ELECTRICAL NETWORK ANALYSIS OF SOCIO-
ECONOMIC SYSTEMS UTILIZING GRAPH THEORY

by

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CHAPTER I

BACKGROUND AND INTRODUCTION

There has not been a great deal of work done in the general area of electrical modeling of socio-economic systems. A good example of what has been done is Koenig's model of a university's flow of finances (10)*.

Koenig's paper demonstrates the application of the methodology of system modeling developed for physical systems in establishing a discrete state model of a nonprofit organization supported by the surrounding community.

One of the larger models which has been done is the outdoor recreational system model of the state of Michigan by Ellis (5). Ellis' problem was very similar to the one which we have chosen to do. He has modeled the outdoor recreational facilities of the state of Michigan utilizing a linear graph method with nodes representing recreational areas and links representing connecting highways. One unique feature of Ellis' system is the fact that he has actually utilized two separate complete models to represent his total model. One model is used to represent the recreational areas themselves while another model is used to represent the localities from which the users of these facilities originate. Dr. Ellis also uses a computer solution for his models which includes the use of computer mapping.

Two examples of work done in the field of transportation utilizing the Integrated Civil Engineering System (ICES) are:

*Refer to bibliography.

a. Traffic Volume Data Analysis (TRAVOL) (9)

ICES TRAVOL is a subsystem for processing, storing, and applying traffic volume data for the purposes of transportation planning and research in an urban, regional, or statewide context.

b. Transportation Network Analysis (TRANSET) (12)

ICES TRANSET I is a processor of transportation network information. It is designed to provide computerized techniques which will aid the engineer in solving transportation engineering problems.

For this research project it is proposed to develop one particular model of the New Hampshire highway system and then to thoroughly investigate this model to determine if it will or will not provide useful information. There are many models which could be proposed and tested and therefore I feel it to be important to concentrate on only one model at a time. By doing this, models may be systematically eliminated until a satisfactory one is found.

The model proposed consists of a graph with nodes representing population centers and links representing connecting highways. This model will represent a D.C. resistive network.

The limitations of the proposed model are as follows:

a. Simplicity. Since there is very little precedent to fall back on, the first model should be as simple as possible.

b. D.C. Resistive Network. This goes along with the simplicity desired (as outlined previously). Later refinements may include the addition of inductance, capacitance, transients, etc.

c. Number of Nodes. The maximum number of nodes allowed in the ECAP computer program (8) is 50. If ECAP is to be used for analysis, as I propose, the number of nodes is then limited to this figure.

Additional links and nodes may be added as necessary to refine the model. This provides a valuable research tool as the model can be changed to simulate such things as the construction of new highways, etc., and then analyzed to determine the effects these would have on the actual highway system.

The type of model proposed lends itself easily to analysis by the IBM ECAP computer program. By using ECAP the model can be accurately and fully investigated with a minimum of time, effort, and money.

CHAPTER II

PRESENTATION OF MODEL AND JUSTIFICATION

The model which was finally evolved for investigation is presented in Appendix I. This final model is the result of many changes and revisions. The complete ECAP program which describes the model is in Appendix II.

When the project was first formulated, there were few preconceived ideas of what social system problem to investigate or how a model for it should be developed. As a starting point a consultation was held with the Resource Development Center at the University of New Hampshire to attempt to find a social systems problem of current investigative interest. After several meetings with Professors Owen Durgin and William Henry at the Resource Development Center, it was decided to attempt to model a major portion of the highway system of the state of New Hampshire.

This model would be used to determine the vehicular traffic flow between communities. The model was then constructed using as a nucleus of nodes a list of communities of interest to the Resource Development Center because of their potential as population growth centers of the state. This list is presented in Appendix III.

Links, representing existing highways and roads, were put in to interconnect the nodes. In addition to the nodes for communities of interest, supernodes were provided for Massachusetts, Maine, Vermont, and Canada. These were to represent major access/egress routes for the state of New Hampshire vehicular traffic.

The initial graph was formed and discussed with the Resource Development Center, resulting in the following changes being made:

a. Consolidation of the following communities into supernodes because of their close physical proximity: (1) Hanover and Lebanon; (2) Jaffrey and Peterborough; (3) Rochester, Somersworth, and Dover.

b. Elimination of the supernode for Canada. The rationale for this is that the bulk of the vehicular traffic flow between New Hampshire and Canada is through Vermont and would be included in the Vermont node.

c. Expansion of the number of Massachusetts nodes from one to three. These three nodes are to represent, approximately, the geographical areas of (1) Boston, (2) Lawrence-Lowell, and (3) Worcester. This more reasonably describes the relationship between Massachusetts and New Hampshire.

d. Expansion of the number of Vermont nodes from one to two, to include the Brattleboro access/egress, in addition to the one at St. Johnsbury.

e. Elimination of overlapping links. Several links were found to overlap without going through a node at the point of intersection. These points were found to actually represent highway intersections which did not occur at a population center. Since this was a physically unrealistic situation, it was easily corrected by the addition of zero-population nodes which actually represented intersections in the model. This also had the incidental effect of changing the graph from non-planar to planar.

These changes resulted in increasing both the number of nodes and the number of branches in the model, but the totals of branches and nodes are still well within ECAP maximum limits.

The next step in development was to determine the parameters of the model and their electrical analogs. From a pragmatic point of view it was necessary to utilize data which was readily available from the Resource Development Center and from the state of New Hampshire. The following data was readily available:

a. population of communities

b. population potential $(\Sigma \frac{P_i P_j}{d_{ij}^2})$

c. vehicular traffic count at specific highway locations throughout the State

d. general road conditions throughout the state

e. distances between communities

f. retail trade information
 (1) number of business establishments
 (2) total yearly sales by busines type
 (3) types of businesses in each community

The problem at this point was to decide which of the above, if any, could be used as parameters to determine vehicular traffic flow.

Before proceeding further I would like to explain a little about the data item called "population potential" in the list above. This quantity is defined as:

$$Q_i = \sum_{j=1}^{n} \frac{P_i P_j}{d_{ij}^2},$$

where:

Q_i = population potential of community i

P_i = population of community i

P_j = population of community j

d_{ij} = airline distance between communities i and j

This summation is taken over <u>every</u> community in the state.

The electrical analog desired is simply that of Ohm's Law (E=IR). Since traffic flow can logically be likened to current flow, it will represent "I" and be the unknown in the equation. This leaves voltage potential (E) and resistance (R) to be defined.

It seemed logical to use either population at a node or population potential (Q_i) at a node to represent voltage potential. It was decided to use the population potential quantity for voltage due primarily to the fact that the Resource Economics Department has found this quantity to be one of the most useful indices in predicting population-related social phenomena (14)*. An appropriate scaling factor was used to make the sources a realistic numerical quantity.

In the preliminary ECAP computer runs these "voltage sources" were inserted in each branch in the following manner: the voltage sources for each pair of nodes associated with a branch were added together to form a total branch voltage source. This

*See Durgin, <u>"New Hampshire Regions,"</u> New Hampshire Division of Resources and Economic Development, pp. 7ff.

was done without regard to polarity which is one reason why the initial computer runs raised enough questions for the model to be considered unsatisfactory.

The method of inserting the voltage sources was then changed so as to accurately tie down the potential at each node to the value of the node's voltage source. The primary advantage of doing this was the complete elimination of any question of polarity. The method used made polarities meaningless so they could then be ignored.

The method of inserting voltage sources consists of adding another branch at each node which contains the voltage source and an insignificantly small resistance (ECAP will not accept a zero resistance in a branch). This branch runs from the node to an artificial ground node and therefore serves to effectively stabilize the node voltage at the voltage level of the source.

Once the problem of sources was resolved, the parameter remaining to be defined was that of resistance. As with other parts of this problem there are many possible options to be considered in determining the resistance parameter.

Basically, resistance is defined as:

$$R = \frac{\rho l}{A}, \quad \text{where}$$

R = resistance

ρ = resistivity

l = length

A = cross-sectional area

Initially I decided to attack the problem as follows:

Let $R = k\ell$, where $k = \frac{\rho}{A}$

Then if k is arbitrarily made unity,

$R = \ell$ = mileage

The next step was to run the program and, using already available data on traffic flow, try to determine "k" in the equation above.

An alternative would be to assign a value for "A" in the resistance equation based on the highway and then try to determine a value for "ρ" based on computer results for current.

A third alternative is to use actual driving time between nodes as resistance. This quantity should include all factors which make up resistance and should be an accurate quantity. This was not done due to non-availability of data.

A fourth alternative is to plug in the actual traffic count figures as currents and use ECAP to solve for the resistance. An attempt could then be made to analyze these resistance values to determine their actual composition. This could not be done due to lack of traffic count figures for many highways.

The results of the analysis of this model are presented in the next chapter.

Parenthetically, it should be noted that, if the correct parameters can be identified, this model can be used to solve problems other than vehicular traffic flow. Examples of possible problems are (1) the flow of commerce and trade between communities and (2) population flow between communities. However, the vehicular traffic flow problem seemed to be a good choice to test the model since actual traffic count figures from the state of New Hampshire are readily available. Comparison of experimental results with actual data is an excellent way to test the validity of the method and the model.

CHAPTER III

RESULTS

The results of the ECAP analysis of the model are presented on the attached sheet in tabular form.

The items presented include the current in selected branches along with the traffic flow vs. current ratio. This data is presented for several conditions of out-of-state node potentials. The results do not vary to any degree no matter what potential at which the out-of-state nodes are set. The low, medium, and high settings for these nodes are arbitrary figures and bracket the full span of quantities used elsewhere in the program. The data items which are labeled with the name of an out-of-state node were obtained by setting all other out-of-state nodes equal to zero and the one mentioned to a nominal value.

The traffic data for 1966 was used because that is one of the years for which population data is available. February is the low traffic month of the year.

This data is analyzed and discussed in Chapter IV.

The complete ECAP program and computer analysis of the model are included in Appendix II.

HIGHWAY & RECORDER LOCATION	I89 Warner	F.E. Everett Tpk. Hooksett	F.E. Everett Tpk. Merrimack	101A Milford	101 Amherst	101 Marlboro	I93 Meredith	I93 Campton	16 Ossippee	3 Northumberland	I95 Toll Booth	I95
Graph Branch No.	B20	B28	B39	B42	B41	B45	B13	B9	B12	B2	B32	B33
Traffic Flow (Adjusted Avg. Day-Feb. '66)	1340	7339	5267	3992	4130	4305	3135	2355	1931	1302	10,432	---
OS=0												
I	.9424	37.02	37.53	15.98	51.38	1.363	.0482	.0356	1.676	.0190	4.527	.0008
TF:I	1422	198.2	140.3	249.8	80.38	3158	65,040	66,150	1152	68,530	2304	---
OS=Low												
I	.9424	37.02	37.53	15.98	51.38	1.363	.0482	.0358	1.676	.0190	4.533	1.665
TF:I	1422	198.2	140.3	249.8	80.38	3158	65,040	65,780	1152	68,170	2301	---
OS=Med												
I	.9420	37.02	37.52	15.99	51.38	1.363	.0482	.0370	1.674	.0200	4.589	16.66
TF:I	1423	198.2	140.4	249.7	80.38	3158	65,040	63,650	1154	65,100	2273	---
OS=High												
I	.9386	37.02	37.50	16.02	51.38	1.370	.0482	.0487	1.656	.0293	5.150	166.6
TF:I	1428	198.2	140.5	249.2	80.38	3142	65,040	48,360	1166	44,440	2026	---
Boston Only												
I	.9424	37.02	37.53	15.98	51.38	1.363	.0482	.0356	1.676	.0190	4.514	16.65
TF:I	1422	198.2	140.3	249.8	80.38	3158	65,040	66,150	1152	68,530	2311	---
Lawrence-Lowell Only												
I	.9424	37.02	37.52	15.99	51.38	1.363	.0482	.0356	1.676	.0190	4.527	.0002
TF:I	1422	198.2	140.4	249.7	80.38	3158	65,040	66,150	1152	68,530	2304	---
Worcester Only												
I	.9424	37.02	37.53	15.98	51.38	1.362	.0482	.0356	1.676	.0190	4.527	.0008
TF:I	1422	198.2	140.3	249.8	80.38	3161	65,040	66,150	1152	68,530	2304	---

CODE: OS=Potential of out-of-state nodes; I=Current; TF= Traffic flow

HIGHWAY & RECORDER LOCATION	I89 Warner	F.E. Everett Tpk. Hooksett	F.E. Everett Tpk. Merrimack	101A Milford	101 Amherst	101 Marlboro	I93 Meredith	I93 Campton	16 Ossippee	3 Northumberland	I95 Toll Booth	I95
. Johnsbury Only												
I	.9424	37.02	37.53	15.98	51.38	1.362	.0482	.0369	1.676	.0200	4.527	.0008
TF:I	1422	198.2	140.3	249.8	80.38	3161	65,040	63,820	1152	65,100	2304	---
ine Only												
I	.9424	37.02	37.53	15.98	51.38	1.363	.0482	.0356	1.674	.0190	4.602	.0008
TF:I	1422	198.2	140.3	249.8	80.38	3158	65,040	66,150	1154	68,530	2267	---
attleboro Only												
I	.9420	37.02	37.53	15.98	51.38	1.364	.0482	.0356	1.676	.0190	4.527	.0008
TF:I	1423	198.2	140.3	249.8	80.38	3156	65,040	66,150	1152	68,530	2304	---
affic Flow djusted Avg. y-1966)	1740	10,692	7358	5474	5322	5541	5643	3161	2651	1878	18,295	
=0												
I	.9424	37.02	37.53	15.98	51.38	1.363	.0482	.0356	1.676	.0190	4.527	
TF:I	1846	288.8	196.1	342.6	103.6	4065	117,100	88,790	1582	98,840	4041	
ta with resistance weighting ctors of 1, 2, & 3 included represent road conditions.												
Traffic Flow (Adjusted Avg. Day-Feb. '66)	1340	7339	5267	3992	4130	4305	3135	2355	1931	1302	10,402	---
OS=0												
I	.4714	37.03	37.54	15.98	51.39	.4549	.0488	.0179	.8387	.0063	4.528	.0008
TF:I	2843	198.2	140.3	249.8	80.37	9464	64,240	132,600	2302	206,700	2304	---

CHAPTER IV

CONCLUSIONS AND FUTURE WORK

The results of the analysis of this model indicate that the model is unsatisfactory in its present form. The model merits some further investigation, but unless the problem areas outlined below can be resolved, a new, and probably significantly different model, will need to be devised.

A principal problem area is a conflict between net current flow and total traffic flow. The ECAP analysis solves for the net current flow in a branch, i.e. the difference between positive and negative currents flowing between nodes. The traffic count data, in contrast, represents the total traffic in a branch, i.e. the sum of "positive" and "negative" traffic flows between nodes.

Analysis of the traffic flow vs. current ratio (as presented in Chapter III) clearly shows three categories, or groups, of roads (among the branches analyzed). A listing of the highway segments in these groups is included as Appendix V to this report.

For example, the traffic count vs. current ratio for an adjusted average day in February, 1966* (with the potentials of the out-of-state nodes set equal to zero and using R=L for all roads), separates into the three following distinct groups:

1. 80 - 200
2. 1100 - 3100
3. 65,000 - 68,000

These ratios represent Actual Traffic/Computed Current. It can be shown that another way of expressing this ratio, with T'_{ij} representing actual traffic count, is $\frac{kLT'_{ij}}{Q_i - Q_j}$.

This is quite a significant development and should be thoroughly investigated. On a first analysis it would seem that these categories would represent "grades" of roads corresponding to "resistance", or difficulty in traveling on these roads.

A comparison of these figures with known road conditions seems to bear out this assumption. The group with the largest ratios represents low-current branches, which in turn represent high-resistance (and/or low-voltage) branches due to Ohm's Law.

(*Traffic count data for the month of February, 1966, was used in this analysis since it represents the low traffic count of the year and thus the out-of-state nodes can be logically set equal to zero. This was tested and proved true. Ratios in Chapter III when out-of-state nodes were not zero were not significantly different from those when they were zero. This is due to the fact that in this model each node is "tied" to a definite potential; and varying any nodal potential, including the out-of-state nodes, only affects current flow in the branches directly connected to that node.

The year 1966 was used because this is one of the years for which population data is available.)

An analysis of these ratio groups shows that the roads represented by low-current branches are actually difficult-to-travel roads, while those represented by low ratios (high current) are for the most part multi-lane easily traveled roads (refer to list in Appendix V).

The exception to the above is that the branches which have a zero-population highway intersection for one node (e.g., Branch 32 and Branch 13) fall in a resistance category much higher than they should be. The only reasonable explanation for this lies solely in the differences in nodal potentials across the affected branches. As pointed out earlier, the ratio

$$\frac{T'_{ij}}{T_{ij}} = \frac{T'_{ij}kL_{ij}}{Q_i - Q_j} = \frac{T'_{ij}kL_{ij}}{\Delta Q}$$

where $\Delta Q = Q_i - Q_j = \Delta v$

The range of Δv for each group is as follows:

1. 200 - 775
2. 30 - 105
3. 0.7 - 1.6

These Δv's easily account for the separation of the various groups. The zero-potential node affects these Δv's by making either Q_i or Q_j equal to zero.

Utilization of a resistance multiplier of 1, 2, or 3 to indicate general ease of travel over each road and highway (see Chapter III) did not provide any conclusive results. The three categories of highways remained intact, but the ratios became more widely scattered. This was to be expected, since the value for "k" in the ratio $\frac{T'_{ij}kL_{ij}}{Q_i - Q_j}$ was being assigned a value of 1, 2, or 3 instead of being kept at 1 as it had been previously. Since the higher resistance roads were assigned the values of 2 and 3, and since the ratios for these roads were already the largest ratios, these ratios naturally became larger and diverged. This indicates that this method of resistance adjustment is not valid. A more appropriate method to try would be the use of resistance scaling factors which would merge all three ratio groups into one group. These factors would probably be divisors and could be selected to force the ratios to converge to any desired quantity.

However, I feel that additional effort toward adjusting the resistance values would be of little use at this time. This model has serious deficiencies which should be resolved first.

In addition to the conflict between <u>net</u> current flow and <u>total</u> traffic flow discussed earlier, another major problem has resulted from the decision to "tie down" the potential at each node to the value of the population potential at that node. Although this procedure eliminates the problem of determining the meaning of polarities in the various current flows, it presents the very serious problem of "fixing" the current flow in each branch completely independent of variations in other branches. For example, changing the out-of-state node potentials from zero to a very large value has virtually no effect on the current flow in any branch except the ones containing the out-of-state nodes. This is due to Ohm's Law in that the current solved for in each branch is: $I = \frac{E}{R} = \frac{Q_i - Q_j}{kL_{ij}}$. As just explained, Q_i and Q_j (as well as k and L_{ij}) are fixed quantities for each branch and therefore almost complete isolation exists between branches.

I feel that this model has been reasonably thoroughly investigated and, while satisfactory results were not obtained, much knowledge and insight into the problem were gained. This investigation can easily form a sound basis for development of a "second-generation" model.

Future Work:

1. Resolve the problem of net current flow vs. total traffic flow. This may require the use of two separate models, one for computing "negative" current and one for computing "positive" current. I am using the terms "positive" and "negative" in an arbitrary sense to indicate that the total current in a branch is made up of two components; one flowing from node i to node j and the other flowing from node j to node i. The total current is then the algebraic sum of these two components.

If a method could be developed to solve for these two components separately, then the sum of their absolute values would correspond to the traffic count figure.

Until this problem is resolved, this model is of little value.

2. Resolve the problem of "fixing" the node voltages and thereby isolating the branches from each other. This would require a different method of inserting voltage sources so that the node voltages could "float" and therefore be responsive to

changes throughout the entire system. This then presents the problem of determining polarities for the sources and the location in the graph where they should be inserted. They are now inserted between the respective nodes and ground, in series with a very small resistance. They could be inserted between the nodes and this is where the polarity problem comes in. This problem should be resolved in conjunction with the problem outlined in Paragraph 1 above.

3. Consider the use of factors other than those already used in this project; such as volume of retail trade, number of vehicles registered in a community, etc., as parameters in solving the graph.

4. The zero-population highway intersection nodes and out-of-state nodes must be restudied to determine their actual effects and what improvements could be made in their representation. Eliminating the fixed node voltages would be a help in this item.

5. The traffic terminating at a node vs. traffic simply passing through a node must be represented in the model. This requires exploring network flow analysis techniques (which are beyond the scope of this report) as outlined in Chapter 7 of Busacker & Saaty (3).

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APPENDIX I

DIAGRAM OF MODEL

APPENDIX II

ECAP PROGRAM AND MACHINE RUN

APPENDIX III

LIST OF COMMUNITIES OF INTEREST

Colebrook
Berlin
Lancaster
Conway
Littleton
Hanover
Lebanon
Plymouth
Rochester
Somersworth
Dover
Laconia
Concord
Claremont
Newport
Keene
Portsmouth
Manchester
Hampton
Plaistow
Salem
Nashua
Milford
Jaffrey
Peterborough

APPENDIX IV

POPULATION POTENTIALS

001	PITTSBURG	446866	405429
002	CLARKSVILLE	53128	48968
003	STEWARTSTOWN	1058246	990718
004	COLEBROOK	6110957	4470454
005	DIXVILLE	2897	0
006	COLUMBIA	319572	285108
007	WENTWORTHS LOC	9725	0
008	STRATFORD	1244752	1109685
009	MILLSFIELD	1298	0
010	ERROL	76202	56840
011	DUMMER	93548	66091
012	NORTHUMBERLAND	7513467	7667309
013	STARK	238443	216808
014	MILAN	868942	702594
015	BERLIN	321491709	271211378
016	LANCASTER	10930111	11276010
017	DALTON	570175	435616
018	WHITEFIELD	3095314	3091825
019	JEFFERSON	621843	728456
020	RANDOLF	128822	132197
021	GORHAM	10787648	9697369
022	SHELBURNE	129067	123174
023	LITTLETON	26244523	26504316
024	MONROE	276247	257134
025	LYMAN	109775	114931
026	CARROLL	188225	175224
027	PINKHAM GRANT	4030	0
028	BATH	541665	482720
029	LISBON	2605720	2428001
030	BETHLEHEM	1079536	1236960
031	LANDAFF	182276	179076
032	FRANCONIA	399787	517420
033	SUGAR HILL	265659	343228
034	HARTS LOC	4068	0
035	JACKSON	177166	203942
036	CHATHAM	55699	47507
037	EASTON	28380	26568
038	HAVERHILL	10521767	10003286
039	BENTON	90733	87433
040	LINCOLN	1841854	2112744
041	BARTLETT	1288319	1234690
042	HALES LOC	2888	0
043	CONWAY	19361447	21210074
044	PIERMONT	375914	317126
045	WARREN	487868	435372
046	WOODSTOCK	938674	815661
047	WATERVILLE	5430	0
048	ALBANY	67044	103940
049	ORFORD	670519	707971
050	WENTWORTH	208821	199952
051	ELLSWORTH	1082	10022
052	THORNTON	406066	411982
053	MADISON	333865	418304
054	EATON	74046	87067
055	RUMNEY	1035752	1034625
056	CAMPTON	1632555	1512465
057	SANDWICH	633859	620145
058	TAMWORTH	1369754	1174742
059	FREEDOM	250139	274611
060	LYME	1548639	1884462
061	DORCHESTER	52657	76995

062	GROTON	62335	81052
063	PLYMOUTH	12148836	10383901
064	HOLDERNESS	1071536	1301182
065	MOULTONBOROUGH	1154723	1399121
066	EFFINGHAM	229320	266777
067	HANOVER	58034884	30292047
068	CANAAN	3202034	2956895
069	HEBRON	134714	139858
070	ASHLAND	3372161	3438714
071	CENTER HARBOR	676128	911140
072	TUFTONBORO	858346	1086949
073	OSSIPEE	2596519	3052598
074	LEBANON	91826243	91373009
075	ENFIELD	4913590	6525133
076	ORANGE	53802	61572
077	ALEXANDRIA	369030	478151
078	BRIDGEWATER	434452	545044
079	BRISTOL	3463501	4096232
080	NEW HAMPTON	1814693	1513009
081	MEREDITH	11698774	13887527
082	WOLFEBORO	8610718	9315047
083	BROOKFIELD	151604	224120
084	LACONIA	248618869	216763050
085	GRAFTON	318961	343245
086	WAKEFIELD	2088158	2243560
087	PLAINFIELD	1900036	1785686
088	GRANTHAM	333293	325566
089	SPRINGFIELD	268025	310379
090	DANBURY	494900	514902
091	HILL	511806	553404
092	SANBORNTON	1834829	2240413
093	GILFORD	7397569	11987933
094	CORNISH	2113417	2506475
095	CROYDON	381906	369896
096	WILMOT	444710	453409
097	ANDOVER	1830946	1623627
098	TILTON	8659351	8141948
099	BELMONT	6228603	8647361
100	GILMANTON	1245888	1206718
101	ALTON	2482163	3361214
102	NEW DURHAM	640307	811267
103	MIDDLETON	489404	444604
104	MILTON	3232720	3978174
105	CLAREMONT	191193934	196487422
106	NEWPORT	34542060	37291964
107	SUNAPEE	2381025	2893848
108	NEW LONDON	4227862	3795036
109	SUTTON	595233	722550
110	SALISBURY	589346	719396
111	FRANKLIN	52894895	74442773
112	NORTHFIELD	5937791	6610772
113	BARNSTEAD	1554873	1871929
114	FARMINGTON	14689337	14897659
115	CANTERBURY	1469834	1938087
116	CHARLESTOWN	8046624	9215966
117	UNITY	1228821	1159396
118	GOSHEN	394389	437265
119	NEWBURY	381768	522632
120	WARNER	1868749	2547998
121	BOSCAWEN	7654692	8476916
122	WEBSTER	798077	1161583

		1962	1960
123	LOUDON	3105400	695430
124	CHICHESTER	2139177	28[illegible]4072
125	PITTSFIELD	8609701	9239104
126	STRAFFORD	1424288	1613922
127	ROCHESTER	274969854	332601925
128	SOMERSWORTH	128928419	148019689
129	ACWORTH	547398	400968
130	LEM9STER	253039	305793
131	BRADFORD	624746	709079
132	HENNIKER	4191961	3154467
133	HOPKINTON	8658992	11752373
134	CONCORD	873622334	721191462
135	EPSOM	2664674	3832881
136	NORTHWOOD	2324615	3595360
137	BARRINGTON	2973715	4716390
138	ROLLINSFORD	18925399	22946466
139	DOVER	441985182	581590446
140	LANGDON	386540	457151
141	WALPOLE	9655993	9643639
142	ALSTEAD	1294099	1617343
143	MARLOW	349689	353108
144	GILSUM	1023817	1231158
145	STODDARD	126183	207311
146	WASHINGTON	132021	151801
147	WINDSOR	36509	37665
148	HILLSBORO	7010712	8411473
149	ANTRIM	2153507	3030382
150	DEERING	471335	602809
151	WEARE	4060517	4435633
152	BOW	5289906	8611974
153	DUNBARTON	1778229	2342447
154	PEMBROKE	21908484	25868863
155	ALLENSTOWN	7360747	8871875
156	HOOKSETT	31690945	67667782
157	DEERFIELD	1595697	2258943
158	CANDIA	6099841	8598918
159	NOTTINGHAM	1293587	1773581
160	MADBURY	4174754	4814415
161	LEE	3168517	3949320
162	DURHAM	44236740	49799861
163	NEWINGTON	26077403	18806754
164	PORTSMOUTH	739318933	595382521
165	NEW CASTLE	3944516	4298346
166	WESTMORELAND	1609607	1712420
167	SURRY	797256	1005337
168	SULLIVAN	429913	554917
169	KEENE	319979430	342233686
170	NELSON	262780	318960
171	ROXBURY	273734	354779
172	BENNINGTON	927797	1014191
173	HANCOCK	1127333	1345768
174	FRANCESTOWN	806770	1060982
175	GREENFIELD	693163	1148839
176	NEW BOSTON	2401930	3928518
177	GOFFSTOWN	86338363	99276731
178	MANCHESTER	7936830510	7777270567
179	RAYMOND	6688495	10360764
180	EPPING	7882799	10823423
181	NEWMARKET	16001426	20169382
182	NEWFIELDS	3773632	4105377
183	GREENLAND	11814224	14818231

		- RPL/d2	1966
184	AUBURN	8005422	11536898
185	CHESTER	3743644	5092447
186	FREMONT	2162941	2833275
187	BRENTWOOD	4976119	5075893
188	EXETER	69924467	67127215
189	STRATHAM	5645781	7981312
190	RYE	35717466	40446517
191	NORTH HAMPTON	11327579	22401464
192	CHESTERFIELD	2924695	3861080
193	MARLBOROUGH	4507827	4761665
194	HARRISVILLE	654676	744647
195	DUBLIN	1156446	1318191
196	PETERBOROUGH	11277213	14282812
197	LYNDEBORO	1111011	1416279
198	MONT VERNON	1675047	2406952
199	AMHERST	9389707	19194445
200	LONDONDERRY	14584627	40135551
201	DERRY	64114592	129227382
202	SANDOWN	971278	1751857
203	DANVILLE	1878462	3388534
204	KINGSTON	6106476	13934017
205	EAST KINGSTON	1694373	2443374
206	KENSINGTON	2176061	3407520
207	HAMPTON	39952819	56033641
208	HAMPTON FALLS	3904645	5223632
209	SEABROOK	7970625	11950379
210	SOUTH HAMPTON	995598	1447914
211	NEWTON	5094768	8869850
212	PLAISTOW	14304016	27514987
213	HAMPSTEAD	4736087	11063868
214	ATKINSEN	5622696	15842916
215	SALEM	100261601	280439481
216	WINDHAM	5541930	13917488
217	PELHAM	11702936	28571291
218	HUDSON	66418759	143896543
219	LITCHFIELD	3483751	7999255
220	MERRIMACK	17544267	45447377
221	NASHUA	1593271666	2126778864
222	BEDFORD	38780624	55924163
223	MILFORD	31543069	43642413
224	HOLLIS	8846581	14310478
225	BROOKLINE	1910680	3199849
226	WILTON	6812705	8129107
227	MASON	675759	946416
228	GREENVILLE	3522277	3855332
229	TEMPLE	533508	609469
230	SHARON	92754	128436
231	NEW IPSWICH	3354270	3995060
232	JAFFREY	12391323	14025456
233	RINDGE	1546064	2140419
234	TROY	3430354	4191221
235	FITZWILLIAM	1500044	1788035
236	SWANZY	17548482	20393790
237	RICHMOND	304373	327610
238	WINCHESTER	7186509	8384234
239	HINSDALE	6591219	8614508

APPENDIX V

THREE CATEGORIES OF ROADS AS DETERMINED
FROM ANALYSIS OF ECAP DATA

CATEGORY 1 - Low Resistance

Branch 42 - Highway 101A - Nashua to Milford

" 28 " 193 - Concord to Manchester

" 39 - F.E. Everett Tpke - Manchester to Nashua

" 41 - Highway 101 - Manchester to Milford

CATEGORY 2 - Medium Resistance

Branch 12 - Highway 16 - Rochester to Conway

Branch 20 - " 103,89 - Claremont to Concord

" 45 - " 124 - Keene to Jaffrey-Peterborough

" 32 - " 195 - Portsmouth to highway intersection

CATEGORY 3 - High Resistance

Branch 2 - Highway 3 - Colebrook to Lancaster

" 9 - " 3,193 - Littleton to Plymouth

" 13 - " 193 - Plymouth to highway intersection

APPENDIX VI

TRAFFIC COUNT DATA - FEB., 1966
AVG., 1966

	Recorder Location	Route Number	Year	Average Sunday	Average Week Day	Average Saturday	Adjusted Average Day	Computed Total Vehicles	% Gain (1)	% Loss (1)
TURNPIKE TRAFFIC	N. H. Turnpike	Toll	1965	16890	10624	13702	11957	334848		
	Total Traffic	I 95	1966	16894	10906	13204	12088	338505	1.1	
	F. E. Everett Turnpike	Toll	1965	8242	4910	6520	5615	157240		
	Merrimack Interchange		1966	8677	5535	6819	6166	172681	9.8	
	F. E. Everett Turnpike	Toll	1965	11565	6352	9076	7485	209611		
	Hooksett Interchange	I 93	1966	14252	7462	10578	8876	248566	18.6	
	Spaulding Turnpike	Toll	1965	5753	3958	5123	4380	122653		
	Dover Interchange		1966	6036	4121	5150	4541	127164	3.7	
	Spaulding Turnpike	Toll	1965	4669	2267	3576	2797	78318		
	Rochester Interchange		1966	4917	2637	3652	3101	87011	11.1	
BYPASS	Nashua Bypass, South		1965	10210	7979	9325	8490	237720		
			1966	9554	9572	10078	9642	269968	13.6	
	Manchester Bypass		1965	15254	11506	13522	12329	345224		
	F. E. Everett Turnpike		1966	15261	12718	14033	13269	371536	[illegible].6	
	Boscawen	US 3&4	1965	3352	2951	3015	3017	84488		
		Bypass	1966	3400	2888	3038	2983	83512	(3)	
INTERSTATE TRAFFIC	Salem	I 93	1965	14105	11459	13337	12106	338948		
			1966	12717	13746	13211	13523	378632	11.7	
	Windham	I 93	1965	9657	7491	8233	7906	221380		
			1966	12046	8459	9823	9173	256856	16.0	
	Londonderry	I 93	1965	8688	7883	8419	8075	226088		
			1966	12886	10577	10177	10887	304852	34.8	
	Manchester	I 193	1965	11307	10065	10449	10227	288324		
			1966	13332	13155	13816	13274	371692	28.9	
	Concord Bypass	I 93	1965	12309	8229	10051	9072	254020		
	South of US 3		1966	12685	9141	10141	9790	274124	7.9	
	Concord Bypass	I 93	1965	11337	10435	11540	10722	300208		
	South of Circle		1966	12873	12507	13462	12695	355480	18.4	
	Concord Bypass	I 93	1965	13180	10573	12687	11247	314928		
	North of Circle		1966	14049	12625	13231	12915	361620	14.8	
	Concord	I 93	1965	11563	7894	9795	8690	243312		
	North of NH 3B		1966	12325	8541	10305	9334	261340	(3)	
	Tilton	I 93	1965	7141	3066	5212	3955	110732		
			1966	5168	3765	4495	4062	113952	(3)	
	Meredith	I 93	1965	5009	2421	4240	3050	85416		
			1966	4851	2711	3633	3149	88156	(3)	
	Ashland	I 93	1965	3864	2379	3650	2773	77636		
			1966	4309	2985	3934	3324	93072	(2)	
	Campton	I 93	1965	2848	1701	2615	1995	55872		
			1966	2928	2056	2368	2232	62504	11.9	
	Hopkinton	I 89	1965	4319	3794	4393	3955	110752		
			1966	5385	5153	5248	5200	145592	31.5	
	Warner	I 89	1965	1502	1176	1440	1260	35288		
			1966	2204	1569	1795	1692	47376	34.5	

(1) "Percent Gain or Loss" is based on corresponding period of preceding year.
(2) Out of operation entire month. (3) Computed figures, based on trend.
Any extensions or additional computations of this report must be approved as to procedure by Planning and Economics Division before use by others.

FOLDOUT FRAME

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NEW HAMPSHIRE

PL

Tra

Net Motor Vehicle F
Net Motor Vehicle F
Net Gas Tax Income
Net Gas Tax Income
Gas Consumption (G
Gas Consumption (G

Construction Projec

Nashua, LS 1872(2),

Total Construction f

Adjusted Average Day	Computed Total Vehicles	% Gain (1)	% Loss (1)
11957	334848		
12088	338505	1.1	
5615	157240		
6166	172681	9.8	
7485	209611		
8876	248566	18.6	
4380	122653		
4541	127164	3.7	
2797	78318		
3107	87011	11.1	
8490	237720		
9642	269968	13.6	
12329	345221		
13269	371536	7.6	
3017	84488		
2983	83512	(3)	
12106	338948		
13523	378632	11.7	
7906	221380		
9173	256856	16.0	
8075	226088		
10887	304852	34.8	
10297	288324		
13274	371692	28.9	
9072	254020		
9790	274124	7.9	
10722	300208		
12695	355480	18.4	
11247	314928		
12915	361620	14.8	
8690	243312		
9334	261340	(3)	
3955	110732		
4069	113952	(3)	
3050	85416		
3149	88156	(3)	
2773	77636		
3324	93072	(2)	
1995	55872		
2232	62504	11.9	
3955	110752		
5200	145592	31.5	
1260	35288		
1692	47376	34.3	

f preceding year.
based on trend.
be approved as to
others.

FOLDOUT FRAME

AUTOMATIC TRAFFIC RECORDER REPORTS
and
MISCELLANEOUS STATISTICS

Released by
NEW HAMPSHIRE DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PLANNING AND ECONOMICS DIVISION

Traffic Information for the Month of February, 1966

STATISTICAL INFORMATION

		1964	1965
Net Motor Vehicle Fees	Month of December	188,135	241,403
Net Motor Vehicle Fees	6 mos. ending 12/31	1,339,346	1,323,052
Net Gas Tax Income	Month of December	532,838	1,381,949
Net Gas Tax Income	6 mos. ending 12/31	8,551,877	8,584,993
Gas Consumption (Gal.)	Month of December	18,371,949	20,546,924
Gas Consumption (Gal.)	6 mos. ending 12/31	123,886,877	132,555,206

Construction Projects:

Nashua, LS 1872(2), P4688B Started in February 2.851 Miles

Total Construction in Operation as of 2/28/66 42.057 Miles

FOLDOUT FRAME 3

FOLDOUT FRAME 1

Recorder Location	Route Number	Year	Average Sunday	Average Week Day	Average Saturday	Adjusted Average Day	Computed Total Vehicles	% Gain (1)	% Loss (1)
North Hampton	US 1	1965	5677	6012	6655	6056	169568		
		1966	4517	6280	6482	6057	169596	0.0	
North Hampton	NH 1A	1965	1769	545	1078	795	22268		
		1966	1789	713	1008	909	25448	14.3	
Hampton Harbor Toll Bridge	NH 1A	1965	4124	798	1692	1401	39224		
		1966	2993	808	1248	1183	33124		15.6
Shelburne	US 2	1965	1737	1270	1526	1373	38452		
		1966	1521	1218	1530	1306	36576		4.9
Jefferson	US 2	1965	[illegible]	479	487	497	13916		
		1966	[illegible]	500	550	529	14800	(2)	
Nashua North of Robinson Rd.	US 3	1965	[illegible]	9626	10517	9671	270796		
		1966	[illegible]	9627	9459	9192	257376		5.0
Merrimack	US 3	1965	3697	3897	3747	3847	107716		
		1966	4067	4217	4189	4192	117364	(3)	
Hooksett	US 3	1965	6356	5493	6331	5736	160608		
		1966	6208	5174	5704	5397	151128		5.9
Lincoln	US 3	1965	2052	1316	1794	1489	41704		
		1966	3471	1668	2576	2055	57548	38.0	
Northumberland	US 3	1965	1211	1444	1389	1403	39280		
		1966	1156	1404	1309	1355	37940		3.4
Manchester So. of Hackett Hill Rd.	NH 3A	1965	2256	2868	2703	2828	79196		
		1966	2500	3238	3272	3137	87848	(3)	
Newington Gen. Sullivan Bridge	US 4	1965	12378	11031	11945	11354	317912		
	NH 16	1966	12299	11510	12508	11765	329428	3.6	
Northwood	US 4	1965	2686	2142	2243	2234	62556		
		1966	2251	2310	2020	2260	63284	1.2	
Chichester	US 4	1965	2939	2925	2715	2897	81116		
	NH 9	1966	3106	3324	3136	3266	91448	12.7	
Andover	US 4	1965	3498	2640	3120	2831	79272		
	NH 11	1966	3366	2333	2587	2517	70472		11.1
Springfield	NH 4A	1965	1162	760	944	844	23624		
		1966	1773	1057	1268	1189	33304	41.0	
Hillsboro	NH 9	1965	1083	1168	1219	1163	32568		
		1966	1476	1389	1362	1398	39132	20.2	
Newport	NH 10	1965	1214	1067	1350	1128	31596		
		1966	1089	981	1378	1053	29488		6.7
Lyme	NH 10	1965	561	405	598	455	12736		
		1966	685	600	743	633	17712	39.1	
Landaff	NH 10	1965	1113	1021	1115	1048	29332		
	US 302	1966	1048	1046	1142	1060	29680	1.2	
Alton	NH 11	1965	1795	793	1244	1001	28016		
		1966	1379	928	1138	1022	28628	2.2	
Marlboro	NH 12	1965	3935	3756	4329	3863	108176		
		1966	4449	3913	4191	4029	112820	4.3	
Claremont	NH 12	1965	3373	2315	3154	2443	68408		
	NH 103	1966	3131	2733	3355	2879	80604	17.8	
Brookline	NH 13	1965	1986	1302	1715	1459	40844		
		1966	2343	1555	2018	1734	48544	(3)	
Dover	NH 16	1965	5774	6524	6653	6435	180188		
		1966	4826	6037	6317	5904	165312		8.3
Somersworth Between NH 16A & 16B	NH 16	1965	3248	3429	4376	3538	99076		
		1966	3139	3432	4132	3490	97724		1.4

Recorder Location

Milton
Ossipee
Jackson
Rumney
Tamworth
Windham
Chichester
Auburn
Marlboro
Temple
Amherst
Candia
Stratham
Milford
Exeter
Chester
Newbury
Meredith
Belmont
Hudson
Lee
Bartlett

URBAN

Nashua Main Street
Manchester Elm Street
Concord North Main Street
Concord North State Street

Rural Stat

...usted ...rage Day	Computed Total Vehicles	% Gain (1)	% Loss (1)	Recorder Location	Route Number	Year	Average Sunday	Average Week Day	Average Saturday	Adjusted Average Day	Computed Total Vehicles	(1)	(1)
056	169568			Milton	NH 16	1965	4740	1862	3422	2466	69[illegible]		
057	169596	0.0				1966	3740	2358	3149	2558	74716	(3)	
795	22265			Ossipee	NH 16	1965	4214	1638	3101	2215	62020		
909	25448	14.3				1966	4203	2029	2527	2411	67500	8.8	
401	39224			Jackson	NH 16	1965	2008	690	1771	1033	28916		
183	33124		15.6			1966	1925	854	1943	1163	32552	12.6	
673	38452			Rumney	NH 25	1965	1527	1267	1731	1370	38372		
806	36576		4.9			1966	1728	1565	1704	1809	43048	17.4	
497	13916			Tamworth	NH 25	1965	1925	1207	2057	1431	40068		
529	14800	(2)			113	1966	2143	1342	1682	1505	42140	5.2	
671	270796			Windham	NH 28	1965	3195	2052	2688	2305	64452		
192	257376		5.0			1966	2330	2076	2352	2152	60247		6.6
147	107716			Chichester	NH 28'	1965	3272	2689	3237	2851	79816		
192	117364	(3)				1966	2377	2131	2516	2221	62192		22.[illegible]
136	160608			Auburn	NH 28	1965	2433	1252	1614	1477	41348		
197	151128		5.9		Bypass	1966	2147	1354	1612	1504	42120	1.9	
[illegible]	41704			Marlboro	NH 101	1965	3802	4077	45[illegible]	4105	114944		
555	57548	38.0				1966	3836	4605	4508	4491	125476	9.3	
103	39280			Temple	NH 101	1965	2321	1897	2060	1985	55[illegible]		
555	37940		3.4			1966	2591	2252	2150	2296	64304	15.[illegible]	
128	79196			Amherst	NH 101	1965	4245	4095	4460	4152	116250		
127	87848	(3)				1966	4520	4276	4762	4370	122352	[illegible]	
154	317912			Candia	NH 101	1965	4466	3613	3875	3915	109620		
165	329428	3.6				1966	4576	4084	3908	4125	115616	5.5	
134	62556			Stratham	NH 101	1965	5027	5975	6083	5855	163940		
160	63284	1.2				1966	4497	6162	6134	5920	165764	1.1	
197	81116			Milford	NH 101	1965	4371	4410	4568	4424	123872		
166	91448	12.7			A	1966	4590	4452	5258	4587	128432	(3)	
131	79272			Exeter	H E	1965	2585	1831	2055	1971	55180		
117	70472		11.1		Exp.	1966	1970	1906	2022	1932	54096		2.0
144	23624			Chester	NH 102	1965	1510	906	1124	1023	28645		
189	33304	41.0				1966	1364	973	1062	1042	29184	1.8	
163	32568			Newbury	NH 103	1965	2674	1725	1860	1850	52[illegible]		
198	39132	20.2				1966	4268	2208	2610	2560	71672	36.2	
128	31596			Meredith	NH 104	1965	2477	1420	2268	1692	47[illegible]		
153	29486		6.7			1966	2234	1798	2156	1912	53532	13.0	
155	12736			Belmont	NH 106	1965	2655	1962	2462	2132	59708		
133	17712	39.1				1966	2900	2370	2722	2496	69888	(3)	
148	29332			Hudson	NH 111	1965	2850	2242	2392	2250	63[illegible]		
160	29680	1.2				1966	1727	2380	2473	2306	64492		2.[illegible]
101	28016			Lee	NH 125	1965	3241	2101	2596	2333	65322		
122	28628	2.2				1966	2853	2255	2409	2362	66148	1.2	
163	108176			Bartlett	US 302	1965	632	441	808	521	14590		
129	112820	4.3				1966	666	441	505	473	13516		7.[illegible]
143	68408			Nashua	US 3	1965	18814	23409	23544	23673	[illegible]		
179	80604	17.8		Main Street		1966	17092	28185	28467	26641	745[illegible]	(3)	
159	40844			URBAN Manchester	US 3	1965	11250	11123	13856	11532	322884		
134	48544	(3)		Elm Street		1966	8983	12806	13800	12402	347252	(3)	
135	180188			Concord	US 3	1965	10582	13251	13851	12955	362752		
104	165312		8.3	North Main Street		1966	9063	12284	13122	11944	334420		7.8
138	99076			Concord	US 3	1965	5674	8277	8732	7970	223164		
190	97724		1.4	North State Street	US 4	1966	5173	9370	9482	8785	245968	10.2	

Rural State Average for the month of February, 1966 shows a 7.4%

FOLDOUT FRAME 2

	Recorder Location	Route Number	Year	Average Sunday	Average Week Day	Average Saturday	Adjusted Average Day	Computed Total Vehicles	% Gain (1)	% Loss (1)
TURNPIKE TRAFFIC	N. H. Turnpike	Toll	1965	24171	15445	20471	17404	6352386		
	Total Traffic	I 95	1966	25101	16285	21477	18295	6677584	5.1	
	F. E. Everett Turnpike	Toll	1965	9799	6134	7819	6896	2517075		
	Merrimack Interchange		1966	9690	6706	8269	7358	2685747	6.7	
	F. E. Everett Turnpike	Toll	1965	14455	8236	11305	9559	3489150		
	Hooksett Interchange	I 93	1966	15817	9266	12663	10692	3902707	11.9	
	Spaulding Turnpike	Toll	1965	6293	4583	5638	4977	1816569		
	Dover Interchange		1966	6549	4922	6200	5339	1948740	7.3	
	Spaulding Turnpike	Toll	1965	5016	2766	4090	3275	1195363		
	Rochester Interchange		1966	5325	3047	4398	3567	1302105	8.9	
BYPASS	Nashua Bypass, South		1965	13922	10083	11332	10807	3944729		
			1966	13934	11635	12512	12090	4412772	11.9	
	Manchester Bypass		1965	18885	14363	17122	15400	5621151		
	F. E. Everett Turnpike		1966	19803	15859	17844	16709	6098934	8.5	
	Boscawen	US 3&4	1965	4053	3299	3624	3453	1260169		
		Bypass	1966	3979	3312	3623	3452	1260074	0.0	
INTERSTATE TRAFFIC	Salem	I 93	1955	19343	16715	19338	17463	6374048		
			1966	23491	21009	23967	21792	7954037	24.8	
	Windham	I 93	1965	12252	9479	10270	9987	3645125		
			1966	14364	11104	12558	11780	4299547	18.0	
	Londonderry	I 93	1965	11892	10170	10998	10533	3844565		
			1966	13518	12243	13171	12559	4584177	19.2	
	Manchester	I 193	1965	14540	12820	13615	13178	4810090		
			1966	17836	16210	17182	16583	6052786	25.8	
	Concord Bypass	I 93	1965	14825	10515	12885	11467	4185391		
	South of US 3		1966	16254	11345	13632	12376	4517417	7.9	
	Concord Bypass	I 93	1965	16460	13113	15332	13906	5075579		
	South of Circle		1966	17760	14150	16540	15015	5480360	(3)	
	Concord Bypass	I 93	1965	16391	13357	14867	14005	5111660		
	North of Circle		1966		Discontinued					
	Concord	I 93	1965	14579	10217	12382	11147	4068473		
	North of NH 3B		1966	15586	10773	13437	11845	4323500	6.3	
	Tilton	I 93	1965	10273	5185	7676	6264	2286540		
			1966	10122	5364	7864	6405	2337834	2.2	
	Meredith	I 93	1965	7204	3912	5466	4603	1679944		
			1966	8886	4770	6747	5643	2059851	22.6	
	Ashland	I 93	1965	5558	3777	4564	4143	1512039		
			1966	6337	4029	5106	4514	1647604	9.0	
	Campton	I 93	1965	3916	2607	3179	2875	1049497		
			1966	4633	2785	3567	3161	1153944	10.0	
	Hopkinton	I 89	1965	5633	4893	5450	5077	1853268		
			1966	6124	5586	6063	5732	2092199	12.9	
	Warner	I 89	1965	2005	1491	1743	1600	584029		
			1966	1993	1656	1904	1740	635020	8.7	

(1) "Percent Gain or Loss" is based on corresponding period of preceding year.
(2) Out of operation entire month. (3) Computed figures, based on trend.
Any extensions or additional computations of this report must be approved as to procedure by Planning and Economics Division before use by others.

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...usted ...erage Day	Computed Total Vehicles	% Gain (1)	% Loss (1)
404	6352386		
205	6677584	5.1	
396	2517075		
358	2685747	6.7	
559	3489150		
692	3902707	11.9	
977	1816569		
339	1948740	7.3	
275	1195363		
567	1302105	8.9	
807	3944729		
090	4412772	11.9	
400	5621151		
709	6098934	8.5	
453	1260169		
452	1260074	0.0	
463	6374048		
792	7954037	24.8	
987	3645125		
780	4299547	18.0	
533	3844565		
559	4584177	19.2	
178	4810090		
583	6052786	25.8	
467	4185391		
376	4517417	7.9	
006	5075579		
015	5480360	(3)	
005	5111660		
147	4068473		
345	4323500	6.3	
264	2286540		
205	2337834	2.2	
503	1679944		
543	2059851	22.6	
43	1512039		
514	1647604	9.0	
275	1049497		
61	1153944	10.0	
77	1853268		
32	2092199	12.9	
00	584029		
40	635020	8.7	

...eceding year.
...d on trend.
...approved as to
...ers.

FORM NO. [illegible]

AUTOMATIC TRAFFIC RECORDER REPORTS
and
MISCELLANEOUS STATISTICS

Released by
NEW HAMPSHIRE DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PLANNING AND ECONOMICS DIVISION

STATISTICAL INFORMATION

COMPARATIVE TRAFFIC FIGURES

for

CALENDAR YEAR 1966

FOLDOUT FRAME /

Recorder Location	Route Number	Year	Average Sunday	Average Week Day	Average Saturday	Adjusted Average Day	Computed Total Vehicles	% Gain (1)	% Loss (1)
North Hampton	US 1	1965	7609	7827	8532	7896	2882190		
		1966	7543	7856	8902	7964	2906703	0.9	
North Hampton	NH 1A	1965	4339	1970	3098	2463	900835		
		1966	4723	2132	3397	2685	979875	8.8	
Hampton Harbor	NH 1A	1965	8730	3697	6793	4855	1772132		
Toll Bridge		1966	8604	3823	6799	4937	1801839	1.7	
Shelburne	US 2	1965	2671	2080	2411	2212	807242		
		1966	2968	2369	2684	2500	912447	13.0	
Jefferson	US 2	1965	1880	1551	1668	1615	589331		
		1966	2176	1857	1945	1915	699105	18.6	
Nashua	US 3	1965	8699	10336	10203	10084	3680631		
North of Robinson Rd.		1966	8396	10513	9922	10126	3695902	0.4	
Merrimack	US 3	1965	4334	4481	4273	4430	1617066		
		1966	4802	5101	4949	5036	1838283	13.7	
Hooksett	US 3	1965	8690	6860	7897	7268	2652927		
		1966	8639	6840	7880	7248	2645378		0.3
Lincoln	US 3	1965	4590	2768	3442	3124	1140165		
		1966	5533	3340	4432	3811	1390873	22.0	
Northumberland	US 3	1965	2015	1867	1981	1904	695114		
		1966	1989	1838	1963	1878	685498		1.4
Manchester	NH 3A	1965	2968	3835	3403	3650	1332245		
So. of Hackett Hill Rd.		1966	3031	4107	3625	3884	1417545	6.4	
Newington	US 4	1965	14083	13300	14712	13613	4968678		
Gen. Sullivan Bridge	NH 16	1966	15060	13945	15294	14300	5219507	5.0	
Northwood	US 4	1965	3426	2547	2768	2704	986959		
		1966	3581	2668	2943	2838	1035848	5.0	
Chichester	US 4	1965	4569	3808	4123	3961	1445947		
	NH 9	1966	4619	3870	4253	4032	1471763	1.8	
Andover	US 4	1965	4022	3088	3756	3316	1210464		
	NH 11	1966	3[illegible]52	2961	3460	3175	1158803		4.3
Springfield	NH 4A	1965	1919	1381	1643	1495	545753		
		1966	1818	1174	1414	1300	474564		13.0
Hillsboro	NH 9	1965	2343	1789	2162	1921	701250		
		1966	2285	1785	2093	1901	693822		1.1
Newport	NH 10	1965	1520	1291	1590	1366	498771		
		1966	1778	1487	1838	1579	576471	15.6	
Lyme	NH 10	1965	1082	780	953	848	309462		
		1966	1223	927	1114	996	363559	17.5	
Landaff	NH 10	1965	1544	1433	1597	1472	537429		
	US 302	1966	1584	1462	1653	1507	550111	2.4	
Alton	NH 11	1965	2590	1380	2052	1648	601515		
		1966	2555	1443	2179	1708	623515	3.7	
Marlboro	NH 12	1965	4849	4340	4811	4480	1635107		
		1966	5129	4523	5081	4690	1711940	4.7	
Claremont	NH 12	1965	3015	2987	3757	3108	1134298		
	NH 103	1966	3457	3376	4349	3529	1287976	13.5	
Brookline	NH 13	1965	2771	1778	2202	1980	722725		
		1966	2969	1990	2558	2216	808950	11.9	
Dover	NH 16	1965	6279	7125	7442	7050	2573206		
		1966	6215	6928	7362	6889	2514584		2.3
Somersworth	NH 16	1965	3413	3681	4417	3748	1367983		
Between NH 16A & 16B		1966	3538	3828	4471	3880	1416219	3.5	

Recorder Location	Rou… Num…
Milton	NH
Ossipee	NH
Jackson	NH
Rumney	NH
Tamworth	NH / 113
Windham	NH
Chichester	NH
Auburn	NH / Byp.
Marlboro	NH
Temple	NH
Amherst	NH
Candia	NH
Stratham	NH
Milford	NH
Exeter	H E / Exp
Chester	NH
Newbury	NH
Meredith	NH
Belmont	NH
Hudson	NH
Lee	NH
Bartlett	US
Nashua Main Street	US
URBAN Manchester Elm Street	US
Concord North Main Street	US
Concord North State Street	US / US

Rural State Ave…

Computed Total Vehicles	% Gain (1)	% Loss (1)
2882190		
2906703	0.9	
900935		
979875	8.8	
1772132		
1801839	1.7	
807242		
912447	13.0	
589331		
699105	18.6	
3680631		
3695902	0.4	
1617066		
1838283	13.7	
2652927		
2645378		0.3
1140165		
1390873	22.0	
695114		
685498		1.4
1332245		
1417545	6.4	
4968678		
5219507	5.0	
986959		
1035848	5.0	
1445947		
1471763	1.8	
1210461		
1158803		4.3
545753		
474664		13.0
701250		
693822		1.1
498771		
576471	15.6	
309462		
363559	17.5	
537420		
550111	2.4	
601515		
623515	3.7	
1635107		
1711940	4.7	
1134298		
1287976	13.5	
722725		
808950	11.9	
2573206		
2514584		2.3
1367983		
1416219	3.5	

Recorder Location	Route Number	Year	Average Sunday	Average Week Day	Average Saturday	Adjusted Average Day	Computed Total Vehicles	% Gain (1)	% Loss (1)
Milton	NH 16	1965	5242	2557	3916	3133	1143683		
		1966	5151	2532	3912	3105	1133431		0.9
Ossipee	NH 16	1965	4225	2247	3239	2670	974492		
		1966	4166	2229	3234	2651	967559		0.7
Jackson	NH 16	1965	2066	1165	1646	1362	496971		
		1966	2374	1375	2034	1620	591363	19.0	
Rumney	NH 25	1965	2392	1952	2351	2071	755980		
		1966	2654	2126	2467	2251	821666	8.7	
Tamworth	NH 25	1965	2525	1803	2216	1965	717171		
	113	1966	2381	1708	2096	1860	679024		5.3
Windham	NH 28	1965	3834	2657	3178	2899	1058003		
		1966	3693	2615	3186	2852	1040822		1.6
Chichester	NH 28	1965	3471	2693	3274	2887	1053629		
		1966	3641	2879	3551	3085	1126030	6.9	
Auburn	NH 28	1965	3109	1730	2276	2004	731477		
	Bypass	1966	3007	1607	2182	1890	689769		5.7
Marlboro	NH 101	1965	4931	5150	5604	5183	1891918		
		1966	5060	5550	5971	5541	2022531	6.9	
Temple	NH 101	1965	3276	2404	2667	2565	936377		
		1966	3409	2648	2904	2807	1024411	9.4	
Amherst	NH 101	1965	5408	5106	5747	5240	1912648		
		1966	5416	5200	5829	5322	1942493	1.6	
Candia	NH 101	1965	6390	4812	5334	5111	1865528		
		1966	6982	5079	5733	5445	1987467	6.5	
Stratham	NH 101	1965	5595	6755	6520	6556	2392597		
		1966	5897	6975	7018	6827	2492010	4.1	
Milford	NH 101	1965	5926	4989	5557	5203	1899193		
	A	1966	5944	5302	5857	5474	1998128	5.2	
Exeter	H E	1965	4150	2599	3364	2929	1069007		
	Exp.	1966	4519	2864	3716	3223	1176571	10.1	
Chester	NH 102	1965	2309	1233	1615	1440	525765		
		1966	2513	1334	1827	1574	574348	9.2	
Newbury	NH 103	1965	3007	2102	2571	2298	838683		
		1966	3221	2201	2765	2429	886418	5.7	
Meredith	NH 104	1965	3536	2323	3106	2607	951684		
		1966	3833	2543	3426	2855	1042129	9.5	
Belmont	NH 106	1965	3254	2587	3271	2779	1014504		
		1966	3367	2708	3407	2903	1059777	4.5	
Hudson	NH 111	1965	3796	3054	3288	3193	1165468		
		1966	3900	3466	3607	3548	1295187	11.1	
Lee	NH 125	1965	4601	2802	3421	3146	1148306		
		1966	4794	2946	3828	3338	1218201	6.1	
Bartlett	US 302	1965	1456	927	1144	1034	377252		
		1966	1679	1033	1286	1162	424013	12.4	
URBAN Nashua	US 3	1965	18836	25389	24668	24353	8888820		
Main Street		1966		Discontinued					
Manchester	US 3	1965	11260	13103	14620	13056	4765514		
Elm Street		1966	10524	13659	14288	13304	4855669	1.9	
Concord	US 3	1965	11153	14266	13986	13783	5030708		
North Main Street		1966	12196	15293	15368	14863	5424844	7.8	
Concord	US 3	1965	6963	10597	10104	10009	3653318		
North State Street	US 4	1966	6988	10870	10503	10263	3746157	2.5	

Rural State Average for 1966 shows a 6.8% increase over 1965.

FOLDOUT FRAME 2