NETWORK ANALYSIS
AND
SCHOOL BUS ROUTES

A Monograph Presented to the Faculty of Graduate Studies and Research, McGill University in Partial Fulfillment of the Requirements for the Degree of Master of Education.

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A B S T R A C T

The aim of this monograph is to teach students at the junior high school level new methods and techniques useful in the study of geography. Through active participation and involvement of the students, data concerning time, passengers, distance, etc., were collected on the bus routes serving the school.

The figures obtained served as a base for calculations of differences or similarities. Essentially, time-distance factors were studied. However, the consideration of how many boys and girls were involved was an interesting side observation as well as the number of students getting off at the various stops. The resulting compilations in graph (schematic, histogram and ogive) and matrix form was a step by step outcome of the project and all presented a comprehensive picture of a network analysis.

The matrices produced were similar to those on any road map, with one important difference, namely, this was a road map produced by the students themselves and relating to their own daily routes.

To Professor Eric Winter

whose expert guidance, patience, and stimulating sense of humour made this paper an enjoyable experience.

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PREFACE

The aim of this paper is to introduce interesting methods to excite, stimulate and effectively communicate content, skills and techniques to students in the secondary II geography program. It is also an attempt to present a change in curriculum content in reply to the challenges set forth by the many critics of our educational system discussed in the introductory chapter.

Although a knowledge of mathematics and geography is useful to teach the quantitative methods outlined in the text, it is not essential. It is my hope that my outline of the work done by several quantitative geographers will provide an interesting and useful foundation leading up to the project itself. These techniques should also provide background material to the teacher for either developing or expanding or modifying the program to suit their individual needs and conditions.

The project could not have been effected without the active participation of the students of Chomedey Polyvalent High School, Laval, Quebec. They patiently co-operated although they were handicapped by a severe winter creating adverse conditions and a teacher's strike which hampered their timing and caused them to do several retakes in their field work. These problems, indirectly, gave them the advantage of combining the results of several observations.

I have placed the data for the entire network in the appendix in order to keep the description of the field work and classroom procedures as brief as possible.

Finally, it is my hope that the techniques acquired by the students will prove useful to them in pursuing advanced studies in the discipline of geography. The collection of statistical data, mapping, cartographic techniques, symbols, and the use of graphs, ogives, matrices, etc., are all basic to quantitative geography.

J. Goldwater

April 1973

CHAPTER I

THE CASE FOR THE STUDENT PROJECT

Schools are blinded by tradition. They are not relevant to today's world. They perpetuate an ivory tower mentality. They are slaves to society's economic demands. These are some of the charges made against the present educational system by the discontent and radical element in our student body of today's generation. This paper will not attempt to defend the present school system. Rather, it is an attempt to be relevant wherever it is possible.

Let us examine some charges made by a high school student against the existing North American educational system. Weisleder (1972, p. 175) voices the malaise and frustration spawned by today's high schools. The main cry is that boredom and apathy are the results of a rigidly imposed conformity and discipline that pervades the system. The attitude of authoritarian dominance and top heavy structure filtering condescendingly down to the students is greatly resented. Putting it bluntly, Weisleder calls the system "plainly boring, irrelevant, regimentary, brutal, insensitive, inflexible, stagnant, dulling, discriminatory, manipulative, oppressive, repressive and suppressive." Complaints are made against competition, in terms of student against student for marks, imposition of course content and overly rigid disciplinary action regarding issues of lesser importance.

To place this in perspective, let us examine the goals of education as set forth by various educators. Johnston (1963, p. 115) states that "the specific goal of the school is the development of the intellectual virtues in its students." The aim a teacher must have, he says, is the aim to inspire a student to learn. A teacher can show the student how to develop the ability to reason from principles to conclusions through the use of a small part of the body of knowledge. The aim towards which a teacher should strive is to effect the ability on the part of the student to get knowledge on his own. Basically, one might say that the teacher should strive to teach the learner how to learn.

Are schools reservoirs of data where the function of the teacher is to pipe the effluent down the throats of a captive audience? Gopsill and Beesley (1964) stress the point that students must be personally involved in their learning. They contend that students should be stimulated to act or to do things which will lead them to acquire information rather than to wait for information to be fed to them. Their belief is that educators must emphasize those skills and activities that help the student concentrate on basic knowledge. "Just as you cannot teach something unless you teach it to someone, neither can you teach someone without teaching him something." (Johnston, 1963, p. 214).

Frankena (1937) believes that education is essentially a process of interaction between people, between teacher and student. His value judgment is that education fulfills itself only insofar as it inspires students to develop their own abilities, to develop their own potential to the fullest possible extent. The basic tenet of Frankena is that the process must be meaningful to the student if there is to result that type of inspiration that can make such positive interaction possible. Like Dewey, he is student-oriented in his approach.

This appears basically sound and logical. However, it fails to consider emotional influences which play an important factor in the development of learning habits. On a one to one basis, given the rapport between student and teacher, it may be possible to infuse the student with the love and knack of learning. In a classroom of 30 or more students, it is difficult and sometimes impossible to reach each child at his own level of ability, interest and emotional make-up as well as acquired attitudes.

Goodman (1960) paints a picture of gloom when he refers to the many fifteen-year olds despairing at their school work and waiting to quit school so that they can do something meaningful. The New York Times, September 7, 1959, quotes Rockefeller, the Governor of New York, as declaring that "we have to constantly devise new ways to bring about a challenge to these young folks and to provide an outlet for their energies."

Along these same lines of frustration, Quarter (1972) argues that the role of the teacher in the classroom is incompatible with education. A teacher is obliged by the pressure placed by society on the school system to socialize and evaluate students as well as teach them. This is a formidable task. Byrne (1972) agrees that society places priorities upon the educational system and that innovations attempted are constrained by these primary considerations.

Quarter (1972, p.51) says that the "hidden curriculum" covers such things as "Punctuality, neatness, diligence, competitiveness, achievement, and submission to authority..." They are the characteristics most relevant to the demands of society for a relatively standardized human model who will fit into the great industrial machine smoothly. In fact, it can be said that this hidden curriculum has more relevance to the spirit of the world of work than the actual course content. Since this is contrary to the spirit of human nature, it requires much coercion on the part of the teacher to effect the desired behaviour. This places him in the unpopular position of an authoritarian. The classroom then becomes "the arena in which the teacher performs the school's function for society" (Quarter, 1972, p. 54).

The situation being such that the evaluation by the teacher determines the student's eligibility for various occupations, the role of the teacher becomes a powerful and punitive one. As long as the teacher has to perform the functions of socialization and evaluation as well as education, only limited variations are possible.

Postman and Weingarten (1969) define the word "educate" in its original context. Basing their definition on the Latin root, "educe", educate means to draw out the latent or potential of a person. This can only be done progressively in relation to what the person already knows. The more a person gets to know, the more he has the capability of learning. Bruner (1969) and Goodman (1960) agree that if a subject is worth knowing, it will stimulate interest. Philosophically, while we might question the categorical sweep of this generalization, we might consider the inverse idea. That is, if a subject is not worth knowing, then...? What is worth knowing? This must be considered from the point of view of the student as well as the point of view of survival in a rapidly changing world of the present and the future. (Postman & Weingartner, 1969). It is important to remember that each individual perceives an object in his own and uniquely subjective way. There is a great tendency on the part of educators to impose their own visions and interpretations upon the students. These traditional methods can be inadequate and arbitrary in achieving insight and understanding of information and interpretation of a given situation. Students need to be encouraged to ask questions and seek out answers for themselves. To survive in a rapidly changing world, the most important achievement in education is to make viable meanings, which should serve the student in ever-changing situations.

While these observations are not new, it is obvious to many educators that there is a large credibility gap between theory and practice. Model lessons can be prepared to impress a visiting observer, but the preparation of many of these lessons require time for creative thought and time for execution and planning. Students of a class vary in intellect and personality. Byrne (1972) states that keen perception and awareness of these differences as well as a matching of content and teaching strategy to meet these individual differences are imperative to help the teacher effect innovation. It is important to keep the material being handled just sufficiently ahead of each student's capacity.

However, in most school systems, teachers are substitute clerks, members of vigilante groups roaming corridors to keep order, garbage pail inspectors on cafeteria duty, supervisors of bus loading, treasurers for book or sweater sales, etc. In the schools of the future, it is hoped that they will be released from these non-teaching tasks to the end that the quality of classroom teaching can be improved.

It is recognized by many that schools are a reflection of the existing society, transmitters of its culture and aims. Since it is felt that our society is geared to a consumer-producer mentality, it follows that an objective critic of our educational system, Byrne, (1972, p. 87) should state: "Given the assumption that schools are necessary for all children and that modern technology provides an efficient mechanism of production, education becomes the shotgun wedding of children and technology. The teacher's role in the arrangement is to conduct the marriage service between the child and technology."

This does not take the whole child into consideration. He becomes an object to be molded according to the dictates of the needs of society. Change must be sought within this framework. Bruner (1969) observes that students should move ahead at their own speed. This is quite valid. But, in actuality, teachers must compromise and adjust their teaching to the reality of a syllabus which is imposed on them by the School Board and which specifies a certain amount of content which must be covered within a given period of time. Also, allowance must be made for examinations to which all students are subjected in spite of the fact that many educators agree that projects and other tests of competence could be considered far superior to a formal examination. For both the student and the teacher, the examination becomes the goal of teaching, rather than the skills, techniques and content of the subject area.

These observations are not only local. In the April 17th issue of Time, David England, Executive Director of the Teachers' Association of Baltimore, writes:

> Job security in teaching, however, has all but disappeared. The nature of teaching is overcrowded, underequipped, urban-suburban and consolidated rural schools, the continued dependence of local boards of education on curriculum that are momentarily irrelevant to students, the pressure of diverse groups to make schools attentive to their separate needs, and the continued invasion of drugs and acts of violence --all these today make teaching a hazardous and unpredictable career.

Under such conditions, it is little wonder that the creative teacher is frustrated, his material is often second grade, and the young cry out for the promised land.

What guidelines can be offered to up-grade teaching and, particularly, the teaching of geography? Goodman (1969) claims that people can be taught anything with the use of proper techniques. While this statement is rather strong, we might well consider the point that he is making. We can successfully motivate students in the classroom providing the material we use makes sense and is useful. How do we determine this? Bruner (1969) would answer that we must restructure our teaching and we must key our efforts in terms of the way that the child sees things. If the subject taught is presented honestly in this way, effective learning can then occur in the student's development.

How does the teacher restructure his teaching in the way that a student sees his world? It must be noted that whatever the choice of the teacher becomes, his guideline still is the prevailing philosophy of the educational system he is in, the intended goal of achievement. Brearley (1967) points out that Piaget feels that a student must have a sound knowledge of spatial relationships to fully appreciate geography. Secondary school teachers must be aware that this mental development occurs at different levels with each child. To be guided to the unknown, the student must be led from the known. Therefore, it is essential for the teacher to be perceptive of how much and what each students knows.

Bloom (1956, p. 33) states that "problem solving or thinking cannot be carried on in a vacuum, but must be based upon knowledge of some of the realities." It must, however, be remembered that knowledge is never fixed nor finite. What may be accepted in 1972 may be outmoded or amended in 1982. A good example of this is the changing concept of the structure of the atom. This is proof of change and revision.

Knowledge becomes either the material with which the problem solving deals or it becomes the test of the adequacy and accuracy of the problem. Bloom (1956) points out that it is generally understood that material learned in an overall and related manner is better retained and comprehended than specifics learned in an isolated manner. However, the generalizations must be related to appropriate concrete phenomena. The compilation and development of facts gathered by the students in the bus route project which will be discussed fully in the following chapters bear out these observations.

James (1958, p. 67) calls students "little pieces of associating machinery", claiming that education consists of the organization of determinate tendencies to associate one thing with another, impressions with consequences, these with reactions, those with results, and so on. In addition to learning through this process of association, an object, even if it is not interesting in itself, may, through becoming associated with an object already stimulating interest, become more interesting in itself. Timing buses, charting data, graphing, evaluating and comparing schedules would be less interesting if learned one at a time than in a complete and progressing project. Assimilation of the material into more complex terms is more natural when done from point to point.

In addition to setting up associative systems, the study of the bus route exposes the student to an understanding of the organization and inter-relation of analysis. It teaches him the pattern and precise terms of applied graphing as well as a basic use of statistics. These skills can then be applied to other areas of study.

"If a student really comprehends something then he can apply it" (Bloom, 1956, p. 120). Comprehension is essential before application.

When a problem is presented, a student will look for familiar elements to guide his actions. He then will restructure the problem along these familiar elements until it falls into a classification to which he can apply a theory, principle, idea or method appropriate to the problem. In using this method, he can arrive at a solution. Here the student has transferred his training to serve him in the face of a new situation.

Bruner (1967) says that "human society is based on a response through reciprocity to other members of one's species." Where reciprocity is required for a group to attain an objective, there seems to be processes which carry the individual along into learning, developing a competence that is required in the setting of the group. This can provide a driving force to learn; this applies to the joint effort required in a group project. If the project relates to a situation which has real meaning in his life, the student is motivated even further, can better understand, remember longer, and more readily transfer what he has learned to new situations.

The above is relevant to the project of the bus route study explained in this monograph. Examining a route which the student uses daily, the student becomes involved in a reciprocity to his fellow students, the bus driver, the traffic (both pedestrian and driver) within the context of a meaningful event of his daily routine.

The Parent Report (1967) suggests using the surrounding environment as the starting point for many courses. This can provide a meaningful connection between daily life and more abstract ideas. From the familiar the student can be led to discover the unfamiliar. The relatedness of a concept derived from the study at hand to another area of a broader scope must be exploited. Exploring local regions presents a problem to teachers inasmuch as there is no previous research material to utilize. Starting from scratch, the teacher must structure his program to fit the needs of the students. He must match areas of endeavour to meet the abilities of the students. He must be aware of side interests which can result and must encourage these even if not being able to adequately encompass them.

However, the teacher must have sufficient background in his subject in order to effectively guide his students. The next two chapters present some of the techniques and applications in quantitative geography. Chapter III will describe the Kissling Model (Kissling, 1966) on which the major part of the classroom project is based.

CHAPTER II

BACKGROUND, DEVELOPMENT AND APPLICATION OF NETWORK ANALYSIS

Introduced by William Garrison in 1960, network analysis in geography, according to Haggett and Chorley (1970), has focussed on the structure and development of spontaneously developed networks. Mathematical problems are simplified using network theories. Many subjects can be generalized to the shape of networks, such as river morphology, transportation systems and regionalization. Haggett treats a road network into a Portugal town from its hinterland as a river system flowing into a sink.

Abler, Adams and Gould (1971) define networks as "structures designed to tie together various points which are located in one-, two-, and three-dimensional space." Unlike a map, the graphs and associated matrices allow us to examine entire systems (such as bus routes, subway lines, intercity transport systems, etc.) and their parts in terms of the whole.

Yeates (1968) names three components in which quantitative analysis is involved:

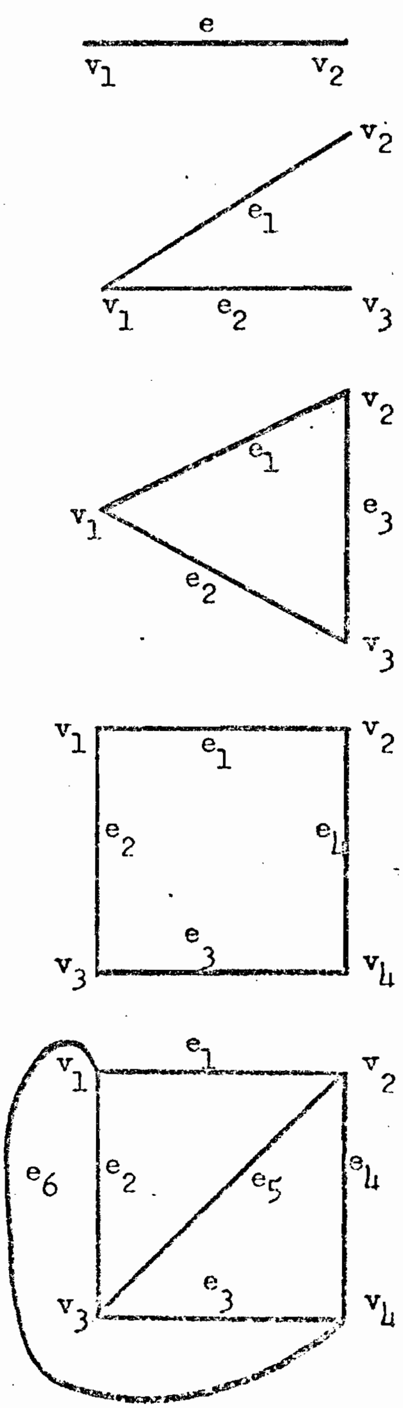
(1) the network of linkages in the transport system,

(2) the interrelationship of the network and the flows,

(3) the flows themselves.

A highly developed network system will have the greatest number of interconnections; quantitative geographers use the term "connectivity."

Yeates borrows from Kansky (1963) in arriving at a formula for connectivity: $B = \frac{e}{v}$, where B is the connectivity index (beta),



(a) $B = \frac{1}{2} = .50$

(b) $B = \frac{2}{3} = .66$

(c) $B = \frac{3}{3} = 1.00$

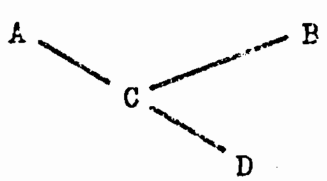
(d) $B = \frac{4}{4} = 1.00$

(e) $B = \frac{6}{4} = 1.50$

FIGURE 1. Connectivity Index in a simple network. After Yeates (1968) and Kansky (1963).

e is the number of edges or links, and v is the number of vertices or nodes. Figure 1 describes five simple networks and their connectivity index. Diagram (e) has the best connectivity (B = 1.50). It is obvious that when B = 0 that there is no network system.

King (1969, p.10) shows how to convert a simple network into a matrix (figure 2). He uses basic matrix algebra to arrive at a "connectivity" matrix. The matrix shows the direct two-way link in the network as one. Where there is no link it is shown as zero. Since a place is not connected to itself the matrix diagonal is obviously zero. In transportation geography, the matrix is raised to a power, which is the diameter of the matrix. Thus the square of the matrix gives the number of two-link connections between the pair of nodes. In other words, the exponent 2 in a matrix tells how many different ways one can go from one node to another node in the network in exactly two steps. By powering and summing the matrix until all zeros are eliminated from the matrix we arrive at a solution, where all the nodes are connected to each other. (See Appendix A for the method of how to multiply and add matrices). By adding the vertical columns in figure 2, it can be seen that node C has the best connectivity with a total of three links. An excellent description of the basics of matrices including a full application of the above process is given in Abler, Adams and Gould (1971, pp.256-263).

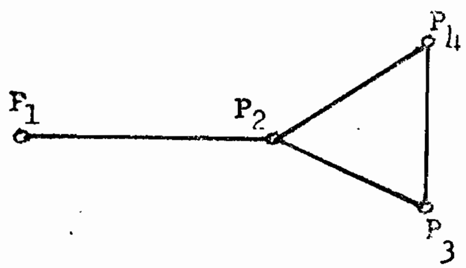


NODES	A	B	C	D
A	0	0	1	0
B	0	0	1	0
C	1	1	0	1
D	0	0	1	0
Totals	1	1	3	1

FIGURE 2.

The above principles are applied to transportation geography to find the best one-step, two-step, or for that matter, any number of steps, connectivity between nodes in a network. A matrix with a diameter of one shows the connectivity of any point in a network to any other point in one step. By squaring the matrix, we can show how to connect points in two steps. By adding the two matrices, we can show the connectivity of any two points in the network by either one-step or two-steps. By powering and summing matrices until all the zeros are eliminated we can arrive at the solution matrix. That is, all points are connected. The summing of rows in the solution matrix shows the best location within the network (the highest total). This process could be used by industry to find the most desirable location in a network of cities.

Abler, Adams and Gould (1971, p.262-263) uses a 4-location network to illustrate the above principle. (figure 3). C^4 is the lowest powered matrix with all zeros eliminated and we might presume that it is the solution matrix. This is true if all journeys must be done in exactly four steps. Thus, in C^4 there are two paths from P_1 to P_2 if we use only four steps: $P_1 \rightarrow P_2 \rightarrow P_3 \rightarrow P_2 \rightarrow P_1$ and $P_1 \rightarrow P_2 \rightarrow P_4 \rightarrow P_2 \rightarrow P_1$. In actual application there should be a choice. The actual solution matrix can be achieved by powering and summing matrices until all zeros have been eliminated (matrix T). Since matrix T is a combination of both C^1 and C^2 we may arrive at the conclusion that it shows the connectivity between points in either one or two steps. By totalling across the rows it may be seen that P_2 (total 8) is the best location in the matrix while P_1 (total 4) is the most isolated.



$= C^1 =$

	P_1	P_2	P_3	P_4
P_1	0	1	0	0
P_2	1	0	1	1
P_3	0	1	0	1
P_4	0	1	1	0

$C^2 =$

From: \ To:	P_1	P_2	P_3	P_4	Row Totals
P_1	1	0	1	1	3 (most isolated)
P_2	0	3	1	1	5
P_3	1	1	2	1	5
P_4	1	1	1	2	5

$C^3 =$

From: \ To:	P_1	P_2	P_3	P_4	Row Totals
P_1	0	3	1	1	5 (most isolated)
P_2	3	2	4	4	13 (best location)
P_3	1	4	2	3	
P_4	1	4	3	2	

$C^4 =$

From: \ To:	P_1	P_2	P_3	P_4	Row Totals
P_1	3	2	4	4	13 (most isolated)
P_2	2	11	6	6	25 (best location)
P_3	4	4	7	6	21
P_4	4	6	6	7	23

$C^1 + C^2 = T =$

From: \ To:	P_1	P_2	P_3	P_4	Row Totals
P_1	1	1	1	1	4 (most isolated)
P_2	1	3	2	2	8 (best location)
P_3	1	2	2	2	7
P_4	1	2	2	2	7

FIGURE 3. Graph C and its connectivity matrices.
After Abler, Adams and Gould (1971, p.262-263).

Kansky (1961, pp.31-32) and Abler, Adams and Gould (1971,p.259) describe the degree of connectivity of a network as the ratio of the existing number of routes to the maximum number of routes possible.

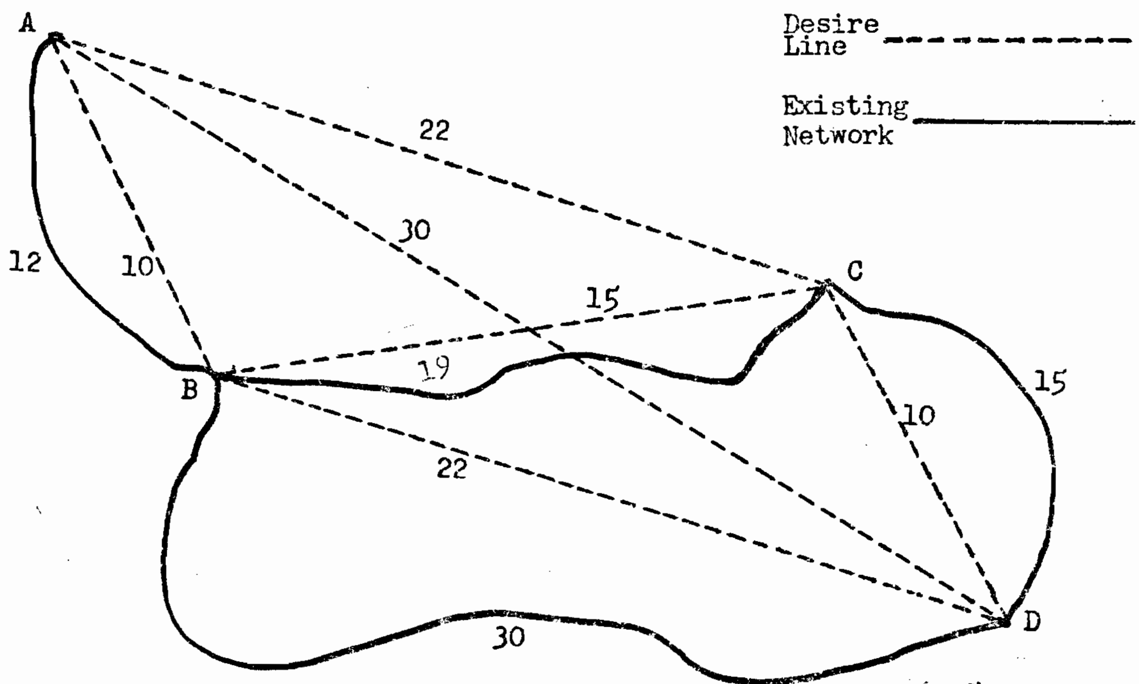
Figure 4 illustrates Kansky's "degree of circuity"as defined by the following formula:

$$\text{Degree of Circuity} = \frac{\sum_{i=1}^{n} (E - D)^2}{v}$$

Where: E is the existing route in miles (links)
D is the length of a "desire line" in miles
v is the number of vertices (nodes)

This formula compares an existing transportation system with an imaginary network. The latter network connects all vertices (nodes) by the shortest possible links (air distance). Kansky refers to this line as a "desire line". It is obvious that if the actual road network follows Kansky's desire line then the degree of circuity of the network would be zero. Thus, the lower the degree of circuity the more efficient the network. Using this system,transportation networks could be planned for maximum efficiency. Not only could the best location be found within a regional network, but the most desirable region could be arrived at using this model. However, it should be realized that this index may be completely different if other factors, such as population and economics are considered. That is, this index could be applied to shipping costs, school buses, speed maps, and other values.

Taaffe (1971) shows how network analysis developed from the earlier studies in transportation and spatial interaction and uses the Brazilian highway network as an example. Graph-theoretic methods were used in the study of accessibility of different points, the effectiveness



Desire Line Distance in Miles

	A	B	C	D
A	-	10	22	30
B	10	-	15	22
C	22	15	-	10
D	30	22	10	-

Existing Network in Miles (Shortest Possible Route)

	A	B	C	D
A	-	12	31	40
B	12	-	19	30
C	31	19	-	15
D	40	30	15	-

Difference in Miles (Existing - Desire)

	A	B	C	D
A	-	2	9	10
B	2	-	4	8
C	9	4	-	5
D	10	8	5	-

Difference in Miles^2

	A	B	C	D
A	-	4	81	100
B	4	-	16	64
C	81	16	-	25
D	100	64	25	-
TOTAL	185	84	122	189

DEGREE OF CIRCUITY

Individual Vertices: $A = \frac{185}{4} = 46.25$ $\quad B = \frac{84}{4} = 21.00$

$C = \frac{122}{4} = 30.50$ $\quad D = \frac{189}{4} = 47.25$

The Network: $$\frac{46.25 + 21.00 + 30.50 + 47.25}{4} = 36.25$$

FIGURE 4. Degree of Circuity, After Kansky (1963, p.31-32).

of different network calculations, and the hierarchy of the various urban centers. Each city in the Brazilian network was computed annually using a matrix of connections and accessibility. By comparing changes in accessibility to urban growth, they were able to minimize the transportation costs while improving transportation.

King, et al (1971) used a network analysis model to determine the optimal transportation patterns of coal in the Great Lakes region. Using the coal producing or receiving centers as nodes, their study investigated least cost flows from fifteen mining centers to nineteen receiving centers around the Great Lakes to supply coal to 139 thermal plants and 21 steel plants. Transportation costs were rail-lake rates over a 104-link transportation network. The connectivity is illustrated in a matrix table with fifteen coal nodes along the horizontal and nineteen receiving nodes along the vertical axes.

Herbert and Murphy (1971), using network analysis, derived an index of accessibility dependent only upon the topological structure of 80 American cities for 1934, 1940, 1950, 1960 and 1970. The authors then arrived at a generalization based on their results, which are quoted as follows:

> 1) Accessibility surface created by drawing isolines reveals a trend from a moderately peaked surface in 1934, to a highly peaked and highly polarized surface by 1970.
> 2) The highest peaks of accessibility have migrated from the southwest in 1934 to the American Manufacturing Belt by 1970.
> 3) Several regional peaks have stabilized as early as 1934.

Morrison (1970) refers to the introduction of quantitative techniques as the "most revolutionary change in the nature of geography in the last decade." In his traffic study of four towns in Great Britain, he illustrates the value of using quantitative methods in teaching geography in co-operation with mathematics teachers. He concludes that the use of models in a network analysis study should be applied to the classroom to make geography more interesting.

Burton (1968) refers to the impact of quantitative approach in geography upon the curriculum of the North American Univesities. Courses based on this approach are now requirements for the graduate studies program. He illustrates the importance of mathematics in geography by showing how geographers are using the mathematical approach to solve their problems. He shows the application of network analysis on such studies as "drainage networks, highway networks, power distribution systems, flood problems, airline routes, social organization, and the venation of leaves." The application of graph-theory mathematics to analyze all manner of collection, distribution, and communication systems is discussed at length.

Abler, Adams and Gould (1971, p.268) illustrate the use of matrix and graph methods in plotting the centermost place in the mid-west regional system of America, proving the unchallenged leadership of Chicago. The effect of the removal of a link in the network is well illustrated. (This will be discussed in Chapter III using the Kissling Model). Points, lines, areas and volumes are basic to the study of movement in geography. However, it is very difficult to map flows and changes in time using the familiar techniques of geography. The quantitative methods, especially the use of matrices, open up a new and efficient method of solving transportation problems which were previously almost impossible to solve. The planning of bus and other transportation routes to connect points in a city or region can be done quite effectively using quantitative methods. These techniques can even be applied in small areas, such as eliminating dead ends in road networks, supermarket layouts (aisles and shelves), etc. In the modern urban rush to efficiency where time and costs are so important, we must reach our objective by the least net effort. One of the classic examples of least net effort is the "travelling salesman path" described in Abler, Adams and Gould and in many other texts on quantitative methods.

The analysis of telephone messages between 12 cities (figure 5) is an excellent examples of the use of a matrix to show how "...telephone calls reflect the prevailing structure of linkages and dominance" (Abler, Adams and Gould, 1971, p.265). This method has many uses in transportation geography from studying shipping costs between points to assessing the traffic in a school building. As a field project, students could be spaced along a bus route to record the number of passengers getting on and getting off at each stop. This is similar to the school project Morrison used in his study. (p.18) However, this system could have a drawback as it would require the students to question each passenger as to their point of origin. Like Morrison's project, it would also require a certain amount of synchronization. Ideally, the best time would be outside the rush hour to be able to get more accurate results. By combining their results, the students would be able to build up a population study on one bus route at a given time. Simultaneously, other groups could be collecting data on other bus lines. By combining their results (in the classroom) a complete network of bus transportation could be developed in a matrix similar to the telephone matrix described above.

Probably the easiest and most desirable place to conduct such an experiment with the least possible effort would be in the school corridors. Through the use of prepared questionnaires, data could be easily collected on the points of departure and destination of each student within the building. Following the techniques described in Chapter IV, a complete network could be completed, showing not only the traffic flow within the building, but also the points of dominance. Most important of all, the

To City[+]

From City	a	b	c	d	e	f	g	h	i	j	k	l
a	0	**75**	15	20	28	2	3	2	1	20	1	0
b[++]	**69**	0	45	50	58	12	20	3	6	35	4	2
c	5	**51**	0	12	40	0	6	1	3	15	0	1
d	19	**67**	14	0	30	7	6	2	11	18	5	1
e[++]	7	40	**48**	26	0	7	10	2	37	39	12	6
f	1	6	1	1	10	0	**27**	1	3	4	2	0
g[++]	2	16	3	3	13	**31**	0	3	18	8	3	1
h	0	4	0	1	3	3	6	0	12	**38**	4	0
i	2	28	3	6	43	4	16	12	0	**98**	13	1
j[++]	7	40	10	8	40	5	17	34	**98**	0	35	12
k	1	8	2	1	18	0	6	5	12	**30**	0	15
l	0	2	0	0	7	0	1	0	1	6	**12**	0
Column Totals[+++]	113	337	141	128	290	71	118	65	202	311	91	39

[+] Largest flow in each row in boldface.

[++] Largest flow from these cities is to a smaller city; thus they are dominant centers.

[+++] A city's size is determined by the number of messages it receives (column totals).

FIGURE 5. Telephone Message Flows Among 12 Cities per Unit Time. After Abler, Adams and Gould (1971,p.265).

students will recognize that this is "their thing" and in the process will learn some of the basic techniques of quantitative geography to prepare them for more advanced studies in that field.

Kimball (1971) uses a similar technique but employs Electronic Data Processing (E.D.P.) to arrive at the solution for routing of school buses. However, this method is too complicated for the secondary students involved in the project and will not be discussed further in this paper. It is worthy to note that Kimball justifies the use of E.D.P. by the realization that it cuts time and costs involved in routing school buses.

Morgan and Kurtzman (1969) employ the use of quantitative methods to study the effect of the students' travelling distance from school against the students' participation in extra curricular activities. Weights were assigned to each activity according to the response of the pupils and a score was arrived at for each item. Since in most regional school districts the distances from home to school were quite long, they were categorized into three groups: less than one mile (walking distance), one to ten miles (bicycle range), and over ten miles (bus travel).

In summary, it is obvious that there are many techniques that can be adapted to the secondary school class room. One of the easiest to employ, with modifications, is that used by Kissling, described in the chapter that follows.

CHAPTER III

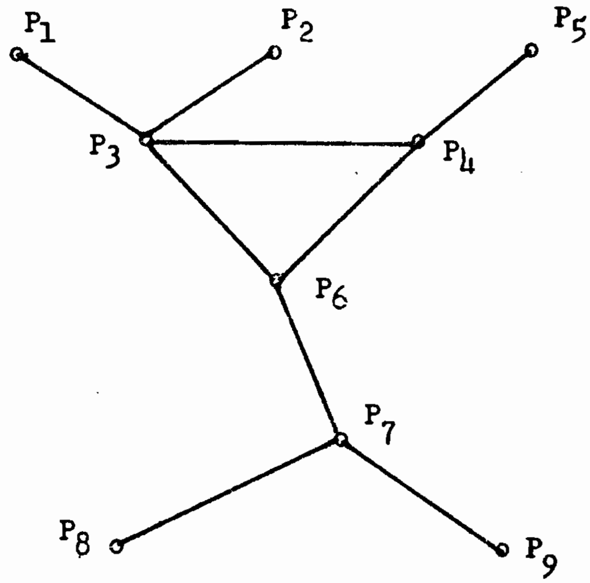
NETWORK ANALYSIS IN PRACTICE - THE KISSLING MODEL

Kissling (1966) presents a good model for the student project. Unlike Abler, Adams and Gould's model (page 13), he applies weighted factors to an imaginary network (figure 6). He then carries his ideas one step further by applying the graph theoretic measure of network dispersion as outlined by Shimbel (1953) to a simplified version of the main highway system of Nelson, New Zealand. (figure 7). (Kissling, 1966, p.56).

In Chapter II, the network was described in its matrix by either a zero or a one. Kissling, however, places a number in the matrix denoting the amount of steps (links) required to go from one node to another within the network. (figure 6). For example, to go from node P_1 to node P_7 requires movement along three links. The number, then, is shown in the matrix cell as three. This sample network can be applied to real life models by placing the figures of the project being measured in the matrix. Figure 5 (Chapter II) applies similar principles to measure telephone calls between cities. However, using this type of model, many variables, such as time, distance, shipping costs, population flow, raw material flow, etc., can be measured.

In the imaginary network in figure 6, Kissling uses Shimbel's measure of accessibility to locate the most desirable location in the network in terms of minimum steps. The lowest total across the row provides the best measure of accessibility within the network. Since all traffic is two-way, the sums across the rows are the same as the sums down the columns, and the network figures below the diagonal are an image of those above it.

NETWORK GRAPH



NETWORK MATRIX

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9
P_1	x	2	1	2	3	2	3	4	4
P_2	2	x	1	2	3	2	3	4	4
P_3	1	1	x	1	2	1	2	3	3
P_4	2	2	1	x	1	1	2	3	3
P_5	3	3	2	1	x	2	3	4	4
P_6	2	2	1	1	2	x	1	2	2
P_7	3	3	2	2	3	1	x	1	1
P_8	4	4	3	3	4	2	1	x	2
P_9	4	4	3	3	4	2	1	2	x

FIGURE 6. Network Graph and Matrix.
After Kissling (1966, p.21).

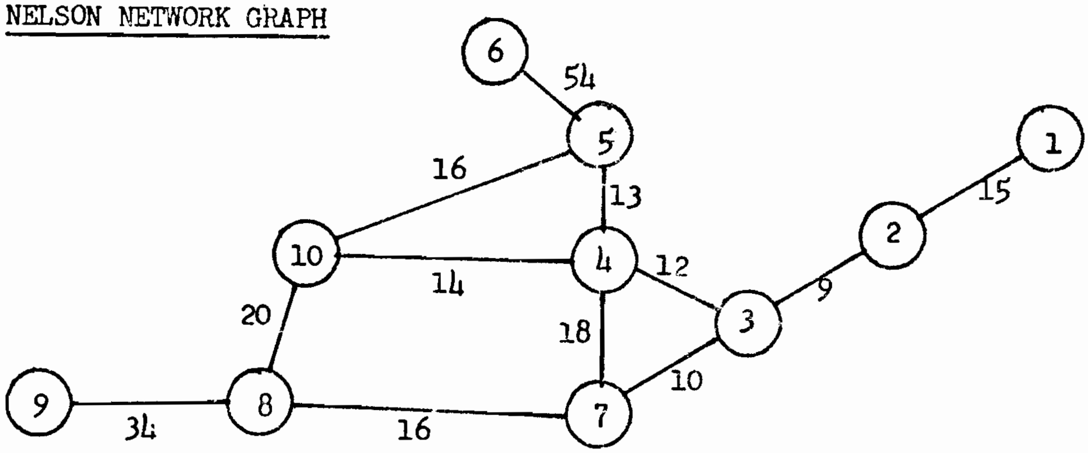
Imagine that figure 6 represents a road network and that the link joining P_3 and P_4 is one-way (P_3 to P_4). Then to go from P_5 to P_1 would require four steps instead of three, but to go from P_1 to P_5 would still take three steps. By changing one or more of the links to one-way it alters the matrix and its corresponding accessibility values.

Kissling uses the model described in figure 7 to illustrate the effect on the accessibility and dispersion values of altering some of the links in the network. In a 10 x 10 matrix, he shows how summing the rows provides the "Shimbel" accessibility measure for each node. In the model (figure 7), row 11 shows node 3 as the most accessible with a value of 271, while node 6 is the least accessible with a value of 760.

He then shows the effect of considering only nodes 2, 4, 6 and 8. The result (column 12) shows node 4 as the most accessible with a reading of 122. Thus, by removing or adding links, an entire network can be altered to obtain the optimum results. Kissling also shows the effect of assigning different functions to each node, such as centres of population, highway intersections, and air and sea transportation centres (see Kissling, 1966, figure 2-3, p.26).

Kissling then continues his analysis of the Nelson network by applying "Shimbel's (1953) graph theoretic measure of network Dispersion." The network Dispersion index is obtained by summing the accessibility values in row 11 (figure 7). It indicates the relative distance from each other of all the nodes within the network. A very low index would indicate that the nodes are clustered together; conversely, a high index indicates a widely dispersed system. Any changes within the network would alter the Dispersion index and would show the relative value of any link by adding or removing it. The relative value of removing different links is indicated by the change in the Dispersion index. That is, the greater the

NELSON NETWORK GRAPH



NELSON NETWORK MATRIX

	1	2	3	4	5	6	7	8	9	10	(11)	(12)
1	x	15	24	36	49	103	34	50	84	50	445	
2	15	x	9	21	34	88	19	35	69	35	325	144
3	24	9	x	12	25	79	10	26	60	26	271	
4	36	21	12	x	13	67	18	34	68	14	283	122
5	49	34	25	13	x	54	31	36	70	16	328	
6	103	88	79	67	54	x	85	90	124	70	760	245
7	34	19	10	18	31	85	x	16	50	32	295	
8	50	35	26	34	36	90	16	x	34	20	341	159
9	84	69	60	68	70	124	50	34	x	54	613	
10	50	35	26	14	16	70	32	20	54	x	317	
									Dispersion		3978	

FIGURE 7. The Nelson, New Zealand, Network Graph and Matrix. After Kissling (1966, p.57-58).

positive change in the index by removing a link, the greater is the value of that link. Conversely, the same condition is true by adding new links, except that the Dispersion index is lowered. (Kissling,1966, p.58-62).

The above discussion is continued by Kissling (1967) using a different sample network. He compares peripheral with central locations and states that "centrally located places in a system tend to be more accessible to all others than do peripheral locations because total distances are minimized." He then concludes that the Shimbel accessibility measure may lead to false impressions.

In the chapter that follows, the gradual development of the bus routes culminate in a series of matrices similar to the ones described above. By using the Shimbel measure, it will be possible to compare the nodes within each bus route, taken separately, and finally culminating in a comparison of the 14 bus routes using the Dispersion Index.

CHAPTER IV

NETWORK ANALYSIS IN THE CLASSROOM - THE STUDENT PROJECT

INTRODUCTION

When this project was carried out, in the spring of 1972, Chomedey Polyvalent High School contained about 3,000 students. About half of these were Junior High School students, aged 12 to 15. Due to the fact that the school could only accommodate about 1,800 students, it was run on an overlapping system and serviced by a fleet of about 36 private school buses. The 38 students involved in this project were in the Junior group and were bused in 14 buses up to distances of about seven miles. These buses traversed a network of roads, under varying conditions of traffic, which resulted in achieving data which provided interesting comparisons. As the students were quite young and about half of them were non-academic, the project had to be well planned in advance to challenge each student at his level of ability.

The class was divided into several groups, with the brighter students acting as team leaders. However, there were five students who did not take buses and they were placed in one group. In order to give them the same experience as the other students, they were taken by car along one of the bus routes. Equipped with stop watches and the necessary data sheets, each student in the car was allotted a job. One student timed the distance between stops, two students counted the number of students leaving the bus at each stop, one student read the odometer (mileage indicator) in the car and the fifth student wrote down the information as it was called out. Besides giving the students the feeling that they too were doing their part, it also supplied the information for a fairly accurate model. They were able to cover the entire route which some of the bused students did not do unless they went to the end of the line. Each student was dropped off at the bus stop nearest to his (or her) home. This made provision for completing the walking data on the worksheet. Actually, this proved both interesting and enjoyable for the students and the driver.

PREPARATION

Prior to starting the project, it was important, on the part of the teacher, to have some basic knowledge of network analysis to ably handle the problems that arose as well as to give the project a definite goal. A description of the various techniques used by quantitative geographers, taken from the texts listed in the bibliography, provided the necessary material. These techniques have been outlined in the preceding two chapters.

The second phase consisted of preparing the necessary materials, such as maps, blank data sheets, graph paper, bristol boards, for each student in the project. Also, each student was given a labelled file folder for his material. Printed flexible tapes (1/16 and 1/32 inch) were purchased, quite inexpensively, to be used for clear routing and graphing. This tape is very popular today in drafting and planning rooms. Its flexibility allows for easy application to maps and graphs, and can be obtained in many designs, such as stars, asterisks, various dotted lines, etc. Maps were obtained by xeroxing, in sections, a large scale map of the region (City of Laval). These provided excellent base maps for each student (see Appendix C, maps). As each phase of the project was completed, the material was added to each student's file. At the same time, the resulting charts, maps, diagrams, graphs, etc., were copied in the Xerox so that a master file was simultaneously printed for the entire network (see Appendix C).

The students were advised which type of equipment to purchase. This included colored pencils, scotch tape, geometry sets, letraset sheets for lettering, and any other material which proved useful.

DATA COLLECTING

Each student on the project was given at least three copies of Worksheet No. 1 (p.31). Additional copies were available if and when required. Ideally, this type of project should be done in a concerted effort during one observation. The best results can then be obtained, eliminating the possibility of buses being switched, students changing buses or students leaving late. In actual experience, it was almost impossible to be accurate due to the irregularity of student departures from school. Such interferences as after-school activities, absenteeism, visits with friends in different areas, etc., resulted in inaccuracies. However, this enhanced the learning process inasmuch as it made the students aware of some of the problems involved in collecting accurate data. This can be applied to enumerations for an election, planning city bus routes, picking a good business location according to population flow, etc. It was agreed, therefore, to synchronize the activities as much as possible.

The two items that were most affected by the variations in the data collected were the number of students on the respective buses and the time between the nodes. This was well illustrated when Route G was subsequently examined. It showed that the time taken to cover the distance was directly proportional to the number of students on the bus. (See Comparison Sheet, p. 47). Kissling (see chapter 3) showed that changes in the network, by removing some of the links in his Nelson model, resulted

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA							ROUTE:
BUS NO. DATE	NAME OF STUDENT						
INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES			
				BOYS	GIRLS	TOTAL	
1. Chomedey High (start)							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							

WALKING DISTANCE (Bus to House) ________ X ________ = ________
No.of paces   Length of pace (feet)   Distance in feet

WALKING TIME (Bus to House) ________ SECONDS

WALKING RATE = Dist./Time = ________ FEET PER SECOND.

in a different accessibility rating and Dispersion Index.

The students were instructed to write down in the node column all the key intersections on their route, especially those where school bus routes crossed. The reason became apparent later on in the project when the overall network map (inset) was completed and they were able to observe the intersections of the routes.

The most difficult job was recording the distances. A few of the students were fortunate to have bus drivers who spoke English and were willing to co-operate by calling out the odometer readings at each node. Also, students not involved in the project willingly gave up the seat behind the driver to make this possible. Unfortunately, this was the exception rather than the rule. However, this problem was overcome with the arrival of spring, when the students were able to cover the route on the weekend on their bicycles or by car and use the odometers in the vehicles to record the necessary information.

The time calculated included the stopping time at the nodes. The students were asked to record the results in seconds so as to avoid the use of decimals or fractions. Some of the students, however, recorded only the time the bus was in motion. This created a delay in the program to allow for retakes involving the same number of students. Some difficulty in obtaining the readings, due to human error in handling the stop watches used, was another factor. However, one of the students suggested comparing the results of the summation of the time column with the actual total time taken to cover the entire route. If, for example, the summation over ten nodes was 500 seconds while the actual total time was 550 seconds. To account for the difference of 50 seconds, five seconds can be added to each node thus giving a more realistic figure. To avoid retakes, it was decided to take the figures of those students who showed maximum time.

Finally, the students counted the number of natural steps to their home from the bus stop as well as the time to do the distance. The calculation of their length of pace and the walking rate provided a useful exercise in the classroom although it had no actual place in the project, as a whole.

The information collected on the bus was then processed at home and all the necessary calculations were completed and neatly recopied, onto the student's second sheet. Each group then met in the classroom and arrived at a compromise on figures which did not agree. Thus the data for each bus, which was finally recorded and xeroxed, was uniform.

The walking distance was easily calculated by using a 100 foot length of the corridor. Since the floor was covered with tiles measuring one foot square, it was a simple matter to count the number of paces over a length of 100 tiles. Thus, if it took 37 steps to cover 100 feet, it was easily calculated that the length of the pace was 100/37 or 2.7 feet. A student who took 350 paces to walk home from the bus stop walked a distance of 350 x 2.7 or 945 feet. The data thus calculated was then placed on a data sheet (Worksheet No. 1) and then, by applying the formula of rate = distance / time, the student's walking rate of 2.1 feet per second was calculated. The results were posted on Worksheet No. 1 (See Bus 32, Route E).

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: E

Samson -Havre des Iles

BUS NO. 32 DATE: Feb.28,1972. NAME OF STUDENT C. Wilson.

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	22.2	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	22.3	.10	20	00	00	00
3. Chomedey - Notre Dame	22.9	.60	85	00	00	00
4. Notre Dame - Labelle	23.4	.50	90	00	00	00
5. Labelle - 7th	23.7	.30	60	01	02	03
6. Labelle - Samson	24.0	.30	50	02	01	03
7. Samson - 85th	24.3	.30	40	04	07	11
8. Samson - 92nd	24.5	.20	70	04	02	06
9. Samson - 95th	24.9	.40	45	03	05	08
10. Samson - 100th -Levesque	25.3	.40	65	03	01	04
11. Levesque - Prom.des Iles	25.6	.30	45	01	01	02
12. Prom.des Iles-Havre Iles	26.0	.40	30	02	01	03
13. Prom.des Iles-Levesque	26.8	.80	30	00	00	00
14. Prom.des Iles- Samson	27.1	.30	20	00	00	00
15.						
16. TOTALS		4.9	650	20	20	40
17.						
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 350 (No.of paces) X 2.7 (Length of pace (feet)) = 945 (Distance in feet)

WALKING TIME (Bus to House) 450 SECONDS

WALKING RATE = Dist/Time = 2.1 feet per second.

DATA PROCESSING AND ANALYZING

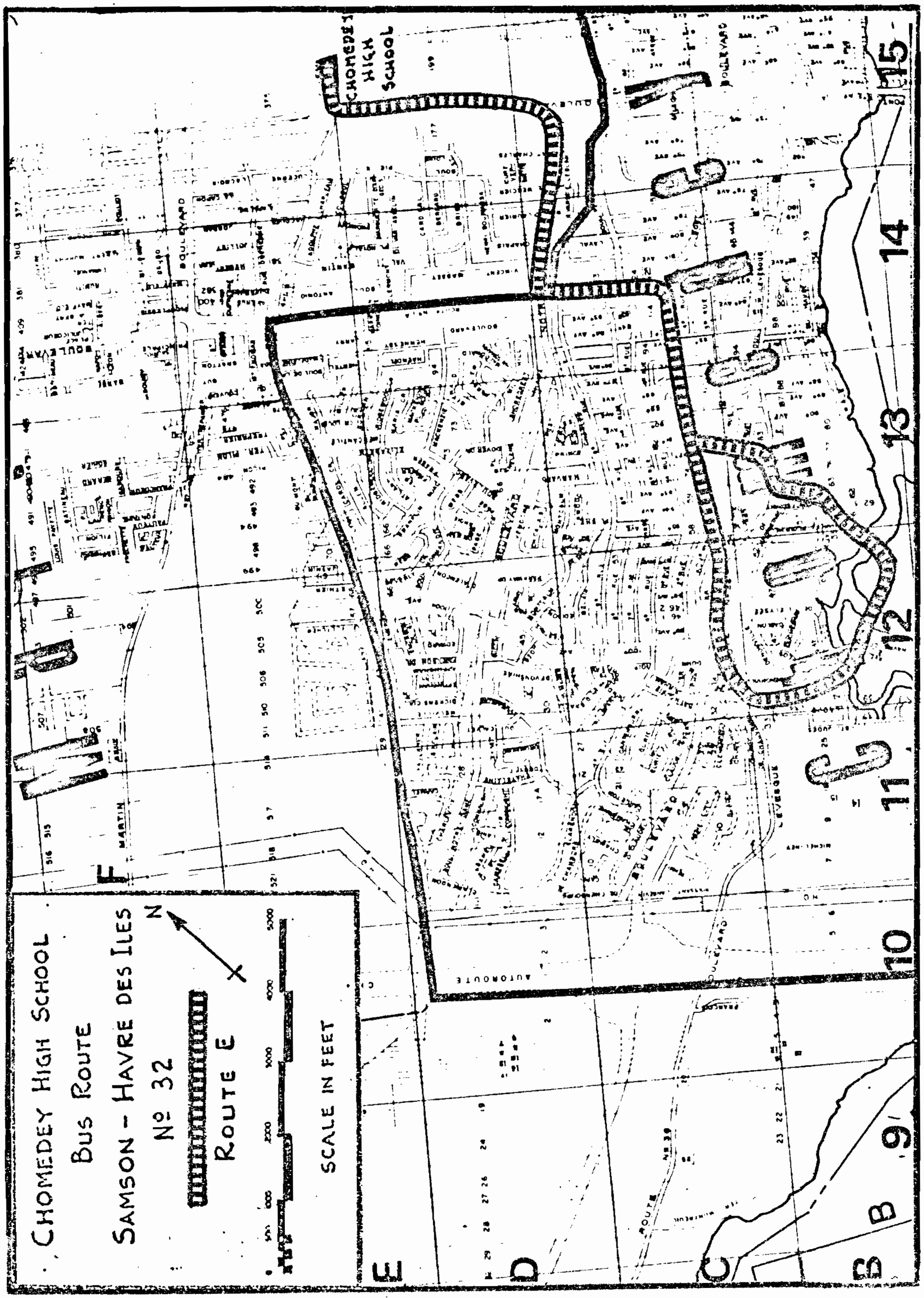
This unit involved the processing of the data collected in the field by transferring numerical figures on to maps, diagrams, graphs, and finally the matrices themselves, the main objectives of the project.

Maps

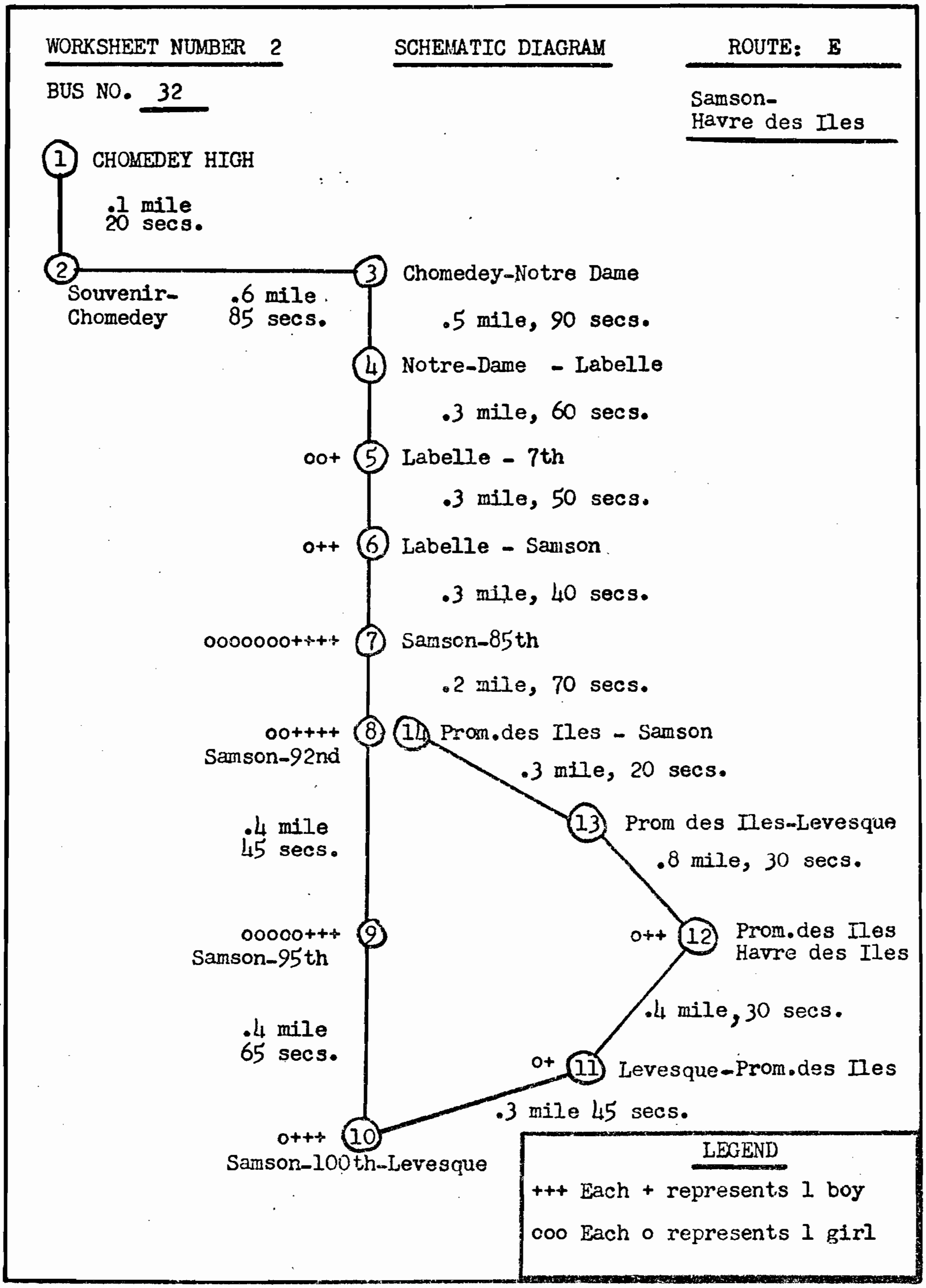
The base maps, which were prepared in advance, were now placed in the file folders and distributed to the students. They were required to colour in all the nodes on the map with a red pencil. Working in teams, and referring to the master map on the wall, the students placed the points of reference, legend, scale and route identification on their maps. The maps were then used as a guideline to draw a schematic diagram.

Schematic Diagram (Worksheet No. 2)

This diagram provided a useful experience in spatial design, and proved to be one of the more difficult assignments. The students were required to sketch a rough diagram in the classroom and to redraw it neatly at home on 8-1/2 x 14 paper. It would have been much easier to use large size drawing paper (or bristol board) especially for the weaker students. However, even though in the latter group the work was poor, it still provided a good learning situation in drawing within a specified area. The students were able to see a fairly good representation of the route of their bus with all the data placed in such a way as to allow them to visualize graphically the information they had collected in their field work. The students were then able to use both worksheets to complete their histograms, ogives and matrices. Freund (1970, p.18 - 24) gives a good description and definition of histograms and ogives to show frequency distributions. He writes: "The number of ways in which frequency distributions can be



Chomedey High School
Bus Route
Samson - Havre des Iles
No 32
Route E
Scale in feet
Chomedey High School


WORKSHEET NUMBER 2
SCHEMATIC DIAGRAM
ROUTE: E
BUS NO. 32
Samson-
Havre des Iles
1 CHOMEDEY HIGH
.1 mile
20 secs.
2
Souvenir-
Chomedey
.6 mile
85 secs.
3 Chomedey-Notre Dame
.5 mile, 90 secs.
4 Notre-Dame - Labelle
.3 mile, 60 secs.
oo+ 5 Labelle - 7th
.3 mile, 50 secs.
o++ 6 Labelle - Samson
.3 mile, 40 secs.
ooooooo++++ 7 Samson-85th
.2 mile, 70 secs.
oo++++ 8
Samson-92nd
14 Prom.des Iles - Samson
.3 mile, 20 secs.
.4 mile
45 secs.
13 Prom des Iles-Levesque
.8 mile, 30 secs.
ooooo+++ 9
Samson-95th
o++ 12 Prom.des Iles
Havre des Iles
.4 mile, 30 secs.
.4 mile
65 secs.
o+ 11 Levesque-Prom.des Iles
.3 mile 45 secs.
o+++ 10
Samson-100th-Levesque
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl

displayed pictorially is practically unlimited, and it depends only on the imagination and the artistic talent of the person who is preparing the presentation."

Histograms and Ogives (Worksheet No. 3a and 3b)

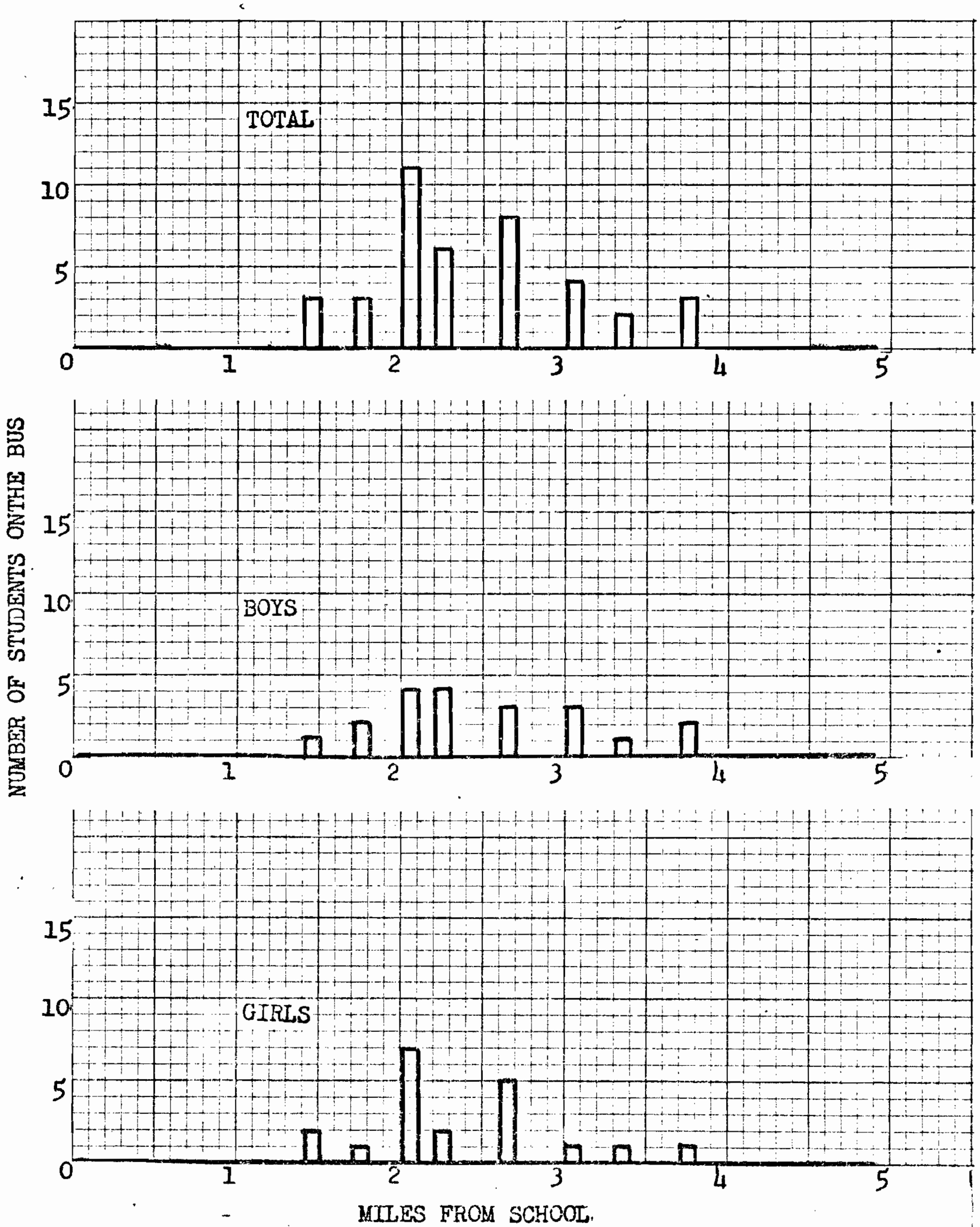
The histograms presented very little difficulty for the students as most of them had been taught how to interpret them in elementary school. When completed, they showed graphically the variations in the number of students leaving the bus at each node. Some of the students questioned the need to show boys and girls separately. It actually served no real purpose other than to show three samples instead of one. The ogives on the following page shows an almost normal curve for the boys but an irregular one for the girls.

The ogives were much more difficult to draw since none of the students had ever seen one. These were drawn on separate graph paper using flexible tape (see Worksheet 3b). Unlike the illustration, they were drawn on a larger scale and showed the variations more effectively. The ogives showed the number of students on the bus at any given distance from school and at the same time showed the rate of disembarkation.

By comparing the histograms and ogives (see following pages), the students were able to arrive at the conclusion that the more uniform the distribution of students along the route, the straighter the slope of the ogive. For example, the girls' histogram of route E, between 3 and 3.8 miles, showed one student leaving the bus at each of three stops in a regular interval. Therefore, the ogive showed a straight line between these points. It also became clear that a change in slope indicated an uneven distribution of students and/or distance.

WORKSHEET NO. 3(a) HISTOGRAMS ROUTE: E

BUS NO. 32 SAMSON -HAVRE DES ILES



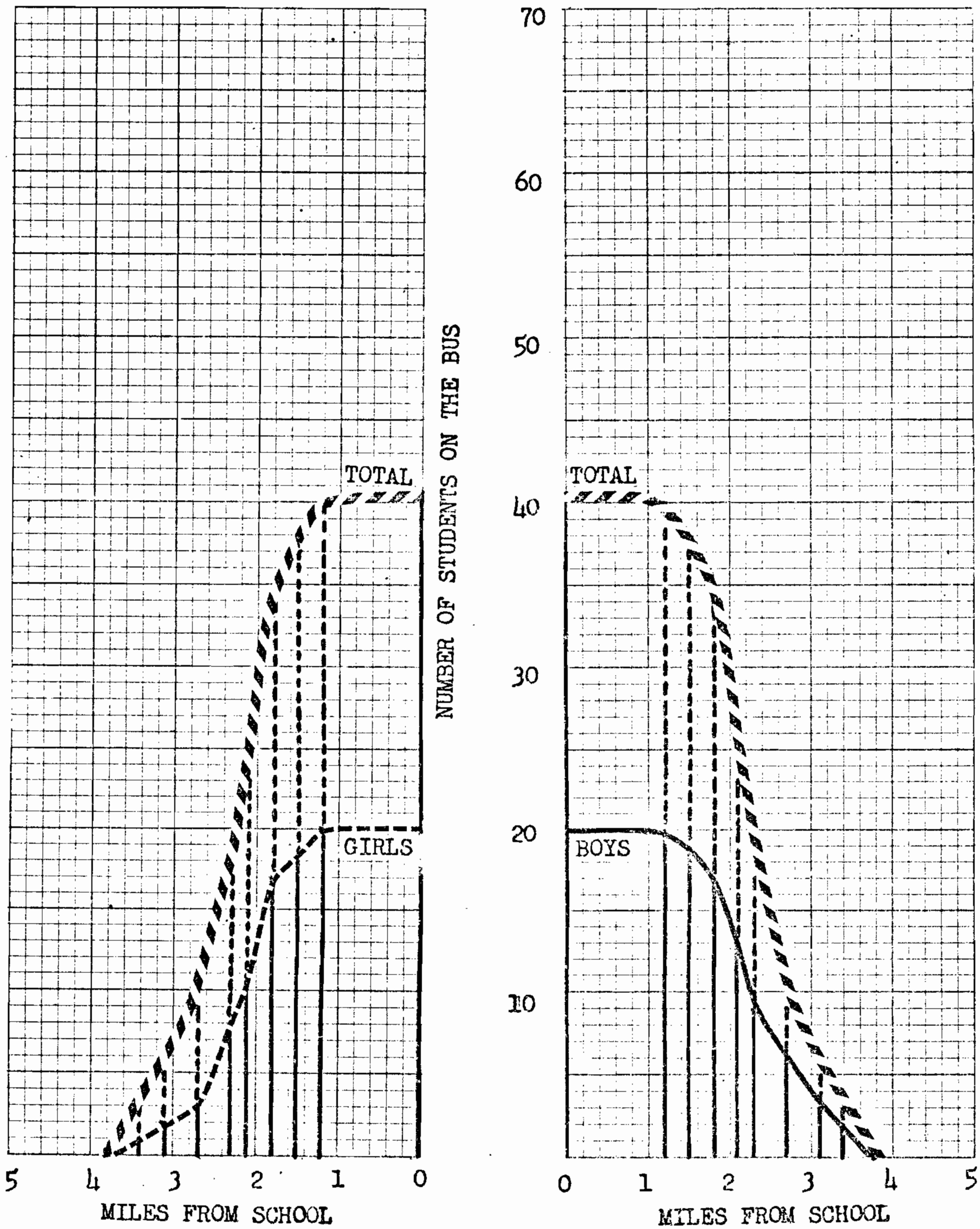
WORKSHEET NO. 3(b)

OGIVES

ROUTE: E

BUS NO. 32

SAMSON - HAVRE DES ILES



An even better illustration of irregularities is apparent in the ogive of route K which shows continuously changing slopes. By comparing the ogives with their histograms, the reason becomes obvious.

An evaluation of the preceding exercise showed that most of the students required a great deal of help in interpreting the graphs. Yet, it was still a useful exercise to serve as an introduction to graphical analysis. The next phase of the program (matrices) proved to be the most interesting.

Constructing the Matrix

The Kissling model described in chapter III provided ideal background for building the matrices of distance and time. It was decided to approach this phase of the program cautiously so as to avoid proceeding beyond the level of ability of the students. With this in mind, it was found that completion of the matrices, followed by a comparison of the dispersion indices for the 14 buses studied, provided a good terminating point for the project. The method of building both matrices is identical, except for the data used.

At this point in the program, each student's file had been completed. The processed data now served as a base for constructing the desired matrix. Each file now contained two blank 18 x 18 matrices, which had been mimeographed in advance, with extra copies available as required.

Since there is no connection between a node and itself, the matrix was started by placing zeros in the diagonal. The second step was to fill in the values along each horizontal row, starting at row one. This process was not too difficult using the schematic diagram (Worksheet No.2). By adding the values between the desired nodes, the value of the required matrix cell was easily obtained. For example, the distance between nodes five and eight is 0.8 (0.3 + 0.3 + 0.2 = 0.8). This value was then placed in the cells of the matrix where row five and column eight and row eight and column five intersected. Taking one cell at a time the matrix can be easily constructed. However, this method can be time consuming since there are 196 cells in a 14 x 14 matrix (route E). It also does not produce a detailed list of calculations and makes it difficult to check for errors. However, for the students taking part in the project the method was quite satisfactory as it is very simple and easy to understand.

A more efficient method to construct the matrix is described in Appendix B, which provides a table of values which in itself is important since it allows the results to be checked for errors. Once the idea is understood it is superior to the method described above. However, it is recommended only for the more advanced students.

In the analysis that followed it was noted that the figures below the matrix diagonal were an image of those above the diagonal. The reason was not obvious at first. However, a comparison of the telephone matrix described on page 21 and the preceding matrices provided the answer. The conclusion was that they are an image of each other only if there is a two-way traffic between the nodes. Since all the students travel two ways along the same route, the resulting matrices are imaged. It was concluded that, in any network, if even one of the links is a one-way route there is no imaged network.

To complete the matrices, each row was totalled. The sum of each row in the matrix shows the accessibility of the node in the network. The lowest value (17.4) showed that nodes seven and eight were the most accessible while the highest value (36.4) showed that node 14 was the least accessible. At this stage each student was able to evaluate his own accessibility but only within his own bus route. However, by totalling the accessibility column he was able to obtain Kissling's Dispersion Index.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1	0.0	0.1	0.7	1.2	1.5	1.8	2.1	2.3	2.7	3.1	3.4	3.8	4.6	4.9	32.2
2	0.1	0.0	0.6	1.1	1.4	1.7	2.0	2.2	2.6	3.0	3.3	3.7	4.5	4.8	31.0
3	0.7	0.6	0.0	0.5	0.8	1.1	1.4	1.6	2.0	2.4	2.7	3.1	3.9	4.2	25.0
4	1.2	1.1	0.5	0.0	0.3	0.6	0.9	1.1	1.5	1.9	2.2	2.6	3.4	3.7	21.0
5	1.5	1.4	0.8	0.3	0.0	0.3	0.6	0.8	1.2	1.6	1.9	2.3	3.1	3.4	19.2
6	1.8	1.7	1.1	0.6	0.3	0.0	0.3	0.5	0.9	1.3	1.6	2.0	2.8	3.1	18.0
7	2.1	2.0	1.4	0.9	0.6	0.3	0.0	0.2	0.6	1.0	1.3	1.7	2.5	2.8	17.4
8	2.3	2.2	1.6	1.1	0.8	0.5	0.2	0.0	0.4	0.8	1.1	1.5	2.3	2.6	17.4
9	2.7	2.6	2.0	1.5	1.2	0.9	0.6	0.4	0.0	0.4	0.7	1.1	1.9	2.2	18.2
10	3.1	3.0	2.4	1.9	1.6	1.3	1.0	0.8	0.4	0.0	0.3	0.7	1.5	1.8	19.8
11	3.4	3.3	2.7	2.2	1.9	1.6	1.3	1.1	0.7	0.3	0.0	0.4	1.2	1.5	21.6
12	3.8	3.7	3.1	2.6	2.3	2.0	1.7	1.5	1.1	0.7	0.4	0.0	0.8	1.1	24.8
13	4.6	4.5	3.9	3.4	3.1	2.8	2.5	2.3	1.9	1.5	1.2	0.8	0.0	0.3	32.8
14	4.9	4.8	4.2	3.7	3.4	3.1	2.8	2.6	2.2	1.8	1.5	1.1	0.3	0.0	36.4
													DISPERSION		334.8

BUS NO. 32. SAMSON - HAVRE DES ILES   MATRIX OF DISTANCE IN MILES   ROUTE: E

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1	000	020	105	195	255	305	345	415	460	525	570	600	630	650	5075
2	020	000	085	175	235	285	325	395	440	505	550	580	610	630	4835
3	105	085	000	090	150	200	240	310	355	420	465	495	525	545	3985
4	195	175	090	000	060	110	150	220	265	330	375	405	435	455	3265
5	255	235	150	060	000	050	090	160	205	270	315	345	375	395	2905
6	305	285	200	110	050	000	040	110	155	220	265	295	325	345	2705
7	345	325	240	150	090	040	000	070	115	180	225	255	285	305	2625
8	415	395	310	220	160	110	070	000	045	110	155	185	215	235	2625
9	460	440	355	265	205	155	115	045	000	065	110	140	170	190	2715
10	525	505	420	330	270	220	180	110	065	000	045	075	105	125	2975
11	570	550	465	375	315	265	225	155	110	045	000	030	060	080	3245
12	600	580	495	405	345	295	255	185	140	075	030	000	030	050	3485
13	630	610	525	435	375	325	285	215	170	105	060	030	000	020	3785
14	650	630	545	455	395	345	305	235	190	125	080	050	020	000	4025
													DISPERSION		48250

BUS NO. 32. SAMSON - HAVRE DES ILES   MATRIX OF TIME IN SECONDS   ROUTE: E

Up to this point, each group of students operated independently, processing and analysing data pertaining to its own bus. This also applied to the four Notre Dame buses (route G). Although it might be argued that this resulted in different mileage figures for the same route (2.8, 2.8, 2.9, and 2.9 miles), it served a useful purpose when the results for all 14 buses were posted. It was pointed out to the students that, for greater accuracy, odometer readings were best when taken to the nearest hundredth. The average for route G was calculated as 2.85 miles.

Each student was given a blank summary sheet of the total network. The team captain of each bus called out the completed data which included the calculation of the rate of speed, in miles per hour, of his bus. With the summary sheet completed, (page 46), it was a relatively simple matter to draw the histograms (page 47) in preparation for an oral analysis of the total network.

ANALYSIS

Due to the time element and other factors mentioned in the preface, it was necessary to limit the final analysis to one period. The students were asked to prepare a brief list of questions to be used in an oral presentation. Some of these questions are listed in appendix D. It would serve no real purpose to answer these questions in detail as most of them were covered during the data processing phase. The important thing to note is that the students did ask questions. Although some of these questions had no bearing on the project, they were of a geographic nature. A limited retentive ability on the part of the weaker students was apparent in some of the questions asked. The questions that had a direct bearing on the analysis of the project were discussed.

THE TOTAL NETWORK — SUMMARY

ROUTE AND BUS NO.	TOTAL DIST. Miles	TOTAL TIME Secs.	TOTAL POPU-LATION	ACCESSIBILITY INDEX DISTANCE LOW	ACCESSIBILITY INDEX DISTANCE HIGH	ACCESSIBILITY INDEX TIME LOW	ACCESSIBILITY INDEX TIME HIGH	DISPERSION INDEX DISTANCE	DISPERSION INDEX TIME	MILES PER HOUR
A - 33	7.2	1337	56	29.0	64.0	5474	11668	637.0	120576	19.4
B - 30	5.4	609	55	22.5	57.9	2586	6462	544.2	63808	31.9
C - 42	2.6	470	50	9.2	26.8	1770	4220	206.5	39140	19.9
D - 56	7.4	1217	51	31.8	82.0	5135	12697	802.9	128993	21.9
E - 32	4.9	650	40	17.4	36.4	2625	5075	334.8	48250	27.1
F - 55	3.0	537	63	11.3	28.1	2318	4674	268.6	52945	20.1
G - 38	2.8	422	37	11.1	25.8	1607	3634	223.2	32892	23.9
G - 40	2.8	601	57	11.1	25.8	2587	4994	223.3	50744	16.8
G - 45	2.9	599	57	11.8	26.3	2680	4897	234.8	51604	17.7
G - 50	2.9	609	60	11.3	26.2	2627	5032	227.6	51976	17.4
H - 61	1.6	465	50	4.3	9.9	1367	2768	66.4	20312	12.4
J - 5	2.0	569	38	5.9	13.3	1578	3638	99.0	26802	12.7
J - 12	1.9	542	41	5.9	13.2	1543	3581	97.5	26278	12.6
K - 24	5.7	922	43	22.3	50.4	3925	9639	514.4	89688	22.3

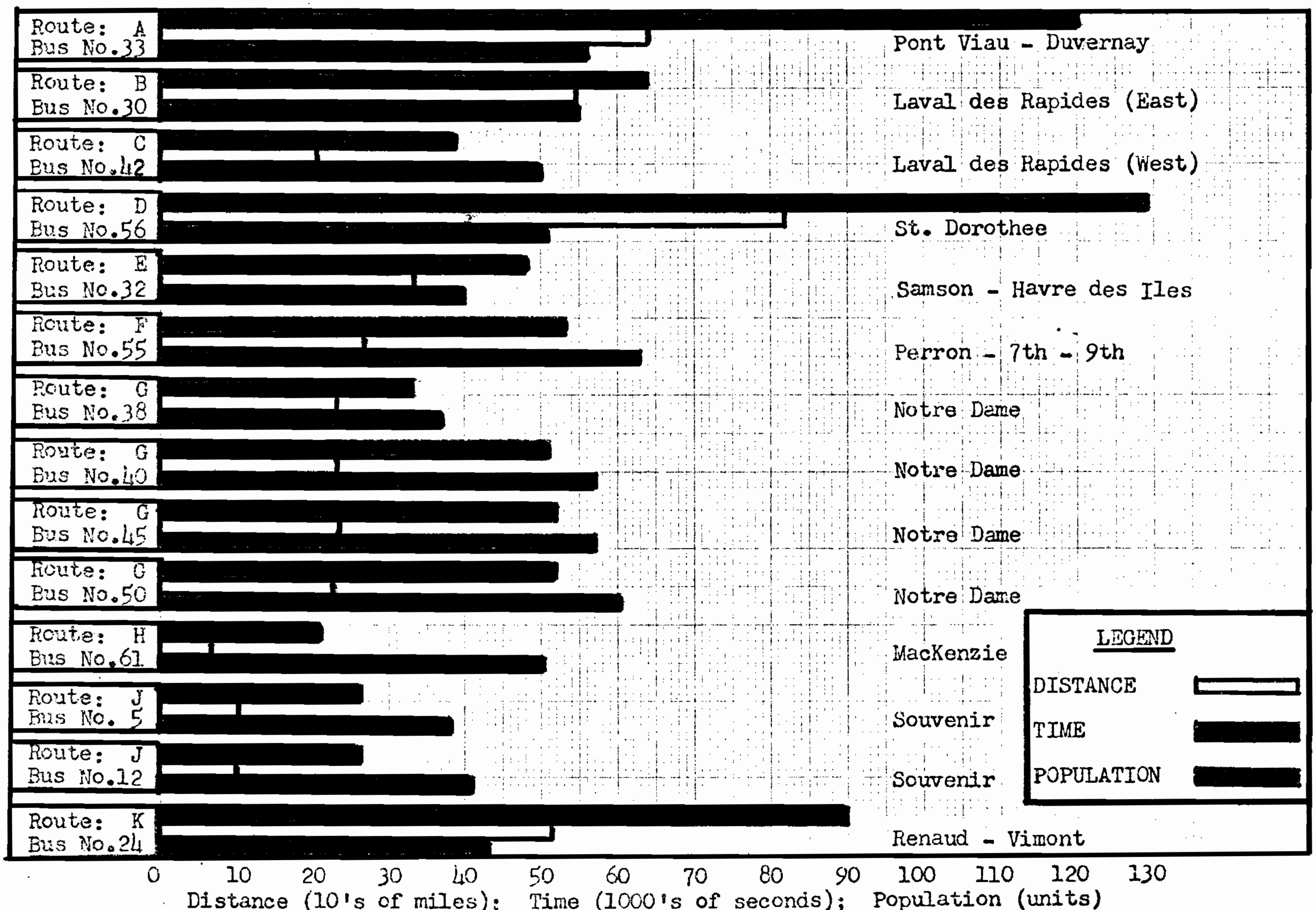
SAMPLE CALCULATION

The figures in the miles per hour column are calculated as follows:

$$\text{Rate} = \frac{\text{Distance}}{\text{Time}} \times 3600$$

(for Route A) $$= \frac{7.2}{1337} \times 3600$$

$$= 19.4 \text{ miles per hour.}$$



GRAPHICAL COMPARISON OF DISPERSION INDICES AND POPULATION

The ideal starting point for the analysis proved to be the Summary and Graphical Comparison sheets (pp. 46-47) since it inspired the students to interpret the total network. They could also see the value of graphs as compared to pure numbers in analysing their project. For example, one of the questions concerned the disparity in the time and distance Dispersion indices on route G. It was easily noticed that while the distances were identical, the time of bus number 38 was considerably lower compared to numbers 40, 45 and 50. In the discussion concerning this, it was also noticed that the number of students on bus 38 was considerably less than the other three. The students learned from this that time and population are directly proportional. It was concluded that unloading time directly affected the time values, regardless of the distances involved. It was easily understood, without referring to the graphs, that the distance and time were also directly proportional.

It was also observed that the buses closest to the high school had a much lower rate of travel than the more distant ones (p.46). For example, bus 61, the shortest route (1.6 miles), travelled at the average rate of 12.4 miles per hour while bus 56, the longest route (7.4 miles), covered its distance at the rate of 21.9 miles per hour. This was an interesting comparison and led to quite a heated discussion. When the students were asked to refer to their map of the total network, (inset), they realized that the latter bus travelled over almost four miles of high speed highway (Boulevard Levesque), with a speed limit of 50 miles per hour, in a sparsely settled area. This had a great effect on the average rate. In contrast to this route, bus 61 passed through two school zones, numerous stop signs and traffic lights and, at no time, could exceed 30 miles per hour.

Studying the graphs (p.47), it was found that when the distance graph (yellow) and the time graph (red) were in closer ratio, a higher speed was indicated. For example, bus 30 (31.9 m.p.h.) showed time and distance graphs as almost the same length but bus 61 (12.4 m.p.h.) showed a distance graph of less than one third of the time graph.

It was pointed out that the number of buses in the area west of the school far outnumbered those in the eastern area. Population concentrations were given as one of the answers. This was disputed by indicating that Laval des Rapides and Pont Viau-Duvernay also had high population concentrations. Further discussion led to the conclusion that the Chomedey area, western section, had a large Jewish population who attend the Protestant schools whereas the eastern sections had a large French population who attend the Catholic schools.

Another question concerning the validity of the matrices was discussed. It was felt that a 14 node matrix should not be compared with an 18 node matrix since the accessibility figures are obtained by cumulative summing of the individual figures. This may be true regarding the distance values since they are fixed, regardless the number of nodes. Since the Dispersion index is directly affected by the accessibility figures, it was agreed that, provided all the bus routes were the same length, there would be a variation in the Dispersion indices if some routes had more stops than the others. It was concluded that the fewer stops made to take on passengers or to let them off, the more efficient the system. It was realized that even the distance comparisons were valid since the number of nodes had an effect on the accessibility index and, although the actual mileage of the route was constant, the effect was similar to increasing the mileage.

The above question covered a difficult concept and only involved a small number of students in the discussion. The matrices had more meaning to most of the students when a number of Esso Imperial road maps were produced. They then noticed the similarity between the mileage matrices on the road map and the ones they had produced. They then were able to read their own product in order to find out the distance as well as the time between two points within their matrix. By crossing over from one matrix to another, by finding a common point of intersection through using the total network map, they were able to connect their own node with any other node within the total area. This part of the project became a game to find out the shortest distance and least amount of time between two points. For example, calculating the time to go from node 8 on route J to node 8 on route K would present little difficulty if we use the high school, node 1 on all matrices, as the "cross over" point. Since the distance from node 8 to node 1 on bus 12 is 367 second and from node 8 to node 1 on bus 24 is 592 seconds, the time to travel between these two nodes is 959 seconds.

In a concluding discussion of the value of network analysis, it was pointed out that, although the values represented in the project were in miles and seconds, other values, such as population numbers, costs of merchandise shipments, traffic numbers, movement of students, both within and outside the school, etc., could be easily substituted.

EVALUATION

Chapter I referred to the apathy and problems in our school systems. If this project, involving student activity, made them more aware of their surroundings and, in an interesting manner, taught them techniques of geography, it achieved the intended aim. It also had the value of being a group activity and a departure from the "lecture " type of lesson so common in the classroom. Mathematically, it taught the students the use of dimension, the method of handling drawing equipment, such as rulers, compasses, colouring pencils, etc. It taught them a systematic approach to arrive at a completed product.

One of the negative aspects was that a small number of students had little or no interest in the work. They were not pressured but allowed to pick out the area that interested them in the group work. In a class of 38 students, this was most expedient. It was possible that these students were not capable of doing work involving a quantitative approach since they were either non-academic students or simply placed in this class because there was no other place for them in an overcrowded school. They did show more interest in the project than normally in regular geography classes. Possibly, a much simpler program including simulated games could have involved them even more.

In review, the data collection phase was relatively simple. It must be emphasized that, in order to get reasonably good results, this phase of the program, more than any other, must be synchronized. It was already pointed out that we had no control over the transferring of buses from one route to another thus leading to some confusion in the processing phase. On the other hand, it did have some value in that it proved how important it was to work together in data gathering, and that, in a way, it was similar to a real life situation where it is not always possible to synchronize efforts. It is, however, recommended that a concerted effort is made to synchronize the data collecting phase in a project of this nature.

Finally, it proved that most students are capable of producing a reasonably good piece of work if it is made interesting and is well organized.

APPENDIX A

MATRIX OPERATIONS

APPENDIX A — MATRIX OPERATIONS

MULTIPLICATION

$$A = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$$

$$A^2 = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix} x \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$$

$$= \begin{pmatrix} (2 \times 2) + (3 \times 4) & (2 \times 3) + (3 \times 5) \\ (4 \times 2) + (5 \times 4) & (4 \times 3 \;\; + (5 \times 5) \end{pmatrix}$$

$$= \begin{pmatrix} 16 & 21 \\ 28 & 37 \end{pmatrix}$$

$$A^3 = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix} x \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix} x \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$$

$$= \begin{pmatrix} 16 & 21 \\ 28 & 37 \end{pmatrix} x \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$$

$$= \begin{pmatrix} (16 \times 2) + (21 \times 4) & (16 \times 3) + (21 \times 5) \\ (28 \times 2) + (37 \times 4) & (28 \times 3) + (37 \times 5) \end{pmatrix}$$

$$= \begin{pmatrix} 116 & 153 \\ 204 & 229 \end{pmatrix}$$

ADDITION

$$A + A^2 = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix} + \begin{pmatrix} 16 & 21 \\ 28 & 37 \end{pmatrix}$$

$$= \begin{pmatrix} (2 + 16) & (3 + 21) \\ (4 + 28) & (5 + 27) \end{pmatrix}$$

$$= \begin{pmatrix} 18 & 24 \\ 32 & 32 \end{pmatrix}$$

A P P E N D I X B

MATRIX CONSTRUCTION

APPENDIX B — ROUTE E Instructions — MATRIX CONSTRUCTION

Starting at the top of the distance column (Worksheet No.1) and successively adding values it is quite simple to complete row one. For example, the values placed in the matrix cells can be calculated as follows:

							a	+	b	=	c
from	node	1	to	node	1:		0.0	+	0.0	=	0.0
"	"	1	"	"	2:		0.0	+	0.1	=	0.1
"	"	1	"	"	3:		0.1	+	0.6	=	0.7
"	"	1	"	"	4:		0.7	+	0.5	=	1.2
"	"	1	"	"	5:		1.2	+	0.3	=	1.5

This process is continued until:

from node 1 to node 14: 4.6 + 0.3 = 4.9.

As a starting point, the diagonal value (0.0) is placed in column c. Column b is an exact replica of the distance column. The value obtained in column c is placed on the next line in column a and, by adding the value already in column b to this value, the next value is obtained for column c. This process is repeated until the row is completed. The values obtained in column c is then placed in its row in the matrix. For example, the value of 4.9 is placed in the intersection of row one and column 14.

This process is continued for row two. As above, the starting point is the diagonal value of 0.0 in column c. The following page illustrates the steps in the calculation of the values of the first 12 rows of the matrix. It should be noted that the values of column b is identical in all 12 calculations except where the diagonal value of 0.0 replaces the value obtained in the worksheet (shown in boldface). That is, the line of 0.0 + 0.0 = 0.0 moves down the rows. For example, row 6 shows the 0.0 on the sixth line. The values for row a are then obtained by placing the row c value in the row a column immediately above and below the diagonal value. This process is repeated until all values are obtained.

APPENDIX B — ROUTE E — MATRIX CALCULATIONS

a	b	c	a	b	c	a	b	c	a	b	c
0.0	**0.0**	**0.0**	0.0	0.1	0.1	0.6	0.1	0.7	1.1	0.1	1.2
0.0	0.1	0.1	**0.0**	**0.0**	**0.0**	0.0	0.6	0.6	0.5	0.6	1.1
0.1	0.6	0.7	0.0	0.6	0.6	**0.0**	**0.0**	**0.0**	0.0	0.5	0.5
0.7	0.5	1.2	0.6	0.5	1.1	0.0	0.5	0.5	**0.0**	**0.0**	**0.0**
1.2	0.3	1.5	1.1	0.3	1.4	0.5	0.3	0.8	0.0	0.3	0.3
1.5	0.3	1.8	1.4	0.3	1.7	0.8	0.3	1.1	0.3	0.3	0.6
1.8	0.3	2.1	1.7	0.3	2.0	1.1	0.3	1.4	0.6	0.3	0.9
2.1	0.2	2.3	2.0	0.2	2.2	1.4	0.2	1.6	0.9	0.2	1.1
2.3	0.4	2.7	2.2	0.4	2.6	1.6	0.4	2.0	1.1	0.4	1.5
2.7	0.4	3.1	2.6	0.4	3.0	2.0	0.4	2.4	1.5	0.4	1.9
3.1	0.3	3.4	3.0	0.3	3.3	2.4	0.3	2.7	1.9	0.3	2.2
3.4	0.4	3.8	3.3	0.4	3.7	2.7	0.4	3.1	2.2	0.4	2.6
3.8	0.8	4.6	3.7	0.8	4.5	3.1	0.8	3.9	2.6	0.8	3.4
4.6	0.3	4.9	4.5	0.3	4.8	3.9	0.3	4.2	3.4	0.3	3.7
	Row 1			Row 2			Row 3			Row 4	

a	b	c	a	b	c	a	b	c	a	b	c
1.4	0.1	1.5	1.7	0.1	1.8	2.0	0.1	2.1	2.2	0.1	2.3
0.8	0.6	1.4	1.1	0.6	1.7	1.4	0.6	2.0	1.6	0.6	2.2
0.3	0.5	0.8	0.6	0.5	1.1	0.9	0.5	1.4	1.1	0.5	1.6
0.0	0.3	0.3	0.3	0.3	0.6	0.6	0.3	0.9	0.8	0.3	1.1
0.0	**0.0**	**0.0**	0.0	0.3	0.3	0.3	0.3	0.6	0.5	0.3	0.8
0.0	0.3	0.3	**0.0**	**0.0**	**0.0**	0.0	0.3	0.3	0.2	0.3	0.5
0.3	0.3	0.6	0.0	0.3	0.3	**0.0**	**0.0**	**0.0**	0.0	0.2	0.2
0.6	0.2	0.8	0.3	0.2	0.5	0.0	0.2	0.2	**0.0**	**0.0**	**0.0**
0.8	0.4	1.2	0.5	0.4	0.9	0.2	0.4	0.6	0.0	0.4	0.4
1.2	0.4	1.6	0.9	0.4	1.3	0.6	0.4	1.0	0.4	0.4	0.8
1.6	0.3	1.9	1.3	0.3	1.6	1.0	0.3	1.3	0.8	0.3	1.1
1.9	0.4	2.3	1.6	0.4	2.0	1.3	0.4	1.7	1.1	0.4	1.5
2.3	0.8	3.1	2.0	0.8	2.8	1.7	0.8	2.5	1.5	0.8	2.3
3.1	0.3	3.4	2.8	0.3	3.1	2.5	0.3	2.8	2.3	0.3	2.6
	Row 5			Row 6			Row 7			Row 8	

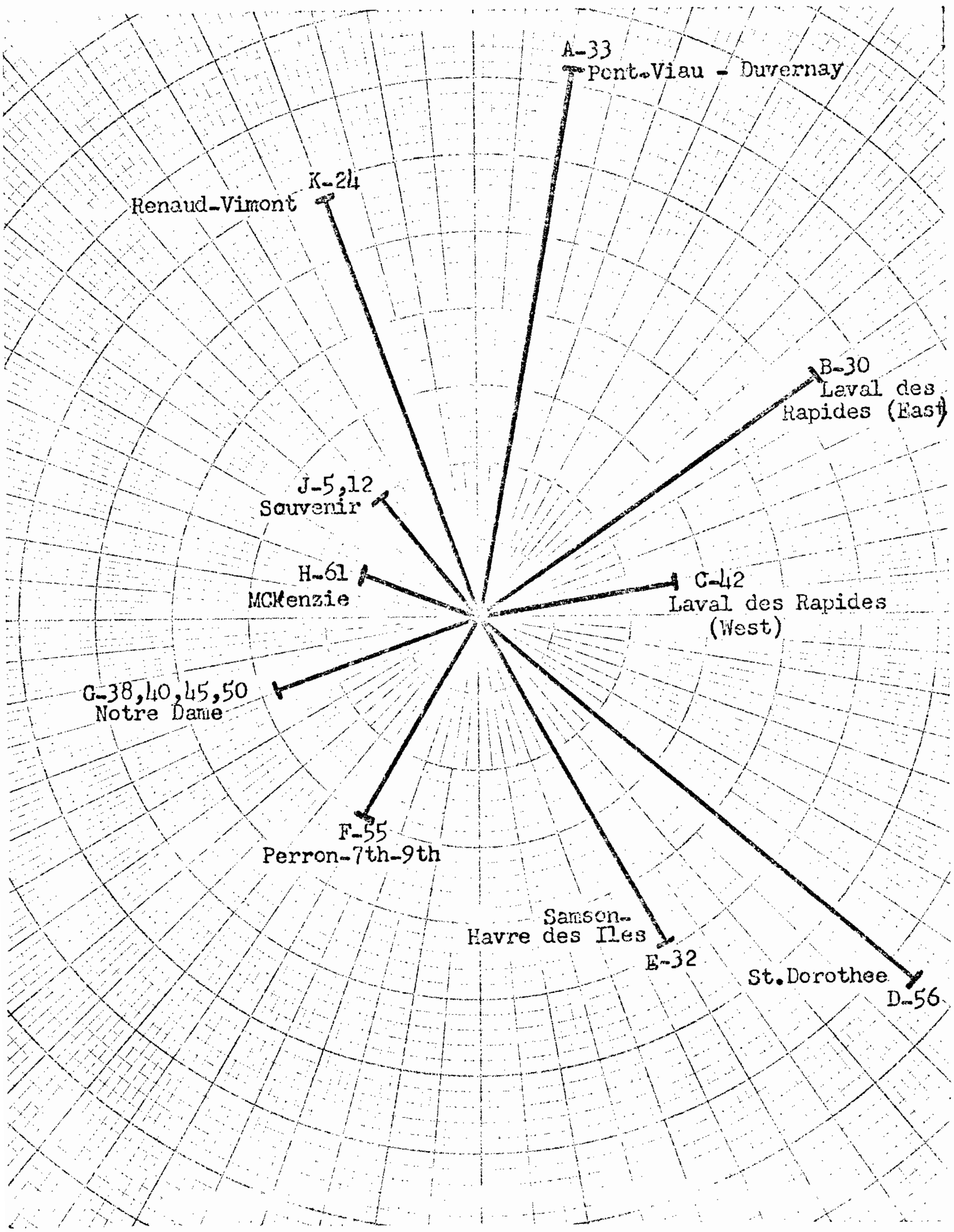
a	b	c	a	b	c	a	b	c	a	b	c
2.6	0.1	2.7	3.0	0.1	3.1	3.3	0.1	3.4	3.7	0.1	3.8
2.0	0.6	2.6	2.4	0.6	3.0	2.7	0.6	3.3	3.1	0.6	3.7
1.5	0.5	2.0	1.9	0.5	2.4	2.2	0.5	2.7	2.6	0.5	3.1
1.2	0.3	1.5	1.6	0.3	1.9	1.9	0.3	2.2	2.3	0.3	2.6
0.9	0.3	1.2	1.3	0.3	1.6	1.6	0.3	1.9	2.0	0.3	2.3
0.6	0.3	0.9	1.0	0.3	1.3	1.3	0.3	1.6	1.7	0.3	2.0
0.4	0.2	0.6	0.8	0.2	1.0	1.1	0.2	1.3	1.5	0.2	1.7
0.0	0.4	0.4	0.4	0.4	0.8	0.7	0.4	1.1	1.1	0.4	1.5
0.0	**0.0**	**0.0**	0.0	0.4	0.4	0.3	0.4	0.7	0.7	0.4	1.1
0.0	0.4	0.4	**0.0**	**0.0**	**0.0**	0.0	0.3	0.3	0.4	0.3	0.7
0.4	0.3	0.7	0.0	0.3	0.3	**0.0**	**0.0**	**0.0**	0.0	0.4	0.4
0.7	0.4	1.1	0.3	0.4	0.7	0.0	0.4	0.4	**0.0**	**0.0**	**0.0**
1.1	0.8	1.9	0.7	0.8	1.5	0.4	0.8	1.2	0.0	0.8	0.8
1.9	0.3	2.2	1.5	0.3	1.8	1.2	0.3	1.5	0.8	0.3	1.1
	Row 9			Row 10			Row 11			Row 12	

The diagonal values are shown in boldface.
Column b is taken from Worksheet No.1
Column $\bar{c}$ is to be entered in the matrix cells.
Column $\underline{a}$ is brought over from column $\underline{c}$.

A P P E N D I X C

DATA FOR

THE TOTAL NETWORK



CHOMEDEY HIGH SCHOOL BUS ROUTES - GRAPHICAL SCALED INDEX

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: A

BUS NO. 33 DATE: March 2,1972. NAME OF STUDENT : G. Gosselin Pont Viau-Duvernay

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	70.7	.00	00	00	00	00
2. Souvenir LeCorbusier	71.6	.90	123	00	00	00
3. LeCorbusier -St.Martin	72.0	.40	63	00	00	00
4. St.Martin - McNamara	72.6	.60	160	00	00	00
5. St.Martin - Valliere	73.4	.80	163	00	00	00
6. St.Martin - Laurentide	73.7	.30	60	00	00	00
7. Laurentide -Souvenir	74.4	.70	98	02	00	02
8. Laurentide - Concorde	74.7	.30	30	02	01	03
9. Concorde - Goineau	75.1	.40	55	10	06	16
10. Concorde-N.D.de Fatima	75.5	.40	105	08	05	13
11. Concorde - J.J.Joubert	75.7	.20	65	02	02	04
12. Concorde - Leblanc	76.0	.30	55	03	03	06
13. Concorde - D'Auteuil	76.9	.90	170	01	03	04
14. Concorde - Lesage	77.4	.50	120	03	02	05
15. Concorde-Rose de Lima	77.6	.20	45	01	01	02
16. Concorde - Levesque	77.9	.30	25	00	01	01
17.						
18. TOTALS		7.20	1337	32	24	56
19.						
20.						

WALKING DISTANCE (Bus to House) 450 (No. of paces) x 2.6 (Length of pace (feet)) = 1170 (Distance in feet)

WALKING TIME (Bus to House) 530 SECONDS

WALKING RATE = Dist/Time = 2.2 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: B						
BUS NO. 30 DATE: March 2,1972. NAME OF STUDENT: G. D'Amico Laval des Rapides (East						
INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	79.5	.00	00	00	00	00
2. Souvenir - LeCorbusier	80.4	.90	84	00	00	00
3. Souvenir - Laval	81.0	.60	65	02	01	03
4. Laval - Concorde	81.3	.30	40	04	03	07
5. Laval - D'Argenteuil	81.6	.30	60	02	02	04
6. D'Argenteuil - Brien	82.0	.40	30	03	01	04
7. Brien - Cartier	82.2	.20	25	02	02	04
8. Cartier - Laval	82.5	.30	28	03	04	07
9. Cartier - Dumoulin	82.7	.20	20	01	00	01
10. Cartier - 15th St.	83.2	.50	30	00	01	01
11. 15th St. - Robin	83.3	.10	20	03	04	07
12. 15th St. - 8th Ave.	83.5	.20	40	02	02	04
13. Meunier - 7th St.	83.8	.30	35	04	02	06
14. 7th St. - 8th Ave.	84.0	.20	45	01	01	02
15. 8th Ave. - Cartier	84.1	.10	20	00	01	01
16. Cartier - Major	84.3	.20	22	01	00	01
17. Major - Des Prairies	84.6	.30	20	00	02	02
18. Des Prairies -Anse Bleue	84.9	.30	25	01	00	01
19.						
20. TOTALS		5.4	609	29	26	55

WALKING DISTANCE (Bus to House) 240 x 2.6 = 624
No.of paces — Length of pace (feet) — Distance in feet

WALKING TIME (Bus to House) 275 SECONDS

WALKING RATE = Dist/Time = 2.1 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: C Laval des Rapides (West)

BUS NO. 42 DATE: Feb.13,1972. NAME OF STUDENT : C. Stewart

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	41.7	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	41.9	.20	35	00	00	00
3. Chomedey - Perron	42.7	.80	90	03	01	04
4. Chomedey - Cartier	43.0	.30	50	00	00	00
5. Cartier - 68th	43.1	.10	20	02	02	04
6. Cartier - 66th	43.2	.10	15	01	00	01
7. Cartier - 64th	43.3	.10	15	07	08	15
8. Cartier - Marois	43.5	.20	35	06	06	12
9. Cartier - 58th	43.6	.10	20	00	00	00
10. 58th - 4th	43.7	.10	20	03	02	05
11. 58th - 5th	43.8	.10	25	03	00	03
12. 58th - 6th	43.9	.10	40	02	01	03
13. 6th - Marois	44.0	.10	25	01	02	03
14. Marois - 5th	44.1	.10	30	00	00	00
15. Marois - 4th	44.2	.10	25	00	00	00
16. Marois - Cartier	44.3	.10	25	00	00	00
17.						
18. TOTALS		2.60	470	28	22	50
19.						
20.						

WALKING DISTANCE (Bus to House) 540 (No. of paces) x 2.6 (Length of pace (feet)) = 1404 (Distance in feet)

WALKING TIME (Bus to House) 632 SECONDS

WALKING RATE = Dist/Time = 2.3 feet per second

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA							ROUTE: D
BUS NO. 56 DATE: Feb.13,1972. NAME OF STUDENT: K. Paul							St.Dorothee
INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL	
1. Chomedey High (start)	22.2	.00	00	00	00	00	
2. Chomedey Bl.- Perron	23.1	.90	141	00	00	00	
3. Perron-Labelle-Samson	23.7	.60	121	00	00	00	
4. Samson - 92nd	24.2	.50	67	00	00	00	
5. Samson-100th-Levesque	24.7	.50	82	00	00	00	
6. Levesque - Carleton	25.4	.70	85	01	01	02	
7. Levesque - Mamel	26.9	1.50	160	13	12	25	
8. Levesque-Jardin St.Dor'e	27.3	.40	73	00	00	00	
9. St.Dorothee-Huberdeau	27.4	.10	13	02	05	07	
10. Huberdeau -Maisoneuve	27.5	.10	30	00	00	00	
11. Maisoneuve-Place George	27.7	.20	35	03	03	06	
12. Maisoneuve - Samson	27.9	.20	58	04	01	05	
13. Samson - Hotel de Ville	28.1	.20	57	01	02	03	
14. Hotel de Ville-Principal	28.5	.40	75	00	00	00	
15. Principal - Gravel	28.9	.40	50	00	01	01	
16. Gravel - 4th	29.2	.30	75	00	01	01	
17. Gravel - Samson	29.3	.10	30	00	01	01	
18. Gravel - Levesque	29.6	.30	65	00	00	00	
19.							
20. TOTALS		7.40	1217	24	27	51	

WALKING DISTANCE (Bus to House) 245 (No. of paces) X 2.6 (Length of pace (feet)) = 637 (Distance in feet)

WALKING TIME (Bus to House) 280 SECONDS

WALKING RATE = Dist/Time = 2.3 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: E Samson -Havre des Iles

BUS NO. 32 DATE: Feb.28,1972. NAME OF STUDENT C. Wilson.

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	22.2	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	22.3	.10	20	00	00	00
3. Chomedey - Notre Dame	22.9	.60	85	00	00	00
4. Notre Dame - Labelle	23.4	.50	90	00	00	00
5. Labelle - 7th	23.7	.30	60	01	02	03
6. Labelle - Samson	24.0	.30	50	02	01	03
7. Samson - 85th	24.3	.30	40	04	07	11
8. Samson - 92nd	24.5	.20	70	04	02	06
9. Samson - 95th	24.9	.40	45	03	05	08
10. Samson - 100th -Levesque	25.3	.40	65	03	01	04
11. Levesque - Prom.des Iles	25.6	.30	45	01	01	02
12. Prom.des Iles-Havre Iles	26.0	.40	30	02	01	03
13. Prom.des Iles-Levesque	26.8	.80	30	00	00	00
14. Prom.des Iles- Samson	27.1	.30	20	00	00	00
15.						
16. TOTALS		4.9	650	20	20	40
17.						
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 350 (No.of paces) X 2.7 (Length of pace (feet)) = 945 (Distance in feet)

WALKING TIME (Bus to House) 450 SECONDS

WALKING RATE = Dist/Time = 2.1 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA							ROUTE: F Perron-7th-9th
BUS NO. 55 DATE: Feb.16,1972. NAME OF STUDENT J. Manuel							
INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL	
1. Chomedey High (start)	94.6	.00	00	00	00	00	
2. Souvenir - Chomedey Bl.	94.7	.10	43	00	00	00	
3. Chomedey - Notre Dame	95.4	.70	63	00	00	00	
4. Chomedey - Perron	95.7	.30	17	00	00	00	
5. Perron - 75th	95.8	.10	24	01	01	02	
6. Perron - 81st	95.9	.10	17	01	01	02	
7. Perron - Labelle - 7th	96.1	.20	32	00	00	00	
8. 7th - 84th	96.2	.10	64	01	00	01	
9. 7th - 85th	96.3	.10	18	02	00	02	
10. 85th - 9th	96.4	.10	27	02	02	04	
11. 9th - 88th	96.6	.20	29	01	01	02	
12. 9th - 92nd	96.7	.10	40	07	05	12	
13. 9th - Sherwood Place	96.8	.10	29	02	01	03	
14. 9th - 95th	96.9	.10	16	06	06	12	
15. 9th - 100th	97.2	.30	53	08	09	17	
16. 100th - Montcalm	97.4	.20	41	04	01	05	
17. 100th - Notre Dame	97.6	.20	24	01	00	01	
18.							
19. TOTALS		3.00	537	36	27	63	
20.							

WALKING DISTANCE (Bus to House) 150 (No. of paces) X 2.4 (Length of pace (feet)) = 360 (Distance in feet)

WALKING TIME (Bus to House) 165 SECONDS

WALKING RATE = Dist/Time = 2.2 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: G

Notre Dame

BUS NO. 38 DATE: Feb.18.1972. NAME OF STUDENT: R. Goodman.

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	58.4	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	58.5	.10	30	00	00	00
3. Chomedey - Notre Dame	59.2	.70	65	00	00	00
4. Notre Dame - St.Charles	59.3	.10	20	00	00	00
5. Notre Dame - Labelle	59.7	.40	61	02	06	08
6. Notre Dame - Haifa	60.0	.30	50	00	03	03
7. Notre Dame - Dover	60.1	.10	15	03	00	03
8. Notre Dame - Elizabeth	60.3	.20	20	01	06	07
9. Notre Dame - 100th	60.6	.30	35	02	03	05
10. Notre Dame - 101st	60.7	.10	18	03	00	03
11. Notre Dame - Dusablon	60.8	.10	18	00	01	01
12. Notre Dame - Ducalvet	60.9	.10	10	00	00	00
13. Notre Dame - Chatelaine	61.0	.10	40	04	03	07
14. Chatelaine - Charlevoix	61.1	.10	20	00	00	00
15. Chatelaine - Souvenir	61.2	.10	20	00	00	00
16.						
17. TOTALS		2.80	422	15	22	37
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 215 (No. of paces) X 2.9 (Length of pace (feet)) = 624 (Distance in feet)

WALKING TIME (Bus to House) 230 SECONDS

Walking Rate = Dist/Time = 4.8 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: G Notre Dame

BUS NO. 40 DATE March 9,1972 NAME OF STUDENT: A. Schleer

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	58.4	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	58.5	.10	30	00	00	00
3. Chomedey - Notre Dame	59.2	.70	72	00	00	00
4. Notre Dame - St.Charles	59.3	.10	39	00	00	00
5. Notre Dame - Labelle	59.7	.40	65	00	01	01
6. Notre Dame - Haifa	60.0	.30	55	06	02	08
7. Notre Dame - Dover	60.1	.10	33	07	02	09
8. Notre Dame - Elizabeth	60.3	.20	45	05	02	07
9. Notre Dame - 100th	60.6	.30	73	06	04	10
10. Notre Dame - 101st	60.7	.10	39	05	03	08
11. Notre Dame - Dusablon	60.8	.10	44	01	01	02
12. Notre Dame - Ducalvet	60.9	.10	28	02	01	03
13. Notre Dame - Chatelaine	61.0	.10	35	02	02	04
14. Chatelaine - Charlevoix	61.1	.10	23	02	00	02
15. Chatelaine - Souvenir	61.2	.10	20	02	01	03
16.						
17. TOTALS		2.8	601	38	19	57
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 357 (No. of paces) x 2.6 (Length of pace (feet)) = 936 (Distance in feet)

WALKING TIME (Bus to House) 420 SECONDS

WALKING RATE = Dist/Time = 2.2 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA							ROUTE: G Notre Dame
BUS NO. 45 DATE: Feb.29,1972. NAME OF STUDENT: C. Cons							
INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES			
				BOYS	GIRLS	TOTAL	
1. Chomedey High (start)	32.7	.00	00	00	00	00	
2. Souvenir - Chomedey Bl.	32.8	.10	20	00	00	00	
3. Chomedey - Notre Dame	33.5	.70	70	00	00	00	
4. Notre Dame - St.Charles	33.6	.10	35	00	00	00	
5. Notre Dame - Labelle	34.0	.40	56	00	00	00	
6. Notre Dame - Haifa	34.2	.20	44	02	02	04	
7. Notre Dame - Dover	34.4	.20	70	10	00	10	
8. Notre Dame - Elizabeth	34.6	.20	50	05	04	09	
9. Notre Dame - 100th	34.9	.30	80	04	00	04	
10. Notre Dame - 101st	35.1	.20	33	06	02	08	
11. Notre Dame - Dusablon	35.2	.10	35	04	03	07	
12. Notre Dame - Ducalvet	35.3	.10	30	04	01	05	
13. Notre Dame - Chatelaine	35.4	.10	23	04	01	05	
14. Chatelaine - Charlevoix	35.5	.10	34	05	00	05	
15. Chatelaine - Souvenir	35.6	.10	11	00	00	00	
16.							
17. TOTALS		2.90	591	44	13	57	
18.							
19.							
20.							

WALKING DISTANCE (Bus to House) 475 (No. of paces) X 2.8 (Length of pace (feet)) = 1330 (Distance in feet)

WALKING TIME (Bus to House) 570 SECONDS

WALKING RATE = Dist/Time = 2.3 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: G

BUS NO. 50 DATE: March 2,1972 NAME OF STUDENT: K. Spoon Notre Dame

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	21.6	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	21.7	.10	20	00	00	00
3. Chomedey - Notre Dame	22.5	.80	80	00	00	00
4. Notre Dame - St.Charles	22.6	.10	20	00	00	00
5. Notre Dame - Labelle	22.9	.30	74	02	03	05
6. Notre Dame - Haifa	23.1	.20	97	04	04	08
7. Notre Dame - Dover	23.3	.20	15	02	02	04
8. Notre Dame - Elizabeth	23.5	.20	37	10	04	14
9. Notre Dame - 100th	23.8	.30	57	01	05	06
10. Notre Dame - 101st	23.9	.10	70	04	02	06
11. Notre Dame - Dusablon	24.0	.10	27	06	04	10
12. Notre Dame - Ducalvet	24.1	.10	32	02	01	03
13. Notre Dame - Chatelaine	24.3	.20	35	02	02	04
14. Chatelaine - Charlevoix	24.4	.10	25	00	00	00
15. Chatelaine - Souvenir	24.5	.10	20	00	00	00
16.						
17. TOTALS		2.9	609	33	27	60
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 314 (No. of paces) X 2.5 (Length of pace (feet)) = 785 (Distance in feet)

WALKING TIME (Bus to House) 300 SECONDS

WALKING RATE = Dist/Time = 2.6 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: H McKenzie

BUS NO. 61 DATE: Feb.15,1972. NAME OF STUDENT: M. Benoliel

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	14.3	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	14.4	.10	37	00	00	00
3. Souvenir - Labelle	14.8	.40	98	00	00	00
4. Souvenir - Jarry	15.1	.30	15	00	00	00
5. Jarry - McKenzie	15.2	.10	105	00	00	00
6. McKenzie - Hennessy	15.3	.10	12	10	05	15
7. McKenzie - Ridgewood Cr.	15.4	.10	50	04	02	06
8. McKenzie - McKenzie Crt.	15.5	.10	40	02	01	03
9. McKenzie - Maria Cresc.	15.6	.10	28	02	03	05
10. McKenzie - Elizabeth	15.7	.10	35	06	04	10
11. Elizabeth - Ridgewood Cr.	15.9	.20	45	06	05	11
12.						
13. TOTALS		1.60	465	30	20	50
14.						
15.						
16.						
17.						
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 140 (No. of paces) X 2.4 (Length of pace (feet)) = 336 (Distance in feet)

WALKING TIME (Bus to House) 150 SECONDS

WALKING RATE = Dist/Time = 2.2 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: J Souvenir						
BUS NO. 5 DATE: Feb.25,1972. NAME OF STUDENT : G. Ernst						
INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	88.3	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	88.4	.10	49	00	00	00
3. Souvenir - Labelle	88.8	.40	74	00	00	00
4. Souvenir - Elizabeth	89.1	.30	120	03	06	09
5. Souvenir - Lynn	89.4	.30	50	02	00	02
6. Souvenir - Webb	89.5	.10	25	05	00	05
7. Souvenir - 100th	89.6	.10	28	02	04	06
8. Souvenir - Emersnn	89.7	.10	30	01	00	01
9. Souvenir - Effingham	89.8	.10	20	00	01	01
10. Souvenir - Melville	89.9	.10	32	02	00	02
11. Souvenir - Chatelaine	90.1	.20	60	06	03	09
12. Chatelaine - Notre Dame	90.3	.20	80	01	02	03
13.						
14. TOTALS		2.00	569	22	16	38
15.						
16.						
17.						
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 180 (No. of paces) X 2.5 (Length of pace (feet)) = 450 (Distance in feet)

WALKING TIME (Bus to House) 200 SECONDS

WALKING RATE = Dist/Time = 1.8 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA ROUTE: J Souvenir

BUS NO. 12 DATE: Feb. 25, 1972. NAME OF STUDENT: E. Kirk

INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	66.9	.00	00	00	00	00
2. Souvenir - Chomedey Bl.	67.0	.10	47	00	00	00
3. Souvenir - Labelle	67.4	.40	72	00	02	02
4. Souvenir - Elizabeth	67.7	.30	132	06	01	07
5. Souvenir - Lynn	67.9	.20	34	01	01	02
6. Souvenir - Webb	68.1	.20	32	01	10	11
7. Souvenir - 100th	68.2	.10	25	03	03	06
8. Souvenir - Emerson	68.3	.10	25	03	01	04
9. Souvenir - Effingham	68.4	.10	20	02	00	02
10. Souvenir - Melville	68.5	.10	30	01	01	02
11. Souvenir - Chatelaine	68.7	.20	90	00	03	03
12. Souvenir - Carnel	68.8	.10	35	01	01	02
13.						
14. TOTALS		1.90	542	18	23	41
15.						
16.						
17.						
18.						
19.						
20.						

WALKING DISTANCE (Bus to House) 195 (No. of paces) X 2.6 (Length of pace (feet)) = 517 (Distance in feet)

WALKING TIME (Bus to House) 240 SECONDS

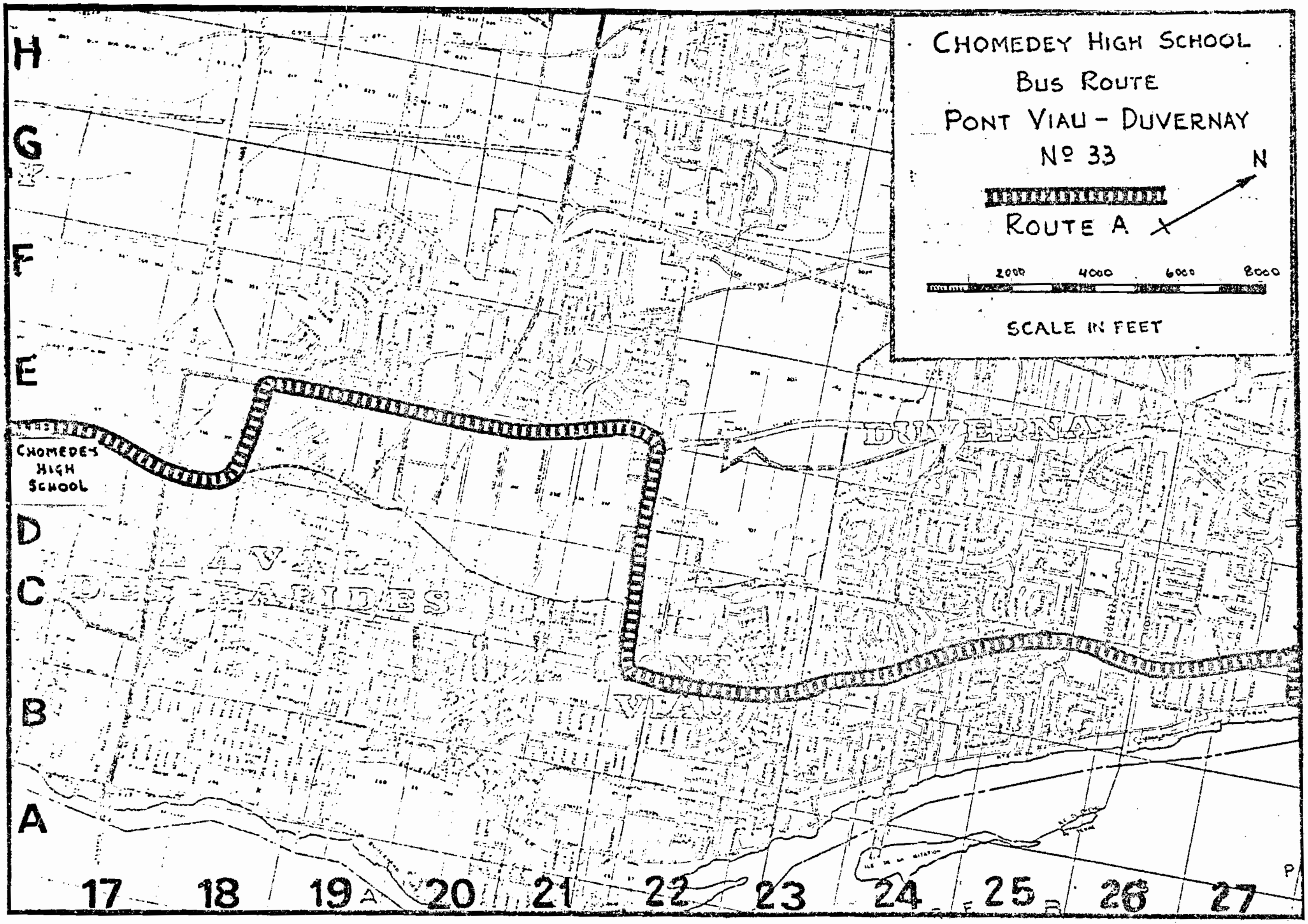
WALKING RATE = Dist/Time = 2.1 feet per second.

WORKSHEET NO.1. POPULATION, TIME AND DISTANCE DATA						ROUTE: K Renaud-Vimont
BUS NO. 24 DATE: March 1,1972. NAME OF STUDENT: L. Faruqi						
INTERSECTION (NODE)	ODOMETER READING	DISTANCE MILES	TIME SECS.	DEPARTURES BOYS	GIRLS	TOTAL
1. Chomedey High (start)	50.8	.00	00	00	00	00
2. Souvenir - LeCorbusier	51.7	.90	104	00	00	00
3. LeCorbusier- St.Martin	52.1	.40	109	00	00	00
4. St.Martin - Tessier	52.4	.30	120	00	00	00
5. Tessier - Quebec	52.6	.20	50	05	03	08
6. Quebec - Maisoneuve	52.7	.10	45	04	01	05
7. Maisoneuve-Lang'r-Laplant	53.1	.40	50	02	00	02
8. Laplant-Wilfred-Lorraine	53.5	.40	114	06	03	09
9. Lorraine-Louise-McNamara	54.0	.50	60	01	02	03
10. McNamara - Pine	54.1	.10	40	02	04	06
11. McNamara - Maple	54.3	.20	30	02	00	02
12. McNamara - St.Martin	54.4	.10	20	00	00	00
13. St.Martin - Valliere	54.9	.50	60	02	02	04
14. St.Martin - Laurentide	55.2	.30	20	00	00	00
15. Laurentide - Richard	55.5	.30	30	01	00	01
16. Laurentide - 10th	56.2	.70	50	01	01	02
17. Laurentide - St.Elzear	56.5	.30	20	00	01	01
18.						
19. TOTALS		5.70	922	26	17	43
20.						

WALKING DISTANCE (Bus to House) 200 (No. of paces) x 2.4 (Length of pace (feet)) = 480 (Distance in feet)

WALKING TIME (Bus to House) 240 SECONDS

WALKING RATE = Dist/Time = 2.0 feet per second.



CHOMEDEY HIGH SCHOOL
BUS ROUTE
PONT VIAU - DUVERNAY
Nº 33
ROUTE A
N
2000
4000
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8000
SCALE IN FEET
CHOMEDEY HIGH SCHOOL
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CHOMEDEY HIGH SCHOOL
BUS ROUTE
LAVAL DES RAPIDES (EAST)
No 30
ROUTE B
N
SCALE IN FEET
CHOMEDEY HIGH SCHOOL
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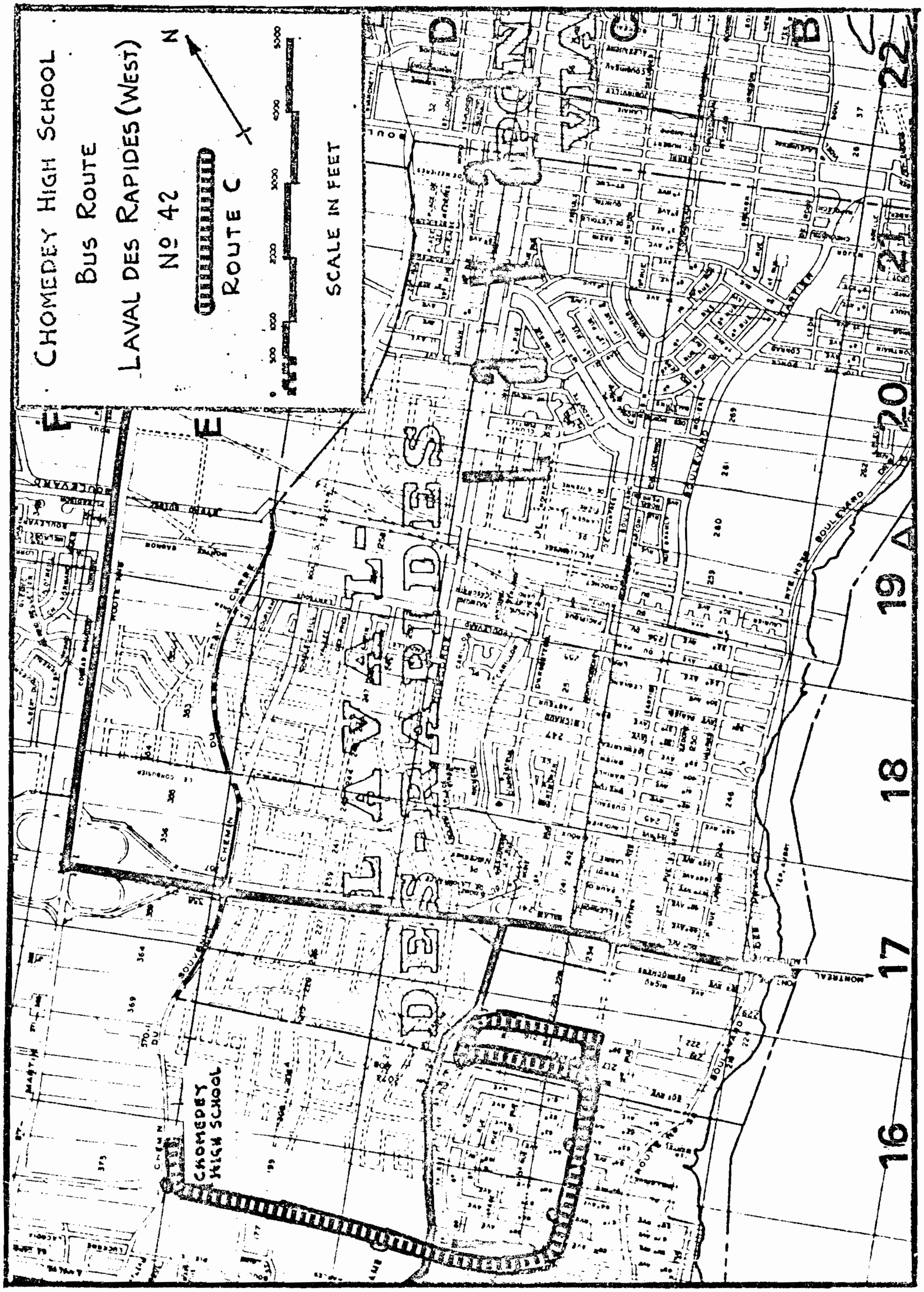
CHOMEDEY HIGH SCHOOL
BUS ROUTE
LAVAL DES RAPIDES (WEST)
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SCALE IN FEET
CHOMEDEY HIGH SCHOOL
16
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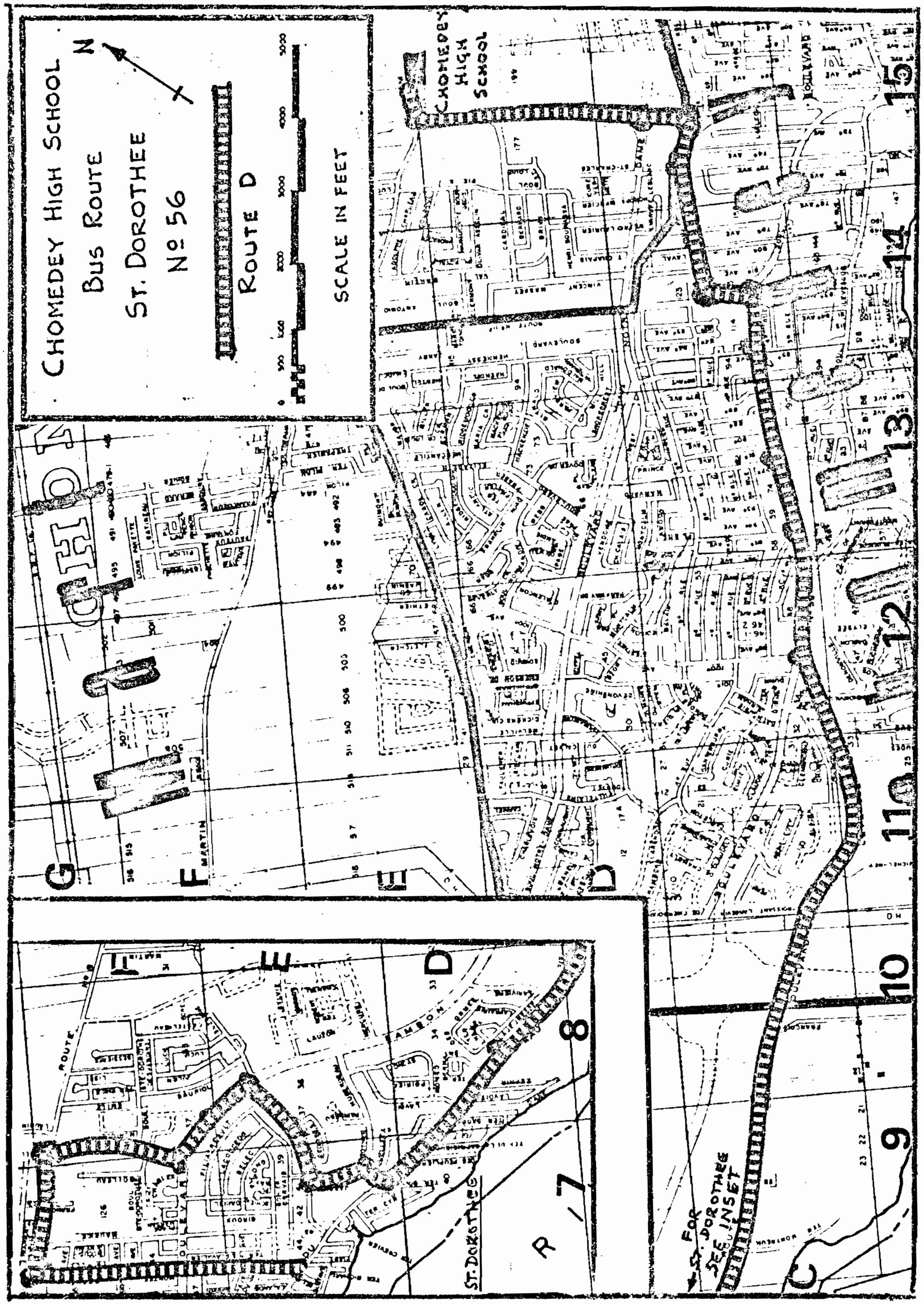
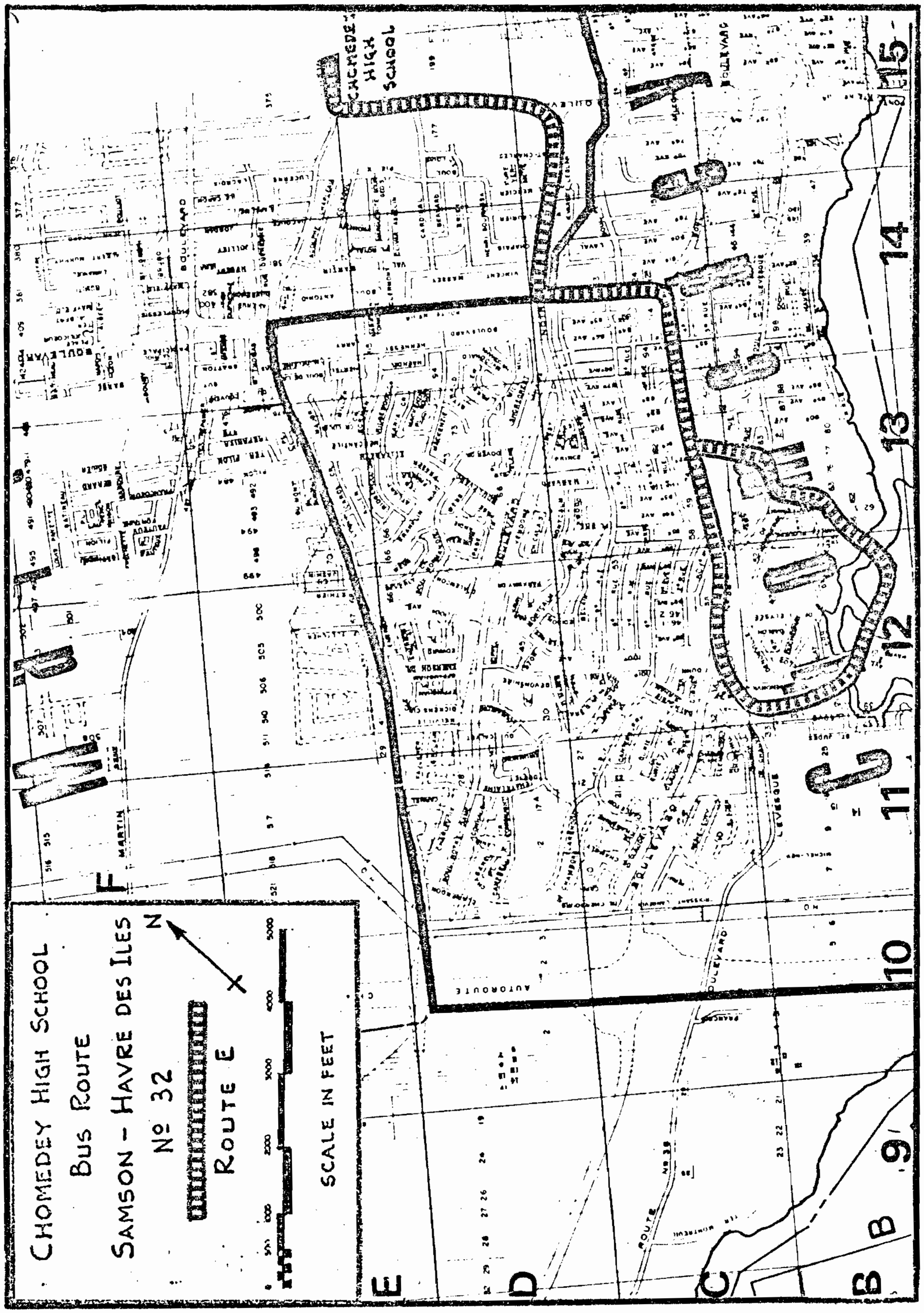
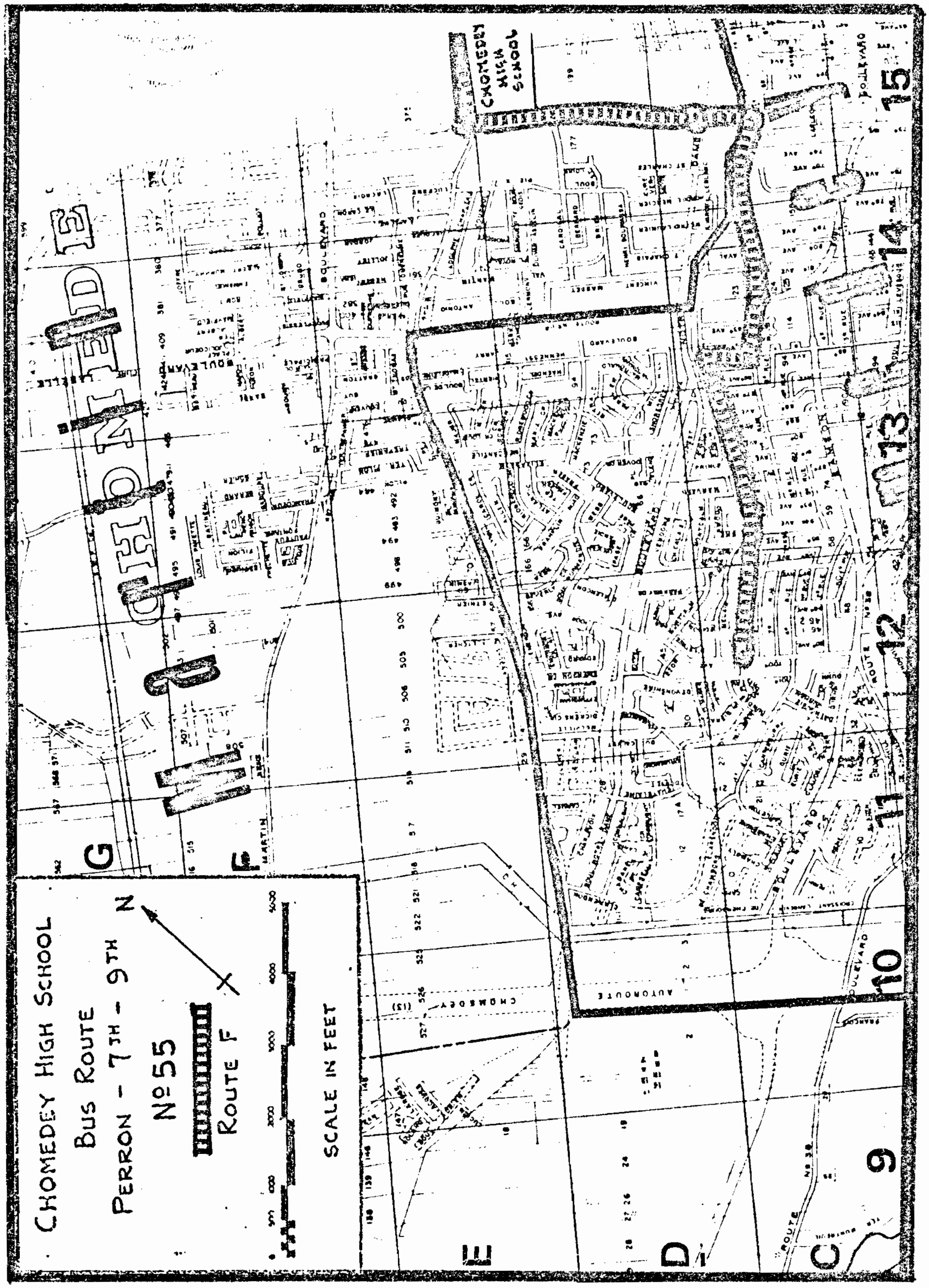
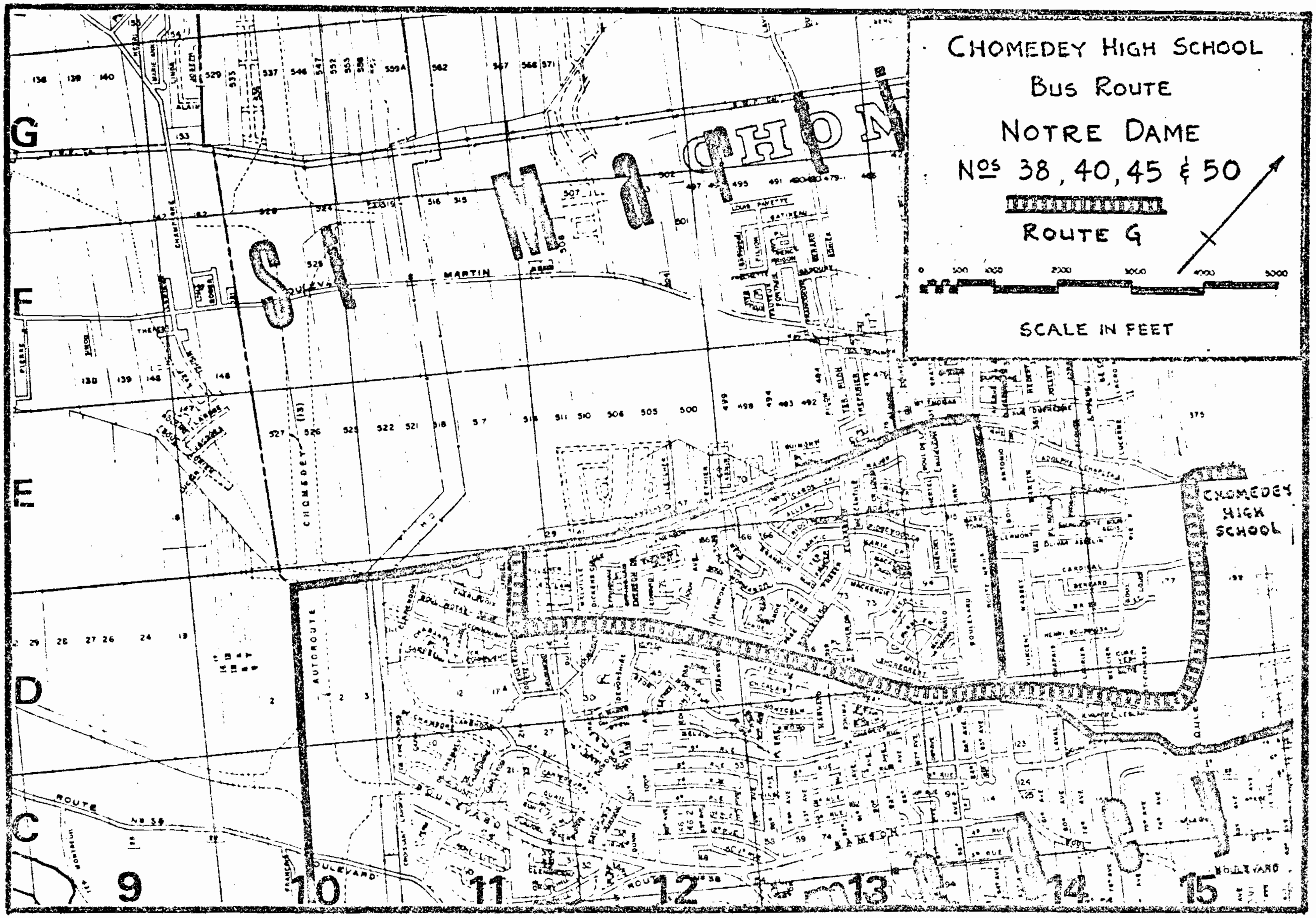
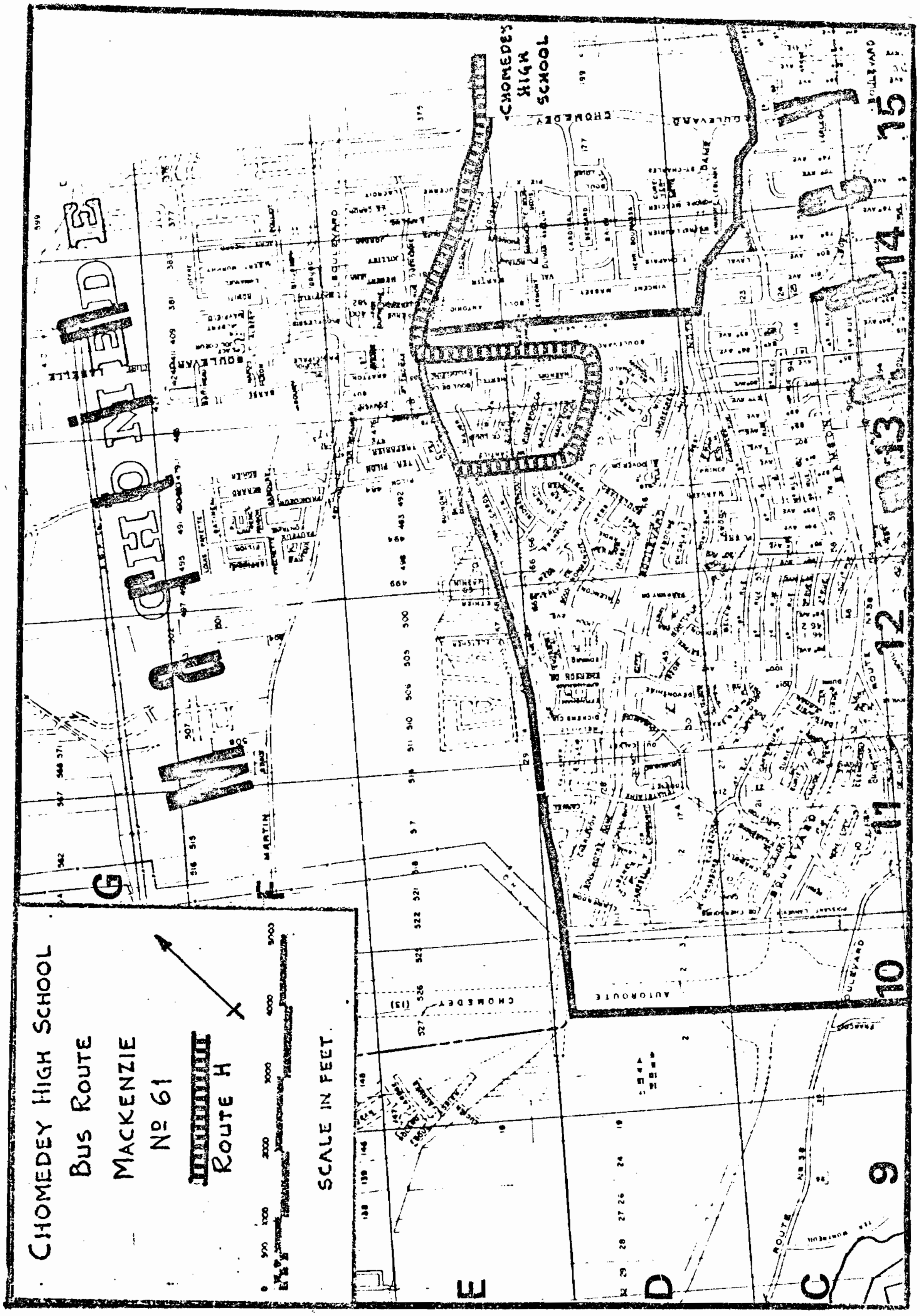
21
22


CHOMEDEY HIGH SCHOOL
BUS ROUTE
ST. DOROTHEE
No 56
ROUTE D
0 500 1000 2000 3000 4000 5000
SCALE IN FEET
CHOMEDEY HIGH SCHOOL
FOR ST. DOROTHEE SEE INSET
ST. DOROTHEE

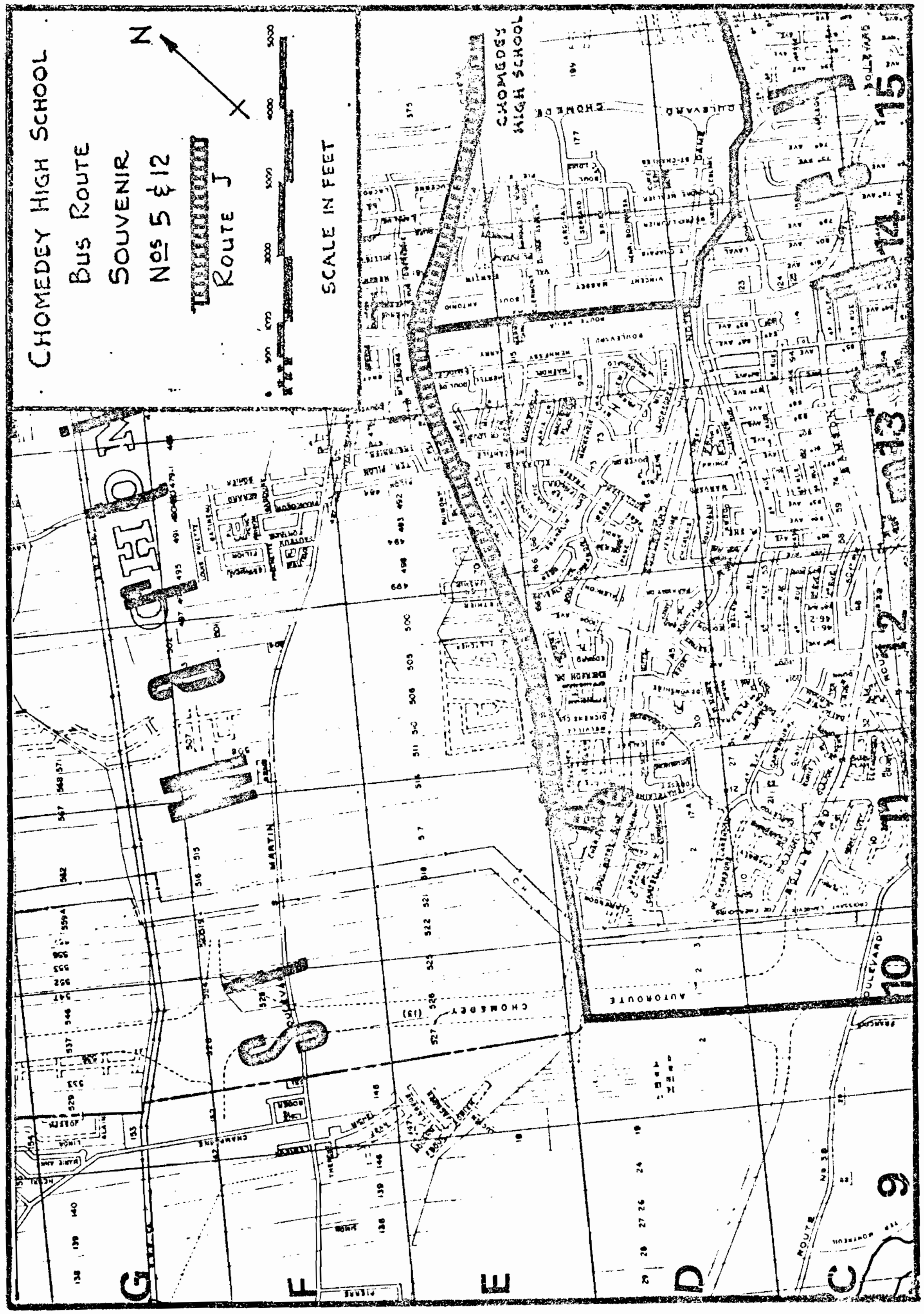

CHOMEDEY HIGH SCHOOL
BUS ROUTE
SAMSON - HAVRE DES ILES
No 32
ROUTE E
SCALE IN FEET
N
CHOMEDEY HIGH SCHOOL

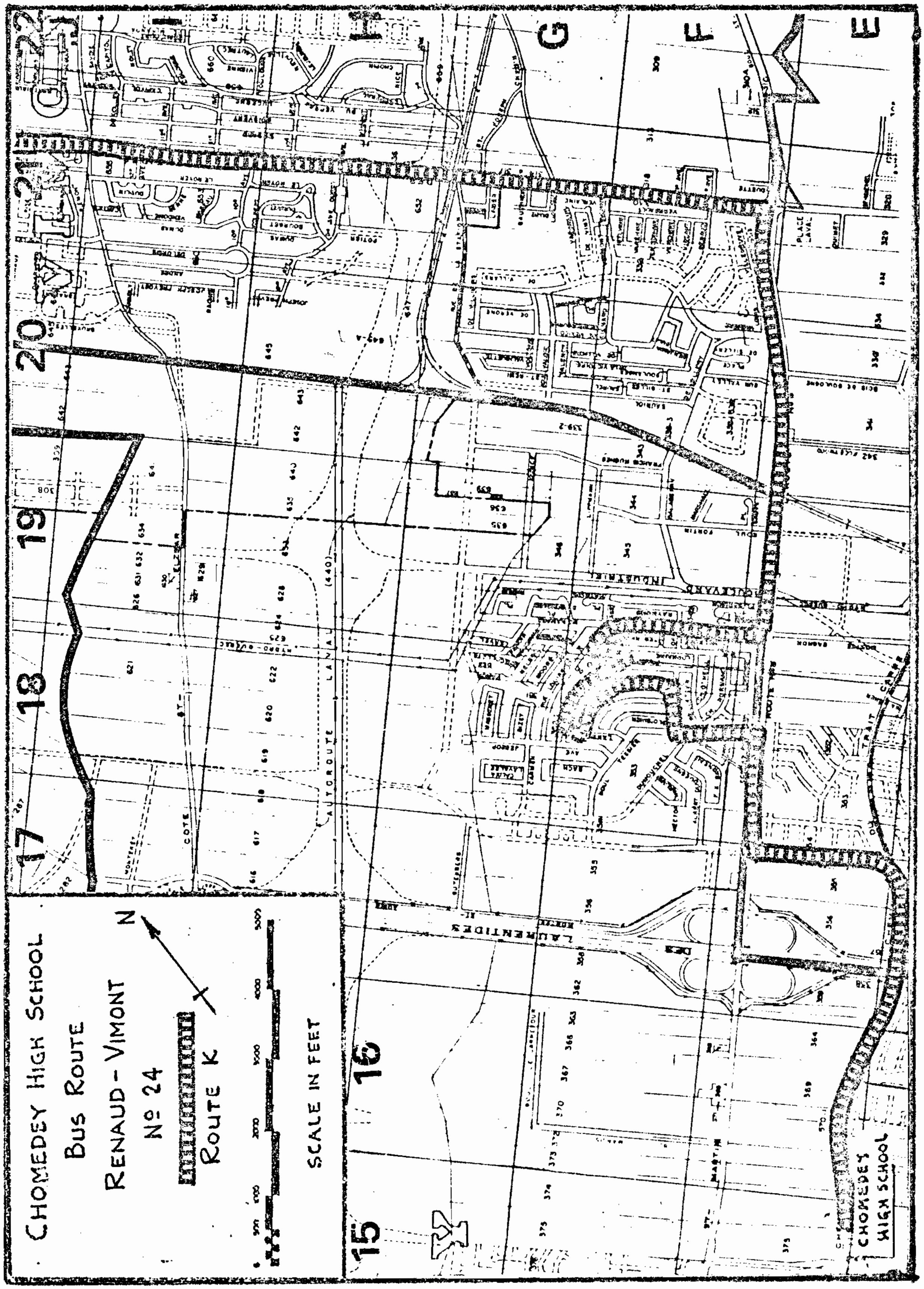

Chomedey High School
Bus Route
Perron - 7th - 9th
No 55
Route F
Scale in Feet
N
Chomedey High School
Autoroute

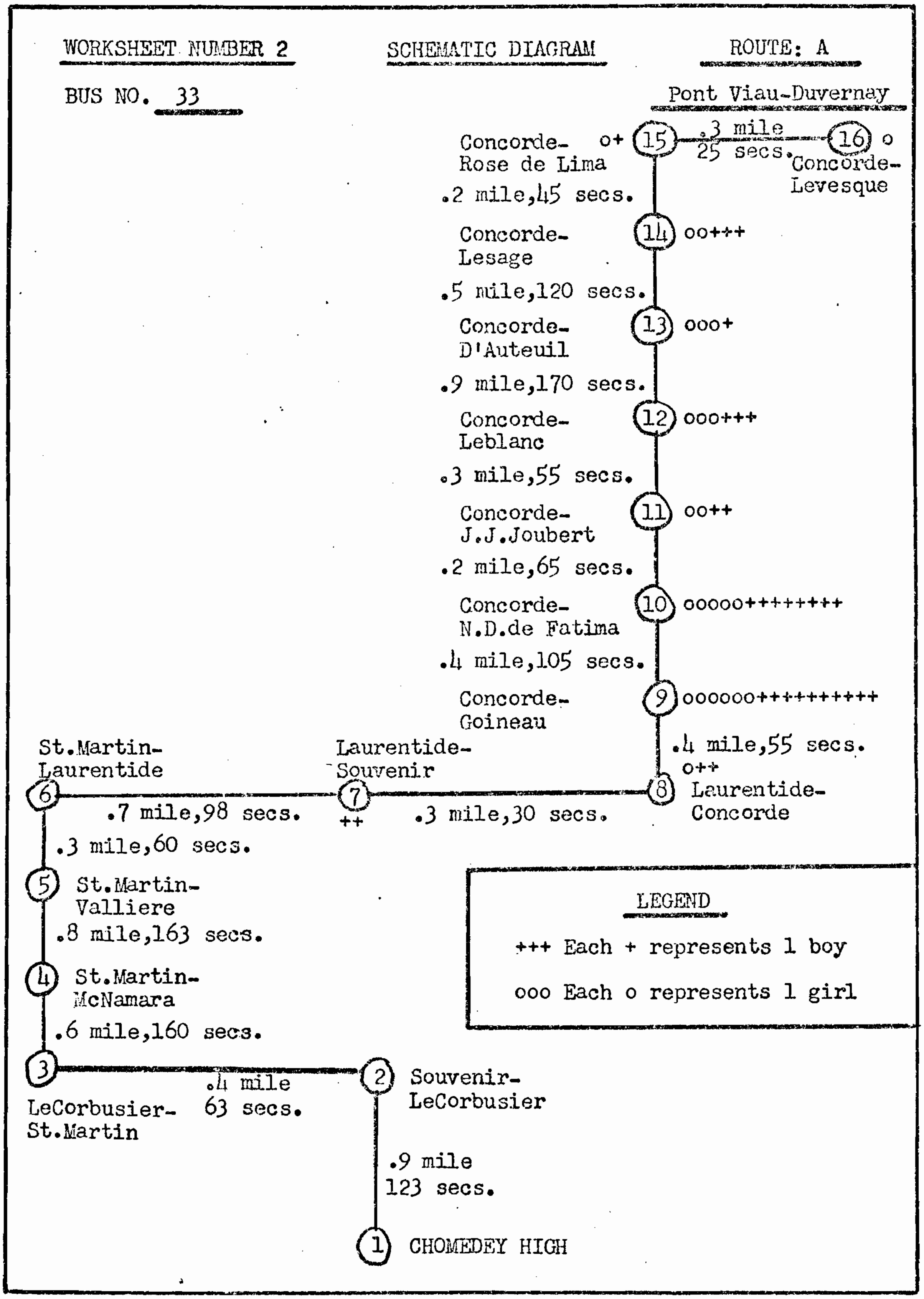

CHOMEDEY HIGH SCHOOL
BUS ROUTE
NOTRE DAME
NOS 38, 40, 45 & 50
ROUTE G
0 500 1000 2000 3000 4000 5000
SCALE IN FEET
CHOMEDEY HIGH SCHOOL
G
F
E
D
C
9
10
11
12
13
14
15
MARTIN
CHOMEDEY
AUTOROUTE
ROUTE

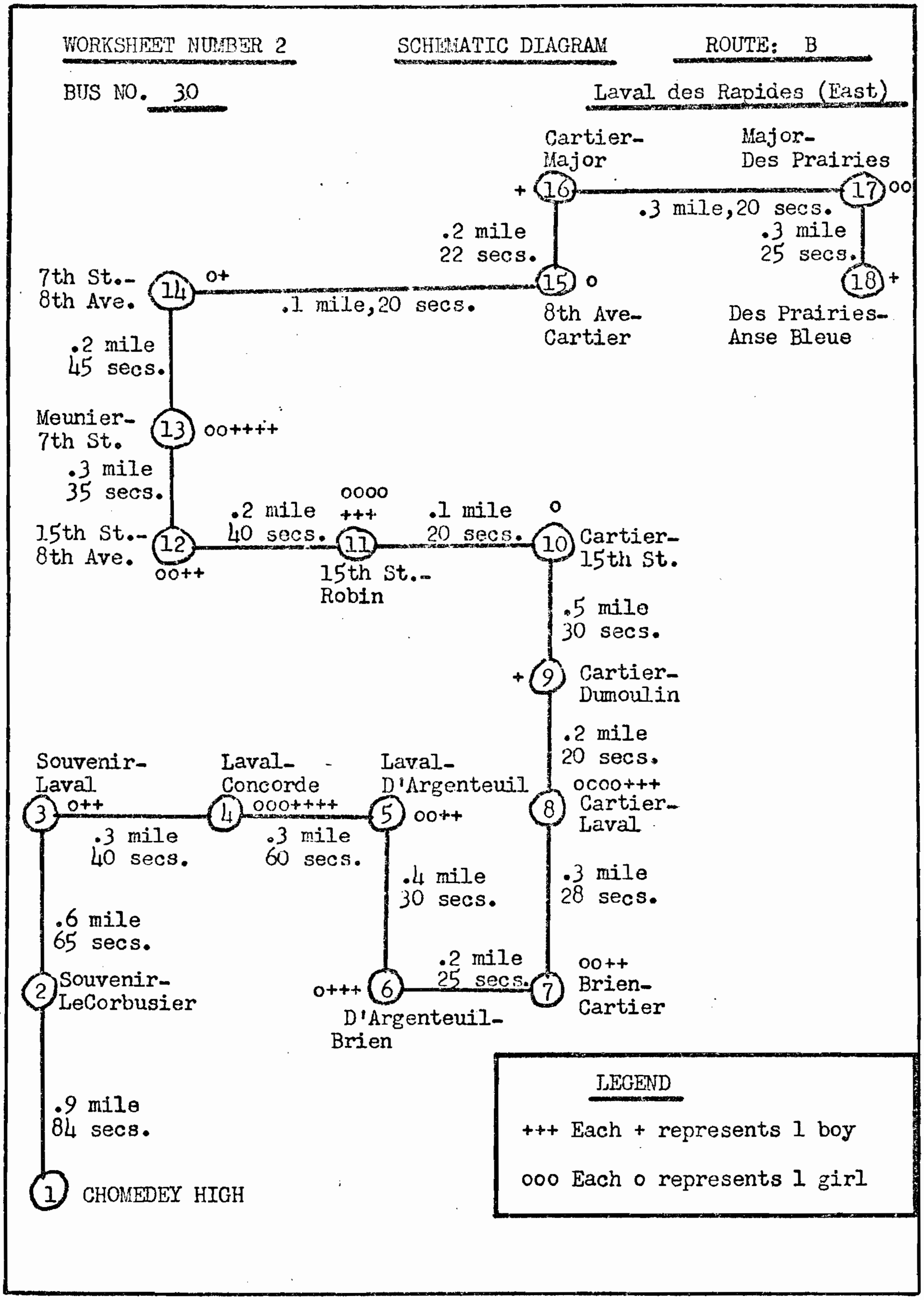


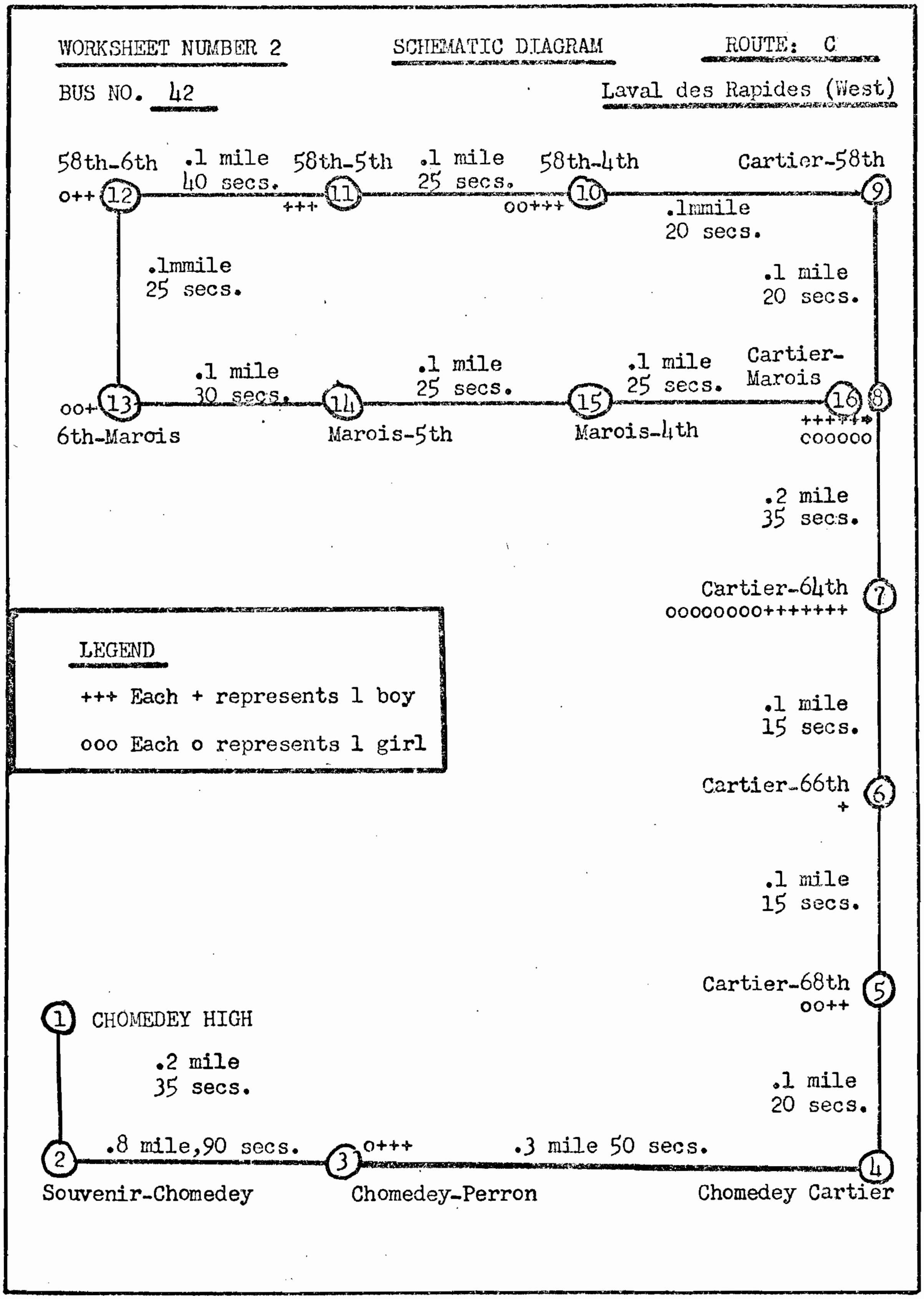
CHOMEDEY HIGH SCHOOL
BUS ROUTE
MACKENZIE
Nº 61
ROUTE H
SCALE IN FEET
CHOMEDEY HIGH SCHOOL

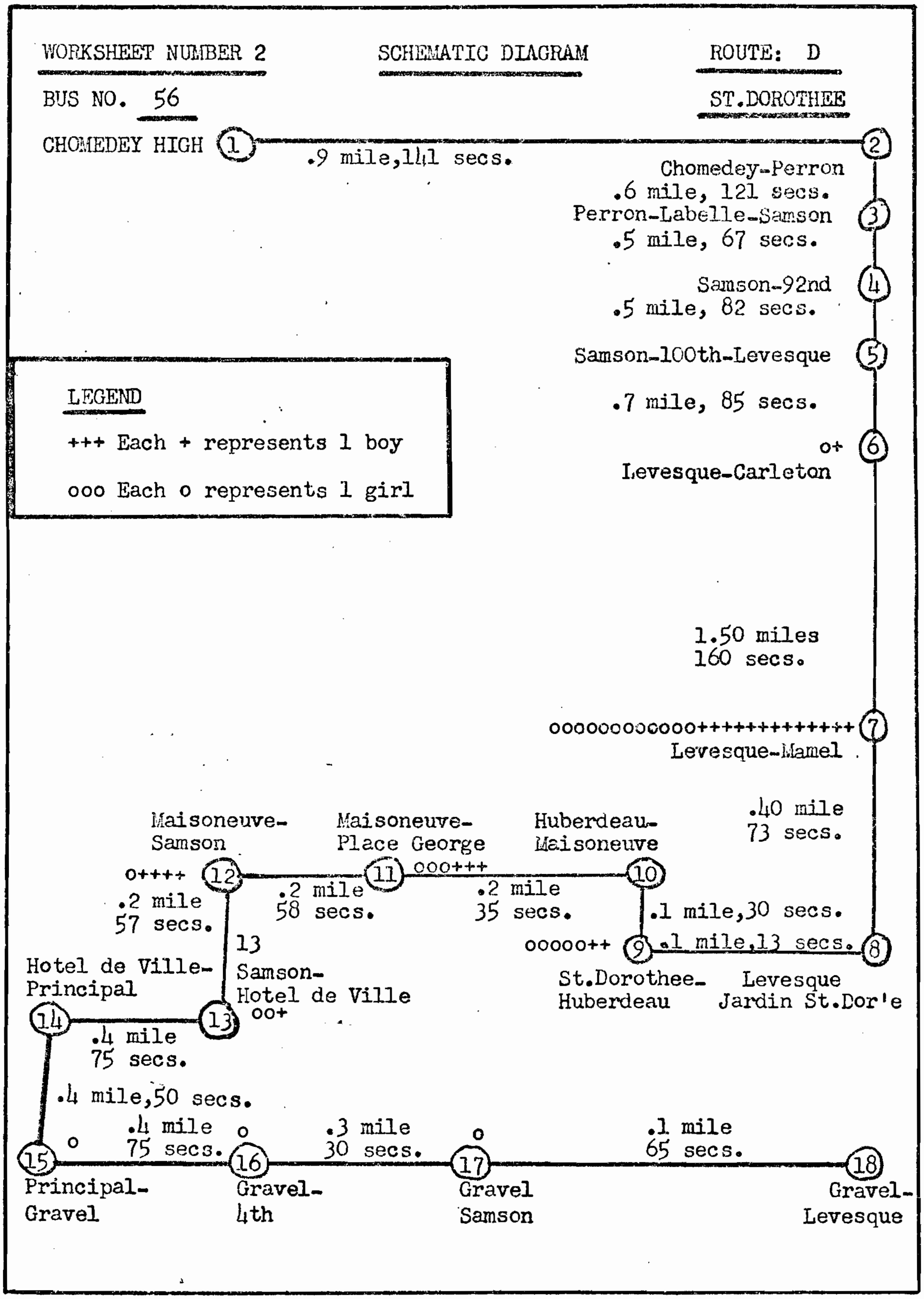

CHOMEDEY HIGH SCHOOL
BUS ROUTE
SOUVENIR
Nos 5 & 12
ROUTE J
SCALE IN FEET
N
CHOMEDEY HIGH SCHOOL
AUTOROUTE
CHOMEDEY
BOULEVARD
MARTIN
G
F
E
D
C
9
10
11
12
13
14
15

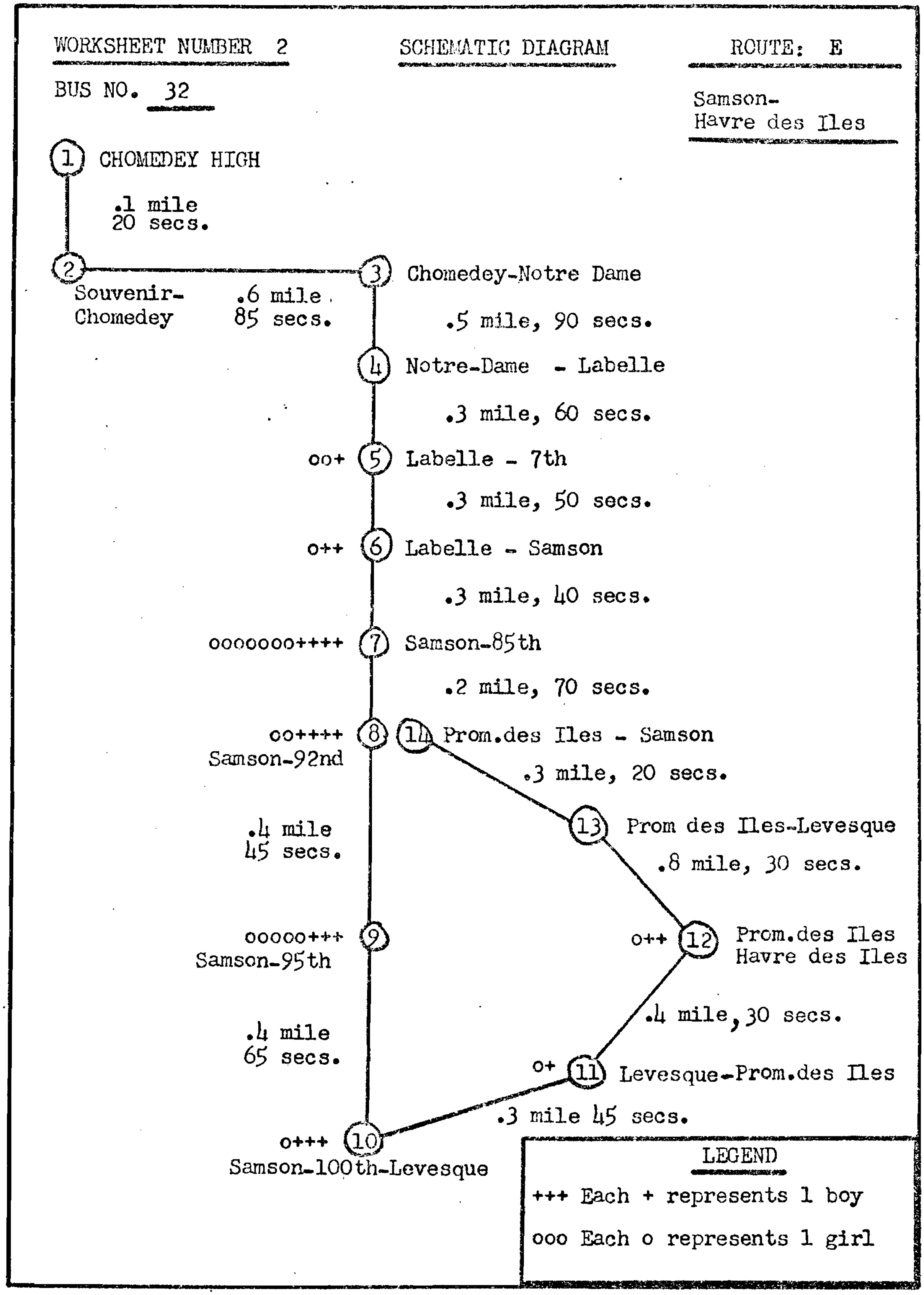

CHOMEDEY HIGH SCHOOL
BUS ROUTE
RENAUD - VIMONT
No 24
ROUTE K
SCALE IN FEET
CHOMEDEY HIGH SCHOOL
LAURENTIDES
AUTOROUTE
INDUSTRIEL
BOULEVARD


WORKSHEET NUMBER 2
SCHEMATIC DIAGRAM
ROUTE: A
BUS NO. 33
Pont Viau-Duvernay
Concorde-Rose de Lima
o+
15
.3 mile 25 secs.
16
o
Concorde-Levesque
.2 mile,45 secs.
Concorde-Lesage
14
oo+++
.5 mile,120 secs.
Concorde-D'Auteuil
13
ooo+
.9 mile,170 secs.
Concorde-Leblanc
12
ooo+++
.3 mile,55 secs.
Concorde-J.J.Joubert
11
oo++
.2 mile,65 secs.
Concorde-N.D.de Fatima
10
ooooo++++++++
.4 mile,105 secs.
Concorde-Goineau
9
oooooo++++++++++
.4 mile,55 secs.
o++
8
Laurentide-Concorde
St.Martin-Laurentide
6
.7 mile,98 secs.
Laurentide-Souvenir
7
++
.3 mile,30 secs.
.3 mile,60 secs.
5
St.Martin-Valliere
.8 mile,163 secs.
4
St.Martin-McNamara
.6 mile,160 secs.
3
LeCorbusier-St.Martin
.4 mile 63 secs.
2
Souvenir-LeCorbusier
.9 mile 123 secs.
1
CHOMEDEY HIGH
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl


WORKSHEET NUMBER 2
SCHEMATIC DIAGRAM
ROUTE: B
BUS NO. 30
Laval des Rapides (East)
Cartier-Major
Major-Des Prairies
+ 16
17 oo
.3 mile, 20 secs.
.2 mile 22 secs.
.3 mile 25 secs.
7th St.-8th Ave.
14 o+
15 o
18 +
.1 mile, 20 secs.
8th Ave-Cartier
Des Prairies-Anse Bleue
.2 mile 45 secs.
Meunier-7th St.
13 oo++++
.3 mile 35 secs.
15th St.-8th Ave.
12 oo++
.2 mile 40 secs.
oooo +++ 11
15th St.-Robin
.1 mile 20 secs.
o 10
Cartier-15th St.
.5 mile 30 secs.
+ 9
Cartier-Dumoulin
.2 mile 20 secs.
Souvenir-Laval
3 o++
Laval-Concorde
4 ooo++++
Laval-D'Argenteuil
5 oo++
oooo+++ 8
Cartier-Laval
.3 mile 40 secs.
.3 mile 60 secs.
.4 mile 30 secs.
.3 mile 28 secs.
.6 mile 65 secs.
2
Souvenir-LeCorbusier
o+++ 6
D'Argenteuil-Brien
.2 mile 25 secs.
7 oo++
Brien-Cartier
.9 mile 84 secs.
1 CHOMEDEY HIGH
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl

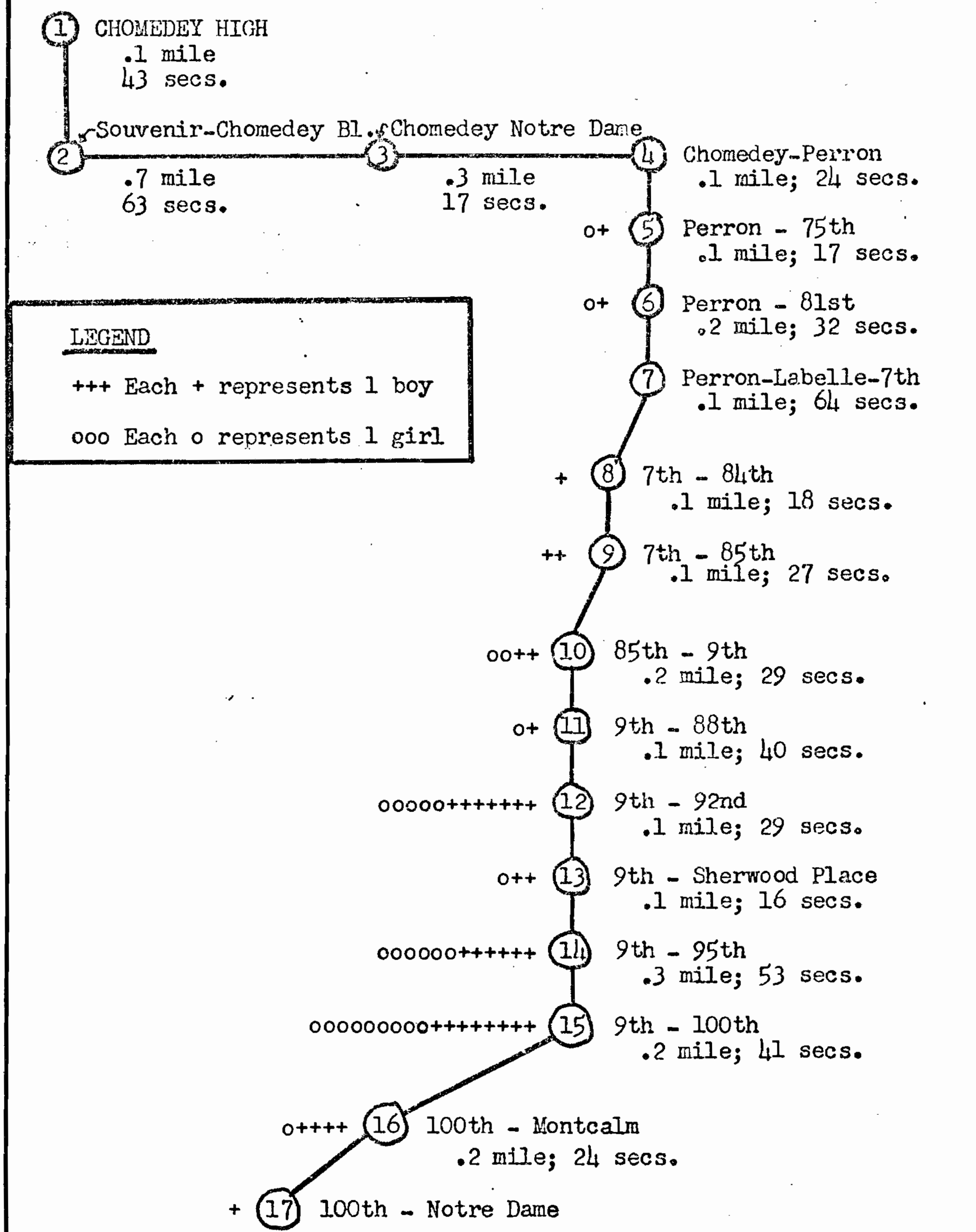

WORKSHEET NUMBER 2
SCHEMATIC DIAGRAM
ROUTE: C
BUS NO. 42
Laval des Rapides (West)
58th-6th
.1 mile
40 secs.
58th-5th
.1 mile
25 secs.
58th-4th
Cartier-58th
o++
12
11
+++
10
oo+++
9
.1mmile
20 secs.
.1mmile
25 secs.
.1 mile
20 secs.
.1 mile
30 secs.
.1 mile
25 secs.
.1 mile
25 secs.
Cartier-
Marois
oo+
13
14
15
16
8
6th-Marois
Marois-5th
Marois-4th
+++++++
oooooo
.2 mile
35 secs.
Cartier-64th
7
oooooooo+++++++
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl
.1 mile
15 secs.
Cartier-66th
6
+
.1 mile
15 secs.
Cartier-68th
5
oo++
1
CHOMEDEY HIGH
.2 mile
35 secs.
.1 mile
20 secs.
2
.8 mile,90 secs.
3
o+++
.3 mile 50 secs.
4
Souvenir-Chomedey
Chomedey-Perron
Chomedey Cartier

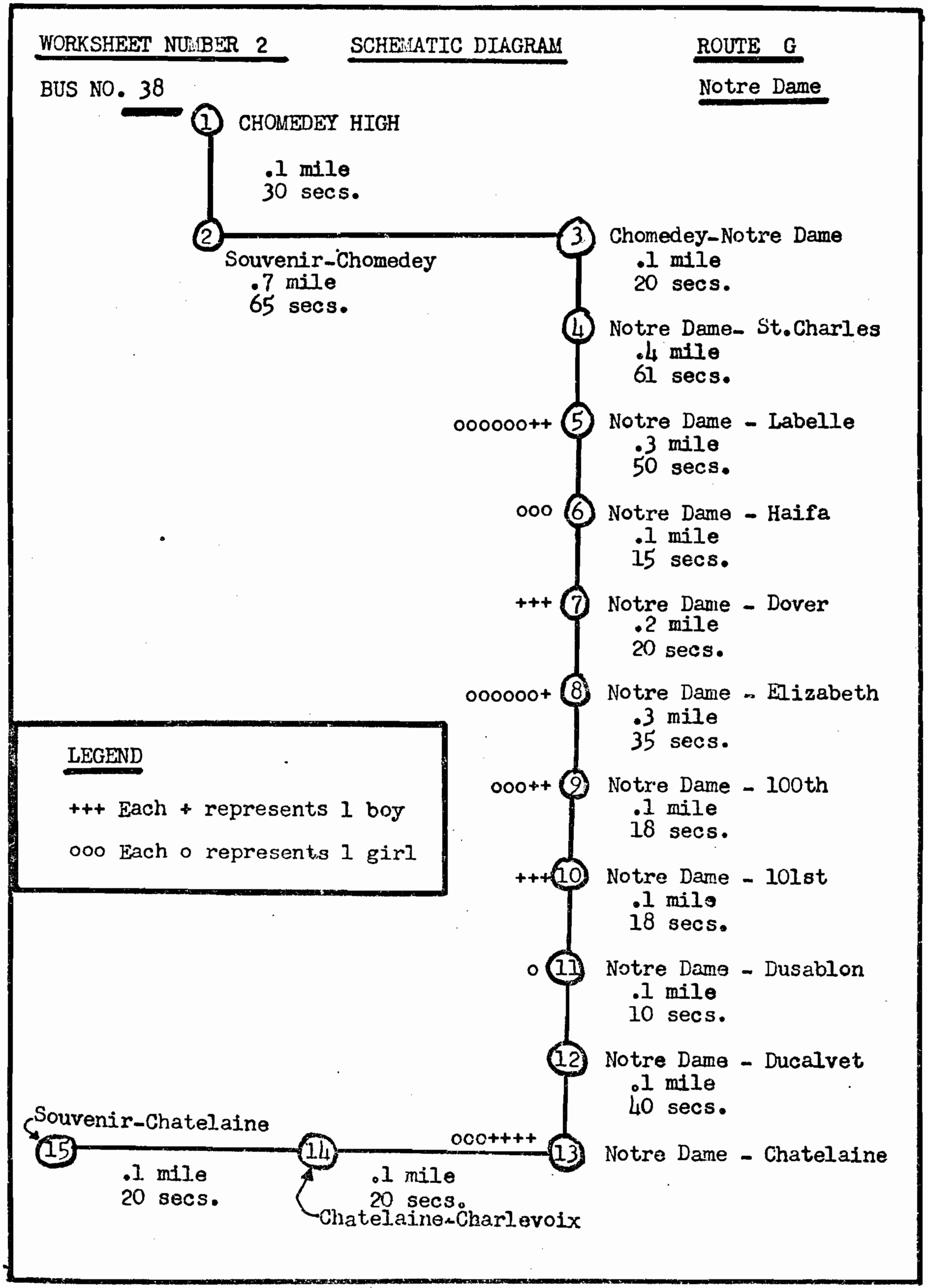

WORKSHEET NUMBER 2
SCHEMATIC DIAGRAM
ROUTE: D
BUS NO. 56
ST.DOROTHEE
CHOMEDEY HIGH
1
.9 mile,141 secs.
2
Chomedey-Perron
.6 mile, 121 secs.
Perron-Labelle-Samson
3
.5 mile, 67 secs.
Samson-92nd
4
.5 mile, 82 secs.
Samson-100th-Levesque
5
.7 mile, 85 secs.
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl
o+
6
Levesque-Carleton
1.50 miles
160 secs.
oooooooooooo++++++++++++
7
Levesque-Mamel
.40 mile
73 secs.
Maisoneuve-
Samson
Maisoneuve-
Place George
Huberdeau-
Maisoneuve
o++++
12
11
ooo+++
10
.2 mile
57 secs.
.2 mile
58 secs.
.2 mile
35 secs.
.1 mile,30 secs.
13
ooooo++
9
.1 mile,13 secs.
8
Hotel de Ville-
Principal
Samson-
Hotel de Ville
St.Dorothee-
Huberdeau
Levesque
Jardin St.Dor'e
14
13
oo+
.4 mile
75 secs.
.4 mile,50 secs.
o
.4 mile
75 secs.
o
.3 mile
30 secs.
o
.1 mile
65 secs.
15
16
17
18
Principal-
Gravel
Gravel-
4th
Gravel
Samson
Gravel-
Levesque

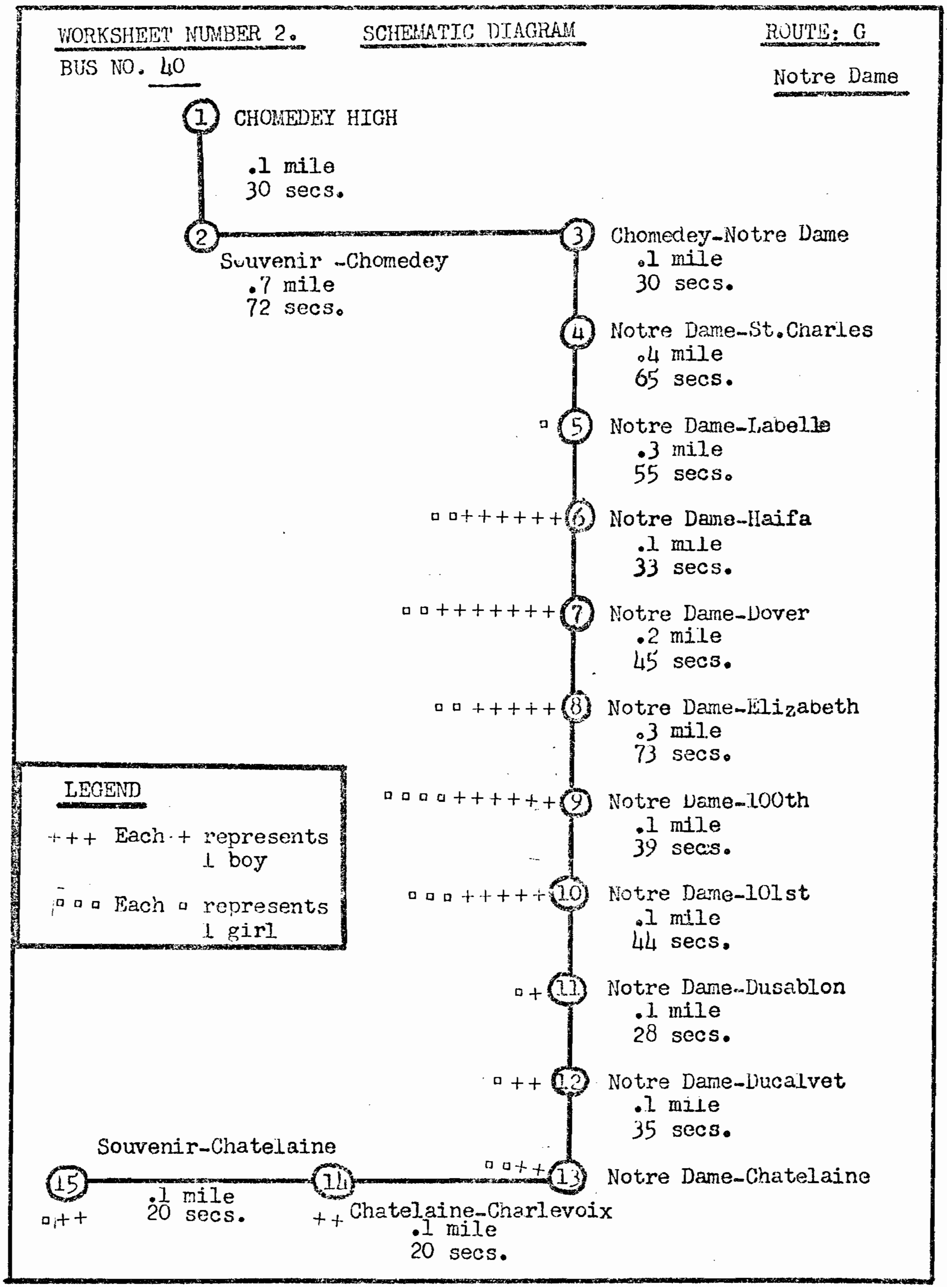

WORKSHEET NUMBER 2
SCHEMATIC DIAGRAM
ROUTE: E
BUS NO. 32
Samson-
Havre des Iles
1 CHOMEDEY HIGH
.1 mile
20 secs.
2 Souvenir-
Chomedey
.6 mile
85 secs.
3 Chomedey-Notre Dame
.5 mile, 90 secs.
4 Notre-Dame - Labelle
.3 mile, 60 secs.
oo+ 5 Labelle - 7th
.3 mile, 50 secs.
o++ 6 Labelle - Samson
.3 mile, 40 secs.
ooooooo++++ 7 Samson-85th
.2 mile, 70 secs.
oo++++ 8 Samson-92nd
14 Prom.des Iles - Samson
.3 mile, 20 secs.
13 Prom des Iles-Levesque
.8 mile, 30 secs.
.4 mile
45 secs.
ooooo+++ 9 Samson-95th
o++ 12 Prom.des Iles
Havre des Iles
.4 mile, 30 secs.
.4 mile
65 secs.
o+ 11 Levesque-Prom.des Iles
.3 mile 45 secs.
o+++ 10 Samson-100th-Levesque
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl

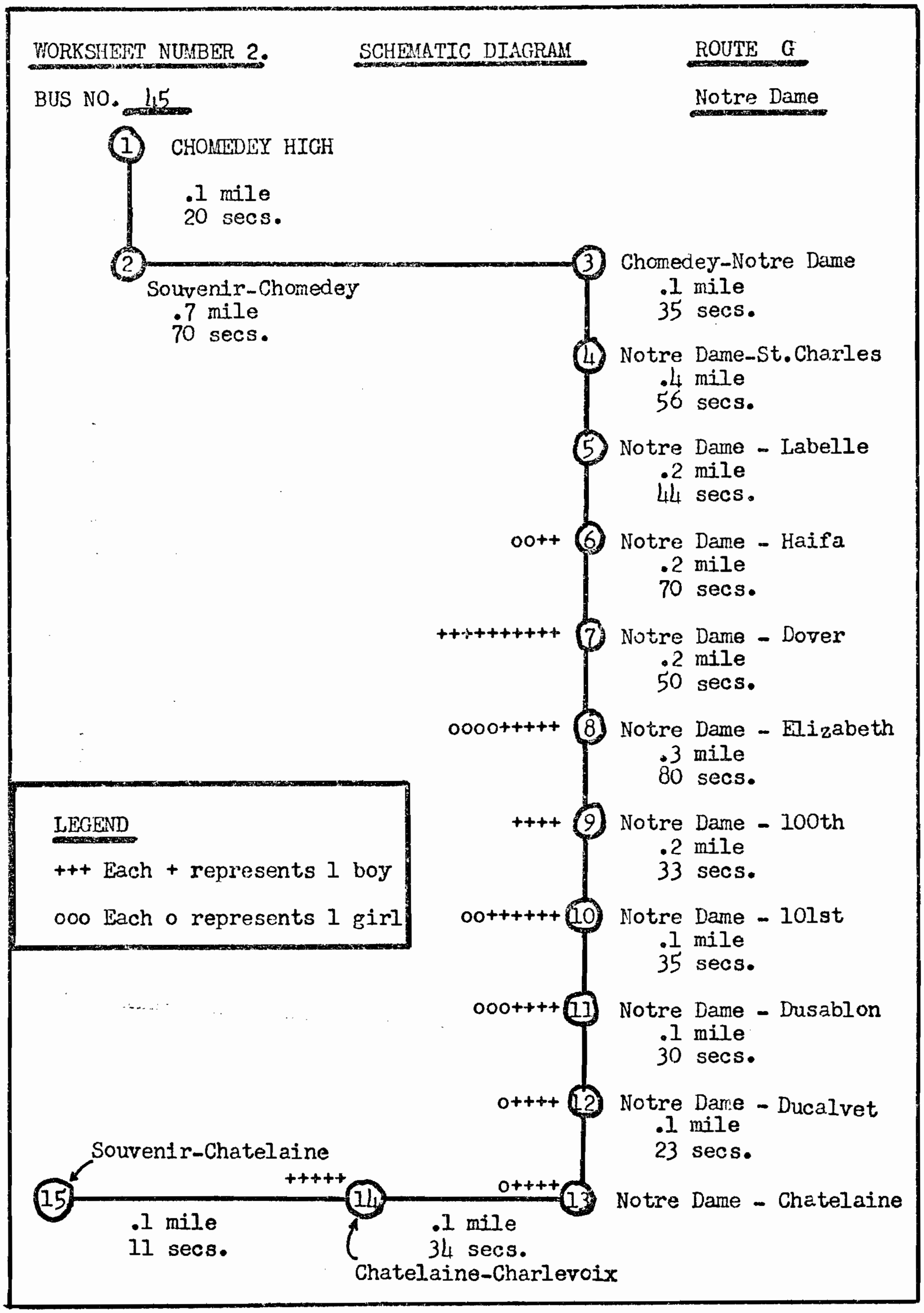
WORKSHEET NUMBER 2 SCHEMATIC DIAGRAM ROUTE: F

BUS NO. 55 Perron-7th-9th




WORKSHEET NUMBER 2
SCHEMATIC DIAGRAM
ROUTE G
BUS NO. 38
Notre Dame
1 CHOMEDEY HIGH
.1 mile
30 secs.
2 Souvenir-Chomedey
.7 mile
65 secs.
3 Chomedey-Notre Dame
.1 mile
20 secs.
4 Notre Dame- St.Charles
.4 mile
61 secs.
oooooo++ 5 Notre Dame - Labelle
.3 mile
50 secs.
ooo 6 Notre Dame - Haifa
.1 mile
15 secs.
+++ 7 Notre Dame - Dover
.2 mile
20 secs.
oooooo+ 8 Notre Dame - Elizabeth
.3 mile
35 secs.
ooo++ 9 Notre Dame - 100th
.1 mile
18 secs.
+++ 10 Notre Dame - 101st
.1 mile
18 secs.
o 11 Notre Dame - Dusablon
.1 mile
10 secs.
12 Notre Dame - Ducalvet
.1 mile
40 secs.
ooo++++ 13 Notre Dame - Chatelaine
14 Chatelaine-Charlevoix
.1 mile
20 secs.
15 Souvenir-Chatelaine
.1 mile
20 secs.
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl


WORKSHEET NUMBER 2.
SCHEMATIC DIAGRAM
ROUTE: G
BUS NO. 40
Notre Dame
1 CHOMEDEY HIGH
.1 mile
30 secs.
2 Souvenir -Chomedey
.7 mile
72 secs.
3 Chomedey-Notre Dame
.1 mile
30 secs.
4 Notre Dame-St.Charles
.4 mile
65 secs.
5 Notre Dame-Labelle
.3 mile
55 secs.
6 Notre Dame-Haifa
.1 mile
33 secs.
7 Notre Dame-Dover
.2 mile
45 secs.
8 Notre Dame-Elizabeth
.3 mile
73 secs.
9 Notre Dame-100th
.1 mile
39 secs.
10 Notre Dame-101st
.1 mile
44 secs.
11 Notre Dame-Dusablon
.1 mile
28 secs.
12 Notre Dame-Ducalvet
.1 mile
35 secs.
13 Notre Dame-Chatelaine
14 Chatelaine-Charlevoix
.1 mile
20 secs.
Souvenir-Chatelaine
15
.1 mile
20 secs.
LEGEND
+++ Each + represents 1 boy
▫▫▫ Each ▫ represents 1 girl


WORKSHEET NUMBER 2.
SCHEMATIC DIAGRAM
ROUTE G
BUS NO. 45
Notre Dame
1 CHOMEDEY HIGH
.1 mile
20 secs.
2 Souvenir-Chomedey
.7 mile
70 secs.
3 Chomedey-Notre Dame
.1 mile
35 secs.
4 Notre Dame-St.Charles
.4 mile
56 secs.
5 Notre Dame - Labelle
.2 mile
44 secs.
oo++ 6 Notre Dame - Haifa
.2 mile
70 secs.
++++++++++ 7 Notre Dame - Dover
.2 mile
50 secs.
oooo+++++ 8 Notre Dame - Elizabeth
.3 mile
80 secs.
++++ 9 Notre Dame - 100th
.2 mile
33 secs.
oo++++++ 10 Notre Dame - 101st
.1 mile
35 secs.
ooo++++ 11 Notre Dame - Dusablon
.1 mile
30 secs.
o++++ 12 Notre Dame - Ducalvet
.1 mile
23 secs.
o++++ 13 Notre Dame - Chatelaine
.1 mile
34 secs.
+++++ 14 Chatelaine-Charlevoix
.1 mile
11 secs.
15 Souvenir-Chatelaine
LEGEND
+++ Each + represents 1 boy
ooo Each o represents 1 girl

WORKSHEET NUMBER 2 SCHEMATIC DIAGRAM ROUTE: G

BUS NO. 50 Notre Dame

Stop		Students	Distance	Time
1	CHOMEDEY HIGH		.1 mile	20 secs.
2	Souvenir-Chomedey		.8 mile	80 secs.
3	Chomedey - Notre Dame		.1 mile	20 secs.
4	Notre Dame-St.Charles		.3 mile	74 secs.
5	Notre Dame-Labelle	ooo++	.2 mile	97 secs.
6	Notre Dame - Haifa	oooo++++	.2 mile	15 secs.
7	Notre Dame - Dover	oo++	.2 mile	37 secs.
8	Notre Dame-Elizabeth	oooo++++++++++	.3 mile	57 secs.
9	Notre Dame - 100th	ooooo+	.1 mile	70 secs.
10	Notre Dame - 101st	oo++++	.1 mile	27 secs.
11	Notre Dame - Dusablon	oooo++++++	.1 mile	32 secs.
12	Notre Dame - Ducalvet	o++	.2 mile	35 secs.
13	Notre Dame-Chatelaine	oo++	.1 mile	25 secs.
14	Chatelaine-Charlevoix		.1 mile	20 secs.
15	Souvenir-Chatelaine			

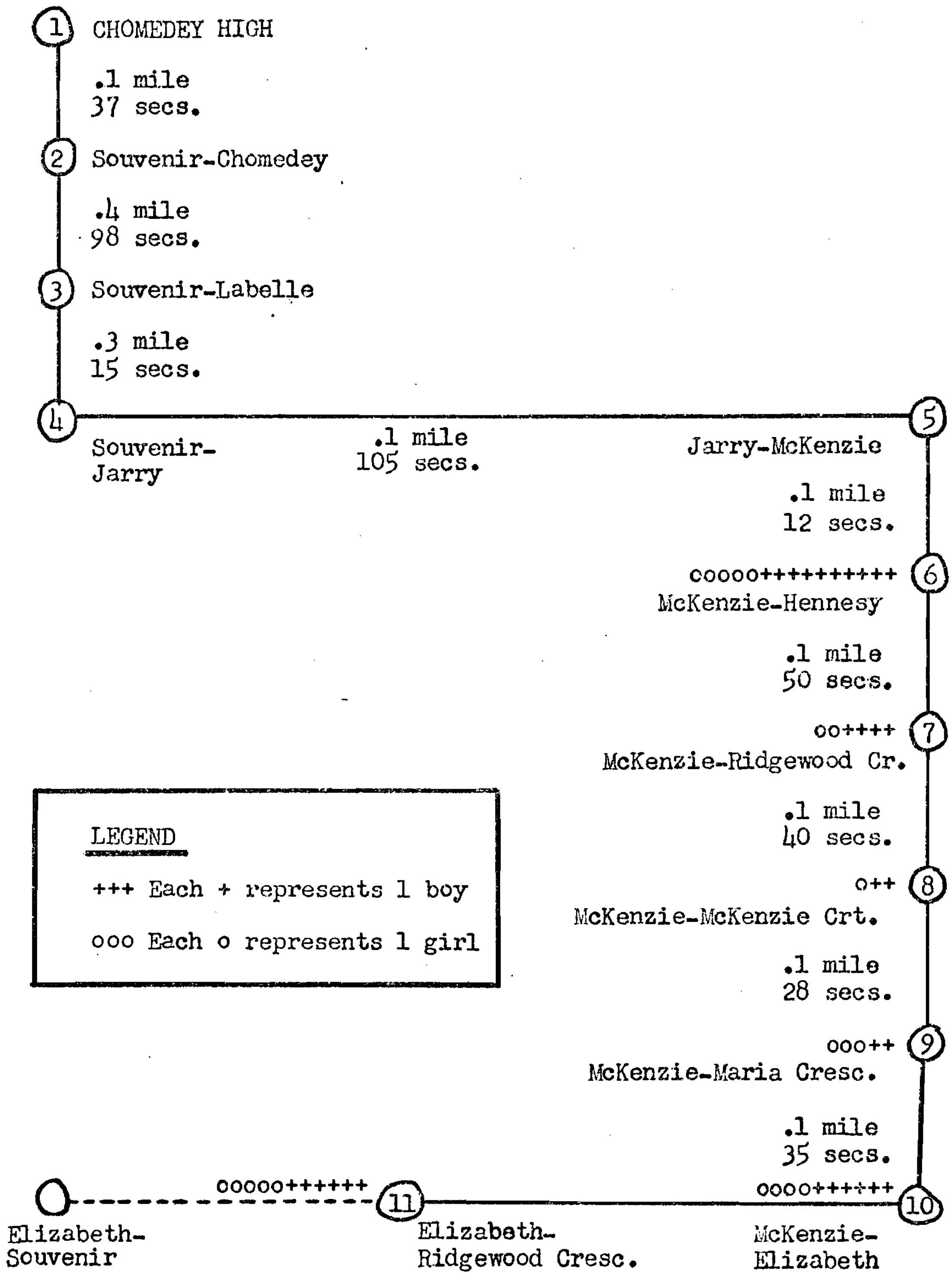
LEGEND

+++ Each + represents 1 boy

ooo Each o represents 1 girl

WORKSHEET NUMBER 2 | SCHEMATIC DIAGRAM | ROUTE: H

BUS NO. 61 | McKenzie



LEGEND

+++ Each + represents 1 boy

ooo Each o represents 1 girl

WORKSHEET NUMBER 2 SCHEMATIC DIAGRAM ROUTE: J

BUS NO. 5 Souvenir

	1	CHOMEDEY HIGH .1 mile 49 secs.
	2	Souvenir -Chomedey Bl. .4 mile 74 secs.
	3	Souvenir-Labelle .3 mile 120 secs.
oooooo+++	4	Souvenir-Elizabeth .3 mile 50 secs.
++	5	Souvenir - Lynn .1 mile 25 secs.
+++++	6	Souvenir-Webb .1 mile 28 secs.
oooo++	7	Souvenir-100th .1 mile 30 secs.
+	8	Souvenir - Emerson .1 mile 20 secs.
o	9	Souvenir - Effingham .1 mile 32 secs.
++	10	Souvenir - Melville .2 mile 60 secs.
ooo++++++	11	Souvenir - Chatelaine .2 mile 80 secs.
oo+	12	Chatelaine - Notre Dame

LEGEND

+++ Each + represents 1 boy

ooo Each o represents 1 girl

WORKSHEET NUMBER 2 | SCHEMATIC DIAGRAM | ROUTE : J

BUS NO. 12 | SOUVENIR

Pupils	Stop	Location	Distance / time to next stop
	1	CHOMEDEY HIGH	.1 mile 47 secs.
	2	Souvenir- Chomedey Bl.	.4 mile 72 seconds
oo	3	Souvenir - Labelle	.3 mile 132 seconds
o++++++	4	Souvenir - Elizabeth	.2 mile 34 seconds
o+	5	Souvenir - Lynn	.2 mile 32 seconds
oooooooooo+	6	Souvenir - Webb	.1 mile 25 seconds
ooo+++	7	Souvenir - 100th	.1 mile 25 seconds
o+++	8	Souvenir - Emerson	.1 mile 20 seconds
++	9	Souvenir - Effingham	.1 mile 30 seconds
o+	10	Souvenir - Melville	.2 mile 90 seconds
ooo	11	Souvenir - Chatelaine	.1 mile 35 seconds
o+	12	Souvenir - Carmel	

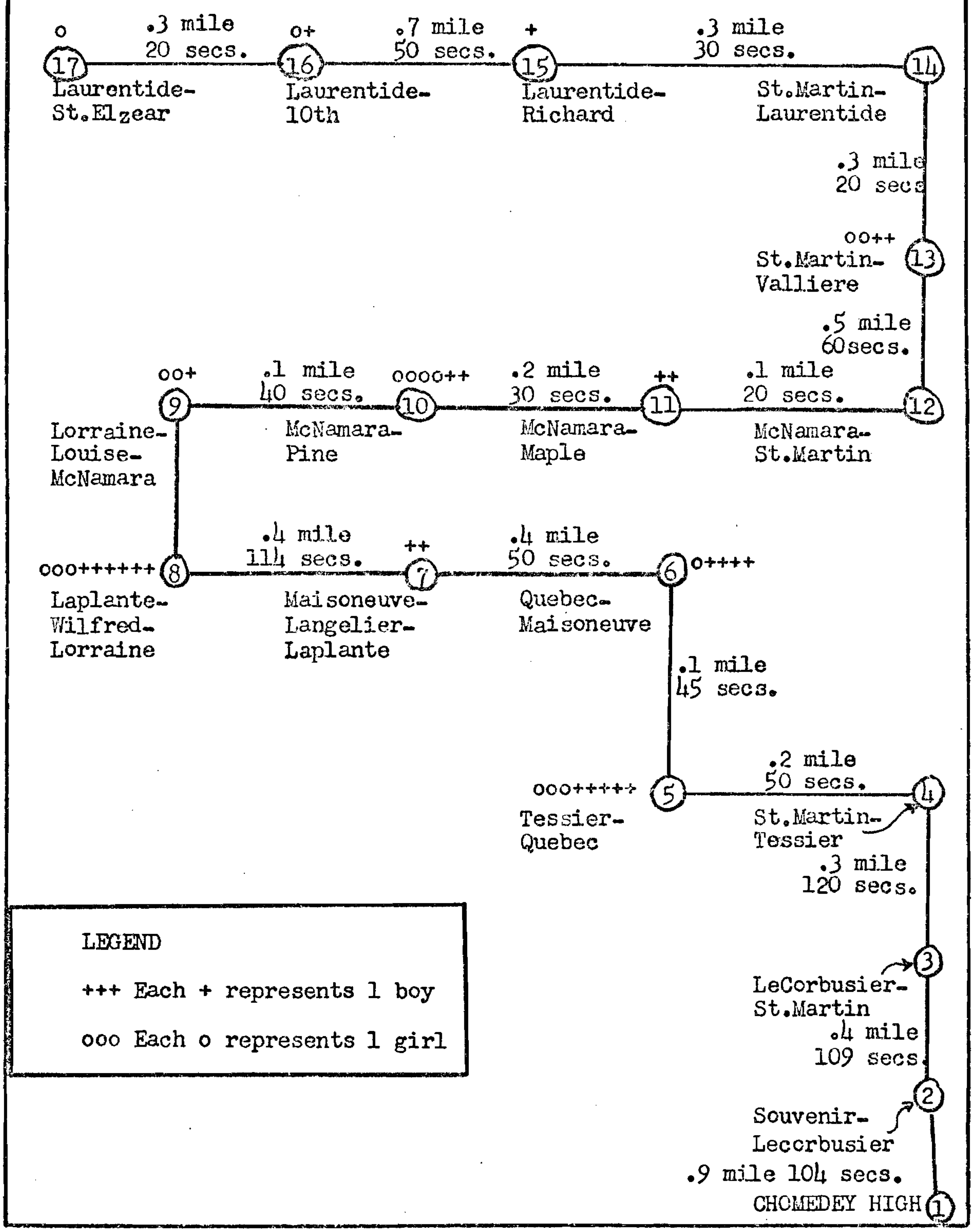
LEGEND

+++ Each + represents 1 boy

ooo Each o represents 1 girl

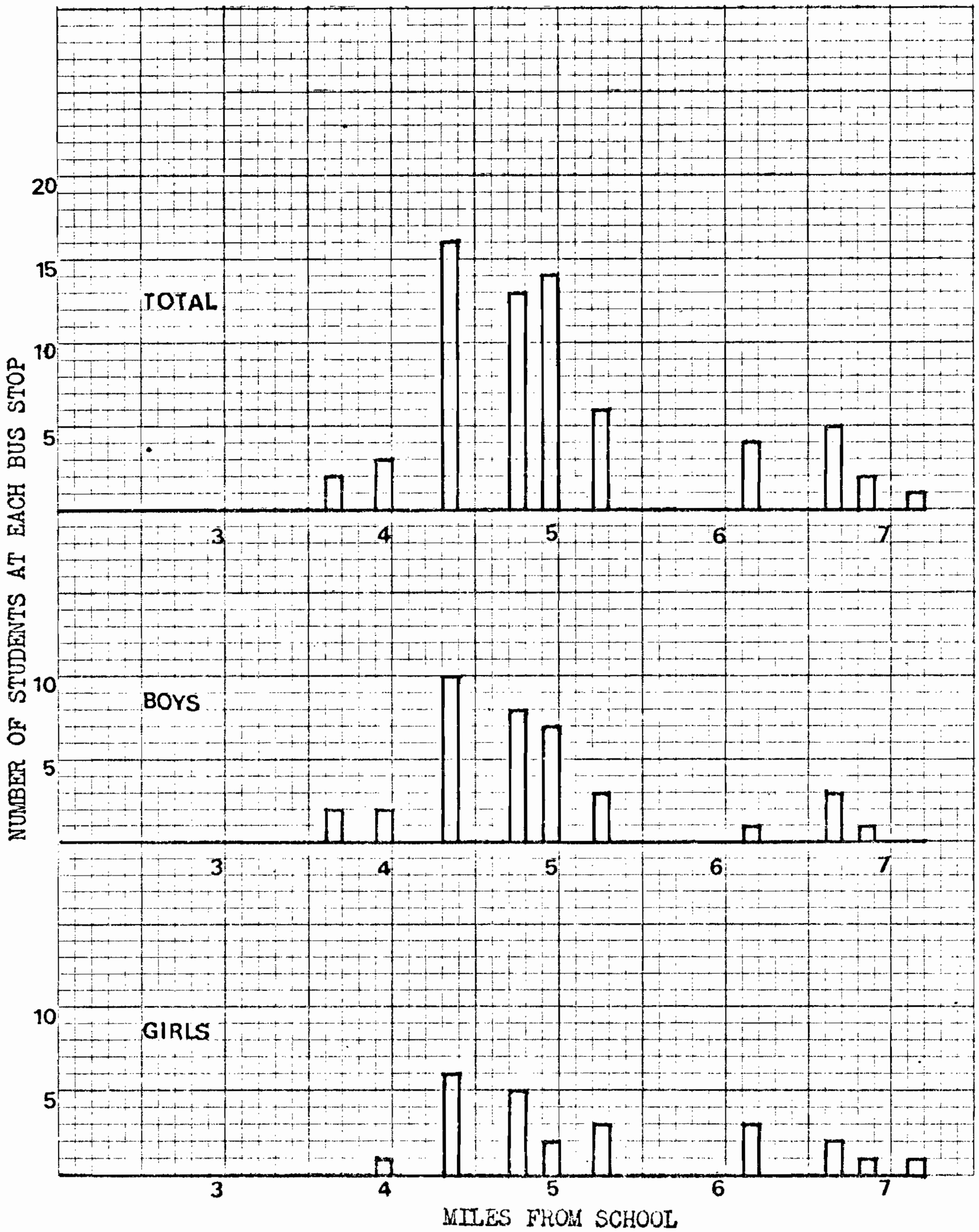
WORKSHEET NUMBER 2 SCHEMATIC DIAGRAM ROUTE: K

BUS NO. 24 Renaud-Vimont



WORKSHEET NO. 3(a) HISTOGRAMS ROUTE: A

BUS NO. 33 Pont Viau-Duvernay



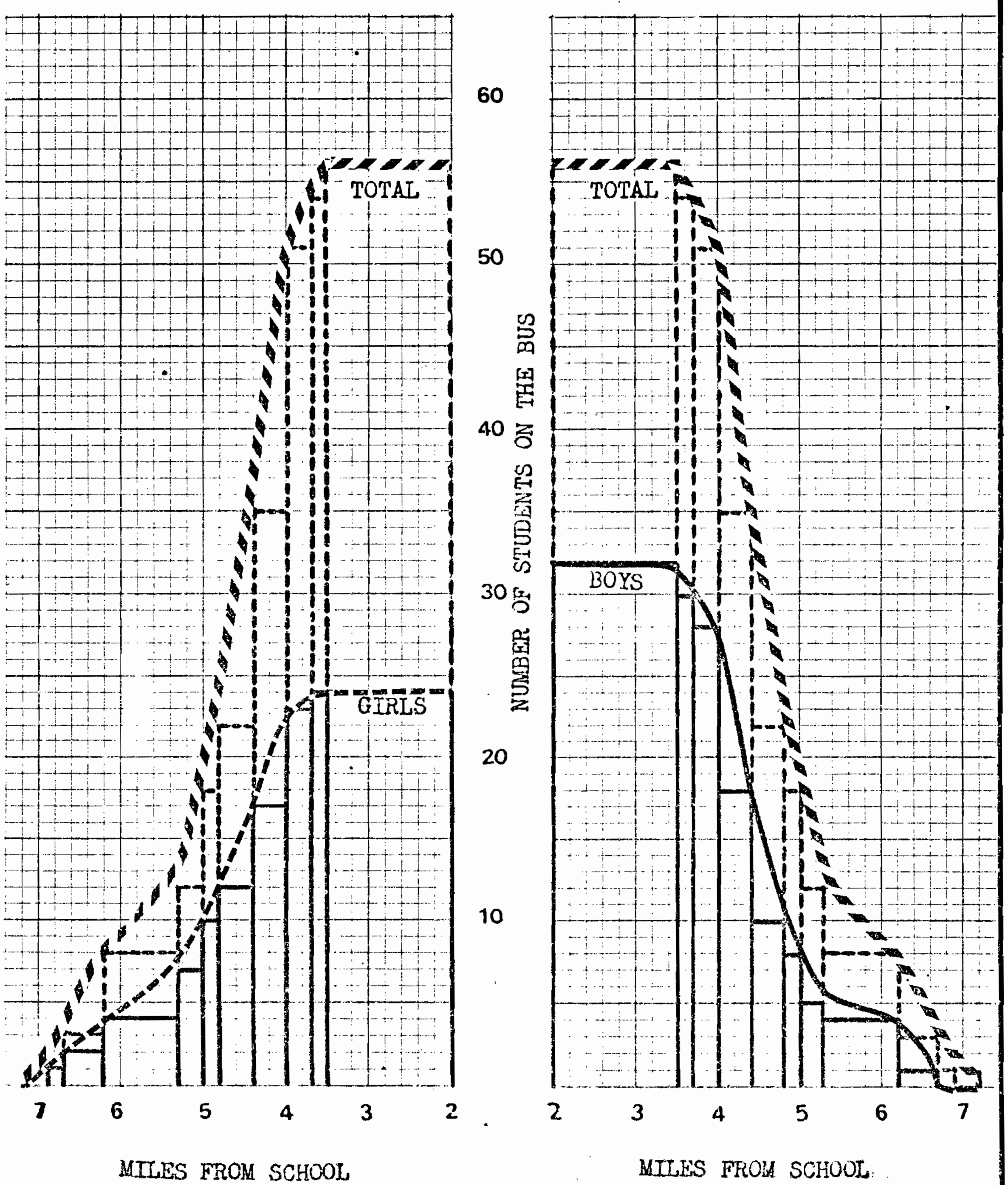
WOKSHEET NO. 3(b)

OGIVES

ROUTE: A.

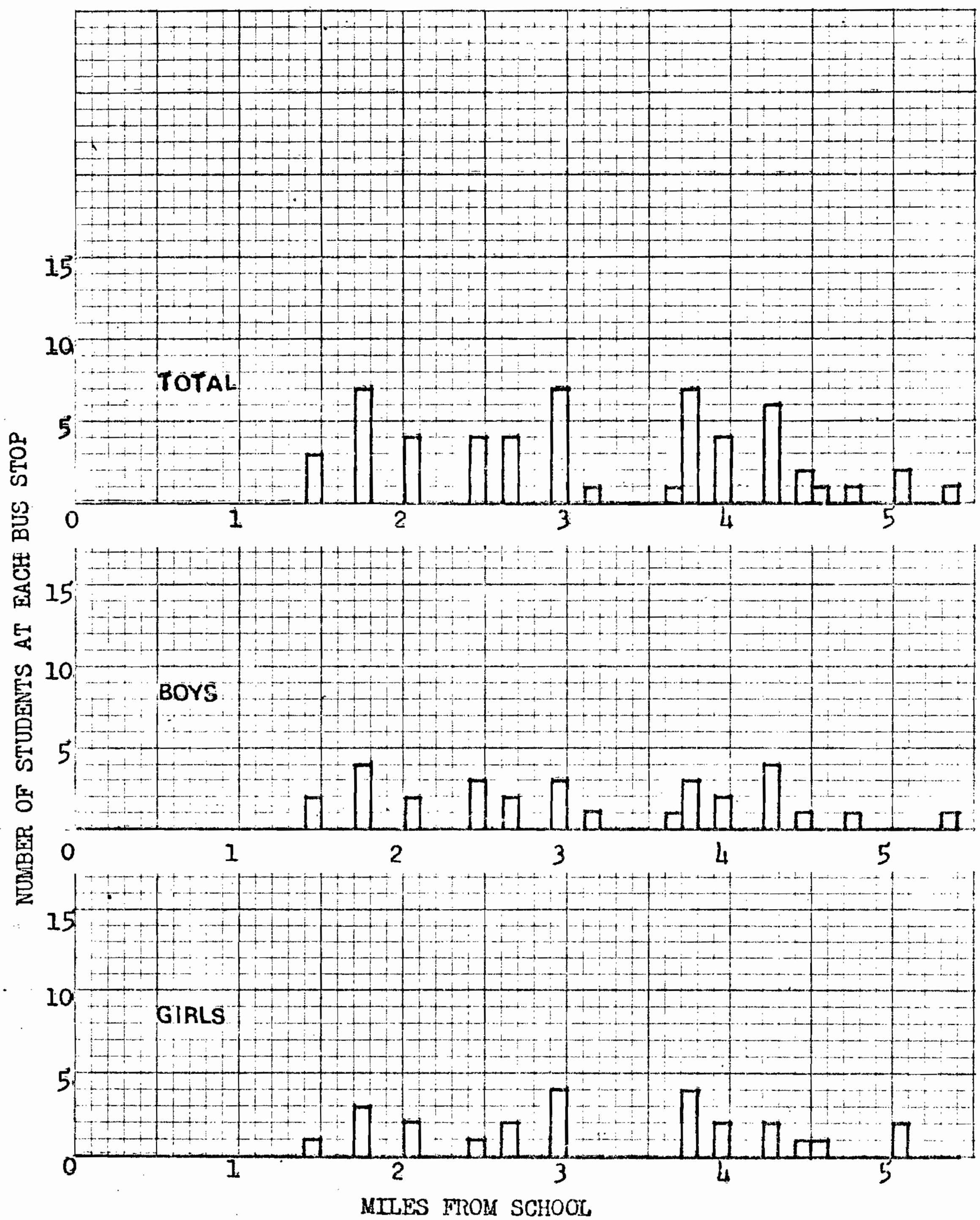
BUS NO. 33.

Pont Viau-Duvernay



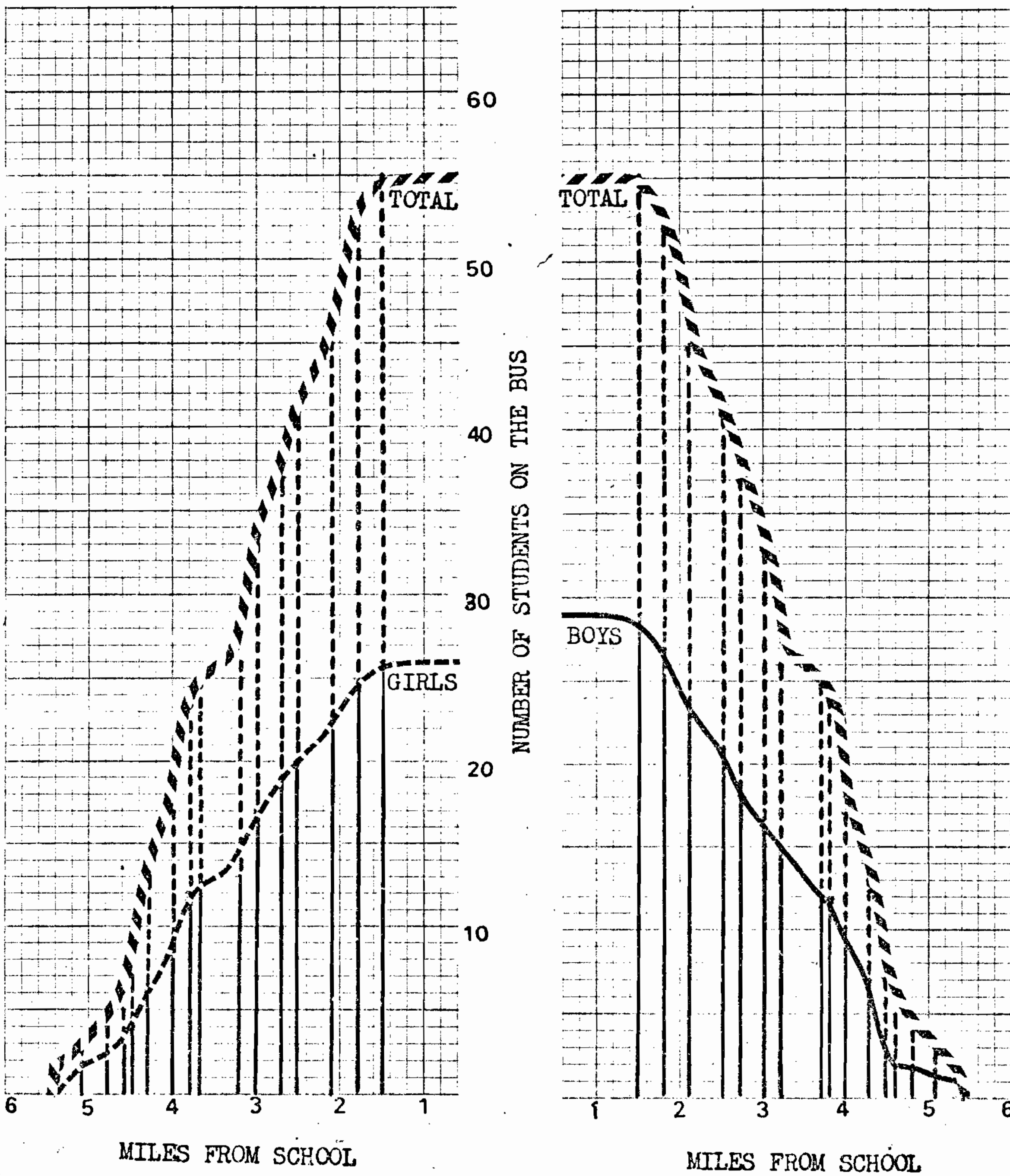
WORKSHEET NO. 3(a) HISTOGRAMS ROUTE: B

BUS NO. 30 Laval des Rapides (East)



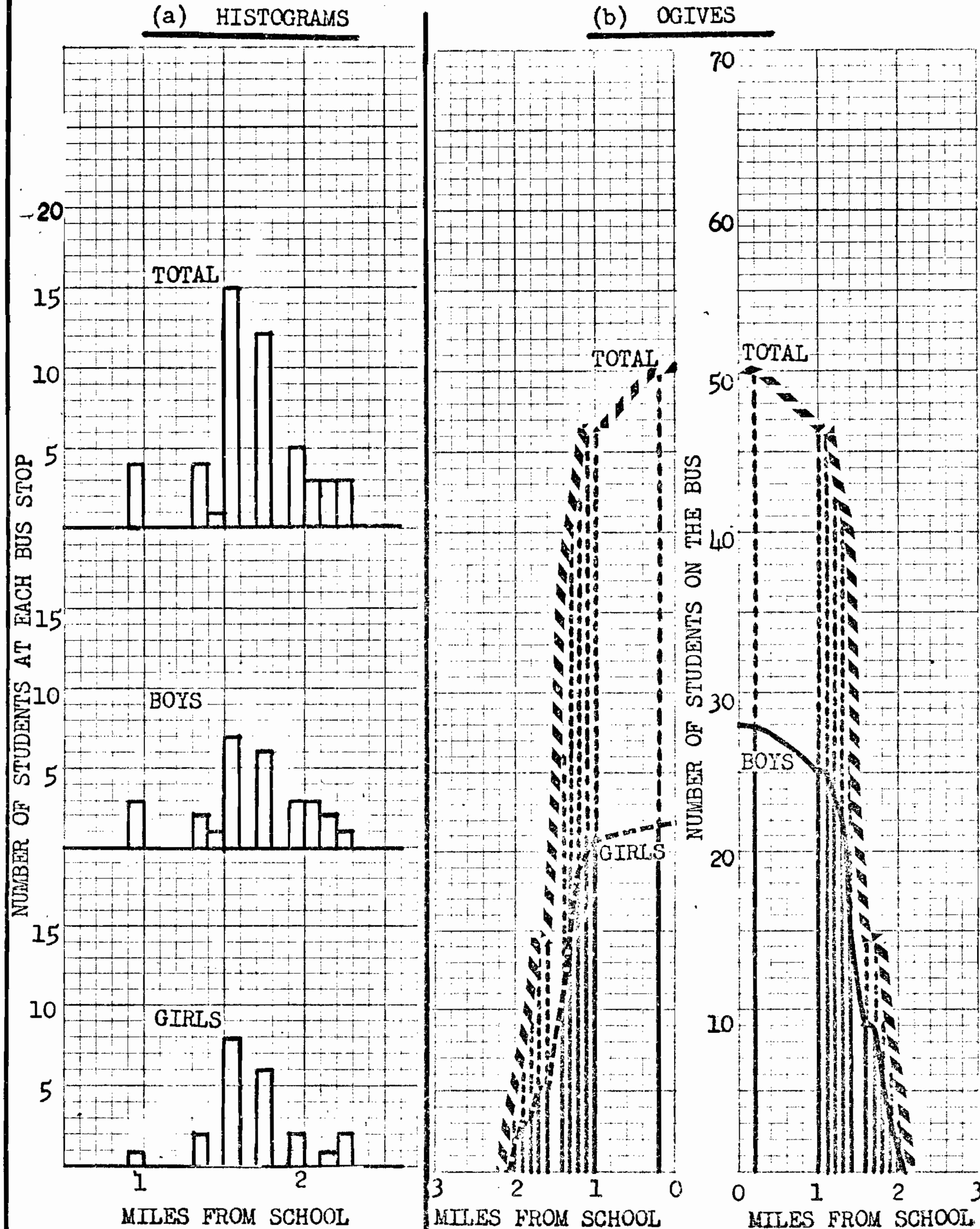
WORKSHEET NO. 3(b) OGIVES ROUTE: B

BUS NO. 30 Laval des Rapides (East)



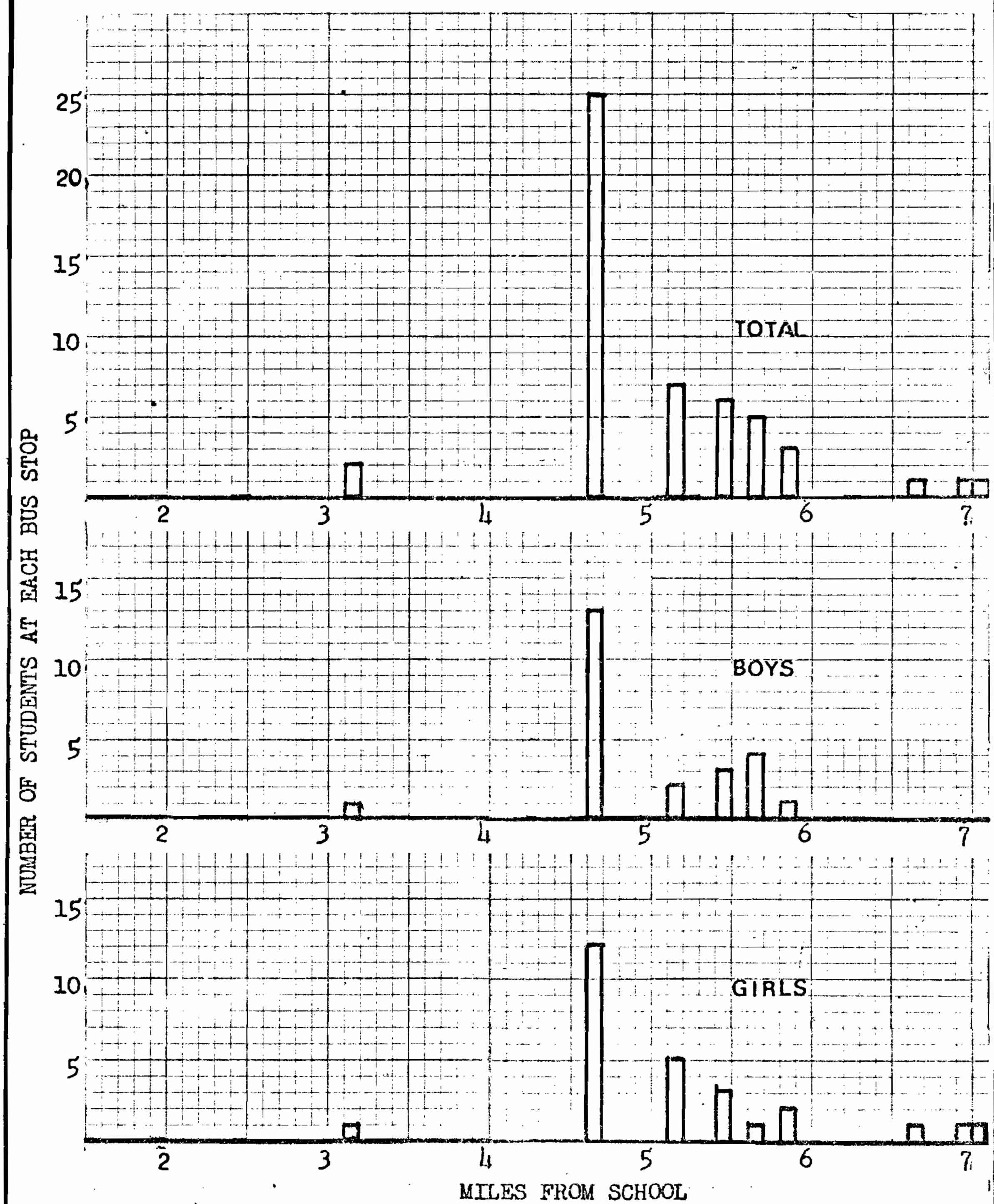
WORKSHEET NO. 3 HISTOGRAMS AND OGIVES ROUTE: C

BUS NO. 42 LAVAL DES RAPIDES (WEST)



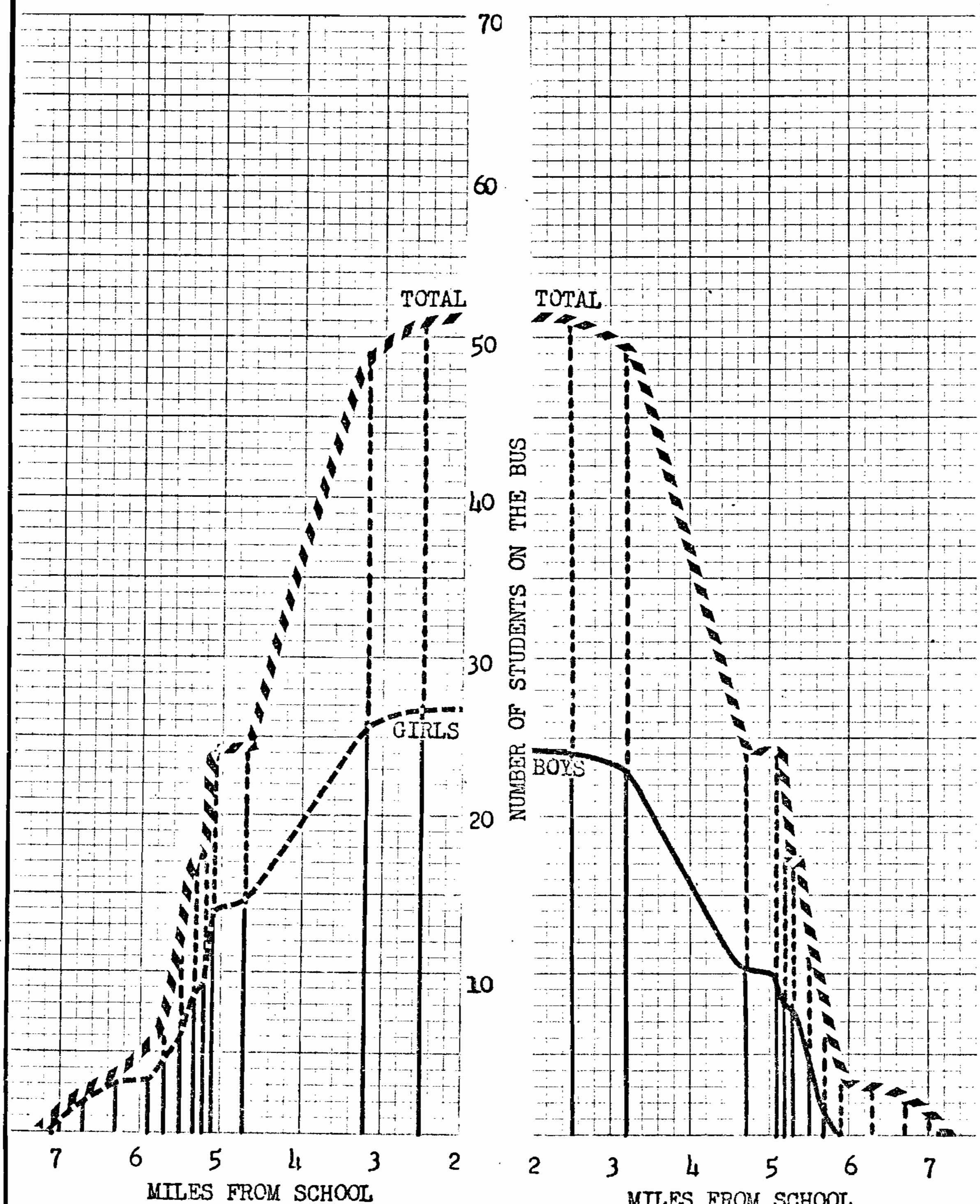
WORKSHEET NO. 3(a) HISTOGRAMS ROUTE: D

BUS NO. 56 ST.DOROTHEE



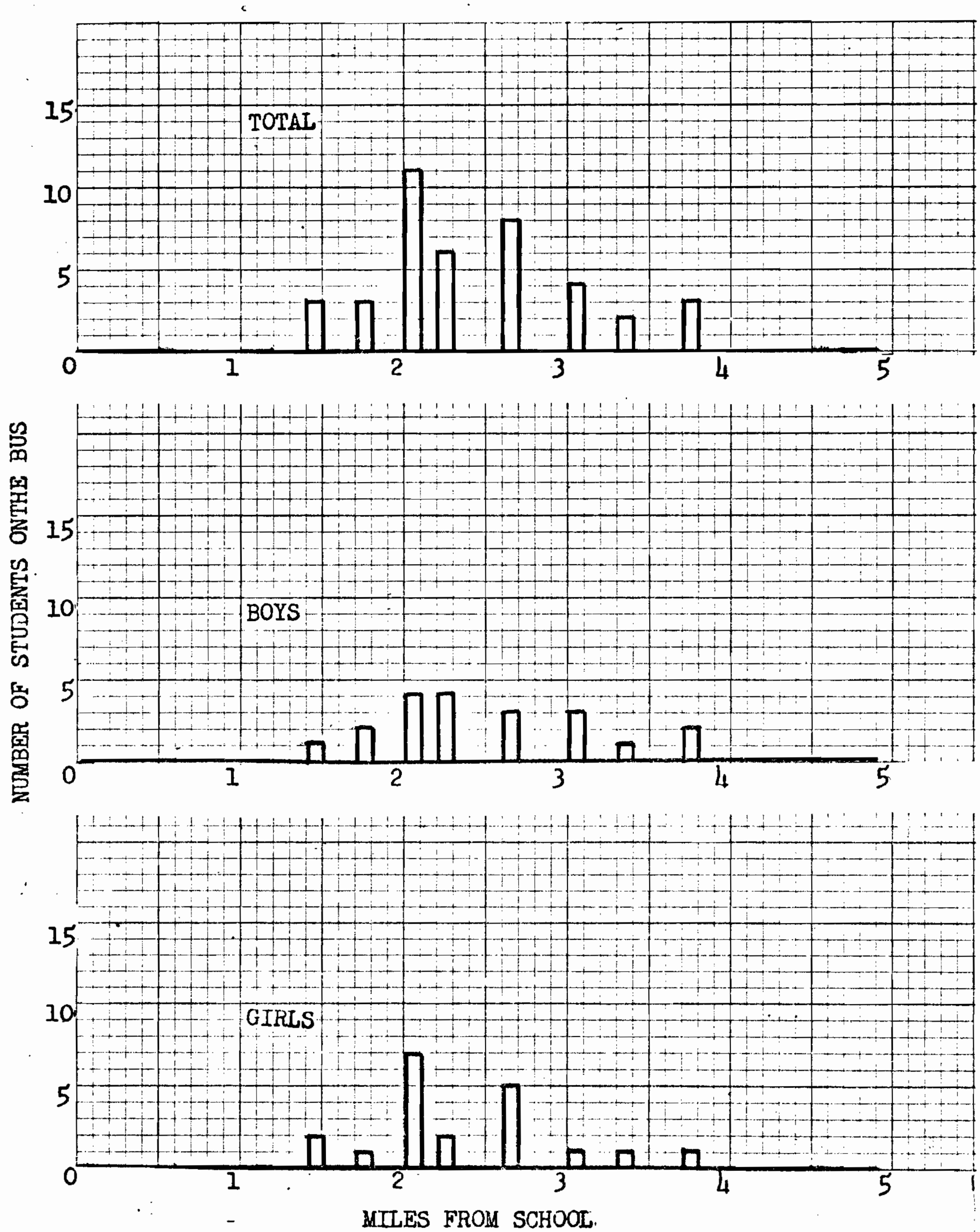
WORKSHEET NO. 3 (b) OGIVES ROUTE: D

BUS NO. 56 ST.DOROTHEE



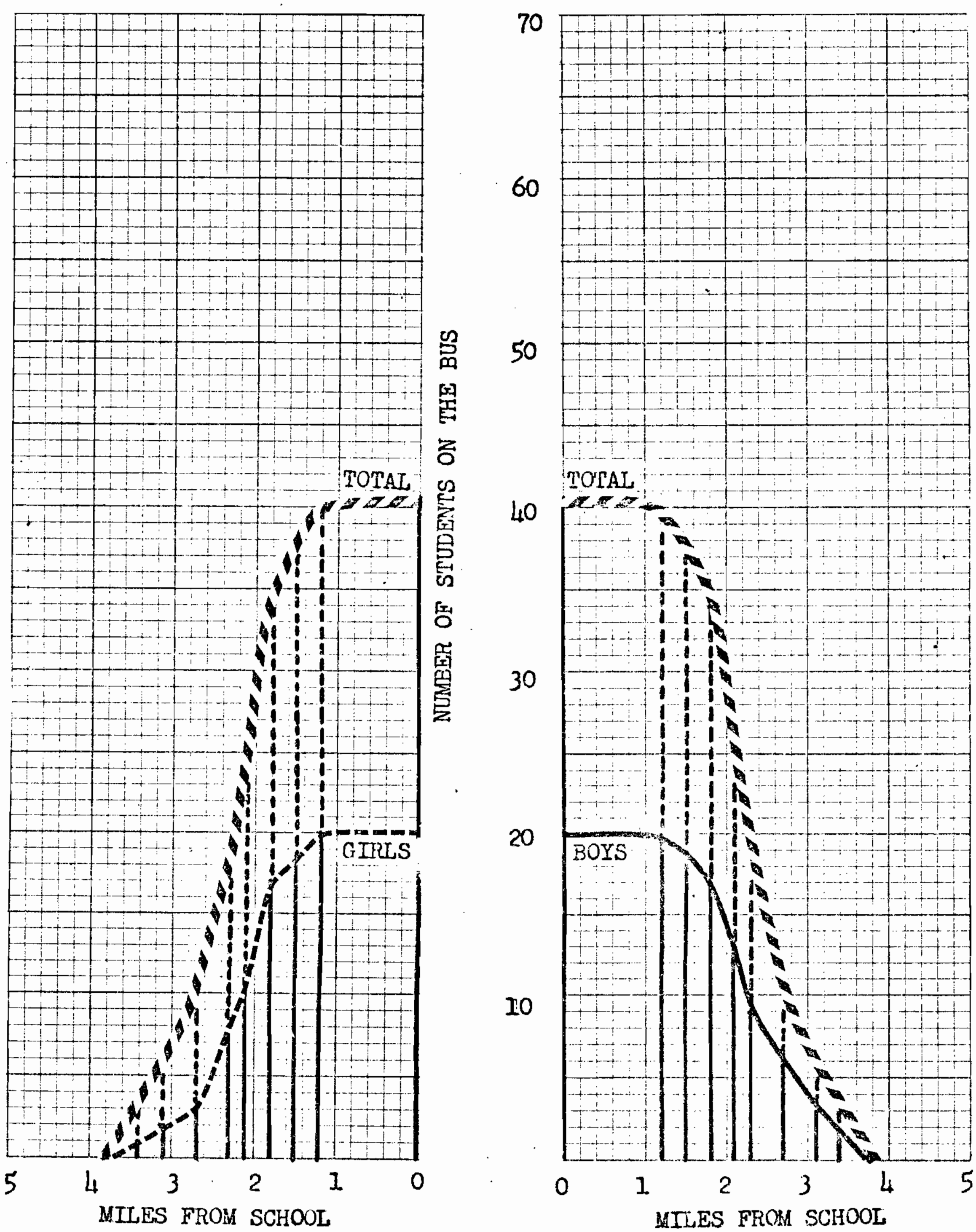
WORKSHEET NO. 3(a) HISTOGRAMS ROUTE: E

BUS NO. 32 SAMSON -HAVRE DES ILES



WORKSHEET NO. 3(b) | OGIVES | ROUTE: E

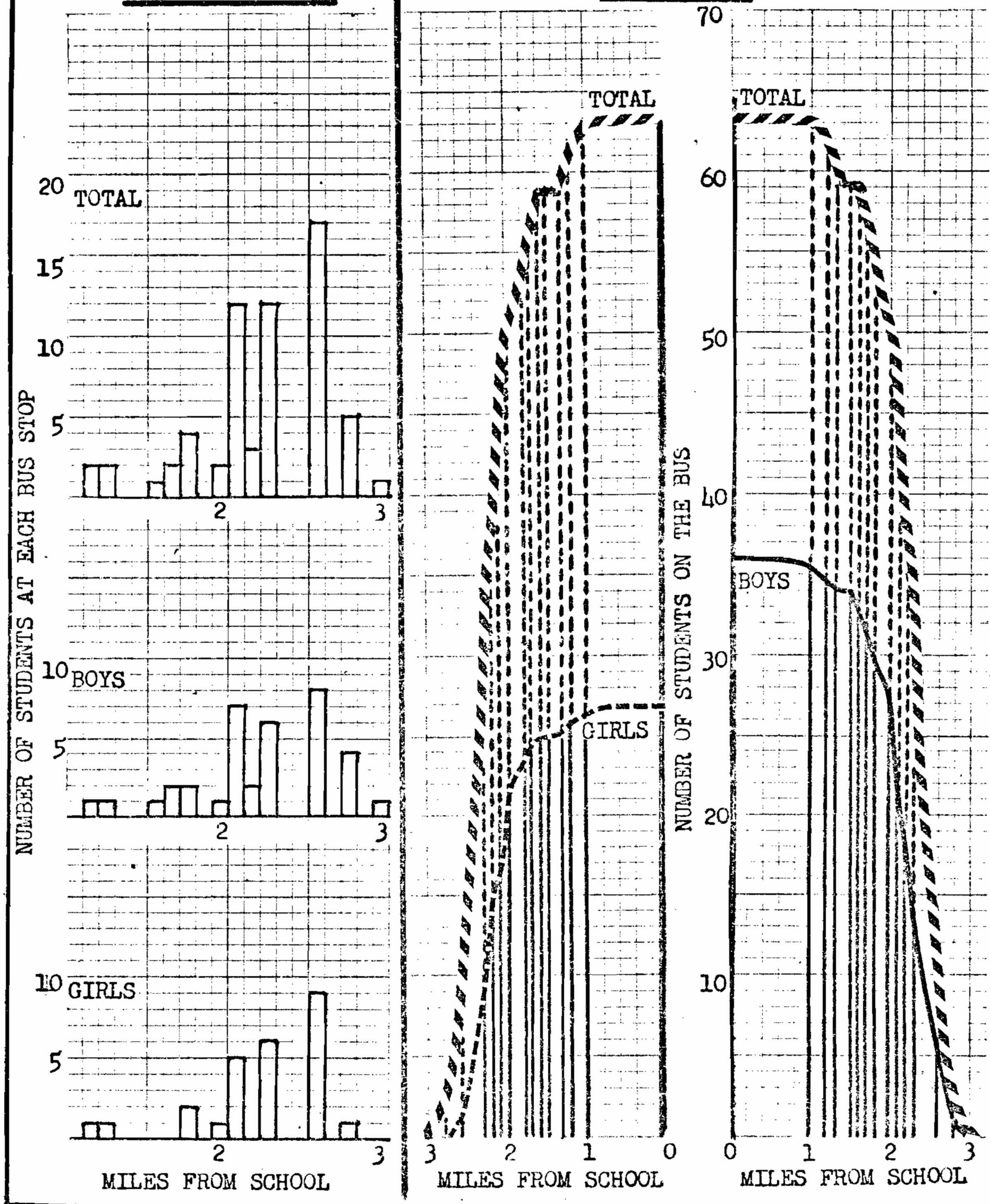
BUS NO. 32 | SAMSON - HAVRE DES ILES



WORKSHEET NO. 3 HISTOGRAMS AND OGIVES ROUTE: F

BUS NO. 55 Perron - 7th - 9th

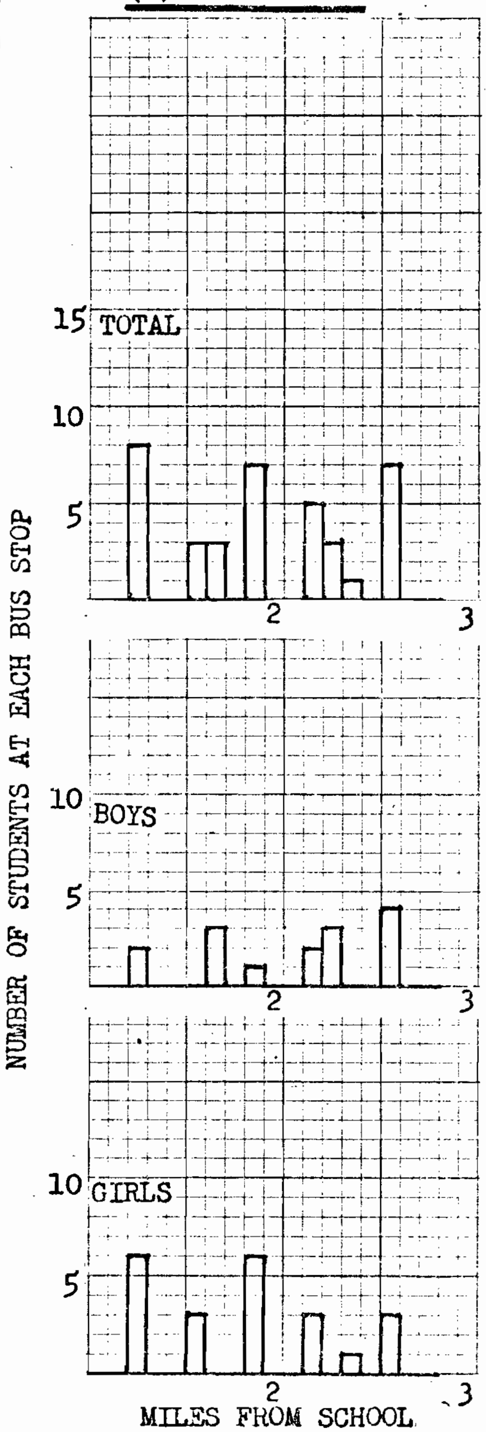
(a) HISTOGRAMS (b) OGIVES



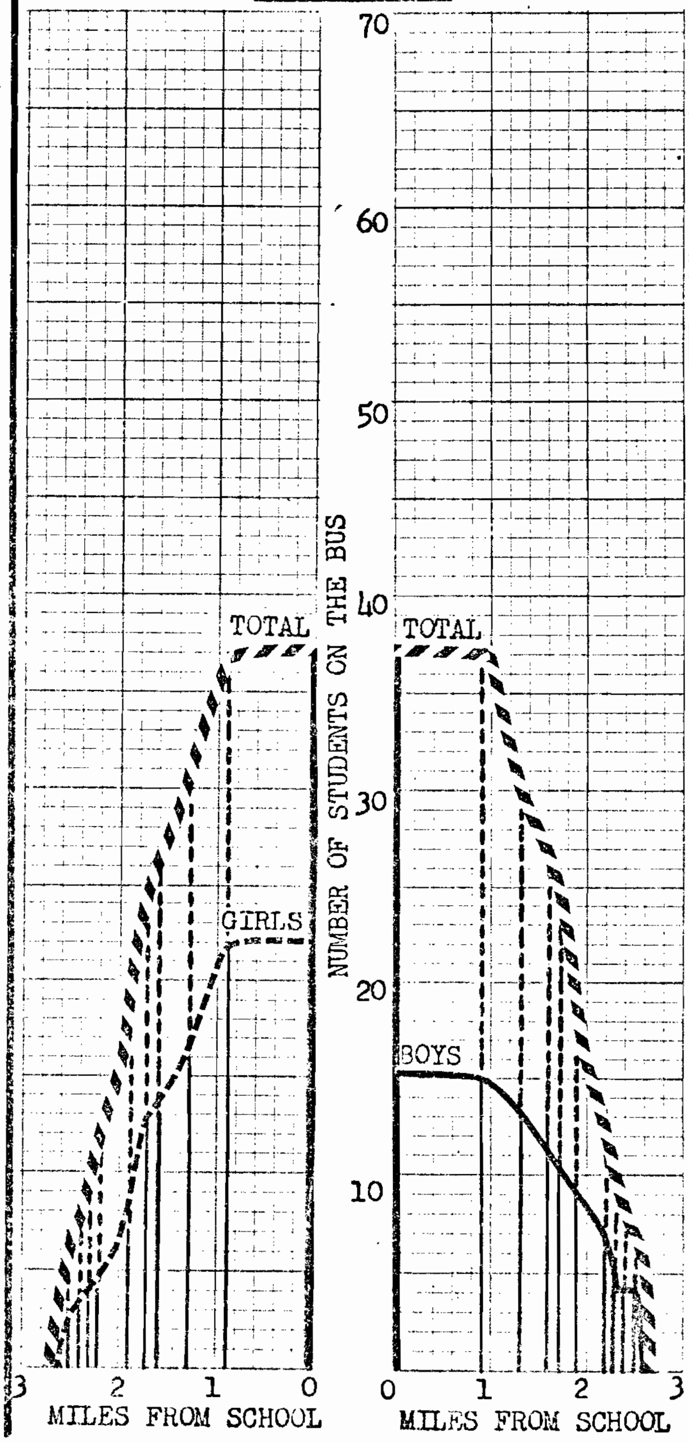
WORKSHEET NO. 3 | HISTOGRAMS AND OGIVES | ROUTE: G

BUS NO. 38 | NOTRE DAME

(a) HISTOGRAMS



(b) OGIVES



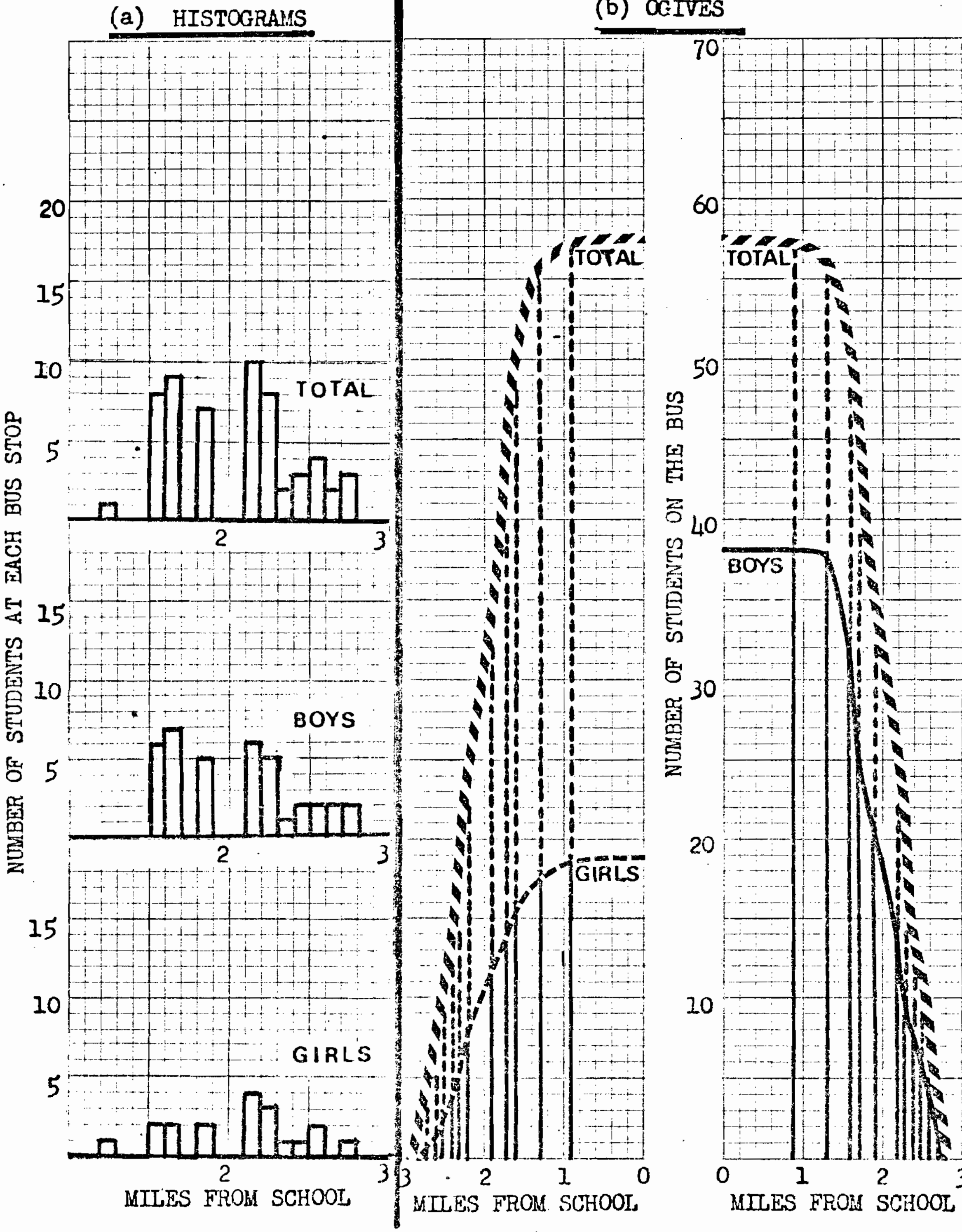
WORKSHEET NO. 3

HISTOGRAMS AND OGIVES

ROUTE: G

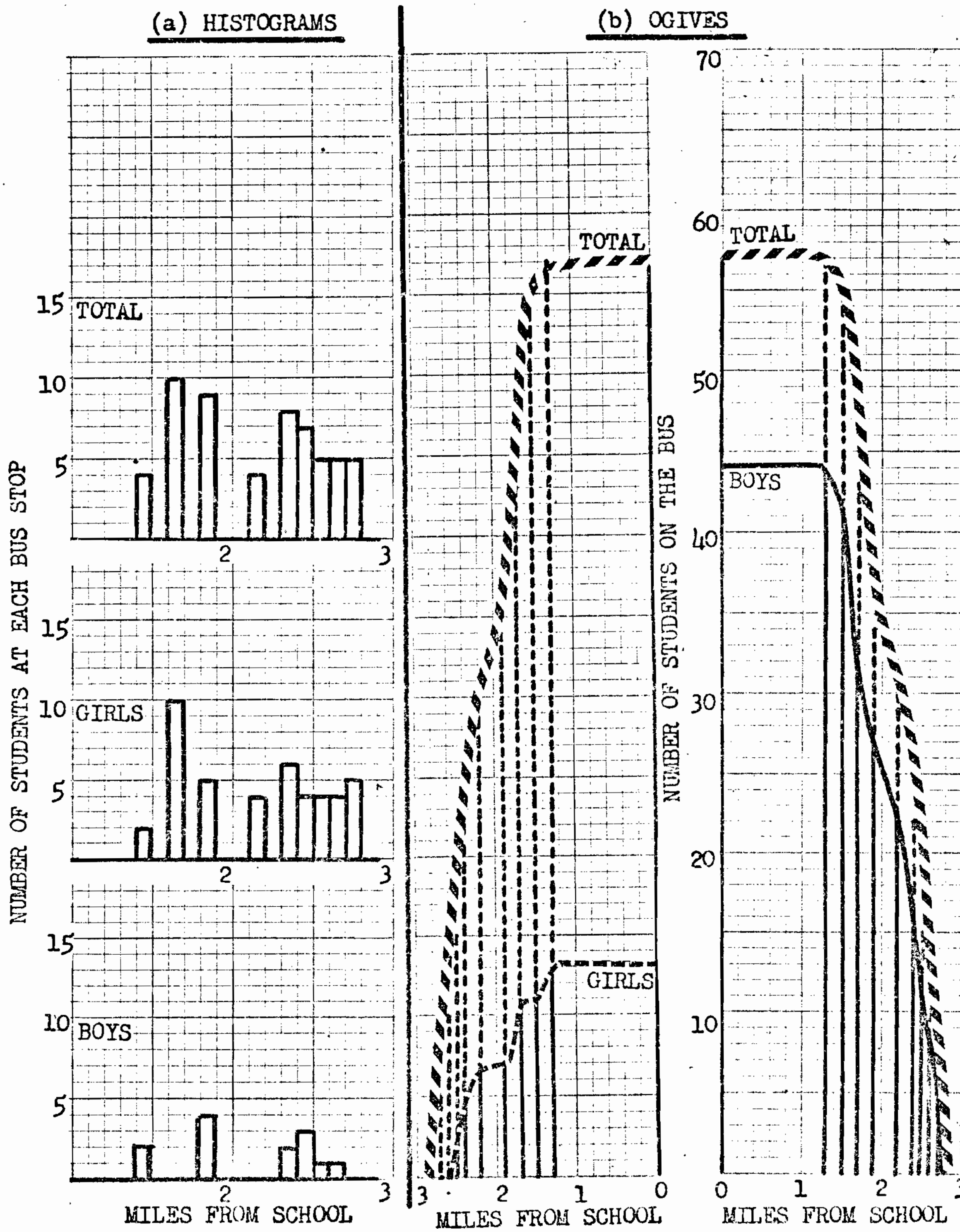
BUS NO. 40

NOTRE DAME



WORKSHEET NO. 3 | HISTOGRAMS AND OGIVES | ROUTE: G

BUS NO. 45 | NOTRE DAME



WORKSHEET NO. 3

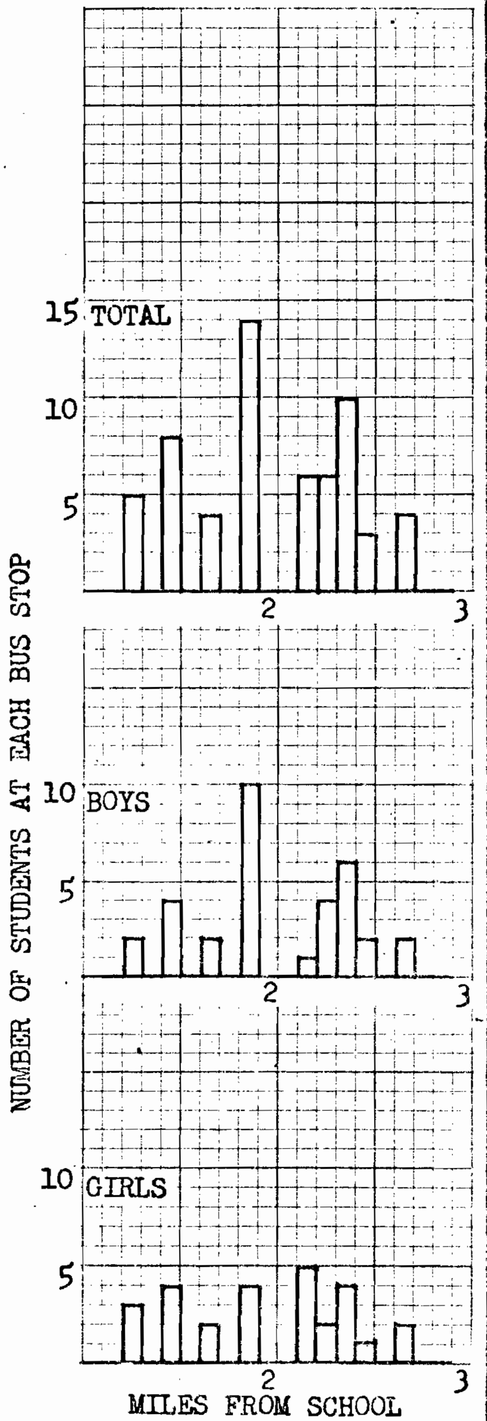
HISTOGRAMS AND OGIVES

ROUTE: G

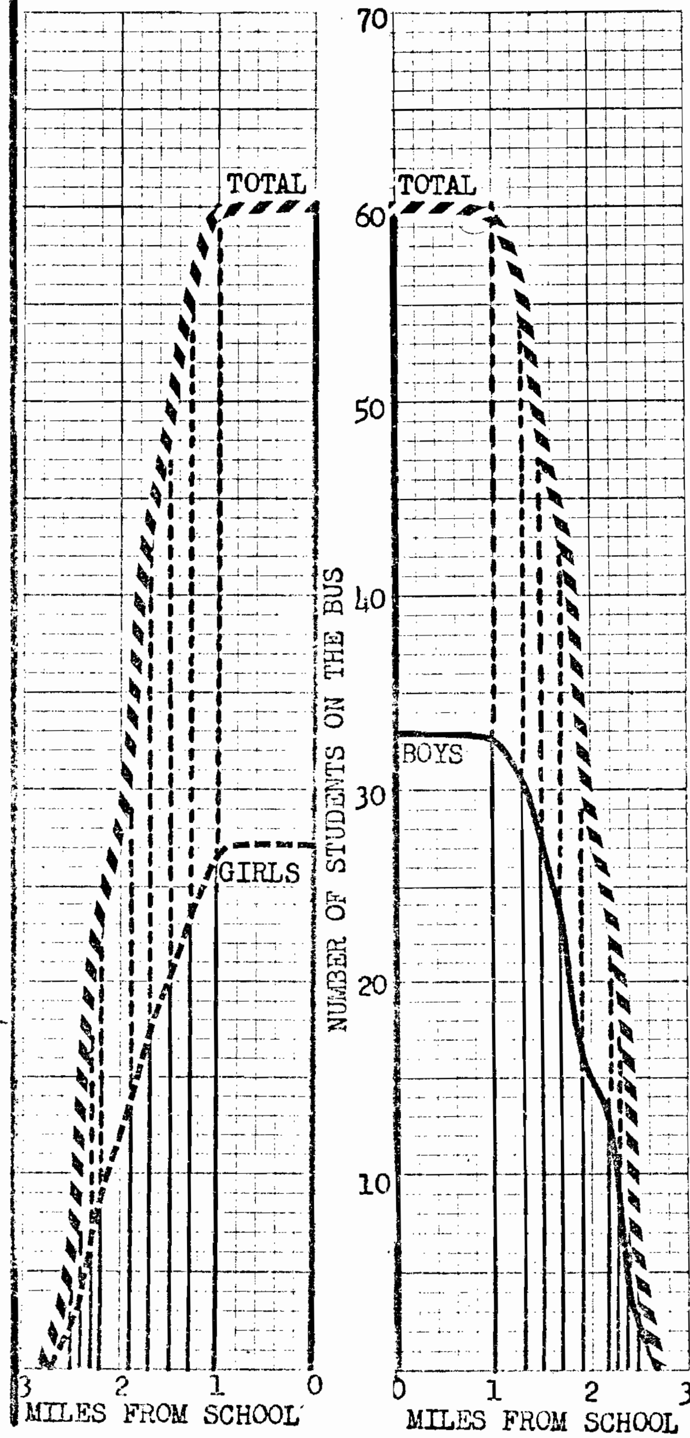
BUS NO. 50

NOTRE DAME

(a) HISTOGRAMS

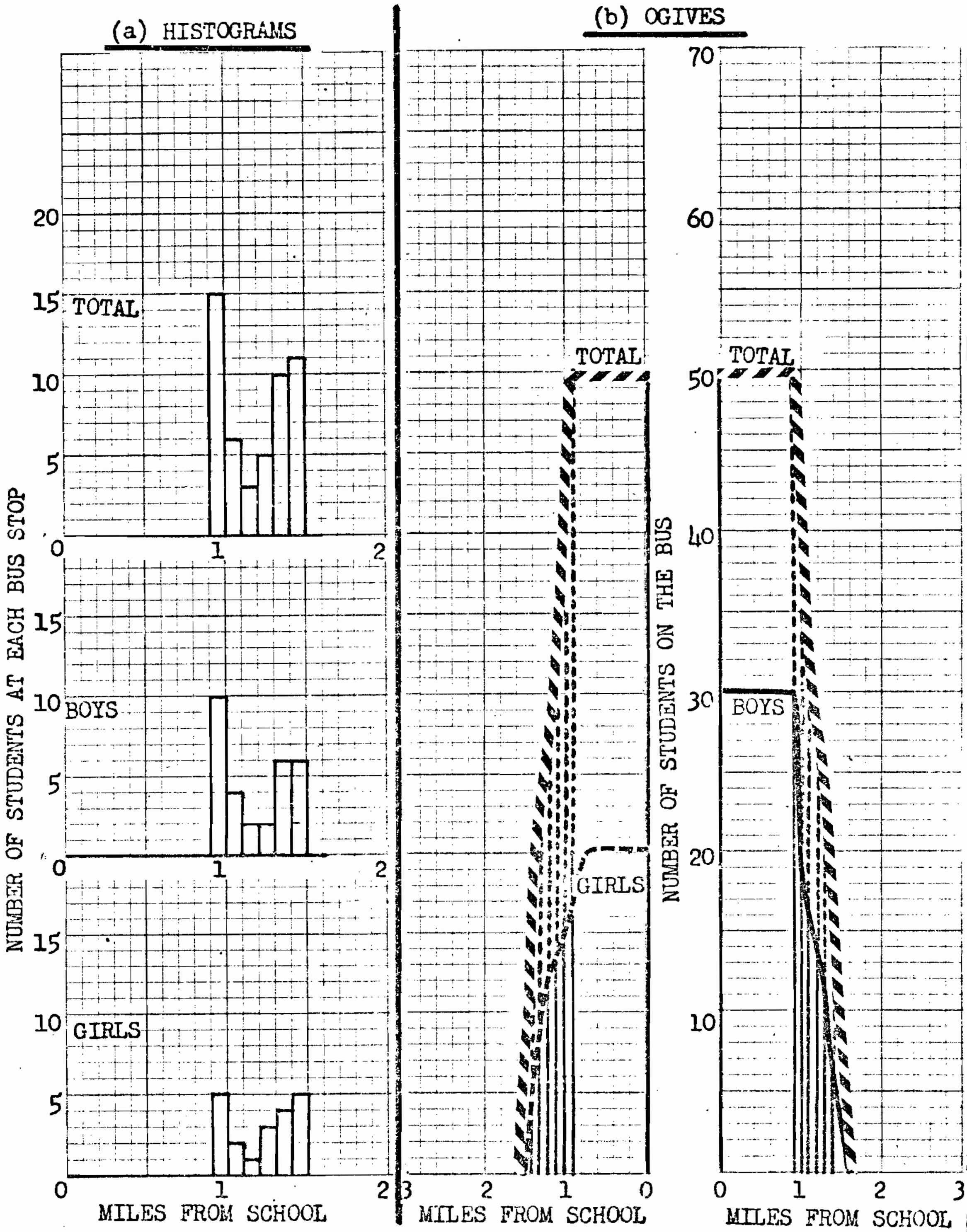


(b) OGIVES



WORKSHEET NO. 3 HISTOGRAMS AND OGIVES ROUTE: H

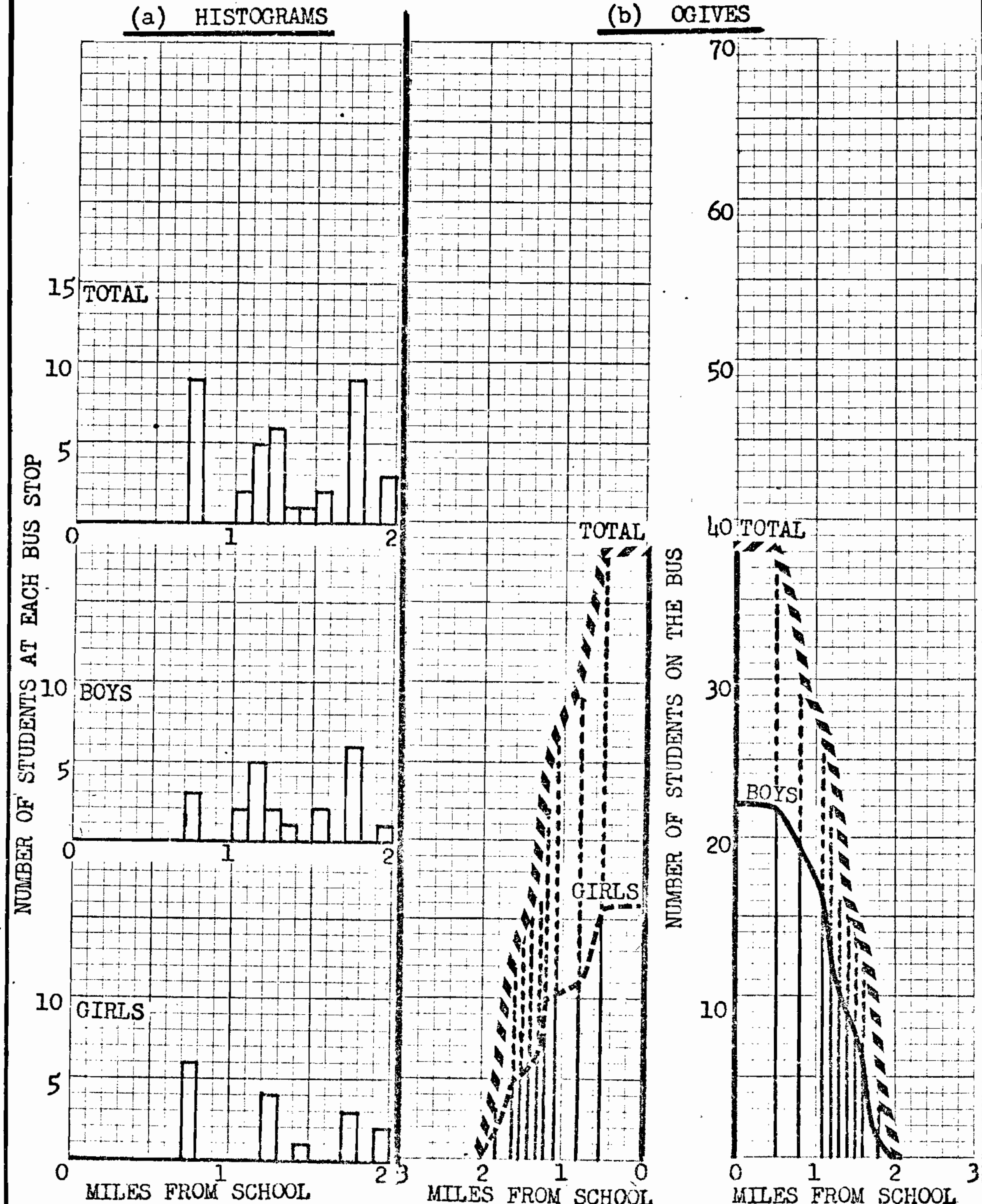
BUS NO. 61 McKENZIE



WORKSHEET NO. 3 | HISTOGRAMS AND OGIVES | ROUTE: J

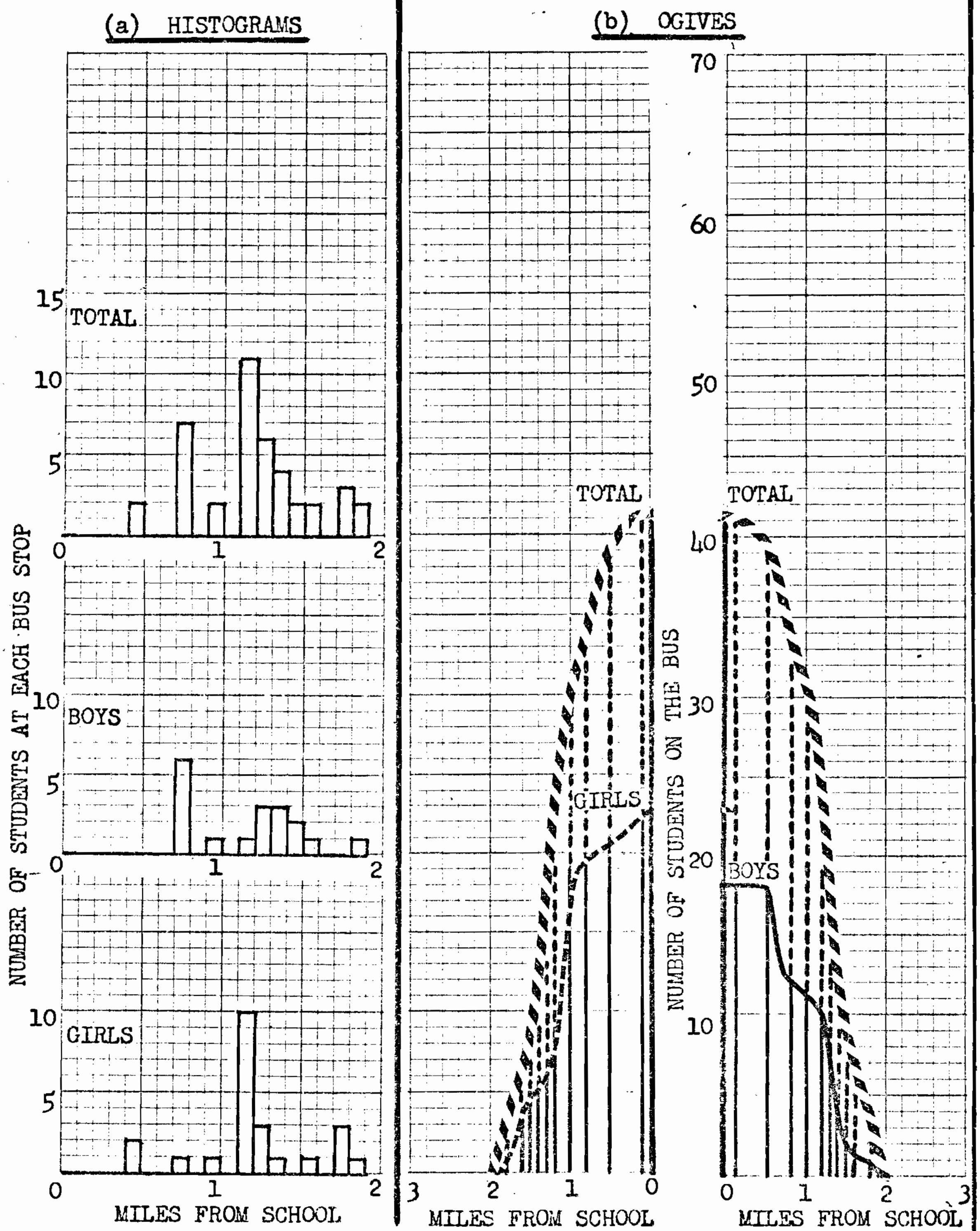
BUS NO. 5 | SOUVENIR

(a) HISTOGRAMS | (b) OGIVES



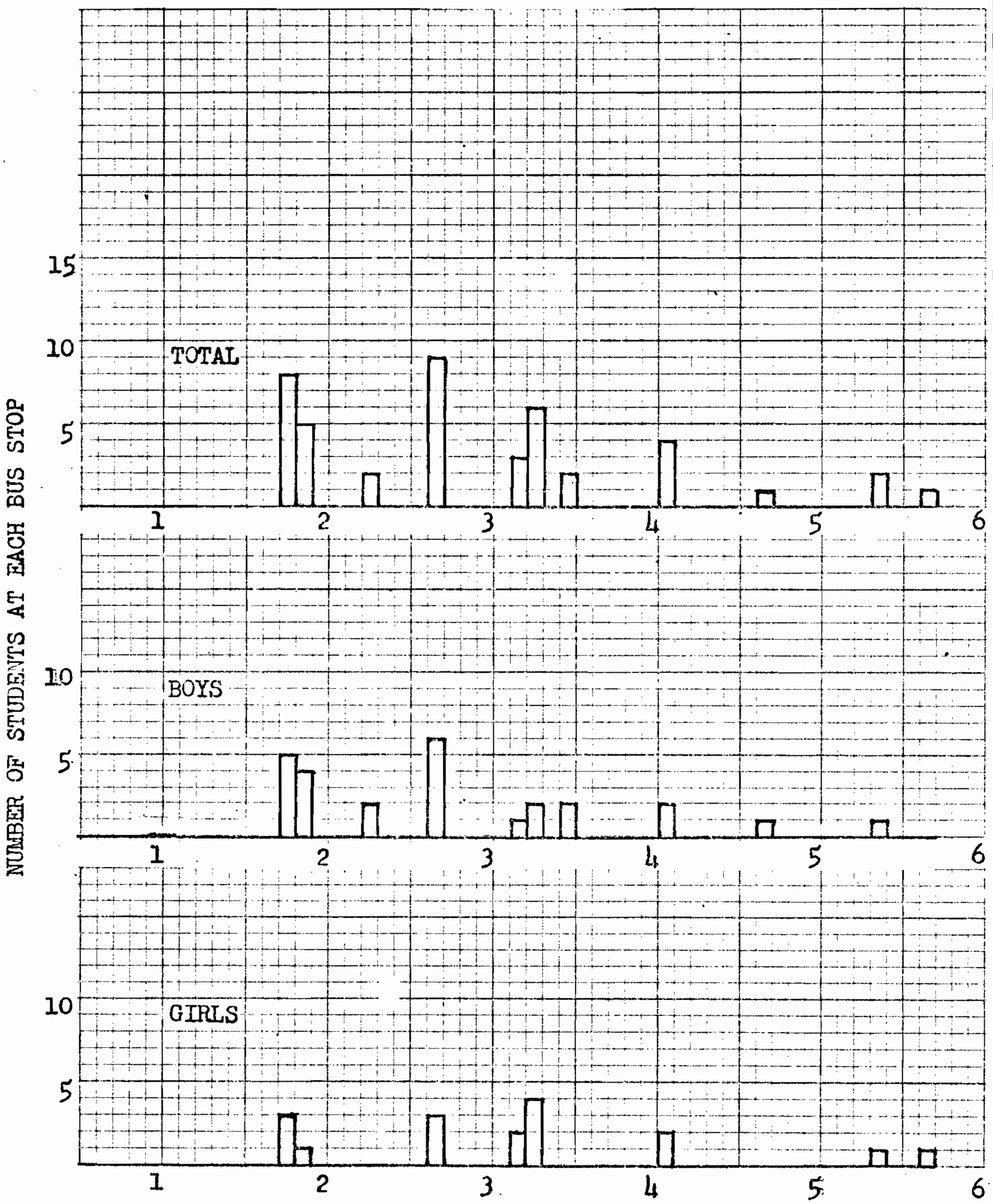
WORKSHEET NO. 3 | HISTOGRAMS AND OGIVES | ROUTE: J

BUS NO. 12 | SOUVENIR



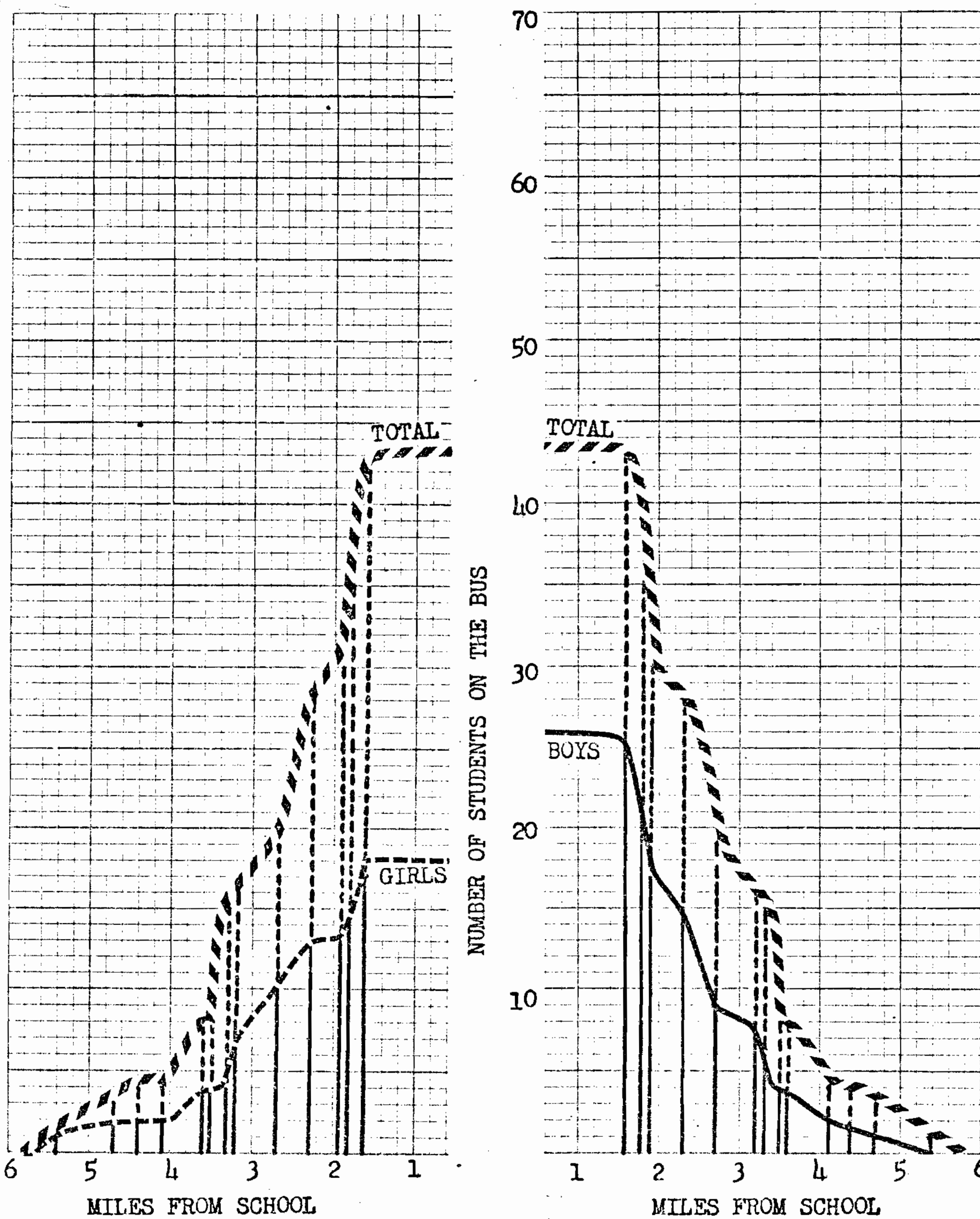
WORKSHEET NO. 3 (a) HISTOGRAMS ROUTE: K

BUS NO. 24 Renaud - Vimont



WORKSHEET NO. 3 (b) OGIVES ROUTE: K

BUS NO. 24 Renaud- Vimont



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL
1	0.0	0.9	1.3	1.9	2.7	3.0	3.7	4.0	4.4	4.8	5.0	5.3	6.2	6.7	6.9	7.2	64.0
2	0.9	0.0	0.4	1.0	1.8	2.1	2.8	3.1	3.5	3.9	4.1	4.4	5.3	5.8	6.0	6.3	51.4
3	1.3	0.4	0.0	0.6	1.4	1.7	2.4	2.7	3.1	3.5	3.7	4.0	4.9	5.4	5.6	5.9	46.6
4	1.9	1.0	0.6	0.0	0.8	1.1	1.8	2.1	2.5	2.9	3.1	3.4	4.3	4.8	5.0	5.3	40.6
5	2.7	1.8	1.4	0.8	0.0	0.3	1.0	1.3	1.7	2.1	2.3	2.6	3.5	4.0	4.2	4.5	34.2
6	3.0	2.1	1.7	1.1	0.3	0.0	0.7	1.0	1.4	1.8	2.0	2.3	3.2	3.7	3.9	4.2	32.4
7	3.7	2.8	2.4	1.8	1.0	0.7	0.0	0.3	0.7	1.1	1.3	1.6	2.5	3.0	3.2	3.5	29.6
8	4.0	3.1	2.7	2.1	1.3	1.0	0.3	0.0	0.4	0.8	1.0	1.3	2.2	2.7	2.9	3.2	29.0
9	4.4	3.5	3.1	2.5	1.7	1.4	0.7	0.4	0.0	0.4	0.6	0.9	1.8	2.3	2.5	2.8	29.0
10	4.8	3.9	3.5	2.9	2.1	1.8	1.1	0.8	0.4	0.0	0.2	0.5	1.4	1.9	2.1	2.4	29.8
11	5.0	4.1	3.7	3.1	2.3	2.0	1.3	1.0	0.6	0.2	0.0	0.3	1.2	1.7	1.9	2.2	30.6
12	5.3	4.4	4.0	3.4	2.6	2.3	1.6	1.3	0.9	0.5	0.3	0.0	0.9	1.4	1.6	1.9	37.4
13	6.2	5.3	4.9	4.3	3.5	3.2	2.5	2.2	1.8	1.4	1.2	0.9	0.0	0.5	0.7	1.0	39.6
14	6.7	5.8	5.4	4.8	4.0	3.7	3.0	2.7	2.3	1.9	1.7	1.4	0.5	0.0	0.2	0.5	44.6
15	6.9	6.0	5.6	5.0	4.2	3.9	3.2	2.9	2.5	2.1	1.9	1.6	0.7	0.2	0.0	0.3	47.0
16	7.2	6.3	5.9	5.3	4.5	4.2	3.5	3.2	2.8	2.4	2.2	1.9	1.0	0.5	0.3	0.0	51.2
															DISPERSION		637.0

BUS NO. 33. PONT VIAU - DUVERNAY

MATRIX OF DISTANCE IN MILES

ROUTE: A

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL
1	0.0	0.9	1.5	1.8	2.1	2.5	2.7	3.0	3.2	3.7	3.8	4.0	4.3	4.5	4.6	4.8	5.1	5.4	57.9
2	0.9	0.0	0.6	0.9	1.2	1.6	1.8	2.1	2.3	2.8	2.9	3.1	3.4	3.6	3.7	3.9	4.2	4.5	43.5
3	1.5	0.6	0.0	0.3	0.6	1.0	1.2	1.5	1.7	2.2	2.3	2.5	2.8	3.0	3.1	3.3	3.6	3.9	35.1
4	1.8	0.9	0.3	0.0	0.3	0.7	0.9	1.2	1.4	1.9	2.0	2.2	2.5	2.7	2.8	3.0	3.3	3.6	31.5
5	2.1	1.2	0.6	0.3	0.0	0.4	0.6	0.9	1.1	1.6	1.7	1.9	2.2	2.4	2.5	2.7	3.0	3.3	28.5
6	2.5	1.6	1.0	0.7	0.4	0.0	0.2	0.5	0.7	1.2	1.3	1.5	1.8	2.0	2.1	2.3	2.6	2.9	25.3
7	2.7	1.8	1.2	0.9	0.6	0.2	0.0	0.3	0.5	1.0	1.1	1.3	1.6	1.8	1.9	2.1	2.4	2.7	24.1
8	3.0	2.1	1.5	1.2	0.9	0.5	0.3	0.0	0.2	0.7	0.8	1.0	1.3	1.5	1.6	1.8	2.1	2.4	22.9
9	3.2	2.3	1.7	1.4	1.1	0.7	0.5	0.2	0.0	0.5	0.6	0.8	1.1	1.3	1.4	1.6	1.9	2.2	22.5
10	3.7	2.8	2.2	1.9	1.6	1.2	1.0	0.7	0.5	0.0	0.1	0.3	0.6	0.8	0.9	1.1	1.4	1.7	22.5
11	3.8	2.9	2.3	2.0	1.7	1.3	1.1	0.8	0.6	0.1	0.0	0.2	0.5	0.7	0.8	1.0	1.3	1.6	22.7
12	4.0	3.1	2.5	2.2	1.9	1.5	1.3	1.0	0.8	0.3	0.2	0.0	0.3	0.5	0.6	0.8	1.1	1.4	23.5
13	4.3	3.4	2.8	2.5	2.2	1.8	1.6	1.3	1.1	0.6	0.5	0.3	0.0	0.2	0.3	0.5	0.8	1.1	25.3
14	4.5	3.6	3.0	2.7	2.4	2.0	1.8	1.5	1.3	0.8	0.7	0.5	0.2	0.0	0.1	0.3	0.6	0.9	26.9
15	4.6	3.7	3.1	2.8	2.5	2.1	1.9	1.6	1.4	0.9	0.8	0.6	0.3	0.1	0.0	0.2	0.5	0.8	27.9
16	4.8	3.9	3.3	3.0	2.7	2.3	2.1	1.8	1.6	1.1	1.0	0.8	0.5	0.3	0.2	0.0	0.3	0.6	30.3
17	5.1	4.2	3.6	3.3	3.0	2.6	2.4	2.1	1.9	1.4	1.3	1.1	0.8	0.6	0.5	0.3	0.0	0.3	34.5
18	5.4	4.5	3.9	3.6	3.3	2.9	2.7	2.4	2.2	1.7	1.6	1.4	1.1	0.9	0.8	0.6	0.3	0.0	39.3
																	DISPERSION		544.2

BUS NO. 30. LAVAL DES RAPIDES (EAST)   MATRIX OF DISTANCE IN MILES   ROUTE: B

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL
1	0.0	0.2	1.0	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	26.8
2	0.2	0.0	0.8	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	24.0
3	1.0	0.8	0.0	0.3	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	14.5
4	1.3	1.1	0.3	0.0	0.1	0.2	0.3	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	11.4
5	1.4	1.2	0.4	0.1	0.0	0.1	0.2	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	10.6
6	1.5	1.3	0.5	0.2	0.1	0.0	0.1	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	10.0
7	1.6	1.4	0.6	0.3	0.2	0.1	0.0	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	09.6
8	1.8	1.6	0.8	0.5	0.4	0.3	0.2	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	09.2
9	1.9	1.7	0.9	0.6	0.5	0.4	0.3	0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	09.2
10	2.0	1.8	1.0	0.7	0.6	0.5	0.4	0.2	0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	09.4
11	2.1	1.9	1.1	0.8	0.7	0.6	0.5	0.3	0.2	0.1	0.0	0.1	0.2	0.3	0.4	0.5	09.8
12	2.2	2.0	1.2	0.9	0.8	0.7	0.6	0.4	0.3	0.2	0.1	0.0	0.1	0.2	0.3	0.4	10.4
13	2.3	2.1	1.3	1.0	0.9	0.8	0.7	0.5	0.4	0.3	0.2	0.1	0.0	0.1	0.2	0.3	11.2
14	2.4	2.2	1.5	1.1	1.0	0.9	0.8	0.6	0.5	0.4	0.3	0.2	0.1	0.0	0.1	0.2	12.2
15	2.5	2.3	1.5	1.2	1.1	1.0	0.9	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0	0.1	13.4
16	2.6	2.4	1.6	1.3	1.2	1.1	1.0	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0	14.8
															DISPERSION		206.5

BUS NO. 42. LAVAL DES RAPIDES (WEST) MATRIX OF DISTANCE IN MILES ROUTE: C

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL
1	0.0	0.9	1.5	2.0	2.5	3.2	4.7	5.1	5.2	5.3	5.5	5.7	5.9	6.3	6.7	7.0	7.1	7.4	82.0
2	0.9	0.0	0.6	1.1	1.6	2.3	3.8	4.2	4.3	4.4	4.6	4.8	5.0	5.4	5.8	6.1	6.2	6.5	67.6
3	1.5	0.6	0.0	0.5	1.0	1.7	3.2	3.6	3.7	3.8	4.0	4.2	4.4	4.8	5.2	5.5	5.6	5.9	59.2
4	2.0	1.1	0.5	0.0	0.5	1.2	2.7	3.1	3.2	3.3	3.5	3.7	3.9	4.3	4.7	5.0	5.1	5.4	53.3
5	2.5	1.6	1.0	0.5	0.0	0.7	2.2	2.6	2.7	2.8	3.0	3.2	3.4	3.8	4.2	4.5	4.6	4.9	48.2
6	3.2	2.3	1.7	1.2	0.7	0.0	1.5	1.9	2.0	2.1	2.3	2.5	2.7	3.1	3.5	3.8	3.9	4.2	42.6
7	4.7	3.8	3.2	2.7	2.2	1.5	0.0	0.4	0.5	0.6	0.8	1.0	1.2	1.6	2.0	2.3	2.4	2.7	33.6
8	5.1	4.2	3.6	3.1	2.6	1.9	0.4	0.0	0.1	0.2	0.4	0.6	0.8	1.2	1.6	1.9	2.0	2.3	32.0
9	5.2	4.3	3.7	3.2	2.7	2.0	0.5	0.1	0.0	0.1	0.3	0.5	0.7	1.1	1.5	1.8	1.9	2.2	31.8
10	5.3	4.4	3.8	3.3	2.8	2.1	0.6	0.2	0.1	0.0	0.2	0.4	0.6	1.0	1.4	1.7	1.8	2.1	31.8
11	5.5	4.6	4.0	3.5	3.0	2.3	0.8	0.4	0.3	0.2	0.0	0.2	0.4	0.8	1.2	1.5	1.6	1.9	32.2
12	5.7	4.8	4.2	3.7	3.2	2.5	1.0	0.6	0.5	0.4	0.2	0.0	0.2	0.6	1.0	1.3	1.4	1.7	33.0
13	5.9	5.0	4.4	3.9	3.4	2.7	1.2	0.8	0.7	0.6	0.4	0.2	0.0	0.4	0.8	1.1	1.2	1.5	34.2
14	6.3	5.4	4.8	4.3	3.8	3.1	1.6	1.2	1.1	1.0	0.8	0.6	0.4	0.0	0.4	0.7	0.8	1.1	37.4
15	6.7	5.8	5.2	4.7	4.2	3.5	2.0	1.6	1.5	1.4	1.2	1.0	0.8	0.4	0.0	0.3	0.4	0.7	41.4
16	7.0	6.1	5.5	5.0	4.5	3.8	2.3	1.9	1.8	1.7	1.5	1.3	1.1	0.7	0.3	0.0	0.1	0.4	45.0
17	7.1	6.2	5.6	5.1	4.6	3.9	2.4	2.0	1.9	1.8	1.6	1.4	1.2	0.8	0.4	0.1	0.0	0.3	46.4
18	7.4	6.5	5.9	5.5	4.9	4.2	2.7	2.3	2.2	2.1	1.9	1.7	1.5	1.1	0.7	0.4	0.3	0.0	51.2
																		DISPERSION	802.9

BUS NO. 56. ST. DOROTHEE — MATRIX OF DISTANCE IN MILES — ROUTE: D

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1	0.0	0.1	0.7	1.2	1.5	1.8	2.1	2.3	2.7	3.1	3.4	3.8	4.6	4.9	32.2
2	0.1	0.0	0.6	1.1	1.4	1.7	2.0	2.2	2.6	3.0	3.3	3.7	4.5	4.8	31.0
3	0.7	0.6	0.0	0.5	0.8	1.1	1.4	1.6	2.0	2.4	2.7	3.1	3.9	4.2	25.0
4	1.2	1.1	0.5	0.0	0.3	0.6	0.9	1.1	1.5	1.9	2.2	2.6	3.4	3.7	21.0
5	1.5	1.4	0.8	0.3	0.0	0.3	0.6	0.8	1.2	1.6	1.9	2.3	3.1	3.4	19.2
6	1.8	1.7	1.1	0.6	0.3	0.0	0.3	0.5	0.9	1.3	1.6	2.0	2.8	3.1	18.0
7	2.1	2.0	1.4	0.9	0.6	0.3	0.0	0.2	0.6	1.0	1.3	1.7	2.5	2.8	17.4
8	2.3	2.2	1.6	1.1	0.8	0.5	0.2	0.0	0.4	0.8	1.1	1.5	2.3	2.6	17.4
9	2.7	2.6	2.0	1.5	1.2	0.9	0.6	0.4	0.0	0.4	0.7	1.1	1.9	2.2	18.2
10	3.1	3.0	2.4	1.9	1.6	1.3	1.0	0.8	0.4	0.0	0.3	0.7	1.5	1.8	19.8
11	3.4	3.3	2.7	2.2	1.9	1.6	1.3	1.1	0.7	0.3	0.0	0.4	1.2	1.5	21.6
12	3.8	3.7	3.1	2.6	2.3	2.0	1.7	1.5	1.1	0.7	0.4	0.0	0.8	1.1	24.8
13	4.6	4.5	3.9	3.4	3.1	2.8	2.5	2.3	1.9	1.5	1.2	0.8	0.0	0.3	32.8
14	4.9	4.8	4.2	3.7	3.4	3.1	2.8	2.6	2.2	1.8	1.5	1.1	0.3	0.0	36.4
													DISPERSION		334.8

BUS NO. 32. SAMSON - HAVRE DES ILES   MATRIX OF DISTANCE IN MILES   ROUTE: E

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
1	0.0	0.1	0.8	1.1	1.2	1.3	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.3	2.6	2.8	3.0	28.1
2	0.1	0.0	0.7	1.0	1.1	1.2	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.5	2.7	2.9	26.6
3	0.8	0.7	0.0	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.2	1.3	1.4	1.5	1.8	2.0	2.2	17.5
4	1.1	1.0	0.3	0.0	0.1	0.2	0.4	0.5	0.6	0.7	0.9	1.0	1.1	1.2	1.5	1.7	1.9	14.2
5	1.2	1.1	0.4	0.1	0.0	0.1	0.3	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.4	1.6	1.8	13.3
6	1.3	1.2	0.5	0.2	0.1	0.0	0.2	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.3	1.5	1.7	12.6
7	1.5	1.4	0.7	0.4	0.3	0.2	0.0	0.1	0.3	0.4	0.6	0.7	0.8	0.9	1.2	1.4	1.6	12.5
8	1.6	1.5	0.8	0.5	0.4	0.3	0.1	0.0	0.1	0.2	0.4	0.5	0.6	0.7	1.0	1.2	1.4	11.3
9	1.7	1.6	0.9	0.6	0.5	0.4	0.3	0.1	0.0	0.1	0.3	0.4	0.5	0.6	0.9	1.1	1.3	11.3
10	1.8	1.7	1.0	0.7	0.6	0.5	0.4	0.2	0.1	0.0	0.2	0.3	0.4	0.5	0.8	1.0	1.2	11.4
11	2.0	1.9	1.2	0.9	0.8	0.7	0.6	0.4	0.3	0.2	0.0	0.1	0.2	0.3	0.6	0.7	0.9	11.8
12	2.1	2.0	1.3	1.0	0.9	0.8	0.7	0.5	0.4	0.3	0.1	0.0	0.1	0.2	0.5	0.6	0.8	12.3
13	2.2	2.1	1.4	1.1	1.0	0.9	0.8	0.6	0.5	0.4	0.2	0.1	0.0	0.1	0.4	0.5	0.7	13.0
14	2.3	2.2	1.5	1.2	1.1	1.0	0.9	0.7	0.6	0.5	0.3	0.2	0.1	0.0	0.3	0.4	0.6	13.9
15	2.6	2.5	1.8	1.5	1.4	1.3	1.2	1.0	0.9	0.8	0.6	0.5	0.4	0.3	0.0	0.2	0.4	17.4
16	2.8	2.7	2.0	1.7	1.6	1.5	1.4	1.2	1.1	1.0	0.7	0.6	0.5	0.4	0.2	0.0	0.2	18.8
17	3.0	2.9	2.2	1.9	1.8	1.7	1.6	1.4	1.3	1.2	0.9	0.8	0.7	0.6	0.4	0.2	0.0	22.6
																DISPERSION		268.6

BUS NO. 55. PERRON-7th - 9th   MATRIX OF DISTANCE IN MILES   ROUTE: F

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	0.0	0.1	0.8	0.9	1.3	1.6	1.7	1.9	2.2	2.3	2.4	2.5	2.6	2.7	2.8	25.8
2	0.1	0.0	0.7	0.8	1.2	1.5	1.6	1.8	2.1	2.2	2.3	2.4	2.5	2.6	2.7	24.5
3	0.8	0.7	0.0	0.1	0.5	0.8	0.9	1.1	1.4	1.5	1.6	1.7	1.8	1.9	2.0	16.8
4	0.9	0.8	0.1	0.0	0.4	0.7	0.8	1.0	1.3	1.4	1.5	1.6	1.7	1.8	1.9	15.9
5	1.3	1.2	0.5	0.4	0.0	0.3	0.4	0.6	0.9	1.0	1.1	1.2	1.3	1.4	1.5	13.1
6	1.6	1.5	0.8	0.7	0.3	0.0	0.1	0.3	0.6	0.7	0.8	0.9	1.0	1.1	1.2	11.6
7	1.7	1.6	0.9	0.8	0.4	0.1	0.0	0.2	0.5	0.6	0.7	0.8	0.9	1.0	1.1	11.3
8	1.9	1.8	1.1	1.0	0.6	0.3	0.2	0.0	0.3	0.4	0.5	0.6	0.7	0.8	0.9	11.1
9	2.2	2.1	1.4	1.3	0.9	0.6	0.5	0.3	0.0	0.1	0.2	0.3	0.4	0.5	0.6	11.4
10	2.3	2.2	1.5	1.4	1.0	0.7	0.6	0.4	0.1	0.0	0.1	0.2	0.3	0.4	0.5	11.7
11	2.4	2.3	1.6	1.5	1.1	0.8	0.7	0.5	0.2	0.1	0.0	0.1	0.2	0.3	0.4	12.2
12	2.5	2.4	1.7	1.6	1.2	0.9	0.8	0.6	0.3	0.2	0.1	0.0	0.1	0.2	0.3	12.9
13	2.6	2.5	1.8	1.7	1.3	1.0	0.9	0.7	0.4	0.3	0.2	0.1	0.0	0.1	0.2	13.8
14	2.7	2.6	1.9	1.8	1.4	1.1	1.0	0.8	0.5	0.4	0.3	0.2	0.1	0.0	0.1	14.9
15	2.8	2.7	2.0	1.9	1.5	1.2	1.1	0.9	0.6	0.5	0.4	0.3	0.2	0.1	0.0	16.2
												DISPERSION				223.2

BUS NO. 38. NOTRE DAME — MATRIX OF DISTANCE IN MILES — ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	0.0	0.1	0.8	0.9	1.3	1.6	1.7	1.9	2.2	2.3	2.4	2.5	2.6	2.7	2.8	25.8
2	0.1	0.0	0.7	0.8	1.2	1.5	1.6	1.8	2.1	2.2	2.3	2.4	2.5	2.6	2.7	24.5
3	0.8	0.7	0.0	0.1	0.5	0.8	0.9	1.1	1.4	1.5	1.6	1.7	1.8	1.9	2.0	16.8
4	0.9	0.8	0.1	0.0	0.4	0.7	0.8	1.0	1.3	1.4	1.5	1.6	1.7	1.8	1.9	15.9
5	1.3	1.2	0.5	0.4	0.0	0.3	0.4	0.6	0.9	1.0	1.1	1.2	1.3	1.4	1.5	13.1
6	1.6	1.5	0.8	0.7	0.3	0.0	0.1	0.3	0.6	0.7	0.8	0.9	1.0	1.1	1.2	11.6
7	1.7	1.6	0.9	0.8	0.4	0.1	0.0	0.2	0.5	0.6	0.7	0.8	0.9	1.0	1.1	11.3
8	1.9	1.8	1.1	1.0	0.6	0.3	0.2	0.0	0.3	0.4	0.5	0.6	0.7	0.8	0.9	11.1
9	2.2	2.1	1.4	1.3	0.9	0.6	0.5	0.3	0.0	0.1	0.2	0.3	0.4	0.5	0.6	11.4
10	2.3	2.2	1.5	1.4	1.0	0.7	0.6	0.4	0.1	0.0	0.1	0.2	0.3	0.4	0.5	11.7
11	2.4	2.3	1.6	1.5	1.1	0.8	0.7	0.5	0.2	0.1	0.0	0.1	0.2	0.3	0.4	12.2
12	2.5	2.4	1.7	1.6	1.2	0.9	0.8	0.6	0.3	0.2	0.1	0.0	0.1	0.2	0.3	12.9
13	2.6	2.5	1.8	1.7	1.3	1.0	0.9	0.7	0.4	0.3	0.2	0.1	0.0	0.1	0.2	13.8
14	2.7	2.6	1.9	1.8	1.4	1.1	1.0	0.8	0.5	0.4	0.3	0.2	0.1	0.0	0.1	15.0
15	2.8	2.7	2.0	1.9	1.5	1.2	1.1	0.9	0.6	0.5	0.4	0.3	0.2	0.1	0.0	16.2
														DISPERSION		223.3

BUS NO. 40. NOTRE DAME — MATRIX OF DISTANCE IN MILES — ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	0.0	0.1	0.8	0.9	1.3	1.5	1.7	1.9	2.2	2.4	2.5	2.6	2.7	2.8	2.9	26.3
2	0.1	0.0	0.7	0.8	1.2	1.4	1.6	1.8	2.1	2.3	2.4	2.5	2.6	2.7	2.8	25.0
3	0.8	0.7	0.0	0.1	0.5	0.7	0.9	1.1	1.4	1.6	1.7	1.8	1.9	2.0	2.1	17.3
4	0.9	0.8	0.1	0.0	0.4	0.6	0.8	1.0	1.3	1.5	1.6	1.7	1.8	1.9	2.0	16.4
5	1.3	1.2	0.5	0.4	0.0	0.2	0.4	0.6	0.9	1.1	1.2	1.3	1.4	1.5	1.6	13.6
6	1.5	1.4	0.7	0.6	0.2	0.0	0.2	0.4	0.7	0.9	1.0	1.1	1.2	1.3	1.4	12.6
7	1.7	1.6	0.9	0.8	0.4	0.2	0.0	0.2	0.5	0.7	0.8	0.9	1.0	1.1	1.2	12.0
8	1.9	1.8	1.1	1.0	0.6	0.4	0.2	0.0	0.3	0.5	0.6	0.8	0.8	0.9	1.0	11.8
9	2.2	2.1	1.4	1.3	0.9	0.7	0.5	0.3	0.0	0.2	0.3	0.4	0.5	0.6	0.7	12.1
10	2.4	2.3	1.6	1.5	1.1	0.9	0.7	0.5	0.2	0.0	0.1	0.2	0.3	0.4	0.5	12.7
11	2.5	2.4	1.7	1.6	1.2	1.0	0.8	0.6	0.3	0.1	0.0	0.1	0.2	0.3	0.4	13.2
12	2.6	2.5	1.8	1.7	1.3	1.1	0.9	0.7	0.4	0.2	0.1	0.0	0.1	0.2	0.3	13.9
13	2.7	2.6	1.9	1.8	1.4	1.2	1.0	0.8	0.5	0.3	0.2	0.1	0.0	0.1	0.2	14.8
14	2.8	2.7	2.0	1.9	1.5	1.3	1.1	0.9	0.6	0.4	0.3	0.2	0.1	0.0	0.1	15.9
15	2.9	2.8	2.1	2.0	1.6	1.4	1.2	1.0	0.7	0.5	0.4	0.3	0.2	0.1	0.0	17.2
														DISPERSION		234.8

BUS NO. 45. NOTRE DAME

MATRIX OF DISTANCE IN MILES

ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	0.0	0.1	0.9	1.0	1.3	1.5	1.7	1.9	2.2	2.3	2.4	2.5	2.7	2.8	2.9	26.2
2	0.1	0.0	0.8	0.9	1.2	1.4	1.6	1.8	2.1	2.2	2.3	2.4	2.6	2.7	2.8	24.9
3	0.9	0.8	0.0	0.1	0.4	0.6	0.8	1.0	1.3	1.4	1.5	1.6	1.8	1.9	2.0	16.1
4	1.0	0.9	0.1	0.0	0.3	0.5	0.7	0.9	1.2	1.3	1.4	1.5	1.7	1.8	1.9	15.2
5	1.3	1.2	0.4	0.3	0.0	0.2	0.4	0.6	0.9	1.0	1.1	1.2	1.4	1.5	1.6	13.1
6	1.5	1.4	0.6	0.5	0.2	0.0	0.2	0.4	0.7	0.8	0.9	1.0	1.2	1.3	1.4	12.1
7	1.7	1.6	0.8	0.7	0.4	0.2	0.0	0.2	0.5	0.6	0.7	0.8	1.0	1.1	1.2	11.5
8	1.9	1.8	1.0	0.9	0.6	0.4	0.2	0.0	0.3	0.4	0.5	0.6	0.8	0.9	1.0	11.3
9	2.2	2.1	1.3	1.2	0.9	0.7	0.5	0.3	0.0	0.1	0.2	0.3	0.5	0.6	0.7	11.6
10	2.3	2.2	1.4	1.3	1.0	0.8	0.6	0.4	0.1	0.0	0.1	0.2	0.4	0.5	0.6	11.9
11	2.4	2.3	1.5	1.4	1.1	0.9	0.7	0.5	0.2	0.1	0.0	0.1	0.3	0.4	0.5	12.4
12	2.5	2.4	1.6	1.5	1.2	1.0	0.8	0.6	0.3	0.2	0.1	0.0	0.2	0.3	0.4	13.1
13	2.7	2.6	1.8	1.7	1.4	1.2	1.0	0.8	0.5	0.4	0.3	0.2	0.0	0.1	0.2	14.9
14	2.8	2.7	1.9	1.8	1.5	1.3	1.1	0.9	0.6	0.5	0.4	0.3	0.1	0.0	0.1	16.0
15	2.9	2.8	2.0	1.9	1.6	1.4	1.2	1.0	0.7	0.6	0.5	0.4	0.2	0.1	0.0	17.3
														DISPERSION		227.6

BUS NO. 50. NOTRE DAME

MATRIX OF DISTANCE IN MILES

ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	TOTAL
1	0.0	0.1	0.5	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.6	09.9
2	0.1	0.0	0.4	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.5	09.0
3	0.5	0.4	0.0	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.1	06.2
4	0.8	0.7	0.3	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.8	04.7
5	0.9	0.8	0.4	0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.7	04.4
6	1.0	0.9	0.5	0.2	0.1	0.0	0.1	0.2	0.3	0.4	0.6	04.3
7	1.1	1.0	0.6	0.3	0.2	0.1	0.0	0.1	0.2	0.3	0.5	04.4
8	1.2	1.1	0.7	0.4	0.3	0.2	0.1	0.0	0.1	0.2	0.4	04.7
9	1.3	1.2	0.8	0.5	0.4	0.3	0.2	0.1	0.0	0.1	0.3	05.2
10	1.4	1.3	0.9	0.6	0.5	0.4	0.3	0.2	0.1	0.0	0.2	05.9
11	1.6	1.5	1.1	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.0	07.7
									DISPERSION			66.4

BUS NO. 61. McKENZIE. MATRIX OF DISTANCE IN MILES ROUTE: H

	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1	0.0	0.1	0.5	0.8	1.1	1.2	1.3	1.4	1.5	1.6	1.8	2.0	13.3
2	0.1	0.0	0.4	0.7	1.0	1.1	1.2	1.3	1.4	1.5	1.7	1.9	12.3
3	0.5	0.4	0.0	0.3	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.5	09.1
4	0.8	0.7	0.3	0.0	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.2	07.3
5	1.1	1.0	0.6	0.3	0.0	0.1	0.2	0.3	0.4	0.5	0.7	0.9	06.1
6	1.2	1.1	0.7	0.4	0.1	0.0	0.1	0.2	0.3	0.4	0.6	0.8	05.9
7	1.3	1.2	0.8	0.5	0.2	0.1	0.0	0.1	0.2	0.3	0.5	0.7	05.9
8	1.4	1.3	0.9	0.6	0.3	0.2	0.1	0.0	0.1	0.2	0.4	0.6	06.1
9	1.5	1.4	1.0	0.7	0.4	0.3	0.2	0.1	0.0	0.1	0.3	0.5	06.5
10	1.6	1.5	1.1	0.8	0.5	0.4	0.3	0.2	0.1	0.0	0.2	0.4	07.1
11	1.8	1.7	1.3	1.0	0.7	0.6	0.5	0.4	0.3	0.2	0.0	0.2	08.7
12	2.0	1.9	1.5	1.2	0.9	0.8	0.7	0.6	0.5	0.4	0.2	0.0	10.7
												DISPERSION	99.0

BUS NO. 5. SOUVENIR. MATRIX OF DISTANCE IN MILES ROUTE: J

	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1	0.0	0.1	0.5	0.8	1.0	1.2	1.3	1.4	1.5	1.6	1.8	1.9	13.2
2	0.1	0.0	0.4	0.7	0.9	1.1	1.2	1.3	1.4	1.5	1.7	1.8	12.1
3	0.5	0.4	0.0	0.3	0.5	0.7	0.8	0.9	1.0	1.1	1.3	1.4	08.9
4	0.8	0.7	0.3	0.0	0.2	0.4	0.5	0.6	0.7	0.8	1.0	1.1	07.1
5	1.0	0.9	0.5	0.2	0.0	0.2	0.3	0.4	0.5	0.6	0.8	0.9	06.3
6	1.2	1.1	0.7	0.4	0.2	0.0	0.1	0.2	0.3	0.4	0.6	0.7	05.9
7	1.3	1.2	0.8	0.5	0.3	0.1	0.0	0.1	0.2	0.3	0.5	0.6	05.9
8	1.4	1.3	0.9	0.6	0.4	0.2	0.1	0.0	0.1	0.2	0.4	0.5	06.1
9	1.5	1.4	1.0	0.7	0.5	0.3	0.2	0.1	0.0	0.1	0.3	0.4	06.5
10	1.6	1.5	1.1	0.8	0.6	0.4	0.3	0.2	0.1	0.0	0.2	0.3	07.1
11	1.8	1.7	1.3	1.0	0.8	0.6	0.5	0.4	0.3	0.2	0.0	0.1	08.7
12	1.9	1.8	1.4	1.1	0.9	0.7	0.6	0.5	0.4	0.3	0.1	0.0	09.7
											DISPERSION		97.5

BUS NO. 12. SOUVENIR. MATRIX OF DISTANCE IN MILES ROUTE: J

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
1	0.0	0.9	1.3	1.6	1.8	1.9	2.3	2.7	3.2	3.3	3.5	3.6	4.1	4.4	4.7	5.4	5.7	50.4
2	0.9	0.0	0.4	0.7	0.9	1.0	1.4	1.8	2.3	2.4	2.6	2.7	3.2	3.5	3.8	4.5	4.8	36.9
3	1.3	0.4	0.0	0.3	0.5	0.6	1.0	1.4	1.9	2.0	2.2	2.3	2.8	3.1	3.4	4.1	4.4	31.7
4	1.6	0.7	0.3	0.0	0.2	0.3	0.7	1.1	1.6	1.7	1.9	2.0	2.5	2.8	3.1	3.8	4.1	28.4
5	1.8	0.9	0.5	0.2	0.0	0.1	0.5	0.9	1.4	1.5	1.7	1.8	2.3	2.6	2.9	3.6	3.9	25.8
6	1.9	1.0	0.6	0.3	0.1	0.0	0.4	0.8	1.3	1.4	1.6	1.7	2.2	2.5	2.8	3.5	3.8	25.9
7	2.3	1.4	1.0	0.7	0.5	0.4	0.0	0.4	0.9	1.0	1.2	1.3	1.8	2.1	2.4	3.1	3.4	23.9
8	2.7	1.8	1.4	1.1	0.9	0.8	0.4	0.0	0.5	0.6	0.8	0.9	1.4	1.7	2.0	2.7	3.0	22.7
9	3.2	2.3	1.9	1.6	1.4	1.3	0.9	0.5	0.0	0.1	0.3	0.4	0.9	1.2	1.5	2.2	2.5	22.2
10	3.3	2.4	2.0	1.7	1.5	1.4	1.0	0.6	0.1	0.0	0.2	0.3	0.8	1.1	1.4	2.1	2.4	22.3
11	3.5	2.6	2.2	1.9	1.7	1.6	1.2	0.8	0.3	0.2	0.0	0.1	0.6	0.9	1.2	1.9	2.2	22.9
12	3.6	2.7	2.3	2.0	1.8	1.7	1.3	0.9	0.4	0.3	0.1	0.0	0.5	0.8	1.1	1.8	2.1	23.4
13	4.1	3.2	2.8	2.5	2.3	2.2	1.8	1.4	0.9	0.8	0.6	0.5	0.0	0.3	0.6	1.3	1.6	26.9
14	4.4	3.5	3.1	2.8	2.6	2.5	2.1	1.7	1.2	1.1	0.9	0.8	0.3	0.0	0.3	1.0	1.3	29.6
15	4.7	3.8	3.4	3.1	2.9	2.8	2.4	2.0	1.5	1.4	1.2	1.1	0.6	0.3	0.0	0.7	1.0	32.9
16	5.4	4.5	4.1	3.8	3.6	3.5	3.1	2.7	2.2	2.1	1.9	1.8	1.3	1.0	0.7	0.0	0.3	42.0
17	5.7	4.8	4.4	4.1	3.9	3.8	3.4	3.0	2.5	2.4	2.2	2.1	1.6	1.3	1.0	0.3	0.0	46.5
																DISPERSION		514.4

BUS NO. 24. RENAUD-VIMONT MATRIX OF DISTANCE IN MILES ROUTE: K

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL
1	0000	0923	0186	346	509	569	667	697	752	857	922	977	1147	1267	1312	1337	11668
2	0123	0000	0063	223	386	446	544	574	629	734	799	854	1024	1144	1189	1214	09946
3	0186	0063	0000	160	323	383	481	511	566	671	736	791	0961	1081	1126	1151	09190
4	0346	0223	0160	000	163	223	321	351	406	511	576	631	0801	0921	0966	0991	07590
5	0509	0386	0323	163	000	060	158	188	243	348	413	468	0638	0758	0803	0838	06296
6	0569	0446	0383	223	060	000	098	128	183	288	353	408	0578	0698	0743	0768	05926
7	0667	0544	0481	321	158	098	000	030	085	190	255	310	0480	0600	0645	0670	05534
8	0697	0574	0511	351	188	128	030	000	055	160	225	280	0450	0570	0615	0640	05474
9	0752	0629	0566	406	243	183	085	055	000	105	170	225	0395	0515	0560	0585	05474
10	0857	0734	0671	511	348	288	190	160	105	000	065	120	0290	0410	0455	0480	05684
11	0922	0799	0736	576	413	353	255	225	170	065	000	055	0225	0345	0390	0415	05944
12	0977	0854	0791	631	468	408	310	280	225	120	055	000	0170	0290	0335	0360	06274
13	1147	1024	0961	801	638	578	480	450	395	290	225	170	0000	0120	0165	0190	07634
14	1267	1144	1081	921	758	698	600	570	515	410	345	290	0120	0000	0045	0070	08834
15	1312	1189	1126	966	803	743	645	615	560	455	390	335	0165	0045	0000	0025	09374
16	1337	1214	1151	991	838	768	670	640	585	480	415	360	0190	0070	0025	0000	09734
														DISPERSION			120576

BUS NO. 33. PONT VIAU - DUVERNAY

MATRIX OF TIME IN SECONDS

ROUTE: A

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL
1	000	084	149	189	249	279	304	332	352	382	402	442	477	522	542	564	584	609	6462
2	084	000	065	105	165	195	220	248	268	298	318	358	393	438	458	480	500	525	5118
3	149	065	000	040	100	130	155	183	203	233	253	293	328	373	393	415	435	460	4208
4	189	105	040	000	060	090	115	143	163	193	213	253	288	333	353	375	395	420	3728
5	249	165	100	060	000	030	055	083	103	133	153	193	228	273	293	315	335	360	3128
6	279	195	130	090	030	000	025	053	073	103	123	163	198	243	263	285	305	330	2888
7	304	220	155	115	055	025	000	028	048	078	098	138	173	218	238	260	280	305	2738
8	332	248	183	143	083	053	028	000	020	050	070	110	145	190	210	232	252	277	2626
9	352	268	203	163	103	073	048	020	000	030	050	090	125	170	190	212	232	257	2586
10	382	298	233	193	133	103	078	050	030	000	020	060	095	140	160	182	202	227	2586
11	402	318	253	213	153	123	098	070	050	020	000	040	075	120	140	162	182	207	2626
12	442	358	293	253	193	163	138	110	090	060	040	000	035	080	100	122	142	167	2786
13	477	393	328	288	228	198	173	145	125	095	075	035	000	045	065	087	107	132	2996
14	522	438	373	333	273	243	218	190	170	140	120	080	045	000	020	042	062	087	3356
15	542	458	393	353	293	263	238	210	190	160	140	100	065	020	000	022	042	067	3556
16	564	480	415	375	315	285	260	232	212	182	162	122	087	042	022	000	020	045	3820
17	584	500	435	395	335	305	280	252	232	202	182	142	107	062	042	020	000	025	4100
18	609	525	460	420	360	330	305	277	257	227	207	167	132	087	067	045	025	000	4500
																		DISPERSION	63808

BUS NO. 30. LAVAL DES RAPIDES (EAST) MATRIX OF TIME IN SECONDS ROUTE: B

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL
1	000	035	125	175	195	210	225	260	280	300	325	365	390	420	445	470	4220
2	035	000	090	140	160	175	190	225	245	265	290	330	355	385	410	435	3730
3	125	090	000	050	070	085	100	135	155	175	200	240	265	295	320	345	2650
4	175	140	050	000	020	035	050	085	105	125	150	190	215	245	270	295	2150
5	195	160	070	020	000	015	030	065	085	105	130	170	195	225	250	275	1990
6	210	175	085	035	015	000	015	050	070	090	115	155	180	210	235	260	1900
7	225	190	100	050	030	015	000	035	055	075	100	140	165	195	220	245	1840
8	260	225	135	085	065	050	035	000	020	040	065	105	130	160	185	210	1770
9	280	245	155	105	085	070	055	020	000	020	045	085	110	140	165	190	1770
10	300	265	175	125	105	090	075	040	020	000	025	065	090	120	145	170	1810
11	325	290	200	150	130	115	100	065	045	025	000	040	065	095	120	145	1910
12	365	330	240	190	170	155	140	105	085	065	040	000	025	055	080	105	2150
13	390	355	265	215	195	180	165	130	110	090	065	025	000	030	055	080	2350
14	420	385	295	245	225	210	195	160	140	120	095	055	030	000	025	050	2650
15	445	410	320	270	250	235	220	185	165	145	120	080	055	025	000	025	2950
16	470	435	345	295	275	260	245	210	190	170	145	105	080	050	025	000	3300
														DISPERSION			39140

BUS NO. 42. LAVAL DES RAPIDES (WEST)   MATRIX OF TIME IN SECONDS   ROUTE: C

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL
1	0000	0141	262	329	411	496	656	729	742	772	807	865	922	997	1047	1122	1152	1247	12697
2	0141	0000	121	188	270	355	515	588	601	631	666	724	781	856	0906	0981	1011	1076	10411
3	0262	0121	000	067	149	234	394	467	480	510	545	603	660	735	0785	0860	0890	0955	08717
4	0329	0188	067	000	082	167	327	400	413	443	478	536	593	668	0718	0793	0823	0888	08913
5	0411	0270	149	082	000	085	245	318	331	361	396	454	511	586	0636	0711	0741	0806	07093
6	0496	0355	234	167	085	000	160	233	246	276	311	369	426	501	0551	0626	0656	0721	06413
7	0656	0515	394	327	245	160	000	073	086	116	151	209	266	341	0391	0466	0496	0561	05443
8	0729	0588	467	400	318	233	073	000	013	043	078	136	193	268	0318	0393	0423	0488	05161
9	0742	0601	480	413	331	246	086	013	000	030	065	123	180	255	0305	0380	0410	0475	05135
10	0772	0631	510	443	361	276	116	043	030	000	035	093	150	225	0275	0350	0380	0445	05135
11	0807	0666	545	478	396	311	151	078	065	035	000	058	115	190	0240	0315	0345	0410	05205
12	0865	0724	603	536	454	369	209	136	123	093	058	000	057	132	0182	0257	0287	0352	05437
13	0922	0781	660	593	511	426	266	193	180	150	115	057	000	075	0125	0208	0230	0295	05787
14	0997	0856	735	668	586	501	341	268	255	225	190	132	075	000	0050	0125	0155	0220	06379
15	1047	0906	785	718	636	551	381	318	305	275	240	182	125	050	0000	0075	0105	0170	06869
16	1122	0981	860	793	711	626	466	393	380	350	315	257	208	125	0075	0000	0030	0095	07787
17	1152	1011	890	823	741	656	496	423	410	380	345	287	230	155	0105	0030	0000	0065	08172
18	1247	1076	955	888	806	721	561	488	475	445	410	352	295	220	0170	0095	0065	0000	09239
																	DISPERSION		128993

BUS NO. 56. ST.DOROTHEE. MATRIX OF TIME IN SECONDS ROUTE: D

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1	000	020	105	195	255	305	345	415	460	525	570	600	630	650	5075
2	020	000	085	175	235	285	325	395	440	505	550	580	610	630	4835
3	105	085	000	090	150	200	240	310	355	420	465	495	525	545	3985
4	195	175	090	000	060	110	150	220	265	330	375	405	435	455	3265
5	255	235	150	060	000	050	090	160	205	270	315	345	375	395	2905
6	305	285	200	110	050	000	040	110	155	220	265	295	325	345	2705
7	345	325	240	150	090	040	000	070	115	180	225	255	285	305	2625
8	415	395	310	220	160	110	070	000	045	110	155	185	215	235	2625
9	460	440	355	265	205	155	115	045	000	065	110	140	170	190	2715
10	525	505	420	330	270	220	180	110	065	000	045	075	105	125	2975
11	570	550	465	375	315	265	225	155	110	045	000	030	060	080	3245
12	600	580	495	405	345	295	255	185	140	075	030	000	030	050	3485
13	630	610	525	435	375	325	285	215	170	105	060	030	000	020	3785
14	650	630	545	455	395	345	305	235	190	125	080	050	020	000	4025
														DISPERSION	48250

BUS NO. 32. SAMSON - HAVRE DES ILES   MATRIX OF TIME IN SECONDS   ROUTE: E

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
1	000	043	106	123	147	164	196	260	278	305	334	374	403	419	472	513	537	4674
2	043	000	063	080	104	121	153	217	235	262	291	331	360	376	429	470	494	4029
3	106	063	000	017	041	058	090	154	172	199	228	268	297	313	366	407	431	3210
4	123	080	017	000	024	041	073	137	155	182	211	251	280	296	349	390	414	3023
5	147	104	041	024	000	017	049	113	131	158	187	227	256	272	325	366	390	2807
6	164	121	058	041	017	000	032	096	114	141	170	210	239	255	308	349	373	2688
7	196	153	090	073	049	032	000	064	082	109	138	178	207	223	276	317	341	2528
8	260	217	154	137	113	096	064	000	018	045	074	114	143	159	212	253	277	2336
9	278	235	172	155	131	114	083	018	000	027	056	096	125	141	194	235	259	2318
10	305	262	199	182	158	141	109	045	027	000	029	069	098	114	167	208	232	2345
11	334	291	228	211	187	170	138	074	056	029	000	040	069	085	138	179	203	2432
12	374	331	268	251	227	210	178	114	096	069	040	000	029	045	098	139	163	2629
13	403	360	297	280	256	239	207	143	125	098	069	029	000	016	069	110	134	2835
14	419	376	313	296	272	255	223	159	141	114	085	045	016	000	053	094	118	2979
15	472	429	366	349	325	308	276	212	194	167	138	098	069	053	000	041	065	3562
16	513	470	407	390	366	349	317	253	235	208	179	139	110	094	041	000	024	4095
17	537	494	431	414	390	373	341	277	259	232	203	163	134	118	065	024	000	4455
															DISPERSION			52945

BUS NO. 55. PERRON - 7th - 9th   MATRIX OF TIME IN SECONDS   ROUTE: F

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	000	030	095	115	176	226	241	261	296	314	332	342	382	402	422	3634
2	030	000	065	085	146	196	211	231	266	284	302	312	352	372	392	3244
3	095	065	000	020	081	131	146	166	201	219	237	247	287	307	327	2529
4	115	085	020	000	061	111	126	146	181	199	217	227	267	287	307	2349
5	176	146	081	061	000	050	065	085	120	138	156	166	206	226	246	1922
6	226	196	131	111	050	000	015	035	070	088	106	116	156	176	196	1672
7	241	211	146	126	065	015	000	020	055	073	091	101	141	161	181	1627
8	261	231	166	146	085	035	020	000	035	053	071	081	121	141	161	1607
9	296	266	201	181	120	070	055	035	000	018	036	046	086	106	126	1642
10	314	284	219	199	138	088	073	053	018	000	018	028	068	088	108	1696
11	332	302	237	217	156	106	091	071	036	018	000	010	050	070	090	1766
12	342	312	247	227	166	116	101	081	046	028	010	000	040	060	080	1856
13	382	352	287	267	206	156	141	121	086	068	050	040	000	020	040	2216
14	402	372	307	287	226	176	161	141	106	088	070	060	020	000	020	2436
15	422	392	327	307	246	196	181	161	126	108	090	080	040	020	000	2696
													DISPERSION			32892

BUS NO. 38. NOTRE DAME

MATRIX OF TIME IN SECONDS

ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	000	030	102	141	206	261	294	339	412	451	495	523	558	581	601	4994
2	030	000	072	111	176	231	264	309	382	421	465	493	528	551	571	4604
3	102	072	000	039	104	159	192	237	310	349	393	421	456	479	499	3812
4	141	111	039	000	065	120	153	198	271	310	354	382	417	440	460	3461
5	206	176	104	065	000	055	088	133	206	245	289	317	352	375	395	3006
6	261	231	159	120	055	000	033	078	151	190	234	262	297	320	340	2731
7	294	264	192	153	088	033	000	045	118	157	201	229	264	287	307	2632
8	339	309	237	198	133	078	045	000	073	112	156	184	219	242	262	2587
9	412	382	310	271	206	151	118	073	000	039	083	111	146	169	189	2660
10	451	421	349	310	245	190	157	112	039	000	044	072	107	130	150	2777
11	495	465	393	354	289	234	201	156	083	044	000	028	063	086	106	2997
12	523	493	421	382	317	262	229	184	111	072	028	000	035	058	078	3193
13	558	528	456	417	352	297	264	219	146	107	063	035	000	023	043	3508
14	581	551	479	440	375	320	287	242	169	130	086	058	023	000	020	3761
15	601	571	499	460	395	340	307	262	189	150	106	078	043	020	000	4021
													DISPERSION			50744

BUS NO. 40. NOTRE DAME

MATRIX OF TIME IN SECONDS

ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	000	020	090	125	181	225	295	345	425	458	493	523	546	580	591	4897
2	020	000	070	105	161	205	275	325	405	438	473	503	526	560	571	4637
3	090	070	000	035	091	135	205	255	335	368	403	433	456	490	501	3867
4	125	105	035	000	056	100	170	220	300	333	368	398	421	455	466	3552
5	181	161	091	056	000	044	114	164	244	277	312	342	365	399	410	3160
6	225	205	135	100	044	000	070	120	200	233	268	298	321	355	366	2940
7	295	275	205	170	114	070	000	050	130	163	198	228	251	285	296	2730
8	345	325	255	220	164	120	050	000	080	113	148	178	201	235	246	2680
9	425	405	335	300	244	200	130	080	000	033	068	098	121	155	166	2760
10	458	438	368	333	277	233	163	113	033	000	035	065	088	122	133	2859
11	493	473	403	368	312	268	198	148	068	035	000	030	053	087	098	3034
12	523	503	433	398	342	298	228	178	098	065	030	000	023	057	068	3244
13	546	526	456	421	365	321	251	201	121	088	053	023	000	034	045	3451
14	580	560	490	455	399	355	285	235	155	122	087	057	034	000	011	3825
15	591	571	501	466	410	366	296	246	166	133	098	068	045	011	000	3968
														DISPERSION		51604

BUS NO. 45. NOTRE DAME

MATRIX OF TIME IN SECONDS

ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1	000	020	100	120	194	291	306	343	400	470	497	529	564	589	609	5032
2	020	000	080	100	174	271	286	323	380	450	477	509	544	569	589	4772
3	100	080	000	020	094	191	206	243	300	370	397	429	464	489	509	3892
4	120	100	020	000	074	171	186	223	280	350	377	409	444	469	489	3712
5	194	174	094	074	000	097	112	149	206	276	303	335	370	395	415	3194
6	291	271	191	171	097	000	015	052	109	179	206	238	273	298	318	2709
7	306	286	206	186	112	015	000	037	094	164	191	223	258	283	303	2664
8	343	323	243	223	149	052	037	000	057	127	154	186	221	246	266	2627
9	400	380	300	280	206	109	094	057	000	070	097	129	164	189	209	2684
10	470	450	370	350	276	179	164	127	070	000	027	059	094	119	139	2894
11	497	477	397	377	303	206	191	154	097	027	000	032	067	092	112	3029
12	529	509	429	409	335	238	223	186	129	059	032	000	035	060	080	3253
13	564	544	464	444	370	273	258	221	164	094	067	035	000	025	045	3568
14	589	569	489	469	395	298	283	246	189	119	092	060	025	000	020	3843
15	609	589	509	489	415	318	303	266	209	139	112	080	045	020	000	4103
														DISPERSION		51976

BUS NO. 50. NOTRE DAME

MATRIX OF TIME IN SECONDS

ROUTE: G

	1	2	3	4	5	6	7	8	9	10	11	TOTAL
1	000	037	135	150	255	267	317	357	385	420	465	2768
2	037	000	098	113	218	230	280	320	348	383	428	2455
3	135	098	000	015	120	132	182	222	250	285	330	1769
4	150	113	015	000	105	117	167	207	235	270	315	1694
5	255	218	120	105	000	012	062	102	130	165	210	1379
6	267	230	132	117	012	000	050	090	118	153	198	1367
7	317	280	182	167	062	050	000	040	068	103	148	1417
8	357	320	222	207	102	090	040	000	028	063	108	1537
9	385	383	285	270	165	153	103	063	035	000	045	1677
10	420	383	285	270	165	153	103	063	035	000	045	1922
11	465	428	330	315	210	198	148	108	080	045	000	2327
										DISPERSION		20312

BUS NO. 61. McKENZIE.

MATRIX OF TIME IN SECONDS

ROUTE: H

	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1	000	049	124	244	294	319	347	377	397	429	489	569	3638
2	049	000	075	195	245	270	298	328	348	380	440	520	3148
3	124	075	000	120	170	195	223	253	273	305	365	445	2548
4	244	195	120	000	050	075	103	133	153	185	245	325	1828
5	294	245	170	050	000	025	053	083	103	135	195	275	1628
6	319	270	195	075	025	000	028	058	078	110	170	250	1578
7	347	298	223	103	053	028	000	030	050	082	142	222	1578
8	377	328	253	133	083	058	030	000	020	052	112	192	1638
9	397	348	273	153	103	078	050	020	000	032	092	172	1718
10	429	380	305	185	135	110	082	052	032	000	060	140	1910
11	489	440	365	245	195	170	142	112	092	060	000	080	2390
12	569	520	445	325	275	250	222	192	172	140	080	000	3190
												DISPERSION	26802

BUS NO. 5. SOUVENIR.

MATRIX OF TIME IN SECONDS

ROUTE: J

	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1	000	047	119	251	285	317	342	367	387	417	507	542	3581
2	047	000	072	204	238	270	295	320	340	370	460	495	3111
3	119	072	000	132	166	198	223	248	268	298	388	423	2535
4	251	204	132	000	034	066	091	116	136	166	256	291	1743
5	285	238	166	034	000	032	057	082	102	132	222	257	1607
6	317	270	198	066	032	000	025	050	070	100	190	225	1543
7	342	295	223	091	057	025	000	025	045	075	165	200	1543
8	367	320	248	116	082	050	025	000	020	050	140	175	1593
9	387	340	268	136	102	070	045	020	000	030	120	155	1673
10	417	370	298	166	132	100	075	050	030	000	090	125	1853
11	507	460	388	256	222	190	165	140	120	090	000	035	2573
12	542	495	423	291	257	225	200	175	155	125	035	000	2923
											DISPERSION		26278

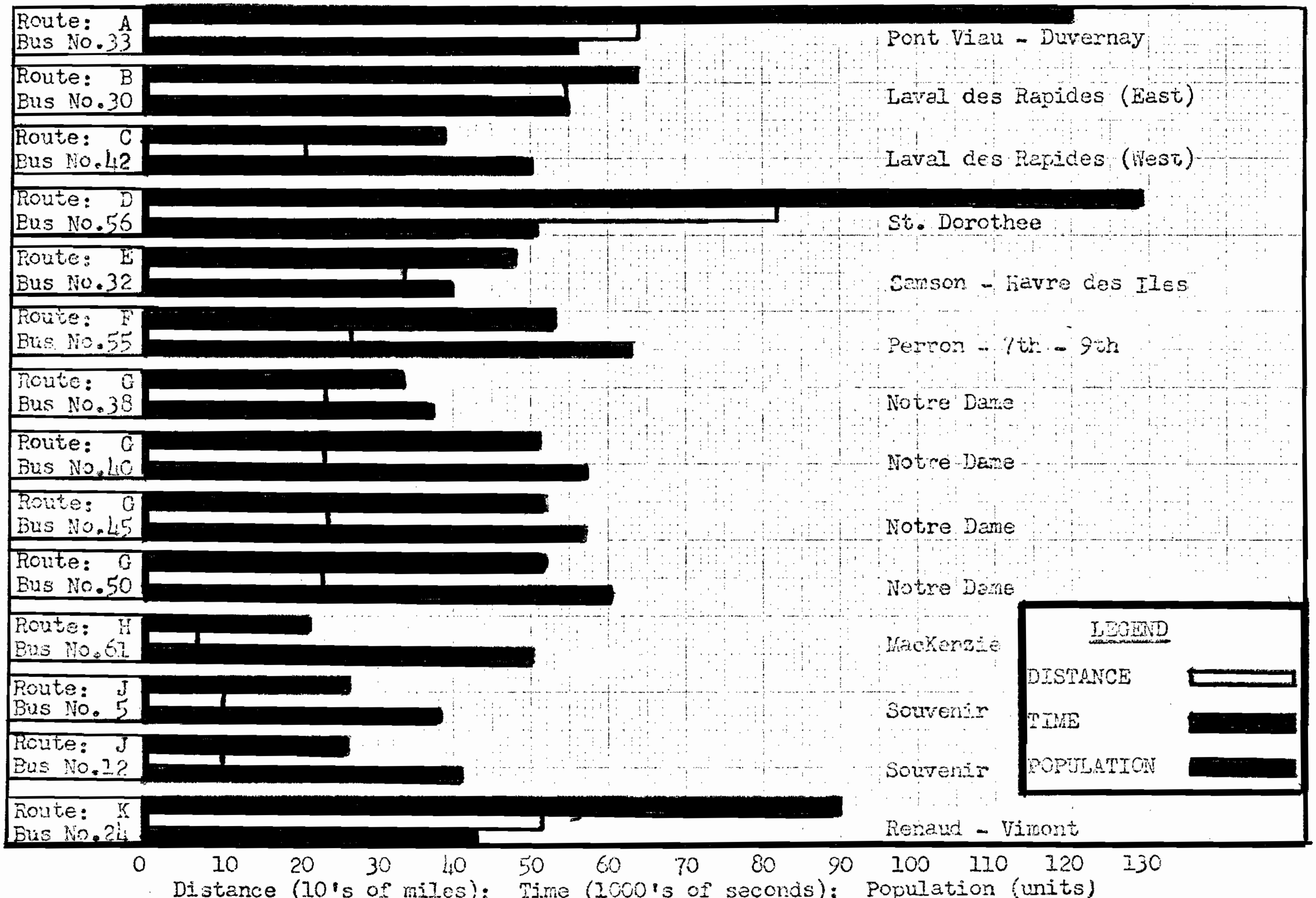
BUS NO. 12. SOUVENIR. MATRIX OF TIME IN SECONDS ROUTE: J

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
1	000	104	213	333	383	428	478	592	652	692	722	742	802	822	852	902	922	9639
2	104	000	109	229	279	324	374	488	548	588	618	638	698	718	748	798	818	8079
3	213	109	000	120	170	215	265	379	439	479	509	529	589	609	639	689	709	6662
4	333	229	120	000	050	095	145	259	319	359	389	409	469	489	519	569	589	5342
5	383	279	170	050	000	045	095	209	269	309	339	359	419	439	469	519	539	4892
6	428	324	215	095	045	000	050	164	224	264	294	314	374	394	424	474	494	4577
7	478	374	265	145	095	050	000	114	174	214	244	264	324	344	374	424	444	4327
8	592	488	379	259	209	164	114	000	060	100	130	150	210	230	260	310	330	3985
9	652	548	439	319	269	224	174	060	000	040	070	090	150	170	200	250	270	3925
10	692	588	479	359	309	264	214	100	040	000	030	050	110	130	160	210	230	3965
11	722	618	509	389	339	294	244	130	070	030	000	020	080	100	130	180	200	4055
12	742	638	529	409	359	314	264	150	090	050	020	000	060	080	110	160	180	4155
13	802	698	589	469	419	374	324	210	150	110	080	060	000	020	050	100	120	4475
14	822	718	609	489	439	394	344	230	170	130	100	080	020	000	030	080	100	4755
15	852	748	639	519	469	424	374	260	200	160	130	110	050	030	000	050	070	5085
16	902	798	689	569	519	474	424	310	250	210	180	160	100	080	050	000	020	5735
17	922	818	709	589	539	494	444	330	270	230	200	180	120	100	070	020	000	6035
															DISPERSION			89688

BUS NO. 24. RENAUD-VIMONT

MATRIX OF TIME IN SECONDS

ROUTE: K



GRAPHICAL COMPARISON OF DISPERSION INDICES AND POPULATION

A P P E N D I X   D

SAMPLE QUESTIONS

APPENDIX D

SAMPLE QUESTIONS

Which is the busiest bus route?

Which node is furthest from school? In miles? In seconds?

Which buses go directly to school?

Which route requires the bus to make the most stops?

Do the speed limits have an effect on the bus routes?

Which routes have the fastest and slowest speed limits?

Which trip is faster, the trip to school, or the trip home?

Do stop signs have an effect on the timing?

What effect does weather have on the trip?

Does the size of the bus have any effect on the timing?

Was the time the bus was stopped included in the timing?

What topic was most useful in the project?

Why bother to separate the sexes in the statistics?

Why is there a line drawn diagonally across the matrix?

Why are there zeroes in the matrix diagonal?

Why are most buses concentrated in one section, less than three miles from school?

Where do you find matrices similar to the one in the project?

Are graphs adequate?

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