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Outside Plant Construction  
and Maintenance

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All Areas

CABLE MAINTENANCE

CABLE FAILURES - RESTORATION OF TOLL FACILITIES

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1. GENERAL

1.01 This Section G74.940.1, which is similar and relates to Section E21.907, has been prepared for inside and outside plant forces to describe the basic procedure to be followed in restoring facilities after major toll cable failures. The procedures to be followed for service restoration after facilities are restored are covered in Bell System Practices Section E21.910.

1.02 Since the failure may be located in either aerial, underground, or buried type of cable plant and since one or more cables may be either

completely or only partially failed, it is impossible in an instruction of this type to cover all combinations or circumstances. Basic splicing and testing procedures have been developed, however, and it will usually be possible to make use of the methods outlined in this instruction, or some modification of these methods.

1.03 In the majority of cable failures, facilities can be most rapidly restored by the use of 20 gauge, specification AT-6422 bridle wire, since it is easily transported and can be quickly prepared for splicing into varying lengths of break. In some instances it may be more desirable to use emergency cable or a replacing section of cable. When practicable, however, the use of bridle wire should be contemplated.

1.04 Because the objective is to restore service as quickly as possible, some items are included as temporary measures which would not be considered good practice in permanent work.

## 2. SAFETY PRECAUTIONS

2.01 Since abnormal working conditions are usually present in the restoration activity at cable failures, it is particularly important that safe working practices be carefully observed. Some typical items to be considered are listed below.

### 2.02 Aerial Cable Failures:

(a) Suspension or guy strand involved in a fire may become annealed and lose a considerable portion of its strength. If this condition is suspected, the messenger should not be ridden until tested. If the use of a cable car is necessary, an auxiliary strand should be placed.

(b) Wherever the overall restoration job is improved, damaged aerial cables should be lowered to the ground. The elimination of platforms will frequently result in safer working conditions and the consequent comfort to the splicers will undoubtedly speed up the overall restoration work.

(c) If poles are leaning or broken, they should be piked or temporarily guyed since unbalanced loads may exist to such an extent that a man's weight may be enough to bring other poles down.

(d) Wind storms that damage aerial cable lines may also fell power lines across the messenger and sheath. If a storm of this type has been experienced, it is advisable to inspect power crossings and conflicts in the vicinity of the cable failure. In any case, the messenger and sheath should be temporarily grounded on either side of the break since high induced voltages or lightning may be experienced.

#### 2.03 Underground Cable Failures:

- (a) Standard tests for gas in manholes should be made before entrance by workmen engaged in the restoration.
- (b) Precautions should be taken against cave-ins and when it is necessary to chip out duct, goggles should be used for eye protection.
- (c) Sheath continuity should be maintained for lightning and electrolysis reasons and for protection against high induced voltages. A bond shall be placed across the sheath break for this purpose.

#### 2.04 Buried Cable Failures:

- (a) Precautions should be taken to avoid cave-ins in digging trenches and splicing pits for the restoration workers.
- (b) Sheath continuity should be maintained for lightning and electrolysis reasons and for protection against high induced voltages. A bond shall be placed across the sheath break for this purpose.

2.05 Other Considerations:

- (a) Care should be taken in using boats or rafts on swollen streams and life preservers should be worn when working over deep water.
- (b) Sufficient and adequately placed artificial lighting should be provided for night operations to avoid unnecessary hazards from poor visibility.

3. INITIAL DUTIES OR PRIMARY TESTBOARD FORCES

3.01 As soon as it is known that a major failure has occurred, the testboard should report the failure in accordance with Bell System Practices Section E12.506 and will be advised as to steps to be taken to restore the outside plant.

3.02 The district equipment superintendent or equivalent supervisor responsible for cable restoration should be informed of the trouble and the general section of the cable route involved.

3.03 The necessary location measurements and preliminary computations should be completed as soon as possible and this information should be transmitted to the outside forces with instructions for contacting the testboard from some convenient point near the approximate location of the failure.

3.04 Every effort should be made to contact patrolmen, construction crews or others who may be working near the measured location to determine, if possible, the exact location and nature of the failure and thus aid in the dispatching of the restoration forces.

3.05 If K carrier facilities are involved in the failure, a two-man crew for each cable failed should be dispatched to the auxiliary station or to each of the auxiliary stations adjacent to the trouble. Each two-man crew should be composed of at least one man with testboard or transmission experience and one man experienced in central office work. From check-off lists, prepared in advance of the

failure, the crews shall assemble the necessary materials and test equipment and transport them to the auxiliary stations.

3.06 A supervisor, preferably a district toll maintenance supervisor or equivalent, should go to the auxiliary repeater station on the attended control station side of the failure, to act as the local sub-control if the break is located between two auxiliary stations.

3.07 The testboard shall act as an intermediary between the outside forces and the office of the supervisor in charge of the restoration in locating crews, and arranging for necessary work equipment and materials.

3.08 When communication is again established with the outside forces from the approximate location of the trouble, the final location computations should have been completed or a report from the field should permit directing them to the scene of the failure. At this time a definite agreement should be made for a method of establishing initial communication with the scene of the failure. The following are some suggested methods:

- (a) A gas pressure terminal or other station terminal if nearby and not shorted or grounded as a result of the failure.
- (b) In some twin cables designed for K or L carrier, the gas pressure talking pair or the cable maintenance pair are on the tracer pair or a pair of the tracer quad in the outside layer. In failures involving one of these cables, communication can be immediately established without tone identification.
- (c) In other cables designed for K carrier, certain sections may be in a single sheath with layer shielding to separate the two directions of transmission. In this type of installation, the twin cable sections may have the gas pressure talk and the cable maintenance circuit in the respective core quads of the two cables

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and in the single layer shielded sections the two respective circuits may be located in the tracer quad of the outside layer under the sheath and the core quad under the shield. Advantage may be taken of this type of installation to facilitate establishing initial communication.

(d) In cables not spliced in the manner indicated in (b) and (c) above, a selected pair of the cable can be toned and identified at the break for an initial communication circuit.

3.09 The control test rooms shall have prepared in advance, the following information on form No. P-2068 for cable route involving K carrier facilities.

(a) K carrier system.

(b) K unit.

(c) K pair numbers associated in the section involved.

(d) Quad mate to the K pair if the cables are quadded. (This is to facilitate reassociating the pair numbers in an individual quad which were purposely separated in the quad-splitting splices.)

3.10 Upon receipt of the authorized priority list, the assigned priority number shall be entered on Form P-2068 and the information will then be used to prepare Form P-2069 which is to be used in the restoration work.

3.11 If the priority list is available before the departure of the auxiliary station crews, a copy of Form P-2068 should be available for their use in preparing Form P-2069 at the auxiliary stations. If this is not possible, the information can be telephoned to them prior to the restoration operations.

3.12 Sample forms P-2068 and P-2069 with the method of preparation are appended to this section.

#### 4. INITIAL DUTIES OF OUTSIDE FORCES

4.01 Upon receiving notification from the test-board that a major failure has occurred, the district equipment superintendent or equivalent supervisor shall take the following steps.

- (a) Locate and dispatch the required restoration forces to the approximate failure location.
- (b) Instruct the crews to call the testboard for a more definite location as outlined in paragraph 3.03.
- (c) From check-off lists, prepared in advance of the failure, assemble the necessary materials and work equipment and transport them to the scene of the failure.

4.02 Upon arriving at the scene of the failure, a quick survey shall be made of the damage giving particular attention to the following:

- (a) Exact location.
- (b) Cause of trouble.
- (c) Length of cable affected.
- (d) Method which should result in the fastest and most practical service restoration.
- (e) Condition of roads and best route for access to the failure location.
- (f) Any conditions which may have a bearing on the method or progress of the restoration.
- (g) Estimated quantity and type of material and equipment required.

4.03 The outside forces should then get in contact with the testboard as outlined in paragraph 3.08.

4.04 If the trouble is due to moisture, gas should be applied at a pressure not exceeding 15 pounds on each side of the damaged sheath if it will aid in preventing further trouble. If the trouble is not due to moisture, gas shall be applied as required in standard practices.

4.05 After eliminating any unsafe conditions as outlined in Part 2, the crews will then proceed with the restoration.

## 5. OUTLINE OF RESTORATION PROCEDURES

5.01 When a light moisture leak occurs in a cable and an exact location is not obtainable, the trouble can sometimes be temporarily cleared by placing gas on the cable at each side of the computed location. This method applies primarily to cable not under gas pressure.

5.02 If the location of the moisture leak is known and the trouble is confined to a relatively short section of cable, the sheath should be opened (aerial, buried or underground cable in a manhole) and cleared by boiling with paraffin or with the use of desiccant.

5.03 Damage due to excavating or similar activities which usually cause trouble over a relatively short section of cable may be cleared by piecing out the conductors.

5.04 Troubles due to lightning or other electrical disturbances should be cleared as outlined in standard practices.

5.05 When an appreciable length of cable has been damaged by fire or some other external cause, it will be necessary to restore the facilities by cutting new conductors around the damaged section. In most instances the quickest way to do this is to cut in 20-gauge bridle wire. This method is applicable to aerial and buried cables and to underground

cables where it is practicable to uncover the damaged portion. In the case of underground cable when it is necessary to extend the conductors between man-holes, it is usually more practicable to restore the facilities by laying a length of emergency cable on the ground. There may also be cases where, because of highway conditions, it may be necessary to initially pull a replacing section of cable in the ducts.

5.06 There are two basic splicing methods for restoring cable facilities known as the "One to One" and "Layer Rotation" methods. It is impracticable to formulate any definite rules to follow which would cover all types of cable failures. Each failure must be analyzed and the procedure to be followed must be based on conditions existing at the time of the trouble. In some cases it will be desirable to use a combination of both methods.

5.07 When bridle wire or a temporary section of cable has been used for the initial restoration, the cutover to the permanent section should be made using high frequency identification sets, in accordance with Section G72.259, applying the half tap method to cut over the working circuits.

#### One to One Method

5.08 The "One to One" method involves toning out the conductors from the adjacent offices and identifying them at each end of the damaged section. This method provides for the restoration of the desired facilities such as program and K circuits first and leaving the facilities of least importance until the last.

5.09 In general, this method should be employed as follows:

- (a) Establishing talking circuits to the splicers and other communicating facilities required by restoration forces.
- (b) Restoring facilities requested on a prior-

ity sequence basis including carrier, program and special services.

- (c) Restoring all facilities, if practicable, in any toll cable failure.
- (d) Restoring facilities when a construction splice is involved in the damaged section.

#### Layer Rotation Method

5.10 The "Layer Rotation" method provides for splicing the quads starting with the marker quad in the outside layer. In some cases this method is more rapid than the "One to One" method; however, it does not permit any choice of circuits to be restored and there are more possibilities of splicing errors.

5.11 This method is best adapted to the larger size toll cables containing numerous circuits, other than special, program or K carrier circuits, which terminate in widely scattered locations. In cases of this nature, it makes possible the restoration of the short haul circuits described without the necessity of sending an identifying tone from each of the numerous terminals or offices. In the event of a failure involving a cable of this type which carries a K carrier complement and long haul loaded facilities as well, the "One to One" method should be used to restore the through facilities and consideration should be given to restoring the short haul facilities by the "Layer Rotation" method. Initial boarding of the cable before restoration work begins may greatly facilitate this type of restoral.

#### 6. ORGANIZATION - GENERAL

6.01 The organizational setup to cover a typical restoration job using bridle wire and basic splicing methods is shown on Figure 3.

6.02 The overall job of restoration should be supervised by those familiar with all phases of both inside and outside plant. This responsibility should be taken jointly by the toll central office supervisor and the field supervisor or dele-

gated representative.

6.03 The field supervisor should be located at the scene of the failure. The central office supervisor should be located at the office adjacent to and on the side of the break next to the control office. This may be the control office proper or if the failure is between two auxiliary stations, the auxiliary station on the control office side.

6.04 It is the duty of the combined supervision to effectively coordinate the inside and outside plant efforts until the service has been completely restored.

6.05 It is better to have an excess of manpower at the scene of a cable failure than it is to have too few and no one will be criticized for dispatching more men than are finally needed. The additional help can be used to advantage in furnishing relief, running errands, arranging for lunches, keeping testing equipment in operating condition and otherwise assisting in the smooth functioning of the outside work.

6.06 The toll central office supervisor and the field supervisor should make arrangements for the men and material as requested by the test-board and the outside maintenance forces respectively and should review the restoration plans from a safety standpoint.

6.07 The general office should lend assistance and should keep higher supervision informed of the progress of the restoration work. Considerable assistance can be given in connection with the coordination between the testroom and the Traffic Control Bureau in determining which important services should be routed over other facilities and which ones should be given preference in first being made good through the break.

## 7. PREPARATION OF EMERGENCY BRIDLE WIRE

7.01 Pre-tagged bridle wire ropes, 75 feet in

length and in units of 10 pairs shall be prepared and stocked at strategic locations along the major cable routes. The preparation of these ropes shall be as follows:

- (a) The bridle wire shall be placed in 10-hole tagboards made up of canvas strips with brass grommet holes which may be made up locally in accordance with Figure 2.
- (b) The bridle wire pairs shall be identified and placed in the same numbered holes at either end of the rope. The two tagboards associated with one rope shall be given a group or tagboard number such as #1, #2, #3, etc.
- (c) The bridle wire shall be pulled through the holes of the tagboard a sufficient distance to permit bunching and binding in order to prevent accidental removal of wires from the tagboard in handling. In addition the bridle wire should be taped at sufficient intervals along its length to permit easy coiling and uncoiling without kinking or tangling.
- (d) The individual wires of each pair of bridle wire shall be identified and cut long and short respectively at each end to permit ease and accuracy in splicing. The smooth insulation wire shall be cut long (tip) and the rough insulation wire shall be cut short (ring).
- (e) Approximately 3 inches of insulation should be removed from each wire and care should be taken not to nick the wire as this is likely to result in a broken wire in handling or when the pigtail is made with the cable conductor.
- (f) A sufficient number of ropes shall be prepared to permit complete restoration of a cable or cables in the specific area where they are contemplated for use. It is important that a group of ropes held in a stock location for emergency use, shall be stored in such a manner that they are readily available and easily transported to the scene of the failure.

7.02 While experience indicates that 75 feet of  
bridle wire will be sufficient to bridge  
nearly all breaks, additional reels of bridle wire  
and extra tagboards should also be provided at the  
failure location. This will protect against an ab-  
normally large failure condition.

7.03 When it is necessary to prepare the bridle  
wire for splicing at the break, the follow-  
ing procedure shall be used:

(a) The bridle wire should be laid out and  
placed in 10-hole tagboards of the type  
indicated in Figure 2. Care should be taken  
that no errors in tagging occur and since a  
butt splice will be made at each end of the  
break, the bridle wire should be of sufficient  
length to provide about 10 feet of slack at  
each end.

(b) The insulation can be easily removed by  
heating over a splicer's furnace until the  
insulation is thoroughly softened and burned.  
A yellow flame should be used to avoid damage  
to the conductors. After burning the bridle  
wire, it can be placed on a hard surface and  
the charred insulation scraped off, using a 3  
inch putty knife or similar tool. Care should  
be taken not to nick the conductor during the  
scraping operation.

(c) The individual wire should then be thor-  
oughly cleaned with abrasive cloth to in-  
sure a good connection with the cable conductor  
as no soldered joints will be made in the tem-  
porary restoration.

(d) The conductors shall be cut long and short.  
The wire of the bridle wire pair with  
smooth insulation shall be cut long (tip) and  
the rough insulation shall be cut short (ring).

NOTE: The Long Lines Department of the  
A.T. & T. Company associate the  
smooth insulation with the ring wire and  
the rough insulation with the tip wire.

## 8. SPLICING AND TESTING

8.01 Since the methods of restoration described in this section apply to temporary measures, the pigtails should not be soldered.

8.02 The bridle wire should be laid out in such a manner that it will not interfere with other work operations. When placed for aerial cable, it should be tied down at intervals to prevent whipping in the wind. Also, if a twin K cable failure has occurred, it will be desirable to separate the two directions of transmission by keeping the bridle wire associated with one cable separate from the bridle wire associated with the other cable.

8.03 The pigtails shall be protected with standard cotton sleeves. These may be slipped over the pigtail after the splice is made. A bend in the pigtail after the sleeve is placed will prevent the sleeve from falling off. If available, an additional man can handle the work of placing sleeves so that the splicers are able to concentrate on only the splicing work.

8.04 After the splices have been completed and checked by the testboards, desiccant shall be introduced and the splices wrapped down with muslin or rubber bandages (or CR tape). Since it is not practicable to seal the splices, the twist should be bent downward so it cannot lead water into the cable. A drip ring of friction tape should be formed on the sheath.

### One to One Method

8.05 The one to one method, as outlined in this section, has proved to be both fast and accurate with a minimum of confusion and verbal information during the actual restoration.

8.06 The identifying and toning arrangement between the man at the sending station (toner) and the man identifying at the splice (identifier) contemplates the use of standard equipment without internal modification and an additional local buzzer circuit at the sending station.

8.07 After identifying and splicing, the pairs are given an overall continuity and turnover check between testboards.

8.08 As soon as the continuity test has been made, the pair is made good to the control office for service restoration as covered in Section E21.910.

8.09 The sequence of operations utilizing the one to one method of splicing on a typical toll cable restoration follows:

#### Preparatory Arrangements

(a) The testboards shall isolate the particular section of cable to be restored by placing dummy plugs in the equipment jacks associated with the line jacks looking toward the failure.

(b) The splicers will clear the cable conductors sufficiently to enable the identifier to fan out the pairs or quads for ease in identifying.

(c) A talking circuit is established between each toner at the testboards and each respective identifier at the break. The necessary order wire, supervisory circuit and other talking circuits to be used in the restoration will then be terminated or spliced through the break.

(d) Figure 3 indicates the sequence of pair restoration and manpower requirements for a typical K carrier cable failure.

#### Toning and Identifying

(a) The toning and identification wiring arrangement at the testboard and at the failure location is indicated schematically in Figure 1.

(b) The tone from the type 76A set is sent from the testboard on the required pair. The identifier locates the pair with the 108A amplifier at the break.

(c) With his snips connected to a 76A set, to utilize the buzzer circuit associated therewith, the identifier cuts the insulation of each conductor until his buzzer operates. This is the ring conductor of the pair and the identifier cuts this conductor 3"-4" shorter than the tip wire.

(d) With the circuit arrangement, the buzzer at the testboard also operates in unison with the buzzer at the splice indicating to the toner that the pair has been identified. This serves not only to check the correctness of identification but also allows the toner to note the time on Form P-2069 and to anticipate that the identifier will soon be ready for the next pair.

(e) When the cable involved is paired, the identifier will say "next pair" and the toner will send the tone on the next required pair.

(f) When the cable is quadded, the identifier will say "other side" and the toner will send the tone on the quad mate to the pair last identified. The identifier will again cut this pair with the tip long and the ring short but with the tip conductor of the quad mate, 3"-4" shorter than the ring wire of the first pair of the quad. Upon completion of the quad, the identifier will say "next quad" and the toner will send the tone on the required pair of the next quad.

(g) The toner selects the sequence of pairs to be identified from the information indicated on Form P-2069 which he has prepared in advance from the approved priority list. Since the pairs shown on Form P-2069 are associated with the numbered holes on the tagboards, a check will be made at the completion of each 10-

pair tagboard group with the statement "last pair of tagboard #1, #2, etc."

(h) As the identifier completes the identification of a pair or the pairs of a quad with the conductors cut suitably long and short, the pair or quad is handed to the splicer for splicing to the bridle wire.

(i) The splicer will butt splice pair to pair consecutively with the long wire of the cable pair spliced to the long wire of the bridle pair followed by the short conductors of each. If the cable is quadded, the longest cable pair shall be spliced first, followed by the second or shorter pair of the quad.

(j) Care shall be exercised by the identifier that identified pairs or quads shall not accumulate ahead of the splicer to the extent that an error may occur.

(k) The splicer should not remove the bridle wire from the tagboard.

### Continuity Testing

(a) As soon as the toners at both ends of the failed section have indicated on Form P-2069 that a particular pair has been identified at both sides of the break, the continuity checkers at the testboards prepare to check the pair for continuity and turnovers of the tip and ring.

(b) The method used for testing continuity consists of placing metallic battery at one end and a zero-centered voltmeter at the other end of the section. The negative battery is connected to the tip wire and positive battery is connected to the ring wire of the pair under test. A deflection of the voltmeter indicates that the pair has been spliced through; a deflection to the right indicates correct splicing and a deflection to the left indicates a tip and ring turnover.

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(c) If a tip and ring turnover exists on a particular pair, this is noted on Form P-2069 and the splicer corrects the error upon completion of the splicing work. Since each pair is identified on Form P-2069 with its associated tagboard and hole number, the splicer can correct tip and ring turnovers without further tone identification.

(d) When continuity has been established in the section, the dummy plugs shall be removed from the equipment jacks and the pair turned up to the control for overall checking and service make-good in accordance with Section E21.910.

(e) The continuity checker at the testboard at or nearest to the control testboard shall enter the time continuity is established in the section and the time the pair is turned up to the control testboard on Form P-2069.

#### Layer Rotation Method

8.10 The "layer rotation method" may be used following restoration of important facilities by the "one to one method", or may in some instances be employed entirely to restore large complement voice frequency cables.

8.11 It will not be practicable to carry out the "layer rotation" splicing on a tip and ring identification basis since the "one to one" splicing method described in this practice is more satisfactory from both a speed and accuracy standpoint, in restoring facilities where tip and ring continuity is initially required.

8.12 Where a portion or all of the cable complement may be terminated at a large number of offices and terminals, or when the conductors are not terminated on protector frames with primary jack appearances, it will usually be desirable to restore these facilities by the layer rotation splicing method without regard to tip and ring identity at the splice. The sequence of operations utilizing this method of "layer rotation" splicing on a typi-

dal restoration follows:

### Preparatory Arrangements

- (a) The testboard or testboards will, if possible, isolate the section of cable to be restored by placing dummy plugs in the equipment jacks associated with the line jacks looking toward the failure or by removing the heat coils on the protector strip at the main frame.
- (b) Before any conductors are spliced, each layer of conductors on any cable to be restored in whole or in part by the "layer rotation" method should be bound with tape. The outside layer shall be bound close to the sheath, then bent back and the next and succeeding layers bound individually and bent back. This will preserve the sequence of pairs or quads in the layer which may otherwise be disrupted during splicing.
- (c) If a considerable portion of the complement is to be restored by the "one to one" method prior to the "layer rotation" splicing, it may be desirable in the judgment of the field supervisor, to board all of the cable conductors by layer sequence prior to any splicing work.
- (d) The necessary talking circuit or circuits between the break and the testboard or testboards involved should be established by tone identification.

### Splicing and Identifying

- (a) The splicers restore the pairs or quads in sequence beginning with the tracer (pair or quad No. 1) in the outside layer and continuing in the direction of the blue pair or blue white quad. Any pairs or quads already restored on the "one to one" basis are, of course, skipped and the splicers proceed to the succeeding pairs or quads. As the tagboards of 10

pairs each are spliced to the cable conductors, the splicers proceed with the next higher numbered tagboard, always working in the required direction around the layer and working in successive layers from the outer layer towards the core. The splicers or the field supervisor shall check frequently on the color of insulation, paper stain or binder string being spliced to a particular bridle wire pair number to determine that the work is being completed correctly.

(b) For quadded cable, the first pair of the quad, identified by color code, is spliced to the first bridle wire pair and the second pair of the quad to the next bridle wire pair.

(c) To identify the facilities completed by the splicing crews, the test room may employ one of the following two methods. The decision as to which method to use is dependent upon the particular conditions and assignments in the failed cable.

Method 1: When a 10-pair bridle wire tagboard is spliced through, an outside man at one end of the break can apply tone from a type 76A or 76B set, to each of the ten completed pairs. A man at the control testboard can then scan the line jacks with a receiver to detect the tone and thus the facilities which have been spliced through the break. This will not interrupt the splicing work.

Method 2: The control test room can scan the line jacks with a voltmeter to detect the shorts at the far end created by the terminating equipment. The magnitude of the meter deflection may be used to determine whether the short is at the terminal or at the failure location.

### Continuity Testing

(a) When a circuit is found to be spliced through the failure, a ground, continuity and turnover check should be made by the test-

board or testboards.

(b) Any pairs found turned over, and it may be expected that fifty per cent will be turned over, shall be temporarily corrected when required by the use of a short turnover cord between the "line" and "equipment" jacks at the testboard.

(c) When the pairs have been checked and any turnovers corrected, they should be turned over to the control office for service make-good.

(d) Upon completion of the temporary restoration work and before the start of permanent repairs, any turned over pairs should be corrected at one of the splices.

## 9. TESTING CIRCUITS AND EQUIPMENT

9.01 The order wire setups required to coordinate the various operations in order to properly restore a major cable failure are shown in Figure 3.

9.02 The testboard should direct the establishment of the above order wires and make sure that they are satisfactory for communication before any service restoration work is done.

9.03 A 76A type tone source should be available at all times and maintained for instant use at all main central offices.

9.04 The following portable equipment should be available for dispatching to the K carrier auxiliary repeater station or stations:

- (a) Testing tone (76A or 76B)
- (b) Voltmeter (zero-center)
- (c) 4.5, 22.5 and 45-volt dry batteries
- (d) Patch cords

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(e) Type 151A plugs

(f) Dummy plugs

9.05 Batteries should be available in the main office for use in applying metallic battery to the pairs for making overall continuity and turn-over tests. Since this test requires only that a deflection be obtained on the testboard voltmeter, the amount of voltage used is not critical and a single 22.5-volt battery will suffice. The negative side should be connected to the tip and the positive side to the ring.

## 10. EMERGENCY SUPPLIES AND ADVANCE ARRANGEMENTS

10.01 The division plant manager or equivalent supervisor shall supplement this section with a list of the emergency cable and loading coils available in his territory. This list shall also give the names and telephone numbers of trucking companies which can be used to transport reels of cable.

10.02 The division plant manager or equivalent supervisor shall also supplement this section to list the amounts of bridle wire and other emergency supplies normally maintained by each store-room or kept in the various test rooms.

10.03 The division plant manager or equivalent supervisor shall supplement this section to cover any special local conditions to which the procedures outlined in these instructions would not be applicable.

10.04 The district equipment superintendent or equivalent supervisor in charge of cable maintenance shall keep extra copies of the supplemental information on hand so they can be given to construction or other forces used in the restoration work.

## EXHIBIT 1

FORM P- 2088  
2-48K CARRIER SYSTEM ASSIGNMENTS

CABLE SACRAMENTO-RENO "A"

SHEET 1 OF

SECTION SACRAMENTO-ROSEVILLE

2 SHEETS

K CARRIER SYSTEM	K UNIT	K PAIR NO	QUAD MATE PAIR NO.	PRIORITY NO.
1K SLK-SF	KU 501	1	6	21
2K SLK-SF	KU 502	2	7	32
3K SLK-SF	KU 503	3	18	25
4K SLK-SF	KU 504	4	19	29
1K RENO-SF	KU 505	5	20	24
2K RENO-SF	KU 506	6	1	28
2JK PTLD-SF	KU 507	7	2	5
5K SLK-SF	KU 508	8	14	12
6K SLK-SF	KU 509	9	15	27
7K SLK-SF	KU 510	10	13	14
1K RENO-SAC	KU 511	11	16	23
2K RENO-SAC	KU 512	12	17	30
8K SLK-SF	KU 513	13	10	26
2K LA-SLK	KU 514	14	8	22
1K LA-SLK	KU 515	15	9	11
3K LA-SLK	KU 901	16	11	2
1K SAC-SLK	KU 902	17	12	17
1JK OAK-PTLD	KU 903	18	3	6
1JK SAC-TDLS	KU 904	19	4	7
4K LA-SLK	KU 905	20	5	3
5K LA-SLK	KU 906	21	26	20
6K LA-SLK	KU 907	22	27	13
1K OAK-OMA	KU 908	23	38	10
1K DNVR-SF	KU 909	24	39	19
1K OAK-SLK	KU 910	25	40	15
1K OMA-SF	KU 911	26	21	1
2K OMA-SF	KU 912	27	22	8
7K LA-SLK	KU 913	28	34	9
8K LA-SLK	KU 914	29	35	4
9K LA-SLK	KU 915	30	33	16
10K LA-SLK	KU 916	31	36	33
11K LA-SLK	KU 917	32	37	36
1K DNVR-OAK	KU 918	33	30	35
2K OAK-OMA	KU 919	34	28	31
3K OAK-OMA	KU 920	35	29	18
4K OAK-OMA	KU 921	36	31	34
5K OAK-OMA	KU 922	37	32	37
SPARE PAIR	-	38	23	-
" "	-	39	24	-
" "	-	40	25	-
" "	-	41	49	-
" "	-	42	56	-
" "	-	43	55	-
" "	-	44	54	-
" "	-	45	53	-

RESTORATION  
OF TOLL  
FACILITIES

ANNEX 2  
 'K' CARRIER FACILITIES

FORM P-2060  
2-46

TOLL CABLE RESTORATION

TAGBOARD NO 1

CABLE SACRAMENTO-RENO "A"

DATE 2-1-46

LOCATION SACRAMENTO S.T.T. (W-E)

BY J. DOE

PRIORITY NO	K PAIR OR PAIR NO	TAG-BOARD HOLE NO	IDENTIFY OK TIME	CONTINUITY CHECK OK TIME	TURNUP TO CONTROL TIME	CIRCUIT OR CARRIER	REPEATER NO.	TURNUP TO TRAFFIC TIME	TELEGRAPH FACILITY	TURNUP TO CUSTOMER TIME	
-	85	1				G.P. ALARM (NOT NECESSARY TO SPICE THRU INITIALLY)					
-	86	2	2:06			G.P. TALK IDENTIFICATION OK. - TOWER TO SPICER					
-	55	3				SPARE K OR V PAIR (NOT NECESSARY TO SPICE THRU INITIALLY)			NOTE: BRIDLE WIRE IN TAGBOARD HOLES 1-6 ARE RESERVED FOR ESTABLISHING CIRCUITS USED BY RESTORATION MEN		
-	56	4	2:12	2:15	2:15	SPARE K OR V PAIR CONTINUITY CHECK OK					
-	83	5	2:13	2:14	2:14	EXPRESS ORDER WIRE (W-E)					
-	84	6	2:13	2:15	2:15	EXPRESS ORDER WIRE (E-W)					
1	26	7	2:16	2:18	2:18	1K SF. OMAHA		2:28			
20	21	8	2:17	2:19	2:20	5K LA-SLK		2:05			
2	16	9	2:18	2:21	2:22	3K LA-SLK		2:35			
16	11	10	2:19	2:22	2:23	1K RENO-SAC		2:58			

REMARKS

EXHIBIT 3  
VOICE FREQUENCY FACILITIES

FORM P. 2000  
2-46

TOLL CABLE RESTORATION  
TAGBOARD NO 3

CABLE SAN JOSE - WATSONVILLE "A"

DATE 2-20-46

LOCATION SAN JOSE PRIMARY BOARD

BY R. ROE

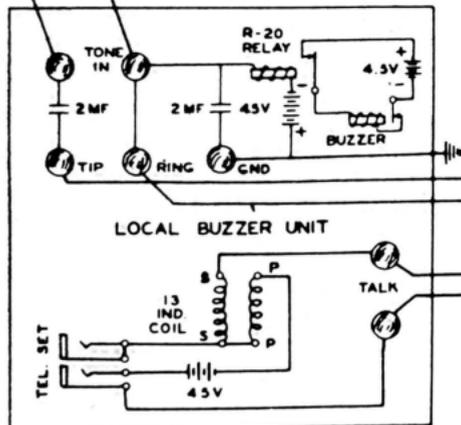
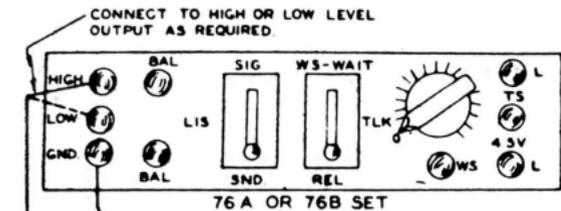
PRIORITY NO.	K PAIR OR PAIR NO	TAG-BOARD HOLE NO.	IDENTIFY OK TIME	CONTINUITY CHECK OK TIME	TURNUP TO CONTROL TIME	CIRCUIT OR CARRIER	REPEATER NO.	TURNUP TO TRAFFIC TIME	TELEGRAPH FACILITY	TURNUP TO CUSTOMER TIME
9	19	1	6:10	6:11	6:12	9 LA-SJ	28	6:15		
40	20	2	6:11	6:12	6:13	2 SF-SBAR	110	6:19	SS Wc-WVL	6:19
						10 LA-SJ	26	6:15		
10	23	3	6:12	6:13	6:14	701L-SJ	32	6:18		
11	24	4	6:13	6:14	6:15	26L-SJ	38	6:18	57 Wc-WVL	6:18
						801L-SJ	33	6:18		
12	71	5	6:14			N3101-SJ	64		MX 23 (W-R) Wc-WVL	
28	72	6	6:15	6:16	6:17	N3301-SJ	65		MX 23 (E-W)	
						N3301-SJ	66	6:22	Wc-WVL	
13	113	7	6:16	6:17	6:18	1 SLNS-SF	111	6:26		
36	114	8	6:17	6:18	6:19	7 SLNS-SF	109	6:26	38 JO-WVL	6:25
						2 SLNS-SF	107	6:26		
14	135	9	6:18	6:19	6:20	3 OAK-WVL	16	6:35	MF 10 (W-R) Wc-WVL	6:35
22	136	10	6:19	6:20	6:21	3 H6CY-SJ	20	6:30	MF 10 (E-W)	
						6 SF-WVL	15	6:35	Wc-WVL	6:35

REMARKS <sup>6</sup>NOTE: PAIR 71 IN HOLE 5 OF TAGBOARD 3 HAS TIP AND RING TURN-OVER - WILL BE CORRECTED AFTER ALL PAIRS ARE SPLICED THROUGH.

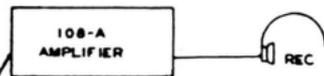
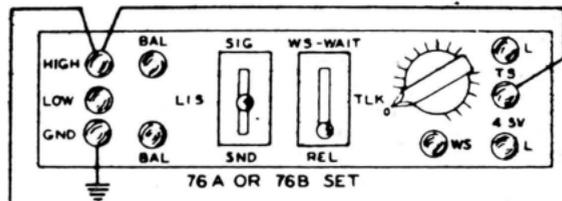
RESTORATION  
OF TOLL  
FACILITIES

ONE - TO - ONE METHOD OF CABLE RESTORATION - EQUIPMENT ARRANGEMENTS  
 FIGURE 1

TONERS EQUIPMENT ARRANGEMENT AT  
 CENTRAL OFFICE

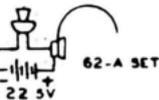


IDENTIFIERS EQUIPMENT ARRANGEMENT  
 AT SPLICE



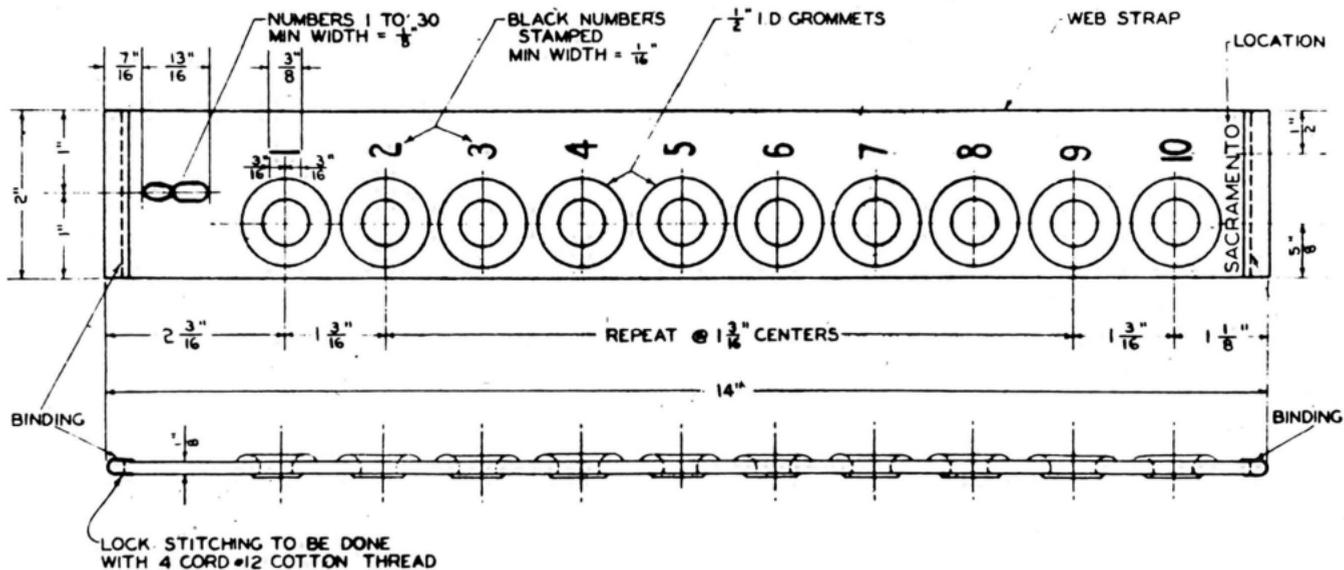
PAIR TO BE IDENTIFIED

TALKING PAIR



NOTE: IF A CABLEMAN'S TALKING SET IS AVAILABLE,  
 INTERCONNECT WITH 108-A AMPLIFIER IN ACCORDANCE  
 WITH B.S.P. G72 263 AND USE IN PLACE OF 62-A SET

BRIDLE WIRE TAG BOARD  
FIGURE 2



NOTE  
ALL DIMENSIONS SHALL SHOW  
REASONABLE CORRESPONDENCE  
TO FIGURES SHOWN

FIGURE 3  
SEQUENCE OF FACILITY RESTORATION AND MANPOWER REQUIREMENTS  
TYPICAL TWIN "K" CABLE FAILURE

