SUMMARY AND ANALYSIS OF CONTACT NOISE MEASUREMENTS STEP-BY-STEP AND COMMUNITY DIAL OFFICES

1. GENERAL

1.01 This section discusses the interpretation of data collected with the 30A Level Distribution Register (30A LDR) in surveys of contact noise in step-by-step dial offices.

1.02 Three methods of rating contact noise performance have been chosen as a result of studies of a number of surveys. These are:

(A) Per Cent Seconds Noisier than 30 dba

(B) Distribution of Calls with Respect to Noise Transmission Impairment (NTI)

(C) Eight Per Cent Point

1.03 Method (A) is for use in connection with a planned new method for interpreting the results of contact noise surveys. Under this method, the results are expressed in terms of the per cent of time that the noise exceeds a given level of noise.

1.04 Method (B) provides a method to care for those cases where it may be desirable to make a more detailed analysis of the measurements by obtaining a distribution of calls with respect to the noise transmission impairment (NTI) per call. It is of particular value in offices where a concentrated maintenance program is to be undertaken. This might involve such things as adjusting wiper tension, replacing wiper cords, and bank cleaning, which would otherwise be handled on a "routine" or an "as required" basis. Analysis, by this method, of surveys made before and after such a program, gives a good picture of the improvement obtained in terms of reduced transmission impairment.

1.05 Method (C) gives the noise level which is exceeded 8 per cent of the time. This can not be compared with visual measurements made in the past (see 2.09).

1.06 The front of Form E-3861 has been designed to provide space for recording the data taken during a survey consisting of 200 50-second calls as described in Section 226-836-500. Data collected on a typical survey are illustrated by Fig. 1. The back of the form provides space for developing and summarizing the results of the survey. The detailed procedures for using this part of the form are given under 2. METHOD. A facsimile of the results of a survey is shown by Fig. 2.

2. METHOD

(A) Per Cent Seconds Noisier than 30 dba

2.01 The "per cent seconds noisier than 30 dba" method is the simplest means of interpreting the data obtained with the 30A LDR, the value for a given survey being obtained directly from Form E-3861. Present experience indicates that the percentage of testing time that the noise exceeds 30 dba may vary over the range from less than 1 per cent to about 6 per cent in the line finder offices and may be as high as 10 to 20 per cent in the line switch offices. This method will be used for interpreting the results of all routine contact noise measurements, and a value greater than 4 per cent for line finder offices and slightly higher for line switch offices will generally indicate a need for remedial action. However, until experience has been obtained with the new measuring methods in a particular area, the analysis described in 2.03 to 2.06 should be made as part of the interpretation of all contact noise surveys.

2.02 In the lower right-hand corner of the front of Form E-3861, there are two spaces, designated A and B, in which are shown the total number of one-second intervals noisier than 20 and 30 dba, respectively, during the 10,000 seconds that elapse while 200 50-second

test calls are being made. In order to translate these figures to percentages of the 10,000 seconds of testing time, all that need be done is to point off 2 decimal places in each figure. These percentages are then entered in Lines (A) and (B) of the SUMMARY on the back of the form.

(B) Distribution of Calls with Respect to Noise Transmission Impairment (NTI)

2.03 Surveys for the distribution of calls with respect to noise transmission impairment (NTI) may be made both before and after a concentrated maintenance program (see 1.04), and the results analyzed in the manner described in 2.04 to 2.06, inclusive, to obtain the distribution of calls with respect to NTI. The relationship used in obtaining the transmission impairment is based on the register readings >30 from the noise survey. The register readings >20 are omitted from any calculations concerning the distribution curve. In order to show graphically the improvement obtained by performing this work, it will be desirable to show the "before" and "after" distributions on a single curve sheet. Comparisons made on this basis are of particular interest, since emphasis is placed on those calls having high noise levels for a large portion of their duration. Such calls have large noise transmission impairments and are potential sources of subscriber complaints.

Note: Noise transmission impairment is the impairment to telephone transmission caused by noise, and is expressed in terms of the db reduction in speech volume on a circuit with reference noise (17 dba across receiver) that would cause an equal impairment.

2.04 A table is provided in the lower left-hand corner of the back of Form E-3861 (see Fig. 2) for recording the data required to obtain the distribution curve for a given survey. The number of calls having seconds per call noisier than 30 dba (>30) for each class interval of five seconds shown in Column ① is determined from the survey data shown on Fig. 1 and is recorded in Column ②. The manner in which the number of calls in each class interval is obtained is illustrated by the following example which covers the first 20 of the total of 200 calls shown on Fig. 1. It should be noted that the first two digits were omitted from the register readings when recorded.

Calls to Terminating Number 5-0020

5-0020	>30 Register Readings	* Seconds per Call>30	Class Interval
	Start 1866		
Orig. 1	-	0	0
" 2	-	0	0
" 3	71	5	1-5
" 4	73	2	1-5
" 5	76	3	1-5
" 6	83	7	6-10
" 7	84	1	1-5
" 8	-	0	0
" 9	86	2	1-5
" 10	1886	0	0

Calls to Terminating Number 5-0756

5-0756			
	Start 1886		
Orig. 1	89	3	1-5
" 2	-	0	0
" 3	91	2	1-5
" 4	-	0	0
" 5	93	2	1-5
" 6	-	0	0
" 7	-	0	0
" 8	94	1	1-5
" 9	96	2	1-5
" 10	1897	1	1-5

Scratch Tally Sheet

Class Interval	No. of Calls
0	/////
1-5	//////
6-10	/
11-15	
16-20	
21-25	
26-30	
Etc.	

* Difference in successive register readings in preceding columns.

2.05 The first and second columns of the example duplicate, in slightly different form, the first column and the ">30" columns for the first 2 terminating numbers shown on the front of Form E-3861. The "seconds per call>30 dba" column in the example shows the difference in successive readings in the preceding column, and the last column shows the class interval (seconds per call noisier than >30 dba) in which these calls fell. In actual practice the difference in successive readings would be obtained from the ">30" column on the

front of Form E-3861 and scored directly on a scratch tally sheet as illustrated. Therefore, the tally sheet is the only portion of the example which need be used. The results of the tally sheet should be entered in Column ② of the table on the back of the form, and accumulated "Upwards" in Column ③. Since the survey covers 200 calls the corresponding cumulative percentages entered in Column ④ are obtained by taking one-half of the values in Column ③. The cumulative percentages in Column ④ should be plotted on the adjoining graph against the values of NTI in Column ⑤, shown at the top of the graph as PLOTTING POINTS, and a smooth curve drawn through these points. The cumulative percentages of calls impaired more than 2 db and 7 db, respectively, are obtained from the curve and entered in Lines (C) and (D) of the SUMMARY.

2.06 Contact noise measurements in connection with some special maintenance work which it is thought will decrease noise conditions are normally made both before and after the work is performed. The graph used for the illustration shows that the distribution of calls with respect to NTI has a relatively sharp bend at about 2 db of NTI and only 3 per cent of the calls have a noise impairment in excess of 2 db. Based on a limited number of surveys the shape of the curve, particularly the portion beyond 2 NTI-DB, is important. If the distribution curve for a particular office has appreciably higher levels than the illustration, in this region, an investigation should be made to determine the cause of the high levels. Inspection of the data as originally recorded on Form E-3861 will indicate the combinations of calling and called lines involved in the noisiest calls. Repeated connections should be established between these lines until a high noise condition is again obtained. The connection should be held and traced to locate the source of the noise: i.e., bank terminal, wiper, wiper cord, or other source. This procedure should indicate the cause of the high noise conditions and should accordingly furnish a guide as to the further action required.

2.07 These characteristics of the NTI distribution will be useful as a performance index, after sufficient surveys have been made in this or other step-by-step offices to furnish a basis for a performance scale. Until such a scale can be made available, these figures may be used to compare performance of an office before and after some special work to reduce noise has been performed.

(C) Eight Per Cent Point

2.08 The 8 per cent point corresponds to the noise value (noise dba) that is exceeded 8 per cent of the total observing time. It is obtained by plotting on the graph, in the upper left-hand corner of the back of Form E-3861, the values shown as (A) and (B) of the SUMMARY, and by extending a straight line through these two points. The point where this straight line intersects the 8 per cent line of the graph is the 8 per cent point and is the value to be entered as (E) of the SUMMARY.

2.09 The characteristics of step-by-step contact noise are such that measurements made by using the 30A LDR can not be compared with those made in the past, where visual observations of the noise meter were made. For this reason there is no direct relation between the old 4 point average (8 per cent point) and the present 8 per cent point.

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CONTACT NOISE SURVEY
STEP - BY - STEP OFFICES

CITY BETA
OFFICE ALPHA-5
ORIGINATING EQUIPMENT
☒ LINE FINDER
☐ LINE SWITCH

DATE 9-25-50
2B SET NO. 38176
POT. 15 DB WTG. F1A OBSERVERS DFS

TERM.→	50020		5-0756		5-1275		5-2096		5-3047		5-4737		5-5482		5-6201		5-7313		5-8061		TOTAL	
LEVEL→	>20	>30	>20	>30	>20	>30	>20	>30	>20	>30	>20	>30	>20	>30	>20	>30	>20	>30	>20	>30	>20	>30
TIME→	9:30		9:42		9:55		10:07		10:20		10:43		10:56		11:07		11:20		11:32			
ORIG 1	*90	–	40	89	54	–	98	–	–	–	89	56	23	–	46	–	73	92	92	97		
" 2	–	–	–	–	56	98	05	18	38	34	01	64	–	–	48	82	74	–	97	00		
" 3	97	71	44	91	64	02	10	21	44	36	02	–	25	74	–	–	–	–	98	01		
" 4	06	73	–	–	66	–	12	23	–	–	04	65	–	–	53	84	77	93	12	03		
" 5	09	76	47	93	67	–	22	28	47	37	–	–	29	–	59	–	78	–	13	–		
" 6	21	83	–	–	79	08	24	29	52	40	12	69	35	78	62	86	81	96	14	–		
" 7	24	84	–	–	–	–	–	–	–	–	16	70	41	80	–	–	83	–	20	07		
" 8	25	–	48	94	83	09	25	–	55	41	19	72	42	–	–	–	85	–	46	20		
" 9	28	86	51	96	88	11	31	33	57	–	22	73	45	–	–	–	88	–	47	–		
" 10	7831	1886	7862	1897	7894	1914	7933	1933	7962	1944	8022	1973	8045	1980	8065	1989	8089	1996	8147	2020		
START	7785	1866	7831	1886	7852	1897	7894	1914	7933	1933	7985*	1954*	8022	1973	8045	1980	8065	1989	8089	1996		
NET	46	20	21	11	42	17	39	19	29	11	37	19	23	7	20	9	24	7	58	24	339	144
TIME→	1:15		1:26		1:38		1:51		2:02		2:30		2:42		2:56		3:09		3:22			
ORIG 1	05	68	–	–	87	19	06	25	64	54	22	88	53	07	70	18	09	41	75	76		
" 2	08	69	64	09	88	–	07	–	–	–	27	89	–	–	72	19	–	–	25	93		
" 3	12	71	69	13	89	–	10	28	68	55	28	–	56	08	77	–	–	–	–	–		
" 4	15	72	72	–	91	–	22	38	71	57	31	91	59	11	92	31	12	43	–	–		
" 5	37	90	73	–	92	–	33	42	74	59	34	93	–	–	–	–	15	44	28	95		
" 6	44	95	74	–	94	–	47	48	–	–	40	98	61	13	–	–	16	–	30	97		
" 7	46	97	–	–	97	–	54	49	76	60	–	–	62	14	94	33	18	–	32	99		
" 8	48	98	78	14	02	23	55	–	77	61	43	01	–	–	–	–	20	–	–	–		
" 9	52	00	84	16	–	–	56	60	84	64	–	–	–	–	98	34	22	–	0042 **47	2309 **13		
" 10	8256	2103	8285	2117	8304	2124	8359	2151	8394	2171	8444	2206	8466	2216	8504	2238	8529	2247	8651	2314		
START	8200*	2065*	8256	2103	8285	2117	8304	2124	8359	2151	8415*	2185*	8449	2206	8466	2216	8504	2238	8529	2247		
NET	56	38	29	14	19	7	55	27	35	20	34	21	17	10	38	22	25	9	122	67	420	225
TOTAL	102	58	50	25	61	24	94	46	64	31	71	40	40	17	58	31	49	16	170	81	759 (A)	369 (B)

*Note that this figure is different from the reading at the finish of the preceding set of 10 calls, as a result of check tests or adjustment on the 30A LDR between sets of calls.

**Note 10 false registrations between calls 8 & 9, not counted in net score. New start reading entered at top of Box 9.

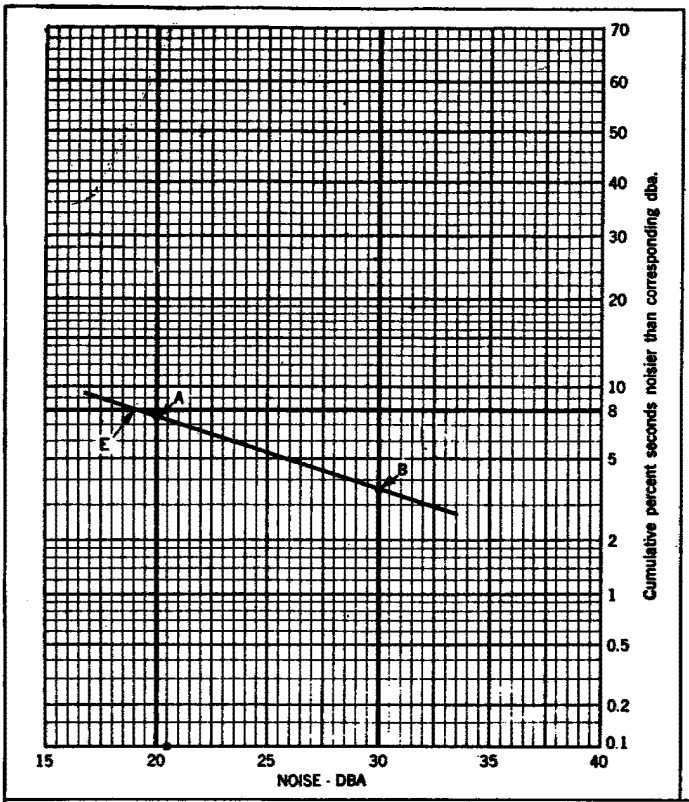
Fig. 1 - Front of Form E-3861

SUMMARY OF CONTACT NOISE MEASUREMENTS
STEP - BY - STEP OFFICES

CITY Beta
OFFICE Alpha-5
DATE 9-25-60

ORIGINATING EQUIPMENT

☒ LINE FINDER
☐ LINE SWITCH



SUMMARY	
(A) Percent seconds noisier than 20 dba	7.6
(B) Percent seconds noisier than 30 dba	3.7
(C) Percent calls impaired more than 2 db	3.0
(D) Percent calls impaired more than 7 db	0
(E) Noise - DBA Exceeded 8 % of time	19

① CLASS INTERVAL (Sec. Per Call Noisier Than 30 dba)	CALLS ② Number in Class	③ Cumulative Number	④ Cumulative Percent	⑤ NTI - DB
0	83	200	100	
1-5	105	117	58.5	0.2
6-10	7	12	6.0	1.2
11-15	2	5	2.5	2.4
16-20	2	3	1.5	3.7
21-25				5.1
26-30	1	1	0.5	6.6
31-35				8.1
36-40				9.7
41-45				11.4
Over 45				
Total	200			

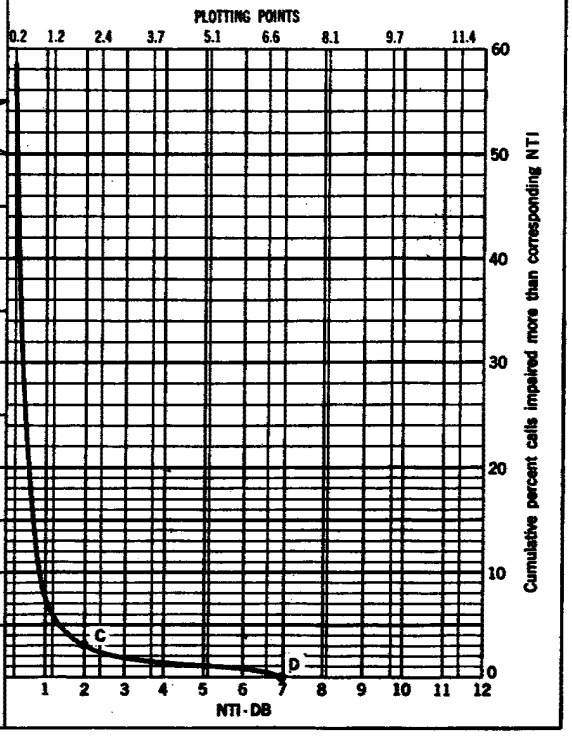


Fig. 2 - Back of Form E-3861