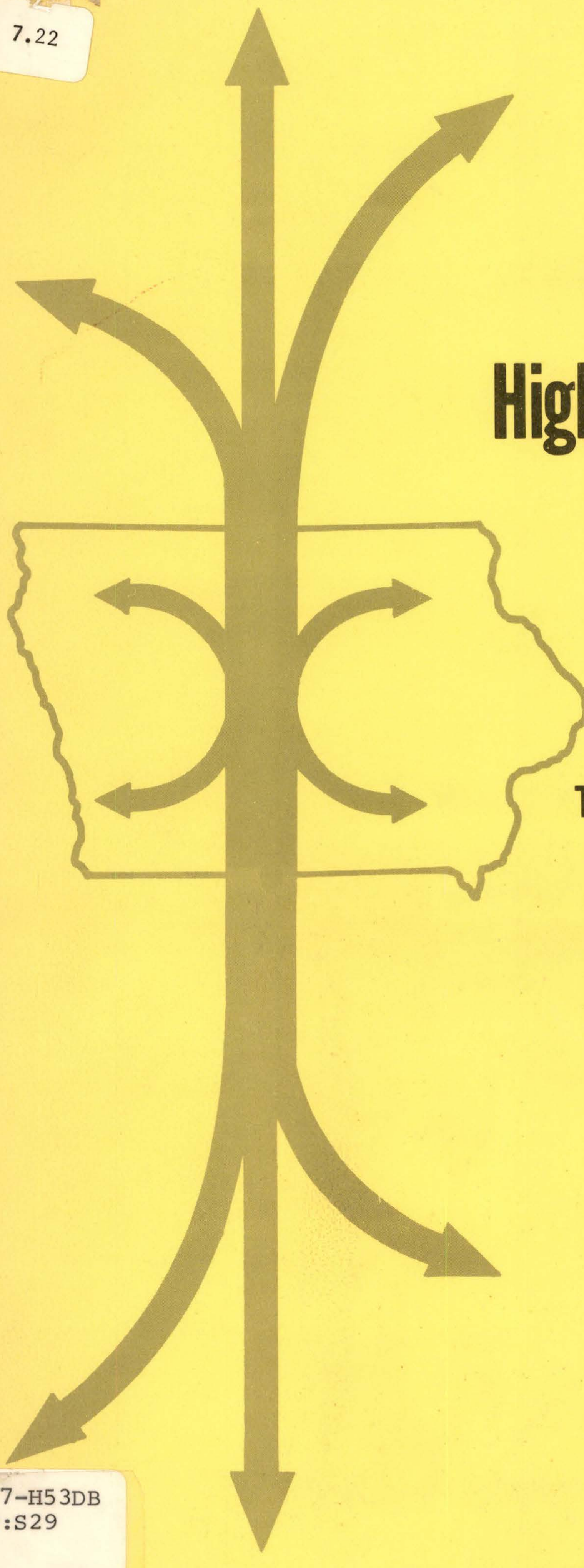

Iowa Statewide Highway Transportation Study

TRIP DATA ANALYSIS

Vol. 1-D

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STATEWIDE HIGHWAY TRANSPORTATION STUDY

Trip Data Analysis

Volume 1-D

Compiled by

Transportation Data Base Department
Division of Planning
Iowa State Highway Commission

In Cooperation With
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DATA ANALYSIS

Introduction

The Transportation Data Base Department, in conjunction with the Federal Highway Administration, (FHWA), have committed funds towards a Statewide Planning process. A comprehensive work program and proposed work schedule was published in May 1973.

The object of this report is to present the data and conclusions drawn from the analysis of the origin and destination information. Comments on the advisability and correctness of the approach used by Iowa are encouraged.

Chi-Square Analysis

In the summer of 1972, the Iowa State Highway Commission collected origin and destination information at 91 cordon line stations located about the perimeter of the State. The cordon lines were located, with the exception of three areas, on the State boundary line. In the Davenport area, the Sioux City area, and the Council Bluffs area, the cordon line was the urban area boundary around these three cities.

The primary objective of this study was to evaluate the changes in travel distribution which may have occurred since the 1960 origin and destination study. The evaluation method applied statistically compared the new data with the old.

Ultimately, the data collected in the 1972 external survey will be inserted into the statewide transportation study base year trip table. This data will provide the external-external and external-internal portions of the base year trip table. The bulk of the trip interchange possibilities, the internal-internal trip, will have to be obtained from: (1) Existing origin and destination information; (2) New O & D data collected at selected locations; and (3) Synthetic trip generation equations.

The Transportation Data Base Department has a vast reservoir of origin and destination data, (approximately 160 studies), from which to draw these internal-internal trip movements. It is possible, as has been done in studies conducted by other states, to take this raw data and its accompanying distribution, and apply the trip information to the base year trip. Because the establishment of a reliable and accurate base year trip table is of paramount importance to the projections later made in study processes, we were reluctant to follow established precedents without further study. Therefore, considerable time was devoted to the analysis of old and new O & D data at selected stations.

For the purpose of the analysis, we were comparing the old O & D information versus the new information. The data was grouped on a county, city and region format. Compatibility of the grouping technique between the old and new data was strictly adhered to. All calculations were performed on a Monroe 1830 programmable calculator to eliminate possible math error.

The Chi-Square test methodology follows:

Step 1: The trips for both the old and new data were summarized by county, town or area. A minimum acceptable observation of approximately five (5) trips per destination was arbitrarily established.

Step 2: Based on the empirical data, (observed), compute the theoretical, (expected), frequency per cell, where:

E_{1i} = expected trips for old O & D data for ith cell.

E_{2i} = expected trips for new O & D data for ith cell.

O_{1i} & O_{2i} = observed trip frequency for new and old O & D data respectively for the ith cell.

N_1 & N_2 = total number of trips interviewed for old and new data respectively.

$N = N_1 + N_2$

$P_1 = N_1/N$ percent of total for old data

$P_2 = N_2/N$ percent of total for new data

$E_{1i} = (O_{1i} + O_{2i})\ P_1$

$E_{2i} = (O_{1i} + O_{2i})\ P2$

Step 3: Compute Chi-Square statistic (X^2) for each set of data:

$$X_1^2 = \sum_{i=1}^{K} \left(\frac{O1i - E1i}{E1i}\right)^2 = \sum_{i=1}^{K} \left(\frac{O1i - E1i}{E1i}\right)^2$$

$$X_2^2 = \sum_{i=1}^{K} \left(\frac{O2i - E2i}{E2i}\right)^2 = \sum_{i=1}^{K} \left(\frac{O2i - E2i}{E2i}\right)^2$$

$$X^2 = X_1^2 + X_2^2$$

Step 4: Degrees of freedom used will be K-1, where K= number of comparison zones.

Step 5: Confidence coefficient is 0.95 (0.95 is traditionally the most often selected in statistical comparisons of this nature).

Step 6: Accept null hypothesis if X^2 statistic is less than the table value:

H_o: $O_{1i} = O_{2i}$ for all i = 1....,K

H_a: $O_{1i} \neq O_{2i}$ for at least one i

One of the major advantages of the Chi-Square test is that the assumption of normality is not necessary. That is, there is no requirement that the data fall symmetrically about the sample mean. Therefore, the theory that traffic distribution follows a probability function controlled primarily by population and distance, makes no difference in terms of the Chi-Square test requirements. However, one drawback to this type of analysis is that the test is sensitive to small cell frequencies. As will be demonstrated later, variability between the two sets of data, (e.g., 18 trips old data and five trips new data), in a cell with low expected frequency will contribute heavily to a large value of X^2 and hence rejection of the null hypothesis.

Summary of Tests Performed

Following is an explanation of the testing procedure for the individual O & D's studied. Referral to Appendix I will orient the reader on the location of each study.

I. Interstate 35 Northern Corridor (7 stations studied)

A. Station 7014 (U.S. 169) - Appendix II-A

The initial test run on this station indicated a marginal rejection region. The data was initially grouped into 31 zones. However, by combining zones 27 and 28, a positive, or acceptable X^2 statistic was obtained. Analysis of this data indicates that a raw volume factor, (based on Internal-External and External-Internal trip totals), applied to the 1960 data to extrapolate to 1972 estimated distribution, would achieve 88 percent predictability. This means, that by adjusting the old data to reflect the current volume, only 12 percent error is expected. If the old data were left in its present state, 81 percent predictability is anticipated. (See Appendix V for definition of "predictability %".)

B. Station 7015 (Iowa 254) - Appendix II-B

The initial test on this station passed the X^2 test criterion. This is a low volume station, with marginal through trip occurrence. Because of the high content of local trips and the stable population in the area, acceptance of the data was expected.

1. Predictability % with volume adjustment: 84%

2. Predictability % with no adjustment: 77%

C. Station 7016 (County Road) - Appendix II-C

The data comparison on this station failed to pass its first run. Close scrutiny of the data revealed a coding error in the 1960 information for Mitchell County, (Zone 4). After this zone was deleted from the analysis, the X^2 statistic was acceptable. As a footnote, errors of this type obviously would not have been detected without another set of data with which to compare against the old information. As we fill our base year trip table in the future, errors of this type obviously would not be correctable unless they are blatantly wrong.

1. Predictability % with volume adjustment: 94%

2. Predictability % with no adjustment: 47%

D. Station 7017 and 7019 (U.S. 69 and U.S. 65) - Appendix II-D

At the outset of the Chi-Square analysis, it was recognized that the influence of completed or partially completed Interstate facilities would substantially influence the traffic distribution on the existing primary system. The initial Chi-Square analyses were made separately for the two stations, U.S. 65 and U.S. 69.

Analysis of the data; and the accompanying high Chi-Square statistic, revealed that Interstate generation, diversion and the change in trip patterns significantly affected the trip distribution. Because U.S. 65 and U.S. 69 are high volume primary roads and carry a large number of long distance trips, it was decided to treat the two stations as one.

The first analysis was made on all Internal-External and External-Internal trips interviewed at the two stations. The Internal-External and External-Internal trips for the old and new origin and destination data were grouped by county. The resulting Chi-Square statistic was extremely high but areas of large variability were immediately recognizable. Careful scrutiny of the first analysis indicated that a study of Interstate 35 corridor trips only might prove to be fruitful. The 37 counties lying adjacent to Interstate 35 were extracted from the total trip listing. Because the trips within this corridor make up 92 percent of the total trips interviewed, acceptability of the statistical test would impart a high degree of confidence to the data. The resulting computed Chi-Square values fell well within the confines of the tabular standards, (see Appendix II-D). While it is recognized that the isolation of the 37 counties falling inside the I-35 corridor is not a valid statistical technique, the high predictability, (92 percent), indicates that the raw factoring of O & D information is an attractive alternative to the use of old information.

Of the areas falling outside the I-35 corridor influence, only 19 counties, or four percent of the total trips, were rejected in the Chi-Square analysis. Had the old origin and destination data been used without factoring for raw volume changes, only 55 percent of the new data would have accurately been predicted.

E. Station 7018 - County Road - Appendix II-E

This station is a low volume local county road with a short duration trip characteristic. The statistical comparison of the old and new data passed on the first attempt with no data adjustments.

F. Station 7020 - U.S. 218 - Appendix II-F

U.S. 218, during the 12 year interim between the two O & D's, has experienced negligible traffic growth (.6 percent per year). However, the trip distribution to several zones at this station has undergone a significant metamorphosis. Trips with termini in Cerro Gordo County have fallen precipitously since the 1960 cordon line study. Reference to the U.S. 65

station data indicates that it is likely that this trip interchange has shifted from U.S. 218 to U.S. 65 with the completion of I-35 in Minnesota. The massive trip difference to Cerro Gordo County and a disproportionate distribution to Howard County led to rejection of the data for U.S. 218. The Howard County data disparity is a low volume difference with an extremely high change in frequency. Although this particular cell comprises less than one percent of the Internal-External and External-Internal trip total, the computed variance accounts for 17 percent of the Chi-Square total. By eliminating the Cerro Gordo and Howard County trips from the analysis, a positive Chi-Square total is achieved.

II. Analysis of the 1961 and 1971 Elkader O & D's (Appendix III)

A possible technique for completing the internal trip table would be to incorporate available internal origin-destination data in the trip matrix. While this technical approach is expedient and relatively inexpensive, application of this approach must be carefully considered due to the implication on the total planning process. A study was undertaken utilizing the Chi-Square statistical technique, whereby the Internal-External and External-Internal trips interviewed at the external stations were analyzed for statistical compatability. The analysis of the stations at Iowa 13 North, Iowa 13 South, and Iowa 56 West indicated the following:

A. All studies made on a direct comparison of either the individual stations or of all stations combined resulted in failure to pass the Chi-Square test.

B. Analysis of the interview station locations indicated that all of the 1961 stations were close to, if not within, the corporate limits of Elkader. In all cases the 1971 stations were a considerable distance from the Elkader city limits. Because of the station location changes from 1961 to 1971, the rural trips for all stations were dropped from the comparison. This deletion from the total data resulted in an acceptable Chi-Square statistic for Iowa 56 West as shown in Appendix III-A. The stations on Iowa 13 North and Iowa 13 South responded favorably to the omission of these rural trips but still did not pass the Chi-Square test. At this juncture it is not certain whether or not the rural trips will be incorporated into the trip matrix. There is some question as to whether our network and node sequence is capable of responding to the rural type, or short duration trip.

C. An additional impact of the station location change on Iowa 13 South was that trips interviewed from Elkader to the towns of Littleport, Elkport, Garber and Colesburg in 1961, were not interviewed in 1971 due to the movement of the interview location south of the county road serving these towns. Refer to Appendix III-B for the Chi-Square analysis of trips at Iowa 13 South with the rural trips and trips affected by the station location change deleted.

D. Road network changes have a major impact on the traffic distribution within the area of the improvement, addition or relocation. Between 1961 and 1971 the county road connecting Elkader to Postville was improved and paved. The comparison of the two years of data indicates that the trip interchange between Elkader and the affected towns was significantly altered by the improvement, as shown in Appendix III-C. The deletion of these affected trips from the analysis lowered the Chi-Square statistic considerably but the test results were still negative. It should be noted that had the 1961 origin and destination data been used in the base year trip table, proper assignment of these affected trips would have been realized due to the physical improvement of this facility and the corresponding changes to travel times and roadway conditions.

E. The separate Chi-Square tests were made by vehicle type. The trip data was separated into passenger car and truck categories. Deletion of the trips as enumerated above, and an analysis by vehicle type resulted in acceptable values of the test statistics for Iowa 13 South and Iowa 56 West. The Iowa 13 North test was rejected due mainly to the trip interchange between Garnavillo and Elkader. It appears from an analysis of the historical taxable retail sales for Garnavillo that a loss in local trade has occurred in this town, and a corresponding increase in the retail sales totals for Elkader has occurred. This fact, along with the corresponding increase in traffic between these two towns, leads one to suspect that the trip data is correct.

The Elkader O & D's were studied for a variety of reasons. It was felt that if an acceptable Chi-Square test result could be obtained from the analysis, inferences could be drawn from this to other origin and destination studies having similar characteristics. The Elkader interview stations experienced a very small volume increase over the ten year period. No major primary route construction occurred during this time and the economic base of the area remained fairly stable. By comparing the socio-economic characteristics and the resulting travel generated by these parameters, it is hoped that parallels may be drawn to other origin and destination studies of similar size. Factors from this analysis of Elkader may be developed for population and trip length to update the older O & D information to the current data.

III. Analysis of the 1958 and 1968 Hampton O & D's

After completing the analysis of the Elkader data, it was felt that a study should be made of an area that is influenced by major primary traffic. The City of Hampton and its two O & D's conducted in 1958 and 1968 were therefore selected for scrutiny and application to the Chi-Square test.

Two of the stations studied, Iowa 3 East and U.S. 65 South, passed the Chi-Square test following the deletion of the rural type trip (refer to Appendices IV-A and B respectively). The ability of Iowa 3 East to pass the test was anticipated by the analyst. However, it was expected that U.S. 65 South and North would reflect the partial redistribution of traffic due to the completion of Interstate 35 south of Hampton, and therefore experience difficulty in passing the Chi-Square test. Our analyses of the I-35 corridor, and in particular U.S. 65 and U.S. 69 on the northern border, demonstrated that travel patterns at both of these facilities have been realigned. It was, therefore, an unexpected acceptable Chi-Square statistic that was achieved for U.S. 65 South.

Conversely, U.S. 65 North failed to pass the tests except with severe selective grouping. Scrutiny of the cells receiving particularly high variability quotients indicated that 70 percent of the variance can be attributed to cities within ten miles of Hampton. Again, this demonstrates the unanticipated consistency of long range trip patterns that might have been affected by I-35.

By way of explanation of the apparent contradiction in traffic distribution, (i.e., the observed shift in traffic at U.S. 65 and U.S. 69 along the northern border as opposed to the consistency of long range trip patterns on U.S. 65 North and South at Hampton), one must recognize the time frames of the two comparisons. Interstate 35 was completed to U.S. 20 in December of 1967. When the current Hampton O & D was conducted (June of 1968), it could be postulated that shifts in traffic destination had not been consummated in such a short time interval. However, by 1972, when the interviews were obtained along the northern border, sufficient time had elapsed to allow for the change in travel patterns precipitated by the I-35 completion in Iowa as well as in Minnesota.

The final Hampton origin and destination station analyzed was Iowa 3 West. The test results for this location failed to pass even when selective grouping techniques were imposed (see Appendix IV-D). The major contributing factor to the high cell variability was the paving of a north-south county road immediately west of Hampton. The improvement of this facility diverted trips from Hampton to Iowa Falls that were previously using U.S. 65 South.

The analysis of the Hampton origin and destination studies again demonstrates, as illustrated in Table 1, that factoring of old data achieves a better predictability percent.

Summary of Chi-Square Analysis

The Chi-Square test reacts _most_ sensitively to low cell frequencies where variability is high. Our experience with the Chi-Square test is that the test is extremely sensitive to changes in trip frequency for locations with only a limited number of trips. We, therefore, feel that, while traffic distribution is certainly predictable, a test of the distribution is not able to withstand the strictures of the Chi-Square test.

Further, the manipulation of the data, (i.e., eliminating rural trips, adjusting for station location changes and splitting trip data by vehicle type), to improve the distribution comparison is _not_ an acceptable technique. The purpose of the data analysis was to test the integrity of the old versus new trip distribution. Adjustments to the data where multiple reports are available is a valid approach, but dual origin and destination reports are the exception rather than the rule. No uniform adjustment patterns were ascertainable from our analysis. Therefore, data adjustment to achieve passable Chi-Square results is tenuous. The reliability obviously is contingent upon the adjuster's knowledge of travel patterns and land use changes in the area.

The most valuable by-product of conducting the Chi-Square analysis was the realization that the trip distribution of the data could be improved upon by the simple process of expanding the old data by a factor developed from a comparison of the old and new internal-external and external-internal totals. The improvement of the data has been referred to in prior documentation as the "Predictability %" (see Appendix V).

The fact that data integrity can be improved upon by a simple factoring procedure is of no value unless a reliable means of factoring the internal-external and external-internal information can be devised. For example, if we have a 1961 origin and destination report and no subsequent studies, development of internal-external and external-internal factors would not be possible. What is needed, therefore, is a set of independent parameters which would uniquely describe the anticipated internal-external and external-internal trip growth. The following section of documentation devotes itself to that problem.

TRIP GROWTH FACTORS

The intent of this entire study is to determine the feasibility of utilizing the older origin and destination data for incorporation into the base year, 1972 trip table. Earlier documentation has emphasized the critical need for a method of updating the old data to current standards. A study, independent to the Chi-Square analysis was undertaken after the need for factors was ascertained.

All dual origin and destination reports were collected and summarized in tabular form. The unique characteristics defined in each report were:

1. Total trips - old and new
2. Internal-external and external-internal trips - old and new
3. Population - 1960 and 1970
4. Distance from the Interstate
5. Retail sales (county) - for respective years

A total of 33 cities were analyzed (66 reports). This data was studied for possible inter-variable correlation. It soon became apparent that retail sales totals by county would be of little value in our analysis. The method of tabulating retail sales data has changed markedly over the historical period making a common base comparison impossible.

Initially an attempt was made to regress the % internal-external and external-internal trip change to the multiple variables: (1) Total trip change, (%); (2) population change; and (3) the inverse of distance from Interstate. Utilizing a stepwise regression program, BMD02R, the independent variables listed above were regressed on the dependent variable to determine if linear relationships were prevalent. The following equation was used to describe the relationship:

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + e$$

where:

Y = % change internal-external and external-internal trips

X_1 = % change total trips

X_2 = Population %

X_3 = Inverse of distance from parallel Interstate routes

The resulting computed <u>R^2</u> and <u>Standard Error of Estimate</u> were .6398 and 2.2485 respectively. The <u>"R^2"</u> term is a statistical measure of the total variability in the dependent variable (where the variability is measured as the squared deviation from the mean), which is explained by the independent variables in the model. The value of R^2 may fall between 0 and 1, where "1" indicates that the total variance has been completely explained by the independent variables used. The "<u>Standard Error of Estimate</u>" is a measure of the degree of variation of the observed data about the regression line. It is an indication of the error expected in predicting the dependent variable from the independent variable(s) in the equation. The value of R^2 should be "reasonably" large if the model developed from the data is to be used for predicting future values. Similarly, one would hope for a "reasonably" low value of the Standard Error of Estimate. Because the above computed statistical measures were felt to be unsatisfactory, further analysis to the data was made.

A total of 105 station locations were utilized in the initial analysis (refer to Appendix VI-1). It was decided to characterize these geographical points into sets of areas of influence. Through a series of trial and error, the following sub-divisions of the data were devised:

I. Population of Town Increases, no Interstate Influence;

II. Population of Town Decreases, no Interstate Influence;

III. Major Primary Stations Within Immediate Interstate Corridor;

IV. Peripheral Interstate Influence;

V. Rural Stations, no Interstate Influence.

Briefly, the following documentation will state the hypotheses generated and the conclusions drawn from the above sets of information.

I. Population of Town Increases, no Interstate Influence

Because the population growth of a town is a critical factor in internal-external and external-internal trip growth, it was hypothesized that a linear function might be apparent between internal-external and external-internal trips and total trips. An indication from earlier data inquiry established that as city population increases, the internal-external and external-internal trip growth exceeds the growth experienced in total trips.

A sample size of 30 was obtained for this data set (see Appendix V-2). A simple linear regression model in the form of $Y = a + bx$ was established and computed where:

Y = % change in internal-external and external-internal trips

x = % change in total trips

a = Y intercept

b = slope

Reference to Appendix VI - 2 will graphically demonstrate the strong linear relationship between these two variables. An R^2 ratio and Standard Error of Estimate of .8380 and 1.1518 were computed. The R^2 term indicates that a significant portion of the variability in Y is explained by the total trip increase or decrease. Extreme care was taken with this, and all studies to eliminate possible bias in the data and grouping techniques. If data points appeared inconsistent with the trend, the information was examined for error or physical changes that might affect the results. If no valid explanation of data ambiguity was found, the information was retained in the analysis.

The results of the regression fit substantiate the hypotheses that internal-external and external-internal trips <u>do</u> increase at a higher rate than do total trips when the population of the study town increases.

II. Population of Town Decreases, no Interstate Influence

Because many of Iowa's minor population centers have suffered population declines from 1960 to 1970, it was felt that a unique linear relationship should and could be established to describe the travel emanating from these areas. Cities south of Interstate 80 have experienced especial decreases in population, therefore, the bulk of our sample, (N = 22), was obtained from towns in the southeastern and southwestern part of Iowa.

The simple regression model explained in Section I, above was applied to the data. The following statistical measures were obtained:

R^2: .8232

Standard Error of Estimate: 1.1699

Refer to Appendix VI-3 for the graphical material and the computed slopes and intercept. As expected, the relationship that exists between internal-external and external-internal trips and total trips is one of compatibility. As the population decreases, one would expect a corresponding drop in internal-external and external-internal trips and, therefore, total trips. Because the internal-external and external-internal trips only comprise a portion of the total trip movement, one would expect that internal-external and external-internal trip growth be less, or decrease be greater, than the change sustained by the total trips.

III. Major Primary Stations Within Immediate Interstate Corridor

(Appendix VI-4)

Because Iowa's Interstate system generally follows north-south or east-west routing, definition of stations affected by Interstate diversion was easily discernible. Primary routes that have experienced severe Interstate diversion for which we have adequate material are U.S. 6, U.S. 30, Iowa 92 and U.S. 69. Utilizing these routes, 13 sets of data for this trip growth criterion were accumulated. The following statistical measures were computed:

R^2: .9115

Standard Error of Estimate: 1.5114

It was expected, and the result of regression analysis supports our hypothesis, that the heavy loss in through trips at the local interview stations results in a disproportionate ratio between the two trip type parameters. The exceedingly high ordinate intercept of 5.9808 and the steep slope of 1.37607 is a demonstration of this phenomenon.

To explain the results obtained, one could rationalize that in order for an entry to be included within this data set, significant losses in external-external trips should have occurred. Further, if a loss in total trips has transpired, it seems axiomatic that the loss occurring to the external-external trips would be greater than the loss experienced by the internal-external or external-internal trips.

IV. Peripheral Interstate Influence (Appendix VI-5)

The prerequisite for inclusion of information within this data set was that the route suffered marginal Interstate diversion, (i.e., U.S. 34, U.S. 20 and U.S. 169). It could be argued that Iowa 3, U.S. 18 and Iowa 14, for example, were affected by Interstate completion. We agree, but the extent of the loss in trips as a percent of the total, and/or the characteristic of these roads as not being major through primary routes obviated admission into this trip growth category.

It was anticipated that the internal-external and external-internal growth rate would exceed that experienced by the total trip movement. The results of the regression analysis support our hypothesis for total trip values within certain limits. The qualification to our proposition is that as total trip growth increases or decreases at a higher rate, the net difference between the two parameters is smaller. The following statistical measures were obtained from the simple linear regression analysis:

R^2: .8887

Standard Error of Estimate: .8990

V. Rural Stations, no Interstate Influence (Appendix VI-6)

Early in our study process, the need for rural origin and destination trip growth factors was identified. Because there exists a massive amount of data that could be utilized from the

1960 Missouri Valley Study, development of internal-external and external-internal factors were determined as being of critical importance. For purposes of this analysis, the trips being studied were internal, internal-external and external-internal if interviewed at the external corridor line, and internal-external and external-internal if interviewed within the state's perimeter. The slope and intercept computed generally falls between the values calculated for Sections I and II. The statistical measures achieved from the regression analysis were:

R^2: .8751

Standard Error of Estimate: .8788

Figure VI-7 illustrates a composite of the five graphs.

Application of Factors

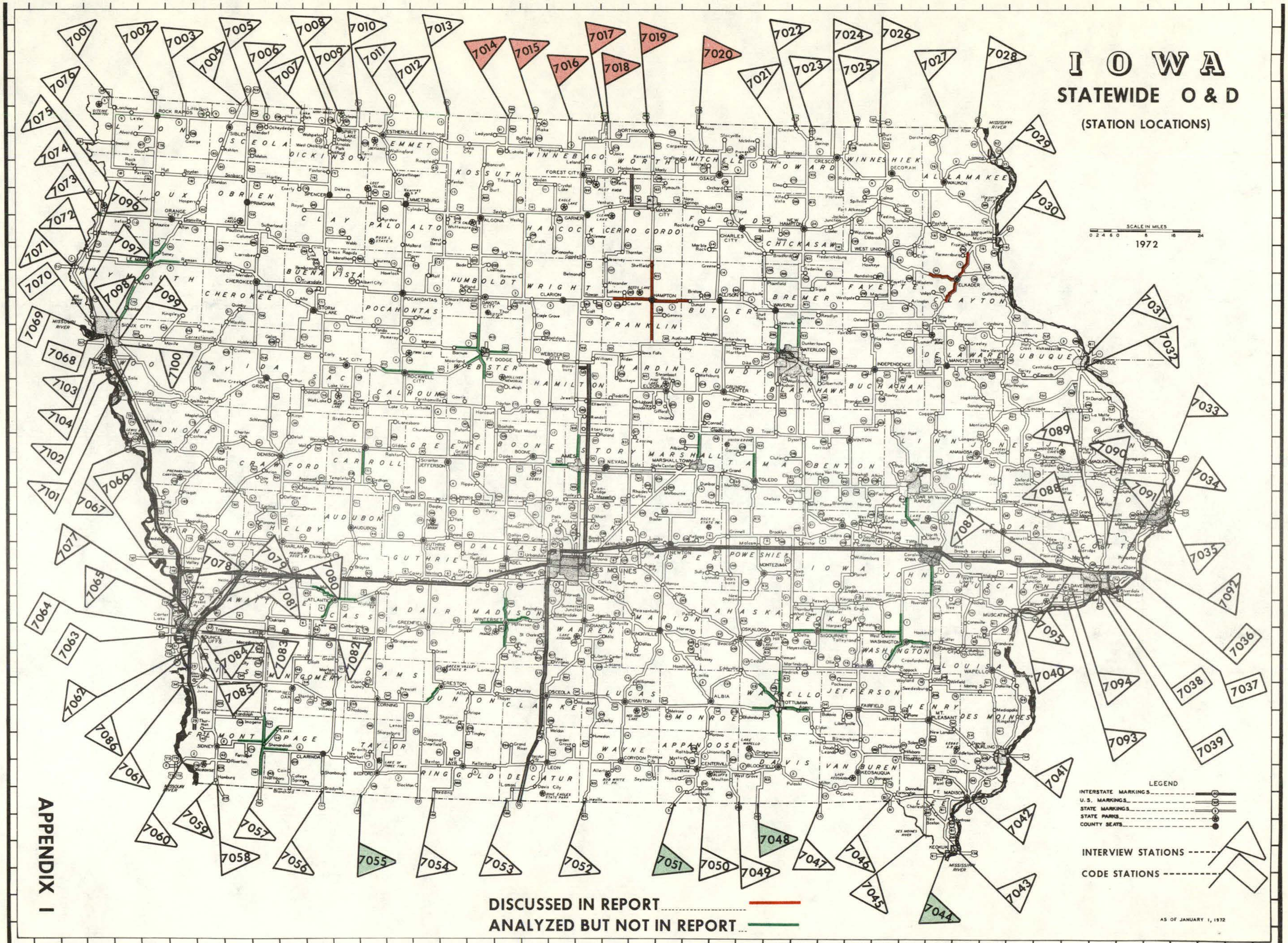
A cursory review of existing reservoir of origin and destination information indicates that approximately 400 station locations can be updated by utilizing the respective groups of the trip growth factors. Based on the sample tabulated to develop the growth factors, it is estimated that the total trips adjusted will be in excess of one million. This estimate is considered conservative because the larger metropolitan areas were not part of the original sample.

Reference to Appendix VI-8 will indicate the anticipated application of the five sets of factors. This map is not to be considered as the final copy, but should be evaluated for general appropriateness. If no major procedural errors are discovered, this map will be exhaustively reviewed and/or revised.

Conclusions

The Statewide Transportation Section has adopted an administrative policy that it will investigate all avenues for improving the base data that will be utilized in our specific area of study. At an early stage in our development, we committed ourselves to the research of means by which the old trip information might be given more authenticity. We feel that our "trip growth" study has merit and is a significant step towards the improvement of basic data inputs.

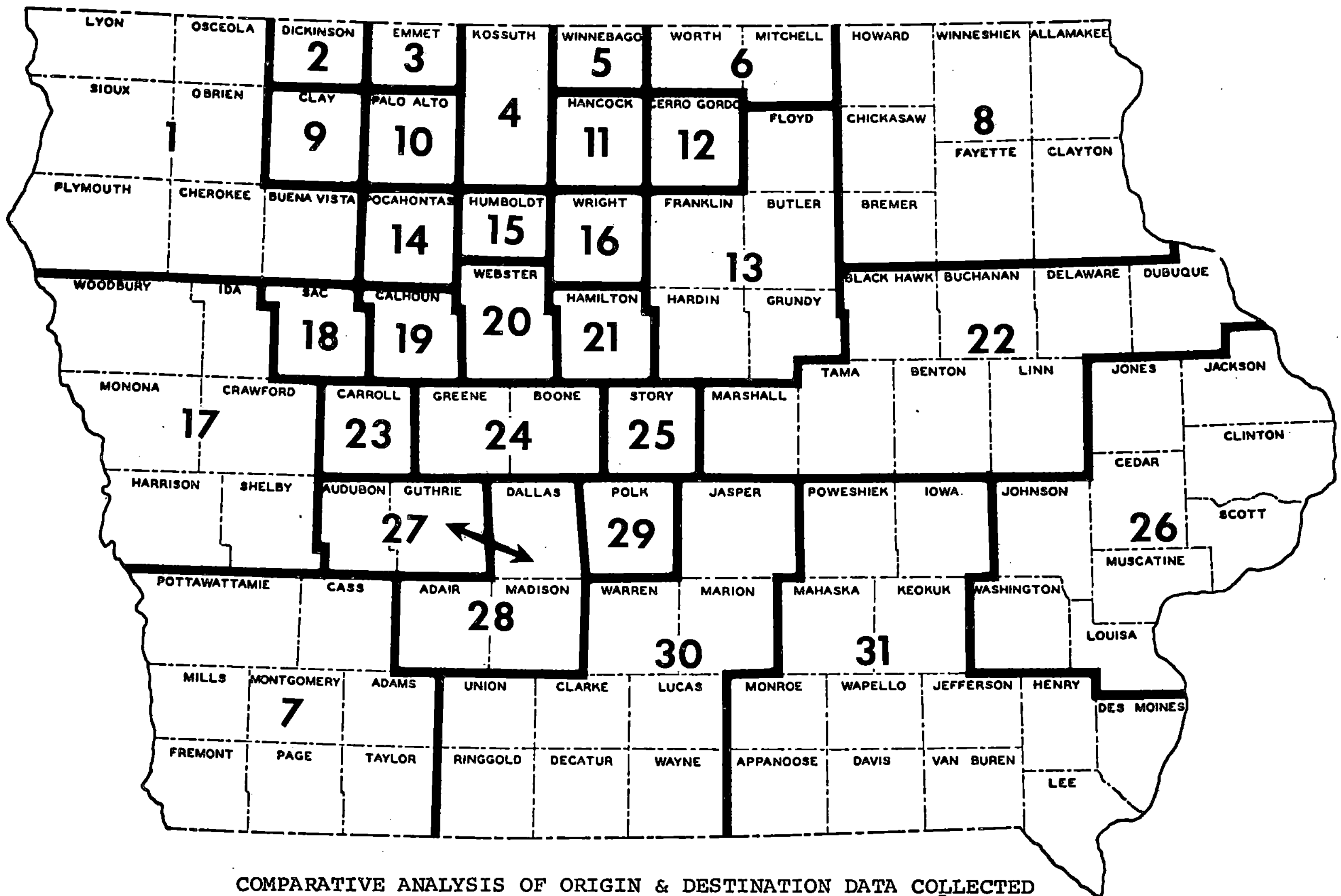
This department, in light of the development of internal-external and external-internal trip growth factors, is proposing to update the existing origin and destination trip records to the 1972 base year. It is our hope to utilize as fully as possible the existing trip data. As expressed in previous documentation, we are satisfied that trip growth factors will substantially improve the integrity of the traffic distribution. We are, however, hopeful that further studies may be conducted by other states to ascertain the impact that trip purpose might have on similar type of analysis.


IOWA
STATEWIDE O & D
(STATION LOCATIONS)
SCALE IN MILES
1972
LEGEND
INTERSTATE MARKINGS
U.S. MARKINGS
STATE MARKINGS
STATE PARKS
COUNTY SEATS
INTERVIEW STATIONS
CODE STATIONS
DISCUSSED IN REPORT
ANALYZED BUT NOT IN REPORT
AS OF JANUARY 1, 1972

APPENDIX I

Town	Year	Station No.	Location	Total Trips
	1961	7014	U.S. 169	1533
	1972			1692

ZONING



COMPARATIVE ANALYSIS OF ORIGIN & DESTINATION DATA COLLECTED DURING 2 DIFFERENT TIME PERIODS USING CHI-SQUARE (X^2) TEST

Appendix 2-A

STATEWIDE O&D CHI^2 COMPARISON

TOWN ______________ STATION LOCATION U.S. 169

YEARS OF O&D 1961 1972 STATION NUMBER 7014

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	x_1^2	x_2^2
1	Refer to Map 2A	9	5	.83	.75
2		5	11	.89	.81
3		30	35	.03	.02
4		936	1020	.04	.04
5		209	290	3.35	3.04
6		5	7	.09	.08
7		7	3	1.06	.96
8		8	3	1.47	1.33
9		5	6	.01	.01
10		33	22	1.80	1.63
11		20	26	.16	.14
12		27	30	.00	.00
13		9	9	.02	.02
14		11	14	.07	.06
15		12	25	1.78	1.61
16		8	18	1.54	1.39
17		9	7	.26	.23
18		3	9	1.28	1.16
19		6	5	.11	.10
20		62	52	1.13	1.02
21		7	5	.29	.27
22		11	8	.43	.39
23		7	12	.46	.41
24		9	4	1.29	1.17
25		13	11	.22	.20
26		6	5	.11	.10
27		4	7	.41	.37
28		8	2		
29		37	30	.83	.75
30		10	4	1.68	1.52
31		7	7	.02	.02
32					
33					
34					
Total		1533	1692	21.64	19.61

DEGREES OF FREEDOM : 29

1. X^2 TOTAL 41.25

2. X^2 STATISTIC FROM BELOW 42.6

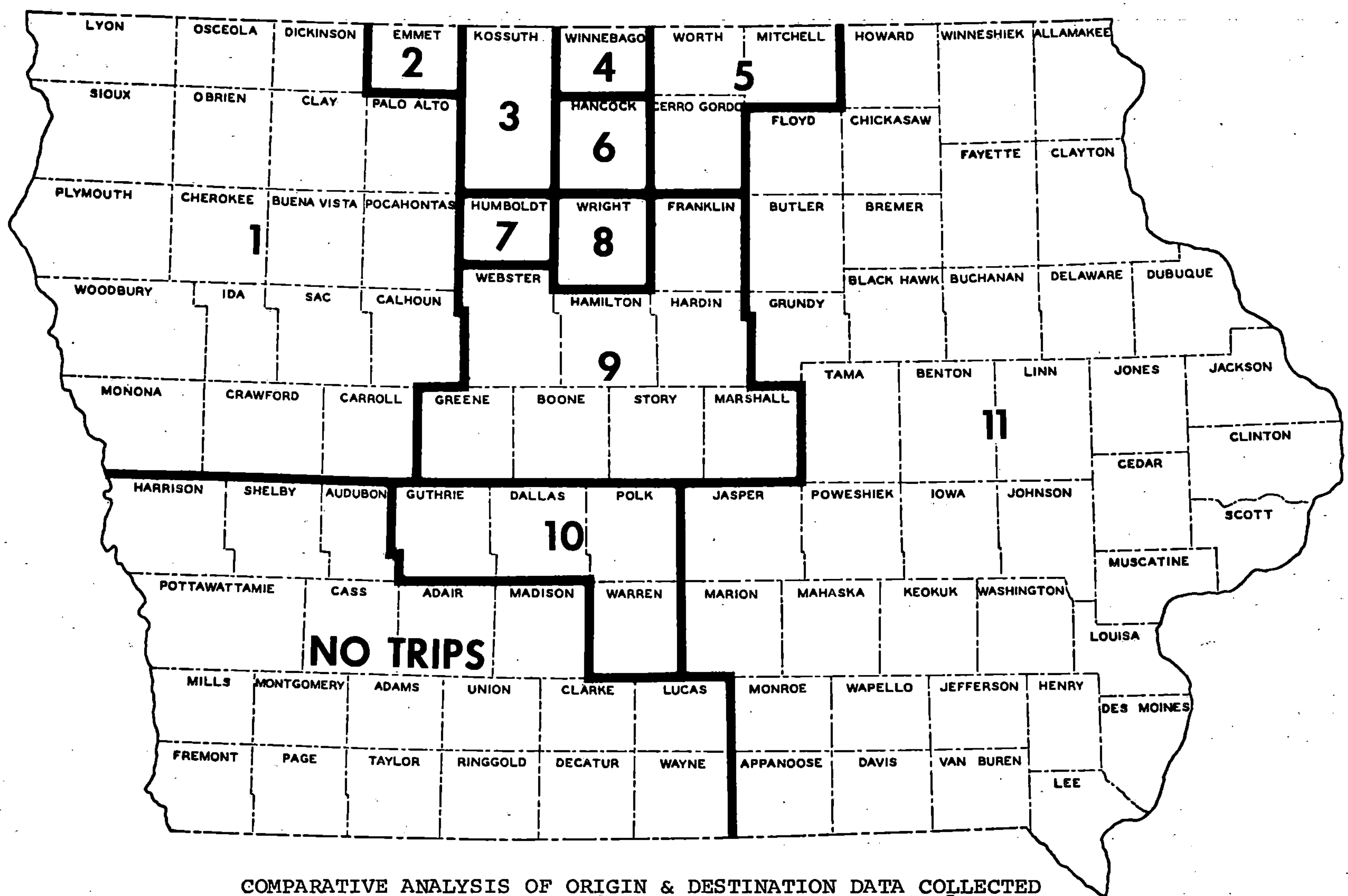
2. - 1 = +
 -

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Town	Year	Station No.	Location	Total Trips
	1961	7015		342
	1972			434

ZONING



COMPARATIVE ANALYSIS OF ORIGIN & DESTINATION DATA COLLECTED DURING 2 DIFFERENT TIME PERIODS USING CHI-SQUARE (X^2) TEST

Appendix 2-B

STATEWIDE O&D CHI^2 COMPARISON

TOWN ____________ STATION LOCATION ____________

YEARS OF O&D 1961 1972 STATION NUMBER 7015

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Refer to Map 2B	7	4	.96	.75
2		2	8	1.31	1.04
3		23	27	.04	.03
4		284	334	.50	.39
5		5	6	.00	.00
6		4	17	2.98	2.35
7		2	8	1.31	1.04
8		5	5	.08	.06
9		5	7	.02	.01
10		3	9	.99	.78
11		2	9	1.67	1.32
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		342	434	9.87	7.78

DEGREES OF FREEDOM 10

1. X^2 TOTAL 17.65

2. X^2 STATISTIC FROM BELOW 18.3

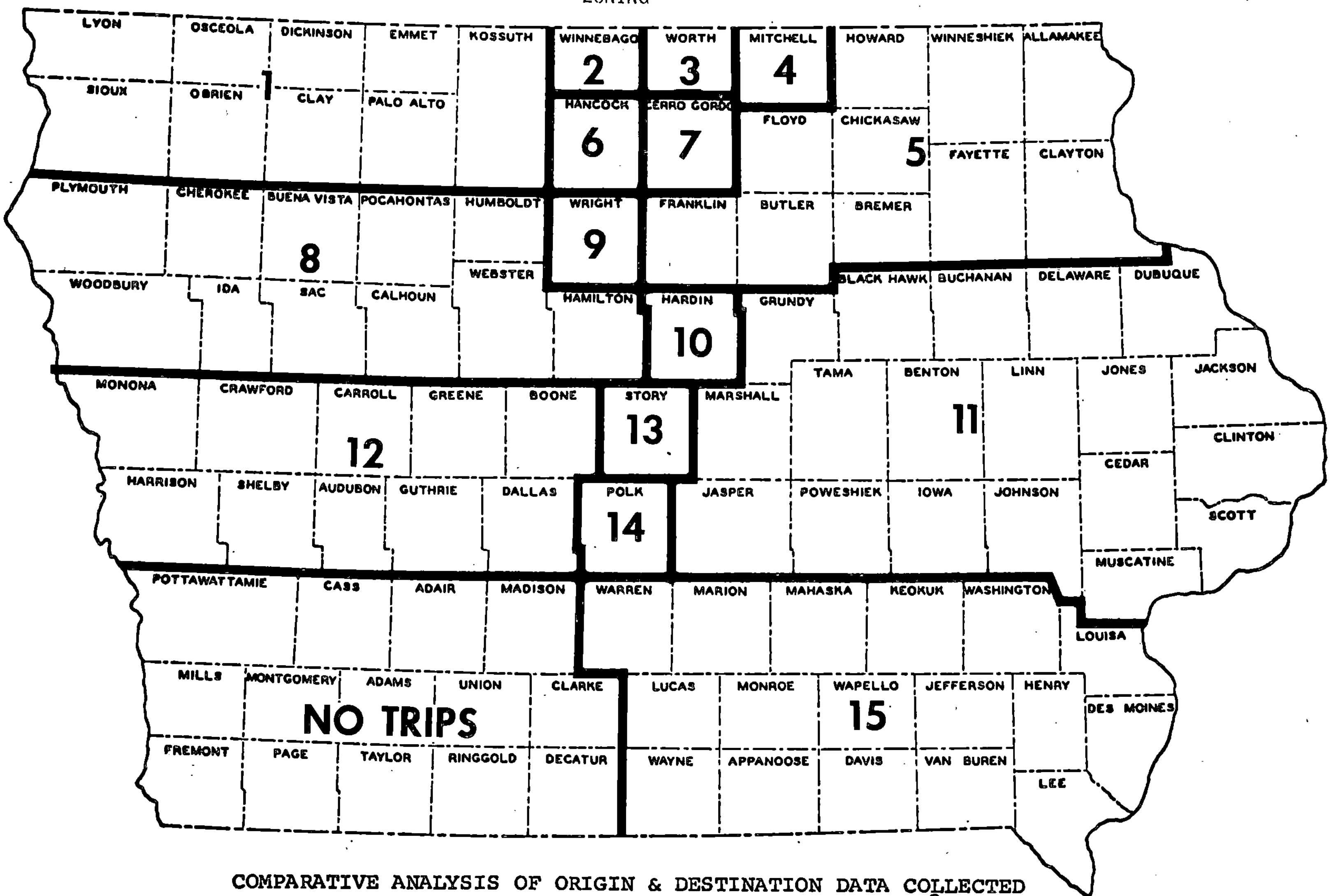
2. - 1 = +

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Town	Year	Station No.	Location	Total Trips
	1961	7016	Co. Road	314
	1972			545

ZONING



COMPARATIVE ANALYSIS OF ORIGIN & DESTINATION DATA COLLECTED DURING 2 DIFFERENT TIME PERIODS USING CHI-SQUARE (X^2) TEST

Appendix 2-C

STATEWIDE O&D CHI^2 COMPARISON

TOWN ______________ STATION LOCATION Co. Rd.

YEARS OF O&D 1961 1972 STATION NUMBER 7016

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Refer to Map 2C	2	10	1.30	.75
2		220	382	.00	.00
3		7	14	.06	.03
4		32*	1*	--	--
5		7	8	.42	.24
6		7	12	.00	.00
7		19	34	.01	.00
8		3	8	.26	.15
9		3	9	.44	.25
10		4	6	.03	.02
11		8	9	.51	.30
12		5	6	.24	.14
13		6	9	.05	.03
14		17	29	.00	.00
15		6	9	.05	.03
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		314	545	3.37	1.94

DEGREES OF FREEDOM 13

1. X^2 TOTAL 5.31

2. X^2 STATISTIC FROM BELOW 22.4

2. - 1 = +

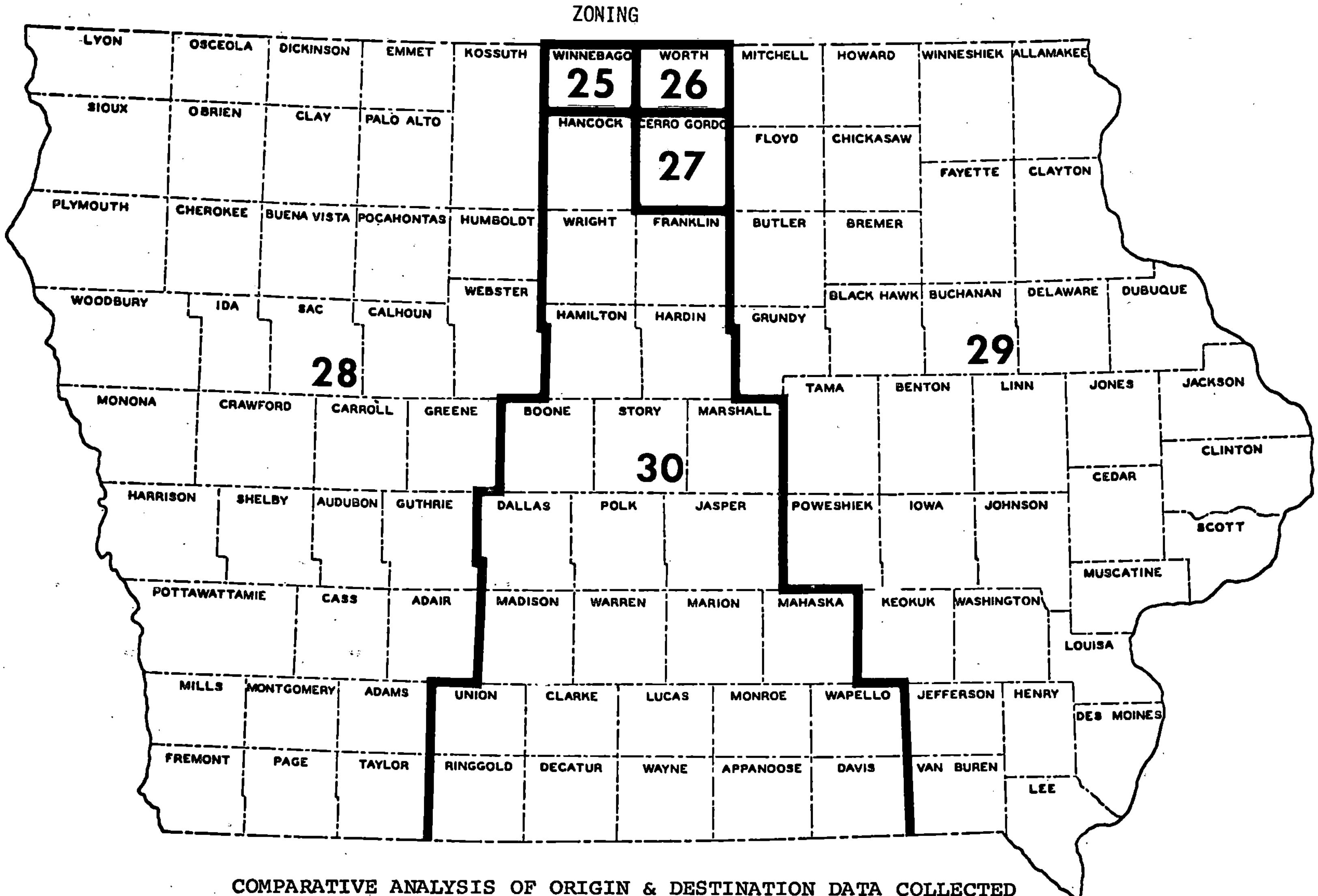
IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

* Excluded from Final Study

Appendix 2-D

Town	Year	Station No.	Location	Total Trips
	1961	7018	Worth Co.	303
	1972			247



COMPARATIVE ANALYSIS OF ORIGIN & DESTINATION DATA COLLECTED DURING 2 DIFFERENT TIME PERIODS USING CHI-SQUARE (X^2) TEST

STATEWIDE O&D CHI^2 COMPARISON

TOWN ______ STATION LOCATION Worth Co.

YEARS OF O&D ______ STATION NUMBER 7018

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25		42	22	1.29	1.58
26		227	177	.09	.11
27		20	28	1.57	1.93
28		3	4	.19	.23
29		3	2	.02	.03
30		8	14	1.40	1.72
31					
32					
33					
34					
Total		303	247	4.56	5.59

DEGREES OF FREEDOM 5

1. X^2 TOTAL 10.15

2. X^2 STATISTIC FROM BELOW 11.1

2. - 1 = +

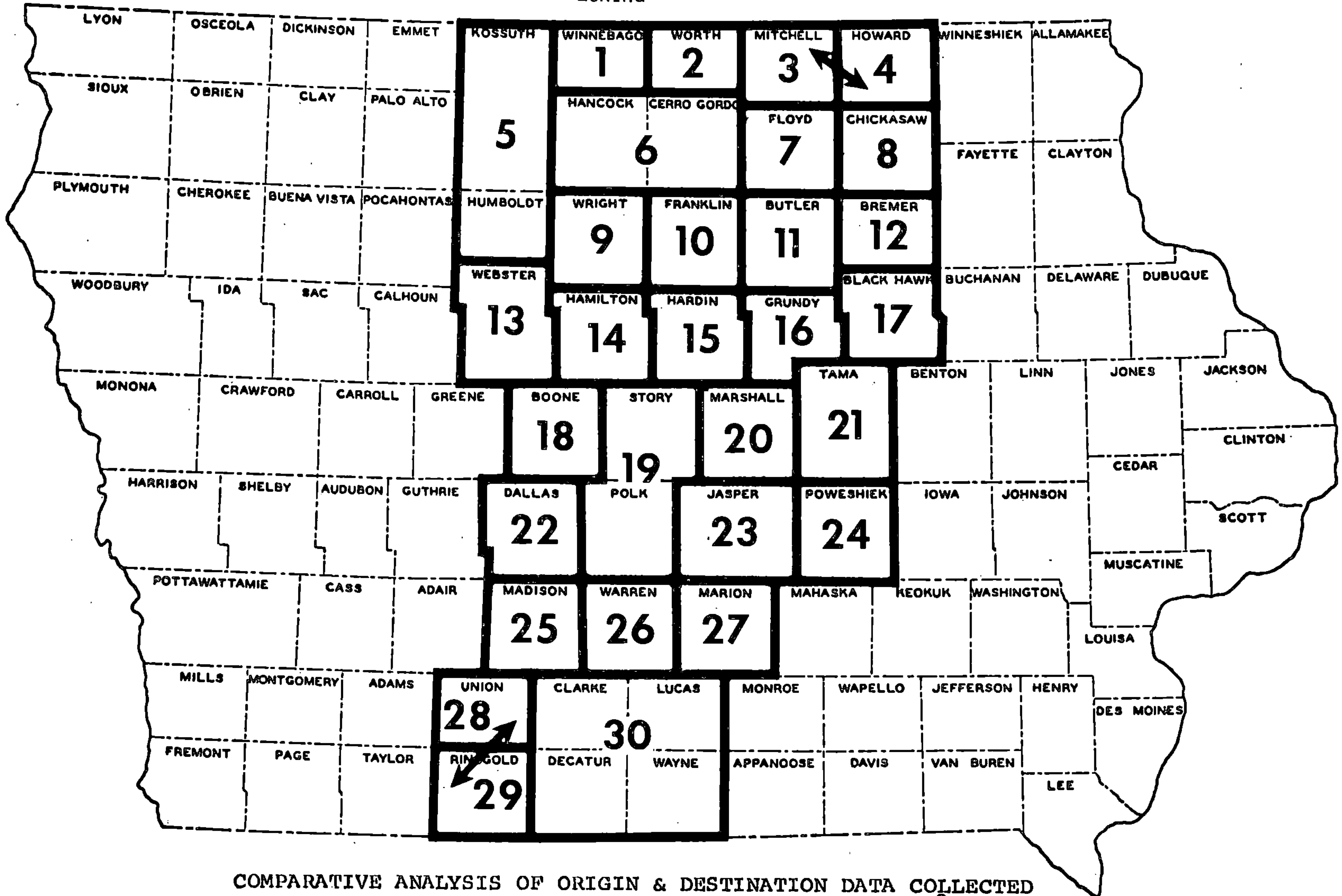
IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Co. Rd. I-35 Corridor

Town	Year	Station No.	Location	Total Trips
	1961	7017	U.S. 69 & U.S. 65	2944
	1972	7019		5324

ZONING



COMPARATIVE ANALYSIS OF ORIGIN & DESTINATION DATA COLLECTED DURING 2 DIFFERENT TIME PERIODS USING CHI-SQUARE (X^2) TEST

Appendix 2-E

STATEWIDE O&D CHI^2 COMPARISON

TOWN ________ STATION LOCATION ________

YEARS OF O&D 1961 1972 STATION NUMBER 7017 7019

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	x_1^2	x_2^2
1	Refer to Map 2E	712	1219	.87	.48
2		683	1271	.23	.13
3		32	72	.68	.38
4		1	2	--	--
5		43	79	.00	.00
6		616	1184	.97	.54
7		30	63	.29	.16
8		5	6	.30	.17
9		80	120	1.08	.60
10		31	64	.24	.13
11		11	32	1.21	.67
12		7	21	.88	.49
13		51	99	.11	.06
14		30	38	1.38	.76
15		31	63	.18	.10
16		11	12	.96	.53
17		43	95	.77	.42
18		15	41	1.22	.68
19		373	645	.31	.17
20		49	61	2.47	1.36
21		2	13	2.09	1.16
22		9	11	.50	.27
23		35	35	4.07	2.25
24		10	18	.00	.00
25		2	7	.45	.25
26		6	11	.00	.00
27		10	21	.10	.05
28		4	8	.08	.04
29		2	1	--	--
30		10	12	.60	.33
31					
32					
33					
34					
Total		2944	5324	22.06	12.20

DEGREES OF FREEDOM 28

1. X^2 TOTAL 34.26

2. X^2 STATISTIC FROM BELOW 41.3

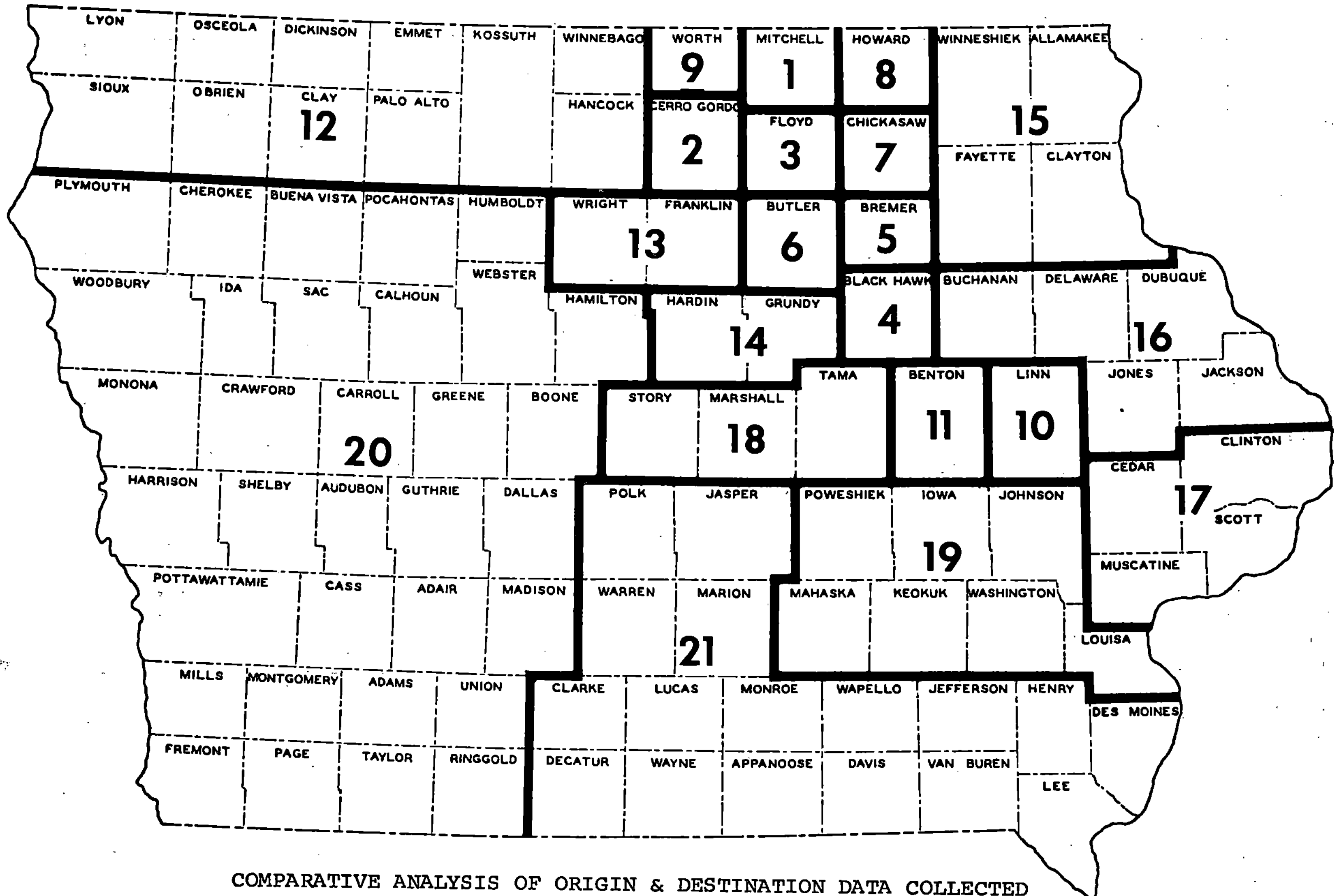
2. - 1 = + −

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Town	Year	Station No.	Location	Total Trips
	1961	7020	U.S. 218	1392
	1972			1633

ZONING



COMPARATIVE ANALYSIS OF ORIGIN & DESTINATION DATA COLLECTED
DURING 2 DIFFERENT TIME PERIODS USING CHI-SQUARE (X^2) TEST

Appendix 2-F

STATEWIDE O&D CHI^2 COMPARISON

TOWN ______ STATION LOCATION ______

YEARS OF O&D 1961 1972 STATION NUMBER 7020

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1		762	848	.60	.51
2		206*	122*	--	--
3		80	115	1.06	.90
4		100	150	1.97	1.68
5		24	37	.59	.50
6		18	20	.02	.01
7		16	15	.21	.18
8		1*	18*	--	--
9		10	10	.07	.06
10		31	48	.79	.67
11		7	10	.09	.07
12		9	15	.38	.32
13		9	11	.00	.00
14		13	17	.05	.04
15		16	17	.04	.04
16		12	22	.85	.72
17		137	113	.43	.36
18		23	32	.21	.18
19		32	26	1.06	.90
20		28	41	.44	.38
21		154	101	1.40	1.19
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		1392	1633	10.24	8.73

DEGREES OF FREEDOM 18

1. X^2 TOTAL 18.97

2. X^2 STATISTIC FROM BELOW 28.9

2. - 1 = + -

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

* Excluded from final study - see documentation

STATEWIDE O&D CHI^2 COMPARISON

TOWN Elkader STATION LOCATION Iowa 56 W

YEARS OF O&D 1961 1971 STATION NUMBER

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Elgin	46	61	.15	.11
2	Fayette	10	14	.01	--
3	W. Union	35	46	.14	.09
4	Wadena	18	23	.11	.08
5	Volga	99	165	.61	.42
6	Arlington	3	8	.48	.33
7	Decorah - Calmar	5	10	.19	.13
8	Clermont	4	6	--	--
9	Waucoma	4	5	.03	.02
10	Fayette Co.	4	13	1.22	.83
11	Lamont	4	2	1.01	.69
12	Strawberry Point	3	2	.47	.32
13	Rural	-	-	--	--
14	Other	7	4	1.44	.98
15	Ia.	9	10	.22	.15
16	Counties	2	4	.08	.05
17	External	3	2	.47	.32
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		256	375	6.62	4.52

DEGREES OF FREEDOM 15

1. X^2 TOTAL 11.14

2. X^2 STATISTIC FROM BELOW 25.0

2. - 1 = +

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Cars Only - No Rural Trips

STATEWIDE O&D CHI^2 COMPARISON

TOWN Elkader STATION LOCATION Iowa 135

YEARS OF O&D 1961 1971 STATION NUMBER ______ ______

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Bremer - Black Hawk	9	12	.02	.02
2	Polk - Story	10	13	.04	.03
3	Linn, Jones, Johnson, Scott	30	34	.59	.41
4	Edgewood	11	16	--	--
5	Mederville	30	29	1.48	1.02
6	Strawberry Point	96	171	1.50	1.03
7	Osborne	14	17	.15	.10
8	Volga	53	80	.03	.02
9	Manchester	20	28	.01	.01
10	Dubuque	2	5	.25	.17
11	Oelwein	3	14	2.22	1.53
12		2	5	.25	.17
13		2	4	.08	.06
14	Externals	2	3	--	--
15	Towns South	26	20	2.81	1.93
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		310	451	9.45	6.50

DEGREES OF FREEDOM 14

1. X^2 TOTAL 15.95

2. X^2 STATISTIC FROM BELOW 23.7

2. - 1 = + / -

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Cars Only - Rural Trips Deleted, Adjustments for Sta. Location

STATEWIDE O&D CHI^2 COMPARISON

TOWN Elkader STATION LOCATION Ia. 13 N

YEARS OF O&D 1961 1971 STATION NUMBER

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1		6	5	.27	.21
2	Waukon	6	4	.57	.45
3	Postville *	15	1	8.91	7.05
4	Clayton	16	29	.76	.60
5	Farmersburg *	75	65	2.81	2.22
6	Froelich	6	4	.57	.45
7	Garnavillo	128	252	9.45	7.47
8	Guttenburg	104	111	.86	.68
9	Luana	4	8	.32	.25
10	St. Olaf *	139	120	5.30	4.19
11	Marquette	8	1	4.08	3.22
12	McGregor	58	99	1.85	1.47
13	Monona	64	89	.19	.15
14	Dubuque	23	13	3.17	2.51
15	Rural			--	--
16	Garber, Luxemburg, Dyersville	9	6	.85	.67
17	Elgin, Calmar	5	4	.26	.21
18	Wisc. & Ill.	31	50	.64	.50
19	Minn.	1	10	3.06	2.42
20	Lansing	2	14	3.63	2.87
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		700	885	47.54	37.60

DEGREES OF FREEDOM 18

1. X^2 TOTAL 85.14

2. X^2 STATISTIC FROM BELOW 28.9

2. - 1 = + −

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Cars Only - Rural Trips Dropped

* This presentation does not reflect adjustments made to data because of County Road improvement - Towns or Areas affected are marked by *.

STATEWIDE O&D CHI^2 COMPARISON

TOWN Hampton STATION LOCATION Iowa 3 East

YEARS OF O&D 1958 1968 STATION NUMBER

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Howard - Chickasaw	2	10	2.26	1.94
2	Bremer	32	33	.13	.11
3	Fayette - Clayton	12	12	.08	.07
4	Black Hawk	38	66	2.09	1.80
5	Southeast Co.	9	16	.56	.48
6	Out of State	4	7	.23	.20
7	Out of State	4	7	.23	.20
8	Allison	33	45	.25	.22
9	Aplington	1	11	3.72	3.19
10	Aredale	44	47	.09	.08
11	Bristow	41	57	.40	.34
12	Dumont	285	300	.86	.70
13	Kesley	9	19	1.19	1.03
14	Clarksville	15	18	--	--
15	Greene	10	23	1.80	1.55
16	Parkersburg	5	9	.33	.29
17	Shell Rock	10	12	--	--
18	Dougherty	4	3	.18	.16
19	Charles City	15	13	.33	.28
20	Grundy Co.	4	4	.03	.02
21	Hardin Co.	6	4	.41	.35
22	Hansell	264	285	.43	.37
23	Geneva	36	28	1.40	1.21
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		883	1029	16.99	14.58

DEGREES OF FREEDOM 22

1. X^2 TOTAL 31.57

2. X^2 STATISTIC FROM BELOW 33.90

2. - 1 = + −

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Rural Trips Deleted - Class II & III

Appendix IV-A

STATEWIDE O&D CHI² COMPARISON

TOWN Hampton STATION LOCATION U.S. 65 South

YEARS OF O&D 1958 1968 STATION NUMBER

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Co's North	13	13	.01	.01
2	Co's West	7	8	.02	.02
3	Boone Co.	8	6	.19	.18
4	Story Co.	11	20	1.15	1.10
5	Marshall & Jasper	22	26	.09	.09
6	Polk Co.	46	60	.66	.64
7	Black Hawk	10	24	2.65	2.54
8	Co's South	8	12	.33	.31
9	Co's South	5	8	.29	.28
10	Butler Co.	5	7	.13	.12
11	Grundy Co.	7	12	.57	.54
12	Hamilton Co.	15	7	1.67	1.60
13	Alden	9	14	.45	.43
14	Eldora	17	26	.78	.74
15	Ia. Falls	249	245	.22	.21
16	Ackley	78	90	.21	.21
17	Bradford	65	59	.31	.30
18	Geneva	203	175	1.76	1.69
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		778	812	11.48	11.00

Less Rural Trips

DEGREES OF FREEDOM 17

1. X^2 TOTAL 22.48

2. X^2 STATISTIC FROM BELOW 27.60

2. - 1 = + / -

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

STATEWIDE O&D CHI^2 COMPARISON

TOWN Hampton STATION LOCATION U.S. 65 North

YEARS OF O&D 1958 1968 STATION NUMBER

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Out of State	31	30	2.07	1.34
2	Other Counties	6	5	.65	.42
3	Other Counties	15	17	.47	.30
4	Butler Co.	17	9	4.51	2.92
5	Clear Lake	28	24	2.81	1.82
6	Mason City	255	458	2.24	1.45
7	Dougherty	15	18	.32	.21
8	Rockwell	34	44	.37	.24
9	Swaledale	5	7	.02	.01
10	Thornton	9	6	1.64	1.06
11	Floyd Co.	9	17	.14	.09
12	Hancock Co.	2	8	.95	.61
13	Chapin	146	108	21.44	13.86
14	Sheffield	185	429	13.07	8.46
15	Hansell	7	1	4.74	3.06
16	Latimer	5	8	--	--
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
Total		769	1189	55.44	35.86

DEGREES OF FREEDOM 15

1. X^2 TOTAL 91.30

2. X^2 STATISTIC FROM BELOW 25.00

2. - 1 = + −

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

Rural Deleted - Class II & III

STATEWIDE O&D CHI^2 COMPARISON

TOWN Hampton   STATION LOCATION Iowa 3 W

YEARS OF O&D 1958   1968   STATION NUMBER

ZONE	CITY OR COUNTY	OLD TRIP DISTR.	NEW TRIP DISTR.	X_1^2	X_2^2
1	Out of State	10	12	.14	.09
2	Northwest	3	7	.27	.18
3	Kossuth	15	5	5.92	4.02
4	Winnebago Co.	14	0	12.31	8.34
5	Woodbury - Ida	4	11	.70	.48
6	Buena Vista - Sac	5	7	--	--
7	Pocahontas Co.	3	9	.70	.48
8	Humboldt Co.	18	11	3.37	2.28
9	Webster Co.	8	22	1.40	.95
10	Southwest Co.	9	8	.66	.45
11	Story Co.	6	7	.11	.07
12	Polk Co.	5	16	1.43	.97
13	Clear Lake	4	21	3.69	2.50
14	Meservey	9	16	.12	.08
15	Webster City	10	17	.08	.05
16	Williams	4	5	.04	.02
17	Kanawha	4	11	.70	.48
18	Klemme	7	7	.32	.22
19	Garner	14	4	6.22	4.22
20	Alden	2	17	4.20	2.85
21	Iowa Falls	9*	112*	32.55	22.07
22	Clarion	41	83	1.65	1.12
23	Eagle Grove	11	14	.08	.05
24	Dows	85	105	.88	.60
25	Goldfield	5	8	.01	.01
26	Rowan	22	32	--	--
27	Belmond	35	35	1.59	1.08
28	Alexander	54	47	4.26	2.89
29	Bradford	6	22	2.50	1.69
30	Coulter	172	209	2.12	1.44
31	Latimer	234	341	.01	.01
32	Popejoy	10	15	--	--
33					
34					
Total		838	1236	88.03	59.69

DEGREES OF FREEDOM 31

1. X^2 TOTAL 147.72

2. X^2 STATISTIC FROM BELOW 45.0

2. - 1 = $\overset{+}{-}$

IF 2 - is + THEN THE DIFFERENCE IN THE DATA IS WITHIN ACCEPTABLE LIMITS

5.	11.1
6.	12.6
7.	14.1
8.	15.5
9.	16.9
10.	18.3
11.	19.7
12.	21.0
13.	22.4
14.	23.7
15.	25.0
16.	26.3
17.	27.6
18.	28.9
19.	30.1
20.	31.4
21.	32.7
22.	33.9
23.	35.2
24.	36.4
25.	37.7
26.	38.9
27.	40.1
28.	41.3
29.	42.6
30.	43.8
31.	45.0
32.	46.2
33.	47.4
34.	48.6
35.	49.8
36.	51.0
37.	52.2
38.	53.4
39.	54.6
40.	55.8
41.	57.0
42.	58.1
43.	58.1
44.	60.5
45.	61.7
46.	62.8
47.	64.0
48.	65.2
49.	66.3
50.	67.5
51.	68.7
52.	69.8
53.	71.0
54.	72.1
55.	73.3

* Affected by improvement of North-South County Road
Rural Trips Deleted - Class II & III

Appendix IV-D

PREDICTABILITY %

The definition of "Predictability %" is: The sum of the old trip data by cell that describes the cell frequency of the new trip data. The computation of the individual measures by percent is as follows:

1. Predictability % Old Data: The absolute value of the difference between the old cell frequency and the new cell frequency are summed. The sum of these differences is divided by the "new" internal-external and external-internal trip total. The quotient is the percentage <u>not</u> explained by the old data distribution.
2. Predictability % Adjusted Data: The cell frequencies of the old data are expanded by the factor developed from the comparison of the old and new internal-external and external-internal totals. The absolute value of the difference between the <u>adjusted</u> old data and the new data is then summed. The procedure for obtaining the "Predictability %" is obtained in the same procedure as enumerated above.
3. The change, (Δ), or improvement to one's data by factoring is also indicated in the table.

Example: Station 7018 - County Road

Zone	Old Trip Distribution	New Trip Distribution	Factor	Old Trips Adjusted	Absolute Value Old	Absolute Value Adjusted
1	42	22	.815	34	20	12
2	227	177	.815	185	50	8
3	20	28	.815	16	8	12
4	3	4	.815	3	1	1
5	3	2	.815	2	1	0
6	8	14	.815	7	6	7
Total	303	247		247	86	40

I. Predictability % Old: 247-86/247 = 65.19%

II. Predictability % Adjusted: 247-40/247 = 83.81%

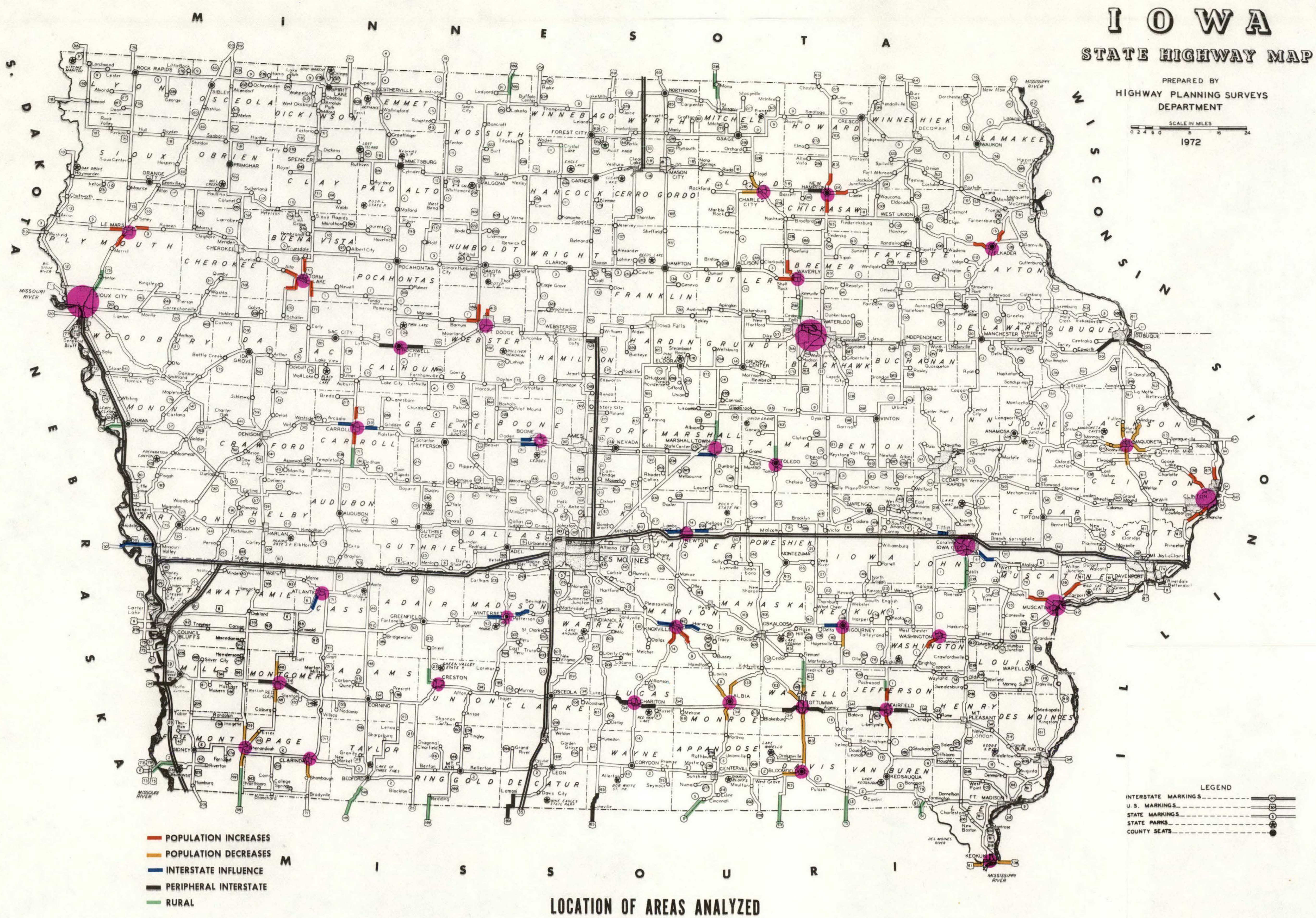
III. The difference, or improvement to the data by factoring is: 83.81% - 65.19% = 18.62%

The following table describes the "Predictability %" of the old and adjusted data for the reports analyzed:

Predictability %

(Table 1)

Location	Route	Int.-Ext. & Ext.-Int. Total Old	Int.-Ext. & Ext.-Int. Total New	Predictability % Old	Predictability % Adjusted	%
Elkader	Ia 13 S	320	452	47.20%	68.71%	22%
Elkader	Ia 13 N	700	885	63.36%	63.39%	1%
Elkader	Ia 56 W	256	375	64.54%	82.14%	18%
Station 7016	Co. Road	314	545	46.71%	94.14%	47%
Station 7018	Co. Road	303	247	65.19%	83.81%	19%
Station 7053	US 69 S	469	625	58.40%	70.44%	12%
Station 7048	US 63 S	853	1712	48.31%	84.00%	36%
Station 7057	US 59 S	820	1214	65.99%	89.37%	23%
Hampton	US 65 S	1047	1069	84.47%	85.97%	2%
Hampton	Ia 3 E	883	1029	83.29%	83.29%	-
Hampton	Ia 3 W	838	1236	59.87%	82.06%	22%
Hampton	US 65 N	1173	1944	54.07%	74.85%	21%
Station 7017 &	7019	2917	5273	55.38%	91.59%	36%
Station 7014	US 169	1533	1692	81.45%	88.13%	7%
Station 7020	US 218	1688	1789	83.40%	87.27%	4%
Station 7015	Ia 254	342	434	77.42%	84.34%	7%
Atlantic	US 6	4134	5445	71.10%	78.24%	7%
Ames	US 30 W	3628	4459	69.55%	79.57%	10%
Keokuk	US 218 NW	3613	4537	70.73%	79.90%	9%
LeMars	US 75 N	2801	3500	72.83%	76.92%	4%
LeMars	Ia 3 W	483	683	63.69%	84.49%	21%
Rockwell City	US 20 E	1556	2365	63.71%	73.70%	10%
Washington	Ia 1 SW	1692	2149	67.47%	76.41%	9%
Washington	Ia 1 & Ia 92E	2429	3570	57.79%	69.78%	12%
Shenandoah	Ia 2 W	1104	1061	66.36%	67.49%	1%
Shenandoah	US 59 N	749	1234	56.81%	73.84%	17%
Ottumwa	US 34	5070	6630	66.30%	86.12%	20%



LOCATION OF AREAS ANALYZED

AS OF JANUARY 1, 1973

Appendix VI-1

TABLE-1

NO APPRECIABLE INTERSTATE INFLUENCE

CITY POPULATION INCREASES

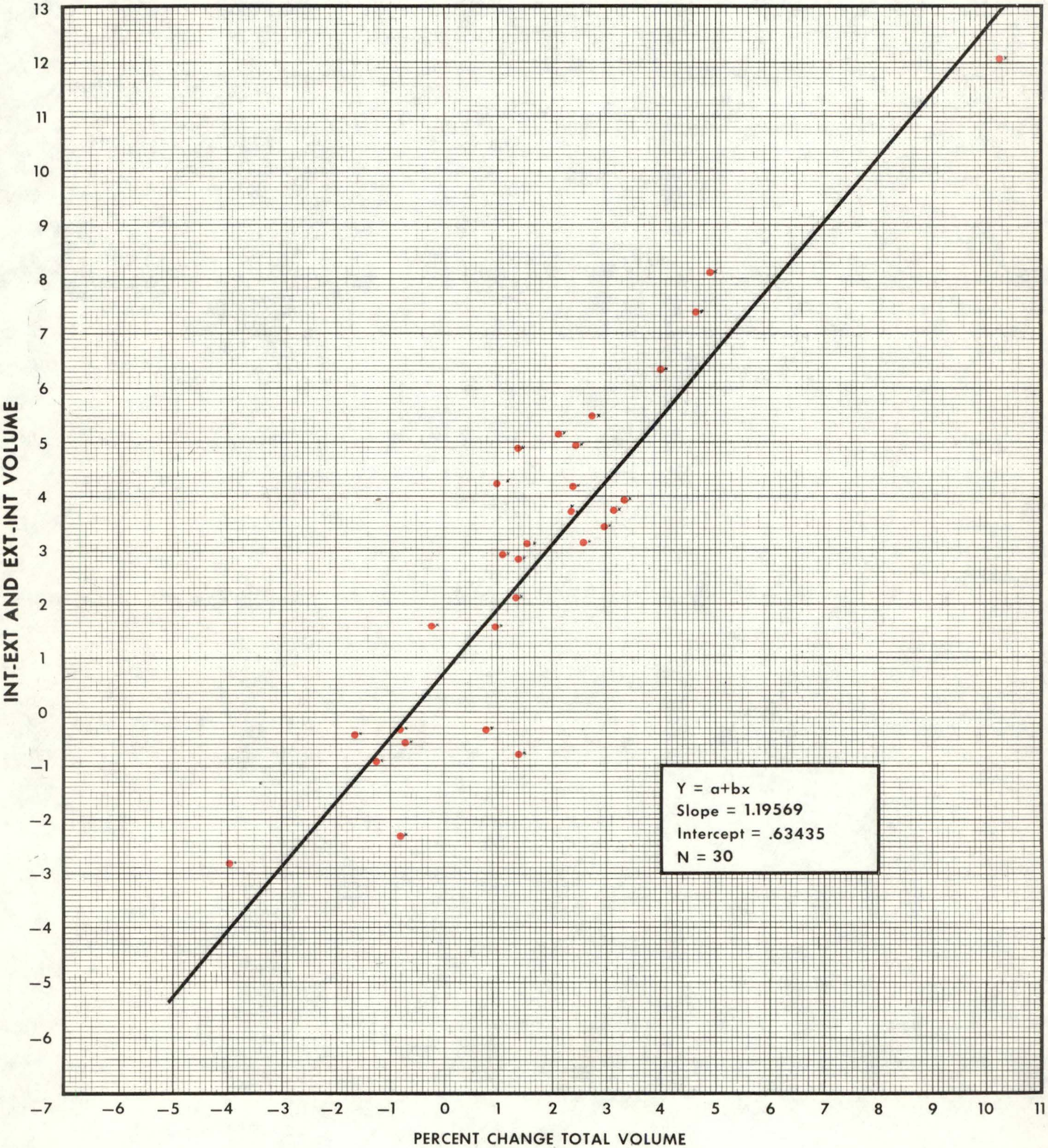


TABLE - 2
NO APPRECIABLE INTERSTATE INFLUENCE
CITY POPULATION DECREASES

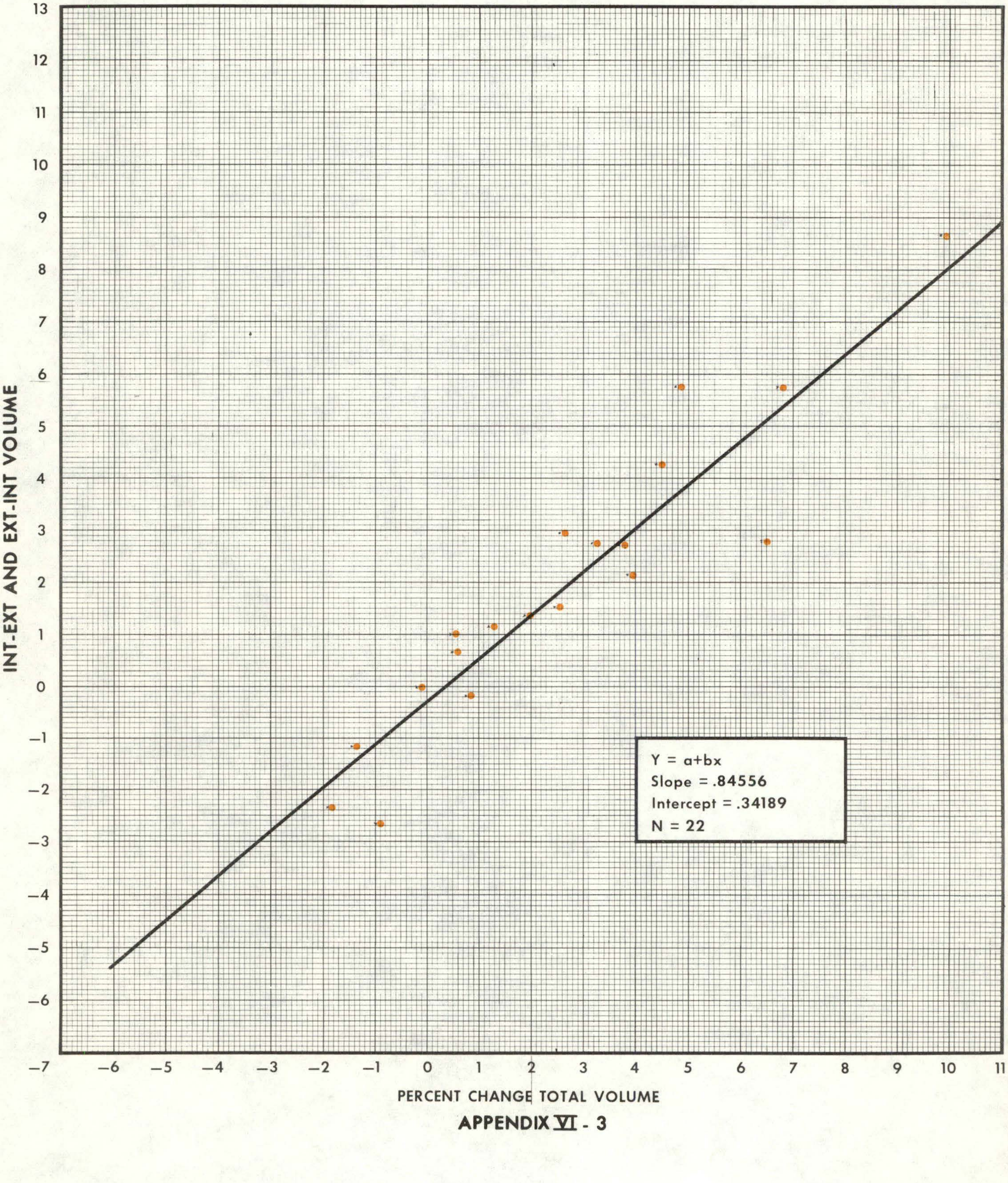


TABLE - 3

MAJOR PRIMARY

IMMEDIATE INTERSTATE CORRIDOR INFLUENCE

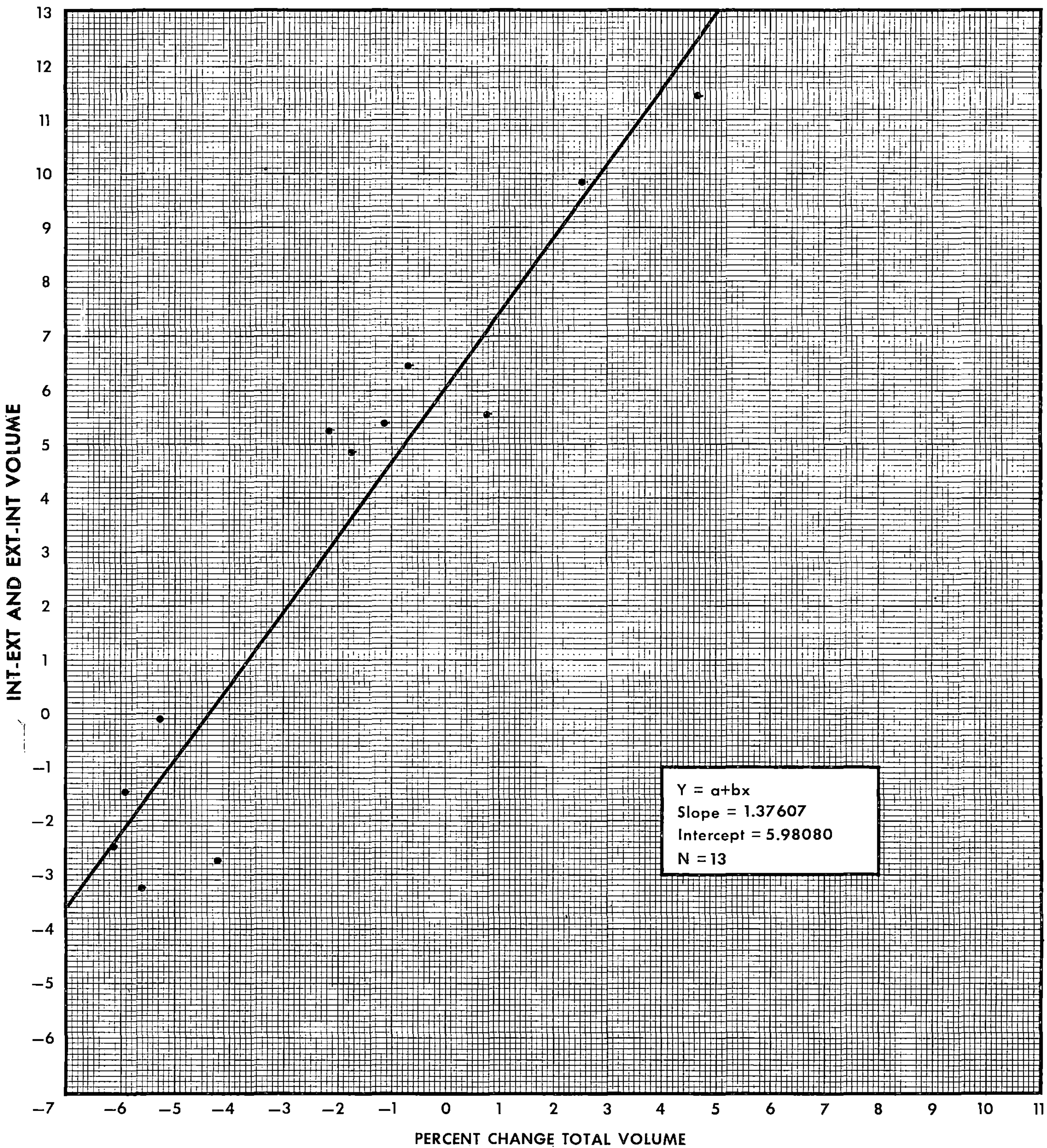


TABLE - 4

PRIMARY

PERIPHERAL INTERSTATE INFLUENCE

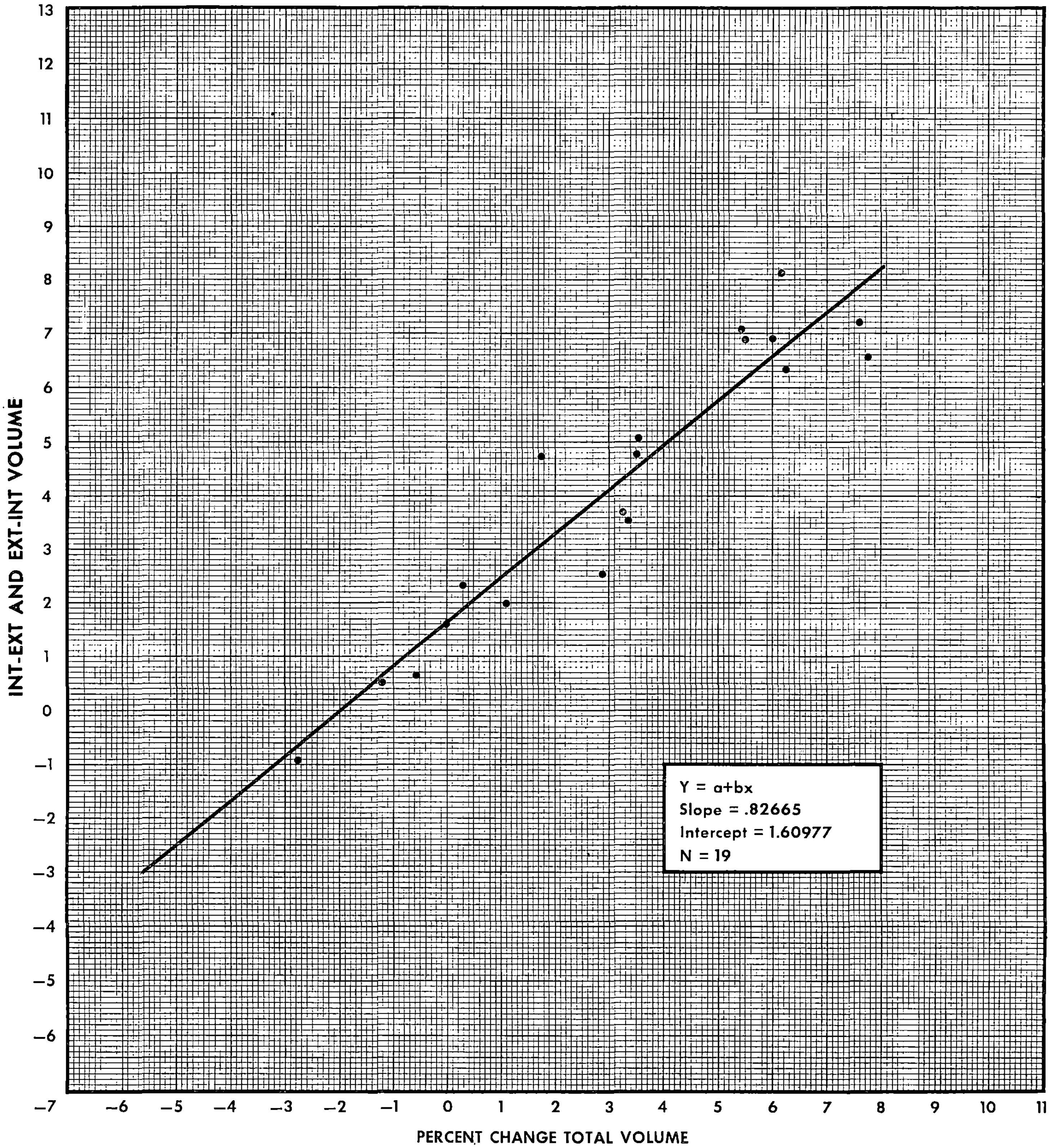
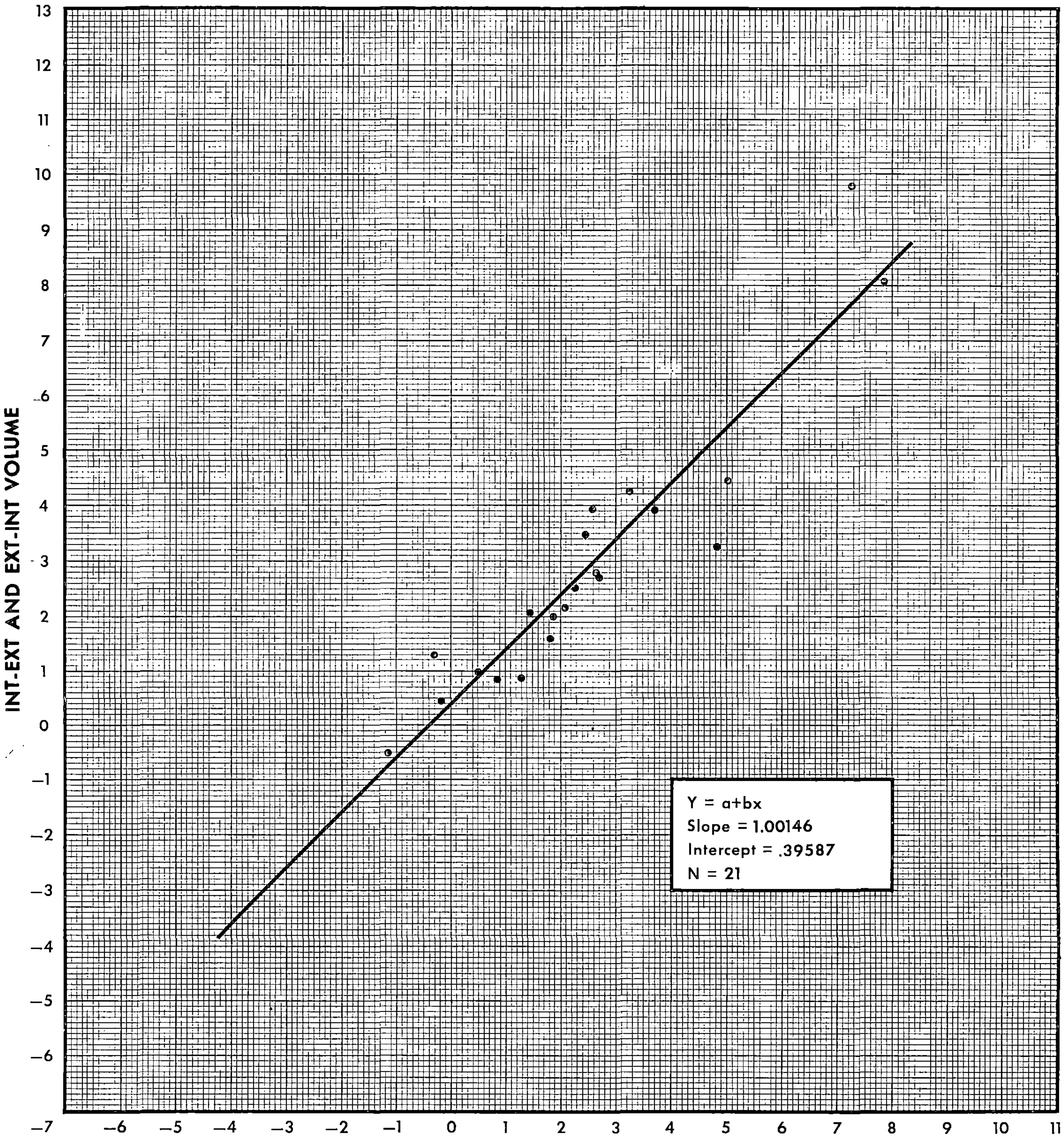
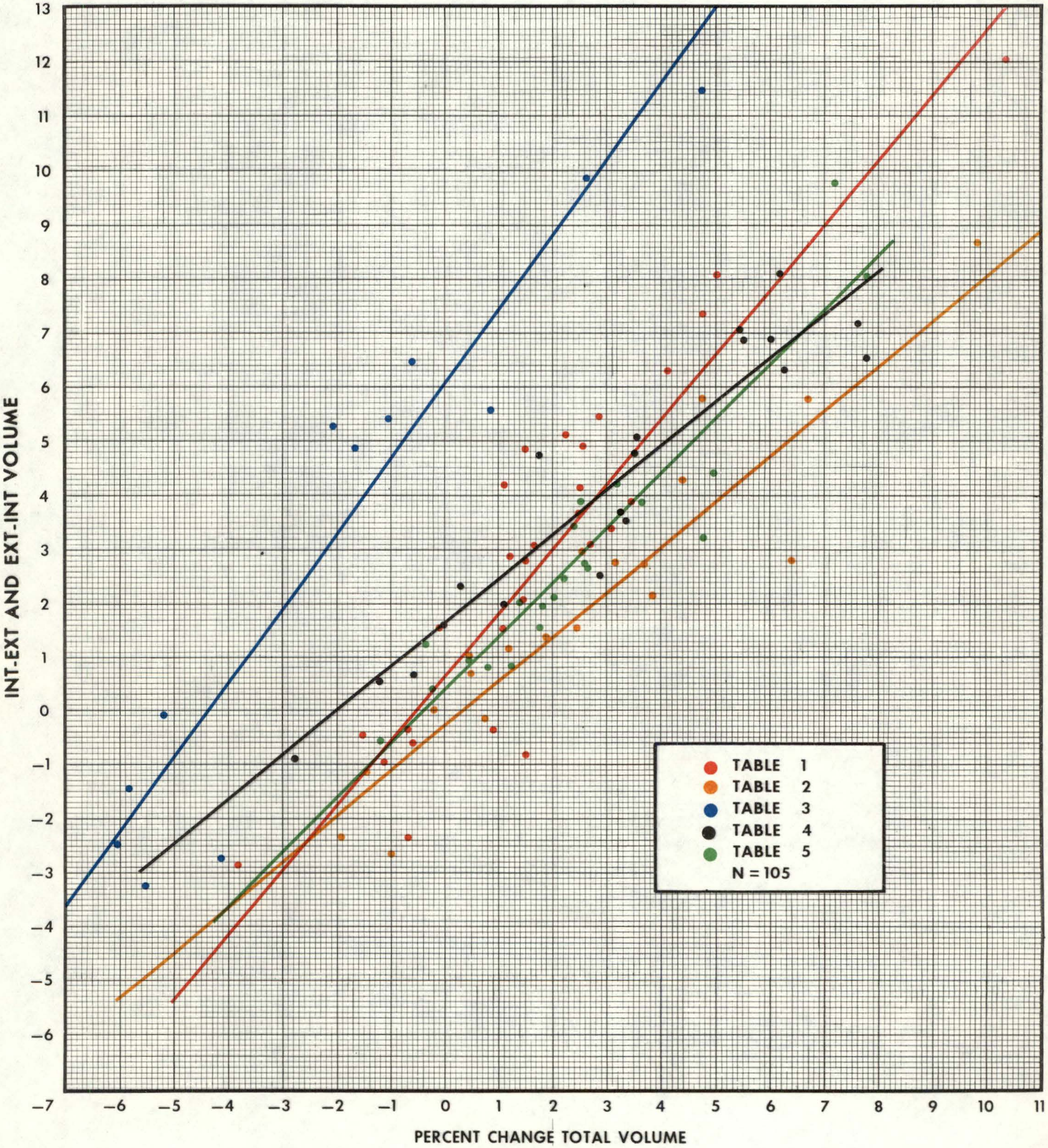


TABLE - 5
RURAL PRIMARY
NO INTERSTATE INFLUENCE



COMPOSITE



APPENDIX VI - 7

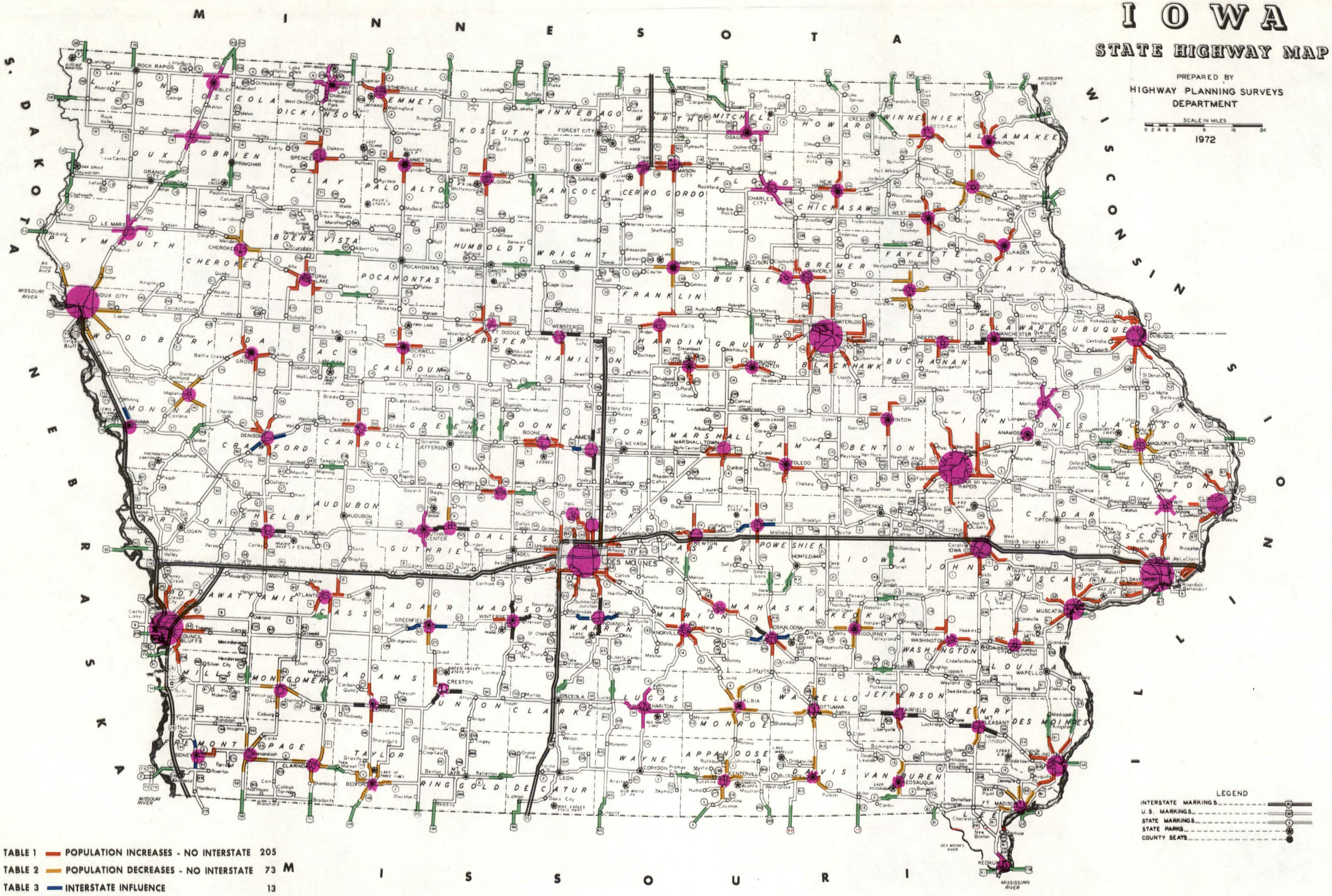


TABLE 1	POPULATION INCREASES - NO INTERSTATE	205
TABLE 2	POPULATION DECREASES - NO INTERSTATE	73
TABLE 3	INTERSTATE INFLUENCE	13
TABLE 4	PERIPHERAL INTERSTATE INFLUENCE	24
TABLE 5	RURAL STATIONS - NO INTERSTATE	82
		397

Appendix VI-8

AS OF JANUARY 1, 1973