

CONFORMANCE TESTING OF SUBSCRIBER CABLES
ADMINISTRATIVE PROCEDURES

<u>CONTENTS</u>	<u>PAGE</u>
1. GENERAL	1
2. RESPONSIBILITIES.	2
3. PROCEDURES.	5
4. COMPLEMENT DIAGRAMS	10
5. FORMS	12

1. GENERAL

1.01 This practice replaces Bell System Practice Section 330-300-526. This practice also describes the administrative responsibilities and procedures that are required to establish and maintain an effective subscriber cable conformance testing program. The conformance testing procedure is intended to give support and/or be used in conjunction with other recommended Bell System and Company Practices that deal with defective cable pair administration as listed below:

- (a) Section 680-300-012, Construction Plans - Cable Transfers.
- (b) Section 620-050-020, Cable Transfer Administration.
- (c) Section V61.308, Defective Cable Pair Recovery Plan and Defective Pair Administration Plan AT&T.

1.02 Before these procedures are implemented in an organizational entity, there must be a firm commitment by all management levels of construction, engineering and cable maintenance organizations that their respective groups will accept the responsibilities and adhere to the procedures outlined in the following provisions of this practice.

- 1.03 After splicing work is completed, conformance tests shall be made:
- (a) On all new, extended, and/or rearranged loaded cables.
 - (b) On all new main frame terminated, non-loaded cables.
 - (c) On all existing non-loaded cables when 2000 feet or more of new cable is added.
 - (d) On all existing non-loaded cables when 50 pairs or more are rearranged.
 - (e) On all energized feeder pairs terminated on a Serving Area Interface (SAI) and all feeder pairs released from an existing multiple plant area by the introduction of a serving area interface. (This test will recapture all pairs shown as defective in the ECCR's that were cleared by separating the feeder from the distribution cables with an interface.)

1.04 The responsibility for performing the testing function is the Cable Maintenance Organization. Testing should be performed by a permanently assigned management level employee with the title or equivalent level of Assistant Manager-Conformance Testing. The required number of testers will depend on the following factors in each Area, Division or District:

- (a) Amount of new plant placed and subject to testing.
- (b) Amount of loaded plant versus non-loaded plant.
- (c) Amount of rearrangement work subject to testing.
- (d) Geographic size of the administrative units.

- (e) The basic level of defects in the cable plant which can result in additional analysis of defects and in subsequent retesting.

1.05 Consideration must be given for a "backup" tester in those locations where only one tester is established. The testing force should be sized to meet the average testing requirements of the administrative entity so that facility needs are not impeded and/or work orders delayed in closing pending the completion of conformance testing. Work should be tested on a "first in - first out" basis. However, if periodic fluctuations in the testing work load results in more work on hand than can be tested in the required time frame, the loaded cables should be tested, and the non-loaded cables released for customer service if facility requirements are urgent. When conformance tests are not possible to perform due to pending service requirements, the Construction test reports, E6254 and E4108, per the Defective Pair Administration Plan and Cable Transfer Administration practice should be evaluated by the OSP engineer for acceptance or subsequent action.

1.06 Testing time charges by the conformance testers should include all time necessary to drive, set up, test and perform clerical functions associated with each authorization being tested. Time required by various occupational groups which are involved in record verification, preparation of defective pair lists, testing, defective pair recovery and record posting should be charged to the appropriate account codes for the work operations being performed in accordance with the Accounting Handbook Telephone Plant, Section V27.202. Construction work units are authorized and credit is given for conformance testing activity per the Plant Cost Results Plan, Part 202, effective January, 1978.

2. RESPONSIBILITIES

2.01 The following paragraphs outline the responsibilities of the various work groups associated with conformance testing.

2.02 Outside plant engineering shall:

- (a) Design the cable plant in accordance with standard engineering practices.
- (b) Review the design of the entire facility from the MDF to the serving terminal when making additions or rearrangements.
- (c) Incorporate into the current work order necessary corrections to eliminate existing design deviations.
- (d) Issue construction work orders, construction drawings, and plan changes.
- (e) Select jobs to be conformance tested as specified in (1.03).
- (f) Issue Complement Diagram, Form E6410 (Figures 2, 2A, 2B, and 2C) as required.
- (g) Analyze test results.
- (h) Issue jobs or plan changes to correct major design defects disclosed in existing plant by tests.
- (i) Weigh the economics, determine the immediate need of facilities, and specify the course of action to be taken by cable maintenance forces on jobs when 5 percent or more pair defects are determined by testing to be in existing cable complements that are not due to design or construction activity.

- (j) Make determination as to whether a job should be approved for closing or if further attempts at clearing cable defects are to be made by construction and/or cable maintenance using the criteria specified in paragraphs 3.10 and 3.17.
- (k) Provide engineering assistance as required.

2.03 Construction forces shall:

- (a) Construct cable plant in accordance with engineering plans, attempting to keep man-made defects to a minimum. Alert Outside Plant engineering, in those cases where the presurvey shows that if a job is built or spliced as designed, the end results could be the creation of defective pairs or an undesirable plant condition. Construction must insist the job be redesigned to eliminate the identified problem(s).
- (b) Locate and clear, if economical, all DC defects in new cables before conformance testing is attempted. Prepare a Construction Cable Completion Test Report, Form E-6254 (Exhibits 6 & 6A), listing all defective pairs, tested in new, replaced, or extended cable plant. Forward Form E-6254 to the conformance testing coordinator.

NOTE: Defective cable pairs, one percent or greater of the total pairs in newly constructed cable sections and five percent of the total pairs in newly extended cable counts are considered excessive and must be approved by appropriate higher levels of engineering management (See paragraph 3.17). Where economically feasible, pair defects should be cleared before a job is accepted and closed out so that the number of defective pairs do not exceed one percent in the new, and five percent in the existing cable plant.

- (c) Utilize opening and closing number procedures. (Sections 620-020-005 and 660-101-302).
- (d) As required, test and verify from the splice opening the defective cable pairs determined to be in the counts involved with the splicing work operation(s) per Section 620-050-020, Cable Transfer Administration, Section 680-300-012, Construction Plans - Cable Transfers, and Section V61.308, Defective Cable Pair Recovery Plan. Clear defective pairs if possible in the splices and counts where working. Clearing defective cable pairs in existing cables is not a primary construction responsibility, however, a reasonable effort should be made to test and clear any defective pairs suspected to be at the construction splice location(s). Utilize Form E4108, Report of Defective Cable Pair, (Exhibits 5 and 5A) to update the defective pair information. Forward Form E4108 to the Assignment Office, the Repair Service Bureau or Cable Maintenance Center responsible for maintaining the defective pair file and the conformance testing coordinator.
- (e) Notify the conformance test coordinator, with the Test Notification, Form E6412 (Exhibits 4 & 4A) when splicing work is complete on an authorization and ready for conformance testing. Copies of Construction Test Reports, Form E6254 and Form E4108 should also be sent to the coordinator to assist the tester in determining the location of defects detected during conformance testing.

- (f) Locate and clear DC and/or AC defects identified by conformance testing which are in the new cable or otherwise caused by construction activity as requested by OSP engineering.
- (g) Close out the work authorization when notified that the final percent of defects is acceptable or is approved by the appropriate level of engineering management as specified in paragraphs 3.17 and 3.21.

2.04 The conformance tester shall:

- (a) Be a management level employee with the title or equivalent of Assistant Manager-Conformance Testing normally reporting to the Cable Maintenance Organization.
- (b) Identify defective pairs, categorize and locate the source of AC defects.
- (c) Locate the source of DC defects in new plant and specify a work location on the authorization where the defects are located.

Note: The tester should list and classify all defects on the Test Report, Form SW6411, as design, construction or existing (non-design). Defects must be determined to be in the new or existing plant. The tester should attempt to locate those defects (specify a work location on the print) determined to be in the new plant by using additional testing techniques and/or manpower as required. Test reports Form E-6254 and Form E-4108 provided by construction can be valuable in determining the location of most defects and can minimize the necessity of needing an additional tester

in the field to locate defects.

However, if the volume of DC defects are sufficient to warrant correction, and the defects cannot be located from single end testing or from analyzing other available test information, it may be necessary to have a tester on both ends of the cable to measure the defects. In these cases, if no field test points are available without opening splices and/or the cable sheath, assistance from construction splicing or cable maintenance forces may become necessary for further testing and location of defects. Time spent locating these defects should be charged to the authorization being tested in accordance with the Accounting Handbook-Telephone Plant, Section V27.202.

The tester should not attempt to clear defects, except in isolated cases. However, he is obligated to give assistance to those assigned to clearing them. Special efforts to "pin-point" defects identified to be in existing plant should not be expended by the tester unless there are a large number of defects known to be in the existing plant prior to the conformance testing. In these cases, previous arrangements should be coordinated with cable maintenance by the testing coordinator for assistance in sectionalization of the defects.

To assist cable maintenance forces in clearing defective pairs identified to be in the existing plant, the tester should indicate on the test report all information which may be of value. For example, shorts and grounds should be identified by resistance; opens should be identified by total capacitive length from the test point.

2.05 The conformance testing coordinator shall:

- (a) Be part of the Division or Area Facilities Services or Engineering staff responsible for cable maintenance functions.
- (b) Review work orders; cable prints and complement diagrams; assign testing work to be performed; receive, review and forward test results; and act as liason between the tester, the Outside Plant engineer, Construction Management Centers and the Cable Maintenance Center.
- (c) Accumulate testing data, maintain Log Sheets, Form SW6411B (Exhibit 3) and issue monthly and quarterly reports, Conformance Testing-Results, Form SW6416 (Exhibit 10) as required in (3.23).

2.06 Cable assignment forces and the Repair Service Bureau (RSB) or Cable Maintenance Center (CMC) responsible for the defective pair file will ensure that cable pairs identified by conformance testing are posted to the Exchange Customer Cable Records (ECCR's) and defective pair file respectively. (See Section 680-300-012.)

2.07 Cable maintenance forces shall:

- (a) Locate and clear DC and/or AC defects identified in existing cables by conformance testing as requested after service and economic conditions have been evaluated by the OSP engineer. (See Section V61.308, Defective Pair Administration.)

3. PROCEDURES

3.01 The following paragraphs describe the step-by-step administrative procedures for conformance testing of subscriber cables, which provide an optimum amount of testing, i.e., sufficient testing to economically identify, categorize, and locate a high percentage of the actual faults with an excellent degree of accuracy. The flowchart in Exhibit 1 summarizes these steps.

3.02 The Outside Plant engineer should determine whether conformance testing is required for each routine order and/or estimate, using the criteria in paragraph 1.03. When testing is required, the engineer will:

- (a) Prepare a complement diagram for each design complement to be conformance tested. (See Part 4.)
- (b) Review the design of the facility from the wire center to the serving terminal, using the complement diagram. Incorporate any design corrections on the new work order. The preferred method of reviewing the design is by accessing the REDCAP function of the Universal Cable Circuit Analysis Program (UNICCAP), covered in Section 856-100-100, which will evaluate the design, diagnose the deviation, and print the correction for resistance designed plant. A manual/visual review also is possible.
- (c) For long loaded cables, calculate the expected return loss, insertion loss, and resistance to the field test point, and post these values on the complement diagram. (See paragraph 4.03.) The preferred method for obtaining these values is by using UNICCAP. When using UNICCAP, specify the type of termination to be used by the tester (115

repeat coil or 4066 precision network) for making return loss measurements. The type of return loss measuring set (54C or KS-20501) also must be specified. The calculated value will vary with the type hardware used.

(d) Indicate on the construction work prints "Conformance testing required." Issue the work prints with the complement diagrams in the normal manner indicating that copies are to be sent to construction, assignment, and the conformance test coordinator. The total number of pairs to be AC tested and/or DC tested should be designated by a splicing operation and located on the appropriate print(s) of the authorization. (See Plant Cost Results Plan, Part 204, January, 1978.)

(e) Retain a copy of the complement diagram in a pending file until testing has been completed and the job closed out.

(f) After the job has been closed, the complement diagram and test results should be retained and filed by cable and complement for future use by the OSP engineer. A properly maintained file can considerably reduce the engineer's future work load.

3.03 The coordinator will record the order number and date of receipt of the complement diagram on Form SW6411B, Log Sheet (Exhibit 3). The coordinator should review the complement diagram in order to make preliminary plans for testing. If in the course of reviewing the complement diagram, design problems are discovered, the coordinator should query the engineer. The coordinator will provide the tester with a copy of the construction work print and complement diagram.

3.04 Construction, upon receipt of the construction work print, will schedule and complete the work as designed.

3.05 The Assignment Office upon receipt of the construction work print, will perform the normal assignment functions associated with the order and take additional steps to ensure that:

(a) The coordinator is notified when service orders are being delayed pending completion of the test.

(b) Where appropriate, a release is obtained from the Outside Plant engineer to assign in properly tested complements when the final approval is being delayed because of defects in other complements.

3.06 The Construction Management Center will notify the test coordinator when all splicing work has been completed and is ready for testing by using Form E6412, Test Notification (Exhibit 4). Associated copies of Form E6254, Construction Cable Completion Test Report (Exhibit 6), and Form E4108, Report of Defective Cable Pairs (Exhibit 5) should also be sent with the test notification.

3.07 The test coordinator will determine if all required tests have been made by construction and reported on Form E6254, Construction Cable Completion Test Report, and Form E4108, Report of Defective Cable Pairs. When all necessary test information has been received from construction, the coordinator will schedule and dispatch the required number of testers to accomplish the tests as specified in Section 330-300-527. One tester is required to test from the wire center for non-loaded and short loaded cables. Cables with seven loading points or more require a tester in the field and one at the main distribution frame.

3.08 When notified by the coordinator that the order is ready for testing, the tester will perform the conformance tests as outlined in Section 330-300-527. Testing must be carried out as soon as possible, with initial tests being completed within 10 days and final tests (i.e., after all corrective actions have taken place) being completed within 30 days. The test results should be noted on Form E-6413, Test Notes (Exhibit 7). The tester then should summarize the results by listing each defective pair, categorizing the defect, and specifying the location of the fault on Form SW6411, Test Report (Exhibit 8). Copies of the test report and test notes will be returned to the coordinator.

3.09 The test coordinator will note the receipt of the test reports on Log Sheet, Form SW6411B (Exhibit 3). The coordinator will review the test results and make appropriate notations concerning the defects. The test report will then be signed and copies sent to the Construction Management Center and the Outside Plant engineer indicating the initial test has been performed. The test reports and associated notes are filed with the complement diagram pending further action. If the percent of defects in the existing plant is 5% or greater and the defects are not due to design deviations or construction activity, a copy of the test report should be sent to cable maintenance for reference in case defective pair clearing is requested by OSP engineering. Subsequently, the coordinator should be advised by engineering if corrective action is planned. In cases where there are no defects, the report will have the same distribution and be noted as a final test.

3.10 Outside Plant engineering, upon receipt of the test report from the coordinator, will review the defects listed to determine if they are due to existing plant, design or

record deviations, or whether they are due to the current construction activity. If design deviations are causing type A defects, the engineer may be required to issue another work order or plan change to correct the situation. When the design deviations are causing type B defects, the engineer should make a comparison of the cost required to make the correction versus the estimated improvement in plant availability and performance. If the engineer concludes that the defects are due to current construction activity, the Construction Management Center will dispatch splicers and clear the defects. If there are neither design nor construction defects on the current order and the existing defects do not exceed 5%, the engineer will approve the closing of the work order and follow the procedures in paragraph 3.21.

If existing defects, other than design, are 5% or greater, service requirements and economic conditions must be considered by the engineer concerning the existing cable defects. If the engineer considers it necessary to clear the existing defects, the involved complements should be added to the Defective Pair Priority Clearing List, Form E6286 (See Section V61.308, Defective Pair Administration Plan). The engineer should request the Repair Service Bureau or Cable Maintenance Center responsible for defective pair recovery to prepare a Bulk Defective Pair Dispatch Ticket, Form E6253 (Exhibit 9) listing the defective pairs which require clearing. Reference to the involved work authorization should be noted on Form E6253. Cable maintenance forces should be dispatched as indicated by the OSP engineer's priority to attempt clearing the defects.

NOTE: On occasion, the OSP engineer may want to close a job that has defects without requesting an attempt to clear the defects. This can be accomplished if the engineer can

economically justify the action and gain the approval of the appropriate level of engineering management using Form SW6411A, Closing Approval (Exhibit 11). (See paragraph 3.17.) If existing defects are to be cleared on a Bulk Defective Pair Dispatch Ticket by cable maintenance, or a subsequent work authorization is issued to correct the deviations, the ticket number and/or correcting work authorization number should be indicated on the Closing Approval Form for tracking purposes.

3.11 The Construction Management Center upon receipt of the test report from the coordinator, will review the defects identified and contact the OSP engineer to determine which construction defects must be cleared and/or which design deviations will be corrected on the current order. If cable maintenance receives a test report concerning an excessive number of existing defects, the Cable Maintenance Center or responsible Assistant Manager-Cable Maintenance should contact the OSP engineer to determine if existing defects must be cleared on the order and if the Bulk Defective Pair Dispatch Ticket, Form E6253, will be issued.

3.12 Construction forces will correct all design and construction caused defects on the current order specified by the OSP engineer. Cable maintenance forces will correct the existing defects not caused by design, or current construction activity as determined by the OSP engineer upon receipt of a Bulk Defective Pair Dispatch Ticket, Form E6253.

3.13 The Construction Management Center will notify the coordinator, using Test Notification, Form E6412, when corrective work has been completed. The form will list the pairs that have been corrected but not necessarily the work that was done to clear

the defects. When cable maintenance has been requested to clear existing cable defects associated with a current order and the work is completed, the Cable Maintenance Center or responsible Assistant Manager-Cable Maintenance should notify the coordinator using the Test Notification, Form E6412, and attach a copy of the Bulk Defective Pair Dispatch, Form E6253. If the work order is not being held open pending correction of the existing pair defects, Form E6253 should be processed per Section V61.308, Defective Pair Administration Plan.

3.14 Testers will retest the pairs that are listed on the test notification form as corrected. The testers will list any pairs that are found defective on the bottom half of the form and forward it to the coordinator.

3.15 The test coordinator will review the report and follow the procedures covered in paragraph 3.09.

3.16 The Construction Management Center will review the conformance test results indicated on the bottom of the test notification form. If all defects have been cleared, the center will contact the engineer to get approval to close out the job. If there are still excessive defects, the center will contact the engineer and discuss what further corrective action may be taken to clear the remaining defective pairs.

3.17 Outside Plant engineering, on contact from the Construction Management Center, will review the remaining defective pairs. After the review, if the engineer feels that construction should take other steps to clear additional defects, these steps will be outlined and construction forces will make another attempt at clearing the defective pairs. If the engineer feels that a reasonable effort has been made to clear

the defects or further action is not economical (the defect rate is less than 1% due to construction activity or design and less than 5% existing defects), the OSP engineer can approve the order for closing by signing and forwarding a Closing Approval, Form SW6411A, to the Construction Management Center and the test coordinator. If the engineer feels that sufficient corrective effort has been made but the defect rate exceeds 1% caused by construction activity or design and/or 5% existing, a Closing Approval Form (Exhibit 11A) will be prepared outlining the situation and submit it for approval to the appropriate levels of engineering management. The purpose of the Closing Approval Form is to keep middle and upper management aware of the quality of work being produced and of the volume of excessive existing defects being extended in new cable plant. The engineering management levels assigned to approve closing of orders with a substandard volume of pair defects in new and/or existing cables are:

<u>APPROVAL</u>	<u>DESIGN AND/OR CONST. DEFECTS</u>	<u>EXISTING DEFECTS</u>
a. 1st level	Less than 1%	Less than 5%
b. 2nd level	1% or greater but less than 2%	5% or greater but less than 6%
c. 3rd level	2% or greater but less than 3%	6% or greater but less than 7%
d. 4th level	3% or greater	7% or greater

NOTE: To classify defects properly as construction, design, or existing for reporting purposes of this practice, the following rationale and definitions should apply:

Construction defects are those that can be attributed directly to the construction work activity specified on the current work order. Construction

defects may appear in new and/or existing cable plant. They will include manufacturing defects located in new cable sections placed.

Design defects are those that can be attributed to deficiencies in the make up of the overall cable complement design which may be found in the new and/or existing cable plant. Design defects may be the result of record deviations or incomplete work operations reflected on associated open or previously closed authorization.

Existing defects are those which cannot be attributed to the construction activity on the current authorization and are not caused by the complement design of the new and/or existing cable plant.

3.18 The Construction Management Center, when advised by the OSP engineer that the job can be closed, will take the normal steps required in closing out the job. However, if advised that further corrective action must be taken, the center will direct construction forces to resume their efforts of clearing the remaining defective pairs.

3.19 Construction forces will attempt to correct the remaining defects, and advise the Construction Management Center of the results.

3.20 The Construction Management Center will repeat the process, starting with the steps described in paragraph 3.13.

3.21 When all the defects are cleared or the level of defects caused by the work performed on the current order is acceptable to the appropriate level of engineering management, the Outside Plant engineer will note "Job Closed" on the engineering copy of the test report, and forward copies to the

coordinator, Assignment Office, RSB, and Construction Management Center with a properly authorized Closing Approval Form, SW6411A.

3.22 The Assignment Office will post all defects listed on the engineer's copy of the test report to the Exchange Customer Cable Records (ECCR's). When assigning cable pairs, the Assignment Office should assign pairs with no defects as a first choice and pairs with type B defects as a second choice. Pairs with type A defects should not be assigned. Pairs with type B defects must not be assigned to data or other special services. When the ECCR's have been posted, the test reports should then be sent to the Repair Service Bureau or Cable Maintenance Center responsible for the defective pair file. The test reports should be reconciled with the defective pair files in accordance with Section 660-003-012.

3.23 The coordinator, upon receipt of the engineering copy of the Test Report and Closing Approval Form, completes all entries on the appropriate Log Sheet, Form SW6411B for the involved authorization. The final test report, associated complement diagram, and the closing approval is filed for reference and subsequent reporting purposes. Monthly, the coordinator will prepare a report Form SW6416, Conformance Testing Results (Exhibit 10), to reflect the testing activity for the current month. Quarterly, Form SW6416 will be used to accumulate and summarize monthly results required for a quarterly report. The same form should be used to prepare annual reports (See Appx. 1). The coordinator will distribute the report to District, Division, and Area Manager levels in both Facilities and Installation and Repair Services. The Area quarterly reports should be forwarded by the 25th of the month following each quarter to: Assistant

Vice-President-Facilities Services, St. Louis, Missouri. In addition, all Texas Area quarterly reports should be forwarded as directed to: Assistant Vice-President-Customer Services, Dallas, Texas.

4. COMPLEMENT DIAGRAMS

4.01 Complement diagrams are straight-line circuit illustrations of the cable complements that are to be conformance tested. These diagrams provide:

- (a) A simple, uncluttered presentation of the loop makeup so that it can be evaluated with respect to the value of the design strategy used.
- (b) An aid to the tester in performing instrument tests.
- (c) An aid to the tester in identifying, categorizing and locating the various cable defects found by conformance testing.

NOTE: The complement diagram is required to assist the conformance tester in determining if pair troubles revealed by conformance testing are due to design deviations, non design existing defects, or new construction caused defects resulting from splicing activity on the current order. Therefore, when a splicing work operation, such as a cable transfer (throw) or energizing dead cable pairs, solely involves existing cable plant, the OSP engineer should make an appropriate notation above the circuit line illustration on the complement diagram, i.e., "Cable Throw" or "Pairs Energized", with an arrow extended from the note to the exact point of the splicing operation on the illustration. In addition,

the footage to this location should be indicated. This information will enable the tester to identify the distance to all construction splicing operations involved with nonextended existing cable plant directly from the complement diagram. Without this information on the complement diagram, the tester is required to review all associated work prints, locate splicing operations, and compute distances to the various operations from the work prints. The work print method of locating distance to splicing operations, which deals exclusively with existing cable pairs, is time consuming and can contribute to errors in categorizing defects if calculations are in error or if work operations are missed.

4.02 A set of complement diagrams is required on every construction job that requires testing. See paragraph 1.03 for the selection criteria. A separate diagram is required for each design complement, i.e., one diagram will suffice for all pairs having the same exact physical makeup. A complement should not be thought of as any specific number of pairs such as 25, 50, or 100. The complement diagram is used for all types of plant design, including nondedicated multiples, Serving Area Concept, Unigauge, Long Route, and Dedicated Outside Plant. It must show the makeup of the facility from the wire center to the serving terminal.

4.03 The complement diagram form will accommodate seven complement diagrams per sheet. Figures 2A, 2B and 2C show complement diagrams prepared for three types of facilities: non loaded; short loaded; and long-loaded cables, respectively. For long-loaded cables, the Engineer must post expected transmission values and network and BOC settings to the right-hand side of the form. (See Exhibit 2C). The preferred method for obtain-

ing this data is via UNICCAP. Based on the computed expected values for loop resistance, insertion loss, and return loss, the engineer will know in advance if the facility meets transmission requirements. If the expected values are marginal or unacceptable the engineer can modify the design, consistent with the prevailing rules, and resubmit the circuit to UNICCAP for a reappraisal. When accessing UNICCAP for an estimate of return loss, care must be taken to enter the exact length after the last load coil to the test point. The test point must be between 3000 and 6000 feet after the last coil, and should be a pedestal, cross box, ready-access terminal, or any other arrangement where the pairs can be accessed and that portion of the loop beyond the test point can be isolated. If a test point (terminal) is not provided by the engineer, return loss measurements cannot be made and the effectiveness of the conformance testing program will be severely reduced. This is illustrated in Exhibit 2C, where a test point is not located between 3 and 6 kilofeet after the last load coil for the 426 through 475 count. For these cases, an additional insertion loss measurement is taken at 3 kHz so the slope can be evaluated. The network settings are for a 4066A-type network and 4066C BOC or a 115-type network.

4.04 After the complement diagrams have been prepared, the OSP engineer must evaluate them with respect to the rules used for the design strategy. These also should be noted on the form under Design Rule - Limit. The vast majority of cable facilities are resistance designed, and therefore a synopsis of the rules follows:

- Resistance Design--Nonloaded: Maximum loop resistance is 1300 ohms or the office limit, whichever is less. Maximum length is 18,000 feet, with no more than 6000 feet of bridged tap.

- Resistance Design--Loaded (H-88): Maximum loop resistance is 1300 ohms or the office limit, whichever is less. Load all loops over 18,000 feet. The first load should be 3000 feet from the wire center; the remaining loads every 6000 feet \pm 120 feet. The far-end section, including bridged tap, must be greater than 3000 and less than 12,000 feet (15,000 feet in exceptional cases). No bridged tap should exist between load coils.

4.05 For engineering personnel studying complex configurations, the REDCAP function of UNICCAP has been provided. It will accept data from the complement diagram, analyze the circuit, and diagnose errors. It also will provide solutions to design errors.

5. FORMS

5.01 The following is a list of forms recommended for use in Southwestern Bell with the conformance testing program:

- (a) Complement Diagram, Form E6410 (Exhibit 2) is a straight-line circuit illustration of cable complements that are to be conformance tested. Exhibits 2A, 2B, and 2C show examples of complement diagram forms with typical entries for non-loaded, short-loaded and long-loaded facilities. The complement diagrams should be issued at the same time as work prints, reflecting conformance testing work operations.
- (b) Log Sheet, Form SW6411B (E6411) (Exhibit 3) is maintained by the test coordinator as an aid in organizing the testing job. The form contains data used in preparing the monthly and quarterly results reports. Authorizations should be logged in by the date

that work prints are received indicating conformance testing. Appendix 1 covers the proper method of maintaining Form SW6411B.

- (c) Test Notification, Form E6412 (Exhibit 4) is issued by the Construction Management Center and is returned by the coordinator with test results noted or attached. It is designed to reduce the need for verbal communications, although on occasion, verbal communications may be needed to clarify certain situations. The form is also issued by the Cable Maintenance Center or Assistant Manager-Cable Maintenance as notice to the coordinator to retest existing defective pairs when engineering has requested cable maintenance to clear the defects prior to approval to close the order. Exhibit 4A illustrates typical entries on a test notification form.
- (d) Test Notes, Form E6413 (Exhibit 7) is used by the tester as a work sheet to post test results. All appropriate blanks should contain test data as determined by the tester. Exhibits 7A, 7E, and 7C illustrate typical entries on the test note forms for various types of cable tested.
- (e) Test Report, Form SW6411 (E6414) (Exhibit 8) is prepared by the tester and is used to summarize the defects from the test notes. It may also be used to assist in preparation of monthly and quarterly results reports. Exhibit 8A shows a test report with typical entries.

- (f) Closing Approval, Form SW6411A (E6415) (Exhibit 11) is prepared by the Outside Plant engineer on all authorizations and is forwarded to the appropriate level of engineering management for approval to close out jobs if a sub-standard number of defects exist. (See paragraph 3.17). Exhibit 11A shows a closing approval form with typical entries for a job requiring third level engineering approval to close.
- (g) Conformance Testing - Results, Form SW6416 (E6416) (Exhibit 10) is a report issued monthly and quarterly by the coordinator showing the conformance testing results. Appendix 1 covers the proper method of preparing Form SW6416.
- (h) Construction Cable Completion Test Report, Form E6254 (Exhibit 6) is used to list defective pairs detected by construction testing on all new, replaced or extended cable jobs. The form only lists defects found in the new cable sections. The defects listed on this form can be useful in analyzing the overall conformance test results for the associated job and should accompany Test Notification, Form E6412 when sent to the coordinator. Other distribution of Form E6254 is discussed in Section V61.308, Defective Pair Administration Plan. Exhibit 6A lists the information to be recorded on Form E6254.
- (i) Report of Defective Cable Pairs, Form E4108 (Exhibit 5) is prepared by assignment to list existing defective cable pairs involved with cable throws (Section 680-300-012) and on request by construction for jobs where new cable extensions or tap-ins are associated with existing cable plant (Section V61.308). Form E4108 is used by construction to verify and record the direction and/or location of existing cable defects in open splices for the counts involved in the splicing work. The conformance tester will utilize the updated defective pair information recorded on Form E4108 by construction to assist in locating and determining which defects found by conformance testing are new or existing. Exhibit 5A illustrates typical entries recorded on Form E4108.
- (j) Bulk Defective Pair Dispatch Ticket, Form E6253 (Exhibit 9) is prepared by the Repair Service Bureau or Cable Maintenance Center to list defective cable pairs in complements which are assigned to cable maintenance forces for clearing. For the purpose of the conformance testing program, the Outside Plant engineer will request the RSB or Cable Maintenance Center to prepare Form E6253 for clearing excessive numbers of existing defective cable pairs identified by conformance testing procedures if service requirements and economic conditions justify their immediate clearance by cable maintenance forces. See Section V61.308, Defective Pair Administration Plan, for the preparation and other uses of Form E6253 in conjunction with the defective pair recovery program. Exhibit 9A lists the information to be recorded on Form E6253.
- 5.02 All forms listed in paragraph 5.01 can be ordered from the local Western Electric Company Distribution Center.
- 5.03 Appendix 1 (attached) provides detailed instructions for accumulating data and reporting conformance testing results using Southwestern Bell Forms SW6411B and SW6416.

EXHIBIT 2
COMPLEMENT DIAGRAM

E6410

COMPLEMENT DIAGRAMS													
WIRE CENTER	ORDER NUMBER	DATE ISSUED	ORIGINATOR			DESIGN RULE-LIMIT (OHMS OR ZONE)	MAKE UP		EXPECTED RETURN LOSS (DB)	EXPECTED INSERTION LOSS (DB)	PRECISION AND BOC SETTINGS 4066 or 115	MDF	FIELD
			PAIR COUNT	TELEPHONE NO.	RES.		UNIGAUGE	LONG RT.					
Count													
Count													
Count													
Count													
Count													
Count													
Count													

LEGEND: Cable Gauge Change → Cable Gauge 19 22 24 26 Existing Cable Load LC BOC New Cable Load LC BOC L-Loop W-Branch X-Cross-Connect O/W-Open Wire R-Rural Wire U-Urban Wire Test Point ▲

EXHIBIT 2A

COMPLEMENT DIAGRAM FOR NONLOADED FACILITY

E6410

COMPLEMENT DIAGRAMS											
WIRE CENTER	ORDER NUMBER	DATE ISSUED	ORIGINATOR	DESIGN RULE-LIMIT (OHMS OR ZONE)		MAKE UP		EXPECTED RETURN LOSS (DB)	EXPECTED INSERTION LOSS (DB)	PRECISION AND BOC SETTINGS 4066 or 115	MDF FIELD
CABLE NUMBER	PAIR COUNT	TELEPHONE NO.	RES. 1300-Ω	UNIGAUGE	LONG RT.	KFT	RES.				
MADISON	53728	5/23/77	R. BAILEY								
14	1-600	555-2121									
Count						19					
1-600						22					
						24					
						26	15	1250			
						T	15	1250			
						19					
						22					
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MDF ▲
 20
 15KF
 101 MAIN ST. (NEW OFFICE BLDG)

LEGEND: Cable Gauge Change → Existing Cable Load [LC] Capacitor [BOC] New Cable Load [LC] Capacitor [BOC] L-Loop W-Branch X-Cross-Connect Terminal O/W-Open Wire Test Point ▲ R-Rural Wire U-Urban Wire

EXHIBIT 2B

COMPLEMENT DIAGRAM FOR SHORT LOADED FACILITY

E6410

COMPLEMENT DIAGRAMS										
WIRE CENTER	ORDER NUMBER	DATE ISSUED	ORIGINATOR							
REMOTE	57525	6/17/77	A. BAILEY							
CABLE NUMBER	PAIR COUNT	TELEPHONE NO.	DESIGN RULE-LIMIT (OHMS OR ZONE)			MAKE UP		EXPECTED RETURN LOSS (dB)	EXPECTED INSERTION LOSS (dB)	PRECISION AND BOC SETTINGS
15	1-100 401-600	555-2121	RES.	UNIGAUGE	LONG RT.	KFT	RES.	1 KHZ/3 KHZ	MDF FIELD	
Count						19	21	350		
1-100	MDF					22				
Count						24	12	921		
401-500	MDF					26				
Count						19	11	180		
501-600	MDF					22				
Count						24	15	775		
Count						26	26	982		
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EXHIBIT 4

TEST NOTIFICATION FORM

E6412

TEST NOTIFICATION – CONFORMANCE TESTING

To: _____ Coordinator

From: _____ Construction Control Foreman

Date: _____

Construction work on order number _____
has been completed and the work is ready for testing.

or

The faulty pairs identified on order number _____
have been corrected and are ready for retest.

Attached is a list of the pairs and faults.

_____ and/or

To: _____ Construction Control Foreman

From: _____ Coordinator:

Date: _____

Testing has been completed Retesting has been completed.

Attached is a list of the defects.

and/or

EXHIBIT 4A

TYPICAL TEST NOTIFICATION

E6412

TEST NOTIFICATION - CONFORMANCE TESTING

To: MR. W. BROWN Coordinator
 From: Ms J. SMITH Construction Control Foreman
 Date: 7/29/77

Construction work on order number 56789
 has been completed and the work is ready for testing.

or

The faulty pairs identified on order number _____
 have been corrected and are ready for retest.

Attached is a list of the pairs and faults.

_____ and/or

To: Ms. J. SMITH Construction Control Foreman
 From: MR. W. BROWN Coordinator
 Date: 8/7/77

Testing has been completed Retesting has been completed.
 Attached is a list of the defects.

and/or

TOO MANY TROUBLES TO LIST HERE, SEE
ATTACHED TEST REPORT

EXHIBIT 6A

E6254 INFORMATION

Information to Record on Form E-6254
Construction Cable Completion Test Report

The following information should be recorded on the Construction Cable Completion Test Report. The numbers listed below correspond to the numbers on the log as shown:

- (1) *Job Order/Estimate Number:* Indicate number of job triggering the work.
- (2) *Area/Division:* Indicate Area and/or Division in which job is located.
- (3) *District:* Indicate District in which job is located.
- (4) *All New Cable:* Mark "X" in box if job is all new cable. Includes complete replacement of existing plant.
- (5) *Extension of Existing Plant:* Mark "X" in box if job is extension of existing Plant.
- (6) *Replacement of Existing Plant:* Mark "X" in box if job partially replaces existing cable.
- (7) *C.O.:* Name of Central Office in which cable and count is located.
- (8) *Cable Number:* Indicate number designation of cable covered by completion report. Use separate Completion Test Report for each cable number designation involved on the job.
- (9) *Cable Count:* Indicate cable count corresponding to cable number designation.
- (10) *Total Pairs Terminated:* Indicate total conductor pairs terminated or involved on this job.
- (11) *% Defective Pairs:* Total number of defective pairs listed on report divided by total pairs terminated, multiplied by 100.
- (12) *Pair Number:* Number designation of defective pair.
- (13) *Defect:* Type of defect associated with defective pair (e.g., x'ed, short open, etc.)
- (14) *Remarks:* Descriptive details of defect if available (e.g., open in section between MH 22 and MH 23, etc.)
- (15) *Posted Defective Pair File:* Month, day, and initials of employee posting information to Defective Pair File.
- (16) *Posted ECCR:* Month, day, and initials of employee posting information in ECCR.
- (17) *Construction Supervisor:* Signature of second level construction supervisor responsible for the job.
- (18) *Date:* Date of signature in item 17.
- (19) *Approved:* Signature of district level Outside Plant Engineer responsible for design of job.
- (20) *Date:* Date of signature in item 19.

EXHIBIT 8A

TYPICAL TEST REPORT

REF. 330-300-900 SW

TEST REPORT - CONFORMANCE TESTING
(MECHANIZED INPUT DOCUMENT)

SW6411 (3-78)
(E6414)

ORDER NO. 50111		PRINT NO. 1		DISTRICT CENTRAL		WIRE CENTER MADISON		CABLE 22		COUNT 201-500 5' 901-1100	
TESTER T. EDWARDS		DATE 7/14/77		TOTAL PAIRS TESTED: NON-LOADED: LOADED:		500 0 500		TEST REPORT		INITIAL RETEST FINAL	
NOTE: DEFECT RATE 15 12.4%		DEFECT RATE: %		DESIGN	CONST	EXIST	TOTAL	HOURS			
				5.0	5.6	1.8	12.4	9 1/4			
PAIR NO.	AC DEFECT		DC DEFECT		DESCRIPTION/LOCATION	CLASSIFICATION			DATE CLEARED		
	A	B	A	B		DESIGN	CONST	EXIST			
451 FO	25	-	-	-	7TH L.C. MISSING ON ALL 25						
500	-	-	-	-	PAIRS / PRT. 2 OPER 3.						
1051 FO	-	25	-	-	THE SPARING BTN 3 rd 4 th			25			
1100	-	-	-	-	LOADING POINTS IS 7000'						
951			✓		TIP GROUND		1				
957			✓		TIP GROUND		1				
958			✓		TIP GROUND		1				
967			✓		OPEN			1			
969			✓		RING GROUND			1			
975			✓		SHORT CIRCUIT			1			
976			✓		OPEN			1			
983			✓		TIP GROUND			1			
987			✓		TIP GROUND			1			
988			✓		OPEN			1			
991			✓		RING GROUND			1			
992			✓		SHORT CIRCUIT			1			
	25	25	7	5	TOTALS	25	28	9			

EXHIBIT 9A

FORM E-6253 INFORMATION

Information to record on Form E-6253

Bulk Defective Pair Dispatch Ticket

The following information should be recorded on the Bulk Defective Pair Dispatch Ticket. The numbers listed below correspond to the numbers on the ticket as shown:

- (1) *C.O.*: Name of Central Office in which cable pairs are located.
- (2) *Repair Service Bureau*: Name of the Repair Service Bureau controlling above Central Office.
- (3) *Ticket Number*: Repair Service Bureau or Cable Maintenance Center number designation of ticket dispatched. Should reflect month and consecutive ticket number for that month (e.g., sixth ticket dispatched in May would be: 05-06).
- (4) *Cable Number*: Feeder or distribution designation of cable containing 50-pair complement.
- (5) *Pair*: The pair number of each pair listed as defective in the file within the 50-pair complement.
- (6) *5039 Ticket Number*: Number on cable trouble ticket in Defective Pair File.
- (7) *Defect*: Defect recorded on Cable Trouble Ticket.
- (8) *Testman Test*: Result of test by testman before ticket is dispatched. Distribution pairs should be tested by cable repairman in field.
- (9) *Disposition - Remarks*: Record pertinent remarks relating to respective pair (e.g., pair bad between MH22 and 23; cleared; pair good in term. 2010, open R in term. 2220; UBP, etc.)
- (10) *Posted Defective Pair File*: Month, day, and initials of employee processing information through Defective Pair File (e.g., 5/22/RHD).
- (11) *Posted ECCR*: Month, day, and initials of employee processing information through ECCR.
- (12) *Testman*: Initials of testman making test prior to dispatching.
- (13) *Date Dispatched*: Month, day and year ticket dispatched.
- (14) *Cable Repairman*: Initials of repairman doing field work.
- (15) *Date Closed*: Month, day, and year ticket closed out.
- (16) *Time Required*: Hours and tenths charged by craftsman to work on respective ticket. This should agree with repairman's time report.

EXHIBIT 11

CLOSING APPROVAL FORM

REF. 330-300-900 SW

SW6411A (3-78)
(E6415)

CLOSING APPROVAL FORM – CONFORMANCE TESTING

TO: _____ FROM: _____ DATE: _____

Construction work on order number _____ print(s) _____ has been completed and conformance tests have been performed.

Closing approval is required by _____ level engineering management because final conformance tests indicate that the defects range is:

<u>DESIGN AND/OR CONST.</u>	<u>EXISTING</u>	<u>APPROVAL REQUIRED</u>
<input type="checkbox"/> Less than 1%	<input type="checkbox"/> Less than 5%	<input type="checkbox"/> 1st level
<input type="checkbox"/> 1% or greater but less than 2%	<input type="checkbox"/> 5% or greater but less than 6%	<input type="checkbox"/> 2nd level
<input type="checkbox"/> 2% or greater but less than 3%	<input type="checkbox"/> 6% or greater but less than 7%	<input type="checkbox"/> 3rd level
<input type="checkbox"/> 3% or greater	<input type="checkbox"/> 7% or greater	<input type="checkbox"/> 4th level

A total of _____ pairs were conformance tested and _____ pairs are classified defective as follows:

<u>REASON</u>	<u>INITIAL DEFECTS</u>	<u>FINAL DEFECTS</u>	<u>PERCENT FINAL DEFECTS</u>
Design	_____	_____	_____
Construction	_____	_____	_____
Existing	_____	_____	_____
Total	_____	_____	_____

The complements tested are recommended for acceptance with the final remaining defects as indicated above.

Rationale: _____

1st level <input type="checkbox"/>	APPROVED <input type="checkbox"/>	REJECTED <input type="checkbox"/>	SIGN: _____
2nd level <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TITLE _____
3rd level <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TITLE _____
4th level <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TITLE _____
			TITLE _____

REMARKS: _____

EXHIBIT 11A

TYPICAL CLOSING APPROVAL

REF. 330-300-900 SW

SW6411A (3-78)
(E6415)

CLOSING APPROVAL FORM - CONFORMANCE TESTING

TO: R. Wilson
J. WRIGHT FROM: R. BAILEY
R. WILSON DATE: 7/19/77
7/20/77

Construction work on order number 53208 print(s) 1 has been completed and conformance tests have been performed.

Closing approval is required by 3RD level engineering management because final conformance tests indicate that the defects range is:

DESIGN AND/OR CONST.

EXISTING

APPROVAL REQUIRED

- Less than 1%
- 1% or greater but less than 2%
- 2% or greater but less than 3%
- 3% or greater

- Less than 5%
- 5% or greater but less than 6%
- 6% or greater but less than 7%
- 7% or greater

- 1st level
- 2nd level
- 3rd level
- 4th level

A total of 550 pairs were conformance tested and 33 pairs are classified defective as follows:

REASON	INITIAL DEFECTS	FINAL DEFECTS	PERCENT FINAL DEFECTS
Design	<u>15</u>	<u>15</u>	<u>2.72 %</u>
Construction	<u>7</u>	<u>1</u>	<u>0.18 %</u>
Existing	<u>17</u>	<u>17</u>	<u>3.09 %</u>
Total	<u>39</u>	<u>33</u>	<u>6.0 %</u>

The complements tested are recommended for acceptance with the final remaining defects as indicated above.

Rationale: The 15 pairs with type B, AC design defects all have excess bridge top and minor transmission impairment. The condition will be eliminated when print 4, EST. 7632 is completed, providing relief and enabling us to break the bridges. When completed, the design and const. defects will be 0.18%

- | | | |
|---|--|-----------------------------------|
| 1st level <input checked="" type="checkbox"/> | APPROVED <input checked="" type="checkbox"/> | REJECTED <input type="checkbox"/> |
| 2nd level <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3rd level <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 4th level <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

SIGN: R. Bailey
TITLE ASST. MGR. OSP ENGINEERING
R. Wilson
TITLE MGR. OSP ENGINEERING
J. Wright
TITLE DIST MGR. OSP ENGINEERING
TITLE _____

REMARKS: _____

