THE ACADEMY OF ELECTRICAL CONTRACTING

Paper presented by

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Denver Area Survey of Manpower Requirements for
Electrical Construction Industry
With a Forecast of Apprentice Requirements
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1. INTRODUCTION

Since the manpower requirements of the electrical construction industry are supplied by I. B. E. W., and inasmuch as new journeymen are developed by apprentice training which requires four years, it is incumbent upon the agencies of the industry to carefully plan ahead for these requirements, in order to maintain the stability of the industry and offer proper services to the public.

Nothing could be more disrupting to worker and contractor alike than a shortage of manpower.

Our best intelligence must be drawn upon to forecast the manpower requirements of a growing industry in a growing economy, and properly train men to fulfill these requirements.

It must be recognized that this problem is national as well as local in scope. The industry could not function if it depended entirely on local union membership. When a large job is involved in an area, it is mandatory to rely on "travelers" to meet the need for extra help.

Each local union must do its part in developing some travelers to meet the temporary peaks of employment of other locals if the overall movement is to be successful

Coordination of "travelers" should
be done at the national level, because it is a
problem involving many local unions, no one of
which is independent in the solution of this problem.

2. OBJECTIVES

In its simplest form, the objective of the industry must be to forecast as accurately as possible each year the manpower requirements for the four year period ahead, and provide proper training for the number of men required to meet the needs.

The plain facts are, I. B. E. W. furnishes the men, and the contractors train and keep them busy. A real team effort which requires complete cooperation.

The results of this report indicate that predicting the number of men is directly related to certain economic factors and is not difficult, but training will be a sizeable task which will require good management and considerable understanding and cooperation on the part of the contractors and their journeymen. This will be an effort that will tax to the limit the entire organization of our industry.

WE MUST DO IT NOW!

3. DENVER MANPOWER STATISTICS

A study of the historical statistics of the Denver manpower situation reveals the following:

1. Attrition of electrical workers resulting from all causes averages 3% per year.

2. The increase of local union membership during the past 11 years has been erratic, inconsistent, and apparently developed without proper planning. The net result has been that workers have lost considerable time of employment.

3. It appears that workers were taken into the membership without proper apprentice training. This is unnecessary and costly to the productive efforts of the entire industry. The elimination of such things as this can only be achieved by proper planning.

4. It is apparent that the present plans for manpower development are woefully inadequate for the immediate future, and drastic changes in concept are required to solve the problem.

TABLE OF DENVER MANPOWER STATISTICS

YEAR	DE-CEASED	PENSION	WITHDR'L	DROPPED	RETIRED TRAVEL MISC.	TOTAL MEMBERS LOST	APPR. COMPL.	TOTAL APPR.	APPR. CANCEL.	TOTAL MEMBERS	TOTAL WORK-ING
1955	2	4	0	5	7	18	15	77	0	616	
1956	2	2	3	4	4	15	9	82	8	661	
1957	9	8	1	15	29	62	12	109	7	769	
1958	11	5	32	6	4	58	10	130	7	866	
1959	4	3	7	1	3	18	26	124	16	994	
1960	6	3	7	10	5	31	31	111	5	999	
1961	11	8	7	4	4	34	42	124	3	1089	
1962	6	15	10	11	4	46	27	161	3	1120	
1963	3	9	12	6	7	37	21	148	2	1121	
1964	7	7	3	14	4	35	39	131	1	1166	
1965	10	4	4	4	8	30	53	101	1	1196	
1966	17	7	3	13	4	44	34	110	7	1206	
1967	14	16	9	10	2	51	29	129	2	1214	
1968	9	8	4	17	6	44	22	145	2	1251	
1969	11	11	7	11	3	43	29	169	6	1276	1294
1970	17	14	10	10	3	54	42	179	1	1327	1691

RATIO ELECTRICIAN TO DENVER POPULATION (5 COUNTY)

Year	Denver Population	Number of Electricians	Electricians per 1000 Population
1955	750,000	616	.822
1956	785,500	661	.842
1957	819,500	769	.94
1958	856,000	866	1.01
1959	892,000	994	.90
1960	929,383	999	1.086
1961	964,000	1,089	1.13
1962	1,010,000	1,120	1.10
1963	1,043,000	1,121	1.075
1964	1,063,000	1,166	1.095
1965	1,074,000	1,196	1.11
1966	1,096,243	1,206	.910
1967	1,109,970	1,214	.910
1968	1,123,696	1,251	.896
1969	1,137,423	1,276	.890
1970	1,227,529	1,327	.925

4. DENVER ECONOMIC DATA

The two factors which seem to reflect the need for electrical workers most prominently are:

1. Total kilowatt hours used.

2. Population.

Each of these must be related directly to the geographical area under consideration. Most generally this would be the area involved in jurisdiction of the Local Union.

Accurate kilowatt hour sales are available from the utility for past, present or future considerations.

Likewise, population statistics are available from the Chamber of Commerce for the past, present or future.

It appears that the important criteria for the electrical construction industry is kilowatt hour per person.

It is impossible for an area to be over-built commercially at any one time. Industrial areas must recognize that basic industries such as autos, or steel, are built up to a capacity for which operations require three or four years to reach the peak - before

more construction is required.   Therefore,

knowledge of the local scene is essential to

forecasting.

Also, a serious reduction of work force

by one major industry can affect the whole community

for a year or more.

These irregularities are indigenous to

the local area, and therefore forecasting must be

based on data which reflects the local conditions.
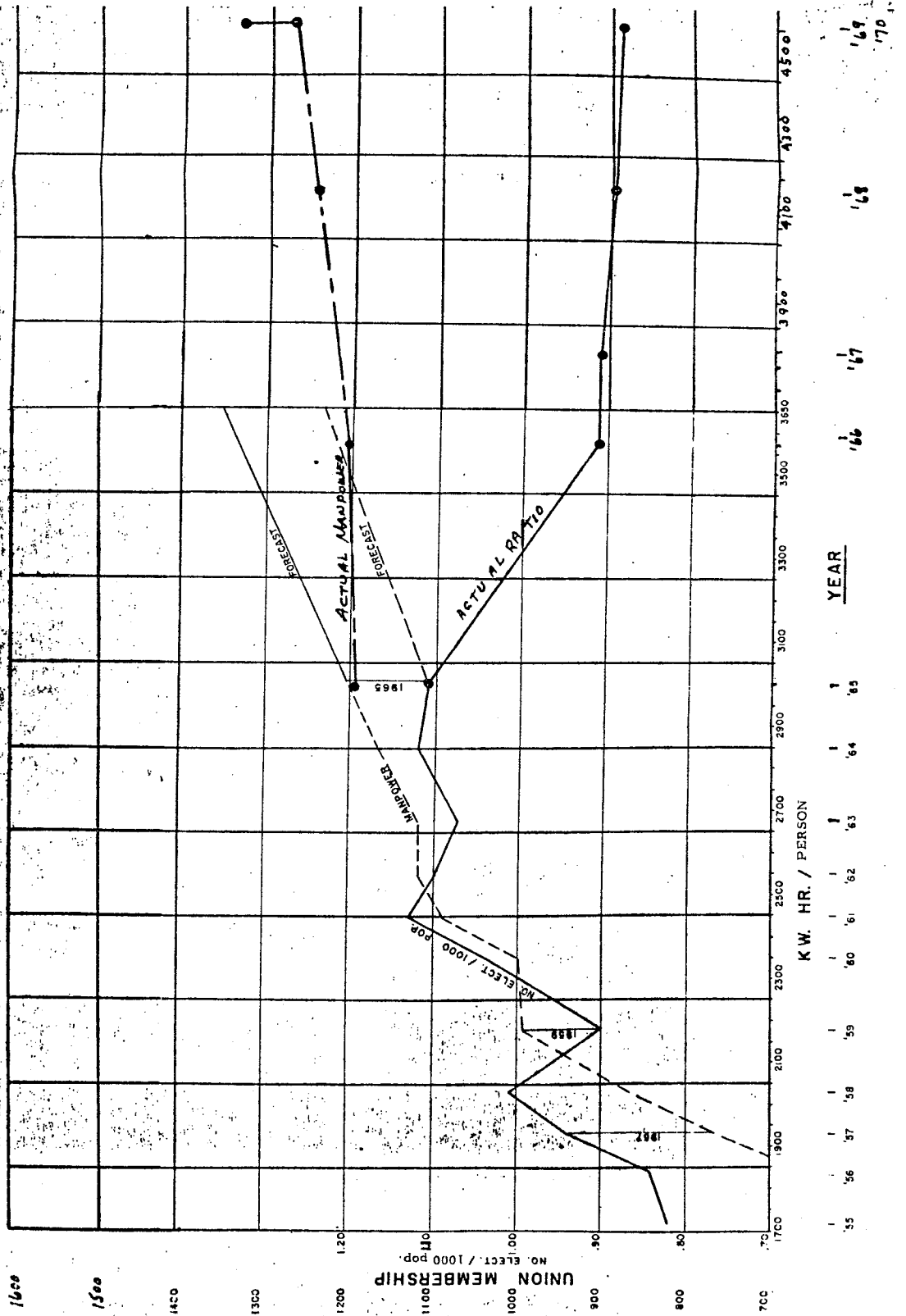
METRO DENVER AREA POPULATION

YEAR	POPULATION	DIFFERENCE	% INCREASE
1955	750,000		
		35,500	4.74
1956	785,500		
		34,000	4.32
1957	819,500		
		36,500	4.46
1958	856,000		
		36,000	4.20
1959	892,000		
		37,383	4.18
1960	929,383		
		34,600	3.74
1961	964,000		
		46,000	4.77
1962	1,010,000		
		42,000	4.20
1963	1,043,000		
		20,000	2.00
1964	1,063,500		
		10,500	1.00
1965	1,074,000		
		30,000	2.80
		Actual 22,243	2.04
1966 (Fore.)	1,104,000		
Actual	1,096,243		
		32,000	2.80
		Actual 13,747	2.06
1967 (Fore.)	1,136,000		
Actual (Est.)	1,109,970		
		32,000	2.80
		Actual 13,726	2.04
1968 (Fore.)	1,168,000		
Actual (Est.)	1,123,696		
		32,000	2.80
		Actual 13,727	2.01
1969 (Fore.)	1,209,000		
Actual (Est.)	1,137,423		
		32,000	2.80
		Actual 90,106	7.95
1970 (Fore.)	1,232,000		
Census	1,227,529		

METRO DENVER KILOWATT HOURS USED

YEAR		MILLION KW. HR.	DIFFERENCE		% INCREASE
1955		1,285			
				155	12.1
1956		1,440			
				147	10.2
1957		1,587			
				160	10.1
1958		1,747			
				212	12.1
1959		1,959			
				228	11.6
1960		2,187			
				174	8.0
1961		2,361			
				213	9.0
1962		2,574			
				220	8.6
1963		2,794			
				247	8.9
1964		3,041			
				170	5.6
1965		3,211			
				171	5.5
			Act.	700	21.8
1966	Est.	3,382			
	Act.	3,911	Est.	270	8.0
			Act.	272	6.9
1967	Est.	3,652			
	Act.	4,183	Est.	315	8.6
			Act.	457	11.0
1968	Est.	3,967			
	Act.	4,640	Est.	383	9.6
			Act.	468	10.0
1969	Est.	4,350			
	Act.	5,108			
			Act.	471	9.2
1970	Act.	5,579			

DENVER KILOWATT HOURS/1000 POPULATION

YEAR		PUBLIC SERVICE COMPANY KILOWATT HOURS	DENVER METRO POPULATION	KILOWATT HOURS/ PERSON
1955		1,284,849,000	750,000	1,710
1956		1,440,306,000	785,500	1,830
1957		1,587,212,000	819,500	1,930
1958		1,747,484,000	856,000	2,030
1959		1,958,935,000	892,000	2,180
1960		2,187,034,000	929,385	2,350
1961		2,361,105,000	964,000	2,450
1962		2,574,390,000	1,010,000	2,550
1963		2,793,758,000	1,043,000	2,680
1964		3,041,142,000	1,063,500	2,850
1965		3,210,982,000	1,074,000	3,000
1966	Est.	3,382,000,000	1,104,000	3,050
	Act.	3,911,000,000	1,096,243	3,580
1967	Est.	3,652,000,000	1,136,000	3,250
	Act.	4,183,673,000	1,109,970	3,780
1968	Est.	3,967,000,000	1,168,000	3,400
	Act.	4,640,233,000	1,123,696	4,120
1969	Est.	4,350,000,000	1,200,000	3,650
	Act.	5,108,627,000	1,137,423	4,580
1970	Act.	5,579,814,000	1,227,529	4,550

UNION MEMBERSHIP

NO. ELECT. / 1000 pop.

KW. HR. / PERSON

YEAR

ACTUAL MANPOWER

FORECAST

FORECAST

ACTUAL RATIO

MANPOWER

NO. ELECT / 1000 POP.

1965

1959

1961

5. U. S. ECONOMIC DATA

National economic indicators are extremely important to the local scene to use as a guide for trends. The following are most applicable:

1. GROSS NATIONAL PRODUCT.

2. VOLUME OF ELECTRICAL CONSTRUCTION WORK - (McGraw-Hill).

3. NATIONAL KILOWATT HOUR SALES.

4. NATIONAL PERSONAL INCOME.

5. POPULATION.

National statistics are very reliable, whereas local figures of certain types are less dependable - especially to conform to the exact areas under consideration.

NATIONAL KILOWATT SALES/1000 POPULATION

YEAR	NATIONAL KW. HR. SALES IN BILLIONS		U.S.A. POPULATION	KW./PERSON	RATIO TO DENVER
1955			165,700,000		
1956		530.1	168,800,000	3,140	1.71
1957		557.8	171,400,000	3,250	1.67
1958		569.1	174,200,000	3,270	1.62
1959		626.8	177,300,000	3,540	1.62
1960		681.2	180,000,000	3,780	1.60
1961		718.6	183,000,000	3,920	1.60
1962		773.7	185,200,000	4,175	1.64
1963		828.1	188,700,000	4,400	1.64
1964		887.5	192,000,000	4,610	1.61
1965		945.7	195,000,000	4,850	1.61
1966	Est.	998.5	197,500,000	5,050	
	Act.	1,038.9	196,907,000	5,270	
1967	Est.	1,069.1	201,000,000	5,260	
	Act.	1,107.0	199,119,000	5,550	
1968	Est.	1,144.8	203,000,000	5,660	
	Act.	1,202.3	201,177,000	6,090	
1969	Est.	1,226.4	206,500,000	5,940	1.63
	Act.	1,307.1	203,213,000	6,430	
1970	Act.	1,391.5	204,765,770	6,800	1.50

ELECTRICAL CONSTRUCTION - McGRAW-HILL

YEAR	VOLUME OF SALES (MIL)	DIFFERENCE	PERCENT	CUMULATIVE PERCENT
1955	3,500			
		250	7.15	7.15
1956	3,750			
		294	7.84	14.99
1957	4,044			
		189	4.68	19.67
1958	4,233			
		430	10.02	29.69
1959	4,663			
		387	8.29	37.98
1960	5,050			
		329	6.52	44.50
1961	5,379			
		388	7.21	51.71
1962	5,767			
		352	6.10	57.81
1963	6,119			
		594	9.70	67.51
1964	6,713			
		429	6.38	73.89
1965	7.142			
		638	8.94	82.83
1966	7,780 Projected			
		2,501	32.20	
1968	10,281			
		1,438	14.00	
1969	11,719			
		500	4.26	
1970 Est.	12,219			
		1,425	11.63	
1971 Fore.	13,644			

GROSS NATIONAL PRODUCT

YEAR	G. N. P. IN BILLIONS	DIFFERENCE	% INCREASE	CUMULATIVE % INCREASE
1955	397.5			
		21.7	5.6	
1956	419.2			
		21.9	5.2	10.8
1957	441.1			
		6.2	1.4	12.2
1958	447.3			
		36.4	8.1	20.3
1959	483.7			
		20.1	4.2	24.5
1960	503.8			
		16.3	3.2	27.7
1961	520.1			
		40.2	7.7	35.4
1962	560.3			
		28.9	5.1	40.5
1963	589.2			
		39.7	6.8	47.2
1964	628.7			
		41.4	6.6	53.9
1965	Est. 670.1			
	Actual 684.9	36.1	5.3	59.1
		Actual 65.0	Actual 9.5	
1966	Est. 706.2			
	Actual 749.9	35.5	5.0	64.2
		Actual 43.6	Actual 5.8	
1967	Est. 741.7			
	Actual 793.5	31.0	4.2	68.4
		Actual 72.2	Actual 9.1	
1968	Est. 772.7			
	Actual 865.7	37.1	4.8	73.2
		Actual 94.3	Actual 10.9	
1969	Est. 809.8			
	Actual 960.0	Actual 31.0	Actual 3.2	
1970	Actual 991.0			
		Actual 93.0	Actual 9.4	
1971	Est. 1,084.0			

6. INTERPRETATION OF ECONOMIC TRENDS

In order to determine the manpower requirements of our industry, it is necessary each year to forecast requirements four years ahead.

The best way to achieve this is to follow reliable economic trends which reflect the conditions which influence electrical construction work.

A projection of each of the important economic trends indicates the following average yearly increases over the next four years:

1. GROSS NATIONAL PRODUCT -------------- 8% INC.

2. VOLUME OF ELECTRICAL

    CONSTRUCTION WORK------------------- 10% INC.

3. NATIONAL K.W. SALES ------------------ 7% INC.

The chart showing economic trends indicates a conservative trend since 1955 of 7%.

Thus, the use of 6% annual increase in important economic indicators would provide a conservative trend for evaluating the annual increase in electrical construction manpower required to meet the needs of our industry.

In addition to this, there must be a reasonable clue to local conditions, and this is represented by kilowatt hours used per person.

A combination of these two guides should provide a trend in requirements for electrical workers.

A graph has been prepared to provide a means for determining manpower requirements for cities of various sizes.
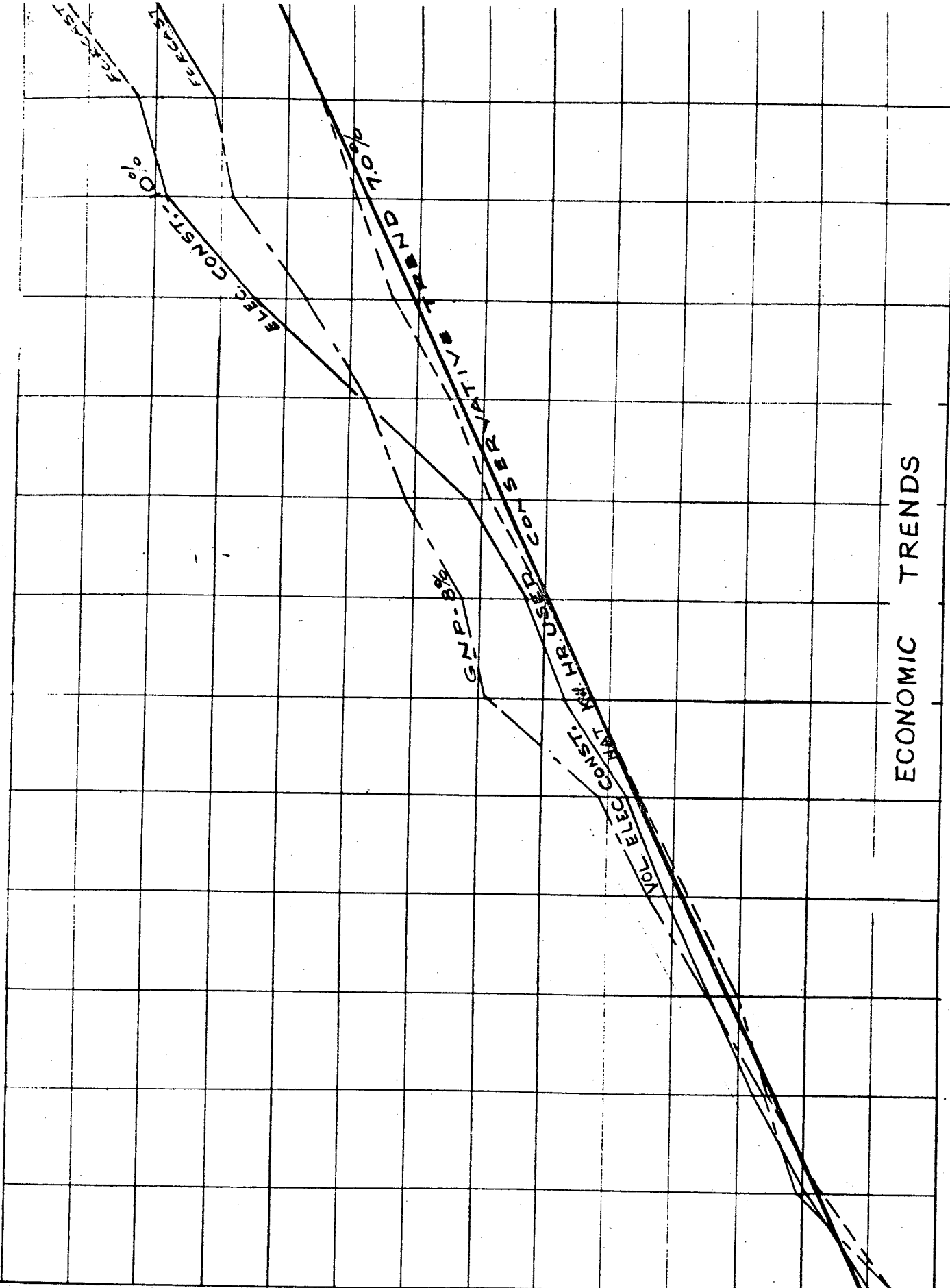
ECONOMIC TRENDS

YEAR

58 59 60 61 62 63 64 65 66 67 68 69 70 7

110

150

200

755 = 100

PERCENT INCREASE

ELEC. CONST. 10%

ELEC. CONST. FORECAST

GNP CONST. FORECAST

GNP - 8%

TREND 7.0%

CONSERVATIVE

TOTAL ELEC. CONST. KW. HR. USED NAT'L

7. <u>NATIONAL WORKERS FLOAT</u>

The electrical construction industry

could not function properly if there were not some

men available to meet the requirements of large

jobs which require men in excess of local union

membership.

In the past, conditions have been such

that some areas were depressed when others were up, and

for the most part it averaged out in such a manner that

jobs were manned from union membership. In more

recent months, this has not been the case - many jobs

were manned by workers outside the industry.

This serious problem cannot be left to

chance. It is an important responsibility of our

national organization, and must be managed properly.

There are two alternatives for developing this source

of manpower.

1. Each local union furnishes men in

proportion to their population relative to the total,

for example:

Denver Population - 1965.......1,074,000

National Population - 1965
(Projected)...................195,000,000

Denver Area Represents .55 of 1% of
National.

If each Local Union provided additional

men for the National Travelers equal to 1/2 of 1%

of their membership - the need could be satisfied.

2.   The national organizations to develop

one local union to provide all float.

It appears that this important function of

our manpower requirements must be properly

managed to provide this important segment of the

work force.

8. <u>DETERMINATION OF MANPOWER REQUIREMENTS</u>
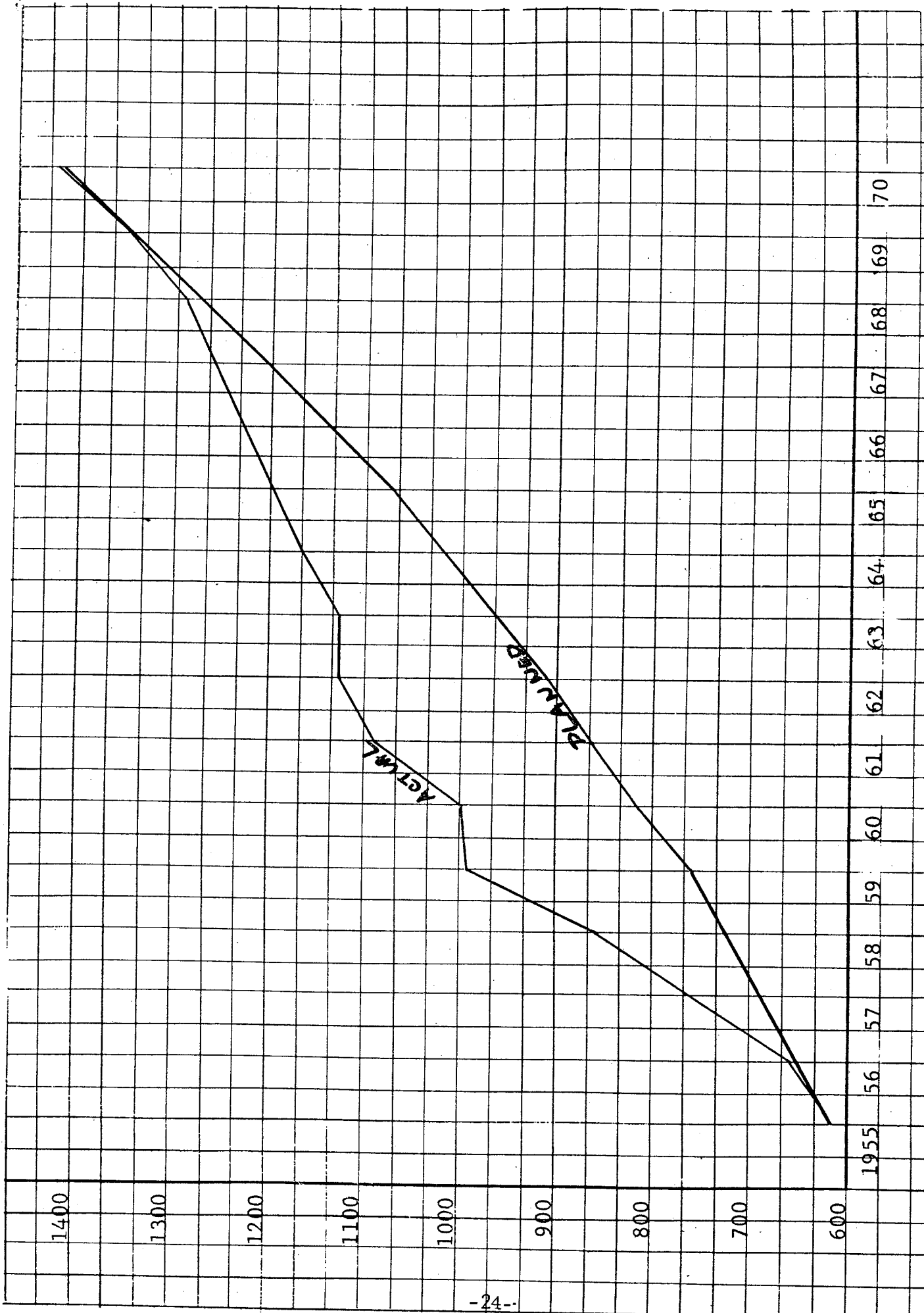
In order to satisfy the demands for workers, three facts are apparent:

1. Each year we must furnish new men to replace those lost by attrition. Statistics show this averages 3% per year.

2. New men must be trained each year to serve the additional growth requirements of the economy which is at least 6% per year.

3. New men must be trained to serve the national float requirements of the industry. Half of one percent of the local union manpower would at this time be 6 men per year for Denver.

Thus, in order to replace the 3% loss and add 6% for economic gain - a formula is developed which results in an annual gain of 9% plus 6 men for national float.

To verify the formula, a table of comparison using the 1955 membership as a base has been developed and projected to 1969, in order to forecast the requirements for the next four years.

DEVELOPMENT OF MANPOWER REQUIREMENTS BY FORMULA - ON 1955 BASE

YEAR	MEMBER CARRYOVER	LESS 3% ATTRITION	NET	PLUS 9%	REQ'D. FOR NAT'L. FLOAT	MEMB. BY FORMULA	ACTUAL MEMB.	ACTUAL OVER	ACTUAL UNDER
1955						616	616	0	0
1956	616	18	598	54		652	661	9	
1957	652	20	632	57		689	769	80	
1958	689	21	668	60		728	866	138	
1959	728	21	707	63		770	994	224	
1960	770	23	747	67		814	999	185	
1961	814	24	790	71		861	1089	228	
1962	861	25	836	75		911	1120	209	
1963	911	27	884	79		963	1121	158	
1964	963	29	934	84		1018	1166	148	
1965	1018	30	988	89		1077	1196	119	
1966 Forecast	1077	32	1045	94		1139	1196	59	
1966 Actual		44	1033	93		1126	1206	80	
1967 Forecast	1139	34	1105	99	7	1211	1198		18
1967 Actual	1126	51	1075	97		1179	1214	35	
1968 Forecast	1204	36	1166	111	6	1283	1193		105
1968 Actual	1172	44	1128	101		1235	1251	16	
1969 Forecast	1277	38	1239	112	6	1357	1178		198
1969 Actual	1229	43	1186	108		1300	1276		24
1970	1300	54	1246	112	7	1365	1327		38

PROPOSED UNION MEMBERSHIP BY FORMULA

R.E.J. 3-18-66

9. <u>MANPOWER GRAPH</u>

This graph may be used in the following

manner:

1. To verify the size of the organization

required to furnish proper manpower to install

electrical work for an area of a certain population.

2. To forecast manpower requirements for

the future by means of projecting kilowatt hour

sales of electricity and population increases.

<u>HOW TO USE THE GRAPH</u>

1. Select the appropriate population in

the left hand column. For the most part, this will

represent the area served by the local union.

2. Determine the kilowatt hour sales for

the same population area, recognizing type of

utility, and resolve this in terms of kilowatt hour

per 1000 population. Follow the line up to the point

of intersection with the population line and interpolate

manpower.

To verify the immediate situation, use

today's figures. To forecast four years from now -

use reliable data for 1969.

This graph, properly used, will provide minimum quantities required according to normal conditions. Towns of 5000 population or less should be factored down unless supported by heavy industry.

For example:

Denver's 1965 population was 1,080,000, and 3,210 million kilowatt hours were sold, resulting in 3000 kilowatt hour per 1000 population. Reference to the graph for gas and electric utility shows a manpower requirement of 1100. (Actual manpower was 1196 with men unemployed a large part of the time.)

Denver's 1969 population is forecast at 1,194,000. Power forecast 4,350 million kilowatt hours. Thus resulting in 3,650 kilowatt hour/1000 population. Reference to the graph results in manpower of 1350.

In this manner, a forecast can be made for any city or metro area, or local union jurisdiction.
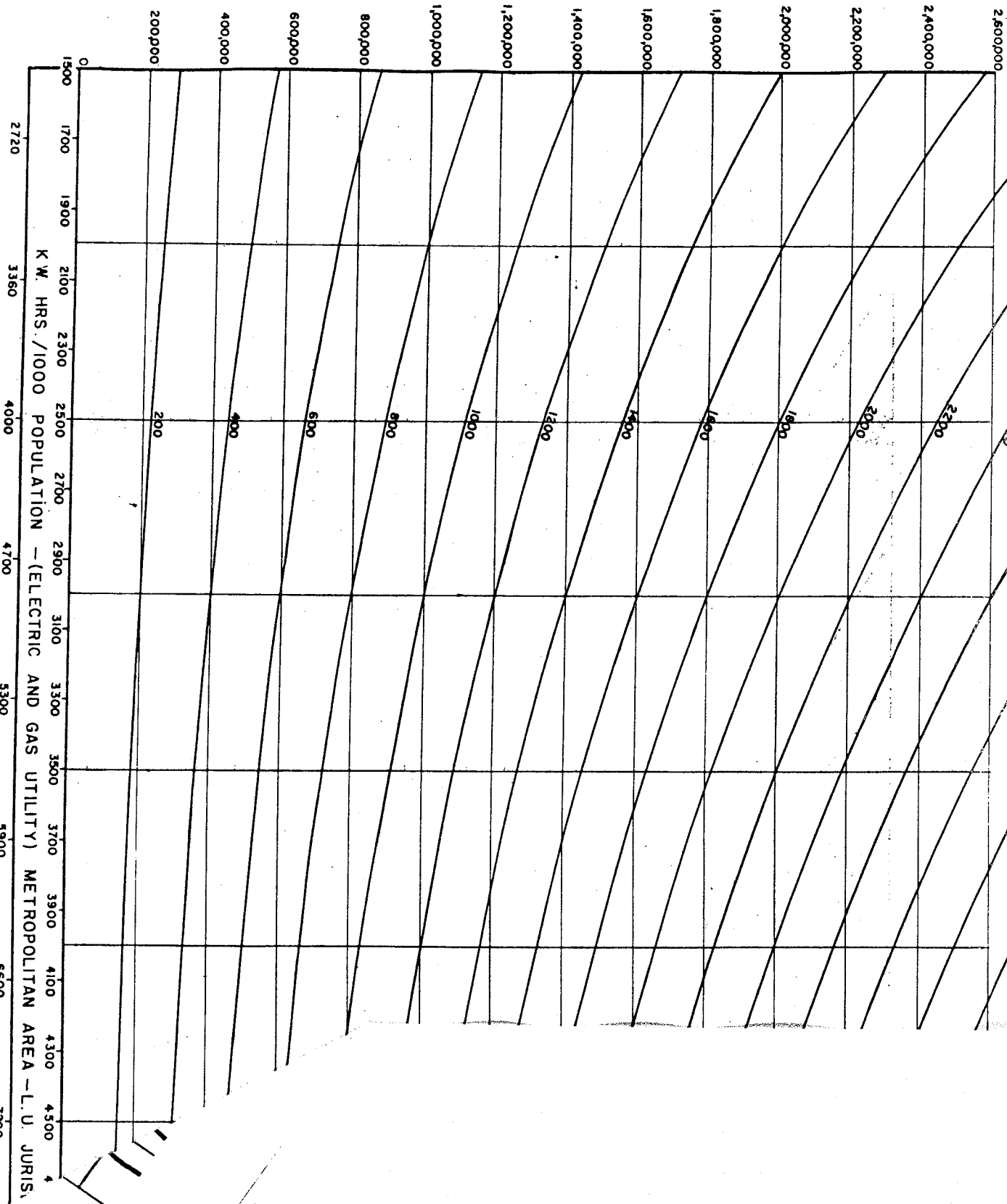
MANPOWER REQUIREMENT GRAPH FOR VERIFYING SIZE AND FORECASTING REQUIREMEN

10. TRAINING REQUIREMENTS FOR DENVER MANPOWER

Both the graph and the formula forecast about the same manpower requirements over the next four years.

Therefore, immediate plans should be made to train manpower on the following basis:

Apprentices now in training:

To turn out in 1966   -   34

To turn out in 1967   -   29

To turn out in 1968   -   21

To turn out in 1969   -   20

Total   104

FORECAST BY FORMULA:

Start in 1966 - 1st Year Apprentices - 197
or outside initiates

Start in 1966 - 2nd Year Apprentices - 105
or outside initiates

Start in 1966 - 3rd Year Apprentices -   18
or outside initiates

TOTAL MEN TO BE IN TRAINING
(Including above apprentices)   424

On this basis the total union manpower available will be the following:

1966   -   1198

1967   -   1211

1968   -   1283

1969   -   1365

These numbers include 19 men for national float.

To accomplish this training, it will be necessary to harness the efforts of the entire industry. Management will be taxed to the limit, and complete cooperation and understanding will be required by all members of the industry.

An alternative to this vast amount of training is to take into union membership from other channels of the industry at least 50 men per year, and then the training of apprentices can be reduced to a more comfortable number.

11. SUMMARY

It appears that there is little or no
mystery surrounding the manpower requirements
for the electrical construction business.

The economic indicators which provide
forecasting of trends are completely applicable
to our business.

Because the indicators are sensitive to
change, it behooves us to watch developments
constantly.

However, more is involved than just
forecasting. A whole new industry attitude and
change in concept must be accomplished relative
to training. We must look forward to the avail-
ability of fully trained workmen to do our work,
and these must be subjected to constantly improved
apprentice training.

More men must be trained than ever
before, and the contractor must do the job.

If electrical contractors made maximum
use of their sales opportunities, and the local
union agreements are not restrictive to the point
of increasing competition, there is every reason
to believe that the fulfillment of forecasts could

result in steady employment.

Thus, we must have confidence in intelligent planning and forecasting.

Inasmuch as "travelers" are such an important part of our industry, and because each local union in the country is involved in providing manpower, this important aspect of the business requires national coordination and management. It is conceivable that computer tabulation of national manpower distribution would be a practical tool of management for this purpose.