesis had noted changes effective in January 1992.

**Table 1(a): Company Comparison -- Installation, Maintenance, & Customer Complaints -- 1995 (Annualized)**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>ACCESS SERVICES PROVIDED TO CARRIERS -- SWITCHED ACCESS</b>									
Percent Installation Commitments Met	82.3	91.9	99.1	96.0	92.8	95.9	73.3	93.0	95.6
Average Installation Interval (days)	56.2	35.0	23.1	41.4	32.5	33.3	21.9	32.8	NA
Average Repair Interval (hours)	27.4	6.6	3.1	16.0	6.4	3.5	8.7	12.0	3.1
<b>ACCESS SERVICES PROVIDED TO CARRIERS -- SPECIAL ACCESS</b>									
Percent Installation Commitments Met	81.5	92.7	90.7	88.7	96.7	88.4	69.5	92.9	95.2
Average Installation Interval (days)	17.3	15.3	12.6	21.8	23.0	NA	14.8	12.1	1.8
Average Repair Interval (hours)	4.0	2.2	3.0	8.2	3.7	2.1	6.3	8.1	3.0
<b>LOCAL SERVICES PROVIDED TO RESIDENTIAL AND BUSINESS CUSTOMERS</b>									
Percent Installation Commitments Met	98.6	99.7	98.7	97.6	99.1	99.2	97.3	98.1	98.9
Residence	99.1	99.7	98.8	98.5	99.2	99.3	97.8	98.5	99.1
Business	96.7	99.4	98.3	95.7	98.9	98.6	94.6	95.9	97.9
Average Installation Interval (days)	3.0	1.6	NA	6.7	2.7	1.4	1.9	3.1	2.9
Residence	2.6	1.4	NA	5.4	2.3	1.3	1.3	2.9	2.5
Business	4.2	3.3	NA	7.4	4.2	1.7	3.4	4.1	4.9
Initial Trouble Reports per Thousand Lines	226.4	242.1	289.1	323.6	156.8	214.3	184.8	198.0	242.7
Total MSA	224.6	245.6	284.4	335.5	155.6	218.3	183.5	187.0	NA
Total Non MSA	245.6	200.1	308.2	247.2	181.9	222.1	189.3	226.2	NA
Total Residence	279.2	280.5	322.2	373.0	194.5	258.7	208.4	214.6	NA
Total Business	119.9	173.0	209.0	209.7	92.1	127.1	126.4	152.9	NA
Troubles Found per Thousand Lines	140.1	178.8	145.4	219.9	112.8	146.8	121.9	150.6	181.7
Repeat Troubles as a Pct. of Trouble Rpts.	18.2%	27.8%	15.3%	17.4%	18.0%	13.3%	26.7%	13.3%	11.8%
Total Residence	18.1%	29.6%	15.3%	17.1%	17.5%	13.5%	25.7%	13.2%	12.2%
Total Business	18.2%	22.3%	15.5%	18.9%	19.6%	12.2%	31.0%	13.7%	9.7%
Res. Complaints per Mill. Res. Access Lines	164.8	50.4	75.4	924.0	11.5	44.9	953.4	107.9	132.5
Bus. Complaints per Mill. Bus. Access Lines	54.7	14.6	40.2	490.8	3.2	20.6	544.5	NA	82.2

Please refer to text for notes and data qualifications

**Table 1(b): Company Comparison -- Switch Downtime & Trunk Blocking -- 1995 (Annualized)**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>Total Access Lines In Thousands</b>	18,348	19,167	20,168	15,959	17,692	13,799	14,309	16,362	6,568
<b>Total Trunk Groups</b>	1,288	1,506	3,712	1,092	1,680	1,070	2,490	2,339	1,333
<b>Total Switches</b>	1,416	1,408	1,653	1,293	822	1,493	1,672	4,383	1,644
<b>Switches with Downtime</b>									
<b>Number of Switches</b>	1,137	432	232	165	157	608	1,547	822	217
<b>As a percentage of Total Switches</b>	80.3%	30.7%	14.0%	12.8%	19.1%	40.7%	92.5%	18.8%	13.2%
<b>Average Switch Downtime In seconds per Switch</b>									
<b>For All Events</b>	144.3	38.9	209.1	333.0	38.6	216.0	468.1	362.7	226.5
<b>For Unscheduled Events Over 2 Minutes</b>	92.2	23.5	202.1	304.9	29.1	177.0	413.3	351.6	198.2
<b>For Unscheduled Downtime More than 2 Minutes</b>									
<b>Number of Occurrences or Events</b>	50	27	111	101	15	67	138	328	124
<b>Events per Hundred Switches</b>	3.5	1.9	6.7	7.8	1.8	4.5	8.3	7.5	7.5
<b>Events per Million Access Lines</b>	2.73	1.41	5.50	6.33	0.85	4.86	9.64	20.05	18.88
<b>Average Outage Duration In Minutes</b>	43.5	20.4	50.2	65.0	26.5	65.7	83.4	78.3	43.8
<b>Average Lines Affected per Event In Thousand</b>	17.5	27.0	10.4	13.4	12.6	8.5	5.4	5.0	5.8
<b>Outage Line-Minutes per Event In Thousands</b>	2,027.4	543.3	194.4	694.8	360.4	240.8	419.2	169.4	190.7
<b>Outage Line-Minutes per 1,000 Access Lines</b>	5,524.8	765.3	1,070.2	4,397.2	305.5	1,169.5	4,042.8	3,395.8	3,599.8
<b>For Scheduled Downtime More than 2 Minutes</b>									
<b>Number of Occurrences or Events</b>	182	37	15	5	13	144	239	24	39
<b>Events per Hundred Switches</b>	12.9	2.6	0.9	0.4	1.6	9.6	14.3	0.5	2.4
<b>Events per Million Access Lines</b>	9.92	1.93	0.74	0.31	0.73	10.44	16.70	1.47	5.94
<b>Average Outage Duration In Minutes</b>	3.4	3.3	2.9	7.3	4.9	3.5	3.7	11.0	18.6
<b>Avg. Lines Affected per Event In Thousands</b>	23.8	27.1	32.5	22.2	20.2	11.9	7.2	7.9	7.1
<b>Outage Line-Minutes per Event In Thousands</b>	77.7	80.7	97.6	220.5	67.5	47.7	45.6	54.8	56.8
<b>Outage Line-Minutes per 1,000 Access Lines</b>	770.3	155.8	72.6	69.1	49.6	497.7	762.0	80.3	337.1
<b>% Trunk Grps. Exceeding 3 Month Blocking Objectives During Calendar Year</b>	1.01%	2.86%	0.89%	6.78%	1.19%	0.65%	2.05%	4.19%	2.10%

Please refer to text for notes and data qualifications

**Table 1(c): Company Comparison -- Switch Downtime Causes -- 1995 (Annualized)**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>TOTAL NUMBER OF OUTAGES</b>									
1. Scheduled	182	37	15	5	13	144	239	24	39
2. Proced. Errors -- Telco. (Inst./Maint.)	2	3	0	9	1	20	45	19	19
3. Proced. Errors -- Telco. (Other)	5	2	19	0	1	1	10	30	3
4. Procedural Errors -- System Vendors	0	2	11	0	2	1	2	7	5
5. Procedural Errors -- Other Vendors	4	0	2	0	1	2	6	3	10
6. Software Design	24	5	26	11	1	27	12	82	13
7. Hardware design	0	1	3	12	0	1	0	8	2
8. Hardware Failure	13	12	29	12	7	9	48	141	29
9. Natural Causes	1	1	0	3	0	0	1	18	15
10. Traffic Overload	0	0	0	0	1	0	1	0	0
11. Environmental	0	0	0	0	0	1	4	7	3
12. External Power Failure	0	0	0	10	0	1	2	6	2
13. Massive Line Outage	0	0	0	3	0	4	0	2	1
14. Remote	0	0	1	0	0	0	0	0	2
15. Other/Unknown	1	1	20	41	0	0	7	5	20
<b>TOTAL OUTAGE LINE-MINUTES PER THOUSAND ACCESS LINES</b>									
1. Scheduled	770.3	155.8	72.6	69.1	49.6	497.7	762.0	80.3	337.1
2. Proced. Errors -- Telco. (Inst./Maint.)	1311.1	38.7	0.0	56.4	1.5	145.5	460.3	54.0	435.0
3. Proced. Errors -- Telco. (Other)	3249.5	85.3	161.1	0.0	0.8	145.5	159.8	279.7	7.0
4. Procedural Errors -- System Vendors	0.0	31.0	88.6	0.0	5.4	2.7	33.2	74.6	580.4
5. Procedural Errors -- Other Vendors	6.5	0.0	56.2	0.0	93.1	59.5	86.0	30.1	62.9
6. Software Design	76.9	201.2	159.0	718.9	112.3	104.5	887.0	811.5	360.3
7. Hardware design	0.0	7.8	26.7	889.0	0.0	3.3	0.0	187.9	100.9
8. Hardware Failure	875.5	156.5	250.4	1258.2	90.3	66.4	339.1	1370.1	1047.1
9. Natural Causes	2.1	239.4	0.0	195.4	0.0	0.0	0.2	494.0	621.1
10. Traffic Overload	0.0	0.0	0.0	0.0	2.1	0.0	1.2	0.0	0.0
11. Environmental	0.0	0.0	0.0	0.0	0.0	281.9	1573.9	54.9	6.9
12. External Power Failure	0.0	0.0	0.0	560.8	0.0	283.8	501.2	18.0	2.1
13. Massive Line Outage	0.0	0.0	0.0	145.6	0.0	76.5	0.0	6.3	29.3
14. Remote	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	201.4
15. Other/Unknown	3.2	5.5	327.8	573.0	0.0	0.0	0.8	14.6	145.4

Please refer to text for notes and data qualifications

**Table 1(d): Company Comparison -- 1995 Customer Perception Surveys**

<b>Company</b>	<b>Ameritech</b>	<b>Bell Atlantic</b>	<b>BellSouth</b>	<b>NYNEX</b>	<b>Pacific</b>	<b>SBC</b>	<b>US West</b>	<b>GTE</b>
<b>Percentage of Customers Dissatisfied</b>								
<b>Overall:</b>								
Residential	1.24	7.51	1.39	17.12	10.82	6.75	5.00	7.34
Small Business	2.29	8.03	4.05	18.79	11.28	6.92	7.19	12.23
Large Business	8.35	11.19	5.38	17.90	8.41	2.92	8.33	4.18
<b>Installations:</b>								
Residential	3.60	5.90	6.27	13.46	7.75	4.80	4.08	7.34
Small Business	9.62	8.33	4.07	22.55	9.13	6.20	11.05	12.23
Large Business	7.18	13.61	NA	22.22	9.37	7.57	13.90	4.18
<b>Repairs:</b>								
Residential	8.63	12.21	10.87	22.52	17.06	8.18	10.82	10.76
Small Business	11.79	10.72	4.49	20.13	14.95	7.28	15.22	11.96
Large Business	9.22	19.05	NA	25.95	14.00	9.54	13.63	4.74
<b>Business Office:</b>								
Residential	4.89	4.55	5.88	12.46	9.31	7.26	5.68	2.60
Small Business	5.91	5.12	3.62	12.92	10.15	7.31	4.70	7.89
Large Business	11.24	13.14	NA	25.00	7.40	8.02	9.65	3.43

*Please refer to text for notes and data qualifications*

**Table 1(e): Company Comparision -- 1995 Customer Perception Surveys**

<b>Company</b>	<b>Ameritech</b>	<b>Bell Atlantic</b>	<b>BellSouth</b>	<b>NYNEX</b>	<b>Pacific</b>	<b>SBC</b>	<b>US West</b>	<b>GTE</b>
<b>Sample Sizes -- Customer Perception Surveys</b>								
<b>Overall:</b>								
Residential	16,848	77,127	21,488	151,349	71,197	61,320	12,229	13,903
Small Business	8,154	68,200	132,530	104,082	69,918	60,185	12,500	6,991
Large Business	3,477	1,412	11,858	2,112	648	14,073	33,375	886
<b>Installations:</b>								
Residential	39,267	27,007	58,781	42,377	30,522	19,866	3,070	13,903
Small Business	3,696	25,221	65,677	37,442	30,508	20,081	4,850	6,991
Large Business	675	1,602	NA	1,548	625	7,900	6,345	886
<b>Repairs:</b>								
Residential	38,810	27,153	65,684	66,898	20,288	20,522	3,049	13,709
Small Business	3,747	23,474	45,394	41,461	23,326	20,424	4,845	6,965
Large Business	724	1,307	NA	1,557	597	6,756	6,435	931
<b>Business Office:</b>								
Residential	31,837	22,310	45,515	42,074	20,387	20,932	3,015	13,759
Small Business	4,124	19,505	11,329	25,179	16,084	19,680	4,686	7,009
Large Business	705	898	NA	192	520	4,094	6,510	935

Please refer to text for notes and data qualifications



**Table 2(a): Company Comparison -- Installation, Maintenance, & Customer Complaints -- 1996**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>ACCESS SERVICES PROVIDED TO CARRIERS -- SWITCHED ACCESS</b>									
Percent Installation Commitments Met	61.1	88.1	98.3	78.5	92.8	88.9	85.8	97.1	96.8
Average Installation Interval (days)	54.2	29.0	24.9	58.2	37.9	30.2	18.8	32.2	4.3
Average Repair Interval (hours)	28.0	9.3	2.1	NA	21.5	3.7	8.1	13.4	3.8
<b>ACCESS SERVICES PROVIDED TO CARRIERS -- SPECIAL ACCESS</b>									
Percent Installation Commitments Met	87.9	92.4	89.2	77.5	93.6	80.9	83.8	92.3	97.0
Average Installation Interval (days)	18.4	14.6	13.2	29.3	22.6	0.0	14.1	11.5	6.2
Average Repair Interval (hours)	3.7	2.5	3.3	10.7	4.7	2.1	5.1	8.9	3.1
<b>LOCAL SERVICES PROVIDED TO RESIDENTIAL AND BUSINESS CUSTOMERS</b>									
Percent installation Commitments Met	98.3	99.3	98.7	98.1	99.0	99.0	97.8	98.0	98.8
Residence	98.4	99.4	98.9	98.5	99.0	99.1	98.3	98.4	99.0
Business	97.1	98.7	97.5	96.0	98.7	98.1	94.3	95.6	97.8
Average Installation Interval (days)	2.2	1.6	0.7	3.1	2.2	0.7	1.3	2.8	2.9
Residence	2.0	1.5	0.6	2.9	1.9	0.7	0.7	2.6	2.5
Business	3.5	2.6	1.4	5.3	3.4	0.7	3.4	4.2	5.1
Initial Trouble Reports per Thousand Lines	218.9	176.4	280.3	237.7	126.3	244.3	191.2	201.0	222.6
Total MSA	217.1	179.5	274.5	243.1	126.0	245.0	186.3	191.7	212.8
Total Non MSA	238.7	159.9	307.6	203.7	132.7	240.8	208.9	224.1	234.8
Total Residence	281.6	216.3	317.4	273.5	153.8	296.9	221.2	222.8	254.1
Total Business	103.3	112.8	195.7	158.2	79.0	129.2	122.0	143.9	140.3
Troubles Found per Thousand Lines	141.8	98.4	137.8	133.0	93.6	166.4	128.4	150.0	166.5
Repeat Troubles as a Pct. of Trouble Rpts.	16.7%	37.5%	17.4%	22.9%	15.9%	15.1%	31.2%	15.0%	12.7%
Total Residence	16.7%	39.9%	18.0%	22.9%	15.6%	15.4%	30.3%	14.7%	13.1%
Total Business	16.3%	29.4%	15.4%	23.1%	16.9%	13.2%	34.9%	16.3%	10.6%
Res. Complaints per Mill. Res. Access Lines	174.3	112.6	66.1	1,061.6	13.4	42.2	731.6	165.8	12.1
Bus. Complaints per Mill. Bus. Access Lines	29.1	24.6	31.6	576.9	5.2	17.6	419.5	86.8	5.2

Please refer to text for notes and data qualifications

**Table 2(b): Company Comparison -- Switch Downtime & Trunk Blocking -- 1996**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>Total Access Lines in Thousands</b>	19,553	20,767	21,822	16,541	20,466	14,104	15,405	17,393	6,956
<b>Total Trunk Groups</b>	1,578	1,677	3,706	1,087	1,956	875	2,555	2,893	1,046
<b>Total Switches</b>	1,410	1,396	1,650	1,245	826	872	1,521	4,396	1,658
<b>Switches with Downtime</b>									
<b>Number of Switches</b>	738	609	252	123	149	1,010	889	530	147
<b>As a percentage of Total Switches</b>	52.3%	43.6%	15.3%	9.9%	18.0%	115.8%	58.4%	12.1%	8.9%
<b>Average Switch Downtime in seconds per Switch</b>									
<b>For All Events</b>	149.4	220.3	236.9	115.5	46.2	437.5	301.2	354.8	351.0
<b>For Unscheduled Events Over 2 Minutes</b>	105.9	194.7	221.4	98.6	15.2	511.2	205.9	336.7	344.1
<b>For Unscheduled Downtime More than 2 Minutes</b>									
<b>Number of Occurrences or Events</b>	82	25	114	41	14	144	128	288	117
<b>Events per Hundred Switches</b>	5.8	1.8	6.9	3.3	1.7	16.5	8.4	6.6	7.1
<b>Events per Million Access Lines</b>	4.19	1.20	5.22	2.48	0.68	10.21	8.31	16.56	16.82
<b>Average Outage Duration in Minutes</b>	30.3	181.2	53.4	49.9	15.0	51.6	40.8	85.7	81.3
<b>Average Lines Affected per Event in Thousand</b>	15.8	23.2	14.4	15.3	29.8	12.3	7.3	5.2	5.5
<b>Outage Line-Minutes per Event in Thousands</b>	218.5	914.5	384.4	319.9	136.7	459.8	218.7	171.4	219.8
<b>Outage Line-Minutes per 1,000 Access Lines</b>	916.4	1,101.0	2,008.1	792.9	93.5	4,694.3	1,817.4	2,837.9	3,696.5
<b>For Scheduled Downtime More than 2 Minutes</b>									
<b>Number of Occurrences or Events</b>	186	44	52	25	44	141	256	16	15
<b>Events per Hundred Switches</b>	13.2	3.2	3.2	2.0	5.3	16.2	16.8	0.4	0.9
<b>Events per Million Access Lines</b>	9.51	2.12	2.38	1.51	2.15	10.00	16.62	0.92	2.16
<b>Average Outage Duration in Minutes</b>	2.7	3.0	4.3	9.4	2.8	2.9	3.8	20.2	11.3
<b>Avg. Lines Affected per Event in Thousands</b>	19.4	29.4	28.0	49.7	58.3	14.7	6.3	6.9	10.8
<b>Outage Line-Minutes per Event in Thousands</b>	53.3	94.7	102.9	299.6	182.5	58.5	21.1	78.7	44.4
<b>Outage Line-Minutes per 1,000 Access Lines</b>	507.3	200.6	245.2	452.8	392.3	585.3	350.8	72.4	95.8
<b>% Trunk Grps. Exceeding Blocking Objectives</b>	8.05%	16.99%	1.30%	18.22%	6.34%	2.97%	4.77%	3.18%	15.39%

*Please refer to text for notes and data qualifications*

**Table 2(c): Company Comparison -- Switch Downtime Causes -- 1996**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>TOTAL NUMBER OF OUTAGES</b>									
1. Scheduled	186	44	52	25	44	141	256	16	15
2. Proced. Errors -- Telco. (Inst./Maint.)	9	3	0	0	0	4	10	14	13
3. Proced. Errors -- Telco. (Other)	3	1	25	2	1	5	9	17	3
4. Procedural Errors -- System Vendors	25	2	18	5	1	4	2	2	7
5. Procedural Errors -- Other Vendors	1	0	3	2	1	3	0	11	6
6. Software Design	23	1	19	2	1	85	45	74	7
7. Hardware design	2	2	5	0	0	4	0	0	5
8. Hardware Failure	16	10	24	7	4	14	18	137	31
9. Natural Causes	2	3	8	8	0	9	2	16	17
10. Traffic Overload	0	0	0	0	0	0	0	0	0
11. Environmental	1	0	0	0	0	0	1	1	1
12. External Power Failure	0	0	0	3	0	0	2	11	2
13. Massive Line Outage	0	0	0	0	0	15	0	5	2
14. Remote	0	0	1	1	0	1	0	0	3
15. Other/Unknown	0	3	11	11	6	0	39	0	20
<b>TOTAL OUTAGE LINE-MINUTES PER THOUSAND ACCESS LINES</b>									
1. Scheduled	507.3	200.6	245.2	452.8	392.3	585.3	350.8	72.4	95.8
2. Proced. Errors -- Telco. (Inst./Maint.)	83.7	135.0	0.0	0.0	0.0	6.8	38.3	109.4	275.8
3. Proced. Errors -- Telco. (Other)	84.5	111.5	355.1	10.0	6.8	311.0	41.6	127.6	100.4
4. Procedural Errors -- System Vendors	106.8	140.3	193.7	56.2	19.6	653.7	116.3	1.4	46.4
5. Procedural Errors -- Other Vendors	0.2	0.0	37.2	21.8	18.2	111.2	0.0	222.6	128.5
6. Software Design	403.8	2.7	134.8	17.1	4.2	177.6	436.5	713.6	81.5
7. Hardware design	7.7	68.3	31.6	0.0	0.0	47.6	0.0	0.0	45.8
8. Hardware Failure	212.6	348.5	334.3	152.4	31.0	2530.6	327.3	1406.0	995.7
9. Natural Causes	8.3	270.6	766.3	48.8	0.0	52.8	714.1	170.6	679.4
10. Traffic Overload	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11. Environmental	8.8	0.0	0.0	0.0	0.0	0.0	41.0	9.1	0.8
12. External Power Failure	0.0	0.0	0.0	240.7	0.0	0.0	47.5	57.5	80.5
13. Massive Line Outage	0.0	0.0	0.0	0.0	0.0	791.2	0.0	20.0	195.0
14. Remote	0.0	0.0	13.0	4.6	0.0	11.9	0.0	0.0	648.2
15. Other/Unknown	0.0	23.9	142.1	241.4	13.7	0.0	54.9	0.0	418.4

Please refer to text for notes and data qualifications

**Table 2(d): Company Comparison -- 1996 Customer Perception Surveys**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE
<b>Percentage of Customers Dissatisfied</b>								
<b>Overall:</b>								
Residential	2.90	2.25	6.28	3.83	3.99	7.12	8.67	3.07
Small Business	2.36	5.96	12.10	3.74	5.39	6.72	12.38	5.97
Large Business	10.86	9.18	3.92	20.24	6.21	8.21	8.00	1.51
<b>Installations:</b>								
Residential	4.13	8.66	5.19	14.13	3.10	5.83	5.33	7.31
Small Business	8.20	6.48	3.47	20.53	4.54	6.89	11.31	13.39
Large Business	9.38	11.36	NA	23.42	7.42	11.21	23.00	0.74
<b>Repairs:</b>								
Residential	9.55	20.69	8.72	27.33	7.41	8.44	10.50	13.43
Small Business	10.88	9.20	4.32	23.37	7.61	6.57	12.80	14.11
Large Business	11.83	13.17	NA	30.07	7.93	7.94	22.00	1.61
<b>Business Office:</b>								
Residential	5.94	11.17	5.21	18.90	2.07	7.15	2.17	1.88
Small Business	6.02	5.22	2.31	15.86	4.02	6.64	3.56	4.70
Large Business	13.37	9.79	NA	12.51	2.70	13.78	9.00	0.00

*Please refer to text for notes and data qualifications*

**Table 2(e): Company Comparison -- 1996 Customer Perception Surveys**

<b>Company</b>	<b>Ameritech</b>	<b>Bell Atlantic</b>	<b>BellSouth</b>	<b>NYNEX</b>	<b>Pacific</b>	<b>SBC</b>	<b>US West</b>	<b>GTE</b>
<b>Sample Sizes -- Customer Perception Surveys</b>								
<b>Overall:</b>								
Residential	7,269	4,486	159,902	3,805	70,539	59,701	7,773	9,296
Small Business	6,530	2,768	120,400	3,156	68,727	59,740	7,833	9,083
Large Business	5,001	554	8,863	8,054	499	12,922	6,780	634
<b>Installations:</b>								
Residential	23,050	18,724	57,596	39,524	30,444	19,362	4,208	9,513
Small Business	5,839	17,828	85,446	35,171	29,532	19,781	4,195	9,546
Large Business	1,201	1,163	NA	5,300	485	6,938	3,525	476
<b>Repairs:</b>								
Residential	23,170	18,853	57,615	50,427	19,495	19,933	3,565	8,877
Small Business	5,916	17,701	66,227	34,684	22,021	20,061	3,638	8,905
Large Business	1,200	980	NA	4,492	479	5,096	3,495	467
<b>Business Office:</b>								
Residential	14,792	14,368	37,577	20,526	20,600	20,406	4,206	9,463
Small Business	6,530	12,897	91,671	9,675	17,174	19,898	4,063	6,454
Large Business	800	622	NA	3,502	408	3,372	3,375	453

*Please refer to text for notes and data qualifications*

**Table 3(a): Company Comparison -- Installation, Maintenance, & Customer Complaints -- 1997**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>ACCESS SERVICES PROVIDED TO CARRIERS -- SWITCHED ACCESS</b>									
Percent Installation Commitments Met	51.5	82.2	99.0	97.3	92.9	82.3	90.9	94.7	96.9
Average Installation Interval (days)	50.3	33.9	22.0	16.3	84.0	34.0	33.1	30.4	4.1
Average Repair Interval (hours)	10.8	6.4	1.3	NA	14.0	2.9	17.0	13.4	24.3
<b>ACCESS SERVICES PROVIDED TO CARRIERS -- SPECIAL ACCESS</b>									
Percent Installation Commitments Met	92.5	93.1	88.5	98.6	89.4	80.1	86.7	89.7	97.8
Average Installation Interval (days)	13.4	15.0	13.9	11.8	107.5	0.0	22.1	12.9	7.1
Average Repair Interval (hours)	3.1	2.3	3.3	2.9	5.2	2.0	3.4	7.3	11.7
<b>LOCAL SERVICES PROVIDED TO RESIDENTIAL AND BUSINESS CUSTOMERS</b>									
Percent Installation Commitments Met	98.5	98.9	98.7	98.2	96.4	98.9	97.8	98.3	98.2
Residence	98.6	99.1	98.9	98.4	96.5	98.9	98.1	98.6	98.3
Business	97.3	97.5	97.8	97.0	95.8	98.3	95.4	95.8	97.6
Average Installation Interval (days)	2.2	2.6	0.7	1.0	3.0	0.7	1.2	2.9	2.9
Residence	2.1	2.4	0.6	0.9	2.8	0.7	0.8	2.8	2.7
Business	3.1	3.7	1.1	1.3	4.0	0.6	2.9	4.0	4.9
Initial Trouble Reports per Thousand Lines	205.3	166.1	274.1	187.4	105.0	241.4	188.3	186.7	202.5
Total MSA	203.7	168.0	259.8	192.9	NA	245.8	184.1	182.8	150.0
Total Non MSA	222.2	141.4	358.8	151.4	NA	218.1	204.2	196.6	304.8
Total Residence	262.5	199.4	312.9	228.1	NA	291.9	220.5	206.7	241.9
Total Business	99.8	109.2	184.3	114.4	NA	127.3	117.8	NA	NA
Troubles Found per Thousand Lines	205.3	90.0	137.4	128.4	76.4	152.1	127.2	143.3	202.5
Repeat Troubles as a Pct. of Trouble Rpts.	7.1%	22.8%	17.4%	19.5%	16.5%	16.6%	33.0%	13.9%	NA
Total Residence	7.0%	24.0%	18.0%	19.6%	16.8%	16.9%	32.3%	14.1%	NA
Total Business	7.2%	19.3%	14.9%	19.2%	15.1%	14.9%	36.1%	13.1%	NA
Res. Complaints per Mill. Res. Access Lines	240.9	93.3	52.9	539.5	52.2	52.3	532.3	112.7	15.2
Bus. Complaints per Mill. Bus. Access Lines	49.6	36.4	28.5	263.9	8.3	24.5	307.7	57.5	3.0

Please refer to text for notes and data qualifications

**Table 3(b): Company Comparison -- Switch Downtime & Trunk Blocking -- 1997**

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>Total Access Lines in Thousands</b>	20,335	21,375	23,080	18,339	22,253	15,306	16,132	18,319	7,293
<b>Total Trunk Groups</b>	1,568	1,133	3,584	1,064	1,979	832	2,818	2,587	3,924
<b>Total Switches</b>	1,435	1,412	1,654	1,291	810	1,690	1,441	4,422	1,605
<b>Switches with Downtime</b>									
<b>Number of Switches</b>	761	262	345	258	148	355	910	408	64
<b>As a percentage of Total Switches</b>	53.0%	18.6%	20.9%	20.0%	18.3%	21.0%	63.2%	9.2%	4.0%
<b>Average Switch Downtime in seconds per Switch</b>									
<b>For All Events</b>	77.8	46.7	314.6	135.6	238.9	360.5	172.4	287.1	223.7
<b>For Unscheduled Events Over 2 Minutes</b>	60.3	28.3	298.0	120.0	223.4	322.4	102.8	281.3	226.9
<b>For Unscheduled Downtime More than 2 Minutes</b>									
<b>Number of Occurrences or Events</b>	42	20	102	44	15	187	85	227	55
<b>Events per Hundred Switches</b>	2.9	1.4	6.2	3.4	1.9	11.1	5.9	5.1	3.4
<b>Events per Million Access Lines</b>	2.07	0.94	4.42	2.40	0.67	12.22	5.27	12.39	7.54
<b>Average Outage Duration in Minutes</b>	34.4	33.3	80.5	58.7	201.1	48.6	29.1	91.3	110.4
<b>Average Lines Affected per Event in Thousand</b>	13.9	31.8	18.7	31.9	32.5	7.0	11.0	5.1	9.4
<b>Outage Line-Minutes per Event in Thousands</b>	338.0	374.3	946.9	1,452.3	786.5	256.6	242.2	166.1	763.3
<b>Outage Line-Minutes per 1,000 Access Lines</b>	698.2	350.2	4,184.5	3,484.5	530.2	3,134.6	1,275.9	2,058.5	5,756.6
<b>For Scheduled Downtime More than 2 Minutes</b>									
<b>Number of Occurrences or Events</b>	45	32	65	32	55	207	143	12	8
<b>Events per Hundred Switches</b>	3.1	2.3	3.9	2.5	6.8	12.2	9.9	0.3	0.5
<b>Events per Million Access Lines</b>	2.21	1.50	2.82	1.74	2.47	13.52	8.86	0.66	1.10
<b>Average Outage Duration in Minutes</b>	3.3	3.6	4.6	5.3	11.6	2.6	3.1	21.8	6.4
<b>Avg. Lines Affected per Event in Thousands</b>	10.6	32.8	31.4	45.3	37.2	8.7	11.3	8.2	35.7
<b>Outage Line-Minutes per Event in Thousands</b>	33.2	116.6	138.3	243.4	458.6	23.3	40.1	67.6	159.1
<b>Outage Line-Minutes per 1,000 Access Lines</b>	73.5	174.6	389.5	424.7	1,133.6	315.4	355.9	44.3	174.5
<b>% Trunk Grps. Exceeding Blocking Objectives</b>	4.53%	42.98%	1.56%	18.52%	5.71%	12.62%	9.08%	1.01%	3.34%

Please refer to text for notes and data qualifications

Table 3(c): Company Comparison -- Switch Downtime Causes -- 1997

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
<b>TOTAL NUMBER OF OUTAGES</b>									
1. Scheduled	45	32	65	32	55	207	143	12	8
2. Proced. Errors -- Telco. (Inst./Maint.)	4	1	0	4	1	2	0	22	5
3. Proced. Errors -- Telco. (Other)	3	4	14	0	2	2	5	6	2
4. Procedural Errors -- System Vendors	4	3	15	4	3	2	0	4	5
5. Procedural Errors -- Other Vendors	0	1	3	3	0	5	0	6	1
6. Software Design	9	1	23	2	0	147	30	47	5
7. Hardware design	0	1	3	4	0	2	8	0	0
8. Hardware Fallure	20	4	35	11	4	12	32	109	12
9. Natural Causes	0	1	2	1	1	4	0	12	8
10. Traffic Overload	0	0	1	0	0	1	1	0	0
11. Environmental	1	0	0	0	0	1	0	2	0
12. External Power Fallure	0	0	3	0	0	1	4	17	4
13. Massive Line Outage	0	0	0	0	0	6	0	2	4
14. Remote	1	0	0	0	1	0	5	0	2
15. Other/Unknown	0	4	3	0	3	2	0	0	7
<b>TOTAL OUTAGE LINE-MINUTES PER THOUSAND ACCESS LINES</b>									
1. Scheduled	73.5	174.6	389.5	424.7	1133.6	315.4	355.9	44.3	174.5
2. Proced. Errors -- Telco. (Inst./Maint.)	5.4	55.4	0.0	167.9	21.7	1.3	0.0	166.5	54.7
3. Proced. Errors -- Telco. (Other)	6.9	96.8	133.2	0.0	38.0	437.5	386.4	90.2	35.5
4. Procedural Errors -- System Vendors	179.5	101.1	120.8	189.2	75.9	549.0	0.0	41.0	205.9
5. Procedural Errors -- Other Vendors	0.0	7.9	150.1	9.7	0.0	59.5	0.0	84.9	2.9
6. Software Design	74.2	5.1	528.5	14.7	0.0	1026.9	25.3	359.5	588.0
7. Hardware design	0.0	2.7	342.3	154.9	0.0	13.1	131.5	0.0	0.0
8. Hardware Fallure	427.9	40.5	388.2	477.3	6.7	421.2	426.1	1045.6	370.9
9. Natural Causes	0.0	13.8	1750.0	82.3	0.2	351.2	0.0	63.9	505.9
10. Traffic Overload	0.0	0.0	47.3	0.0	0.0	15.2	0.4	0.0	0.0
11. Environmental	4.0	0.0	0.0	0.0	0.0	53.3	0.0	25.8	0.0
12. External Power Fallure	0.0	0.0	597.1	0.0	0.0	0.9	264.9	172.2	2177.9
13. Massive Line Outage	0.0	0.0	0.0	0.0	0.0	169.5	0.0	9.0	1419.8
14. Remote	0.3	0.0	0.0	0.0	90.9	0.0	41.4	0.0	9.1
15. Other/Unknown	0.0	27.0	127.0	0.0	296.8	36.0	0.0	0.0	386.1

Please refer to text for notes and data qualifications



**Table 3(d): Company Comparision -- 1997 Customer Perception Surveys**

<b>Company</b>	<b>Ameritech</b>	<b>Bell Atlantic</b>	<b>BellSouth</b>	<b>NYNEX</b>	<b>Pacific</b>	<b>SBC</b>	<b>US West</b>	<b>GTE</b>
<b>Percentage of Customers Dissatisfied</b>								
<b>Installations:</b>								
<b>Residential</b>	5.52	3.11	5.73	11.54	4.00	5.52	4.86	7.77
<b>Small Business</b>	10.24	7.82	5.83	17.13	6.00	6.36	11.88	13.92
<b>Large Business</b>	10.33	9.29	4.49	16.92	8.00	11.85	18.00	6.38
<b>Repairs:</b>								
<b>Residential</b>	10.38	8.34	8.54	21.38	11.00	8.03	7.00	11.80
<b>Small Business</b>	11.93	10.30	7.37	20.21	9.00	5.73	7.96	13.71
<b>Large Business</b>	15.82	9.04	5.62	20.24	10.00	8.07	16.00	6.72
<b>Business Office:</b>								
<b>Residential</b>	8.24	3.47	6.11	14.03	3.00	6.64	2.02	2.15
<b>Small Business</b>	8.55	6.21	6.18	14.50	5.00	5.93	4.48	5.54
<b>Large Business</b>	9.54	5.75	4.15	18.22	7.00	15.41	16.00	0.00

*Please refer to text for notes and data qualifications*

**Table 3(e): Company Comparison -- 1997 Customer Perception Surveys**

<b>Company</b>	<b>Ameritech</b>	<b>Bell Atlantic</b>	<b>BellSouth</b>	<b>NYNEX</b>	<b>Pacific</b>	<b>SBC</b>	<b>US West</b>	<b>GTE</b>
<b>Sample Sizes -- Customer Perception Surveys</b>								
<b>Installations:</b>								
Residential	38,296	18,735	56,352	32,065	28,285	18,900	4,445	16,806
Small Business	13,493	12,913	39,077	30,125	30,498	19,346	3,798	17,079
Large Business	1,839	827	NA	5,879	884	5,285	3,915	863
<b>Repairs:</b>								
Residential	43,567	18,993	55,983	32,351	16,949	19,126	4,117	17,747
Small Business	20,501	17,809	18,266	30,776	23,015	19,052	3,871	16,687
Large Business	2,370	741	NA	5,292	792	3,779	9,360	790
<b>Business Office:</b>								
Residential	26,255	16,170	32,700	22,508	19,081	19,067	4,451	16,668
Small Business	4,037	12,650	22,780	10,614	18,233	19,399	3,773	12,622
Large Business	1,237	750	5,059	2,832	794	2,303	9,135	4

*Please refer to text for notes and data qualifications*