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Bus Scheduling Manual: Traffic Checking and Schedule Preparation

August 1947
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In cooperation with
american public transit association

apta

Bus Scheduling Manual:
Traffic Checking and Schedule Preparation

August 1947,
Reprinted July 1982

Prepared by
Walter S. Rainville, Jr.
American Transit Association

This Version Cooperatively Produced by
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Urban Mass Transportation Administration
Washington, D.C. 20590

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Office of the Secretary of Transportation
Washington, D.C. 20590

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TRAFFIC CHECKING

AND

SCHEDULE PREPARATION

by

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FOREWORD

This scheduling manual was developed through a cooperative effort of transit operators in the American Transit Association (ATA). It was a landmark effort and a valuable contribution to the transit industry. While scheduling practices have advanced significantly since its publication over thirty years ago, the manual is still in demand as a reference source. We believe this is a tribute to the operators who developed the manual and particularly to Walter Rainville, Jr., ATA's longtime Director of Research, who guided the project.

The text of this manual was made available courtesy of the American Public Transit Association, the successor to ATA. The actual distribution was done by the U.S. Department of Transportation.

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Background

This volume is viewed today as a classic reference on manual scheduling practices. It represents a comprehensive effort made over 30 years ago to pull together the state of the practice in this field, and many of those practices still remain valid today.

Because of the classic nature of this reference, it is being reproduced unchanged from its original edition. Operators today should note that some of the technological references in the original volume are dated, and that the advent of hand calculators, data management systems, and microcomputers may have facilitated some of the processes described. These areas in the report should be fairly easy to recognize.

The continued utility of this report stems from the excellent efforts made by Walter S. Rainville, Jr. The contributions of Arthur E. Kern, now with New Orleans Public Service, Inc., should also be recognized and applauded.

The Urban Mass Transportation Administration (UMTA) has attempted to build on this effort. One of the early products of this work is RUCUS, a computer-based RUn CUtting and Scheduling package. UMTA is continuing to develop other such tools. For further information, contact Mr. Brian McCollom of the UMTA Office of Methods and Support, URT-41.

This study, designated as Research Project #6 - "Traffic Checking and Schedule Preparation", has been sponsored by the Operations Division and undertaken, upon approval by the Board of Directors, as part of the A.T.A. Research Program for the Association year 1946-47.

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FOREWORD

This research project was suggested during 1946 by Mr. R. N. Graham, President, The Youngstown Municipal Railway Company, Youngstown, Ohio. It was considered by the Administrative Committee of the Operations Division of the Association on October 9, 1946, at which time it was decided that the Operations Division would sponsor the study and refer the subject to the Research Advisory Committee for consideration as a potential research project. On January 9, 1947 the Research Advisory Committee approved the project as one suitable for undertaking by the Association's Director of Research, and requested the Executive Manager to convey its recommendation to this effect to the Board of Directors with the request that the Board approve the project for study. The Executive Committee of the Board of Directors gave its approval of the project on February 21, 1947.

Objectives

This project has the following basic objectives:

1. The preparation of a comprehensive report on procedural methods for traffic checking and schedule preparation in the transit industry for distribution to the member companies of the Association.

2. The investigation of methods for checking the efficiency of schedules.

3. The development of new and improved techniques in the field of traffic checking and schedule preparation.

Scope

The project embraces a complete coverage of the schedule-making process from start to finish, including:

Fundamental Controls
Passenger Load Checks
Running Time Checks
Headway Specifications
Preparation of Timetables
Cutting of Runs
Assignment of Runs
Measurements of Schedule Efficiency

Plan of Study

The study has been divided into four parts:

Part I: A Sample Procedure for Traffic Checking and Schedule Preparation.

Part II: A Survey of Current Industry Practices.

Part III: An Industry Symposium on Traffic Checking and Schedule Preparation.

Part IV: A Report on the Development of New and Improved Techniques in the Field of Traffic Checking and Schedule Preparation.

Part I has been designed to meet the needs of those properties which have had little or no experience with systematic traffic checking and schedule preparation. An effort has been made to prepare a clear, complete and comprehensive exposition of the procedures involved, with sufficient detail to permit these procedures or similar ones to be adopted if they should prove to meet the need of an individual property. The procedure set up for explanation has been based upon the method used by one representative transit company. This method has been selected solely for purposes of illustration, and does not purport to be the best method or a standard method. It is simply portrayed as one good, practical method which has been used successfully by a representative transit property over a long period of years. Parts II and III will include alternative methods and procedures for the various steps of the schedule-making process, so that the reader may have the benefit of a choice as to the mechanics of the problem and as to points of view relating to policy in this field.

PART II has been designed to provide the member companies with up-to-date information on traffic checking and schedule-making procedures on the various properties which make up the transit industry. It will cover broad principles and policies as well as the details of form, frequency, procedure, etc. This portion of the study will be developed from replies to a comprehensive and specially designed questionnaire to be sent to all operating company members. The results will be set up in tabular summary form to the maximum extent possible. A copy of this questionnaire will be included in Appendix A of Part II. (Part II will be distributed when completed.)

Part III has been designed as a complement to and modifier of Part I in order that the member companies might have the benefit of differing viewpoints with reference to policy and procedure in the individual phases of traffic checking and schedule preparation. In the collection of this symposium the sample procedure, Part I, will be made available to from three to five specialists in each phase. Each of these specialists will be asked to present his comments on the sample procedure and to give the policies and practices of his own company with respect to his particular phase of the problem. This part of the project, in combination with Parts I and II, should provide the member companies with a rather complete resume of the best thinking and

practice in the industry. (Part III will be distributed when completed.)

Part IV has been approved by the Executive Committee, but detailed plans for its execution have not yet been made. The need for investigation into and the development of new and improved techniques for traffic checking and schedule preparation should logically evolve from the process of setting up Parts I, II and III, which cover the manner in which schedules are made at the present time. The problems encountered by the companies should serve as a guide to the specific fields of investigation which should be undertaken. As presently contemplated, this portion of the study would be directed towards finding better ways of getting at the fundamentals of a schedule, such as (1) breaking down the operation into time and motion studies as an approach to fixing schedule speeds, (2) investigating such "short cuts" as might be employed, and (3) determining the degree to which the schedule-making process can be mechanized.

PART I

A SAMPLE PROCEDURE FOR TRAFFIC CHECKING AND SCHEDULE PREPARATION

Acknowledgment

The sample company whose traffic checking and schedule making procedures have been described herein has asked that it be allowed to remain unnamed. This request will be observed, but not without regret, as this procedure prevents giving proper credit to the company and to the individuals associated with it whose cooperation and efforts have made Part I possible.

Much of the material was taken from a former lecture course on schedule-making procedure which was taught to the company's schedule department employees, transportation supervisors and vehicle operators some few years ago. Large portions of the material have been taken verbatim from the company's manuals and lecture notes. Chapters V, VI, VII and VIII have been written after following closely the detailed verbal explanations of the respective processes by various employees of the company's Schedule Department.

The assistance and cooperation rendered by the sample company and its employees is gratefully acknowledged.

W.S.R.

NOTE

Wherever the terms "the sample company" and "the company" are used in the text, they refer to the company whose traffic checking and schedule making procedures are under study in this report.

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PART I

A SAMPLE PROCEDURE FOR TRAFFIC CHECKING AND SCHEDULE PREPARATION

CHAPTER I
INTRODUCTION

There are perhaps no more important elements of transit operations than the functions of traffic checking and schedule preparation. The comfort and convenience of the public, the compensation and working conditions of company employees, and the economic welfare of the company itself are all directly and significantly affected by transit schedules.

For this reason, the money spent for the establishment and maintenance of an adequate schedule department is usually considered money well spent by alert transit managements.

A. Importance of Transit Schedules

The operation of urban transit service in accordance with scientifically predetermined schedules is of the utmost importance to the riding public. The comfort and convenience experienced by the transit patron in availing himself of the service is in large measure dependent upon the skill and care with which schedules have been prepared, and the degree of conformity to these schedules which the operating department is able to achieve in the public streets.

Schedules prescribe the amounts of service which should be operated during different periods throughout the day, in accordance with the corresponding amounts of passenger traffic to be moved. Thus, they insure that ample service will be provided in accordance with the variation in need for service throughout the day. Schedules determine the average load which each vehicle on a route shall carry. Where schedules are adequate and headways (the intervals between vehicles) are properly maintained, the passenger experiences a degree of both convenience and comfort. Where headways are too long with respect to the load to be handled, or where irregular headways result from poor scheduling or improper operating practices, crowding results on some of the vehicles with consequent impairment to the comfort of the patron.

Schedules determine the headway intervals between vehicles for different periods of the day. Thus, schedule-making is intimately associated with the length of time which the passenger has to wait at the curb for a transit vehicle. Theoretically, the average patron waiting for a vehicle has to wait for a length of time equal to one-half the headway. Care must be taken to keep these intervals short enough during the peak periods of the day to provide for the movement of the volume of business which presents itself. These intervals must be sufficiently short at other periods of the day and night so as not to discourage patronage.

Schedules prescribe the time required by vehicles on a route in moving patrons from one point to another. Any speed less than the full speed which can be accomplished with safety at any given time of the day consumes unnecessarily some portion of the passenger's time. The patron is, therefore, directly affected by the efficiency of scheduling from the standpoints of speed and

running time.

Schedules are important to the company's operating personnel for many reasons. In the first place, they prescribe the average load which each vehicle should carry. When improper or irregular headways occur in the actual operation of vehicles in the streets because of some inadequacy of scheduling, some of the operators or crews are required to do more than their fair share of the work of transporting patrons.

Schedules prescribe the working hours of each vehicle operator. In the absence of definitely scheduled working hours, all operators would be subject to call at any time, and their working conditions would be somewhat similar to those of operators designated as "extra men". Under the scheduling process, each regular operator has a definite assignment with a definitely scheduled starting time and finishing time.

Schedules permit vehicle operators to select the types of runs which they best prefer, in accordance with their prescribed seniority rights. Schedules also prescribe the exact amount of wages which each operator receives for regular work and extra work.

Schedules are important to the transit operating company because they form the basis for the orderly conduct of the company's operations. They enable the company to place the service where it is needed and where it will do the most good. The operation of vehicles at irregular or inadequate intervals, their operation at time-consuming speeds, and the provision of an inadequate number of vehicles to handle traffic would produce a service unattractive to patrons, and, therefore, one which would not produce the most revenue for the company.

Schedules are helpful to the company because they constitute a specification for the operation of the service in the public streets. With a theoretical pattern for the service laid out on paper in a systematic manner, supervision can be intelligently applied by the transportation department in conducting actual operations. The times at which vehicles should pass certain "time points" in order to make the service of maximum usefulness to the public are definitely set forth in the schedules, and deviations from these times can be observed by the supervisory personnel and corrective measures suggested. Sometimes upon investigation these corrective measures involve a change in the schedule itself. At other times, however, it is necessary that the vehicle operator be instructed or disciplined for his failure to observe the schedule or for some defect in his working procedure. Having a definitely prescribed operating plan, as represented by the schedule, makes such instruction or discipline easier to apply.

Since the working conditions and the limitations of the individual pieces of work are definitely known and understood by all parties, transit probably attracts a somewhat higher class of labor than that which would be content with a type of work in which the individual job is less clearly defined.

The most significant aspect of the schedule-making process from the company viewpoint is that concerned with costs of operation. Most of the elements of cost in transit operation are associated with the amount of service operated. This is particularly true of the platform labor cost, which is the most important single item of expense. Table I shows platform labor costs in relation to operating revenues and operating expenses for transit operations in the United States. This table indicates that a substantial percentage of the industry's income and

TABLE I

PLATFORM LABOR COST
IN RELATION TO
OPERATING REVENUE AND OPERATING EXPENSES*

YEAR	OPERATING REVENUE ($1,000)	OPERATING EXPENSES ($1,000)	PLATFORM # LABOR COST ($1,000)	PER CENT PLATFORM LABOR COST TO OPERATING REVENUE	PER CENT PLATFORM LABOR COST TO OPERATING EXPENSES
1932	$696,490	$562,850	$160,200	23.0	28.4
1933	642,400	502,420	142,400	22.2	28.4
1934	674,900	525,490	152,100	22.6	28.9
1935	681,400	534,930	153,000	22.5	28.6
1936	727,900	565,180	164,200	22.6	29.0
1937	733,500	588,680	173,000	23.6	29.4
1938	700,800	579,690	174,300	24.9	30.1
1939	720,700	586,600	179,500	24.9	30.6
1940	737,000	598,030	183,900	24.9	30.7
1941	800,300	644,260	198,400	24.8	30.8
1942	1,040,000	769,390	247,000	23.8	32.1
1943	1,294,000	932,970	301,100	23.3	32.3
1944	1,362,300	1,012,070	325,000	23.8	32.1
1945	1,380,400	1,067,140	340,100	24.6	31.9
1946a	1,397,100		384,000	27.5	-

* For transit operations in the United States.
\# Wages of Motormen, Conductors, One-Man Car Operators, Bus Drivers and Trolley Coach Operators.
a Tentative Estimate

expenditures is required to defray the wages of vehicle operators.

Because of the importance of platform labor cost and other elements of "service" cost in determining the over-all results of transit operation, it is extremely important that the management provide the exactly correct amount of service on the streets for its patrons. On the one hand, there must be sufficient service available to hold and attract patronage. On the other hand, the effects of the direct costs of operation make it essential that no more service be operated than that absolutely necessary. Schedule making, when correctly done, is an orderly process for determining the correct amounts of service to be operated, and the times of day and other conditions surrounding their operation so that the service may be rendered in the most effective manner. Inadequate, sloppy operation or inefficient scheduling generally result in more vehicles being used than necessary, with consequent waste of service and the inefficient expenditure of the operating cost dollar. Lack of scheduling, or poor scheduling, with resultant high operating expenses and revenues less than a possible maximu, diminishes the possibility of a company's earning an adequate return on the investment in transit facilities. Proper attention to traffic checking and schedule preparation, on the other hand, tend to assure present investors in the property that the management is doing everything in its power to obtain the maximum of transit riding with the minimum of operating expense in relation thereto. This tends to make the securities of the operating company in question more attractive to present and prospective future investors, and thus insures a flow of needed capital to the transit company.

B. Tests of a Good Schedule

The question of "what constitutes a good schedule" has apparently not yet been solved to the satisfaction of the transit industry. This statement is based upon observation of some leading transit men having wide experience and reputation in the field of traffic checking and schedule preparation, who during the past year have been seeking ways by which company managements can measure schedule efficiency. If men of this caliber are at a loss to know what the measures of schedule efficiency are, this phase of the problem undoubtedly furnishes a fertile field for research.

Some of the tests of a good schedule are, of course, obvious. The average load per vehicle during peak hours, for example, should check closely with the prescribed loading standard. Base, night and other off-peak headways should not be too long. Operating speeds should be as high as possible, consistent with safety. These three tests might well be applied by the public although the company itself has a heavy interest in the first one. Perhaps the transit patron would consider a good schedule to be one which provided every passenger with a seat during the peak period. This, of course, would not constitute a good schedule from the standpoint of the operating company, because transit managements universally know and understand that it is economically impossible to provide a seat per passenger during rush hours.

The operating personnel of a company would perhaps apply different tests to a schedule in order to determine whether it should be classified as good or bad. Operators would, for example, consider a good schedule to be one which included a high percentage of regular runs. Other tests of a good schedule from the standpoint of the operating personnel might be that it include a high percentage of straight day runs; that it involve very few late "reliefs";

and that the relief time either be as short as possible, or that it be long enough to permit the relieved operator to go home for meals with sufficient time for his return to the job. The operating personnel might also classify as "good" a schedule which includes a large number of high-paying runs, or one with slow running time and a long layover on each trip.

Perhaps the most obvious test of the efficiency of a schedule from the standpoint of the operating company would be that the cost of the schedule be as low as possible. This test would, however, have to be applied with a realization that the schedule should not be cut so closely that it would trend to discourage profitable patronage.

Because of the importance of this question of tests of a good schedule and managerial measurements of schedule efficiency, the Administrative Committee of the Operations Division specified, when undertaking the sponsorship of this project, that it include, in addition to traffic checking and schedule preparation, a study of methods for checking the efficiency of schedules. Provision has been made for the appointment of a Research Project Committee to investigate measures of the efficiency of schedules and the schedule-making process. The findings of this Project Committee will be reported upon during the progress of this study.

C. Classification of Schedules

Schedules may be classified in many different ways. Perhaps the simplest classification is that which is based upon the "kind of day." Thus, there are weekday, Saturday, Sunday and holiday schedules. In some instances, the volume of passenger movement on various days of the work week is sufficiently different to justify the preparation of schedules for the several weekdays in order that maximum schedule economy may be achieved. Thus, there may be a schedule for Monday only, coupled with another schedule for Tuesday through Friday, another for Saturday, and still another for Sunday.

The amount of service operated on a Saturday would depend in large measure upon the working habits of the community. The prevalence of a six-day work week as contrasted with a five-day work week in the locality would have its influence upon the Saturday schedule. A full work day on Saturday as opposed to a predominant 1:00 P.M. closing time would also have a pronounced effect upon the Saturday schedule.

Holiday schedules would be influenced by the number of holidays observed in the community throughout the year, and by the presence or absence of special events at points along the transit system which might account for a significant amount of holiday riding. In many cases it is customary to operate the Sunday schedule on a holiday. Special schedules are sometimes required to meet situations peculiar to the community, and in many instances scheduled special services are required to serve fairs, race tracks, and other special or emergency needs.

Schedules may also be classified as "summer" schedules and "winter" schedules. Such schedules would reflect the changes in volume of passenger business occasioned by seasonal changes generally, and by the effects of special seasonal activities on the riding of each line. The closing of schools during the summer months, the closing of stores and other business establishments at different hours in the summer than in the winter, the outflow or inflow of large numbers of vacationers, would all, for example, have a pronounced effect upon schedules.

Other classifications of schedules may occur in specialized instances. The important thing to bear in mind is that there should be as many different kinds of schedules prepared and operated throughout the year as will give the company the fullest opportunity to adjust the service to actual travel needs, in order that maximum operating efficiency may be obtained. It is a great mistake to prepare a set of schedules and to permit them to remain in effect indefinitely without repeated checking and change as frequently as necessary to provide the maximum effective control over the expenditure of the platform labor dollar.

D. Schedule Changes

There are many reasons for making changes in schedules. Schedule changes may be roughly divided into:

1. Normal or routine changes;
2. Abnormal or "out-of-the-ordinary" changes.

Normal or routine changes are brought about by two general classes of causes. First, there would be routine changes in the schedule due to the variation in the total number of patrons handled on the line, that is, a change in the total volume of business, or in its variation according to time of day. Such variations become apparent through regular and systematic load checking of the lines, and may be due to changes in the general level of prosperity of the community, changes in employment or working hours at manufacturing plants or commercial establishments, and changes in the riding habits of individual family groups due to the effects of the private automobile as an alternative means of travel. Then, there are the seasonal changes in the volume of business handled by a line and its time distribution. These have been briefly touched upon in the preceding section. Some of the seasonal changes are due to the closing of schools during the summer months. Others are due to the closing of stores at different hours of the day during the vacation season, the effect of holidays, the migration of persons into or out of the city during the vacation season, and the movement of patrons from one location to another within the city during what might be termed the "moving season". Under normal conditions this latter movement tends to balance itself somewhat as renters "swap" homes. It has perhaps not been a characteristic of most cities in recent years owing to the acute housing shortage which has occurred as a corollary to World War II.

Abnormal schedule changes may result from several types of causes. They may be brought about by route changes due to partial or complete line abandonments, reroutings, the extension of lines, or temporary interruptions resulting from street or other construction work. Changes in schedules may also result - in fact, should result, from a change in the size or type of vehicle used. A change in the size of vehicle should bring about an automatic change in the schedule because of the different seating capacity and standee capacity characteristic of the new vehicle. A change in the type of vehicle usually affects the "schedule-ability" or performance characteristic of the equipment from the standpoints of its rates of acceleration and breaking and its speed characteristics. Some types of vehicles have been found to be "under-powered" and others have been found to be "over-powered" with respect to the total load to be handled at any time. These factors all have their effects upon operating performance. In the case of street car operation a change in equipment as to the number or size of motors, type of control or air brake equipment, a change in the setting of current limit relays, or a pronounced change in line voltage may be sufficient reason for redetermining running times and preparing new schedules. Among the external factors of an abnormal nature might be

included the competitive effect of a change in rates charged by taxicabs, or a change in street traffic conditions. These are all causes for an examination of existing schedules and possible schedule changes.

The alert schedule department will keep itself fully informed as to such causes for schedule changes as may exist or may present themselves during the course of operations. A general knowledge of what is taking place on the system, together with a program of systematic load and running time checks, should be of tremendous help in pointing the way toward temporary or permanent economies from the operating cost standpoint.

In the company which has been selected for the purpose of presenting this sample procedure, the following steps will have already been undertaken as a matter of systematic and regular routine before schedules are changed:

1. The line is checked for passenger load, in order to measure the effectiveness of the schedule currently in effect.

2. The line is checked for running time, in order to determine whether the time allotted between time points is correct for the various periods of the day. (This check is sometimes omitted.)

3. The line is checked for incompleted scheduled trips. An analysis of what are called the "switching reports" is made to determine whether the incompleted trips are due to an inadequacy of the schedule or to other causes.

4. The line is checked for its trends in revenue, revenue per vehicle hour, total passengers and total passengers per vehicle hour. Detailed charts of these and other statistics are posted frequently in order that the schedule department may be constantly informed of these trends.

E. The Company Whose Method Is to be Described

During the early stages of this project a complete review was made of material on traffic checking and schedule preparation in the ATA library, including reports of the work of past committees. This review indicates that there has been and now is a demand for a comprehensive manual on traffic checking and schedule preparation, but that no such comprehensive treatise on the subject - complete from start to finish - has ever been prepared. Some few individual aspects of this broad field have had comprehensive expert attention.

In reviewing the past material, it seemed apparent that the usual history of each attempt to produce a comprehensive work in this field ended when the committee group conducting the study got into controversial issues, such as which company among those represented on the committee had the best method for handling some particular phase of the subject. In other instances a committee may have felt itself handicapped by a lack of standard definitions for terms used in connection with transit operations and schedule making. In such cases considerable attention was usually given to the problem of trying to standardize definitions, and the central objective of putting something together on procedures for traffic checking and schedule preparation was lost in the attempt to reduce the terms used by various companies in the industry to a common denominator. In still other instances, committees made considerable progress until they came to the subject of "run cutting". At this point the

great differences between the calculated schedule vehicle miles, vehicle hours and platform labor costs for a given condition of traffic flow resulting from the greatly varied wage rates and working conditions obtaining on the individual properties seemed to give rise to an impasse. At such times the generally accepted procedure seemed to be to set up a hypothetical route of given physical and passenger traffic characteristics, and to ask each company represented on the committee to prepare schedules, including run cuts, in accordance with the terms and conditions of their individual labor contracts. This process produced much interesting information on the subject of the effect of wages and working conditions upon resultant schedule figures, but did not result in setting down for the guidance of the student of schedule making a procedural method which could be followed in obtaining the desired result under the one set of wage rates and working conditions with which he might be working.

The first objective of the current project is to prepare an exposition, as clearly and as quickly as possible, of the principles and procedures involved in the functions of traffic checking and schedule preparation for the information of all member companies, large and small. It should be possible to attain this objective regardless of the diversity of wages and working conditions, the diversity of opinions on the subject, and the unstandardized nomenclature which characterize the industry.

In order to provide such an exposition of the traffic checking and schedule making process, it was decided to select one representative transit property and to explain in full working detail the processes used by that property. In this way a complete and continuous picture of the schedule making process from start to finish can be set forth. The terms and definitions peculiar to the property under study have been included in Appendix A to Part I for the information of the student of this report, and it should be possible for him to identify from the information given the various fundamental elements of the problem, regardless of the names by which they may be called on his own property. In this way the needs of those properties which have had little or no experience with systematic traffic checking and schedule preparation can be met, without getting off into the "by-ways" of attempting to isolate the "one best" procedure, or trying to produce a standardized nomenclature for the industry. The complementary and modifying material planned for Parts II and III of this project, coupled with the "rugged individualism" characteristic of the transit industry, will afford sufficient insurance against this sample procedure being interpreted to be "the best", "a model", "a standard", or "an ATA approved" procedure.

At this point a brief description of the company whose method is to be used as the "sample" in this study will be given.

The sample company has asked that it be allowed to remain unnamed. This request will be observed, but not without regret, as this procedure prevents giving proper credit to the company and to the individuals associated with it who were responsible for furnishing most of the material upon which this part of the report is based. Much of the material was taken from a former lecture course on schedule-making procedure which was taught to the company's schedule department employees, transportation supervisors and vehicle operators some few years ago. Large portions of the information have been taken verbatim from the company's manuals and lecture notes.

The company in question serves a population of 500,000 people. Its operation includes street cars, trolley coaches and motor buses:

	Number of Routes	Round Trip Route Mileage	Maximum Weekday Scheduled Vehicles
Street Car	10	92.388	232
Trolley Coach	1	5.352	5
Motor Bus	24	152.082	267
TOTAL	35	249.822	504

In the year 1946 this system handled 153,320,000 revenue passengers and 248,090,000 total passengers including transfer riders. In this same year 21,317,000 vehicle miles and 2,123,000 vehicle hours were operated, with a platofrm labor cost of $3,477,819. These figures give some idea as to the general characteristics and magnitude of the sample transit operation.

During the year 1946 a total of 554 separate schedules was built. These schedules are classified as follows:

Winter schedules	403	
Summer schedules	42	
Special schedules	34	
Total schedules	479	(actually placed in effect)
Try-out schedules 1/	75	(for special studies)
Total schedules	554	(actually constructed)

In addition to the above, 575 minor schedule changes were made during the year.

In the sample company the Superintendent of Schedules reports to the General Superintendent of the Transit Department. This places him on a par with the Superintendent of Transportation, who also reports to the General Superintendent. This gives the Schedule Department a positive, independent control over expenditures for platform labor in a manner which is free from any dominance by, although it is cooperative with, the Transportation Department.

There are 17 employees in the schedule department of this company, 3 of whom are employed as load and riding checkers, the remainder being employed in the schedule department office. In addition to the above, the schedule department makes use of as many as 6 extra checkers, drawn from the ranks of the platform personnel, in the conduct of its normal program of systematic load and running time checks.

1/ A "try-out" schedule, on the sample property under study, means a schedule for some currently non-existent situation, such as a projected future route or projected future size and type of vehicle, which has been constructed with all the care and attention given the preparation of an "actual" schedule, including the most economical run-cut possible under the existing (or a contemplated future) labor contract.

The classification of schedule department personnel and the numbers of employees in each classification are given below:

Superintendent	1
Chief Schedule Maker	1
Schedule Makers	6
Schedule Typists	2
Schedule Clerks	3
Stenographer	1
Regular Checkers	3

The organization of the schedule department of the sample company is depicted in Figure 1. This chart includes (in dotted lines) the planning unit of the department, which comes under the supervision of the Superintendent of Schedules and Planning, but which does not enter directly into the routine schedule-making functions of the department. The total cost of the traffic checking and schedule preparation function as performed in the calendar year 1946 by this department was approximately $67,000, excluding Superintendance.

A brief general outline of the procedures used in the preparation of schedules on this property is shown in the Schedule Development Chart, Figure 2. This chart shows the elements of the schedule-making process, as well as the "flow" of steps in the procedure for the sample company. A description of each of these elements will be given in succeeding sections of the report.

F. Basic Control Data

At this point the box marked "revenue trend charts" will be discussed in some detail. The company whose methods are being described herein is a firm believer in having the schedule department fully informed as to significant trends. Some of the background information covers a period of twenty years in the past, and is maintained in the form of tables. The most essential portions of this background material are carried in chart form, and one employee of the department is charged with the responsibility of keeping these charts up to date at all times.

There will be listed below for the benefit of the student who is interested in background control data the types of information maintained by the company as control data in its schedule-making process.

The following information is available in tabular form by years for each of the lines of the system:

Vehicle miles
Vehicle hours
Passenger revenue
Revenue passengers
Transfer passengers
Total passengers
Revenue per vehicle mile
Revenue per vehicle hour

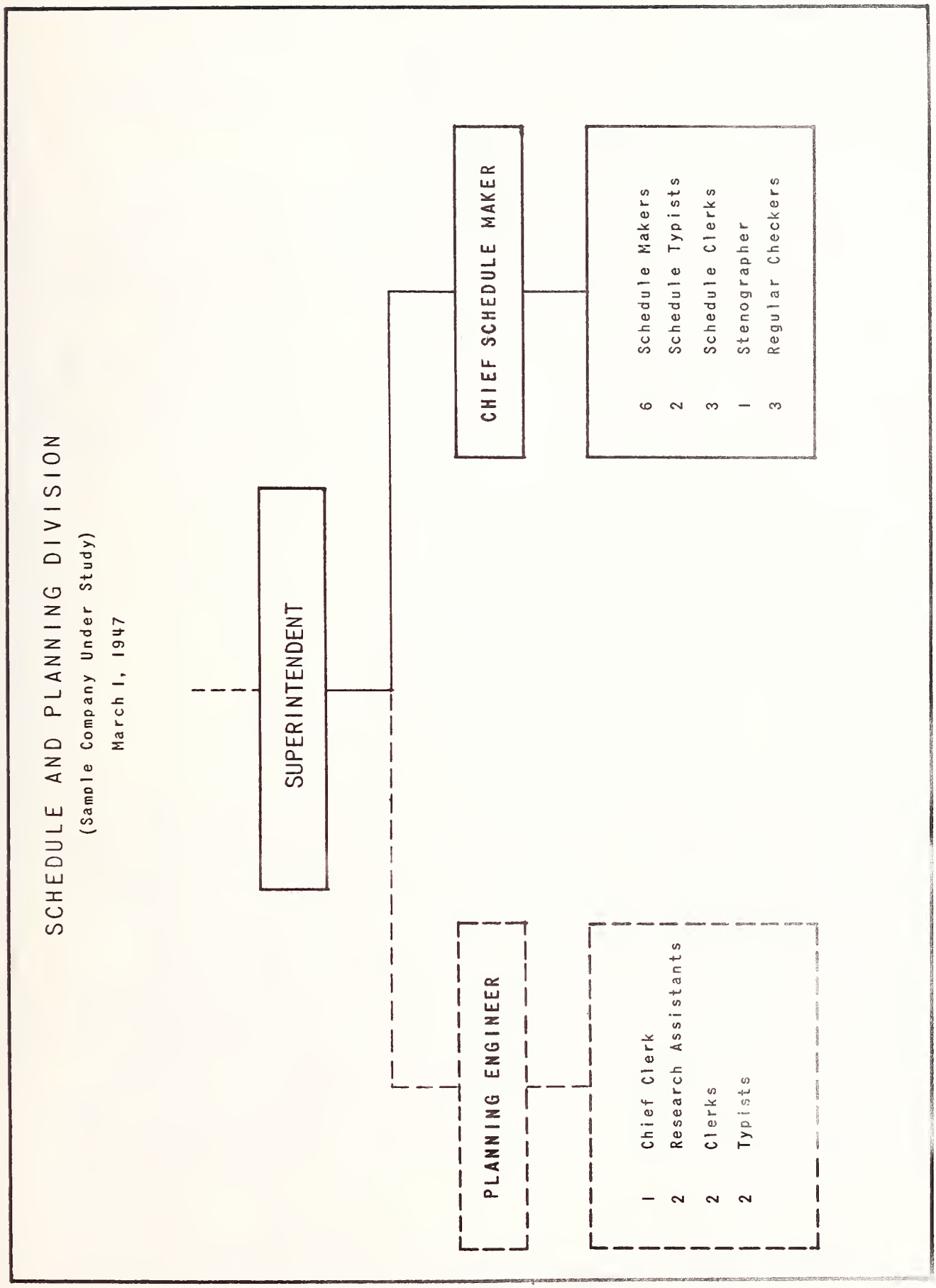


FIGURE 1.
ORGANIZATION CHART OF THE SCHEDULE DEPARTMENT —
SAMPLE COMPANY UNDER STUDY.

Passengers per vehicle mile
Passengers per vehicle hour
Revenue per passenger
Ratio of transfer passengers to revenue passengers
Speed in miles per hour
Number of units operated

In addition to these primary statistics, there are available tabulations of the foregoing data by lines for each year, with the lines arranged in the decreasing order of the magnitude of the figures. In this latter set of tabulations the figures for street car lines are shown in black and the figures for the rubber-tired vehicle lines are shown in red, as the lines are listed in order of magnitude regardless of type of vehicle.

The following data, which are considered most essential as control data by the schedule department, are on charts. There is in each case a chart for the entire system, one for the total of the street car lines, one for the total of the trolley coach lines, and one for the total of the motor bus lines. In addition to these total and "sub-total" charts, there are separate charts for each individual line. The charted information consists of the following:

Vehicle miles
Vehicle hours
Passenger revenue
Total passengers
Revenue per vehicle miles
Revenue per vehicle hour
Total passengers per vehicle mile
Total passengers per vehicle hour
Platform labor cost per vehicle mile
Platform labor cost per vehicle hour

Because of the importance placed upon charted information of this type by the sample company, an illustration is included at this point. Figure 3 shows the daily comparative statement of passenger revenue by lines for the entire system. This statement affords a comparison with the same day (not date) of a year ago with reference to passenger revenue, revenue passengers, transfer passengers, revenue miles, revenue hours, speed and revenue or "earnings" per car hour. This statement is prepared by the Railway Earnings Department of the sample company and distributed to executives and interested departments on the day immediately following each day's business. Figure 4 shows a tabular sheet used for summarizing in the Schedule Department the information taken from the daily comparative statement. The particular sample shown is the "weekday" sheet (Monday to Friday, inclusive) for the sample bus line which will be considered in this report. The daily figures of passenger revenue, car hours, and revenue per car hour are entered on the sheet, and averages are computed for each "weekday" group of 5 days each. These weekly averages are charted regularly on a form like that shown in Figure 5.

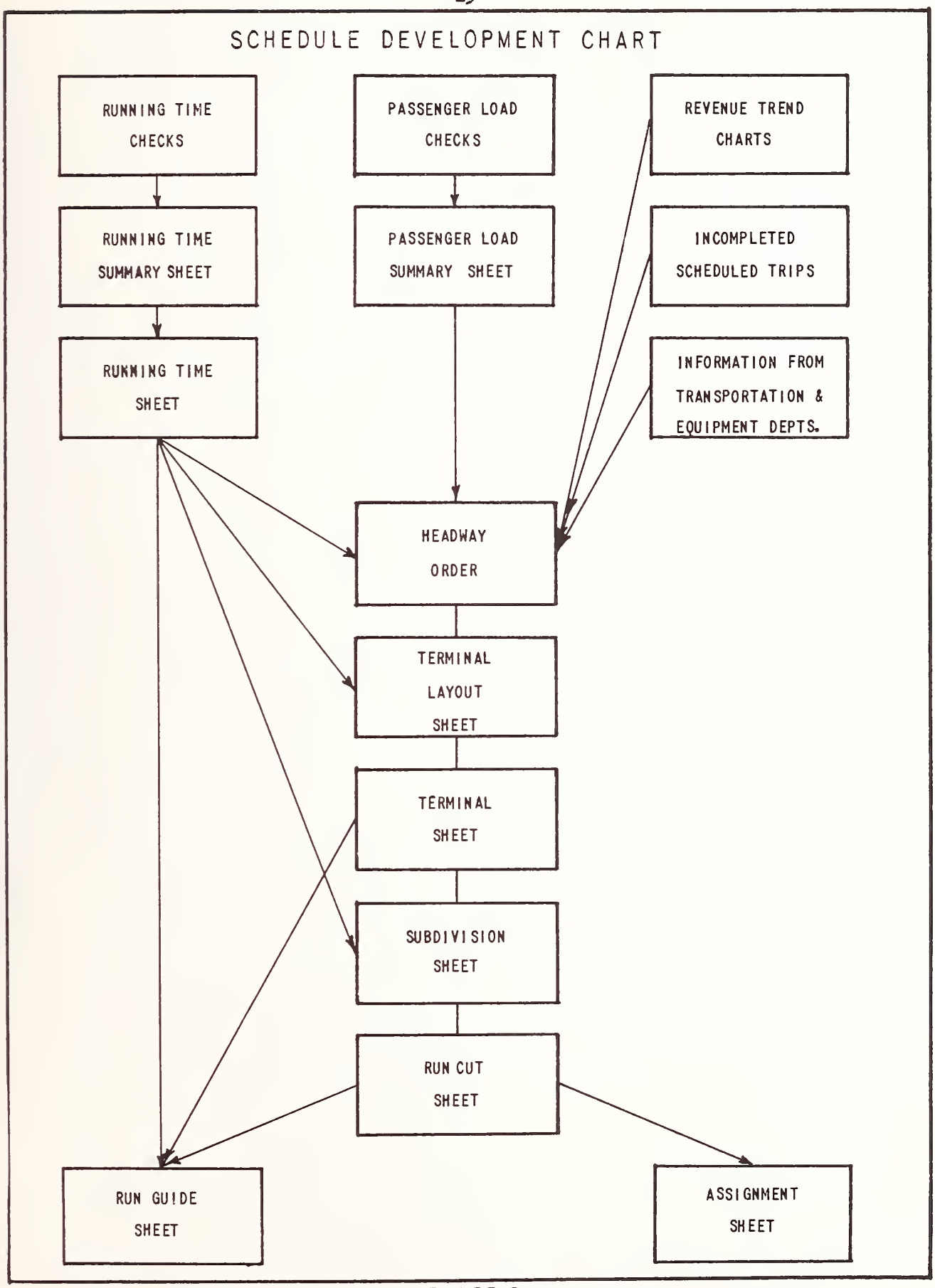


FIGURE 2.
SCHEDULE DEVELOPMENT CHART –
SAMPLE COMPANY UNDER STUDY

This chart shows a comparison for the current year with the year before as to revenue, hours and revenue per hour. The consistent increases in revenue and revenue per hour during the spring of 1946 over the corresponding values for 1945, together with the corresponding passenger load checks, pointed up the needed schedule change which is the subject of discussion at a later stage in this report. The effect of the schedule change is increasing the amount of service on the street as measured by vehicle hours is reflected in the "hours" curve.

Special charts are also maintained in the schedule department which show the numbers of passengers entering and leaving the central business district by 15-minute periods on the individual lines. Other charts of this type compare the current year against the previous year for a full day's business, including the base and night periods. These charts enable the schedule department to follow the trend of the peak-base riding ratio.

The department also maintains a series of bar charts showing passenger revenue by lines and for the system by months. These are valuable trends in their use as guides to schedule changes. Vehicle hours and revenue per vehicle hour are similarly charted for the guidance of the Superintendent of Schedules.

A chart is also maintained which shows the daily average passenger revenue by years plotted as a line for each year according to the names of the days of the week. In other words, the vertical scale on this chart is in Dollars of Passenger Revenue and the horizontal scale consists of the names of the days of the week evenly spaced, beginning with Monday and ending with Sunday. A line is plotted on the chart for each year showing the average daily passenger revenue for Monday, Tuesday, Wednesday, etc. A companion chart (Figure 6) is available which shows the daily average passenger revenue by weekdays for each day of the week over a period of years. In this case the vertical scale of the chart is in Dollars of Passenger Revenue, while the horizontal scale consists of a series of years. A line is plotted on the chart for each day of the week by name showing the average daily passenger revenue for that day in each year. A third chart in this series shows the different days of the week evaluated as index figures, using the average of "Monday through Friday" as 100. A fourth chart is identical with the third one except that Saturday is included in a "Monday through Saturday" combination in determining the base average to be used as 100.

This detail has been given as a guide to the student who wishes to set up schedule control statistics, as well as to show the extent to which the sample company goes in keeping its schedule makers fully informed as to the behavior of transit riding on its individual routes.

Form 748-0488—4-45—2M

DAILY COMPARATIVE STATEMENT OF PASSENGER REVENUE

COMPARING Wednesday, April 3, 1946

WITH " " 4, 1945

WEATHER	1946	1945
	Clear	Showers PM

TEMPERATURE 1946 72° 1945 72°

LINES	REVENUE		PASSENGERS			REVENUE MILES		REVENUE HOURS		SPEED	M.P.H.	EARNINGS PER CAR HOUR	
	Current Year	Previous Year	Cash	Transfer	Free	Current Year	Previous Year	Current Year	Previous Year	Current Year	Previous Year	Current Year	Previous Year
Street Cars													
Cemeteries	147756	133308	21108	15811		18124	17975	2236	2197	8.10	8.18	661	607
West End	133364	131626	19052	11909		24491	25088	2390	2418	10.25	10.38	558	544
Desire	91644	86849	13092	6085		13341	13879	1454	1489	9.18	9.32	630	583
Freret	180618	167457	25814	10781		24337	24198	2690	2647	9.13	9.26	677	633
Gentilly	110901	105885	15843	7626		19910	20467	2086	2157	9.55	9.49	532	491
Jackson	142435	127827	20605	13725		14112	13440	1812	1729	7.79	7.78	796	739
Magazine	263067	243579	37581	14473		36500	36791	3642	3623	10.02	10.16	722	672
Napoleon	37395	34825	4905	4721		5571	5577	698	698	7.98	7.98	492	499
St. Charles	281596	244594	40228	19757		40482	38832	4024	3834	10.06	10.13	700	638
St. Claude	237510	219254	33930	16270		29823	39342	3895	3857	10.22	10.20	610	569
S. Claiborne	175280	163681	25040	12606		25262	25472	2711	2718	9.32	9.37	676	602
Tulane	330337	300720	47191	21925		44641	43691	4829	4635	9.24	9.41	684	649
Miscellaneous													
Chartered													
Total Cars	2130724	1954608	304289	155089		306631	304992	32447	32002	9.45	9.53	657	666
Trolley Coaches													
Broadway	35973	33194	5139	5560		8356	8356	824	824	10.14	10.14	437	403
T'l Trolley Coaches	35973	33194	5139	5560		8356	8356	824	824	10.14	10.14	437	403
Busses													
Bomber Base	17619	30492	2517	2722		10264	15333	726	1007	14.14	15.22	243	303
Canal Blvd.	15498	12236	2214	2306		6105	5550	512	433	11.92	12.82	303	283
Carrollton	4753	3633	679	667		1852	1852	186	185	9.96	10.01	256	196
City Park	95249	87598	13607	5330		15619	15507	1628	1622	9.59	9.56	585	540
Esplanade	96705	87941	13815	6596		16877	16309	1714	1670	9.85	9.77	564	527
Frenchmen	95592	89782	13656	10862		22268	20347	2074	1894	10.74	10.75	461	474
Galvez	79282	76391	11326	7773		18995	18471	1968	1893	9.66	9.70	403	403
Gentilly-Broad	131327	122605	18761	25185		43146	46799	4053	4326	10.65	10.82	324	283
Laurel	67963	64082	9709	6779		14062	14147	1381	1377	10.18	10.28	492	471
Leonidas	39494	37037	5642	4783		10837	10275	1083	1014	10.01	10.14	365	365
Louisiana	131663	115703	18809	21036		32710	33847	3152	3219	10.38	10.52	418	360
Metairie	48797	46102	6971	6573		22159	24819	1692	1894	13.09	13.12	288	244
Nashville	28504	24710	4072	4118		9207	8743	848	813	10.86	10.73	336	304
Orleans Parkway	37436	34698	5347	2932		10857	10903	799	740	13.70	13.92	472	468
Pontch. Beach	14924	12726	2132	2001		5379	3390	454	275	11.85	12.33	329	463
Robt. E. Lee	23117	18778	3331	4084		2908	2862	206	206	14.12	13.90	113	118
Route No. 90	23870	17325	3410	3122		9758	5196	718	480	13.58	10.83	332	361
St. Bernard	118594	107401	16942	8770		20676	19454	2152	2005	9.61	9.70	551	536
St. Claude	11620	9919	1660	2271		2931	3017	285	287	10.29	10.59	408	348
Shipyard	364	4291	52	104		419	1566	47	189	8.92	8.56	78	235
S. Claiborne	3939	3339	477	603		1607	1607	207	207	7.76	7.76	161	161
Lee Circle	2895	—	405	354		1549	—	192	—	8.07		148	
Miscellaneous													
Chartered													
Total Busses	1262745	992609	150221	124695		280181	279211	26071	25741	10.75	10.86	410	386 C.P.M.
GRAND TOTAL	3232442	2982411	459759	285374		595168	592652	59342	58552	10.03	10.12	545	510 .543

Tr. R. 62170

REVENUE MONTH TO DATE 1946- 9857425 REMARKS 1946 None

REVENUE MONTH TO DATE 1945- 8347475 REMARKS 1945 None

FIGURE 3.

DAILY COMPARATIVE STATEMENT OF PASSENGER REVENUE—
SAMPLE COMPANY UNDER STUDY.

CITY PARK BUS LINE

MONDAY TO FRIDAY INCLUSIVE 1946

FORM 742-0400 7-41 1M

APRIL						MAY						JUNE					
Date	Revenue	Total Passengers	Car Hours	Pass. P. C. H.	Rev. P. C. H.	Date	Revenue	Total Passengers	Car Hours	Pass. P. C. H.	Rev. P. C. H.	Date	Revenue	Total Passengers	Car Hours	Pass. P. C. H.	Rev. P. C. H.
Mon. 1	1016		171		5.93	Mon. 6	991		171		5.78	Mon. 3	1019		175		5.82
Tues. 2	967		163		5.94	Tues. 7	936		163		5.75	Tues. 4	990		167		5.94
Wed. 3	952		163		5.85	Wed. 8	947		163		5.82	Wed. 5	968		167		5.80
Thu. 4	939		163		5.77	Thu. 9	938		163		5.75	Thu. 6	954		167		5.72
Fri. 5	996		171		5.81	Fri. 10	945		163		5.80	Fri. 7	940		167		5.64
Total	4870		831		5.87	Total	4757		823		5.76	Total	4871		843		5.76
Aver-age	974		166		5.87	Aver-age	951		165		5.76	Aver-age	974		169		5.76
Mon. 8	1011		171		5.90	Mon. 13	888		171		5.18	Mon. 10	1010		175		5.77
Tues. 9	959		163		5.89	Tues. 14	911		163		5.60	Tues. 11	958		167		5.75
Wed 10	960		163		5.89	Wed. 15	831		163		5.10	Wed. 12	969		167		5.81
Thu 11	919		163		5.64	Thu 16	940		163		5.77	Thu 13	931		167		5.58
Fri 12	982		163		6.03	Fri. 17	943		163		5.79	Fri 14	934		167		5.60
Total	4831		823		5.85	Total	4513		823		5.47	Total	4802		843		5.68
Aver-age	966		165		5.85	Aver-age	903		165		5.47	Aver-age	960		169		5.68
Mon. 15	1036		171		6.05	Mon. 20	957		171		5.59	Mon. 17	974		175		5.56
Tues. 16	935		163		5.74	Tues 21	939		163		5.77	Tues. 18	932		167		5.59
Wed. 17	977		163		6.00	Wed. 22	944		163		5.80	Wed. 19	961		199		4.84
Thu 18	1005		163		6.17	Thu. 23	923		163		5.67	Thu. 20	864		167		5.18
Fri. 19	868*		163*		5.33*	Fri. 24	934		163		5.74	Fri. 21	933		167		5.60
Total	3933		660		5.99	Total	4697		823		5.69	Total	4664		875		5.33
Aver-age	988		165		5.99	Aver-age	939		165		5.69	Aver-age	933		175		5.33
Mon. 22	972		171		5.67	Mon 27	1009		175		5.76	Mon. 24	962		175		5.50
Tues. 23	846		163		5.20	Tues. 28	977		167		5.86	Tues. 25	879		167		5.27
Wed. 24	897		163		5.51	Wed. 29	963		167		5.78	Wed. 26	904		167		5.42
Thu. 25	892		163		5.48	Thu 30	982		167		5.89	Thu. 27	850		167		5.10
Fri. 26	934		163		5.73	Fri. 31	960		167		5.77	Fri. 28	899		167		5.40
Total	4441		823		5.39	Total	4891		843		5.83	Total	4494		843		5.32
Aver-age	888		165		5.38	Aver-age	978		168		5.83	Aver-age	899		169		5.32
Mon 29	969		171		5.66	Mon.						Mon.					
Tues. 30	853		163		5.24	Tues.						Tues.					
Wed 1	968		163		5.94	Wed.						Wed					
Thu. 2	938		163		5.76	Thu.						Thu.					
Fri. 3	1032		163		6.34	Fri.						Fri.					
Total	4760		823		5.77	Total						Total					
Aver-age	952		165		5.77	Aver-age						Aver-age					
*Good Friday, not included in average																	
Total						Total						Total					
Aver-age						Aver-age						Aver-age					

FIGURE 4.

SUMMARY OF DATA FROM DAILY COMPARATIVE STATEMENT—
SAMPLE COMPANY UNDER STUDY.

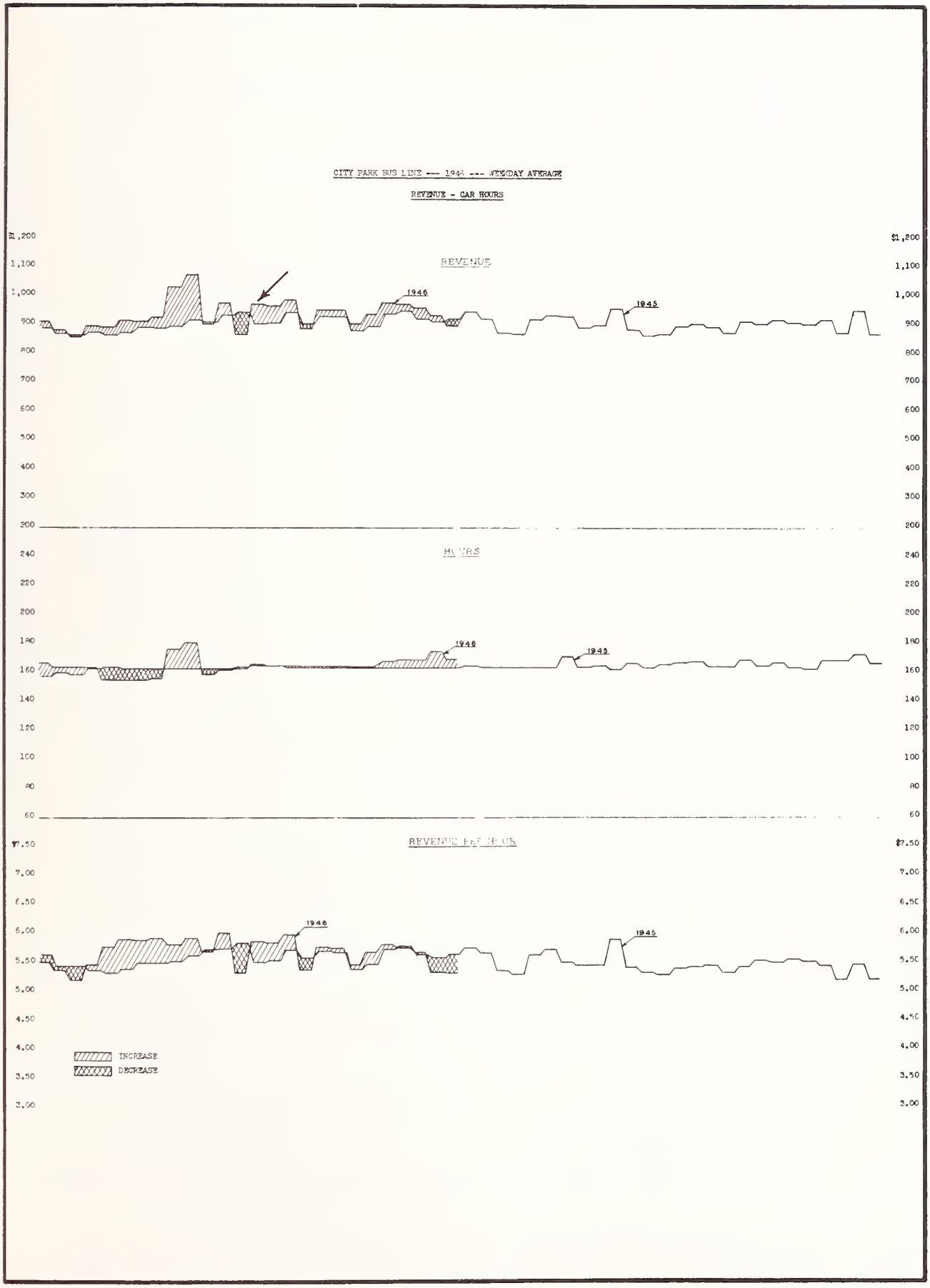


FIGURE 5.
TYPICAL LINE CHART OF CONTROL DATA -
SAMPLE COMPANY UNDER STUDY.

G. Preliminary Considerations

Before an attempt is made to construct a schedule for a transit line, the schedule maker should have certain basic and fundamental facts at his disposal. These facts include the following:

1. A knowledge of the nature of the territory served, including the riding habits of transit patrons on the line.

2. The route mileage of the line, together with the individual distances between selected time points.

3. Types and sizes of vehicles available.

4. Type and size of vehicle best suited to the particular route,

5. Seating capacity of the vehicle to be used.

6. Standing capacity of the vehicle to be used.

7. Ability of the vehicle to be used in service over short or long hours of service.

8. Loading standards to be employed during peak and off-peak periods. Consideration should be given to special local problems which may affect loading standards.

9. The total numbers of patrons to be handled during peak and off-peak hours, together with their distribution by 15-minute or 30-minute periods, depending upon the size of line and time of day.

10. The speeds at which vehicles may be operated during the peak and off-peak periods.

11. The running time required between line terminals during different periods of the day.

12. Flexibility of the line from the standpoint of being able to meet minor changes in running time from trip to trip.

13. The "headway adjustment time" required at line terminals.

14. The total round trip time required during the various periods of the day.

A considerable portion of Part I of this report will be devoted to a discussion of methods for obtaining the basic facts listed above.

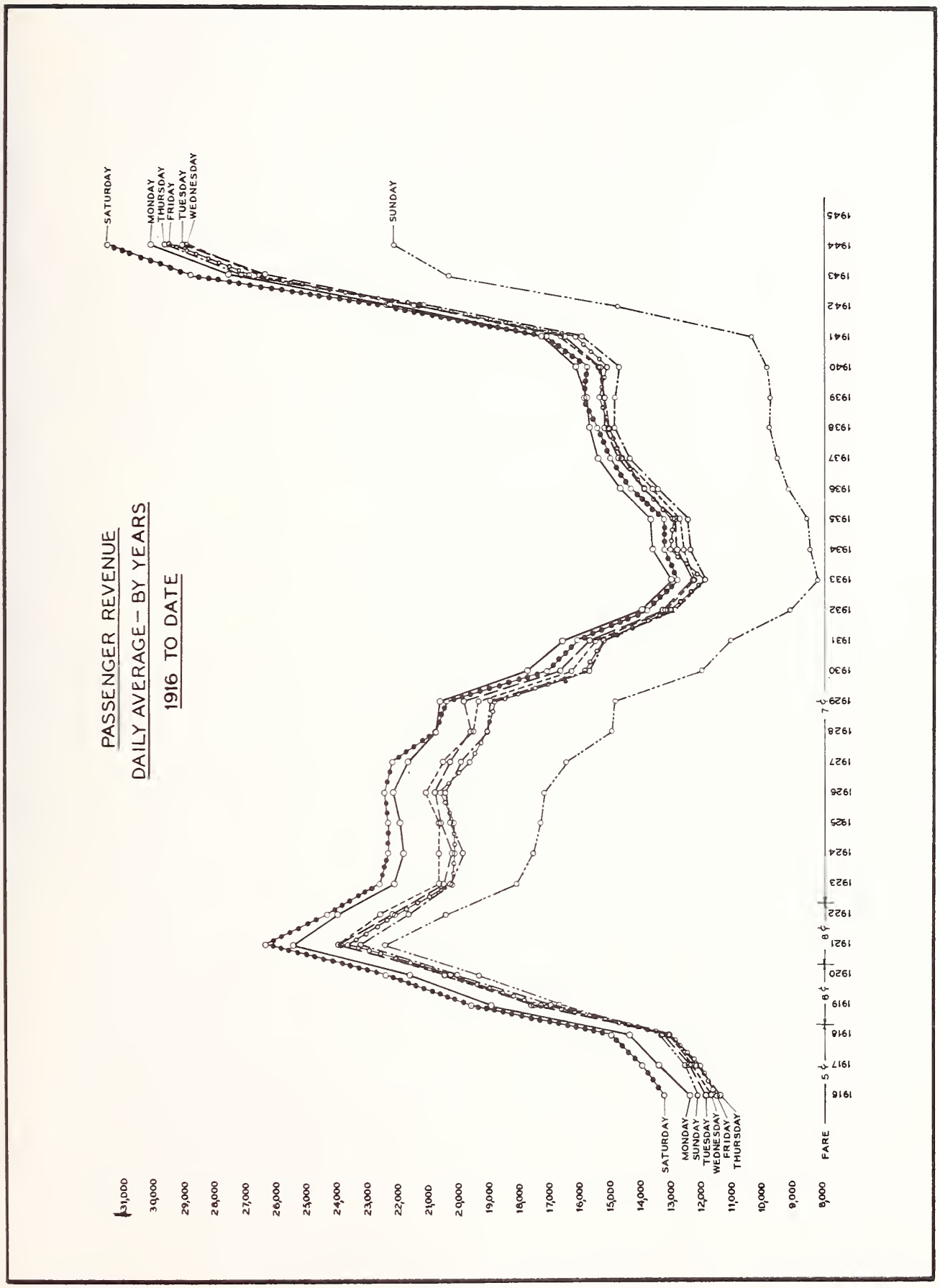


FIGURE 6.
CHART SHOWING RELATIVE IMPORTANCE
OF THE VARIOUS DAYS OF THE WEEK-
SAMPLE COMPANY UNDER STUDY.

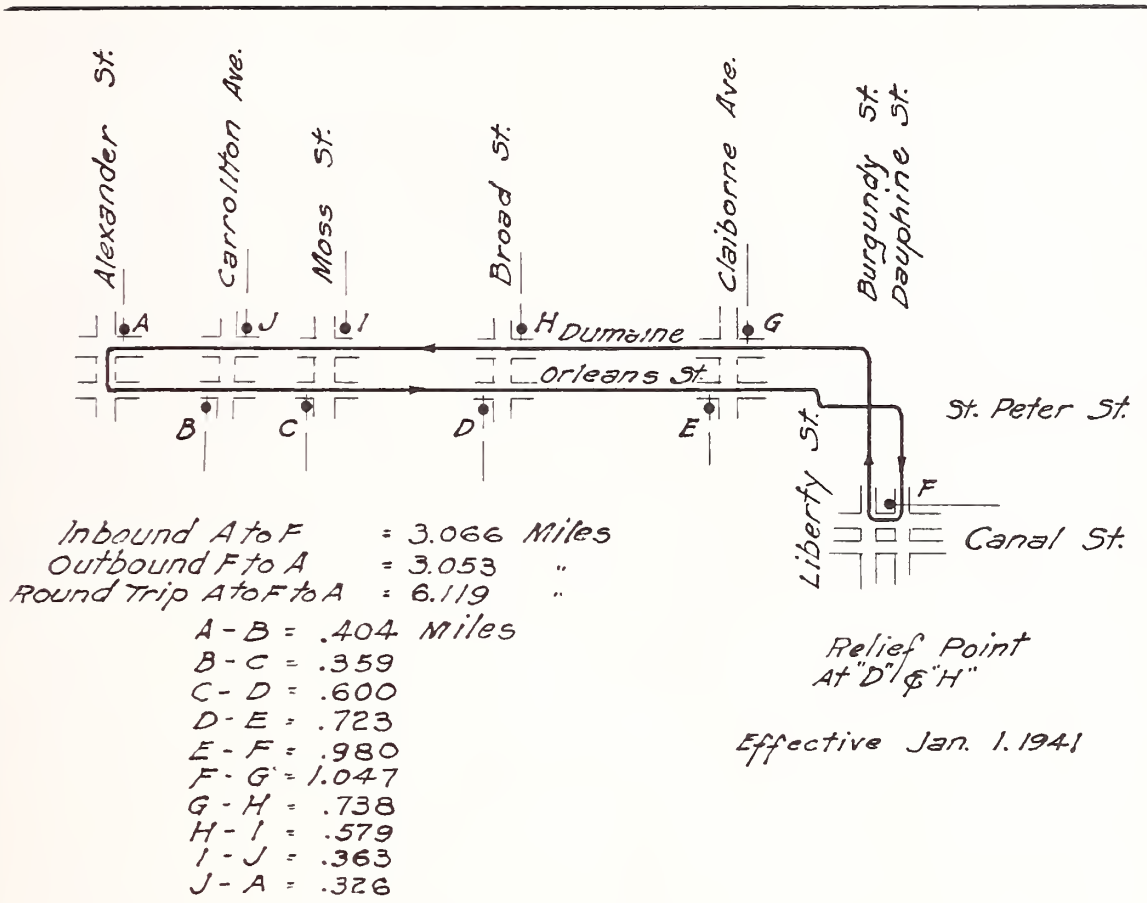
Figure 7 is a sample of the type of route map used by the company whose procedures are under study. This map shows the general layout of the route together with inbound, outbound, and total round trip distances, and the distances between time points. These distances are important in computing the operating speeds which are characteristic of the given line and the size and type of vehicle used thereon. The lower half of the figure shows the routes utilized in moving buses to and from the line in question, together with the distances associated with such movements into and out of the bus garage.

Various methods are employed in the determination of route mileage and the distances between time points. In the case of its street car lines, the company obtains the distance measurements necessary for the preparation of route maps from the alignment drawings of the track and roadway structure. In the case of trolley coach and motor bus lines a surveyor may be employed to determine distances through the use of the tools of his profession. An automobile with an accurate speedometer may be utilized to obtain approximate information as to route mileages and the distances between time points. Special devices are available for measuring distances with considerable accuracy. These are utilized in conjunction with the operation of an automobile over the predetermined route.

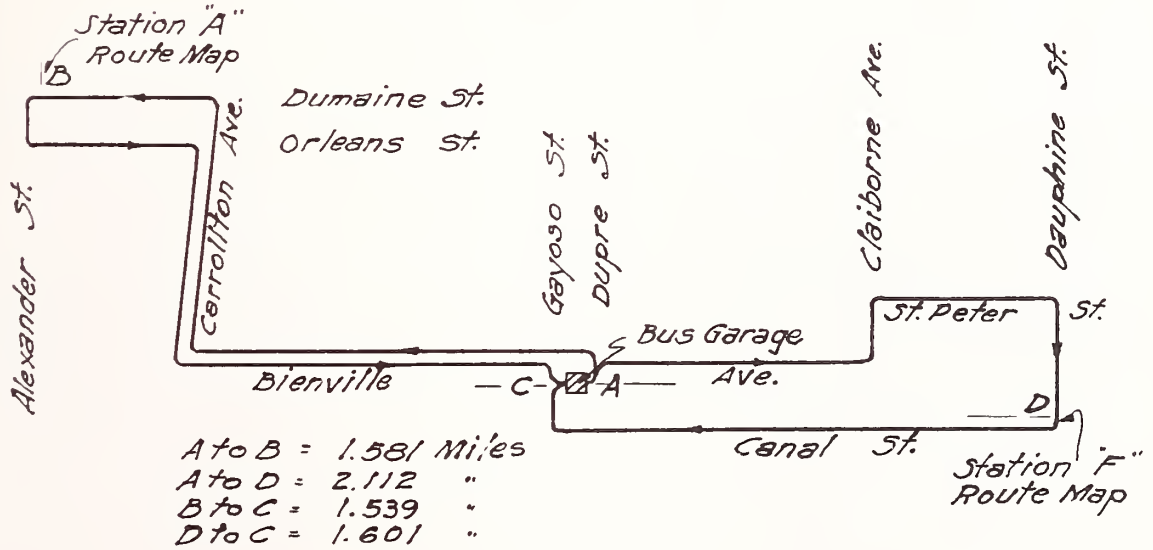
Figure 8 is a picture of the equipment used by the sample property in obtaining distance data and preparing its route maps for motor bus and trolley coach lines. This device and its operation are briefly described as follows:

The equipment includes a "Footometer", coil-spring, wheel carrier, running-board bracket, door bracket, drive cable, and Fifth Wheel and arm. It can be attached to any car in a few minutes without the aid of a mechanic, and may be easily transferred, without alteration, from one car to another. Accuracy is obtained by using a standard bicycle balloon tire, size 24 x 2.125, at practically no air pressure, which prevents bouncing of the wheel and eliminates the effect of tire pressure variation. A coil spring from the wheel hub to the running board bracket, acting like a shock-absorber, holds the wheel to the road. Accuracy can be maintained by increasing the pressure slightly when the wear of the tire, after long usage, reduces its size. The amount of air pressure is adjusted in accordance with test runs over a known distance.

The Footometer is mounted on the door bracket at eye level, and just outside of the window. It can be re-set to ZERO instantly, and has a de-clutching device which permits it to be engaged or disengaged instantly, without stopping the car. To engage the Footometer, Button "A" is pulled outward. To disengage it, Button "B" is pulled outward. When Button "B" has been pulled outward, it can be turned in either direction to set the pointer to the ZERO position on the dial. When the pointer is at the top of the dial, the odometer can be set to ZERO instantly by pressing inward gently on Button "A". A complete revolution of the pointer around the dial indicates the measurement of 100 feet. The odometer, which is similar to the mileage counter in a speedometer, tallies the number of "hundred feet" measured. The capacity of the Footometer is 100,000 feet. At this point, it would be automatically reset to zero.



CITY PARK BUS LINE
REGULAR ROUTE



CITY PARK BUS LINE
OUT & IN STATION

FIGURE 7.
TYPICAL ROUTE MAP -
SAMPLE COMPANY UNDER STUDY.

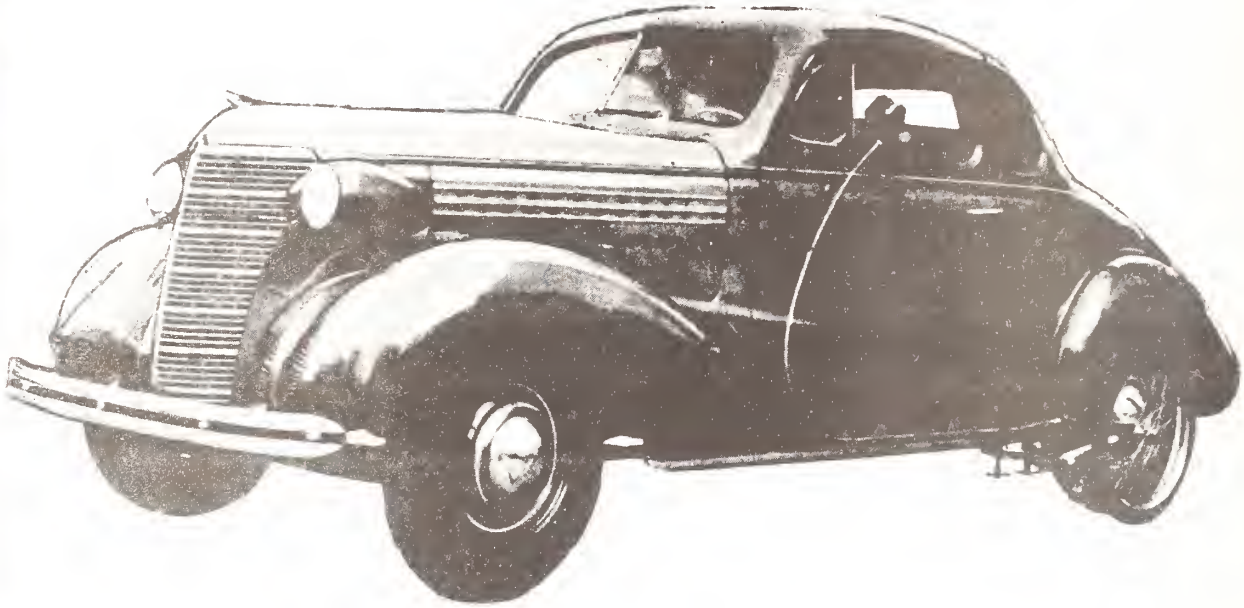


FIGURE 8.
THE "SURVEY FOOTOMETER", DEVICE FOR MEASURING ROUTE DISTANCES — SAMPLE COMPANY UNDER STUDY.

CHAPTER II

PASSENGER LOAD DATA

The following discussion of a method for obtaining and summarizing passenger load data is based upon the procedures used by the sample transit company. Reference to Parts II and III of this project will furnish the student of the report with an insight into other methods of load checking and differing managerial viewpoints with respect to this phase of the schedule-making procedure. Several alternative methods for performing this check are also given in the "Manual of Transit and Traffic Studies" recently issued by the American Transit Association.

A. Importance of Passenger Load Data

Too much emphasis cannot be placed on the need for adequate and properly obtained passenger load data as the fundamental starting point for the process of schedule-making. The schedule maker must have at his disposal up-to-date information concerning the numbers of persons who wish to ride the transit lines at various periods of the day. It has become the general practice of the industry therefore, to regularly check the lines of the system in order to determine the volume of business which must be handled. Such checks are commonly referred to as the "load" check or "point" check. The passenger load check consists essentially of a method for obtaining the numbers of passengers per given time period which pass a certain point on the route known as the "maximum load point".

B. Maximum Load Point

It is, of course, helpful to the schedule maker to know as much as he can about the riding characteristics of the line for which he is about to prepare a schedule. One method for determining the riding characteristics of a line is to take an "on and off" passenger riding check at wide intervals. Such a check consists in recording at each street intersection the numbers of passengers boarding and alighting from each vehicle as it traverses the route from one end to the other. This information enables the load on any one vehicle, and, therefore, the summation of the loads on all vehicles on the line, to be determined by accumulating the differences between the number of passengers boarding and the number of passengers alighting at each intersection. Several methods for conducting passenger "on and off" riding checks are given in the "Manual of Transit and Traffic Studies" previously referred to.

The process of computing the load on the vehicle at each intersection reveals for each vehicle and, therefore, for the average of the line, that point along the route at which the maximum load on vehicles tends to accumulate. This point is known as the "maximum load point". It is significant because it is the control point for making observations as to the volume of business, and its time distribution, which must be handled by a given schedule - either present or proposed.

Having determined the maximum load point for the route, passenger load data are observed and recorded at the location on a routine, systematic basis.

C. Information Required

The information obtained from a passenger load check consists of the following:

Name of the line.
Location at which observations were made.
Direction of travel.

Number of the vehicle.
Time of arrival at maximum load point.
Headway interval between a vehicle and the preceding one.
Number of passengers or "load" on the vehicle.
Train number, run number or other schedule designation.

The day of the week, date, weather conditions and name of the observer are included, together with any special comments, such as the rail condition as affected by rain, etc. on street car lines. If the observer is forced by adverse weather conditions or other good cause to move some little distance away from the regularly designated point of observation, this fact should be noted on the data sheet also.

D. Checking Form

The passenger load checking form used by the company whose methods are under study is shown in Figure 9. This form is filled in with actually observed load data for the line which will be used as the sample throughout the remainder of the study.

E. Detail of Procedure

Perhaps the best method of explaining the detail of passenger load checking procedure would be to include below the general instructions issued to load checkers in the schedule department. These instructions, substantially as they are given to the checkers, are as follows:

GENERAL INSTRUCTIONS TO
LOAD CHECKERS OF THE
SCHEDULE DEPARTMENT

General Duties

The principal duty of a load checker consists of checking the numbers of passengers on street cars, trolley coaches and motor buses as they pass the maximum load point of a line. The following data are ordinarily obtained by the checker:

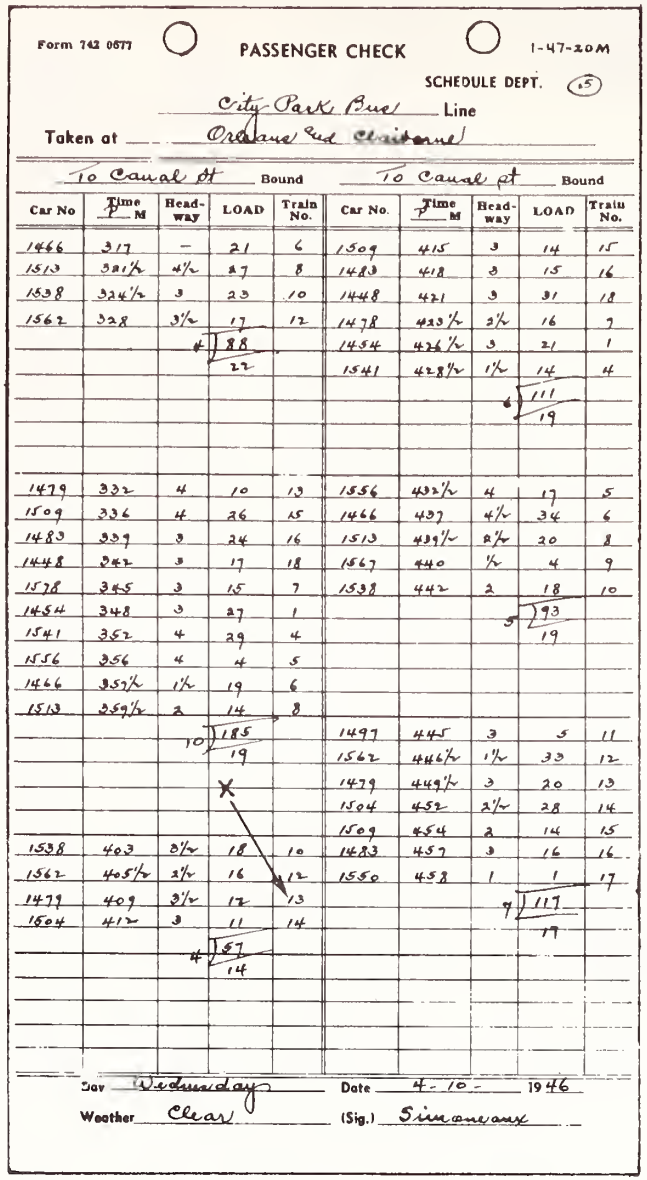
1. Vehicle number.
2. Train number.
3. Arriving time.
4. Maximum load per vehicle.
5. Weather and rail conditions.

From the data obtained, the checker calculates the actual headway that is being maintained, separates the data into proper checking periods, and totals and averages the passenger load within each period. The use of an accurate and suitable watch and the accurate counting of passengers are required of every checker.

Checking Record

A properly filled-out record form has been reproduced in Figure 9.

An experienced load checker usually records first the vehicle number and the train number of the approaching vehicle. He also endeavors to write down the arriving time of the vehicle just before it reaches him, allowing a few seconds



Form 742 0677 PASSENGER CHECK 1-47-20M

SCHEDULE DEPT. (15)

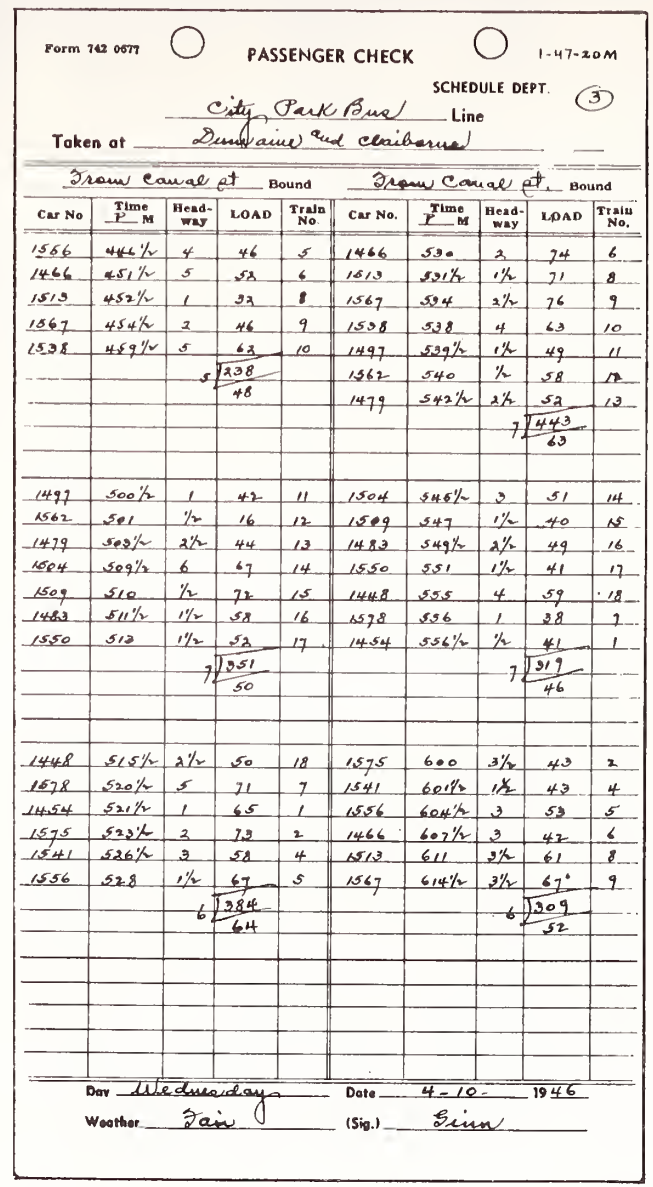
City Park Bus Line

Taken at Orleans and Claiborne

To Canal St Bound					To Canal St Bound				
Car No	Time P M	Headway	LOAD	Train No.	Car No.	Time P M	Headway	LOAD	Train No.
1466	317	–	21	6	1509	415	3	14	15
1513	321½	4½	27	8	1483	418	3	15	16
1538	324½	3	23	10	1448	421	3	31	18
1562	328	3½	17	12	1478	423½	2½	16	7
			4 88		1454	426½	3	21	1
			22		1541	428½	1½	14	4
								6 111	
								19	
1479	332	4	10	13	1556	432½	4	17	5
1509	336	4	26	15	1466	437	4½	34	6
1483	339	3	24	16	1513	439½	2½	20	8
1448	342	3	17	18	1567	440	½	4	9
1578	345	3	15	7	1538	442	2	18	10
1454	348	3	27	1				5 93	
1541	352	4	29	4				19	
1556	356	4	4	5					
1466	357½	1½	19	6					
1513	359½	2	14	8					
			10 185		1497	445	3	5	11
			19		1562	446½	1½	33	12
					1479	449½	3	20	13
					1504	452	2½	28	14
					1509	454	2	14	15
1538	403	3½	18	10	1483	457	3	16	16
1562	405½	2½	16	12	1550	458	1	1	17
1479	409	3½	12	13				7 117	
1504	412	3	11	14				17	
			4 57						
			14						

Day Wednesday Date 4-10- 1946

Weather Clear (Sig.) Simoneaux



Form 742 0677 PASSENGER CHECK 1-47-20M

SCHEDULE DEPT. (3)

City Park Bus Line

Taken at Dumaine and Claiborne

From Canal St Bound					From Canal St Bound				
Car No	Time P M	Headway	LOAD	Train No.	Car No.	Time P M	Headway	LOAD	Train No.
1566	446½	4	46	5	1466	530	3	74	6
1466	451½	5	52	6	1513	531½	1½	71	8
1513	452½	1	32	8	1567	534	2½	76	9
1567	454½	2	46	9	1538	538	4	63	10
1538	459½	5	62	10	1497	539½	1½	49	11
			5 238		1562	540	½	58	12
			48		1479	542½	2½	52	13
								7 443	
								63	
1497	500½	1	42	11	1504	546½	3	51	14
1562	501	½	16	12	1509	547	1½	40	15
1479	503½	2½	44	13	1483	549½	2½	49	16
1504	509½	6	67	14	1550	551	1½	41	17
1509	510	½	72	15	1448	555	4	59	18
1483	511½	1½	58	16	1578	556	1	38	7
1550	513	1½	52	17	1454	556½	½	41	1
			7 351					7 319	
			50					46	
1448	515½	2½	50	18	1575	600	3½	43	2
1578	520½	5	71	7	1541	601½	1½	43	4
1454	521½	1	65	1	1556	604½	3	53	5
1575	523½	2	73	2	1466	607½	3	42	6
1541	526½	3	58	4	1513	611	3½	61	8
1556	528	1½	67	5	1567	614½	3½	67	9
			6 384					6 309	
			64					52	

Day Wednesday Date 4-10- 1946

Weather Fair (Sig.) Linn

FIGURE 9.

PASSENGER LOAD CHECKING FORM – SAMPLE COMPANY UNDER STUDY.

for the vehicle to arrive at the checking point. In this way, only the passenger load remains to be counted when the vehicle arrives at the checking location. Under no circumstances should an operator be asked to "hold" the vehicle while the count is being made. After the vehicle has passed, the checker calculates the headway; and when the proper checking period has elapsed, he totals and averages the passenger loads (Figure 9).

Checkers should note on their checking record sheets all information of a special nature which has relation to the count being made. For example, steamed windows - making it difficult to observe loads, the nature of blockades - if known, re-routing of cars, watch failure, etc.

Checkers should number, date, and sign each sheet of the checking record. Upon completion of the record, it should be placed in an "Official Business" envelope, sealed and delivered to any operator on the line which is being checked. The operator will in turn deliver it to the station master for forwarding to the schedule department.

Passenger loads are totaled and averaged for 15-minute periods during peak hours, and for 30-minute periods during off-peak hours. These periods are not governed by the starting time of the check, but should begin on the quarter, half, or even-hour period. The following tabulation shows when the 15-minute or 30-minute periods are used:

Service	Time Duration	Checking Period (Minutes) Weekday	Saturday	Sunday
Early A.M.	5:00 A.M. - 6:00 A.M.	30	30	30
A.M. Peak	6:00 A.M. - 9:00 A.M.	15	15	30
Basic	9:00 A.M. - 4:00 P.M.	30	30	30
P.M. Peak	4:00 P.M. - 6:30 P.M.	15	15	30
Night	6:30 P.M. -12:00 M.	30	30	30

Vehicle Arriving Time

The time at which a vehicle arrives at a checking point should be determined accurately to the nearest half minute. To decide whether a vehicle arrives at a checking point on the even minute or half minute, consider all time as in even minutes if the second hand is between the 45 and 15 second marks, and as in half minutes if the second hand is between the 15 and 45 second marks. The drawings shown in Figure 10 illustrate how the above rule is used.

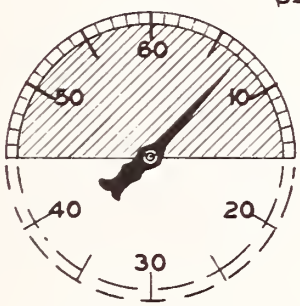
Load checkers are expected to provide themselves with accurate watches of the "railroad" type. The use of watches having less than 17 jewels, and the use of wrist watches of any type, is strictly prohibited.

Load checkers are required to set their watches before beginning each checking assignment. In order to do this, they must secure the correct time from the station out of which the line to be checked operates. Under no circumstances should time be secured from trainmen.

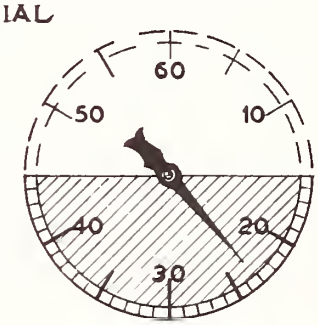
When the correct time is to be obtained over the telephone, the following procedure should be used:

1. Remove watch crystal.
2. Dial main office telephone number.
3. Hold watch or small piece of cardboard on the 60 second mark of the second dial.

SECOND HAND DIAL



EVEN MINUTE



HALF MINUTE

FIGURE 10.
DETERMINATION OF "EVEN MINUTE" AND "HALF MINUTE" FROM SECOND HAND DIAL — SAMPLE COMPANY UNDER STUDY.

4. Ask switchboard operator for proper station.
5. Give name to station and request correct time on the even minute.
6. Remove object holding second hand when time is called.
7. Set minute hand.

Counting Passenger Load

It should be thoroughly understood by all those who receive load checking assignments that the counting of passengers is required, and that estimating or guessing the probable passenger load in a vehicle will not be tolerated. It is realized that proper instructions, together with a certain amount of checking experience, is required in order to develop accurate and efficient checking methods; hence, all who wish to qualify as load checkers must be trained to check under the direct supervision of an experienced load checker designated by the head of the department.

The passenger load in a vehicle may be considered as one of the following general types:

1. Light seated load.
2. Heavy seated load.
3. Load in excess of seating capacity.

No. 1. Light Seated Load - This is the easiest type of load to count, the checker simply counting the number of passengers in the vehicle.

No. 2. Heavy Seated Load - This is the most difficult type of load to count. The opinion of experienced checkers is that it is advisable to count the number of vacant seats, subtract this amount from the vehicle's seating capacity, and add to this the number of standees, if any. (Note - A list of the seating capacities of various types and series of vehicles is furnished to the load checkers.)

No. 3. Load in Excess of Seating Capacity - There are several methods of counting this type of load. The preferable way is to count the standees, at the same time subtracting the few seats that might be vacant. To this amount add the seating capacity of the vehicle.

Checking Location

In order to secure an accurate passenger load count, it is obvious that the checker should place himself in the most advantageous position at the checking point to which he has been assigned. A number of drawings has been prepared showing the physical layout at each of the regular checking locations, and on each drawing the most advantageous positions for ordinary checking conditions are indicated. While these drawings indicate to the checker the proper side of the street from which he should check, they do not show specifically his position with reference to a stopped vehicle. It has been found from experience that he should station himself at a point opposite the front end of a vehicle when it has come to a stop. Assuming this position enables him to walk alongside of the vehicle, and should facilitate the accurate counting of passengers.

The above method of checking passenger loads applies to both "one-way" and "two-way" traffic. When checking "two-way" traffic, the checker should select that

checking location shown on the drawing which will facilitate the counting of loads on vehicles moving in the direction of heaviest travel. The vehicles moving in the opposite direction will have to be checked while they are in motion, but since they are usually lightly loaded, no difficulty should be experienced in counting these passengers.

While reference has been made to definite checking positions which are indicated on the drawings, it is not intended that a checker remain at these points if conditions warrant his shifting to a more advantageous position. For example, during the summer months patrons frequently pull down the window shades on the sunny side of the vehicle, thus making the counting of passengers from this side difficult, if not impossible. Under such circumstances, checkers should take a position facing the sun, on the shady side of the vehicle.

Checking Assignments

In order that a checker may be thoroughly informed concerning each day's work, he is furnished a written assignment which gives him all necessary information. A typical checking assignment form is reproduced in Figure 11.

Checking assignments must be completed unless terminated by proper authority. It is not intended, however, that checkers should expose themselves to inclement weather. They should secure shelter as near as possible to the point of check, continuing the check from this new location until such time as it can be resumed at the regular location.

In the event that a checker finds that he is unable to work his assignment due to illness or other causes, he should communicate with his immediate supervisor as soon as possible, so that other arrangements may be made. If a checker is late in reporting to work, he should state on his checking record the exact time that he began to work, and the reason for his being late.

If checkers are in doubt regarding any detail of their assignments, they should communicate with the schedule department for further information.

Checking Hours

During weekdays the regular checking hours are from 6:00 A.M. to 11:30 P.M. The individual checking assignments may be as follows:

1. From 9:00 A.M. to 12:00 Noon (3 hours) (Monday)
2. From 1:45 P.M. to 6:45 P.M. (5 hours) (Monday)
3. From 6:00 A.M. to 10:15 A.M. ($4\frac{1}{4}$ hours) (Tuesday through Friday)
4. From 3:00 P.M. to 6:45 P.M. (3-3/4 hours) (Tuesday through Friday)
5. From 6:00 A.M. to 2:45 P.M.* (8 hours) (Tuesday through Friday)
6. From 2:45 P.M. to 11:30 P.M.*(8 hours) (Tuesday through Friday)

(*These are the two shifts of the 18-hour check.
Each checker has a 45-minute lunch relief.)

On Saturdays the checking hours are from 6:00 A.M. to 11:30 A.M., and from 12:30 P.M. to 9:00 P.M. On occasion further checks are on Saturdays beyond 9:00 P.M. On Sundays the checking hours are from 2:30 P.M. to 11:30 P.M. It is customary for the sample company to rely upon an analysis of "trip sheets" for Sunday morning loads.

Special instructions are issued from time to time covering checks of other durations, and for other purposes.

Conduct

Checkers should at all times conduct themselves in an orderly manner. While on duty, checkers should not hold unnecessary conversations with persons not connected with the company, nor with company employees unless the conversation relates to company business.

In the event a blockade occurs near the point of check, the checker should offer his services to supervisors or other officials of the transportation department. Any assistance rendered should be noted on the checking record.

Checker's Accuracy Test

The data obtained by load checkers is used to check the efficiency of schedules in effect and, when summarized with other checks, is used in the building of new schedules. Hence, any inaccuracy in counting passenger loads will reflect on the correctness of present schedules, and will be misleading when new schedules are prepared. It is, therefore, the practice of the schedule department to test periodically the accuracy of load checkers. This is done by having some member of the schedule department board a vehicle on the line being checked, in order that he may accurately count the number of passengers in the vehicle as it passes the checking location. Any unusual discrepancy between the count of the load checker and that of the riding checker will be immediately called to the attention of the checker being tested.

A typical "load checker's accuracy test form" is reproduced in Figure 12.

F. Frequency of Checks

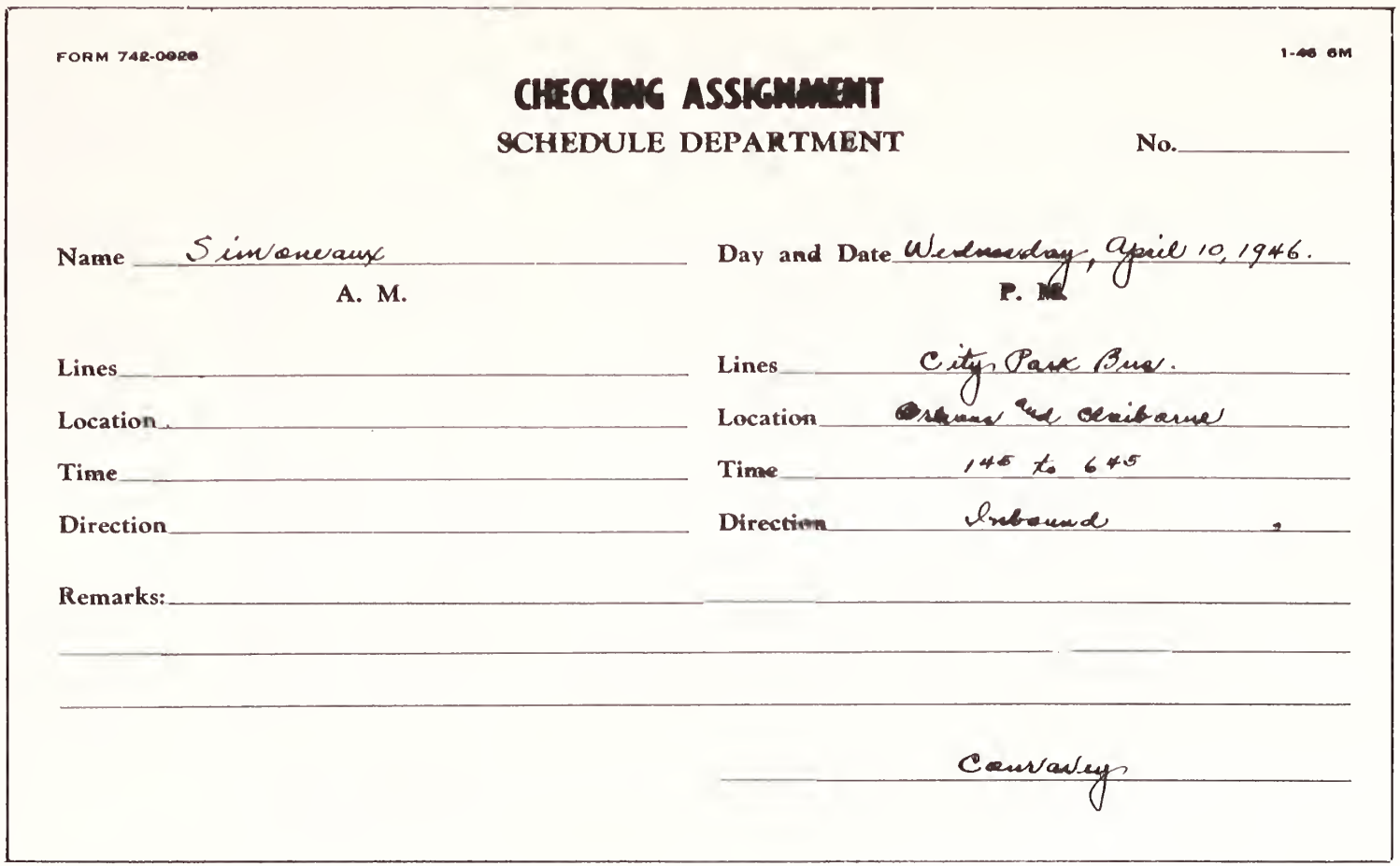
The company conducts a regular, progressive and systematic program of passenger load checks so that its schedule makers may be fully informed as to riding conditions at all times.

Under the systematic program the lines of the system are checked with the following approximate frequencies:

Type of Line	Maximum No. of Peak Vehicles	Frequency of Load Checks
Heavy lines	20-39	Approximately every two weeks
Medium lines	10-19	Approximately every three weeks
Light lines	6-9	Approximately every 4-6 weeks
Very light outlying lines		(Trip sheet analyses are used.)

The majority of checks taken at this time are of 18-hour duration, as it is considered necessary to follow closely the fluctuations in passenger load at all periods of the day. Under normal conditions the 18-hour checks are spaced more widely and supplemented with checks taken during peak hours only.

Figure 13 shows a form utilized by the company in keeping a record of the dates on which its 18-hour passenger load checks are taken on the lines of the system. This record assists the Superintendent of Schedules when making weekly assignments for such checks.



FORM 742-0928 1-46 6M

CHECKING ASSIGNMENT

SCHEDULE DEPARTMENT No. _____

Name Simoneaux

Day and Date Wednesday, April 10, 1946.

A. M.	P. M.
Lines _____	Lines City Park Bus.
Location _____	Location Orleans and Claiborne
Time _____	Time 145 to 645
Direction _____	Direction Inbound

Remarks: _____

Conway

FIGURE 11.
CHECKING ASSIGNMENT FORM—
SAMPLE COMPANY UNDER STUDY.

CHECKER Linn

LINE City Park Bus

LOCATION Dumaine and Claiborne

CAR NO. 1567 TR. NO. 9

DIRECTION out CHECKING CONDITIONS OK

ACTUAL TIME 534 P.M. CHECK TIME 534 P.M.

ACTUAL PASS. 74 CHECK PASS. 76

REMARKS checker in wrong location

CHECKED BY Baget DATE 4-10-46

FIGURE 12.
LOAD CHECKER'S ACCURACY TEST FORM —
SAMPLE COMPANY UNDER STUDY.

STANDING CHECK LOCATIONS

TUESDAY TO FRIDAY 18:00 Hour.

Lines	Locations	Checking Hours	Date of Checks			
Tulane St. Charles	St. Charles & Calliope	6:00 to 2:45 P.M. 2:45 to 11:30 P.M.				
Tulane St. Charles	Tulane & Claiborne	6:00 to 2:45 P.M. 2:45 to 11:30 P.M.				
Canal St. Bernard	Canal & Claiborne	6:00 to 2:45 P.M. 2:45 to 11:30 P.M.				
Esplanade St. Claude	Esplanade & Rampart	6:00 to 2:45 P.M. 2:45 to 11:30 P.M.				
Magazine	Poeyfarre & Camp Poeyfarre & Magazine Poeyfarre & Camp Poeyfarre & Magazine	6:00 to 11:45 A.M. 12:30 to 2:45 P.M. 11:45 to 8:30 P.M. 2:45 to 11:30 P.M.				
Jackson Freret S. Claiborne	Erato & Dryades Clio & Dryades Erato & Dryades Clio & Dryades	6:00 to 11:45 A.M. 12:30 to 2:45 P.M. 11:45 to 8:30 P.M. 2:45 to 11:30 P.M.				
City Park	St. Peter & Rampart Dumaine & Rampart St. Peter & Rampart Dumaine & Rampart	6:00 to 11:45 A.M. 12:30 to 2:45 P.M. 11:45 to 8:30 P.M. 2:45 to 11:30 P.M.				
Desire Gentilly	Ursuline & Royal Dumaine & Bourbon Ursuline & Royal Dumaine & Bourbon	6:00 to 11:45 A.M. 12:30 to 2:45 P.M. 11:45 to 8:30 P.M. 2:45 to 11:30 P.M.				

FIGURE 13.

RECORD OF 18 — HOUR PASSENGER LOAD CHECKS — SAMPLE COMPANY UNDER STUDY.

In addition to the routine program of checks, special checks are conducted when warranted by the following conditions:

1. When routine checks indicate an abnormal condition developing on a line. More frequent checks of the line are made.

2. When reports from the Transportation Department indicate an abnormal or troublesome condition developing. Such lines are re-checked.

3. When special circumstances produce a temporary "shifting" of the maximum load point for a few trips. Such "temporary" maximum load points are checked.

4. When an analysis of passengers transferring from one line to another at certain transfer point is required. The "arriving" and "leaving" loads at such transfer points are checked.

5. When special information concerning passenger loads is required in connection with research and planning studies. Such checks are conducted by the Schedule Division for the Planning Unit.

Extra trainmen are called upon as required to meet any broad or extended program of special checks. Under the normal operations of the Schedule and Planning Division many trainmen have been trained and developed into capable "extra" checkers as a reserve to draw upon.

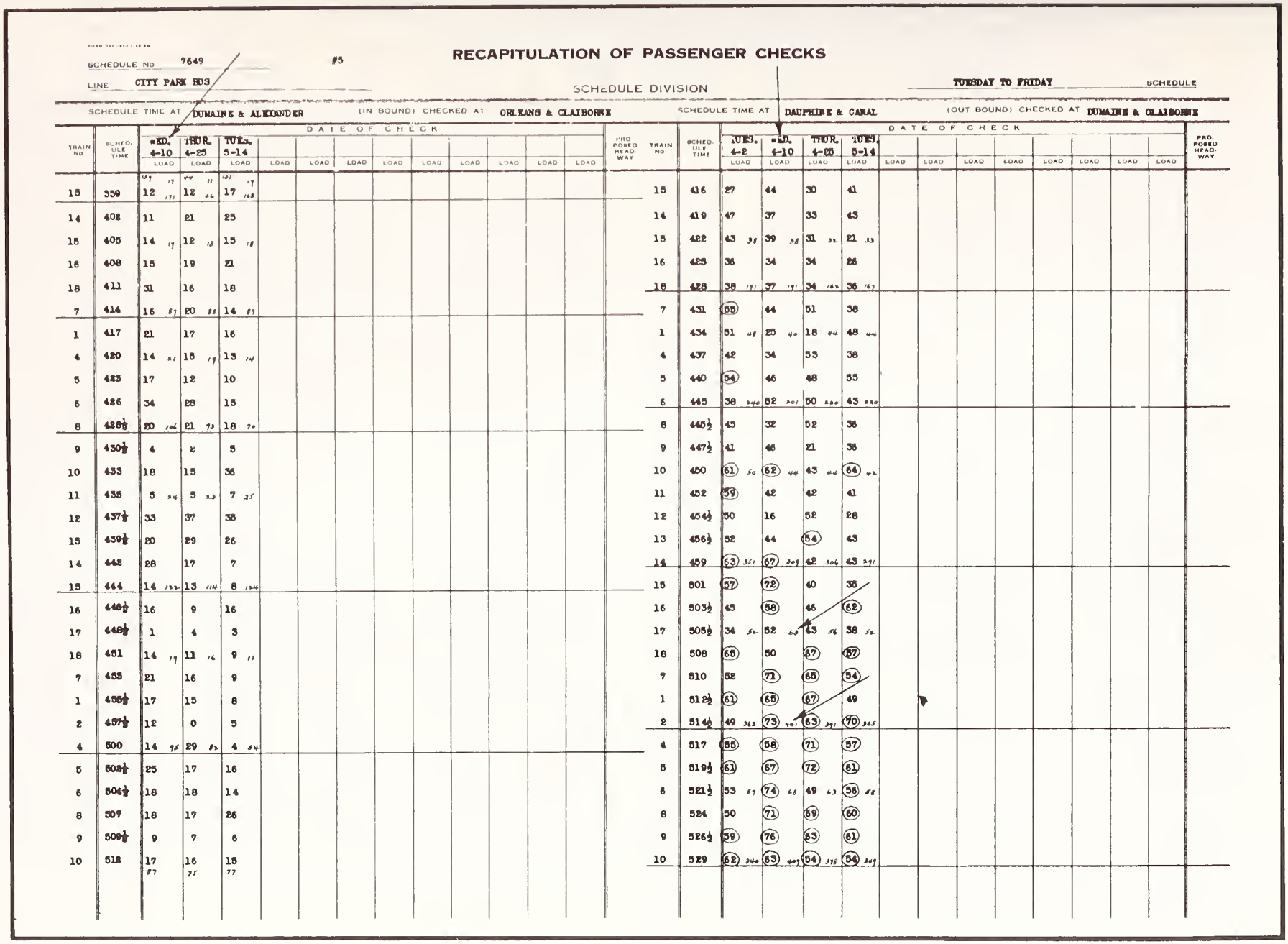
G. Summarization of Passenger Load Data

As explained under "General Instructions to Load Checkers", completed checks are forwarded to the schedule office via company mail.

It is not practical to try to obtain a mental picture of the passenger load carrying characteristics of a line by merely examining the individual checking records as they come in. For this reason a form has been developed for summarizing load check data so that the results of several days' checks may be studied simultaneously. A designated employee in the office enters the checks on the summary sheet. Thus, the assembled data for several load checks will come, upon inspection, to show readily the efficiency of the schedule in effect. It will also provide the basis for the construction of new schedules at some future date.

Figure 14 shows a form called "Recapitulation of Passenger Checks" which is used by the company for summarizing load data. Before beginning to "post" the form from the passenger check sheets, the following information should be inserted in the appropriate spaces:

1. Number of the schedule currently in effect.
2. Name of line.
3. Class of schedule (weekday, Saturday, Sunday).
4. Line terminals for which scheduled time is shown, both inbound and outbound.
5. Checking locations, both inbound and outbound.
6. Train numbers, taken from the terminal sheet for the schedule in effect.
7. Scheduled leaving times, taken from the terminal sheet for the schedule in effect.



RECAPITULATION OF PASSENGER CHECKS

SCHEDULE No. 7649 #5

LINE CITY PARK BUS

SCHEDULE DIVISION

TUESDAY TO FRIDAY SCHEDULE

SCHEDULE TIME AT DUMAINE & ALEXANDER (IN BOUND) CHECKED AT ORLEANS & CLAIBORNE

TRAIN NO	SCHEDULE TIME	WED. 4-10 LOAD	THUR. 4-25 LOAD	TUES. 5-14 LOAD	PROPOSED HEADWAY
15	359	12 171	12 44	17 148	
14	402	11	21	25	
15	405	14 17	12 18	15 18	
16	408	15	19	21	
18	411	31	16	18	
7	414	16 87	20 88	14 87	
1	417	21	17	16	
4	420	14 81	15 19	13 14	
5	423	17	12	10	
6	426	34	28	15	
8	428½	20 146	21 93	18 70	
9	430½	4	2	5	
10	433	18	15	36	
11	435	5 24	5 23	7 25	
12	437½	33	37	38	
13	439½	20	29	26	
14	442	28	17	7	
15	444	14 132	13 114	8 134	
16	446½	16	9	16	
17	448½	1	4	3	
18	451	14 17	11 16	9 11	
7	453	21	16	9	
1	455½	17	15	8	
2	457½	12	0	5	
4	500	14 95	29 85	4 54	
5	502½	25	17	16	
6	504½	18	18	14	
8	507	18	17	26	
9	509½	9	7	6	
10	512	17 87	16 75	15 77	

SCHEDULE TIME AT DAUPHINE & CANAL (OUT BOUND) CHECKED AT DUMAINE & CLAIBORNE

TRAIN NO	SCHEDULE TIME	TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	TUES. 5-14 LOAD	PROPOSED HEADWAY
15	416	27	44	30	41	
14	419	47	37	33	43	
15	422	43 38	39 38	31 32	21 33	
16	425	36	34	34	26	
18	428	38 171	37 191	34 162	36 167	
7	431	(55)	44	51	38	
1	434	51 48	25 40	18 44	48 44	
4	437	42	34	33	38	
5	440	(54)	46	48	35	
6	445	38 340	32 301	30 280	43 320	
8	445½	45	32	32	36	
9	447½	41	46	21	36	
10	450	(61) 50	(62) 44	43 46	(64) 42	
11	452	(59)	42	42	41	
12	454½	30	16	32	28	
13	456½	32	44	(54)	43	
14	459	(63) 351	(67) 309	42 306	43 291	
15	501	(57)	(72)	40	35	
16	503½	45	(58)	46	(62)	
17	505½	34 52	32 63	43 56	38 52	
18	508	(65)	50	(67)	(57)	
7	510	52	(71)	(65)	(64)	
1	512½	(61)	(65)	(67)	49	
2	514½	49 363	(73) 407	(63) 391	(70) 365	
4	517	(56)	(58)	(71)	(67)	
5	519½	(61)	(67)	(72)	(61)	
6	521½	53 67	(74) 68	49 63	(58) 58	
8	524	50	(71)	(69)	(60)	
9	526½	(59)	(76)	(63)	(61)	
10	529	(62) 346	(63) 407	(64) 398	(64) 369	

FIGURE 14.
RECAPITULATION OF PASSENGER CHECKS, OR LOAD CHECK SUMMARY SHEET—
SAMPLE COMPANY UNDER STUDY.

The second step consists of the division of the scheduled leaving times into proper periods of 15 or 30 minutes each, depending upon the time of day (see "General Instructions to Load Checkers"). The division lines, which break the summary sheet into "bands" are drawn for the inbound and outbound directions separately. The lines for the inbound direction are governed by the leaving times of vehicles from the outer terminal of the line, starting with the first vehicle. The division lines for the outbound direction of travel are governed by the leaving times of vehicles from the inner terminal of the line. These lines are drawn according to even 15-minute (or 30-minute) clock intervals.

The third step consists of transferring the actual load data into the appropriate columns and rows on the summary sheet. Each column is headed with the name of the day and the date. Inbound and outbound figures are entered in separate columns. As the data for each day's check is entered, the total number of passengers handled in each time period is determined and entered in the same column at the bottom of the period and just to the right of the column of actual load figures. The total for the period is divided by the number of vehicles contributing to the total in order to determine the average load per vehicle during that period for the day in question. This average figure is entered in the same column and band, midway between the time division lines. This process is repeated for each succeeding day's check.

An example of the method of entering passenger load data on the summary sheet and computing totals and averages is given below. (Please refer to Figures 9 and 14):

The data sheet marked with the Figure 5 in a circle on the left-hand side of Figure 9 has been entered on the inbound (left-hand) half of the summary sheet shown in Figure 14. The date of the check is April 10, and the entries begin with Run No. 13 at the point marked "X" on the passenger check sheet. These loads are listed on the summary sheet beginning opposite Train No. 13 in the upper left-hand corner of Figure 14. These loads, reading vertically, are 12, 11, 14, 15, 31, 16, 21, 14, 17, 34, 20, 4, 18, 5, 33, 20, 28, 14, 16, 1, and etc.

The data sheet marked with the Figure 3 in a circle on the right-hand side of Figure 9 has been entered on the outbound (right-hand) half of the summary sheet shown in Figure 14. The entries begin with Train No. 5 at the top of the passenger check sheet. These loads are listed on the summary sheet beginning opposite Train No. 5 (4:40 P.M.) in the column for Wednesday, April 10th. These loads are 46, 52, 32, 46, 62, 42, 16, 44, 67, 72, 58, 52, 50, 71, 65, 73, 58, 67, 74, 71, 76, and 63, as shown vertically in this column.

This process is, of course, repeated throughout the entire range of the checking period.

Attention should next be directed to the right-hand (outbound) half of the passenger load summary sheet (Figure 14), with particular reference to the 15-minute period "banded off" from 5:00 to 5:15 P.M. (5:01 through 5:14½ P.M.), which embraces Train Nos. 15 through 2 as they pass the outbound maximum load point at Dumaine and Claiborne Sts. In the column for April 10th, the passenger loads for this 15-minute period total 441 passengers, as shown by the figure at the bottom of the time band just off to the right of the entry for Train No. 2.

This figure of 441, when divided by the seven (7) vehicles which pass the outbound maximum load point during the 15-minute period, gives an average load of 63 passengers per bus for that period. This figure "63" is entered in the appropriate column (April 10th) and time band (5:00-5:15 P.M.) just to the right of the column of actual load figures. The totals and averages for each column and time band on the entire series of summary sheets are similarly computed and entered.

As the checks are entered on the sheet the designated employee watches for abnormal loading. The averages computed for each time band on a given day permit the student of the recapitulation sheet to compare loadings for a given time period with the recognized loading standard for that period. After the several days' checks have been entered, totaled and averaged as described above, it is possible to compare the loads on individual vehicles, as well as the daily averages by periods. This comparison of checks made on different days enables the "spotting" of vehicles that consistently carry heavy or light loads. At the same time, this comparison will show whether the average load per vehicle is increasing or decreasing. Such increases or decreases largely determine when a new schedule should be prepared.

The following is a brief analysis of the information appearing on the summary sheet shown in Figure 14:

After the schedule clerk entered the data from the passenger check sheets on the summary form, he placed a circle around all those loads of individual buses which were higher than the average loading standard to be used for scheduling purposes during the particular 15-minute period. For example, the buses used on the sample route are of 40-passenger capacity. Allowing for the 33-1/3% standee load which is generally used as a peak-period average on the bus routes of the company whose schedule-making processes are under study, the peak loading standard on the sample line would be 53 passengers per vehicle. All values of 54 and over have accordingly been circled as "overloads". Throughout the series of checks in this summary there has been a tendency for the number of "circled" loads to increase. In some instances individual loads as high as 69, 70, 71, 72, 73, and 76 may be found. The line has obviously become overloaded, and the summary sheet indicates the need for additional service to be inserted in the schedule as a means of bringing the average actual peak loadings down to a level nearer the approved loading standard. This is a further reason for the revision of the schedule which is to be studied in this report.

Reference to the "Manual of Transit and Traffic Studies" published by the Association, as well as to Parts II and III of this study, will provide the student with alternative methods for summarizing or recapitulating passenger load data.

A further discussion of the use of passenger load summaries in determining new headways when new schedules are to be constructed will be included in Section IV of this report under the heading "HEADWAY ORDER".

At this point, attention will be directed to the running time check, which is required along with the passenger load check in determining the headway order for a new schedule.

CHAPTER III

RUNNING TIME DATA

The following discussion of a method for obtaining and summarizing running time data is based upon the procedures used by the sample transit company. Reference to Parts II and III of this project will furnish the student of the report with an insight into other methods of running time checking and differing managerial viewpoints with respect to this phase of the schedule-making process. Several alternative methods for performing this check are also given in the "Manual of Transit and Traffic Studies" recently issued by the American Transit Association.

A. Importance of Running Time Data

It is extremely important that the schedule maker have at his disposal adequate and correctly obtained data upon which to base an estimate of the running time for the line for which he is about to prepare a schedule. Running time is important because it determines in large measure the degree of convenience which the public will receive from a schedule from the standpoints of speed and elapsed time in their travels. It is also important because it has much to do with the efficiency of a schedule and its resulting cost of operation from the company point of view.

The running time check furnishes a means by which the Schedule Department can evaluate the speed performance of a given vehicle when operated under actual service conditions in the public streets. Any transit vehicle is subject to the effects of various kinds of delays as it traverses its route, and these effects are quite likely to vary markedly during different periods of the day. For example, during the peak hours there is customarily a great volume of private automobiles, taxicabs and commercial motor vehicles, all of which require street space for their movement and contribute to traffic congestion. During these same hours large numbers of persons are using the transit lines in order to reach or leave their places of work. This means that the loads on transit vehicles are greater, that more passengers board and alight at each stop, that stops are more frequent and of longer duration, and that more time is consumed by passengers in moving through the crowded aisles of vehicles to or from the doors. All of these elements contribute to delay and longer running time. In the base period of the day, at night, on Sundays, and in some cases on Saturday afternoons, transit loads are relatively lighter. Stops are less frequent, and there is a smaller passenger interchange with less loss of time at stops. Street traffic is usually reduced in volume at these times, and the vehicles is able to move more easily through the less congested streets. At such periods the interests of both the public and the company are best served by a shorter running time.

It is important to the company which hopes to achieve every possible operating economy consistent with a convenient service to the public, that due attention be given to the variation which takes place in running time during different seasons of the year, on different days of the week, and at different times throughout a single day. The alert Schedule Department will take advantage of the variation in the conditions which produce interference and delay, and will change the running time as frequently as necessary to obtain maximum schedule efficiency.

The company whose schedule-making processes are under study in this report appears to be especially conscious of the importance of frequent changes in running time. It is customary for this company to divide each day

into the following periods from the standpoint of running time changes:

1. Early A.M.
2. A.M. Peak
3. A.M. Basic
4. P.M. Basic
5. P.M. Peak
6. Early Night
7. Late Night
8. Owl

Changes in running time are also made to adapt schedules to the various days of the week, as well as take care of seasonal aspects.

B. Time Points

In order to control the operation of scheduled vehicles so that the service will be available where and when needed, the company has established "time points" along its routes in both directions of operation. The primary purpose of these time points is to keep the vehicles properly spaced, and to prevent an operator from "running away" from passenger loads and imposing them upon the vehicle following. This use of time points must be made effective through supervision and discipline.

It is customary for the company to space its time points so that the running time between them is close to an average of four minutes, and not in excess of six minutes. On lines having a "close headway" or short interval between vehicles - say, $1\frac{1}{2}$ minutes - it would be possible with a 6-minute time point for an operator to run ahead and widen the "gap" between his vehicle and the vehicle behind. It is more difficult to do this with a 4-minute time point interval.

The company requires strict adherence to time at all inbound time points because it wants vehicles to leave the inner terminals of lines on time if possible. On certain lines adherence to time points on the outbound trip beyond a certain point is not rigidly enforced. The point of departure from the rule of adherence is usually the third time point on the outbound leg of the line, and is determined by a study of the area of "pick up" on the outbound route. Time points which are not to be adhered to are not shown on the trainman's "run guide".

Time points for the line under study are listed on the illustrations shown in Figures 15 and 22.

For other methods of determining the locations of and utilizing time points, see Part II of this report.

C. Information Required

The information required from a running time check consists essentially of the following:

1. Name of line being checked.
2. Number of schedule being checked.
3. Vehicle number.
4. Train number according to current schedule.

5. Day of the week.
6. Date of check.
7. Condition of the weather.
8. Signature of the checker.
9. Scheduled time at each time point.
10. Actual check time at each time point.
11. Number of seconds ahead or late at each time point.
12. Time actually used between time points.
13. Observer's estimate or "grading" of the speed of the vehicle.
14. Number of stops made between time points.
15. Passenger load on the vehicle at each time point.
16. Remarks as to any outside condition, such as a traffic light or instance of traffic interference or delay, which may interfere with the progress of the vehicle.
17 Comments of the observer concerning the performance of the operator of the vehicle.

D. Checking Form

The checking form used by the company is shown in Figure 15. There are two sheets to the form, the left-hand one giving the names of the time points, the running times and the speeds for the schedule in effect on the line for the particular daily time period; and the running time check form itself, which is shown on the right-hand side of the figure. Both the running time sheet and the running time checking form are loose-leaf and are placed side by side in a special binder. The sample form has been filled in with an actual set of running time observations for the line which will be used as an example throughout the remainder of the study. Samples of other forms used for collecting running time data may be found in the "Manual of Transit and Traffic Studies" previously referred to.

E. Detail of Procedure

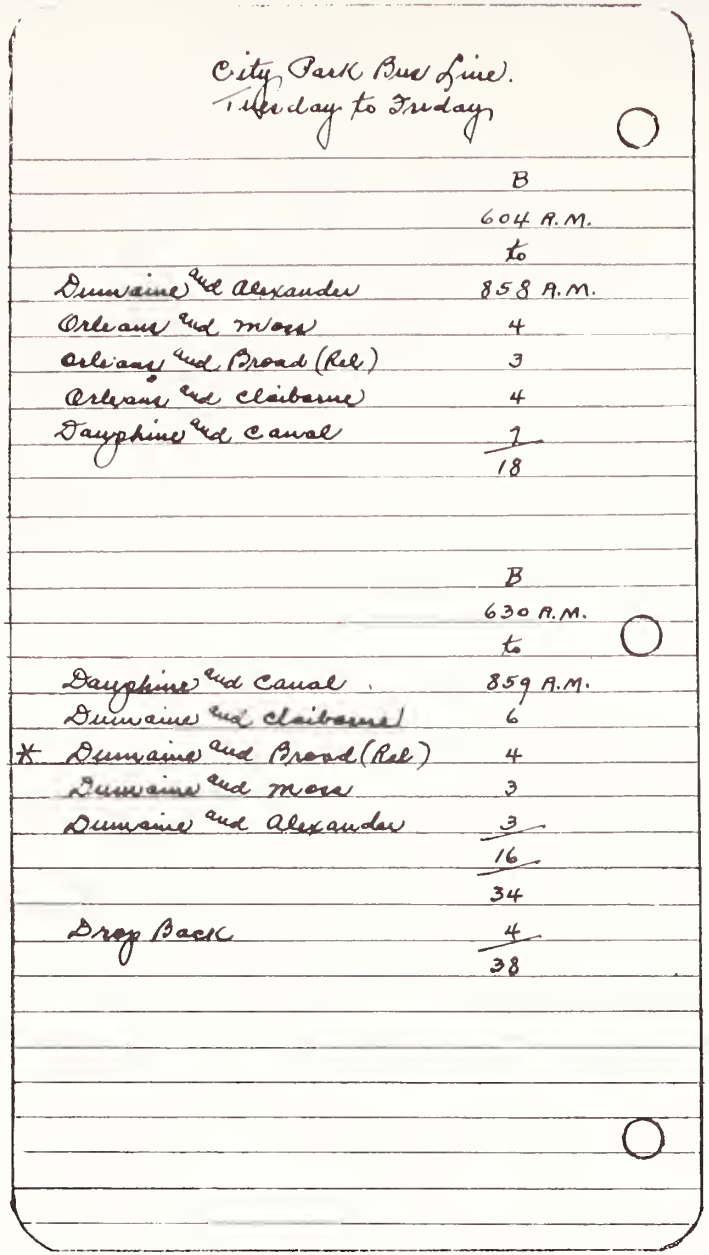
Because of the importance of the running time check to the schedule-making process, extreme care is exercised in the selection of riding checkers. Unlike the passenger load check, for which accuracy tests can be made, it is more difficult to determine the proficiency and judgment of riding checkers. Hence, more dependence must be placed on the proper selection of men to do this type of work. The important characteristics of a good riding checker are as follows:

1. He must be experienced load checker.

2. He should be capable of performing the duties of a vehicle operator, whether this be a street car operator, trolley coach operator or motor bus operator.

3. He must be fast and accurate in mathematics.

4. He must be capable of concentrating on the task of



City Park Bus Line.
Tuesday to Friday

	B
	604 A.M.
	to
Dumaine and Alexander	858 A.M.
Orleans and Moss	4
Orleans and Broad (Rel)	3
Orleans and Claiborne	4
Dauphine and Canal	7
	18
	B
	630 A.M.
	to
Dauphine and Canal	859 A.M.
Dumaine and Claiborne	6
* Dumaine and Broad (Rel)	4
Dumaine and Moss	3
Dumaine and Alexander	3
	16
	34
Drop Back	4
	38

Form 742-0384 12-43 10M

RUNNING TIME CHECK

Schedule Dept.

Sch. No. 7417 Line City Park Bus
Car No. 1516 Train No. 13 A. M. or ~~P. M.~~
Day Friday Weather Fair

Sch. Time	Check Time	Ahead or Late	Time Used	Speed	Stops	Pass.	Remarks
810 00	810 15	- 15	-	-	-	7	30 Drop Back
814 00	814 30	- 30	4 15	F	7	24	
817 00	816 45	+ 15	2 15	F	3	36	
821 00	820 40	+ 20	3 55	3/4	6	45	
828 30	827 40	+ 50	7 00	3/4	9	34	5 15
828 30	827 40	+ 50	-	-	-	9	
834 30	834 25	- 05	6 55	3/4	10	13	
838 30	838 45	- 15	4 10	F	5	21	
841 30	841 25	+ 05	2 40	F	4	9	
844 30	844 10	+ 20	2 45	F	4	6	3 40

Date 11-30-45 Checker Brim

FIGURE 15.
RUNNING TIME CHECK FORM (2 SHEETS),
SAMPLE COMPANY UNDER STUDY.

"judging speed" throughout his entire working day.

5. He must be capable of selecting trips which are truly representative.

6. He should have the ability to discern when a trip is not representative due to excessive delays, etc., in order that he will not continue to waste time by checking a trip which the schedule makers will ultimately discard.

7. He must be entirely reliable and trustworthy.

Perhaps the best method of explaining the detail of the running time check procedure would be to include below the general instructions issued to running time checkers in the Schedule Department of the sample company. These instructions, substantially as they are given to the checkers, are included below:

GENERAL INSTRUCTIONS TO
RUNNING TIME CHECKERS OF THE
SCHEDULE DEPARTMENT

Principal Duties

The principal duty of a riding checker is to compare mentally the speed made by a vehicle being checked with the average speed which it should have made under any given set of conditions. Based on this comparison or "mental evaluation", he "grades" the operating speed of the vehicle accordingly, and tabulates the following data at each time point:

1. Vehicle arriving time (actual).
2. Passenger load.
3. "Graded" speed between time points.
4. Number of stops between time points.
5. Remarks.

From the data obtained, the checker calculates the "ahead" or "late" time at each time point and the amount of time used between time points.

A riding checker is also a schedule observer, and it is his duty to report those things that tend to detract from the efficient operation of the schedules in effect; as, for example, hazardous condition or location of vehicle stops, or badly timed traffic lights.

Checking Assignments

Riding checkers receive instructions from their supervisor in the Schedule Department, who furnishes them with written assignments on a form which is identical with that given to load checkers. (See Figure 11). Checking assignments usually cover a period of 7 days, starting on Monday, and ending the following Sunday. It is the usual practice of the company to use three checkers on such a check, one for the morning period, one for the evening period, and the third one covering both peaks.

During very inclement weather checkers should communicate with their supervisor regarding the advisability of continuing the check.

SCHEDULE NO. 7649
EFFECTIVE MARCH 26, 1946
SUPERSEDING NO. 7540 REVISED
CANAL BUS STATION

CITY PARK BUS LINE

TUESDAY TO FRIDAY

CANCELLED
DATE 5-29-46
SUPERSEDED
BY No. 7730

DUMAINE & ALEXANDER

TRAIN	OUT																								IN	TIME
1	436	444	519	556	635	710	748½	828	906½	949	1027	1105	1143	1221	1259	137	215	257	338	417	455½	534½	610*				618	1342
2	705					713	751	825*	833										OUT	449	457½	536½	616	657½	735½	814	855	113	952
3	708					716	754	831½	911	946*	954																		246
4	595			*604	640	718½	756½	835	915	955½	1033½	1111½	1149½	1227½	105½	143½	220½	302	341	420	500	539	614*				622	1226
5	713					721	759	833*	841										OUT	336	344	423	502½	541½	621	703	741	820½	902	1206	958
6	637				645	724	802	836½	919½	955*	1003				OUT	218	226	307	347	426	504½	544	626	701*					709	817
8	526		534	611	649½	727	805	842	924	1002	1040	1118	1156	1234	112	150	231½	311	350	428½	507	546½	622*					630	1304
9	721					729½	807½	845½	927	929									OUT	422	430½	509½	549	631	708½	746½	827	909½	440	1426
10	646				654	732	810	849½	928½	1008	1046	1124	1202	1240	118	156	237	315	353	433	512	551½	627*					635	1149
11																		OUT	427	435	514	554	629*					637	210
12	610			618	658	735	813	853½	933	1014½	1052½	1130½	1208½	1246½	124½	202½	242	318½	356	437½	516½	556½	636	714	752	834	907*	915	1205
13	653				701	738	816	856*	858							OUT	314	322	359	439½	518½	559	634*					642	233
14																	OUT	354	402	442	521	556*						604	210
15	456	504	546	624	704	740½	819	858	938	1021	1059	1137	1215	1253	131	209	247	325½	405	444	523	602	641	719	757	831*		839	1543
16															OUT	244	252	329	408	446½	525½	605	640*					648	404
17	622			630	707	743	822	902	943	1017*	1025							OUT	440	448½	527½	608½	646½	724½	802½	841	917	1224	1147
18																OUT	324	332	411	451	530	609*					613	249
7	738					746	825	859*	907							OUT	327	335	414	453	532	612	652	730	808	848	924	1152	954
																													165:35

TRAIN											
2	931	1007	1043	1119	1202	1237	105*				
5	938	1014	1050	1126	1158*						
9	945½	1021½	1057½	1135	1217	101	201	301	401	432*	
17	953	1029	1105	1144	1216*						
7	1000	1036	1112	1144*							

DAUPHINE & CANAL

1	500	535	612	652	728	806½	846	924½	1006	1044	1122	1200	1238	116	154	232	314	355	434	512½	551½					
2					731	809														514½	553½	633	714½	752½	831	911
3					734	812	849½	929																		
4				621	658	736½	814½	853	933	1012½	1050½	1128½	1206½	1244½	122½	200½	237½	319	358	437	517	556					
5						739	817												401	440	519½	558½	638	720	758	837½	918
6				703	742	820	856½	937½									243	324	404	443	521½	601	643				
8		550	629	707½	745	823	900	942	1019	1057	1135	1213	1251	129	207	248½	328	407	445½	524	603½					
9					747½	825½	903½													447½	526½	606	648	725½	803½	844	925½
10				712	750	828	907½	946½	1025	1103	1141	1219	1257	135	213	254	332	410	450	529	608½					
11																			452	531	611					
12			636	716	753	831	911½	950	1031½	1109½	1147½	1225½	103½	141½	219½	259	335½	413	454½	533½	613½	653	731	809	850½	
13				719	756	834											339	416	456½	535½	616					
14																		419	459	538						
15	520	602	642	722*	758½	837	916	955	1038	1116	1154	1232	110	148	226	304	342½	422	501	540	619	658	736	814		
16																309	346	425	503½	542½	622					
17			648	725	801	840	920	1000											507	544½	625½	703½	741½	819½	857	933
18																	349	428	508	547						
7					804	843											352	431	510	549	629	709	747	825	904	940

TRAIN								
2	947	1023	1059	1135	1215	1250		
5	954	1030	1106	1142				
9	1001½	1037½	1113½	1151	1230	117	217	317	417
17	1009	1045	1121	1200				
7	1016	1052	1128					

NOTE:* TR.NO. 4 LEAVING DUMAINE & ALEXANDER AT 6:04 A.M. USE "A" RUNNING TIME TO ORLEANS & CLAIBORNE & "B" RUNNING TIME TO DAUPHINE & CANAL.

FIGURE 16.
TYPICAL TERMINAL SHEET-
SAMPLE COMPANY UNDER STUDY.

In the event that a checker is in doubt regarding his assignment, he shall communicate with his supervisor as soon as possible.

Data Furnished to Checkers

When a checker receives an assignment to ride a line, he is furnished with a copy of the terminal sheet for the schedule in effect on that line. Figure 16 shows a typical terminal sheet, which is a complete schedule or "time-table" of the leaving times from the inner and outer terminals of the line.

The running time sheet maintained in the Schedule Department is in its regular form unsuitable for use by a riding checker; hence, all existing running time data for the line and period of the day is retabulated on a special form, which has been shown as the left-hand side of Figure 15. This sheet is placed in the riding checker's loose-leaf binder opposite the actual running time check form, also shown in Figure 15.

After having received his assignment, a checker is at liberty to examine the load check recapitulation or summary sheets, in order to determine on which trips he may expect to find the most representative passenger loads.

Checker's Preparation Before Riding

Before beginning each day's work, a checker shall set his watch in accordance with the instructions given previously under the heading "General Instructions to Load Checkers".

Before beginning each ride, the checker should place the proper running time sheet in the loose-leaf binder opposite the running time checking form.

The next step is to consult the terminal sheet and select a particular vehicle (train number) to ride. This should be done just before checker boards the vehicle preparatory to riding. (It is customary for employees in the Schedule Office to "circle" the terminal times of those peak trips which have heavy loads for the guidance of riding checkers.) The scheduled leaving time for this vehicle should be entered under "Schedule Time" opposite the terminal from which it will leave. Then, by adding to the terminal leaving time the running time allowances between time points, the checker is able to compute the scheduled arriving time at each time point.

General Checking Procedure

When starting to ride, a checker should place himself in a position which will facilitate his observation of the vehicle operator. In the case of two-man street cars (which are common on the lines of the sample company) the position selected should facilitate his observation of both motorman and conductor. A checker may assume either one of two positions:

1. For heavy or light loads - left-hand side of front platform, next to the bulkhead.
2. For light loads only - next to window on first cross-seat on right-hand side of car.

When vehicle leaves its terminal, the checker should record the actual leaving time and passenger load, and compute the "ahead" or "late" leaving time. Time should be recorded to the nearest five (5) second division.

After leaving the terminal and before arriving at the first time point, checker should tally each stop as made and observe operating speed, in order that he may accurately grade this speed upon arriving at the next time point.

Just before reaching the time point, the checker should record the following data:

1. Number of stops made between time points.
2. Passenger load (arriving).

This leaves the checker free to record at the time point:

3. Vehicle arriving time.
4. Average speed ("grade").
5. "Ahead" or "late" time.
6. Time used between time points.

After vehicle has left the time point, passenger load shall be recounted, and the heaviest load tabulated on the checking record, whether it be arriving or leaving.

Grading Speed

Experienced checkers have found it advisable to classify speed as follows:

1.	Full speed.	(F)
2.	Three-quarter speed.	(3/4)
3.	Half speed.	(1/2)
4.	One-quarter speed.	(1/4)

A vehicle is considered as being operated at full speed when the operator or crew is doing its very best to move the vehicle as rapidly as possible over its given route under the prevailing conditions. The following are some "abnormal" examples of "full speed" operation:

1. Vehicle handled by an exceptionally "fast" operator or crew.

2. Vehicle handled by a hard working, yet exceptionally "slow" operator or crew.

3. Vehicle progressing as fast as congested traffic will permit.

4. Vehicle "dragged" by car ahead.

When a checker encounters any of the operating conditions described above, he shall note them on his checking record. There may be many causes which can result in grading a vehicle operator or crew at a speed less than "full". Due to the many possible causes or combinations of causes which contribute to other than full speed operation, it is impracticable to state definitely in written instructions just when the 3/4, 1/2, or 1/4 speed rating should be used. As in the case of load checkers, it is necessary for a student riding checker to work with an experienced checker until he becomes sufficiently proficient in grading speed.

Riding checkers should thoroughly understand that operators are not expected to handle their vehicles in a reckless or unsafe manner in order to secure a full speed rating.

Tally Sheet

In order that checkers may properly distribute their time over the various running time periods of the day, and thus guard against securing an insufficient number of rides during any one period, it is advisable that they keep a record of the number of rides made during the period of the checking assignment. A riding checker's tally sheet has been devised for this purpose, and the manner in which it should be used is illustrated in Figure 17.

Miscellaneous Instructions to Riding Checkers

1. All round trips shall be started from the outer terminal.

2. Upon completion of a round trip, checker should drop back to the vehicle following.

3. Checker should avoid riding vehicles which are late in leaving their outer terminals.

4. Checker should avoid riding a vehicle which is preceded by one that left behind schedule at the outer terminal.

5. In the event that the vehicle being checked uses a different column of running time on an outbound trip from that used on an inbound trip, checker should use a separate record sheet for recording outbound trip data.

6. In the event that a blockade occurs on a line being checked due to a fire, stalled vehicle, accident, etc., checking should cease until such time as vehicles are operating on regular schedule.

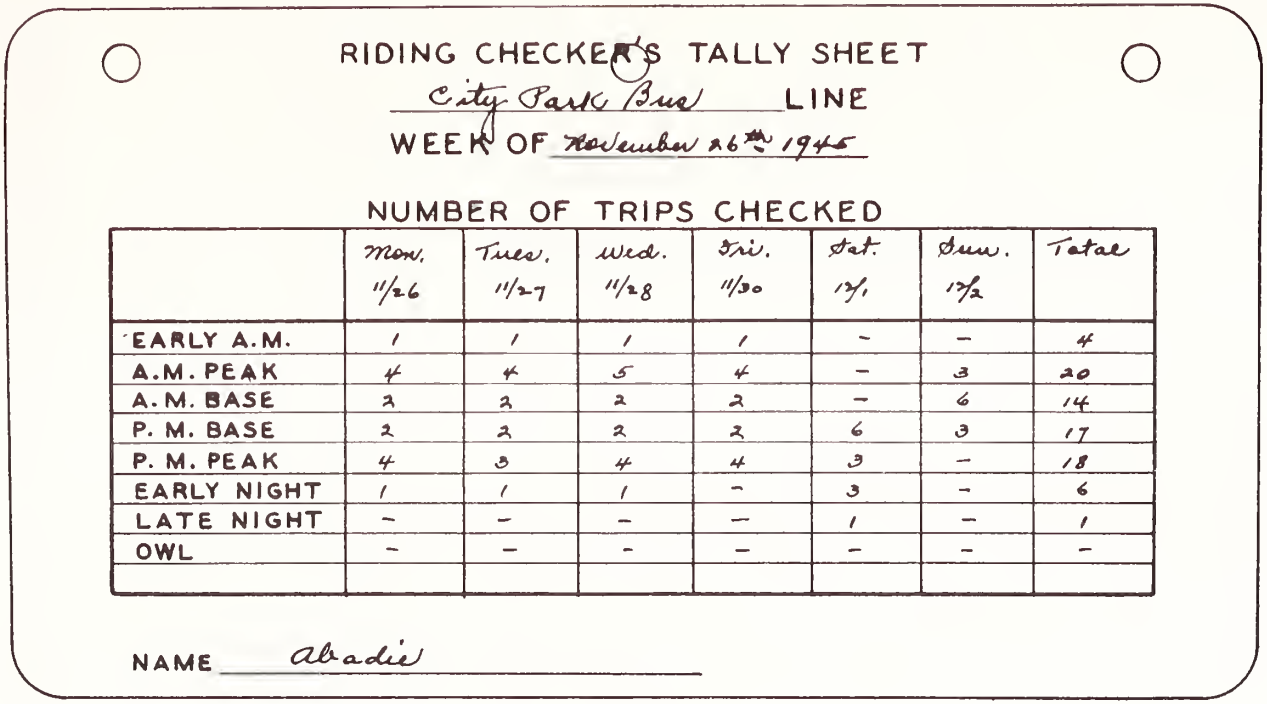
7. Time lost due to minor delays caused by bridge openings, blocked railroad crossings, improperly parked vehicles, single-track operation, etc., shall be noted under "remarks" opposite the time point affected by the delay.

8. Greasy or moist rail conditions caused by fallen leaves, cut grass, rail "sweating", rain, etc., shall be noted on the checking record.

9. Checkers should use the following terms in describing weather conditions:

   Clear
   Cloudy
   Drizzle
   Rain

10. Checkers shall deport themselves in accordance with the instructions for "Conduct" set forth in the "General Instructions to Load Checkers".



RIDING CHECKER'S TALLY SHEET

City Park Bus LINE

WEEK OF November 26th 1945

NUMBER OF TRIPS CHECKED

	Mon. 11/26	Tues. 11/27	Wed. 11/28	Fri. 11/30	Sat. 12/1	Sun. 12/2	Total
EARLY A.M.	1	1	1	1	–	–	4
A.M. PEAK	4	4	5	4	–	3	20
A.M. BASE	2	2	2	2	–	6	14
P. M. BASE	2	2	2	2	6	3	17
P. M. PEAK	4	3	4	4	3	–	18
EARLY NIGHT	1	1	1	–	3	–	6
LATE NIGHT	–	–	–	–	1	–	1
OWL	–	–	–	–	–	–	–

NAME Abadie

FIGURE 17.
RIDING CHECKER'S TALLY SHEET,
SAMPLE COMPANY UNDER STUDY.

F. Frequency of Checks

The company conducts a regular, progressive and systematic program of running time checks so that its schedule makers may be fully informed as to actual conditions at all times.

Under this systematic program the lines of the system are checked with the following approximate frequencies:

Type of Line	Maximum No. of Peak Vehicles	Frequency of Riding Checks
Heavy lines	20-39	Approximately every 8 months
Medium lines	10-19	Approximately every 10 months
Light lines	6-9	Approximately every 12 months
Very light outlying lines		Approximately every 2 - 3 years

Running time checks are not made during the summer months.

It is customary practice to check a line for running time over a period of one full week. Thursday being a light day on most lines, checkers are usually given this day off so that the other six days of the week may be checked.

In addition to the routine program of checks, special checks are conducted when warranted by the following conditions:

1. When routine checks indicate an abnormal condition developing on a line. The line may be checked for two consecutive weeks, or for two weeks at intervals, instead of the usual one week.

2. When reports from the Transportation Department indicate an abnormal or troublesome condition developing, such as difficult traffic conditions on certain lines on certain days. The checking period may be extended, or special checks may be made on the days and at the times indicated in the Transportation Department reports.

3. When a line is re-routed for any significant portion of its length. An adjusted running time is utilized, based upon special checks.

4. When a line terminal is extended by any appreciable distance, or when, more rarely, the distance to a line terminal is shortened. An adjusted running time is utilized, based on special checks.

5. When a new schedule has been placed in effect using vehicles of a different size or type than those formerly utilized on the line. Special riding checks are made in an effort to reduce the running time as operators become more familiar with the new vehicle and the new schedule.

Extra trainmen are called upon to meet any broad or extended program of special checks. Several trainmen are on call who have been trained and developed into capable and reliable running time checkers.

G. Summarization of Running Time Check Data

As in the case of passenger load check data, it is impracticable to obtain a mental picture of the running time actually required on any given line by merely looking at the individual checking records forwarded to the schedule office by the riding checkers. For this reason a form has been developed for summarizing running time check data so that the results of many checks may be studied simultaneously. This assembled data will, upon inspection, show how well the present running time is adapted to the actual conditions of operation, and provides the basis for necessary changes in the running time.

Figure 18 shows the "Running Time Summary Sheet" which is used by the company for summarizing riding check data. Before the observed data are inserted on this form, the summary sheet is headed up with the following information:

1. Name of line.
2. Type of schedule (weekday, Saturday or Sunday).
3. Dates of checks.

The time points are entered by name in the left-hand column of the sheet. The actually observed running times are calculated in accordance with specific instructions which will be given below, and entered in minutes and seconds in the columns headed "actual" under each time period.

The detailed instructions for summarizing riding check data will now be presented in some detail.

Before a new running time is worked up for a particular line, it is necessary to determine the average time required by the average operator or crew in moving the vehicle under actual service conditions from one end of the line to the other, and return (round trip). This is ordinarily done by making a riding check for at least one full week.

Running Time Periods

After a riding check has been made and the data sheets have been sent to the office, they are separated into three groups, namely, (1) weekday (daily except Saturday and Sunday), (2) Saturday, and (3) Sunday. The weekday data sheets are ordinarily divided into eight smaller groups corresponding to the eight running time periods, as follows:

Running Time Periods	Period Time (Inner Terminal)
1. Early A.M.	First car to 6:29 A.M.
2. A.M. Peak	6:30 A.M. to 8:59 A.M.
3. A.M. Basic	9:00 A.M. to 12:59 P.M.
4. P.M. Basic	1:00 P.M. to 4:29 P.M.
5. P.M. Peak	4:30 P.M. to 6:29 P.M.
6. Early Night	6:30 P.M. to 8:14 P.M.
7. Late Night	8:15 P.M. to 12:15 A.M.
8. Owl	12:30 A.M. to last trip.

Segregation of Abnormal Checks

The next step is to take the individual check sheets for each running time group and segregate those records which are "abnormal" from the standpoint of what might be considered to be "average" trips. The average trips, as far as passenger loads are concerned, may be determined by reference to the passenger load check summary sheets. Some of the causes of abnormal trip conditions are:

1. Exceptionally heavy loads.
2. Exceptionally light loads.
3. Accidents.
4. Stalled vehicles.
5. Bridge openings.
6. Railroad crossing delays.
7. Slippery rails.

Riding Check Summary Form

Having removed the abnormal checks from the group, the next step is to "post" the data for the "average" checks on the "Riding Check Summary Sheet" which was shown in Figure 18. This form provides the eight columns necessary for entering the running time check data from the individual trip record sheets (Figure 15). Each column is so headed that the average time used between time points in minutes and seconds may be placed under the appropriate daily time period. The left-hand side of sheet under the heading "Time Points" is reserved for listing the names of the time points being checked.

Running Time Adjustment Form

After the summary sheet has been prepared by properly heading the sheet and listing the time points for the line under consideration, the "Running Time Adjustment Sheet", Figure 19, should be placed in a position that will make it readily available for constant reference.

City Park Bus LINE

Tuesday through Friday SCHEDULE

TIME POINTS	EARLY A.M. ACTUAL	A.M. PEAK ACTUAL	A.M. BASE ACTUAL	P.M. BASE ACTUAL	P.M. PEAK ACTUAL	EARLY NIGHT ACTUAL	LATE NIGHT ACTUAL	OWL ACTUAL
	(22)	(55)	(36)	(32)	(25)	(23)	(11)	
Dumaine & Alexander								
Orleans & Moss	3:33	4:06	3:56	3:43	3:35	3:38	3:24	
Orleans & Broad	-	2:49	-	-	-	-	-	
Orleans & Claiborne	6:05	3:59	5:56	5:51	5:53	5:59	5:02	
Dauphine & Canal	5:23	6:34	6:18	7:06	7:02	6:30	6:00	
TOTAL	15:01	17:28	16:10	16:40	16:30	16:07	14:26	
			To 12:59 P.M.	1:00 P.M. to 3:59 P.M.				
	(13)	(29)	(20)	(35)	(56)	(27)	(28)	
Dauphine & Canal								
Dumaine & Claiborne	5:48	6:09	6:40	6:28	6:27	6:08	6:13	
Dumaine & Broad	3:29	3:57	3:45	3:53	4:09	3:58	3:49	
Dumaine & Moss	3:01	2:41	2:43	2:56	3:05	2:58	2:52	
Dumaine & Alexander	2:23	2:47	2:55	2:41	3:09	2:28	2:48	
TOTAL	14:41	15:34	16:03	15:58	16:50	15:32	15:42	
ROUND TRIP	29:42	33:02	32:13	32:38	33:20	31:39	30:08	

FIGURE 18.
RUNNING TIME SUMMARY SHEET—
SAMPLE COMPANY UNDER STUDY.

RUNNING TIME ADJUSTMENT CHART
Deduction in seconds necessary
to bring vehicle up to full speed.

TIME USED BETWEEN TIME POINTS	Graded Speed			
	F	3/4	1/2	1/4
2:30 to 3:00	0	10	30	45
3:00 to 3:30	0	15	35	50
3:30 to 4:00	0	20	40	55
4:00 to 4:30	0	25	45	60
4:30 to 5:00	0	30	50	65
5:00 to 5:30	0	35	55	70
5:30 to 6:00	0	40	60	75
6:00 to 6:30	0	45	65	80
6:30 to 7:00	0	50	70	85
7:00 to 7:30	0	55	75	90
7:30 to 8:00	0	60	80	95
8:00 to 8:30	0	65	85	100
8:30 to 9:00	0	70	90	105
9:00 to 9:30	0	75	95	110
9:30 to 10:00	0	80	100	115

FIGURE 19.
RUNNING TIME ADJUSTMENT SHEET—
SAMPLE COMPANY UNDER STUDY.

The running time adjustment sheet represents the corrections for different conditions of observed speed which have been built up over a period of years as the result of experience. The form is, of course, tied in with the "grading" of speeds, which was discussed on page 45. These "correcting" figures have proved their accuracy and value in meeting the conditions of the sample company as evidenced by the many successful running time changes, both positive and negative, which have been made through the years.

Averaging Running Time Check Data

The next step is to begin averaging the running time check data by periods. Assume that a new running time is to be worked up for the line under study. The first period to be worked up is the Early A.M. The data are worked out beginning with the first time point after leaving the outer terminal of the line, progressing from time point to time point until all of the available checks for the Early A.M. period have been utilized. In this process all speeds graded other than "full" (F) must be brought up to full speed, using the running time adjustment chart (Figure 19) in the process. These full speed times are totalled and divided by the number of checks used in order to get the average full speed running time for the given time point during the Early A.M. period. This average calculated time should then be placed on the "running time summary sheet" (Figure 18) in the appropriate column. The time is entered in minutes and seconds. This procedure is repeated for each time point until the inner terminal of the line is reached. At this point the "actual" column of the running time summary sheet is totalled. This total is the inbound running time in minutes and seconds that should be used from the outer terminal of the line to the inner terminal.

This process of calculating the full speed running times is continued for each of the time points on the outbound route, beginning at the inner terminal of the line. Upon completion of the tabulation for the outbound direction, the inbound and outbound figures are added to obtain the round trip running time.

A similar procedure is followed in averaging the running times for each of the other daily periods.

An example will be given at this point, utilizing data for the A.M. Peak period in the "reverse" or outbound direction. The figures chosen were taken from a week's running time checks, from which series of observations eight (8) "normal" checks are available. The data from these checks, together with the speed gradings and an estimate of the possible "full speed" time, are given below:

Observations Taken From	Check Time Used (Min.)	Speed Graded As	Possible Full Speed Time
First data sheet	7:00	3/4	6:05
Second data sheet	5:50	F	5:50
Third data sheet	5:55	F	5:55
Fourth data sheet	6:00	F	6:00
Fifth data sheet	6:55	3/4	6:05
Sixth data sheet	6:50	F	6:50
Seventh data sheet	6:10	F	6:10
Eighth data sheet	6:20	F	6:20
		TOTAL	49:15
		Average (TOTAL divided by 8)	6:09

It will be noted that in all cases except the 1st and 5th data sheets, speeds were graded as "full" (F), in which case the check time in minutes and seconds as observed was carried across into the fourth column of the tabulation.

In the case of the first data sheet, the observation "7:00", meaning 7 minutes and no seconds, was accompanied by a speed grading of 3/4. Reference to the running time adjustment chart, Figure 19, shows that for a time of 7:00 to 7:30 under a 3/4 speed grading, 55 seconds should be deducted from the observed time in order to bring the vehicle up to full speed. This deduction of 55 seconds from 7:30 gives the 6:05, or 6 minutes and 5 seconds, entered opposite "First data sheet" in the fourth column of the above tabulation.

In the case of the fifth data sheet, the observed time of 6:55, or 6 minutes and 55 seconds, is accompanied by a speed grading of 3/4. Reference to the running time adjustment chart, Figure 19, shows that for time observations of 6:30 to 7:00, a deduction of 50 seconds is necessary when the speed is graded as 3/4 in order to bring the vehicle up to full speed. This deduction of 50 seconds from the 6:55 observed time results in the 6:05 entered under column four opposite the first column entry of "Fifth data sheet".

At this point the fourth column headed "Possible Full Speed Time" may now be totalled. The total of the eight observations is 49 minutes and 15 seconds (49:15). This total is divided by 8, the number of observations contributing to the total, in order to get the average for the time point indicated in the outbound direction during the A.M. Peak period. This quotient is 6:09, or six minutes and nine seconds. This figure is entered on the running time summary form, Figure 18, opposite the first time point in the outbound direction under the A.M. Peak column.

A similar procedure is followed in averaging and entering the running times for each of the other daily periods.

City Park Bus LINE

DAILY EXCEPT SATURDAY AND SUNDAY

DATE Week of Nov. 26, 1945

	EARLY A.M.	A.M. PEAK	A.M. BASIC	P.M. BASIC	P.M. PEAK	EARLY NIGHT	LATE NIGHT	OWL
INBOUND TRIPS								
Number of trips	3	10	8	13	9	7	12	
Average stops	21	25	23	23	22	21	16	
Average stopping time	220	344	293	299	288	256	178	
Average load	22	55	36	32	25	23	11	
Average stops per mile	6.8	8.2	7.5	7.5	7.2	6.8	5.2	
Average sec. per stop	10.5	13.8	12.7	13.0	13.1	12.3	11.1	
OUTBOUND TRIPS								
Number of trips	4	8	11	15	9	5	10	
Average stops	16	21	21	22	23	20	19	
Average stopping time	197	259	233	251	284	186	176	
Average load	13	29	20	35	56	27	28	
Average stops per mile	5.2	6.9	6.9	7.2	7.5	6.6	6.2	
Average sec. per stop	12.3	12.3	11.1	11.4	12.3	9.3	9.3	
ROUND TRIP								
Average stops	37	46	44	45	45	41	35	
Average stopping time	417	603	526	550	572	442	354	
Average load	18	42	28	34	41	25	20	
Average stops per mile	6.0	7.5	7.2	7.4	7.4	6.7	5.7	
Average sec. per stop	11.3	13.1	12.0	12.2	13.7	10.8	10.1	

FIGURE 20.

DATA ON STOP FREQUENCY AND DURATION DERIVED FROM RUNNING TIME CHECKS—SAMPLE COMPANY UNDER STUDY.

RIDING CHECK SUMMARY SHEET

Daily Except Sat. and Sunday

City Park Bus LINE

a. m. Peak. (Winter)

Month	Jan.	Mar.	Jan.	Mar.	Oct.	Apr.	Oct.	Nov.
Day	13th	3rd	4th	29th	25th	10th	28th	26th
Year	1941	1941	1943	1943	1943	1944	1944	1945
(AVERAGE LOAD)	43	47	51	51	60	52	64	55
Dumaine and Alexander								
To Orleans and Moss	4:53	4:53	4:14	4:02	3:54	4:05	4:15	4:06
To Orleans and Broad	3:43	3:08	2:48	2:54	2:54	2:43	3:03	2:49
To Orleans and Claiborne	3:41	3:42	3:47	3:36	4:14	4:05	4:23	3:59
To Dauphine and Canal	7:04	6:30	6:00	6:14	6:04	6:03	6:31	6:34
Total	19:21	18:13	16:49	16:46	17:06	16:56	18:12	17:28
(AVERAGE LOAD)	21	37	24	18	23	26	24	29
Dauphine and Canal								
To Dumaine and Claiborne	6:20	7:01	6:03	6:05	5:59	6:23	6:01	6:09
To Dumaine and Broad	4:12	4:23	3:53	3:36	3:47	4:08	3:55	3:57
To Dumaine and Moss	3:00	3:01	2:38	2:49	2:51	2:39	2:57	2:41
To Dumaine and Alexander	3:54	4:06	3:03	2:52	2:51	2:55	3:00	2:47
Total	17:26	18:31	15:37	15:22	15:28	16:05	15:53	15:34
Round Trip	36:47	36:44	32:26	32:08	32:34	33:01	34:05	33:02

FIGURE 21.
RIDING CHECK SUMMARY SHEET -
SAMPLE COMPANY UNDER STUDY.

It is customary for riding checkers to carry a stopwatch when making running time check. This watch is used to record the cumulative stop time for each trip. The stop time is noted on the riding check sheet (see "5:15" and "3:40", Figure 15), and is used in conjunction with the other observations taken to compute the average duration of time per stop.

Figure 20 is a tabulation of derived data on stop frequency and duration calculated from the series of running time checks taken for the line under study for the week of November 26, 1945. The following information is included for seven of the eight daily time columns:

Number of trips
Average number of stops
Average stopping time, seconds
Average load (passengers per trip)
Average number of stops per mile
Average duration of stops, seconds.

For example, during the A.M. Peak period on inbound trips there were, on the ten trip-observations considered, an average of 25 stops per trip with an average "total stopping time" per trip of 344 seconds. This is equivalent to an average duration of 13.8 seconds per stop. The inbound distance (Figure 7) is 3.066 miles, so that the average number of stops per mile during the A.M. Peak inbound is 8.2. The average passenger load per bus during this same period is 55 persons. Information of this type is commonly known as "Service Data", and is helpful to equipment and schedule engineers and others concerned with the operating performance of transit vehicles. Having a knowledge of the performance characteristics of the vehicle (acceleration, braking, "speed-time" curves, etc.) and the "service data" (average load, frequency and duration of stops) it is possible to estimate with considerable accuracy the probable schedule speed performance and running time requirements of a given line. These "theoretical" calculations often serve as a check on the actual performance being obtained in service.

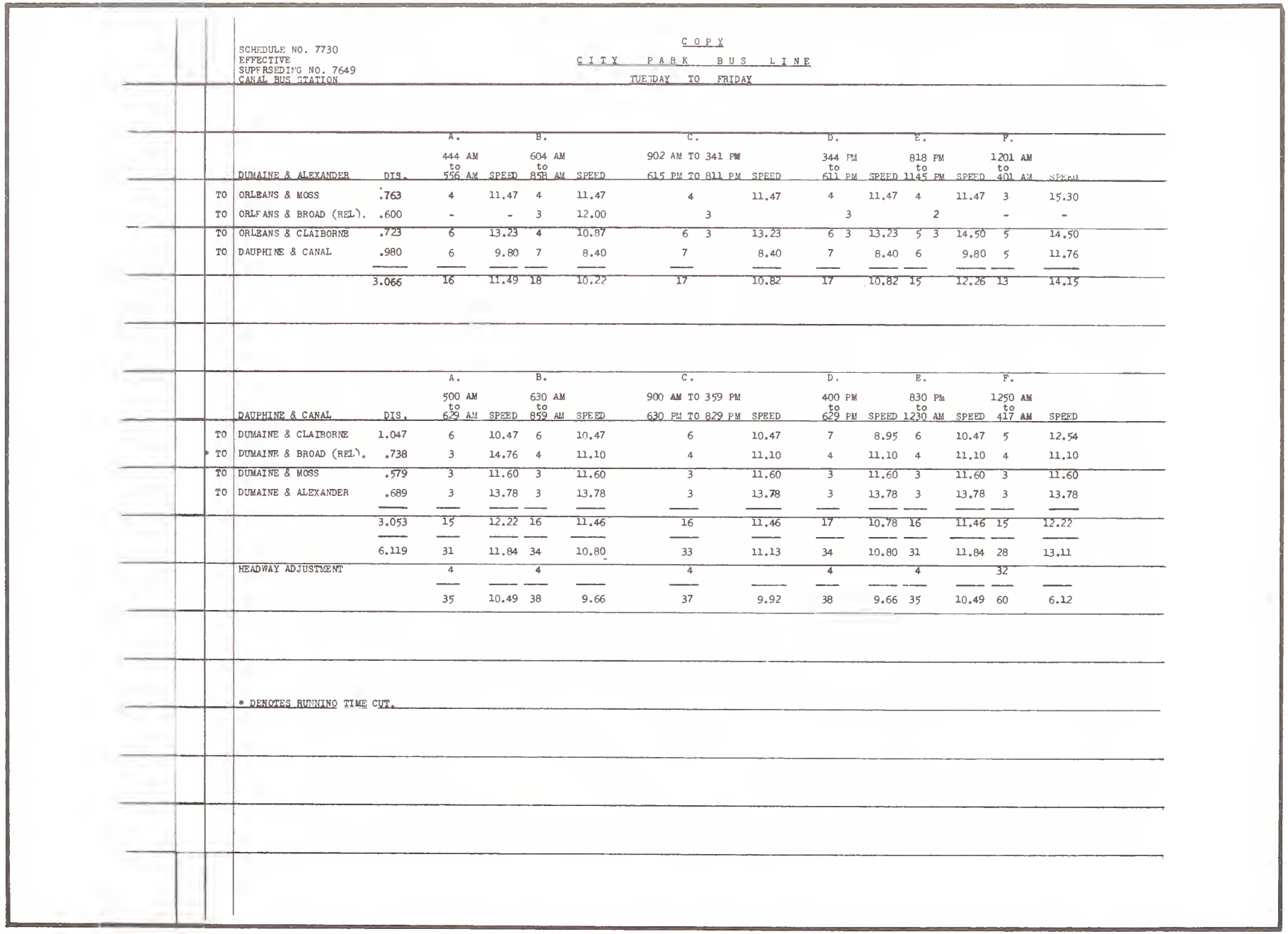
The "Riding Check Summary Sheet" is shown in Figure 21. This record consists of a set of eight (8) similar sheets - one for each daily time period. The particular sheet shown in the figure is the one for the A.M. Peak period. The data from each running time summary (Figure 18) are posted on these sheets so that a progressive record of running time observations and their trends may be available to the schedule makers.

H. Layover, Recovery or Headway Adjustment Time

The "layover", "recovery", or "headway adjustment" time (sometimes referred to as "drop back") is built into the schedule as a "cushion" to take care of the minor delays and interferences which occur along the line. This permits an operator to leave the terminal in accordance with the prescribed table of departing times even though he may have arrived at the terminal a little late as the result of such interferences.

The layover time allowance also provides an opportunity for the operator or crew to get a drink of water, smoke, or avail themselves of the rest room facilities.

On the sample property layovers are provided at the outer terminals of lines, as most lines "loop" in the central business district. Exceptions are two major lines which have a physical terminal in the business area, and



COPY

SCHEDULE NO. 7730
EFFECTIVE
SUPERSEDING NO. 7649
CANAL BUS STATION

CITY PARK BUS LINE

TUESDAY TO FRIDAY

			A. 444 AM to 556 AM		B. 604 AM to 858 AM		C. 902 AM TO 341 PM 615 PM TO 811 PM		D. 344 PM to 611 PM		E. 818 PM to 1145 PM		F. 1201 AM to 401 AM	
	DUMAINE & ALEXANDER	DIS.		SPEED		SPEED		SPEED		SPEED		SPEED		SPEED
TO	ORLEANS & MOSS	.763	4	11.47	4	11.47	4	11.47	4	11.47	4	11.47	3	15.30
TO	ORLEANS & BROAD (REL).	.600	-	-	3	12.00	3		3		2		-	-
TO	ORLEANS & CLAIBORNE	.723	6	13.23	4	10.87	6 3	13.23	6 3	13.23	5 3	14.50	5	14.50
TO	DAUPHINE & CANAL	.980	6	9.80	7	8.40	7	8.40	7	8.40	6	9.80	5	11.76
		3.066	16	11.49	18	10.22	17	10.82	17	10.82	15	12.26	13	14.15

			A. 500 AM to 629 AM		B. 630 AM to 859 AM		C. 900 AM TO 359 PM 630 PM TO 829 PM		D. 400 PM to 629 PM		E. 830 PM to 1230 AM		F. 1250 AM to 417 AM	
	DAUPHINE & CANAL	DIS.		SPEED		SPEED		SPEED		SPEED		SPEED		SPEED
TO	DUMAINE & CLAIBORNE	1.047	6	10.47	6	10.47	6	10.47	7	8.95	6	10.47	5	12.54
TO	DUMAINE & BROAD (REL).	.738	3	14.76	4	11.10	4	11.10	4	11.10	4	11.10	4	11.10
TO	DUMAINE & MOSS	.579	3	11.60	3	11.60	3	11.60	3	11.60	3	11.60	3	11.60
TO	DUMAINE & ALEXANDER	.689	3	13.78	3	13.78	3	13.78	3	13.78	3	13.78	3	13.78
		3.053	15	12.22	16	11.46	16	11.46	17	10.78	16	11.46	15	12.22
		6.119	31	11.84	34	10.80	33	11.13	34	10.80	31	11.84	28	13.11
	HEADWAY ADJUSTMENT		4		4		4		4		4		32	
			35	10.49	38	9.66	37	9.92	38	9.66	35	10.49	60	6.12

* DENOTES RUNNING TIME CUT.

FIGURE 22.
RUNNING TIME SHEET -
SAMPLE COMPANY UNDER STUDY.

two long, outlying crosstown bus lines, which are subjected to interference at several railroad crossings. In these cases layover is allowed at both ends of the line.

On the sample property the layover time allowances average approximately ten per cent of the scheduled running time on lines requiring 40 to 45 minutes per round trip, and approximately seven per cent on lines requiring 60 to 65 minutes per round trip.

I. Preparation of Running Time Sheet

One of the most important details of schedule building is the allotment of the proper amount of running time so that the average crew or operator may operate the schedule efficiently during the different periods of the day. The work of building a new schedule actually starts with the preparation of a new "Running Time Sheet" (see Figure 22).

As previously explained, the data used for building a running time for a particular line are based upon riding checks taken during the various periods of the day for a sufficient number of representative days. These checks, when totalled and averaged according to the instructions in a preceding section, will give the time in minutes and seconds that would be used by an average operator or crew for full speed operation ("F"). As these averages are worked up they are placed on the "riding check summary sheet" (Figure 21).

Comparison of the Running Time Summary Sheet with the Schedule in Effect

Having determined from the riding check summary sheet the amount of running time necessary for the new schedule, the next step is to compare the summary sheet with the schedule in effect in order to find the running time differences. This comparison is made by tabulating by time points on the present running time sheet any proposed running time which is different from the one in effect. The running times which do not change are simply checked off. This comparison of present and proposed running times on the sample property is usually shown in blue pencil, so that any difference between the old and new running times may be detected more easily.

In setting up the running time for the new schedule fractions of a minute are not used. It becomes necessary, therefore, to "give and take" with fractions of a minute as between a given time point and the adjacent ones. In any event, the total time for the round trip as experienced in whole minutes must be equal to or greater than the "fractional" running time of the summary sheet, and must in no case be cut below the calculated total.

Preparing the Running Time Sheet

The next step is to prepare a pencil copy of the new running time sheet, showing the time points and the running time period headings (see Figure 23). The following information is laid out on the blank sheet:

1. Name of line.
2. Schedule in effect (identifying number).
3. Type of schedule (weekday, Saturday or Sunday).
4. Time points (names).

City Park Bus Line
Tuesday to Friday

		Dis.	A	Speed	B	Speed	C	Speed	D	Speed	E	Speed	F	Speed
			A		B		C		D		E		F	
			444 A.M. To 556 A.M.		604 A.M To 858 A.M.		902 A.M. To 341 P.M. / 615 P.M. To 811 P.M.		344 P.M To 611 P.M.		818 P.M. To 1145 P.M.		1201 A.M To 401 A.M.	
	Dumaine and Alexander													
To	Orleans and Mass	.763	4	11.47	4	11.47	4	11.47	4	11.47	4	11.47	3	15.30
To	Orleans and Broad (Rel)	.600	-	-	3	12.00	3 (7)	-	3 (7)	-	2 (6)	-	-	-
To	Orleans and Claiborne	.733	6	13.33	4	10.87	6 3	13.33	6 8	13.29	5 3	14.50	5	14.50
To	Dauphine and Canal	.980	6	9.80	7	8.40	7	8.40	7	8.40	6	9.80	5	11.76
		3.066	16	11.49	18	10.22	17	10.82	17	10.82	15	12.26	13	14.15
			(16)		(18)		(17)		(17)		(15)		(13)	
			A		B		C		D		E		F	
			500 A.M To 629 A.M.		630 A.M To 859 A.M.		900 A.M To 359 P.M / 630 P.M. To 829 P.M.		400 P.M. To 629 P.M.		830 P.M. To 1130 A.M.		1250 A.M. To 417 A.M.	
	Dauphine and Canal													
To	Dumaine and Claiborne	1.047	6	10.47	6	10.47	6	10.47	7	8.95	6	10.47	5	12.54
* To	Dumaine and Broad (Rel)	.738	3	14.76	4	11.10	4 (10)	11.10	4 (11)	11.10	4 (10)	11.10	4	11.10
To	Dumaine and Mass	.579	3	11.60	3	11.60	3	11.60	3	11.60	3	11.60	3	11.60
To	Dumaine and Alexander	.689	3	13.78	3	13.78	3	13.78	3	13.78	3	13.78	3	13.78
		3.059	15	12.22	16	11.46	16	11.46	17	10.78	16	11.46	15	12.22
		6.119	31	11.84	34	10.80	33	11.13	34	10.80	31	11.84	28	13.11
	Drag Bar		4		4		4		4		4		32	
			35	10.49	38	9.66	37	9.92	38	9.66	35	10.49	60	6.12
			(19)		(20)		(20)		(21)		(20)			

FIGURE 23.
PENCIL COPY OF RUNNING TIME SHEET - SAMPLE COMPANY UNDER STUDY.

5. Running time period headings.
6. Proposed running time by periods and by time points (taken from the summary sheet).
7. Distance headings.
8. Speed headings.

When new schedules are made, the time point locations are rarely changed unless conditions warrant such change. The running time period headings usually remain the same, and are changed only when a shift in passenger travel is detected on the "Passenger Check Summary Sheet" (Figure 14). When such shifts in travel occur, then changes in running time period headings are made accordingly.

After preparing the pencil copy of the running time sheet (Figure 23) as described above, the running times are taken from the running time summary sheet (Figure 21) and entered (as whole minutes) on the pencil copy. This completes the time columns except for the entering of the "headway adjustment time" ("drop back"), which is added at the bottom of the sheet following the total round trip running time to get the overall scheduled time for the round trip.

The smaller circled figures appearing to the right of the running times in Columns C, D and E of (Figure 23) are the times from the respective line terminals to the inbound and outbound "relief" points (Rel.) of the line (see Glossary for definition of "relief point"). In column C, for example, the running time of four minutes from Dumaine and Alexander Streets to Orleans and Moss Streets, and the time of three minutes from the latter intersection to the inbound relief point at Orleans and Broad, are combined to give seven minutes, the time in the small circle. Similarly, on the outbound trip the time from the inner terminal to the outbound relief point is 6 plus 4, or 10 minutes.

The larger circled figures appearing below the time columns for each direction of travel are the "running times" to be used in the construction of schedules. In column B, for example, the circled figure "18" is the inbound running time of 18 minutes shown immediately above it as the B column total. The circled figure "20" is the sum of the outbound running time of 16 minutes plus the "drop back" (headway adjustment) time of four minutes, which gives the total time associated with the outbound trip.

These figures are circled for the convenience of the schedule maker.

Mileage Data for the Running Time Sheet

In order to assist the schedule maker in setting up running times which will not make the speeds between time points excessive or unsafe, all running times are shown as "speed" on a miles per hour basis. Hence, it is necessary that the distances between time points, as well as the half-trip and round-trip total distances, be known. These distance figures are obtained from the route map for the line (Figure 7).

Working with the route map, distances are ascertained and entered on the pencil copy of the running time sheet opposite their respective time points. This is done for each individual time point, as well as for the inbound trip total, outbound trip total, and total round trip.

Calculating Speeds

The final step in the completion of the running time sheet consists of calculating the speeds (1) between time points, (2) for the inbound trip. (3) for the outbound trip, and (4) for the total round trip. This last figure is the round-trip running speed from outer terminal back to outer terminal. The overall round-trip schedule speed is determined from the total round-trip time, including headway adjustment time.

Speeds are calculated by first multiplying a distance by 60 and then dividing this product by the time required to travel from one point to another in minutes. The following examples, based upon the data shown in Figure 23, describes how this is done:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \qquad \text{Speed (in M.P.H.)} = \frac{\text{Distance (in Miles)} \times 60}{\text{Time (in Minutes)}}$$

Examples:

(1) Period B, Inbound, Dumaine and Alexander to Orleans and Moss

$$\text{Speed} = \frac{0.763 \times 60}{4} = 11.47 \text{ M.P.H.}$$

(2) Period C, Inbound, Dumaine and Alexander to Dauphine and Canal

$$\text{Speed} = \frac{3.066 \times 60}{17} = 10.82 \text{ M.P.H.}$$

(3) Period D, Round Trip (Running Speed excluding Layover)

$$\text{Speed} = \frac{6.119 \times 60}{34} = 10.80 \text{ M.P.H.}$$

(4) Period D, Round Trip (Schedule Speed including Layover)

$$\text{Speed} = \frac{6.119 \times 60}{38} = 9.66 \text{ M.P.H.}$$

A "speed chart" has been devised by the Schedule Department to facilitate the work of computing speeds for the running time sheet. This chart consists of previously calculated speeds corresponding to the various running times which would ordinarily be associated with each line of the system. Then as the running times for a given line and daily time period are lengthened or shortened, speeds may be read directly and entered on the running time sheet. It is, of course, necessary to revise this chart whenever a change in route length occurs.

A further discussion of the use of the Running Time Sheet in determining new headways when new schedules are to be constructed will be included in the next section of this report under the discussion of "HEADWAY ORDER".

CHAPTER IV

THE HEADWAY ORDER

At this point it is suggested that the reader of this report refer back to Figure 2 - "Schedule Development Chart" to briefly review the "flow" of the steps in the schedule making process of the sample company. Reference to this chart shows that the Headway Order serves as a "hopper" into which the raw materials for "manufacturing" a schedule are poured. It is the focal point to which all field data and derived calculations are drawn before the actual steps of schedule preparation are begun. It is considered to be of such importance by the company that Headway Orders are issued by the Superintendent or the Chief Schedule Maker only.

A. Importance of the Headway Specification or Order

The Headway Order is of primary importance in the schedule making process for the following reasons:

1. It is the "key" to the efficient expenditure of the platform labor dollar, as it specifies the amount of service to be operated during the various periods of the day.

2. It serves as an instruction sheet for the schedule maker, who must follow it exactly.

The Headway Order and the "Running Time Sheet" (Figure 22) together contain all the information necessary for building a "Terminal Sheet" or time-table.

As the headway order is utilized by this company, it may be likened to a doctor's prescription. It prescribes, in the case of lines that are slightly abnormal, definite instructions for putting those lines back into a "healthy" condition. In the case of lines that are unprofitable, it can only alleviate to a certain extent the losses that are being incurred. In the latter cases a "major operation" may be indicated, such as the abandonment of services, their substitution with another vehicle size or type, short-lining, or rerouting, in order to correct the unfavorable conditions which exist.

B. Sources of Information

In building a headway order for a transit line, it is necessary that the proper amount of running time for the new schedule be known. The method used in allotting the proper amount of running has been explained, and the preparation of the running time summary sheet has been described in detail in Chapter III - "Running Time Check."

In addition to the running time, a sufficient number of passenger load checks, taken at the maximum load point, must be tabulated on a form which will show the average number of passengers per vehicle over a 15 - or a 30-minute period, depending upon the time of day. The development of the passenger load summary sheet was described in detail in Chapter II - "Passenger Load Check."

These two sources of data are considered the primary data required for schedule building by the company. While the schedule department relies chiefly on them for determining headways, there are other valuable sources of information that may be used in determining whether or not the schedule in effect is physically or economically sound. Such secondary information pertains to each individual line, and includes the following:

DAILY SWITCHING REPORT

Schedule Department

LINE CITY PARK BUS MONTH MAY 1946

Day & Date	400 to 500	500 to 600	600 to 700	700 to 800	800 to 900	900 to 1000	1000 to 1100	1100 to 1200	1200 to 100	100 to 200	200 to 300	300 to 400	400 to 500	500 to 600	600 to 700	700 to 800	800 to 900	900 to 1000	1000 to 1100	1100 to 1200	1200 to 100	100 to 200	200 to 300	300 to 400	Totals Sch.	Totals Misc.
Wednesday 1																										
Thursday 2																										
Friday 3										x															-	1
Saturday 4																										
Sunday 5																										
Monday 6																										
Tuesday 7																x									-	1
Wednesday 8											x														-	1
Thursday 9																										
Friday 10																										
Saturday 11										x															-	1
Sunday 12																										
Monday 13				x																					-	1
Tuesday 14																										
Wednesday 15																				ⓧ					①	-
Thursday 16														x											-	1
Friday 17																										
Saturday 18																										
Sunday 19																										
Monday 20																										
Tuesday 21																										
Wednesday 22																										
Thursday 23																										
Friday 24																										
Saturday 25																										
Sunday 26																										
Monday 27																										
Tuesday 28																										
Wednesday 29																										
Thursday 30																			x						-	1
Friday 31					x									x											-	2
																									①	9

ⓧ Schedule Causes
x All other causes

FIGURE 24.
DAILY SWITCHING REPORT -
SAMPLE COMPANY UNDER STUDY.

1. Trend charts of
   a. Passenger revenue)
   b. Car hours) See Figure 5.
   c. Revenue per car hour)
   d. Total passengers
   e. Total passengers per car hour

2. Reports on vehicles switched short of terminals because of schedule or other causes. (See "Daily Switching Report" - Figure 24).

3. Speed charts by running time periods.

These secondary data serve as a guide to the schedule maker in formulating judgments and making decisions in the preparation of the headway order.

The following are examples of the use of these secondary data:

The daily switching report for the month of May, 1946 (Figure 24) indicates very little switching of vehicles due to schedule causes. A large number of such switchings would indicate the need for a thorough study of passenger load and running time data.

The revenue trend chart in Figure 5 shows a comparison for the current year with the year before as to revenue, hours and revenue per hour. The consistent increases in revenue and revenue per hour during the spring of 1946 over the corresponding values for 1945, together with the corresponding passenger load checks, pointed up the needed schedule change which is discussed in this report.

C. Loading Standards

Before prescribing headways for any line, it is necessary that the schedule maker know the normal passenger capacity, in terms of seated and standing loads, for the various types of vehicles available to meet the schedule. With this information at hand, it is possible for him to build a schedule using these vehicles in such a way that uncomfortable overloads may be avoided, while at the same time using the minimum amount of running time and the minimum number of vehicles in the interest of economy.

The schedule department of the company has determined upon the following loading standards for its vehicles which will under its specific local conditions, operate the schedules efficiently, while giving maximum service at minimum cost:

NORMAL LOADING STANDARDS

Type of Vehicle	Class of Vehicle	Seating Capacity	Basic Standard		Peak Standard	
			Passengers	% Load	Passengers	% Load
Street Car	400	52	52	100	85	163
Street Car	8/900	52	52	100	85	163
Street Car	1000	52	52	100	85	163
Trolley Coach	1200	44	44	100	58	132
Motor Bus	1500	40	40	100	53	132
Motor Bus	1400	35	35	100	46	131
Motor Bus	1300	31	31	100	41	132

The loading standards for the vehicles in the above table were determined in the following manner:

STREET CARS - The present loading standard of 85 passengers in the peak periods has been determined as the result of experience over a long period of years. Observations were made of the manner in which patrons distributed themselves over the floor space throughout the car under different conditions of loading. Such items as aisle congestion, interference with the ingress and egress of boarding and alighting passengers, and etc., were taken into account. Schedules were built around various average peak loading standards, and the performance of operators and crews under these various experimental conditions was studied. For instance, loading standards of 90 passengers per car were used for an experimental period, but it was found that this tended to cause the schedule speed during peaks to fall off. A reduction was made to 85, which has proven satisfactory from both standpoints - namely, load and speed.

TROLLEY COACHES AND MOTOR BUSES - The present loading standards set forth in the foregoing table were also determined as the result of experience over a period of years. Observations were made of the manner in which patrons distributed themselves throughout the available standing space in the vehicle under different conditions of loading. Various loading standards were experimented with, and the resulting operating performance under actual operating conditions was observed.

The loading standards used in this case may appeal to the reader of this report as being rather low, but it must be remembered that these are the average loading standards over a fifteen minute peak period, and that the loads on individual vehicles may vary widely, some of them reaching well above 150 percent of the normal seating capacity. The sample company has a problem of segregating the races in vehicles under state law, which gives rise to the presence of vacant seats in the rear of a vehicle at times when other portions of the vehicle are filled with seated and standing passengers.

The company maintains drawings of the floor layouts of its various sizes and types of vehicles, upon which are designated the number of passengers in each section of the vehicle which have been found from experience to give the best compromise between a comfortable service to the public and an economical service to the company.

There are many other ways of determining the peak loading standards of vehicles, and the reader is referred to Parts II and III of this study for such alternative methods.

The peak loading standards shown in the preceding table apply only on lines which have heavy passenger travel and which operate on close headways. On lines where travel is light and headways far apart, it is apparent that if headways were furnished in accordance with the amount of business offered the interval between vehicles might be as long as 15 or 20 minutes. To meet this situation a "sliding scale" has been worked out whereby, as headways get longer, the loading standard becomes lower. The following table for street cars demonstrates this sliding scale:

LIMITING HEADWAY LOADING STANDARDS FOR PEAK PERIODS
(400-800-900-1000 Type Steel Street Cars)

Scheduled Headway in Minutes	Average Passengers per Car
1	85
1½	85
2	85
2½	85
3	85
3½	80
4	80
4½	75
5	70
5½	65
6	65
6½	60
7	55
7½	55

There are occasional special emergency cases where loading standards are disregarded and service is furnished according to the type of load.

D. Headway Order Sheet

A sample Headway Order sheet for the line under study is shown in Figure 25A & B.

The information set forth on this control form are as follows:

1. Terminal leaving times of first and last vehicles.

2. Headway, or interval in minutes between vehicles, during different periods of the day.

3. Number of vehicles used during the different periods of the day.

4. Confirmation of the total round trip time.

The sheet is headed with the number of the headway order, the number of the new schedule to be prepared, the name of the line, the type of schedule (weekday,

FORM 742-0633 6-46 1M

SCHEDULED HEADWAY ORDER

(1)

SCHEDULE DEPARTMENT

SCH. No _____ ORDER No _____

City Park Bus LINE Tuesday to Friday SCHEDULE

	Number Of Units	Running Time	Headways in Minutes				Terminal		Remarks
1					4:44	a.m. ✓	Dumaine and Alex.		
2			20 mins	To	5:04	" ✓	"	"	
3			15 "	To	5:34	" ✓	"	"	
4			12 "	To	5:46	" ✓	"	"	
5			10 "	To	5:56	" ✓	"	"	
6			8 "	To	6:04	" ✓	"	"	
7			7 "	To	6:18	" ✓	"	"	
8			6 "	To	6:30	" ✓	"	"	
9			5 "	To	6:45	" ✓	"	"	
10			4½ "	To	6:54	" ✓	"	"	
11			4 "	To	6:58	" ✓	"	"	
12			3 "	To	7:19	" ✓	"	"	
13			2½ "	To	7:49	" ✓	"	"	
14			3 "	To	7:52	" ✓	"	"	
15			2½ "	To	7:57	" ✓	"	"	
16	15 ✓		3 "	To	8:00	" ✓	"	"	
17			2½ "	To	8:05	" ✓	"	"	
18			3 "	To	8:08	" ✓	"	"	
19			2½ "	To	8:13	" ✓	"	"	
20			3 "	To	8:28	" ✓	"	"	
21			3½ "	To	8:42	" ✓	"	"	
22			4 "	To	9:06	" ✓	"	"	
23			4½ "	To	9:33	" ✓	"	"	
24			5 "	To	9:43	" ✓	"	"	
25	6 ✓	37 ✓	6-6½ "	To	2:31	P.M. ✓	Baugh and Canal		
26			5½ "	To	2:53	" ✓	"	"	
27			5 "	To	3:23	" ✓	"	"	
28			4½ "	To	3:32	" ✓	"	"	
29			4 "	To	3:44	" ✓	"	"	
30			3½ "	To	3:58	" ✓	"	"	
31			3 "	To	4:43	" ✓	"	"	
32			2½ "	To	4:45½	" ✓	"	"	
33			2 "	To	4:47½	" ✓	"	"	
34			2½ "	To	4:50	" ✓	"	"	
35			2 "	To	4:52	" ✓	"	"	
36			2½ "	To	4:54½	" ✓	"	"	
37			2 "	To	4:56½	" ✓	"	"	
38			2½ "	To	4:59	" ✓	"	"	

(See Sheet No 2)

CHECKED BY Baget ISSUED TO Caller

DATE 5-22-46 DATE ISSUED 5-20-46

DATE RETURNED 5-20-46

FIGURE 25A.
HEADWAY ORDER SHEET –
SAMPLE COMPANY UNDER STUDY.

FORM 742-0633 6-46 1M

SCHEDULED HEADWAY ORDER

(2)

SCHEDULE DEPARTMENT

SCH. No. _____ ORDER No. _____

City Park Bus LINE Tuesday to Friday SCHEDULE

	Number Of Units	Running Time	Headways in Minutes				Terminal		Remarks
39					4:59	P.M. ✓	Baugh	and Canal	
40	18 ✓		2 mins	To	5:01	" ✓	"	"	
41			2½ "	To	5:03½	" ✓	"	"	
42			2 "	To	5:05½	" ✓	"	"	
43			2½ "	To	5:08	" ✓	"	"	
44			2 "	To	5:30	" ✓	"	"	
45			2½ "	To	5:32½	" ✓	"	"	
46			2 "	To	5:34½	" ✓	"	"	
47			2½ "	To	5:37	" ✓	"	"	
48			2 "	To	5:39	" ✓	"	"	
49			2½ "	To	5:41½	" ✓	"	"	
50			2 "	To	5:43½	" ✓	"	"	
51			2½ "	To	5:46	" ✓	"	"	
52			2 "	To	5:48	" ✓	"	"	
53			2½ "	To	5:50½	" ✓	"	"	
54			2 "	To	5:52½	" ✓	"	"	
55			2½ "	To	6:00	" ✓	"	"	
56			2 "	To	6:08	" ✓	"	"	
57			2½ "	To	6:18	" ✓	"	"	
58			3 "	To	6:21	" ✓	"	"	
59			3½ "	To	6:28	" ✓	"	"	
60			4 "	To	6:32	" ✓	"	"	
61			5 "	To	6:47	" ✓	"	"	
62	7 ✓	37 ✓	5-5½ "	To	8:06	" ✓	"	"	
63			5½ "	To	8:28	" ✓	"	"	
64			6 "	To	8:34	" ✓	"	"	
65	5 ✓	35 ✓	7 "	To	10:26	" ✓	"	"	
66			7½ "	To	10:41	" ✓	"	"	
67			8 "	To	10:49	" ✓	"	"	
68	4 ✓	35 ✓	8½-9 "	To	11:50	" ✓	"	"	
69			10 "	To	12:00	M.N. ✓	"	"	
70			15 "	To	12:30	A.M. ✓	"	"	
71			20 "	To	12:50	" ✓	"	"	
72			27 "	To	1:17	" ✓	"	"	
73			60 "	To	4:17	" ✓	"	"	

CHECKED BY Baget

DATE 5-22-46

ISSUED TO Caller

DATE ISSUED 5-20-46

DATE RETURNED 5-20-46

FIGURE 25B.

HEADWAY ORDER SHEET—
SAMPLE COMPANY UNDER STUDY.

Saturday, Sunday, holiday), the date, and the names of the person preparing the headway order and the person who checked his work. Columns are provided for the number of units, the running time, the headways in minutes, the names of the line terminals, and "remarks".

Before discussing the method of preparing the headway specification, some attention will be given to methods for calculating "headway" and "changes in headway".

E. Procedure for Calculating Headway and Changes in Headway

In preparing the Headway Order, the numbers of vehicles required at different times of the day are determined through an examination of the loads to be handled during those daily periods and the loading standards of the vehicle to be used for those corresponding periods. In each instance the passenger load to be handled in a given time interval is determined from the summary sheet and divided by the loading standard of the vehicle for that time period to determine how many vehicles must pass the maximum load point during that interval in order to handle the passenger load. The corresponding headways are determined by dividing the round-trip running time by the number of vehicles to be used.

When the round-trip running time is exactly divisible by the number of vehicles to be used, and no whole or half minutes are left over, the calculation of headway is a simple mathematical task. The following examples serve to illustrate the calculation:

No. of Vehicles to be Used	Running Time in Minutes	Proposed Headway in Minutes
4	40	10
12	84	7
6	36	6
5	45	9
6	30	5

When the round-trip running time is not exactly divisible by the number of vehicles to be used, then it is necessary to determine the number of vehicles to be operated on a whole minute headway, and the number of vehicles to be operated on a half-minute headway. The problems shown below illustrate how this should be done:

Number of Cars	Running Time (In Minutes)	Allocated Vehicles and Headways			
		Cars	Headway	Cars	Headway
8	35	2	4	6	$4\frac{1}{2}$

1. The number 35 is not evenly divisible by 8.
2. Three minutes are left over.
3. Reducing the three minutes to half-minutes will give six one-half minutes intervals.
4. Therefore, increasing the headway on six vehicles by one-half minute to use up the "left-over" time, will give six vehicles on a four one-half minute headway.

5. The two remaining cars will operate on the four-minute headway.
6. The result will be six cars on $4\frac{1}{2}$ minutes, equalling (6 x $4\frac{1}{2}$) 27 minutes, and two cars on 4 minutes, equalling (4 x 2) 8 minutes, a total of 8 cars and 35 minutes.

Number of Cars	Running Time (In Minutes)	Allocated Vehicles and Headways			
		Cars	Headway	Cars	Headway
7	54	4	$7\frac{1}{2}$	3	8

1. The number 54 is not evenly divisible by 7.
2. Five minutes are left over.
3. Reducing the five minutes to half-minutes will give ten one-half minute intervals.
4. Therefore, increasing the headway on all vehicles by one-half minute will use up seven of these half-minute intervals, leaving three one-half minute intervals as yet unused.
5. Increasing the headway on three cars (on the $7\frac{1}{2}$ minute headway) by one-half minute, will give three cars on an 8 minute headway interval; this uses up all the "left-over" time from the initial division.
6. The four remaining cars will operate on the $7\frac{1}{2}$ minute headway.
7. The result will be three cars on 8 minutes, equalling (3 x 8) 24 minutes, and four cars on $7\frac{1}{2}$ minutes, equalling (4 x $7\frac{1}{2}$) 30 minutes, a total of 7 cars and 54 minutes.

As an example of how headways are changed to bring the average passenger load per car back to normal, assume that the peak loading standard on a certain type of street car is 78 passengers, and that the passenger load summary sheet shows that an average of 90 passengers per car is being handled with cars scheduled to operate on a $4\frac{1}{2}$ minute headway. It is evident from these assumptions that the cars are being overloaded, and, in order to correct the condition, additional cars should be operated on a more frequent headway.

The calculations required in determining the new headway are:

Number of one-half minutes in $4\frac{1}{2}$ minutes = 9.

Number of passengers handled per one-half minute equals 90 divided by 9 = 10.

Number of one-half minutes required in proposed headway equals 78 divided by 10 = 7.8 = 8.

or, 8 x $\frac{1}{2}$ = 4 minutes.

F. Preparing the Headway Specification

The following data have been summarized in greatly condensed form from the superseded running time sheet (not included in this volume):

FORMER RUNNING TIME, MINUTES

	A. Early A.M.	B A.M. Peak	C. Basic Early Night	D. P.M. Peak	E. Late Night	F. "Owl"
Inbound Time	16	18	17	17	16	13
Outbound Time	16	16	17	18	16	15
Headway Adjustment	4	4	4	4	4	32
Total Outbound	20	20	21	22	20	47
Total Round Trip	36	38	38	39	36	60

The corresponding data, as extracted from the new running time sheet (Figure 22), are as follows:

NEW RUNNING TIME, MINUTES

	A. Early A.M.	B. A.M. Peak	C. Basic Early Night	D. P.M. Peak	E. Late Night	F. "Owl"
Inbound Time	16	18	17	17	15*	13
Outbound Time	15*	16	16*	17*	16	15
Headway Adjustment	4	4	4	4	4	32
Total Outbound	19*	20	20*	21*	20	47
Total Round Trip	35*	38	37*	38*	35*	60

Thus, in preparing the Headway Order, the schedule maker must take into account the lowered running time for the new schedule which is indicated for five of the seven daily periods.

The passenger load data upon which the new schedule is to be predicated is shown in Figures 26, 27 and 28. Each of these figures is a composite illustration which includes portions of several sheets of the passenger load summary. For example, the inbound portions of sheets #1, 2 and 3 are shown in Figure 26; the outbound portions of sheets #4, 5 and 6 are shown in Figure 27; and the outbound portions of sheets #7 and 8 (including a trip sheet analysis of the loads on the "owl" run) are shown in Figure 28.

The following problems present themselves upon study of these passenger load summaries:

1. (Figure 26) Loads are satisfactory from the beginning of the schedule through the 7:15 - 7:30 A.M. 15-minute time band. In the 7:30 - 7:45 time band, however, the individual buses carry persistent overloads - on successive days the average loads under the old schedule run 65, 61, 52, 61 for vehicles which seat 40 passengers and have a peak loading standard of 53, and 17 of the 20 buses appearing in this band are circled to denote overloads. Some relief is required in this period.

(* Denotes reduction in new running time as compared with old running time.)

SCHEDULE No. 7649 #1

LINE CITY PARK BUS

SCHEDULE TIME AT DUMAINE & ALEXANDER

TRAIN NO.	SCHEDULE TIME	DATE TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	WED. 5-8 LOAD	LOAD
1	444					
15	504					
1	519					
8	534	31	41	25	22	
15	546					
1	556	51 81	41 41	35 45	22 25	
4	*604	29 34	26 32	43 41	21 26	
8	611	34 48	38 46	38 31	30 41	
12	618	42 37	44 28	40 41	43 36	
15	634	58 74	22 46	41 31	28 31	
17	650	25 33	43 42	42 34	34 28	
1	655	35	37	39	24	
4	640	46 106	45 125	21 102	26 80	
6	645	47	45	43	42	
8	649½	54 43	43 48	45 43	42 46	
10	654	39	52	44	36	
12	658	33 173	52 192	46 178	61 183	
13	701	28	29	38	25	
15	704	26 41	26 43	42 41	28 40	
17	707	56	40	39	24	
1	710	44	59	43	42	
3	718	46 208	50 214	45 207	57 200	
3	714	57	46	44	30	716
4	718½	28	48	29	29	719
8	722	54 24	51 67	52 41	49 60	724
6	724	73	73	56	45	724
8	727	60	58	56	60	724
9	729½	45 338	53 339	60 306	58 301	729
10	732	73	59	46	56	731
12	735	58 68	52 61	56 52	58 61	734
13	738	61	57	57	61	736
15	740½	56	54	54	54	739
17	743	57 318	57 300	44 268	50 305	744

SCHEDULE No. 7649 #2

LINE CITY PARK BUS

SCHEDULE TIME AT DUMAINE & ALEXANDER

TRAIN NO	SCHEDULE TIME	DATE TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	WED. 5-8 LOAD	LOAD
7	746	64	60	43	61	744½
1	748½	34	40	37	44	749
2	751	45 47	27 47	56 47	43 52	752
3	754	37	45	55	63	754½
4	756½	44	62	40	62	757
5	759	55 279	48 284	30 281	40 313	800
6	802	51	53	46	57	802½
8	805	46 50	29 44	44 50	64 57	805
9	807½	56	47	54	51	808
10	810	42	37	50	56	810½
12	813	54 294	52 218	56 250	59 287	813
13	816	36	45	47	35	816
15	819	51 45	49 46	40 44	61 45	819
17	822	48	52	49	38	822
7	825	43	48	43	34	
1	828	49 337	35 339	50 339	55 345	
3	831½	42	50	52	67	
4	835	49 43	48 47	41 45	44 49	
6	838½	54	37	47	47	
8	842	28 173	32 187	41 181	39 177	
9	846	56	24	36	37	
10	850	40 42	43 31	37 40	31 35	
12	854	24	31	39	37	
15	858	49 169	26 134	44 158	35 140	
17	902	45 40	48 38	46 44	45 37	
1	906	35	36	42	35	
3	910½	40 150	27 113	44 132	32 112	
4	915	44	30	33	26	
6	919½	49 44	48 37	47 41	41 37	
8	924	30	38	43	40	
10	928½	54 177	47 157	39 162	39 144	
12	933	34 34	52 43	35 38	30 37	
15	938	31	46	43	51	
17	943	42 107	30 138	37 114	30 111	

SCHEDULE No. 7649 #3

LINE CITY PARK BUS

SCHEDULE TIME AT DUMAINE & ALEXANDER

TRAIN NO	SCHEDULE TIME	DATE TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	WED. 5-8 LOAD	TUES. 5-14 LOAD
1	949	44 44	69 56	39 38	43 46	
4	955½	44 88	42 111	37 74	48 91	
8	1002	33	40	38	33	
10	1008	46 43	42 35	40 40	35 33	
12	1014½	47	26	45	27	
15	1021	57	40	37	42	
1	1027	51 214	28 176	42 202	29 166	
4	1033½	48	46	45	40	
8	1040	41 37	29 32	39 39	14 29	
10	1046	26	39	38	24	
12	1052½	26	30	35	33	
15	1059	42 183	15 159	37 194	34 145	
1	1105	36	33	33	28	
4	1111½	30 31	28 29	30 33	32 30	
8	1118	19	21	31	23	
10	1124	39 134	34 116	36 130	37 120	
12	1130½	40	22	31	42	
15	1137	40	34 26	29 26	42	17 32
1	1143		29	28		44
4	1149½		25	19		32
8	1156	40	18 128	23 130	42	33 176
10	1202		28	19		16
12	1208½		29 23	22 24		45 29
15	1215		17	26		32
1	1221		31	18		24
4	1227½		11 116	36 121		28 165
8	1234		27	31		36
10	1240		28 31	34 30		27 31
12	1246½		44	32		34
15	1253		27	20		35
1	1259		31 157	31 148		25 176
4	105½		21	24		26
8	118		30 51	26 50		18 44

FIGURE 26.

PASSENGER LOAD SUMMARY SHEETS — INBOUND - PORTIONS OF SHEETS #1, #2, AND #3 — SAMPLE COMPANY UNDER STUDY.

PASSENGER CHECKS

#4

E DIVISION

SCHEDULE TIME AT DAUPHINE & CANAL

TRAIN NO	SCHEDULE TIME	DATE OF TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	WED. 5-8 LOAD	TUES. 5-14 LOAD	LOAD
10	135	24		39	25		
12	141½	25 17	26	25 14	31 32		
15	148	39		38	42		
1	154	20 108	26 24	33 131	30 128		
4	200½	25	33	37	42		
8	207	41 37	35 31	35 28	46 39		
10	213	40	31	30	—		
12	219½	29	36	49	(59)		Removed Headway
15	226	49 184	42 177	39 170	46 193		
1	232	48	18	30	35		231
4	237½	25	49	43	25		236½
6	243	30 29	42 34	38 32	30	42 32	242
8	248½	43	31	30		29	247½
10	254	45	44	34		29	253
12	259	43 334	22 306	14 189	40	28 138	258
13	304	32	45	24		46	308
16	309	19	38	35		48	308
1	314	52 35	29 24	43 33		27 27	313
4	319	24	46	24		38	318
6	324	42	29	47		20	323
8	328	23 213	32 219	27 200		42 221	327½
10	332	13	28	28		28	332
12	335½	44	15	21		27	336
13	339	18	30	20		35	340
13	342½	— 31	30 34	31 29		23 32	344
16	346	49	36	43		43	*
18	349	52	29	16		43	347½
7	352	41	41	42		26	351
1	353	26	41	13		23	356½
4	358	33 235	(55) 305	31 245		36 284	358
5	401	25	28	33		37	
6	404	40 40	20 31	43 38		39 35	
8	407	34	40	37		30	
10	410	43	23	30		48	
12	413	(58) 303	46 167	47 192		22 176	

PASSENGER CHECKS

#5

E DIVISION

SCHEDULE TIME AT DAUPHINE & CANAL

TRAIN NO	SCHEDULE TIME	DATE TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	TUES. 5-14 LOAD	LOAD
13	416	27	44	30	41	
14	419	47	37	33	43	
13	422	43 38	39 28	31 32	21 39	
16	425	36	34	34	26	
18	428	38 191	37 191	34 162	36 167	
7	431	(59)	44	51	38	
1	434	51 48	25 40	18 44	48 44	
4	437	42	34	53	38	
3	440	(54)	46	48	53	
6	443	38 240	52 201	50 280	45 280	
8	445½	45	32	52	36	
9	447½	41	46	21	36	
10	450	(61) 50	(62) 44	43 44	(64) 42	
11	452	(59)	42	42	41	
12	454½	50	16	52	28	Removed Headway
13	456½	32	44	(54)	43	
14	459	(63) 261	(67) 209	42 206	43 291	
13	501	(57)	(72)	40	38	
16	503½	45	(58)	46	(62)	
17	505½	34 52	52 63	43 56	38 52	
18	508	(66)	50	(67)	(57)	508
7	510	52	(71)	(65)	(64)	510
1	512½	(61)	(65)	(67)	49	512
2	514½	49 343	(73) 444	(63) 391	(70) 265	514
4	517	(55)	(59)	(71)	(57)	516
5	519½	(61)	(67)	(72)	(61)	518
6	521½	53 57	(74) 63	49 63	(56) 58	520 × 522 524
8	524	50	(71)	(69)	(60)	
9	526½	(59)	(76)	(63)	(61)	526
10	529	(62) 340	(63) 409	(64) 378	(64) 349	528

PASSENGER CHECKS

#6

E DIVISION

SCHEDULE TIME AT DAUPHINE & CANAL

TRAIN NO	SCHEDULE TIME	DATE TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	TUES. 5-14 LOAD	LOAD
11	531	(57)	49	40	49	530
12	533½	51	(58)	(56)	34	532½
13	536½	41 51	52 49	49 47	49 46	534½
14	538	49	51	(56)	51	537
15	540	55	40	39	45	539
16	542½	(65)	49	51	40	540½
17	544½	44 240	41 249	50 249	53 251	550½
18	547	49	(57)	33	41	546
7	549	52	38	34	38	548
1	551½	30 41	41 46	27 37	39 44	550½
2	553½	51	43	46	(59)	554½
4	556	39	45	43	55	559
5	558½	34 245	53 277	44 229	40 249	562½
6	601	(61)	42	47	40	600 × 602
8	603½	(58)	(61)	(63)	(54)	604
9	606	(58) 57	(67) 57	52 51	55 52	606
10	608½	(63)	(62)	42	(66)	608
11	611	(59)	52	(58)	47	610½
12	613½	43 339	(66) 240	44 206	53 213	612
13	616	(65)	(68)	48	38	615½
13	619	42 41	38 46	52 44	40 33	618
16	622	40	46	53	31	621
17	625½	30	38	35	22	624½
7	629	32 207	37 227	33 221	36 167	632
2	633	23	39	41	19	632
5	636	46	43	26	20	637
6	643	48 37	41 35	28 29	36 46	642
9	648	36	16	41	22	647
12	653	46	—	26	32	650
15	658	24 223	— 139	19 171	— 181	
17	703½	20	—	16	—	
7	709	38 37	—	38 39	—	
2	714½	27	—	25	—	Removed Headway
5	720	34	—	29	—	
9	725½	17 134	—	38 146	—	

FIGURE 27.

PASSENGER LOAD SUMMARY SHEETS - OUTBOUND - PORTIONS OF SHEETS #4, #5, AND #6 - SAMPLE COMPANY UNDER STUDY.

PASSENGER CHECKS

#7

DIVISION

SCHEDULE TIME AT DAUPHINE & CANAL

TRAIN No.	SCHEDULE TIME	MON. 4-8 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	TUES. 5-14 LOAD	LC
13	721	33	—	30	—	
15	738	—	—	14	—	
17	742½	— 53	28 25	— 22	18 22	
7	747	—	29	—	20	
2	758½	— Lunch Time	26	— Lunch Time	19	
5	788	—	15 38	—	29 36	
9	803½	—	22	—	13	
13	809	— 20	25 20	— 22	20 21	
15	814	—	13	—	37	
17	819½	—	30	—	16	
7	825	39 30	11 101	22 32	21 107	
2	831	22	18	11	19	
5	839½	29 24	25 24	19 18	23 32	
9	844	23	24	26	30	
13	850½	17	22	19	19	
17	857	23 105	28 121	14 87	21 112	
7	904	19	18	37	25	
2	911	24 20	31 30	18 27	27 37	
5	918	12	24	29	21	
9	925½	26 91	26 119	22 106	34 107	
17	938	24	52	31	42	
7	940	46 25	40 38	38 24	22 83	
2	947	23	27	19	18	
5	954	46 129	33 152	15 97	28 110	
9	1001½	39	21	30	45	
17	1009	24 27	30 32	39 30	28 30	
7	1016	30	46	28	25	
2	1023	18 106	30 127	24 121	28 120	
5	1030	17	14	23	27	
9	1037½	17 23	31 27	11 23	19 23	
17	1045	24	35	16	28	
7	1052	25	33	39	25	
2	1059	21 110	22 121	24 113	15 114	

PASSENGER CHECKS

#8

DIVISION

TUESDAY TO FRIDAY SCHEDULE

SCHEDULE TIME AT DAUPHINE & CANAL (OUT BOUND) CHECKED AT DUMAINE & CLAIBORNE

TRAIN No	SCHEDULE TIME	DATE OF CHECK TUES. 4-8 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	TUES. 5-14 LOAD	LOAD	LOAD	LOAD	LOAD	TRIP SHEET TUES 5-7 LOAD	FRI. 4-26 LOAD	FRI. 5-29 LOAD	THURS. 5-28 LOAD	PROPORED HEADWAY
5	1106	26	19	16	23									
9	1113½	33 24	18 21	14 18	24 24									
17	1121	18	28	23	30									
7	1128	77	62	53	77					39	37	32	30	
2	1135									48	32	39	26	
5	1142									40	77	27	18	
9	1151									23	35	50	39	
17	1200									48	54	26	35	
2	1215									47	59	44	42	
9	1220									21	53	39	31	
2	1250									19	24	25	23	
9	117									21	23	34	21	
9	217									25	36	28	20	
9	317									16	22	26	8	
9	417									9	13	7	7	

FIGURE 28

PASSENGER LOAD SUMMARY SHEETS — OUTBOUND - PORTIONS OF SHEETS #7 AND #8 - SAMPLE COMPANY UNDER STUDY.

2. (Figure 26) While the 7:45 - 8:00 period appears to be adequately served as indicated by averages of 53 or less, and less than 50 per cent of the buses carrying individual overloads, the 8:00 - 8:15 period is showing a tendency (on the last day checked) to exceed the loading standard (53), with four of the five buses on that day being overloaded. Some adjustment is indicated for this period.

3. (Figure 26) From 8:15 A.M. on there is no indication of overloading.

4. (Figure 27) In the late basic "school and shopper band" (3:30 - 4:00 P.M.) the buses appear to be quite lightly loaded (averages of 31, 34, 29 and 32), indicating the possibility of reducing the service somewhat in this period.

5. (Figure 27) In the 5:15 - 5:30 band of the P.M. peak period there is evidence of overloading (average loads of 57, 68, 63 and 58, with a majority of the buses carrying individual overloads, some as high as 71 - 76 passengers against a loading standard of 53). This requires correction. The remainder of the P.M. peak period seems to be adequately cared for.

In preparing the new headway order an effort will be made to correct the above conditions as indicated by the passenger load summaries, and to adjust for the reduced running time which appears possible of attainment.

Reference should now be made to the Scheduled Headway Order, Figure 25 (A & B), the new Running Time Sheet, Figure 22, and the Passenger Load Summaries, Figures 26, 27 and 28.

Early A.M. Period

In building the Headway Order the schedule maker studies each of these exhibits and proceeds to make his entries on the sheet. In the illustration at hand he shows the first bus leaving the outer terminal (Dunmine and Alexander) at 4:44 A.M., as in the existing schedule. Since there is no problem in the Early A.M. hours, he follows the present outer terminal leaving times (shown under "Schedule Time" in Figure 26) until 7:16 A.M., writing the "headway specification" on the form step by step as shown in the first twelve lines of Figure 25A.

A.M. Peak Period

In the A.M. Peak period of the existing schedule there are 14 buses on a 38 minute round trip time. The resulting headway calculation would be:

Number of Buses	Running Time (In Minutes)	Allocated Vehicles and Headways			
		Buses	Headway	Buses	Headway
14	38	8	$2\frac{1}{2}$	6	3

38 divided by 14 equals 2 with 10 minutes over.

10 minutes equal 20 "half-minutes".

Increasing the headway on all 14 buses by one-half minute uses up 14 of the 20 "half-minutes" and leaves 6 over.

Increasing the headway on 6 of the buses by another "half-minute" each uses up the remaining time. Therefore, 8 buses operate on a (2 plus $\frac{1}{2}$) $2\frac{1}{2}$ minute headway, and 6 buses operate on a (2 plus $\frac{1}{2}$ plus $\frac{1}{2}$) 3 minute headway:

8 x $2\frac{1}{2}$		=	20 minutes
6 x 3		=	18 minutes
14	TOTAL		38 minutes

In the 7:30 - 7:45 time band of the existing schedule the average load per bus was 61 passengers on the latest day checked. The average for the four days was 60 passengers per bus. The buses in this period are operating on a $2\frac{1}{2}$ - 3 minute headway - three buses on a $2\frac{1}{2}$ and two buses on a 3. There are:

	3 x 5 "half-minutes", or 15	"half minutes"
plus	2 x 6 "half-minutes", or 12	"half minutes",
a total of 5	27	"half-minutes"

per bus, or 27 divided by 5 = 5.4 "half minutes" per bus.

Number of passengers handled per half minute equals 60 divided by 5.4, or 11.

If the average load is to be reduced to a loading standard of 53, the number of "one-half minutes" required in the new headway equals
53 divided by 11, or 4.82 - Say 5.

This means that the new headway during the 7:30 - 7:45 time band must be
5 x $\frac{1}{2}$ = $2\frac{1}{2}$ minutes
instead of $2\frac{1}{2}$ - 3 as at present. In other words, an additional vehicle should be scheduled past the inbound maximum load point during this period, as determined by the time at the outer terminal of the line.

With an additional (15th) vehicle in the A.M. Peak period of the proposed new schedule, there are 15 buses on a 38 minute round trip time. The resulting headway calculation would be:

Number of Buses	Running Time (In Minutes)	Allocated Vehicles and Headway			
		Buses	Headway	Buses	Headway
15	38	14	$2\frac{1}{2}$	1	3

38 divided by 15 equals 2 with 8 minutes over.

8 minutes equal 16 "half-minutes".

Increasing the headway on all 15 buses by one-half minute uses up 15 of the 16 "half-minutes" and leaves 1 over.

Increasing the headway on 1 of the buses by another "half-minute" uses up this remaining half-minute. Therefore, 14 buses operate on a (2 plus $\frac{1}{2}$) $2\frac{1}{2}$ minute headway, and 1 bus operates

on a (2 plus $\frac{1}{2}$ plus $\frac{1}{2}$) 3 minute headway:

14 x $2\frac{1}{2}$	=	35 minutes
1 x 3	=	3 minutes
15 TOTAL		38 minutes

The schedule maker must now continue with the preparation of the Headway Order, using 15 buses in the morning peak and placing them so that the 7:30 - 7:45 A.M. period operates on a $2\frac{1}{2}$ minute headway.

Resuming at 7:16 A.M., a 3-minute headway interval is added, bringing the time to 7:19 A.M. at the outer terminal, as noted on line 12 of the Headway Order. Then 12 $2\frac{1}{2}$-minute headway intervals are prescribed between 7:19 and 7:49 A.M., which amply covers the "trouble" period of 7:30 - 7:45. This is followed by a 3-minute interval to 7:52, two $2\frac{1}{2}$-minute intervals to 7:57, and so on until 8:13 A.M. is reached. The 12 $2\frac{1}{2}$-minute intervals, the one 3-minute interval, and the two $2\frac{1}{2}$-minute intervals between 7:19 and 7:57 are the "14 x $2\frac{1}{2}$ and 1 x 3 combination" which fits the 15 vehicles into a 38-minute round trip time. The use of 4 $2\frac{1}{2}$- minute intervals and 2 3-minute intervals following 7:57 A.M. places 6 buses instead of 5 in the 8:00 - 8:15 time band, thereby helping to lower the average load in this period and to better distribute the load for the 30-minute period 7:45 - 8:15 A.M.

At 8:16 and following the existing schedule is adhered to until 9:43 A.M. Intervals of 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$ and 5-minutes are prescribed, as indicated on lines 20-24 of the Headway Order (Figure 25A) and in the second portion (sheet #2) of Figure 26, reading from 8:16 down to the 9:43 entry at the bottom of the sheet.

Basic Period

From 9:43 A.M. until 2:31 P.M. the inbound loads are controlling on the line under study. After 2:31 P.M. the inner terminal times are used in completing the Headway Order.

The old basic running time was 38 minutes. The proposed new running time for that period is 37 minutes. Therefore, on the existing schedule (see Figure 26) the basic headways are:

4 buses @ $6\frac{1}{2}$	=	26 minutes
2 buses @ 6	=	12 minutes
6 TOTAL		38 minutes.

On the proposed new schedule the 6 - $6\frac{1}{2}$ minute headway prescribed on the Headway Order between 9:34 A.M. and 2:31 P.M. (line 25, Figure 25A) consists of:

2 buses @ $6\frac{1}{2}$	=	13 minutes
4 buses @ 6	=	24 minutes
6 TOTAL		37 minutes

This letter combination would be used in building the new terminal sheet.

Reference to lines 25 and 26 of Figure 25A and the 2:32 - 3:24 P.M. schedule times in the left-hand group of figures on Figure 27 shows that the schedule maker prescribed the same number and sequence of $5\frac{1}{2}$ and 5 minute headway intervals for the new schedule as on the old one. The entries differ

only by a "clock time" of one minute, ending at 3:23 on the Headway Order and 3:24 on the load summary sheet. Following 3:23 P.M. there is a proposed change in the new schedule in the interest of better load factor and schedule economy.

In the 39-minute period from 3:19 to 3:58 P.M. on the existing schedule (see Figure 27) there are eleven (11) vehicles on headways as follows:

1	@ 5 minutes	=	5 minutes
2	@ 4 minutes	=	8 minutes
4	@ $3\frac{1}{2}$ minutes	=	14 minutes
4	@ 3 minutes	=	12 minutes
11	TOTAL		39 minutes

The 3:30 - 4:00 P.M. time band shows an average load of 31 passengers per vehicle for the four days checked, and 32 per vehicle on the last day checked. The average headway interval during this period on the old schedule is 30 minutes divided by 9 vehicles, or 3.33 minutes. This is the equivalent of 3.33 x 2 or 6.66 (say 7) one-half minute intervals. The average passenger load per "half-minute" is, therefore,

32 divided by 7, or 4.58.

To achieve a load in this period nearer the seated load of 40 passengers, the headway interval should be

40 divided by 4.58, or 8.75, say 9,

"half-minute" intervals. This is equivalent to a 9 x $\frac{1}{2}$ or $4\frac{1}{2}$ minute average headway instead of the present 3-$3\frac{1}{2}$ minute headway for the half-hour period. Actually the schedule maker compromised on a $3\frac{1}{2}$ - 4 minute headway during this period. (See lines 29 and 30, Figure 25A). This reduced the number of trips in the half-hour from 9 to 8, thereby saving a round trip and increasing the average load per bus to:

$$\frac{32 \times 9}{8} = 36 \text{ passengers per bus.}$$

In the 40-minute period from 3:18 to 3:58 P.M. on the proposed schedule (see Figure 25A) there are ten (10) vehicles on headways as follows:

1	@ 5 minutes	=	5 minutes
2	@ $4\frac{1}{2}$ minutes	=	9 minutes
3	@ 4 minutes	=	12 minutes
4	@ $3\frac{1}{2}$ minutes	=	14 minutes
10	TOTAL		40 minutes

This reflects the saving of one bus trip.

From 3:58 P.M. until 5:08 P.M. there are no special situations requiring correction (see Figure 27), and the schedule maker has simply specified these same headway intervals on the new Headway Order (lines 31-38, Figure 25A; lines 39-43, Figure 25B).

P.M. Peak Period

In the P.M. Peak period of the existing schedule there are 17 buses on a 39 minute round trip time. The resulting headway calculation would be:

Number of Buses	Running Time (In Minutes)	Allocated Vehicles and Headways			
		Buses	Headway	Buses	Headway
17	39	10	$2\frac{1}{2}$	7	2

39 divided by 17 equals 2 with 5 minutes over.

5 minutes equal 10 "half-minutes".

Increasing the headway on 10 of the buses by one-half minute uses up these 10 "half-minutes". Therefore, 10 buses operate on a (2 plus $\frac{1}{2}$) $2\frac{1}{2}$ minute headway and 7 buses operate on a 2 minute headway:

10 x $2\frac{1}{2}$	=	25 minutes
7 x 2	=	14 minutes
17 TOTAL		39 minutes

In the 5:15 - 5:30 P.M. time band of the existing schedule the average load per bus was 58 passengers on the latest day checked. The average for the four days was 62 passengers per bus. The buses in this period are operating on a $2\frac{1}{2}$ minute headway. There are:

6 x 5 "half-minutes", or 30 "half-minutes"; this is, of course, 5 "half-minutes" per bus.

Number of passengers handled per half minute equals 62 divided by 5, or 12.

If the average load is to be reduced to a loading standard of 53, the number of "one-half minutes" required in the new headway equals

53 divided by 12, or 4.41 - Say 4.

This means that the new headway during the 5:15 - 5:30 time band must be

$4 - \frac{1}{2}$ = 2 minutes

instead of $2\frac{1}{2}$ as at present. In other words, an additional vehicle should be scheduled past the outbound maximum load point during this period, as determined by the time at the inner terminal of the line.

With an additional (18th) vehicle in the P.M. Peak period of the proposed new schedule, there are 18 buses on a 38 minute round trip time. The resulting headway calculation would be:

Number of Buses	Running Time (In Minutes)	Allocated Vehicles and Headway			
		Buses	Headway	Buses	Headway
18	38	14	2	4	$2\frac{1}{2}$

38 divided by 16 equals 2 with 2 minutes over.

2 minutes equal 4 "half-minutes".

Increasing the headway on 4 buses by one-half minutes uses

up the 4 extra half minutes. Therefore, 14 buses operate on a 2 minute headway, and 4 buses operate on a (2 plus $\frac{1}{2}$) $2\frac{1}{2}$ minute headway:

14 x 2		=	28 minutes
4 x $2\frac{1}{2}$		=	10 minutes
18	TOTAL		38 minutes

The schedule maker must now continue with the preparation of the Headway Order, using 18 buses in the evening peak and placing them so that the 5:15 - 5:30 P.M. period operates on a 2 minute headway.

Resuming at 5:08 P.M., a series of 2 minute headway intervals is added until 5:30 P.M., followed by alternate series of 2- and $2\frac{1}{2}$-minute headways until 6:18 P.M. (lines 44 and 45-57, Figure 25b). This amply covers the "trouble" period of 5:15 - 5:30. The four $2\frac{1}{2}$-minute intervals and the 14 2-minute intervals between 5:01 and 5:39 P.M. are the "14 x 2 and 4 x $2\frac{1}{2}$ combination" which fits the 18 vehicles into a 38-minute round trip time.

Early Night Period

In the "Early Night" period (6:30 - 8:29 P.M.) the old running time is 38 minutes, and the new running time is 37 minutes. The existing schedule calls for seven buses during this period, and there appears to be no reason for a change. Therefore, on the existing schedule (see Figure 28) the basic headways are:

6 buses @ $5\frac{1}{2}$		=	33 minutes
1 bus @ 5		=	5 minutes
7	TOTAL		38 minutes

On the proposed new schedule the arrangement would be:

37 divided by 7 = 5 and 2 minutes over, resulting in

3 buses @ 5		=	15 minutes
4 buses @ $5\frac{1}{2}$		=	22 minutes
7	TOTAL		37 minutes

This latter combination would be used in building the new terminal sheet (see line 62, Figure 25B): The period between 6:18 and 6:47 P.M. is gradually brought down to a 5-$5\frac{1}{2}$ minute headway in successive steps of 3, $3\frac{1}{2}$, 4 and 5-minute headways, as governed by the existing schedule (see Figure 27 and Figure 25B, lines 58-61). Note on Figure 27 that the intervals on the old schedule between 6:19 and 6:48 are the same as those called for on the Headway Order, except that the actual clock time is displaced by one (1) minute.

Late Night and "Owl" Periods

This procedure is continued for the late night period and the "owl" period, as indicated on Figure 25B, lines 63-73. Note that an analysis of operator's trip sheets, rather than actual passenger load observations, is used to provide "load data" for the late night and "owl" periods.

General

It is helpful to the schedule maker in preparing the Headway Order to note the proposed new terminal times in pencil alongside of the existing schedule in the blank spaces provided for that purpose on the load summary sheets (see Figure 26, 27, 28).

The Headway Order herein shown (Figure 25 A and B) has been developed in full in order to present the complete story to the student of this report. In actual practice, the schedule makers on the sample property would fill in "same as existing schedule" to the trouble spot and then list the new headways, instead of listing out the full details on the Headway Order for those portions of the new schedule which are to be identical with the existing schedule.

The sample company does not operate "long-and short-line", or "Turn-back" service on this line. For information concerning the special requirements in schedule procedure for "turn-back" service, as well as a discussion of the proper design of the headway intervals preceding "long-and short-line" vehicles, see Parts II & III of this project. Alternative methods and procedures for determining and specifying headway intervals may also be found in these portions of the report.

G. Effect of "limiting Headways"

Some mention has been made under Section C (Loading Standards) of this chapter of "limiting headway loading standards" for use where schedules based upon the actual amount of passenger business available might produce headway intervals of as long as 15 or 20 minutes.

A study of passenger loads during the Early A.M., the basic, and the night periods of the day (Figure 26, 27, and 28) for the line under study will illustrate the use of "limiting" or "policy" headways.

For example, Early A.M.:

Period	Headway	Average Load per Bus (5-8) *	Seating Capacity
5:30 - 6:00	12 - 10	22	40
6:00 - 6:15	8 - 7	26	40
6:15 - 6:30	7 - 6	36	40
6:30 - 6:45	6 - 5	28	40

Basic

Period	Headway	Average Load per Bus (5-14) *	Seating Capacity
11:30 - 12:00	6 - 6½	32)	40
12:00 - 12:30	6 - 6½	29) Inbound	40
12:30 - 1:00	6 - 6½	31)	40
		(5 - 8) *	
1:30 - 2:00	6 - 6½	32)	40
2:00 - 2:30	6 - 6½	39) Outbound	40

(* Date of Check)

Night

Period	Headway	Average Load per Bus (5-14)*	Seating Capacity
6:15 - 6:30	3 - 3½	33	40
6:30 - 7:00	5	26	40
8:00 - 8:30	5 - 5½	21	40
8:30 - 9:00	6½	22	40
9:00 - 9:30	7 - 7½	27	40
9:30 -10:00	7	28	40

(*Date of Check)

If the above periods were scheduled on the basis of loads and loading standards alone, striving for an average load per bus equal to the seating capacity of 40 passengers, vehicle miles and vehicle hours would be saved for the company - but numbers of vehicles would be reduced and headway (waiting) intervals increased for the riding public.

Considerable difference of opinion exists throughout the industry as to the relationship which exists between "service" (as measured by headway) and "riding" (as measured by revenue passengers). In but few instances has scientific study been used to determine what the headway interval is beyond which prospective patrons will refuse to wait for a transit vehicle and seek other means of transportation. It is hoped that industry-sponsored research in this field will yield worth-while information on this subject. In the meantime, companies resort to "limiting" or "policy" headways at off-peak periods of the day to hold or attract riders, depending upon the trend of riding. In the cases cited above for the sample company, vehicles are loaded to ½ or 3/4 of their seating capacities during off-peak hours in order to hold headways at an attractive level. This company seldom operates a headway of greater than 10 minutes on any line, except for the very late night and "owl" periods. The maximum interval prescribed as a policy headway at various stages of the economic cycle depends largely upon the financial ability of the company to render the service.

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Chapter V - "TERMINAL SHEET" will be devoted to a description of the use of the Headway Order (Figure 25) and the Running Time Sheet (Figure 22) in preparing a Terminal Sheet, or schedule "time table".

CHAPTER V

THE TERMINAL SHEET

This chapter will be devoted to a discussion of the "terminal sheet", or schedule "time-table". The terminal sheet consists essentially of the leaving times of all vehicles from the outer and inner terminals of the route, arranged in orderly fashion.

A. Importance, Value and Uses of the Terminal Sheet

The terminal sheet is the basic time-table which governs the operation of the service on the streets. This sheet, together with the running time between time points, schedules vehicles to leave the line terminals in ample time to pass the maximum load points in each direction just when they are needed to handle the passenger load - not sooner, not later.

The terminal sheet defines and times the amount of work to be performed by each "train", providing a definite basis for dividing the work to be performed by the vehicles into segments of work - called "runs" - to be performed by the operators on a given transit route.

The terminal sheet informs the operator of the vehicle when to depart from each terminal on the successive trips which constitute his run. In combination with the running time sheet, it tells him when he is scheduled to arrive at each time point along the inbound and outbound routes of the line. It is his guide to the day's work, insofar as his scheduled duty to the public is concerned.

The terminal sheet serves as the primary guide to the transportation department's street supervisor in his task of seeing that service is operated in accordance with the schedule. In combination with the running time sheet, it tells him when each vehicle is scheduled to arrive at each time point. This enables him to ascertain whether operations are taking place too far ahead of or behind schedule, and furnishes a basis for corrective disciplinary action or recommendations to the schedule department for an investigation of needed schedule changes. The terminal sheet also provides the supervisor with a basis for switching vehicles short of their terminals, or "spacing" their departures from line terminals, in the event of dislocation in service or emergencies.

Finally, the terminal sheet, in combination with the running time sheet, provides a basis for furnishing schedule information to the riding public. This is especially important in the case of routes having very long headways, and for the convenience of strangers or residents who may be relatively uninformed concerning the transit system. Such information may be distributed through several media, as will be pointed out in Chapter VII.

B. Sources of Information

The sources of information required for the construction of the terminal sheet are:

1. The running time sheet, described in Chapter III.

2. The Headway Order, described in Chapter IV.

Section D of this chapter will be devoted to a full exposition of the method used in building up the terminal sheet from these basic data.

COPY

SCHEDULE NO. 7730
EFFECTIVE
SUPERSEDING NO. 7649
CANAL BUS STATION

CITY PARK BUS LINE

TUESDAY TO FRIDAY

DUMAINE & ALEXANDER

TRAIN	OUT																									IN	TIME
1	436	444	519	556	635	713	752	831½	910½	949	1026	1103	1140	1217	1254	131	208	246	323	402	442	520	558½	633*			641	1405
2	708					716	754½	829*	837								OUT	319	327	405	444	522	601	640	717	754½	833	440	1450
3	556			*604	640	719	757	835	915	955	1032	1109	1146	1223	100	137	214	251	330½	408	446½	524½	604	638*				646	1250
4																			OUT	440	448½	526½	601*				609	129
5	713					721½	800	838½	913*	921						OUT	248	256	334	411	451	529	607½	645½	722½	800	840	1105	1025
6	637				645	724	802½	842	919½	953	*1001							OUT	406	414	453	531	611	651	728	805½	847	1224	1142
7	718					726½	805	839*	847										OUT	447	455	533½	608*					616	258
8	526		534	611	649½	729	808	846	924	1001	1038	1115	1152	1229	106	143	219½	301	337½	417	457	535½	615	656	733	811	844*	852	1526
9																	OUT	333	341	420	459	538	620	701½	738½*	818	854	1157	824
10																OUT	217	225	306	344	423	501	540½	615*				623	406
11																				OUT	455	503	537*					545	50
12																			OUT	339	347	426	505	543	617*			625	246
13	646				654	731½	810½	850	928½	1007	1044	1121	1158	1235	112	149	230½	310½	350	428½	507	545	625	658*				706	1220
14	726					734	813	847*	855										OUT	422	430½	509	547	621*				629	336
15	610			618	658	736½	816	854	933	1013½	1050½	1127½	1204½	1241½	118½	155½	236	315	353	433	511	549	623*					631	1221
16	653				701	739	819	858	938	1011	*1019																			326
17	733					741½	816*	824																						51
18	456	504	546	624	704	744	822	902	943	1020	1057	1134	1211	1248	125	202	241	319	356	435	513	551	630	707	744	817*		825	1529
19	659				707	746½	825	859*	907								OUT	351	359	437½	515½	553½	628*					636	453
20	622			630	710	749	828	906	939*	947								OUT	431	439½	517½	556	635	712	749	826	901	113	1207
																													164:54

TRAIN														
2	908	943	1018½	1100	1135	1217	101	201	301	401	432*			
5	915	950	1026	1057*										
6	922	957	1034	1109	1145	1216*								
9	929	1004	1042½	1117½	1149*									
20	936	1011	1051	1126	1201	1237	105*							

DAUPHINE & CANAL

1	500	535	612	653	731	810	849½	927½	1006	1043	1120	1157	1234	111	148	225	303	341	419	459	537	615½					
2					734	812½												344	422	501	539	618	657	734	811½	848	
3			621	658	737	815	853	932	1012	1049	1126	1203	1240	117	154	231	308	347½	425	503½	541½	621					
4																				505½	543½						
5					739½	818	856½										313	351	428	508	546	624½	702½	739½	817	855	
6				703	742	820½	900	936½											431	510	548	628	708	745	822½	902	
7					744½	823														512	550½						
8		550	629	707½	747	826	904	941	1018	1055	1132	1209	1246	123	200	236½	318	354½	434	514	552½	632	713	750	828		
9																		358	437	516	555	637	718½	755½	834	909	
10																242	323	401	440	518	557½						
11																				520							
12																		404	443	522	600						
13				712	749½	828½	908	945½	1024	1101	1138	1215	1252	129	206	247½	327½	407	445½	524	602	642						
14					752	831													447½	526	604						
15			636	716	754½	834	912	950	1030½	1107½	1144½	1221½	1258½	135½	212½	253	332	410	450	528	606						
16				719	757	837	916	955																			
17					759½																						
18	520	602	642	722	802	840	919½	1000	1037	1114	1151	1228	105	142	219	258	336	413	452	530	608	647	724	801			
19				725	804½	843												416	454½	532½	610½						
20			648	728	807	846	923												456½	534½	613	652	729	806	841	916	

TRAIN										
2	923	958	1033½	1115	1150	1230	117	217	317	417
5	930	1005	1041							
6	937	1012	1048	1124	1200					
9	944	1019	1057½	1132½						
20	951	1026	1106	1141	1215	1250				

NOTES:- * TR.NO. 3 LEAVING DUMAINE & ALEXANDER AT 6:04 A.M. USE "A" RUNNING TIME TO ORLEANS & CLAIBORNE & "B" RUNNING TIME TO DAUPHINE & CANAL.
* TR.NO. 9 LEAVING DUMAINE & ALEXANDER AT 8:18 P.M. USE "C" RUNNING TIME TO ORLEANS & CLAIBORNE & "E" RUNNING TIME TO DAUPHINE & CANAL.

FIGURE 29.
COMPLETED AND TYPED TERMINAL SHEET -
SAMPLE COMPANY UNDER STUDY.

C. Form of the Terminal Sheet

A completed Terminal sheet in its final typed form is shown in Figure 29. It provides the following information:

1. Name of line.
2. Kind of schedule (weekday, Saturday, Sunday).
3. Schedule number.
4. Effective date.
5. Number of superseded schedule.
6. Name of car house or bus station.
7. Names of outer and inner line terminals.
8. Numbers of "Trains", or pieces of work based on equipment to be utilized.
9. Times that vehicles leave the station.
10. Departing times of successive vehicles from outer terminal.
11. Departing times of successive vehicles from inner terminal.
12. Times that vehicles return to the station.
13. Total time that each vehicle is "on the road".
14. Total time that all vehicles are "on the road".

An intermediate working form, called the "terminal layout sheet", is used by the schedule maker in his rough work of computation. This sheet is typed in rearranged form to yield the final Terminal Sheet.

D. Procedure for Setting up the Terminal Layout Sheet

The following outline sets forth the procedure for heading up the Terminal Layout Sheet and the details of the mathematical method of setting up a "time table" for the control of vehicle movements on the line under study. Reference should be made to Figures 30 through 36 for illustrations of these successive steps.

Figure 30:

Step #1. Place the name of the line (City Park Bus Line) on the first heavy horizontal line in the center of the sheet.

Step #2. Place the name of the kind of schedule (Tuesday through Friday) three lines below the line name in the center of the sheet.

Step #3. Place the heading "Train No." in the first column to the extreme left of the sheet, between the heavy vertical ruled lines, and about three lines below that which shows the kind of schedule.

Step #4. The heading "Time Out" is placed in the next column (also between vertical rulings).

Step #5. Three new columns are drawn in with vertical rulings at a distance of approximately 35 vertical spaces from the "Time Out" column. The new column to the left is two spaces wide, and is headed "Time In"; the middle column is two spaces wide and is headed "Total Time"; and the third column is one space wide and is headed "Train No."

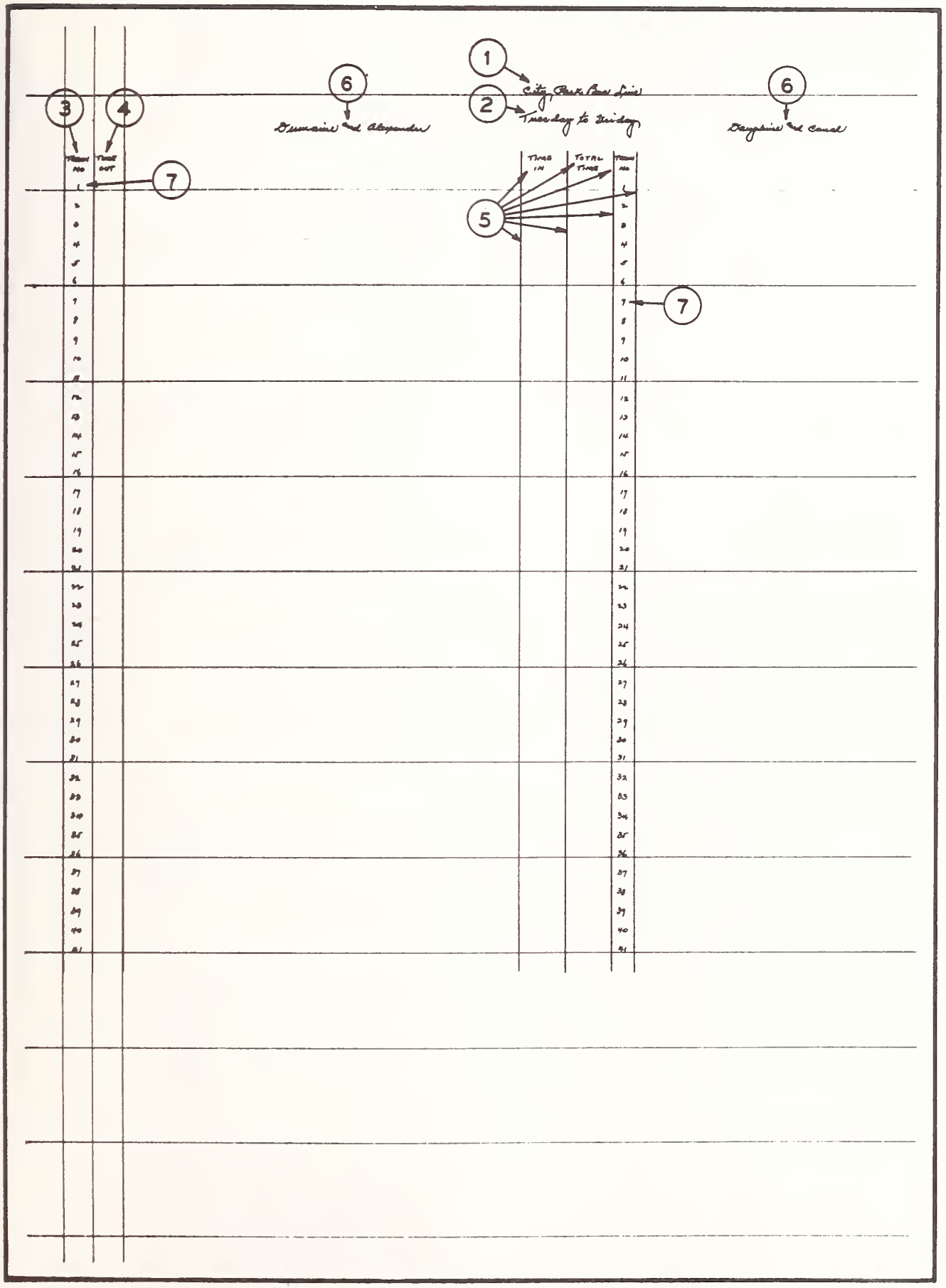

FIGURE 30.
STEPS # 1-7, PREPARATION OF TERMINAL LAYOUT SHEET-
SAMPLE COMPANY UNDER STUDY.

Step #6. The terminal headings are next written in, and are placed a little above the other headings just described. The outer terminal (Dumaine and Alexander) is written in on the left-hand side of the sheet, and the inner terminal (Dauphine and Canal) is placed on the right-hand side.

Step #7. Temporary train numbers are next written in the two "Train No." columns starting above the second heavy horizontal line and writing on every second horizontal line thereafter. About 40 numbers will be written for this particular line.

Figure 31:

Step #8. The headway order, Figure 25, shows the time at which the first bus should leave the outer terminal. This time (4:44 A.M.) is entered opposite Train No. 1 in the second vertical column to the right of the "Time Out" column.

Step #9. Calculate, with the aid of the Running Time Sheet (Figure 22), the time when Train No. 1 will leave the inner terminal, and enter this time on the "Dauphine and Canal" half of the sheet in the second column to the right of the "Train No." column. This calculation is made as follows:

> Column A (Early A.M.) of the Running Time Sheet (Figure 22) shows running time of 16 minutes to the inner terminal of the line. This 16 minutes added to 4:44 gives 4:60 or 5:00 A.M. as the time leaving Dauphine and Canal Streets, since the line takes its "layover" at the outer terminus of the line.

Step #10. Calculate when Train No. 1 will be ready to leave the outer terminal of the line again on its second trip, and write this time very lightly to the right of the Dumaine and Alexander portion of the sheet opposite Train No. 1. This calculation is made as follows:

> Column A (Early A.M.) of the Running Time Sheet shows a running time of 15 minutes to the outer terminal and a headway adjustment time of 4 minutes, a total of 19 minutes before the bus is ready to begin its second inbound trip. This 19 minutes added to the inner terminal leaving time of 5:00 gives 5:19 A.M. as the time to be temporarily written in.

Step #11. Consult the Headway Order and "pull out" the next bus required to give the indicated headway. A twenty minute headway is specified following Train No. 1. 20 minutes plus 4:44 gives 4:64 or 5:04 A.M. This outer terminal leaving time is written opposite Train No. 35 (arbitrarily, but gauged by experience) in order to leave sufficient space in between this entry and Train No. 1 for the other "pull out" buses.

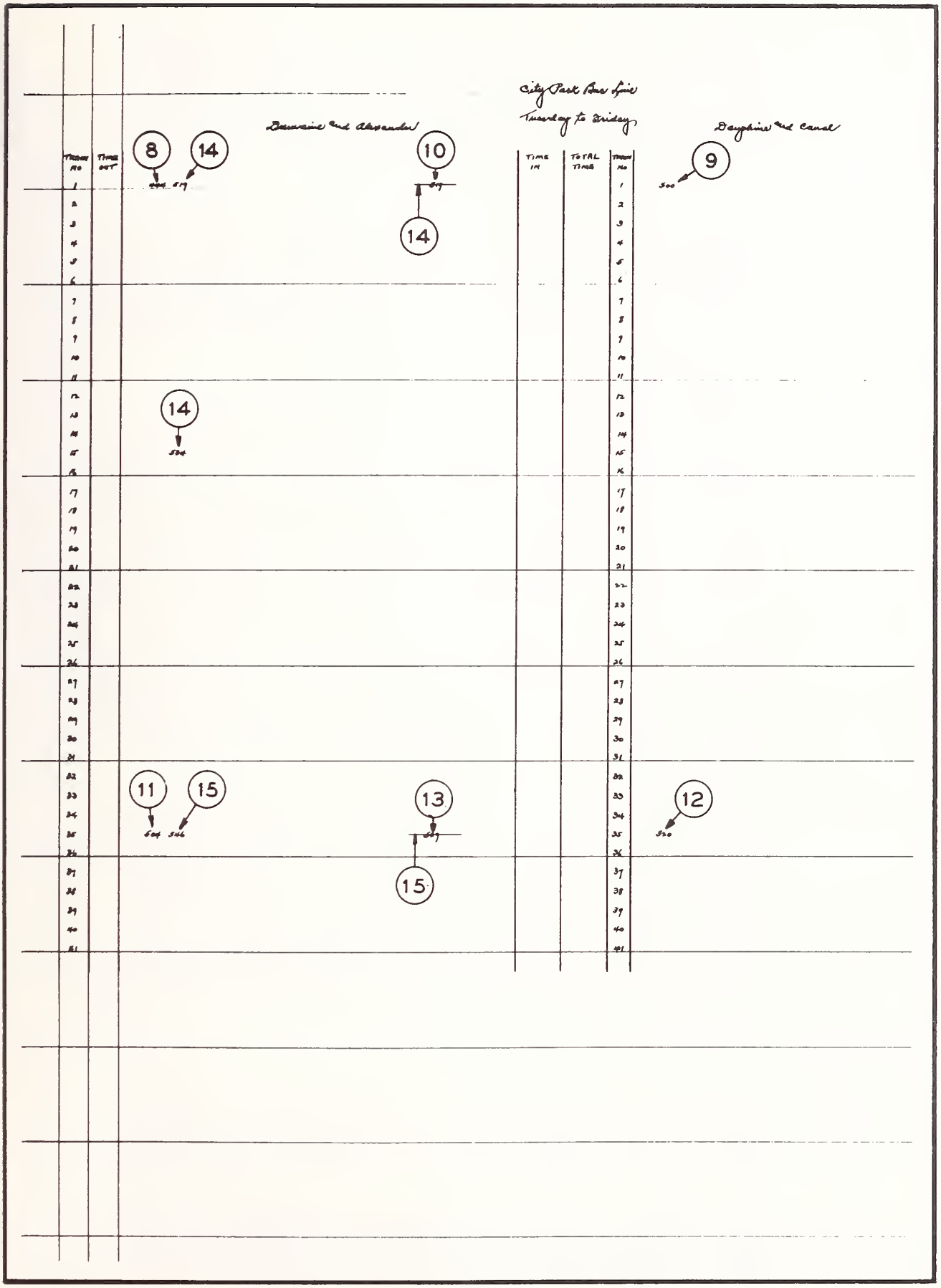

FIGURE 31.
STEPS # 8-15, PREPARATION OF TERMINAL LAYOUT SHEET-
SAMPLE COMPANY UNDER STUDY.

Step #12. Calculate the time when Train No. 35 will leave the inner terminal, and enter this time on the "Dauphine and Canal" half of the sheet in the second column to the right of the "Train No." column opposite Train No. 35. This calculation is identical with that described in Step #9, and results in a figure of 0:16 plus 5:04, or 5:20 A.M.

Step #13. Calculate when Train No. 35 will be ready to leave the outer terminal of the line on its second trip, and write this time in very lightly to the right of the "Dumaine and Alexander" portion of the sheet opposite Train No. 35. This calculation is identical with that described in Step #10, and results in a figure of 0:19 plus 5:20, or 5:39, to be placed temporarily on the sheet.

Step #14. The Headway Order calls for a 15-minute headway from 5:04 to 5:34. This means that a bus must leave the outer terminal at 0:15 plus 5:04, or 5:19 A.M., and another one at 0:15 plus 5:19, or 5:34 A.M. Reference to the "margin time" (Step #10) for Train No. 1 shows it to be ready to leave the outer terminal at 5:19 A.M., so that Train No. 1 can handle the 5:19 A.M. trip. Reference to the "margin time" (Step #13) for Train No. 35 shows that it will not be ready to leave the outer terminal until 5:39 A.M., so that it will not be available for the 5:34 A.M. trip. It is necessary, therefore, to pull out a new bus to handle the trip leaving the outer terminal at 5:34 A.M. The 5:19 time is written in next to the 4:44 time opposite Train No. 1 and erased from its temporary location. The 5:34 time is written in this same column, but opposite Train No. 15 - approximately half-way between Trains Nos. 1 and 35.

Step #15. The Headway Order calls for a 12-minute headway following the trip which leaves the outer terminal at 5:34 (Train #15). 5:34 plus 0:12 gives a calculated leaving time of 5:46 A.M. A study of the "margin time" for Train No. 35 (Step #13) shows that it will be ready to leave the outer terminal at 5:39, so that by giving it an additional "layover" of 7 minutes at the outer terminal it can be scheduled to leave at 5:46 A.M. The time 5:46 is entered opposite Train No. 35 as the outer terminal time for its second inbound trip, and erased from its temporary location.

Figure 32:

Step #16. Calculate the inner terminal time for Train No. 1 on its second trip - 16 minutes running time plus 5:19 equals 5:35 A.M. Enter this time on the right-hand half of the sheet opposite Train No. 1.

Step #17. Calculate the outer terminal time for Train No. 1 on its third trip - 19 minutes running time and headway adjustment time plus 5:35 equals 5:54 A.M. Enter this time temporarily opposite Train No. 1.

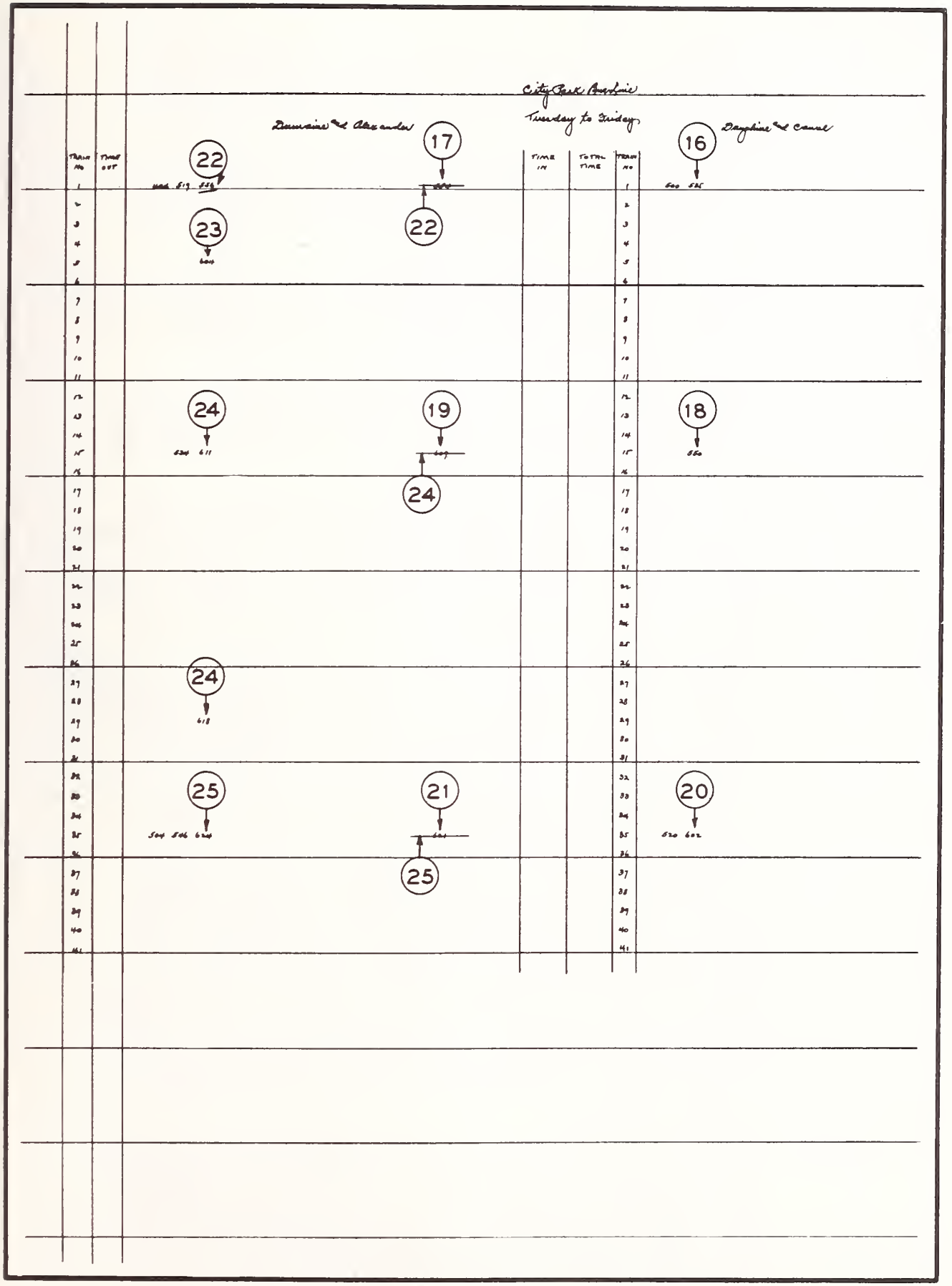

FIGURE 32.

STEPS #16-25, PREPARATION OF TERMINAL LAYOUT SHEET - SAMPLE COMPANY UNDER STUDY.

Step #18. Calculate the inner terminal time for Train No. 15 on its first trip - 16 minutes running time plus 5:34 equals 5:50 A.M. Enter this time on the right-hand half of the sheet opposite Train No. 15.

Step #19. Calculate the outer terminal time for Train No. 15 on its second trip - 19 minutes running time and headway adjustment time plus 5:50 A.M. equqls 5:69, or 6:09 A.M. Enter this time temporarily opposite Train No. 15.

Step #20. Calculate the inner terminal time for Train No. 35 on its second trip - 16 minutes running time plus 5:46 equals 5:62 or 6:02 A.M. Enter this time on the right-hand half of the sheet opposite Train No. 35.

Step #21. Calculate the outer terminal time for Train No. 35 on its third trip - 19 minutes running time and headway adjustment time plus 6:02 equals 6:21 A.M. Enter this time temporarily opposite Train No. 35.

Step #22. The Headway Order calls for a 10 minute headway following the inbound trip at 5:46 A.M. That is, 0:10 plus 5:46 equals 5:56 A.M. The "margin time" for Train No. 1 (5:54 A.M.) shows it to be available for this trip. The actual terminal time of 5:56 is entered opposite Train No. 1, and the calculated time of 5:54 is erased from its temporary location.

Step #23. The Headway Order calls for an 8 minute headway following the 5:56 trip, or a leaving time of 0:08 plus 5:56 equalling 5:64, or 6:04 A.M. - from the outer terminal. The "margin time" of Train No. 15 (6:09) shows that it is not yet available to make this trip, so that a new bus must be pulled out in time to leave the outer terminal at 6:04. This time is entered on the "Dumaine and Alexander" half of the sheet under the 5:56 A.M. time and opposite (temporary) Train No. 5.

Step #24. The Headway Order calls for a 7 minute headway until 6:18, or one bus leaving the outer terminal at 6:04 plus 0:07, or 6:11, and another leaving at 6:11, plus 0:07, or 6:18. The "margin time" of Train No. 15 (see Steps #18 and #19) shows it to be available at 6:09, so with 2 minutes additional layover it can handle the 6:11 trip. This time is entered on the terminal sheet opposite Train No. 15, and the 6:09 time is erased. Since Train No. 35 is not available until 6:21 (see Steps #20 and 21), it is necessary to pull out another bus (temporary Train No. 29) to handle the 6:18 A.M. trip.

Step #25. Reference to the Headway Order shows a headway of 6 minutes required between 6:18 and 6:30 A.M., or buses leaving the outer terminal at 6:24 and 6:30. Train No. 35 ("margin time" of 6:21) is available to handle the 6:24 trip. The 6:24 time is entered on the sheet opposite Train No. 35, and the 6:21 time is erased from its temporary position. The 6:30 A.M. trip will be discussed in connection with Figure 33.

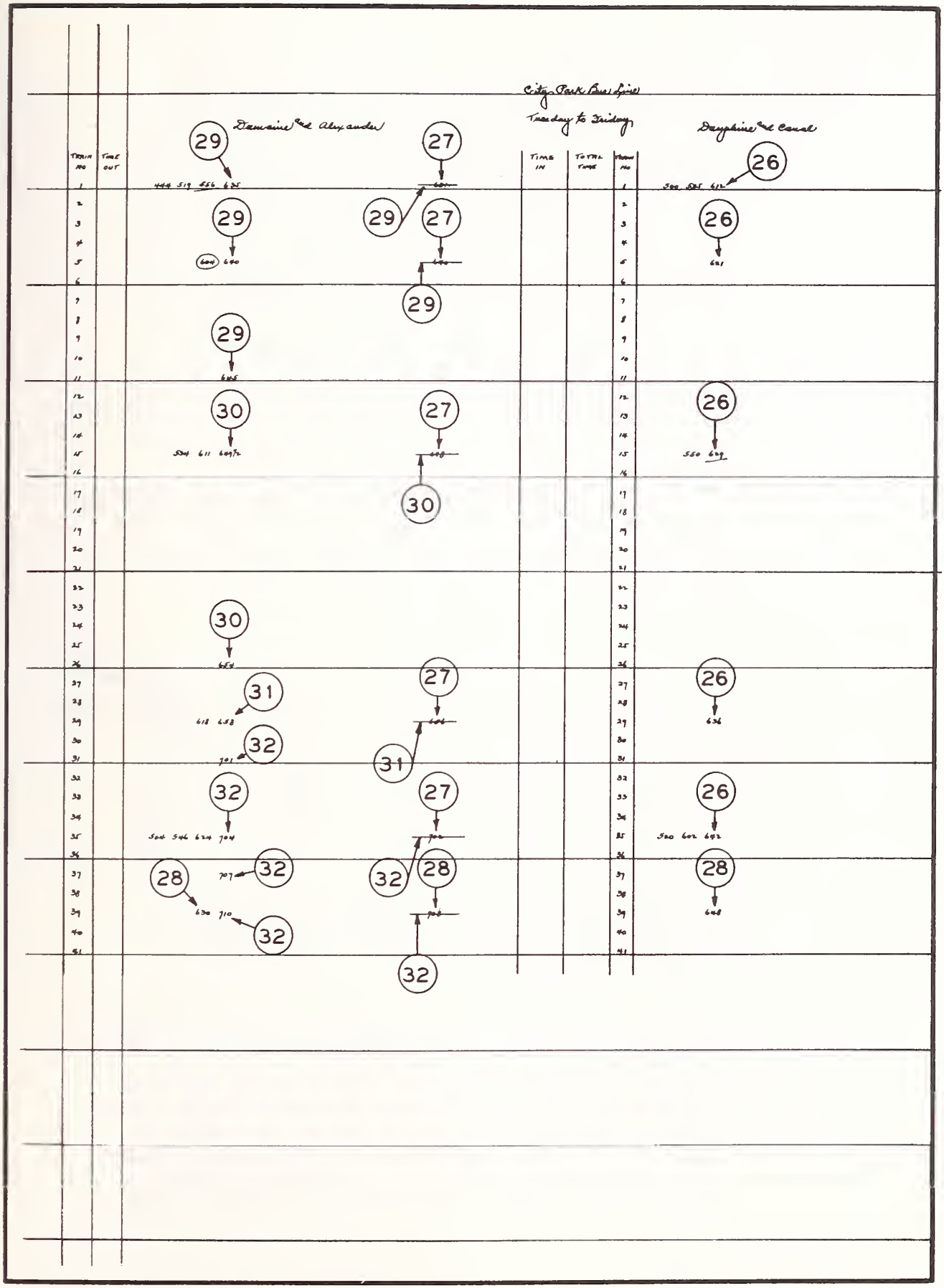

FIGURE 33.

STEPS #26-32, PREPARATION OF TERMINAL LAYOUT SHEET - SAMPLE COMPANY UNDER STUDY.

Figure 33:

Step #26. The inner terminal times for Trains Nos. 1, 5, 15, 29 and 35 are all calculated and entered in the appropriate columns and rows under "Dauphine and Canal". It is necessary to change running time columns after the 5:56 A.M. inbound trip, as indicated by the slanted line (/) drawn under 5:56 opposite Train No. 1 on the "Dumaine and Alexander" side of the sheet. Thus, for Train No. 15 leaving the outer terminal at 6:11 A.M., inbound running time column "B" is used (see Figure 22). 6:11 plus 0:18, the new running time, equals 6:29, the time entered on the "inner terminal" half of the sheet opposite Train No. 15.

Step #27. The "margin times" for these same train numbers are all calculated and entered on the sheet temporarily. It is necessary to change running time columns after the 6:29 A.M. outbound trip, as indicated by the slanted line (/) drawn under 6:29 opposite Train No. 15 on the "Dauphine and Canal" side of the sheet. Thus, for Train No. 29 leaving the inner terminal at 6:36 A.M., outbound running time column "B" is used (see Figure 22). 6:36 plus 0:20, the new running time and headway adjustment time, equals 6:56, the "margin time" entered opposite Train No. 29 on Figure 33. The "margin times" for these runs are as follows:

Train No.	Outer Terminal Time	Inbound Running Time	Inner Terminal Time	Outbound Running Time Plus "Layover"	Calculated "Margin Time"
1	5:56	16(A)	6:12	19(A)	6:31
5	6:04	17(*)	6:21	19(A)	6:40
15	6:11	18(B)	6:29	19(A)	6:48
29	6:18	18(B)	6:36	20(B)	6:56
35	6:24	18(B)	6:42	20(B)	7:02

* "Transition" running time, between "A" and "B"; uses "A" running time to Orleans and Claiborne and "B" running time to Dauphine and Canal.

Step #28. In Step #25 it was indicated that the Headway Order required a trip leaving the outer terminal at 6:30 A.M. Reference to the "margin time" for Train No. 1 (6:31 A.M.) shows it to be just a minute too late to handle the 6:30 trip without cutting the headway adjustment time too short. Therefore, another bus is pulled out of the station to handle the 6:30 trip. The new 6:30 time is entered opposite (temporary) Train No. 39. The inner terminal time (6:48) and the "margin time" (7:08) are then calculated.

Step #29. The Headway Order calls for a headway of five minutes between 6:30 and 6:45 , or departures from the outer terminal at 6:35, 6:40 and 6:45 A.M. Reference to the "margin times" on Figure 33 shows that Train No. 1 (6:31) can handle the 6:35 trip, Train No. 5 can handle the 6:40 trip, while a new bus (temporary Train No. 11) must be pulled out to handle the 6:45 trip. These time entries are made on the terminal sheet, and the corresponding "margin times", where applicable, are erased.

Step #30. The Headway Order calls for a $4\frac{1}{2}$ minute headway from 6:45 to 6:54, or inbound trips at $6:49\frac{1}{2}$ and 6:54. Train No. 15 (margin time of 6:48) is available for the $6:49\frac{1}{2}$ trip, while an additional pull out bus (Train No. 26) is required to meet the 6:54 departure.

Step #31. The 4 minute headway specified for the 6:58 A.M. inbound trip can be met by Train No. 29, which has a "margin time" of 6:56.

Step #32. Reference to the Headway Order shows a 3 minute inbound headway between 6:58 and 7:19, or departures from the outer terminal at 7:01, 7:04, 7:07, 7:10, and etc. Trains Nos. 35 and 39 are available for the 7:04 and 7:10 trips. (Temporary) Trains Nos. 31 and 37 are pulled out to meet the 7:01 and 7:07 demand.

Figure 34:

Step #33. At this point the inner terminal times for Trains Nos. 1, 5, 11, 15, 26, 29, 31, 35, 37, and 39 are all computed and entered on the sheet. The corresponding "margin times" for the succeeding inbound trips are also calculated. Care must be taken to use the appropriate column on the Running Time Sheet.

Step #34. Reference to the Headway Order (see also Step #32) shows a 3 minute inbound headway between 7:10 and 7:19, or departures from the outer terminal at 7:13, 7:16 and 7:19. Trains Nos. 1 and 5 are available for the 7:13 and 7:19 trips, while an additional bus (Train No. 3) is pulled out to take care of the 7:16 departure.

Step #35. The Headway Order calls for a $2\frac{1}{2}$ minute headway from 7:19 to 7:49. Eight of the departures from the outer terminal can be handled by buses already on the line, while four additional pull outs must be made (Train Nos. 9, 13, 27, and 33). All 15 of the A.M. Peak buses are now pulled out and operating on the line.

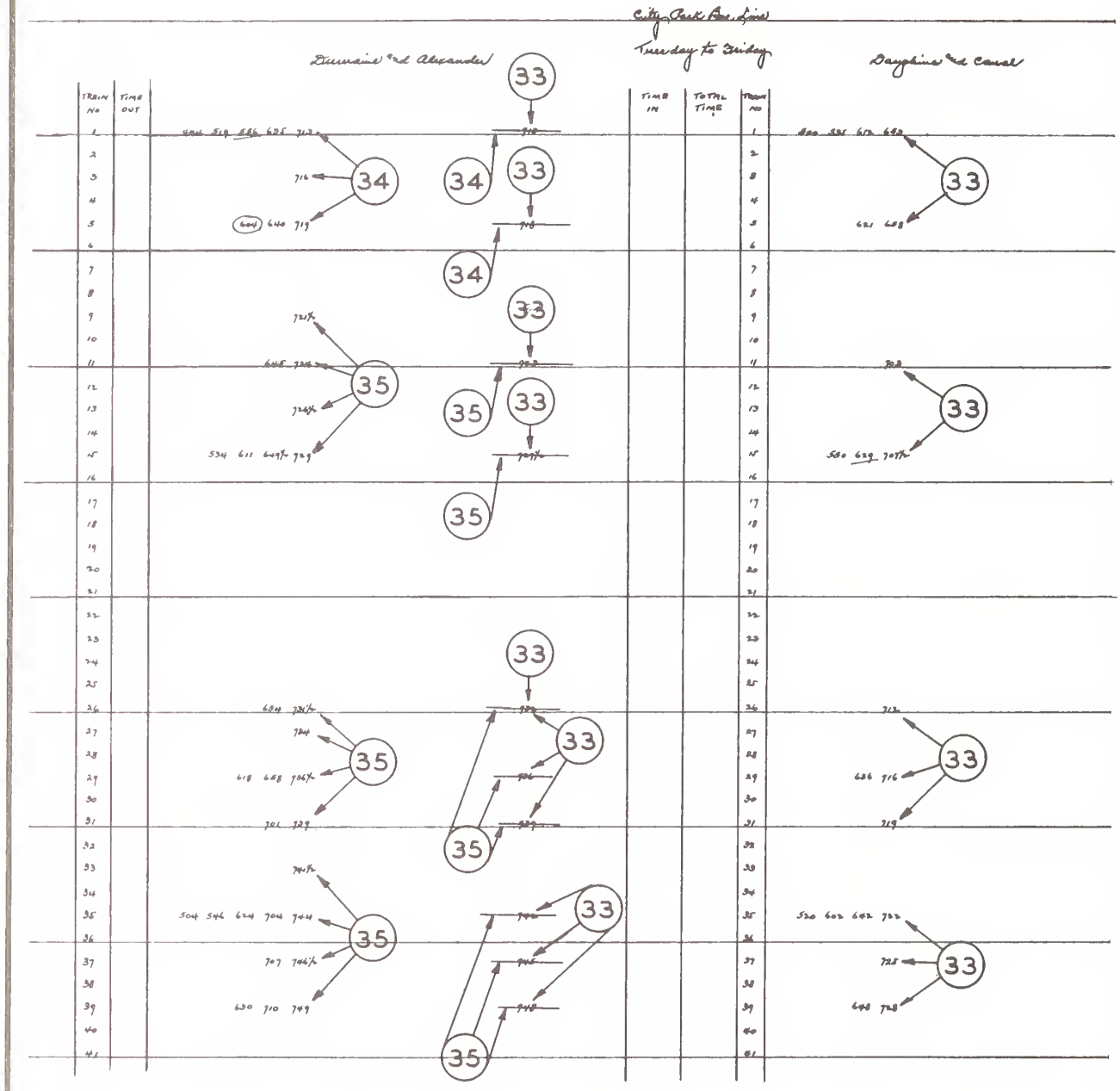

FIGURE 34.

STEPS # 33–35, PREPARATION OF TERMINAL LAYOUT SHEET–
SAMPLE COMPANY UNDER STUDY.

Figure 35:

Step #36. From time to time, as the work progresses, a check should be made by the schedule maker in order to determine the accuracy of his work. This check is illustrated in Figure 35, and is made as follows:

(A) For a given column of outer terminal times (take the 7:13 A.M. column, for example) calculate the corresponding inner terminal times by adding the inbound running time to the outer terminal times. Enter these in the appropriate column on the terminal lay-out sheet. For example:

Train No.	Outer Terminal Time	Inbound Running Time	Calculated Inner Terminal Time
1	7:13	18(B)	7:31
3	7:16	18	7:34
5	7:19	18	7:37
9	7:21½	18	7:39½
11	7:24	18	7:42
13	7:26½	18	7:44½
15	7:29	18	7:47
26	7:31½	18	7:49½
27	7:34	18	7:52
29	7:36½	18	7:54½
31	7:39	18	7:57
33	7:41½	18	7:59½
35	7:44	18	8:02
37	7:46½	18	8:04½
39	7:49	18	8:07

(B) In a similar manner, determine the inner terminal leaving times for the succeeding buses by successively adding headway time; for example:

Train No.	Inner Terminal Time	Specified Headway	Calculated Inner Terminal Time
1 (Start)	7:31	-	-
3	-	3	7:34
5	-	3	7:37
9	-	2½	7:39½
11	-	2½	7:42
13	-	2½	7:44½
15	-	2½	7:47
26	-	2½	7:49½
27	-	2½	7:52
29	-	2½	7:54½

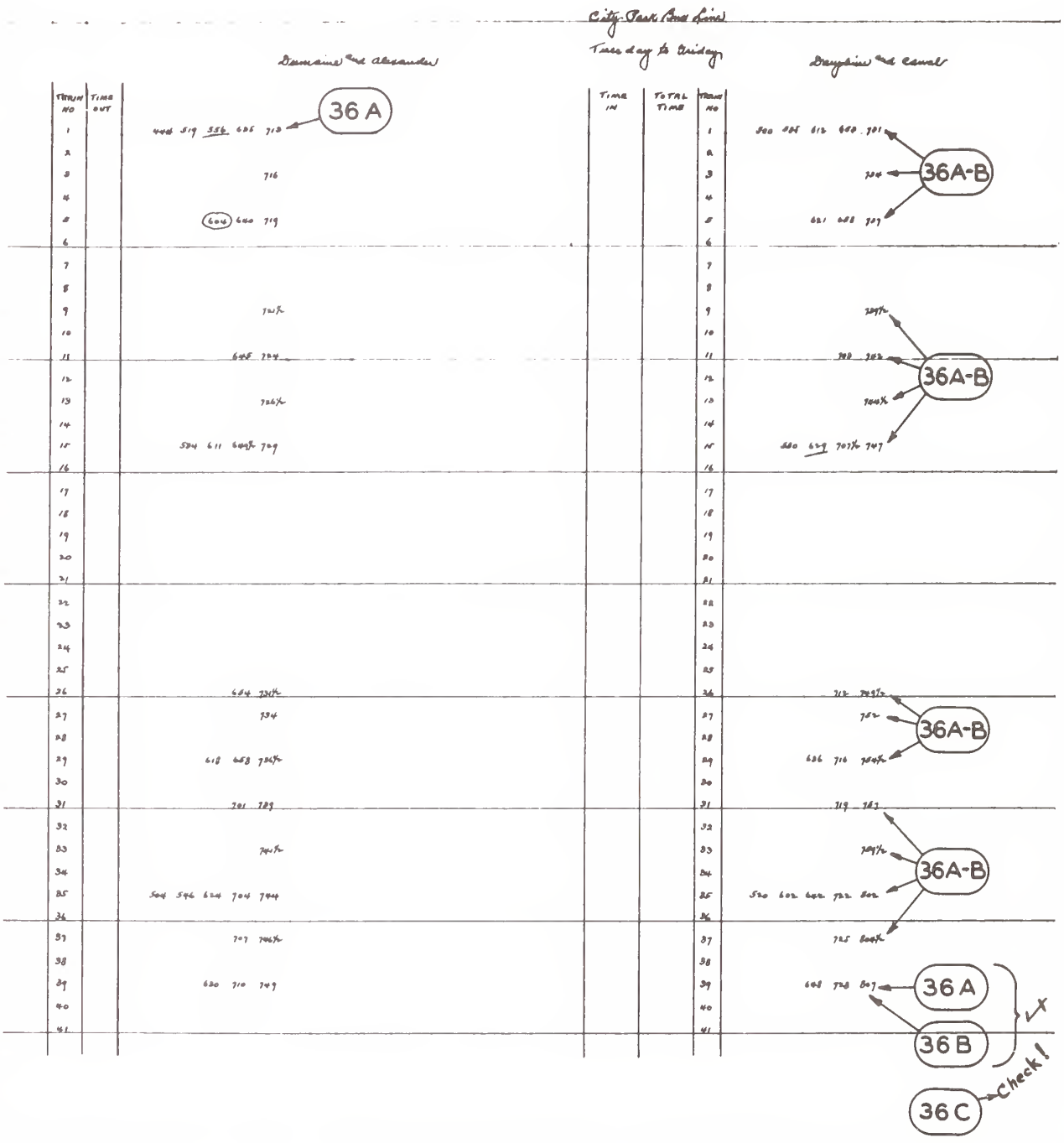

FIGURE 35.

STEPS # 36, A, B & C, PREPARATION OF TERMINAL LAYOUT SHEET – SAMPLE COMPANY UNDER STUDY.

(B) (Continued)

Train No.	Inner Terminal Time	Specified Headway	Calculated Inner Terminal Time
	(continued)		
31	-	$2\frac{1}{2}$	7:57
33	-	$2\frac{1}{2}$	$7:59\frac{1}{2}$
35	-	$2\frac{1}{2}$	8:02
37	-	$2\frac{1}{2}$	$8:04\frac{1}{2}$
39	8:07	$2\frac{1}{2}$	8:07 (Check)

(C) If all calculations have been properly made, the inner terminal time for the last car (Train No. 39 at 8:07 A.M.) will be the same by the two different methods of computation.

(Not Shown):

Step #37. The "margin time" for all buses at the outer terminal is again calculated, using the proper column of running time, and entered temporarily to the right of the appropriate train numbers.

Step #38. The Headway Order is consulted again, and its instructions carefully followed. The time entered in the "margin" will indicate how the buses on the line may be utilized for maintaining the required headway.

Step #39. The three-part operation described recurrently above is continued and repeated across the terminal layout sheet, namely:

(a) Establishing the headway at the indicated terminal from the Headway Order (NOTE - after 2:31 P.M. on the Headway Order Sheet, the inner terminal - "Dauphine and Canal" - is controlling).

(b) Computing the leaving time at the other terminal by the "running time" method of calculation, and checking it by the "headway method" of calculation.

(c) Determining the "margin time" at the first terminal by these two methods of computation.

Throughout the process the Running Time Sheet should be consulted frequently for changes in running time at both terminals. Changes in running time are indicated on the terminal layout sheet by underlining the terminal time of the vehicle which uses the "old" or "previous" running time.

Figure 36:

Step #40. For the method of removing service from the line after the A.M. Peak, consider the sixth outer terminal time column from the left-hand side of the sheet (7:52 A.M. column):

Train No.	Outer Terminal Time	Inbound Running Time	Inner Terminal Time	Outbound Running Time Plus "Layover"	Calculated "Margin Time"
1	7:52	18(B)	8:10	20(B)	8:30
3	7:54½	18	8:12½	20	8:32½
5	7:57	18	8:15	20	8:35
9	8:00	18	8:18	20	8:38
11	8:02½	18	8:20½	20	8:40½
13	8:05	18	8:23	20	8:43
15	8:08	18	8:26	20	8:46
26	8:10½	18	8:28½	20	8:48½
27	8:13	18	8:31	20	8:51
29	8:16	18	8:34	20	8:54
31	8:19	18	8:37	20	8:57
35	8:22	18	8:40	20	9:00
37	8:25	18	8:43	20	9:03
39	8:28	18	8:46	20	9:06

Reference to the Headway Order shows that a 3½ minute headway is required between 8:28 and 8:42, and a 4 minute headway between 8:42 and 9:06. The calculated "margin times" set forth immediately above provide for 2½ and 3 minute headways. The following disposition is made of the above Train Numbers in meeting the headway specification:

Train No.	Calculated "Margin Time"	Disposition
1	8:30	Makes inbound trip at 8:31½ A.M.
3	8:32½(a)	Not needed.*
5	8:35	Makes inbound trip at 8:35 A.M.
9	8:38	Makes inbound trip at 8:38½ A.M.
11	8:40½	Makes inbound trip at 8:42 A.M.
13	8:43(a)	Not needed.*
15	8:46	Makes inbound trip at 8:46 A.M.
26	8:48½	Makes inbound trip at 8:50 A.M.
27	8:51(a)	Not needed.*
29	8:54	Makes inbound trip at 8:54 A.M.
31	8:57	Makes inbound trip at 8:58 A.M.
35	9:00	Makes inbound trip at 9:02 A.M.
37	9:03(a)	Not needed.*
39	9:06	Makes inbound trip at 9:06 A.M.

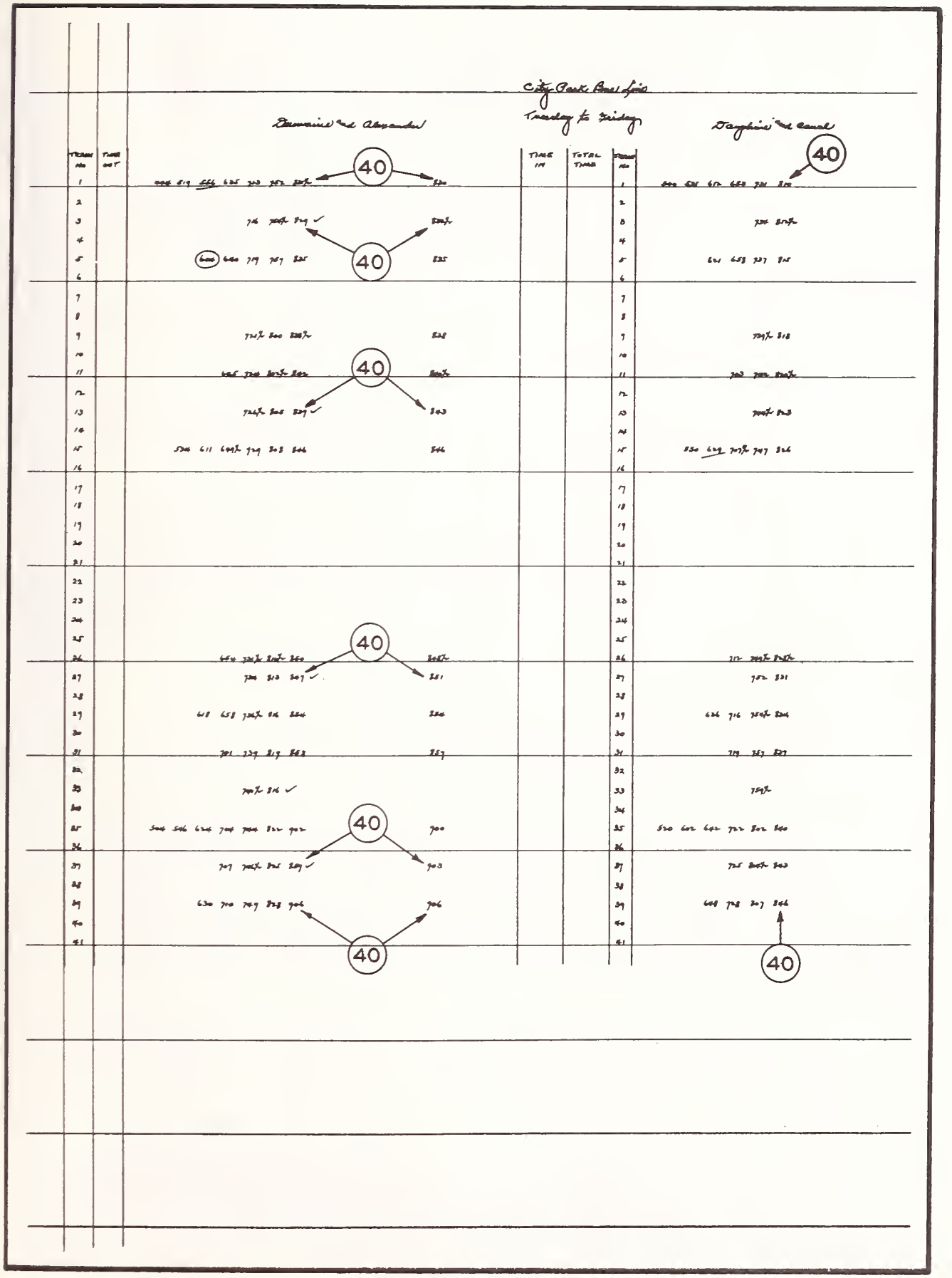

FIGURE 36.
STEP # 40, PREPARATION OF TERMINAL LAYOUT SHEET—
SAMPLE COMPANY UNDER STUDY.

*Decision as to whether these vehicles are to be sent to the garage or tied in with other trains is reserved until the process of "shifting" trains has been completed. This will be discussed in detail in a subsequent section.

(a) The time entered on the terminal layout sheet for these vehicles in the 8:31½ time column is the arriving time at the terminal, as such vehicles would not take a layover if sent to the bus garage.

(Not Shown)

Step #41. This process is repeated until the number of scheduled buses is reduced to six (6) between 10:00 A.M. and 2:31 P.M. at the inner terminal.

Step #42. The number of buses is gradually built up again during the afternoon in accordance with the Headway Order, and in line with the procedure described in Steps #8 - 39 above.

Step #43. After the P.M. Peak period the service volume is progressively deflated in accordance with the Headway Order, and in line with the procedure illustrated in Step #40 above, until only the "owl" bus remains on a 60 minute headway between 1:17 A.M. and 4:17 A.M. as measured at the inner terminal.

E. Procedure for "Shifting" Trains Prior to Run Cutting

The partially completed terminal layout sheet is shown in Figure 37.

At this stage in the schedule making procedure followed by the sample company, it is customary to review the terminal layout sheet with a view to "shifting" and re-combining trains in such a manner as to clear up all the obvious obstacles to a satisfactory run cut. Experience indicates that a terminal layout sheet usually has to be re-arranged after the run cutting process begins in order to secure the best result. As much as possible of this "shifting" of trains is, however, performed before beginning the run cut.

While the essential details of this company's labor agreement with its platform employees will be set forth completely in the next chapter, a few major points will be enumerated below:

1. All regular runs shall be as near eight hours as practicable.

2. No regular run shall exceed eight hours and forty-five minutes except that 5% of the total system man runs may exceed eight hours and forty-five minutes by fifteen minutes.

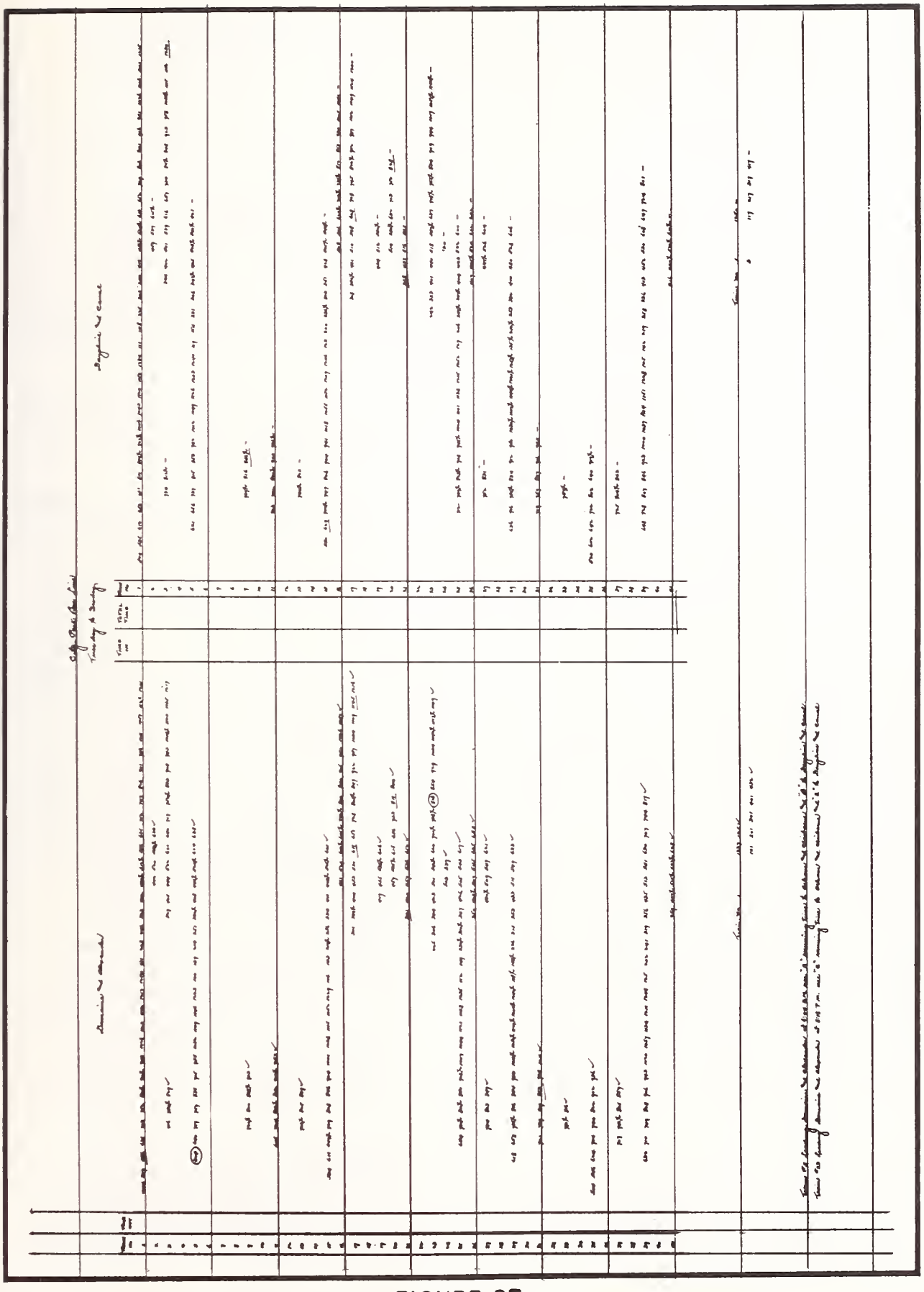

FIGURE 37.
PARTIALLY COMPLETED TERMINAL LAYOUT SHEET—
SAMPLE COMPANY UNDER STUDY.

3. Regular runs that exceed eight hours and forty-five minutes will pay time and one-half after eight hours and forty-five minutes have been exceeded.

4. All regular runs working less than eight hours will pay eight hours.

5. Any run working over eight hours and not more than eight hours and forty-five minutes shall pay straight time.

6. There shall be as many straight runs as economically possible.

The schedule maker, having in mind the general contract provisions outlined above, reviews the rough terminal layout sheet to see that the following conditions are possible of attainment:

1. That the number of early straight runs and late straight runs in the new schedule will be equal to or greater than the number in the existing schedule, all other conditions being equal.

2. That the base cars will come out on the line as early as possible so that as many trips as feasible can be made by regular cars.

3. That the straight runs will fall somewhere between eight hours and eight hours and forty-five minutes.

The first condition, is, of course, associated with the provision of the labor contract that "there shall be as many straight runs as economically possible." The older men on the property, who usually pick the early straight runs, like to get off work as early as possible - around noon or shortly thereafter. They like the straight runs, and like them to begin as early as possible. This also ties in with condition No. 2 as set forth above. From the company's standpoint, it is desirable that the early trips be associated with straight runs so that the number of runs involving high additional "spread" pay may be kept at a minimum. It is, of course, desirable that as many runs as possible fall within the 8:00 and 8:45 straight time rate, as this is the minimum rate that can be paid for productive platform time.

With these thoughts in mind, the schedule maker refers to the run cut sheet of the existing schedule (not shown herein) and finds that there are four (4) early straight runs and seven (7) late straight runs. Since his work will be the subject of review by the Superintendent of Schedules on the one hand and the Trainmen's Association's Schedule Committee on the other, and, further, since the new schedule calls for as many base and night vehicles as the existing schedule, he will strive to set up at least 4 early straight runs and at least 7 late straight runs.

Figure 38 is a duplicate of Figure 37 which will be used in an attempt to trace the process of "shifting" trains. Actually no such sheet exists, as the shifting is done by a series of erasures and re-arrangements which result in the final pencil draft of the terminal sheet. Figure 38 will be used, however, in an attempt to follow the mental processes of the schedule maker as he shifts the trains.

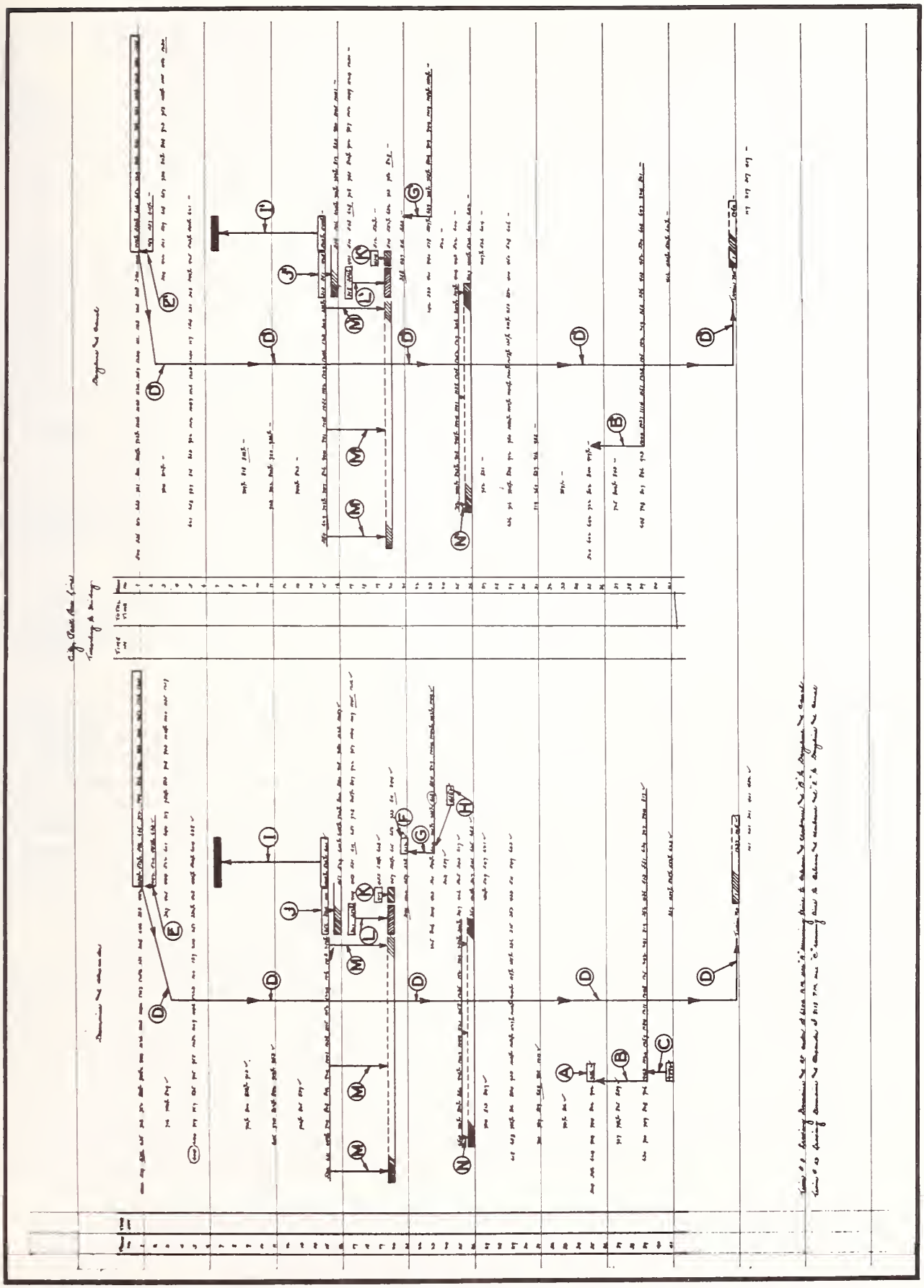

FIGURE 38.
"SHIFTING" THE TERMINAL LAYOUT SHEET-
SAMPLE COMPANY UNDER STUDY.

First, he attempts to make his four early straight runs from the first four buses which pull out of the bus garage, if that is possible. Train No. 1 (4:44 A.M.) is obviously unacceptible of becoming an early straight run. Train No. 35 (5:04 A.M.) is too short to make an early straight run, and indicates the possibilities of "shifting" trains in order to keep this early bus out. Train No. 15 (5:34 A.M.) and Train No. 5 (6:04 A.M.), the fourth pull out bus, are obviously susceptible of becoming straight runs. A fifth vehicle, Train No. 29 (6:18 A.M.) likewise appears susceptible of becoming an early straight run.

Therefore, the schedule maker concludes that, out of the first five pull out buses, there are four possible early straight runs and one early straight run which might probably result from a "shift" of trains.

Continuing with his examination of the terminal layout sheet, the schedule maker considers Train No. 39 (6:30 A.M.), which appears to him to have possibilities of being profitably shifted to combine with Train No. 35 (5:04 A.M.) in an early straight run. Train No. 11 (6:45 A.M.) is a short piece, which off-hand the schedule maker feels might stand alone for the present. Train No. 25 (6:54 A.M.) is the last base bus to reach the line, and it provides the possibilities of a straight run. The process described above is continued until the six (6) base buses have been examined.

After all base buses have been examined for possible early straight runs, a check is made to see that the base buses come out as early as possible. This is done in order to put as many trips as possible on regular buses and to cut the length of tripper runs. This saves the company money by raising the average number of trips on regular runs.

Beginning with Train No. 1 - no change needed, as this is the earliest A.M. bus and is associated with base operations. Nothing much can be done about Train No. 3. Train No. 5 is already a possible early straight run, and is a base bus. Trains Nos. 9, 11 and 13 are short trains which cannot be added to base trips as they show up in Figure 38. Train No. 15 is a base bus. Trains Nos. 25 and 29 both stay on the line during the base period, and there are no apparent earlier trips which could be added to them. Train No. 27 is short, with base buses before and behind it. Trains Nos. 31 and 33 are similar to Trains Nos. 9, 11 and 13, and there would be no apparent shifting at this time unless subsequent steps in run cutting should justify it. Train No. 37 is short and is preceded and followed by longer trains. Trains Nos. 35 and 39, as previously discussed, are susceptible of being combined to advantage. This completes the process of examining the morning portion of the terminal sheet.

The schedule maker is now ready to shift his morning trains. Reference should be made to Figure 38 in following steps A, B and C:

Step A. The time 9:36, representing the arrival time of Train No. 35 at the outer terminal on its last trip, is erased from the terminal layout sheet.

Step B. The outer terminal times of Train No. 39 from 9:43 A.M. through 8:17 P.M. are "shifted" upward into position behind the 9:02 A.M. time of Train No. 35.

Step C. A new terminal time is computed for Train No. 39 - 9:06 plus 17 minutes running time to Dauphine and Canal gives 9:23, which, plus 16 minutes running time back to the outer terminal, equals 9:39 A.M., which is the time that Train No. 39 would return to the bus garage. This time (9:39 A.M.) would be written in behind the 9:06 time for Train No. 39, and followed by a check mark (✓) indicating that this bus would now go to the bus garage.

As a result of this shift, Train No. 35, with two trips earlier than Train No. 39, has become a base bus. The total time (5:04 A.M. to 8:17 P.M.) exclusive of in and out time is 15:13, which approaches two 8-hour regular runs more nearly than Train No. 39's former 13:47. A desirable early straight run has been made possible. This same result could be obtained by dropping the first two trips of Train No. 35 down to Train No. 39. The shift actually used in this case is preferred by the sample company because it involves less total layover time than the alternative method of dropping Train No. 35 down to Train No. 39.

The schedule maker has set up five (5) early straight runs in the new schedule as compared with four (4) in the existing schedule - a gain of one "preferable" run. These early straight runs are associated with Trains Nos. 1, 35 (after "shifting"), 15, 29 and 5.

Attention is next directed towards the afternoon portion of the terminal sheet and the attainment of an objective of at least seven (7) late straight runs.

Train No. 1 runs through until 1:05 A.M., and will provide a late straight run. Train No. 3 is the "owl", and will provide a late straight run. Train No. 16, while presently a little short, is susceptible of being "shifted" into a late straight run. Train No. 17 is a little long for a late straight run, and might be corrected by a suitable shift. Train No. 20 is short, but is so placed on the sheet as to indicate a possible late straight run if properly combined in a shift of trains. Train No. 23 is too long for a late straight run, but might be useful in a shift of trains. The latter portion of Train No. 25 possesses interesting possibilities. Train No. 39, which has already been shifted to Train No. 35 in the A.M. study, will definitely make a late straight run.

Reviewing the above discussion, the schedule maker has two definite late straight runs, -- Trains Nos. 3 and 39 (35 after A.M. shift), and two strong possibilities -- Trains Nos. 1 and 25, either "as is" or on a basis of what can be made out of them. All other late straight runs must be obtained as the result of the "shifting" process. Two other trains -- Nos. 17 and 23, are a little too long, and trippers might have to be made out of parts of them in order to produce late straight runs. This would give six out of the seven needed late straight runs. So far, therefore, there is a possibility of coming up with 6 late straight runs, just 1 short of the number in the existing schedule, a result which would not be received well by either the Trainmen's Committee or the Superintendent of schedules.

Returning his attention to Train No. 1, the schedule maker considers the possibility of combining Trains Nos. 1 and 2 in some manner. If these trains were combined in a shift which would link the 4:44 A.M. time (Train No. 1) with the 6:33 P.M. time (Train No. 2) there would result the early straight run already

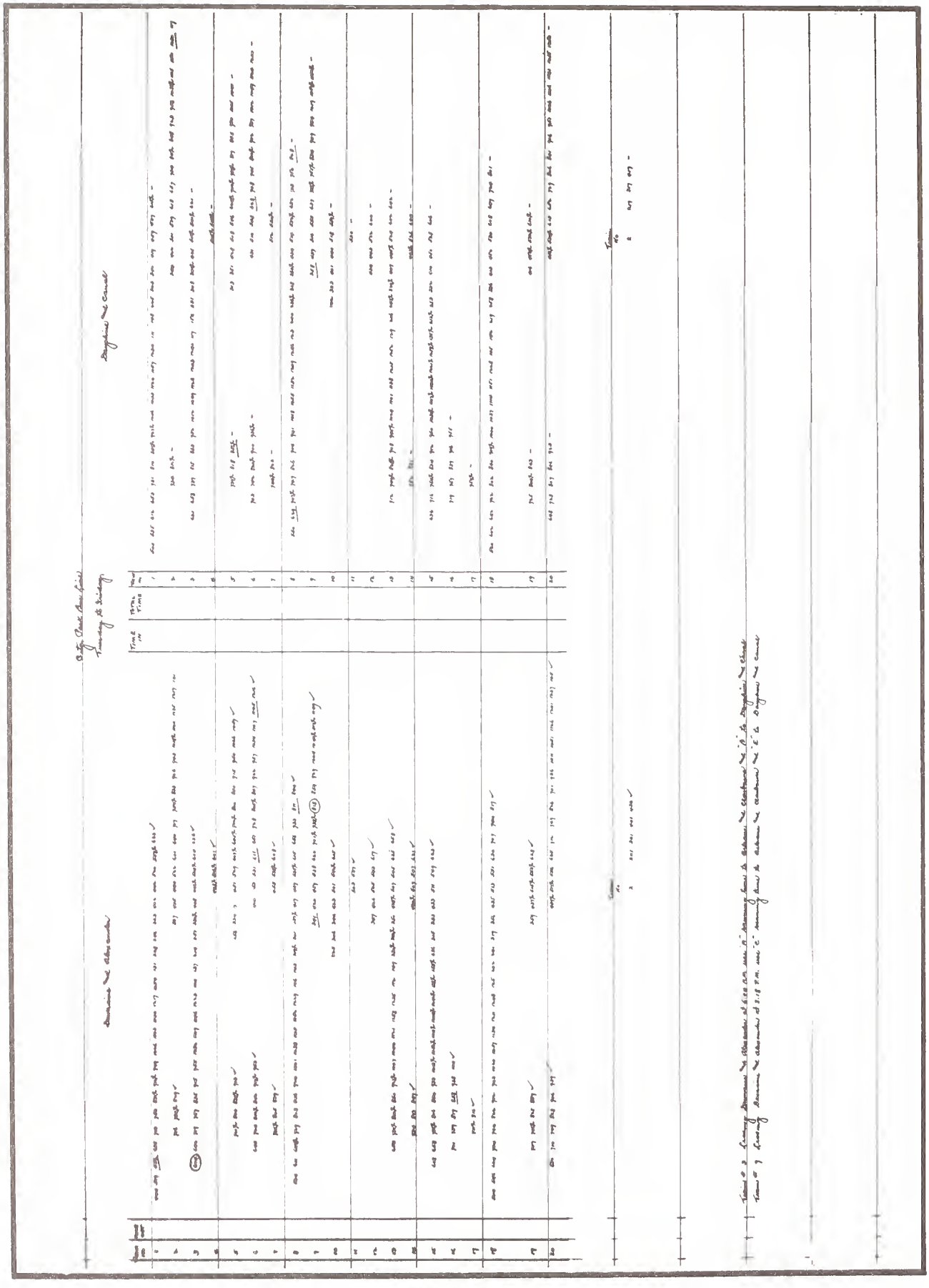

FIGURE 39.
PARTIALLY COMPLETED TERMINAL SHEET-
SAMPLE COMPANY UNDER STUDY.

referred to plus a 6-hour (approximate) piece which might be coupled with a 2-hour (approximate) A.M. tripper to make another regular run. The 4:39½ P.M. to 1:05 A.M. portion of Train No. 1 would yield a late straight run which would fall within the 8 hour and 45 minute limitation. This shift is made in the following steps:

Step D. Remove the terminal times of Train No. 1 from 4:39½ P.M. to 12:01 A.M. inclusive from their present position to the bottom of the sheet to connect up with the 12:37 and 1:05 time entries. Line the 4:39½ up beneath the 4:37½ P.M. time of Train No. 41.

Step E. Move the 4:42 to 6:33 P.M. times of Train No. 2 up to combine them with the remaining portion of Train No. 1.

The schedule maker next turned his attention to Train No. 21, which is too short to give a late straight run, and Train No. 23, which is too long as it stands. By combining that portion of Train No. 23 from 6:20 P.M. to 11:49 P.M. with Train No. 21, a late straight run falling within the 8 hour and 45 minute limitation would result. This shift is made in the following steps:

Step F. The time 6:12, representing the arrival time of Train No. 21 at the outer terminal on its last trip, is erased from the terminal layout sheet.

Step G. The outer terminal times of Train No. 23 from 6:20 through 11:49 P.M. are shifted upward into position behind the 5:38 P.M. time of Train No. 21.

Step H. A new terminal time is computed for Train No. 23 -- 5:40½ plus 17 minutes running time to Dauphine and Canal gives 5:57½, which, plus 17 minutes running time back to the outer terminal, equals 6:14½ P.M., which is the time that Train No. 23 would return to the bus garage. This time is entered as 6:15 (allowing the extra half-minute) behind the 5:40½ time for Train No. 23, and followed by a check mark (✓) indicating that this bus would now go to the bus garage.

Consideration was next given to Train No. 16, which is a little too short, and Train No. 15, which does not presently afford a late straight run. The following steps were taken:

Step I. That portion of Train No. 15 from 4:48½ to 6:01 P.M. inclusive was shifted up to a new position opposite temporary Train No. 7.

Step J. That portion of Train No. 15 from 2:56 to 4:11 P.M. inclusive was shifted down to combine with Train No. 16.

This shift resulted in the production of a late straight run - Train No. 16 - falling within the 8 hour and 45 minute limitation.

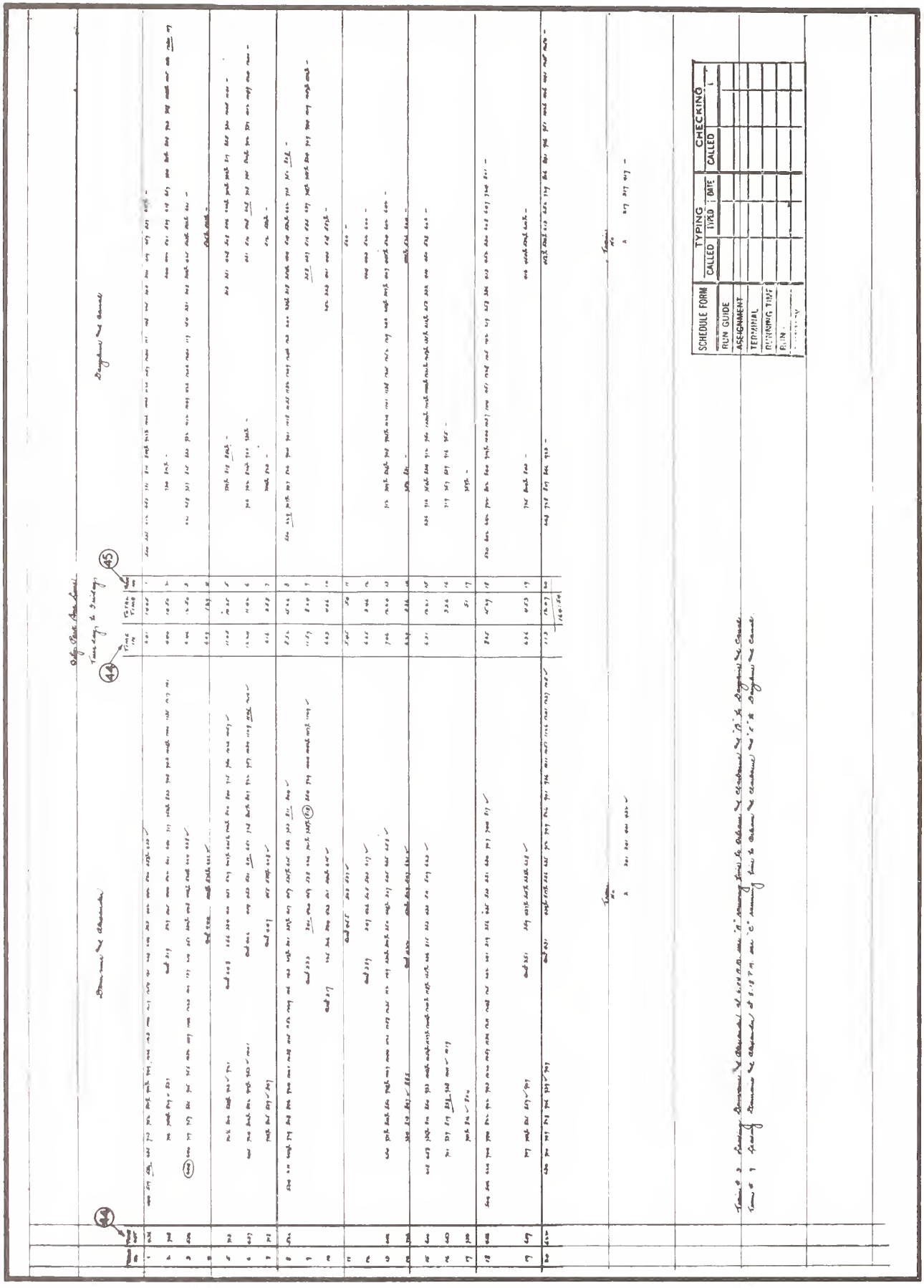

FIGURE 40.
COMPLETED TERMINAL SHEET -
SAMPLE COMPANY UNDER STUDY.

Attention was next directed to the remaining portion of Train No. 15 - a portion approximately nine hours in length with no pull in and standing on the sheet alone. The schedule maker visualized a possible shifting and recombination of parts of Trains Nos. 15, 17, 19 and 20 which would produce a more desirable result. If the 5:34 A.M. time of Train No. 15 could be combined with the 8:44 P.M. of Train No. 20, an early straight run and a late straight run could be developed, with a small amount of allowed time to make them 8 hour runs. If the 3:01 and 3:37½ P.M. trips of Train No. 17 could be shifted elsewhere, the remaining portion of this train would make a late straight run within the 8 hour and 45 minute limitation. These moves were actually accomplished through the following steps:

Step K. The 4:17 P.M. outer terminal time of Train No. 19 was dropped to Train No. 20.

Step L. The 3:01 and 3:37½ P.M. times of Train No. 17 were dropped to Train No. 20.

Step M. The 5:34 A.M. to 2:19½ P.M. times of Train No. 15 were dropped to Train No. 20.

A final shift, designated as Step N on Figure 38, was made to combine the 6:54 A.M. time of Train No. 25 with the 6:58 P.M. time of Train No. 26. This was accomplished by "dropping" the terminal times of Train No. 25 from 6:54 P.M. to 3:10½ P.M. inclusive down to connect with the 3:50 P.M. time of Train No. 26. This resulted in the production of a longer train (by one trip) than that formerly represented by Train No. 25, raising the total time (exclusive of pull in and pull out time) from 11 hours and 23 minutes to 12 hours and 4 minutes. This would make the late straight run formerly noted on Train No. 25 a little later, and leave an early portion of 4½ hours (approximate) which might be profitably combined with some 3½ hour (approximate) P.M. piece.

This completed the shifting of trains during the P.M. period. The schedule maker actually set the stage for eight late straight runs, or one more than those in the existing schedule. These are associated with Trains Nos. 3, 26 (25 after shifting), 39 (35 after A.M. shift), 1 (as shifted to the bottom), 23 (as combined with 21), 16, 17 and 20 (resulting from multiple shift).

It was now necessary for the schedule maker to shift the right-hand portion of the terminal layout sheet to conform to the changes made on the left-hand portion. These changes, designated as B', D'-E', G', I'-J', K'-L'-M', and N' may be easily followed on Figure 38. The letters correspond with the similar letters on the Dumaine and Alexander side of the sheet.

The resulting terminal sheet after the above shifts have been made is shown in Figure 39. The temporary Train Numbers have been replaced with permanent Train Numbers from 1 to 20, beginning consecutively at the top of the sheet. All future reference to train numbers will involve these new numbers of Figure 39.

F. Completion of the Terminal Sheet:

Figure 40:

Step #44. The completed pencil Terminal sheet is shown in

Figure 40. Attention is given to the amounts of "pull out" and "pull in time which should be allowed during the different running time periods of the day. These can be determined from the previous schedule, and modified where necessary in the light of experience or observation. The earliest "Out Time" for a given Train Number should be entered in the appropriate column to the left of the outer terminal times, and the latest "In Time" for a given Train Number should be entered in the column to the right of the outer terminal times. Examples:

Train No. 8 - "Out Time" in Early A.M. is 8 minutes. Bus must leave garage at 5:26 A.M. to be ready to leave outer terminal for first inbound trip at 5:34 A.M.

Train No. 8 - "In Time" in Early Night is also 8 minutes. Bus leaving outer terminal of line at 8:44 P.M. reaches garage and end of day's work at 8:52 P.M.

Train No. 14 -"Out Time" in A.M. Peak "build-up" is 8 minutes. "In Time" after A.M. Peak is also 8 minutes. Note check mark (✓) after 8:47 A.M., indicating that bus leaves outer terminal for garage at 8:47 A.M., reaching there at 8:55 A.M., the figure behind the check mark.

Train No.14 - "Out Time" in P.M. Peak "build-up" in $8\frac{1}{2}$ minutes. (Additional $\frac{1}{2}$ minute allowed to permit time out of garage to be on even minute.) This time allowance (4:22) is indicated by the word "OUT" followed by 4:22, a space, and then by $4:30\frac{1}{2}$, the first P.M. inbound trip time. At the end of its work the bus leaves the outer terminal at 6:21 P.M. for the garage, arriving there 8 minutes later at 6:29 P.M., which time is entered in the "In Time column.

Step #45. The total elapsed time that each Train is in service should be computed and entered in the "Total Time" column. This column should then be added in order to obtain the total number of vehicle hours required by the entire day's schedule.

Examples: Train No. 8 leaves the bus garage at 5:26 A.M. and returns at 8:52 P.M., an elapsed time of

12:00 Noon
- 5.26 A.M.
6:34 hours in A.M.
+ 8:52 hours in P.M.
14:86 or 15:26, total time.

Train No. 14 leaves the bus garage at 7:26 A.M. and returns at 8:55 A.M., an elapsed time of 1:29 hours. This same train leaves the bus garage again at 4:22 P.M. and returns at 6:29 P.M., an elapsed time of 2:07 hours. The total of these two segments of Train No. 14 is 1:29 plus 2:07, or 3:36 hours.

The total vehicle hours for the day is 164:54.

G. Final Form of Terminal Sheet

A finished Terminal Sheet is typed from the pencil "terminal sheet". The completed Terminal Sheet is shown in Figure 29. In this form the inner terminal times are shown in a group below the corresponding outer terminal times. The Schedule Number (7730), its Effective Date, the Schedule Number superseded (7649), and the name of the bus station are shown in the upper left-hand corner of the sheet, in addition to the other features contained on the "terminal layout" form. The notation for running time change is omitted from the typed Terminal Sheet, and the check marks designating "pull in" vehicles on the pencil sheet are replaced by asterisks (*).

Other forms and methods for setting up terminal sheets or time tables, including the "graphical" method, will be discussed in Parts II and III of this report, which will provide a compendium of industry practices and viewpoints on this phase of the schedule making process.

No reference will be made in Part I to the preparation of terminal sheets for "long-and-short-line" routes, or so-called "turn-back" service. The sample company does not generally employ turn-back service in its operations. The reader is referred to Parts II and III, where industry practices and viewpoints on this important phase of schedule making will be discussed.

Consideration will next be given to the process of cutting the terminal sheet into "runs" for assembly into pieces of work for the operating personnel.

CHAPTER VI

RUN CUTTING

A. Importance of Run Cutting

As indicated at the close of the preceding chapter, the process of "run cutting" is essentially a procedure for cutting a transit schedule terminal sheet into "runs" for assembly into pieces of work for the operating personnel. It is by far the most complicated of the procedures which have been examined in this report, and an attempt has been made to illustrate and describe the procedure used by the sample company in such a way that the student of the report may follow this method in every detail.

The run cutting process is of such basic importance that great care, skill and patience are required of the technicians who carry it out. Its importance stems from two sources:

1. The published results of the run cut form the basis on which the operating personnel selects its work, in accordance with seniority. The runs established by the schedule maker must conform to the company's agreement with its trainmen. They prescribe the working hours of each vehicle operator, and determine the exact amount of wages which each operator receives for regular and extra work.

2. The run cut determines the amount of "pay hours" which the company must pay for in order to accomplish the "actual" or productive work hours required to perform a given transit service. The run cut determines the number of "non-productive" platform labor dollars, as well as the number of hours worked at straight time and overtime, together with the various allowances and penalty payments associated with the labor contract.

Summarizing, it may be said that the run cut involves an important "employee relations" aspect on the one hand, and an important "economic" aspect on the other. The ability of a company to successfully combine these two basically important elements in a constructive way will largely determine the success or failure of its transit operations.

It has already been pointed out that the schedule maker must start from a properly constructed and properly "shifted" terminal sheet in order to achieve the best results from the run cut.

B. Controlling Factors

The cutting of runs involves the balancing of the various cost elements of the labor contract against each other in an effort to produce

the most economical combination within the limitations of the specified working conditions. For this reason, an understanding of the provisions, requirements and allowances of the labor agreement is required at the outset.

The important elements of the agreement of the sample company with its platform employees are listed below:

1. Schedules shall be so arranged as to allow regular trainmen and bus operators six days per week and approximately eight hours per day.

2. All regular runs shall be as near eight hours as practicable.

3. No regular run shall exceed eight hours and forty-five minutes except that 5% of the total system man runs may exceed eight hours and forty-five minutes by fifteen minutes.

4. Regular runs that exceed eight hours and forty-five minutes will pay time and one-half after eight hours and forty-five minutes have been exceeded.

5. All regular runs working less than eight hours will pay eight hours.

6. No regular run shall be divided into more than two parts, except that 10% of the total system man runs may be divided into three parts.

7. There shall be as many straight runs as economically possible.

8. Intervals in split runs shall be as short as economically possible. (This does not apply to spread runs as provided for elsewhere.)

9. All "Owl" runs shall be considered as straight runs.

10. Any run, tripper or special working less than five hours and twenty-minutes shall pay time and one-half.

11. Any run, tripper or special working over five hours and twenty minutes and not more than eight hours shall pay eight hours.

12. Any run, tripper or special working over eight hours and not more than eight hours and forty-five minutes shall pay straight time.

13. No tripper or special shall pay less than one hour at the rate of time and one-half (except as provided elsewhere in the contract).

14. For two-part runs having a spread of eleven hours and not more than fourteen hours the following additional rates of pay shall apply:

    Runs having a spread of eleven hours and under eleven hours and thirty minutes -- 15¢ per day.

    Runs having a spread of eleven hours and thirty minutes and under twelve hours -- 30¢ per day.

    Runs having a spread of twelve hours and under twelve hours and thirty minutes -- 50¢ per day.

    Runs having a spread of twelve hours and thirty minutes and under thirteen hours -- 70¢ per day.

    Runs having a spread of thirteen hours and under thirteen hours and thirty minutes -- 95¢ per day.

    Runs having a spread of thirteen hours and thirty minutes and not over fourteen hours -- $1.10 per day.

15. Not more than seven per cent (7%) of the total number of system man runs shall have a spread of over thirteen hours.

16. No run shall have a spread of over fourteen hours.

17. When conductors or bus operators are required to take charge of cars at a distance from the barn, or are required to leave their cars at a point other than the barn, they shall be paid at regular rates per hour for scheduled time allowed the conductor or bus operator in going to or coming from the barn.

There are many other provisions of this labor agreement, but the ones cited above are the general provisions that govern the run cut which will be explained in detail in this chapter.

C. Objectives of the Schedule Maker in "Cutting Up" a Schedule

On the sample property a schedule maker strives for the following objectives in "cutting up" a schedule:

1. He tries to give as many early straight runs as possible - at least as many as the number in the existing schedule.

2. He tries to give as many late straight runs as possible - at least as many as the number in the existing schedule.

3. He tries to keep the amount of "time allowed to 8 hours" at a minimum, as such hours are non-productive.

4. He tries to keep the spread pay allowance at a minimum.

5. He tries to keep the amount of "tripper time" (time and one-half, or "red ink" time) at a minimum. It is preferable to work as much of the schedule as possible into regular runs.

6. He tries to make the schedule as convenient as possible for the trainmen by

    a. Limiting reliefs to the hours between 9:00 A.M. and 10:00 P.M.

    b. Holding the time between reliefs very short (15 or 20 minutes), or else making them long enough to permit trainmen to go home for a meal, and return (1-1½ hours).

    c. Attempting to "balance" the lengths of the portions of a two-piece run so that neither portion is too short.

    d. Keeping to a minimum the spread time of those runs having a spread of less than eleven hours.

Those objectives express briefly the "economic" and "employee relations" aspects of the schedule makers job.

D. The Subdivision Sheet

The Subdivision Sheet is used as an aid in run cutting. It is an intermediate calculation sheet which gives the time each train passes the relief point or points as a preliminary to run cutting. Care must be used in setting it up, as the preparation of the Run Cut Sheet is based upon the Subdivision Sheet and later checked back upon the basic source material. It also serves as a "check" sheet for the run cut process.

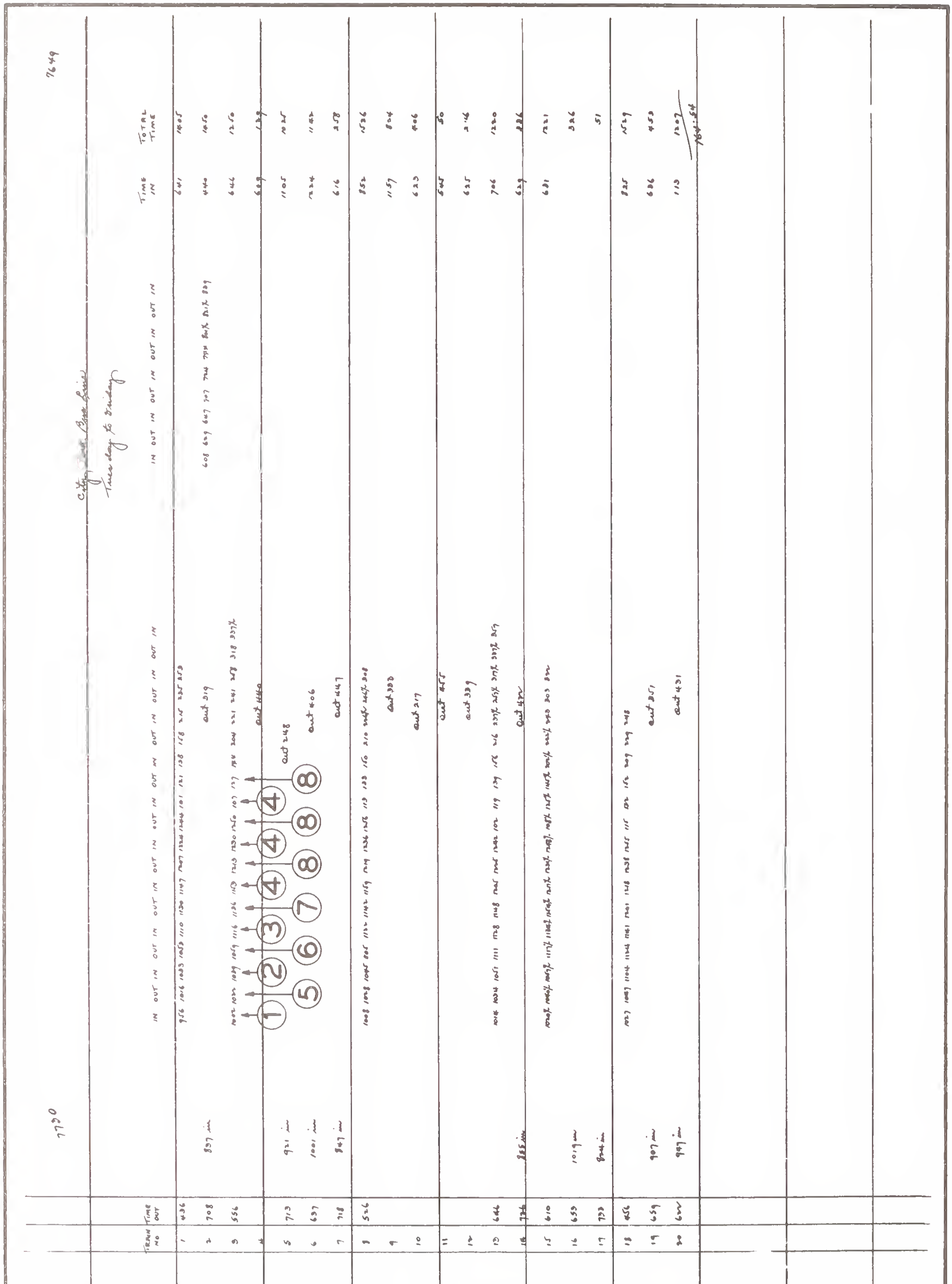

FIGURE 41.
SUBDIVISION SHEET-
SAMPLE COMPANY UNDER STUDY.

The sources of information for preparing the subdivision sheet are the running time sheet (Figure 22) and the terminal sheet (Figure 29).

A sample subdivision sheet for the line under study is shown in Figure 41. The sheet is headed with the name of the line ("City Park Bus Line"), the kind of schedule ("Tuesday to Friday"), the train numbers from the terminal sheet in the extreme left-hand column, and the "time out" for each train number exactly as it appears on the terminal sheet. Columns are also provided for "time in" and "total time". These two columns appear at the extreme right-hand side of the tabulation.

The revised train numbers of the terminal sheet (Figure 29) are copied into the left-hand column of the subdivision sheet, spacing them about every third horizontal line from the top down. Beginning in the ninth column to the right of the "time out" column, the columns are alternately headed "in" for inbound bus trips and "out" for outbound bus trips. These headings are placed on the same horizontal line as the headings "train number", "time out", "time in", and "total time". It is customary for the schedule department to write these headings alternately in black and red ink; that is, all "inbound" headings are written in black ink; all "outbound" headings are written in red ink. Because of the black and white reproduction used in this volume, colors cannot be used.

As a rule, since reliefs on the sample property are not made before 9:00 a.m. or later than 10:00 p.m., relief times are not calculated earlier than 9:00 a.m., or later than 10:00 p.m. In the specific example under consideration, the sheet runs from 10:00 a.m. to 4:00 p.m., except for the "owl".

The advantage of the subdivision sheet as an intermediate data sheet lies in the fact that it will, when completed, show every possible relief time for the line in question so that the schedule maker charged with the responsibility of cutting the terminal sheet into runs may be able to see immediately when each potential "run-ending" occurs by direct inspection rather than having to stop and compute the running time to the relief point in each instance. The subdivision sheet is, therefore, a chart of potential relief times in each direction.

The relief time entries which are placed on the subdivision sheet prepared as described above are computed in the following manner: To the outer terminal leaving time is added the running time from the outer terminal to the relief point on the in-bound trip, and to the inner terminal leaving time is added the running time from the inner terminal to the relief point on the out-bound trip. The running time used must be that which applies to the running time period under consideration.

It is customary, in filling out the Subdivision Sheet, to place all "in-bound" relief times on the sheet before the "out-bound" relief times are calculated, and then to place the outbound times in the alternate spaces between the "in-bound" relief times.

The following examples will serve to illustrate the manner in which the subdivision sheet is filled out.

Taking train No. 3 as an illustration, the following steps are involved in the computation of relief times:

Step #1: Reference to the terminal sheet (Figure 29) shows an outer terminal leaving time for this train number at 9:55 A.M. To this time is added 7 minutes running time (see running time sheet, Figure 22) which is the running time from the outer terminal of the line at Dumaine and Alexander to the in-bound relief point at Orleans and Broad. 9:55 plus 7 equals 10:02. This inbound relief time of 10:02 is entered on the subdivision sheet in the first "in" column opposite train No. 3.

Step #2: The next in-bound trip of train No. 3 leaves the outer terminal of the line at 10:32 A.M. To this time is added the 7 minutes running time from Dumaine and Alexander to Orleans and Broad. This gives a total of 10:39 A.M. This time is entered in the second "in" column opposite train No. 3.

Step #3: The next outer terminal leaving time for train No. 3 is 11:09 A.M. To this is added the 7 minute running time from Dumaine and Alexander to Orleans and Broad, the in-bound relief point. 11:09 plus 7 gives 11:16 A.M. This time is entered in the third "in" column.

Step #4: The succeeding outer terminal leaving times are treated in the manner described in Steps 2 and 3 above so that the relief times for succeeding trips are calculated and entered in the appropriate "in" columns. These times (see entries for train No. 3, Figure 41) are: 11:53, 12:30, 1:07, 1:44, 2:21, 2:58, and 3:37½. As a result of his experience in cutting schedules on the property under study, the schedule maker discontinued the computation of relief times on the subdivision sheet from this point forward, as he knows that no further cuts will be made beyond that time.

Step #5: Referring again to train No. 3 of the terminal sheet for the line under study, we find that the first out-bound leaving time, from the inner terminal of the line at Dauphine and Canal Streets, is 10:12 A.M. To this is added the 10 minute running time from Dauphine and Canal Streets to the out-bound relief point at Dumaine and Broad Streets. 10:12 plus 10 equals 10:22 A.M., which time is entered in the first out-bound or "out" relief time column opposite train No. 3.

Step #6: The next inner terminal time is 10:49 A.M. To this is added the 10 minute running time from the inner terminal at Dauphine and Canal Streets to the outer terminal at Dumaine and Broad Streets. This gives a relief time of 10:59 A.M., which is entered in the second "out" column opposite train No. 3.

Step #7: The next inner terminal time is 11:26 A.M. To this is added the 10 minute running time from the inner terminal of the line to the out-bound relief point, giving a total of 11:36 A.M., which is entered in the third "out" column opposite train No. 3.

Step #8: The same sequence of calculations is continued for other out-bound relief times, giving the following entries which are made on the subdivision sheet: 12:13, 12:50, 1:27, 2:04, 2:41, and 3:18.

These same steps are continued for the other "long-run" buses, such as trains No. 1, 8, 13, 15, 18 and 2.

No relief times are shown for first or last trips, since the vehicle is either coming right out of the bus garage or going directly to it in charge of an operator who is either just going to work, or just getting off. Therefore, no reliefs are made on first or last trips.

Relief times are not computed for those trains which make only a few round trips each. These trains are usually in charge of one operator only from the time the vehicle pulls out of the garage until it pulls in again at the completion of its prescribed run. The out time, in time and total time are entered for these trips however. Take, for example, Train No. 5. This shows out of the bus garage at 7:13 A.M., in the bus garage at 9:21 A.M. Following across the sheet opposite Train No. 5, it shows out of the bus garage again at 2:48 P.M. and into the bus garage at 11:05 P.M. Another example would be Train No. 11, which shows out of the bus garage at 4:55 P.M. and into the bus garage at 5:45 P.M., a total of 50 minutes. There is no problem of reliefs on runs as short as these. Their "in", "out" and "total" times must, however, be shown on the Subdivision Sheet.

Not all properties make use of a computed subdivision sheet as an aid to the preparation of the run cut. On some properties this intermediate calculation is considered a waste of time, and the individual relief times are calculated only at such times as the schedule-maker from experience feels that a run will be cut. It is the opinion of the sample company that it saves time and provides in the long run a better run cut to take the little additional time at the start which is required for the preparation of the subdivision sheet. For comments, opinions and alternative methods of handling this phase of the schedule-making process, the attention of the reader is directed to Parts II and III of this study.

The manner in which the subdivision sheet is utilized in preparing the run-cut sheet will be described in detail under section "E", which follows immediately.

FORM 762-0000 5-48 2M

RUN CUT SHEET

(50) (19)

SCHEDULE No

DATE EFFECTIVE

SUP SCH No

STATION

SCHEDULE DEPARTMENT

City Park Bus LINE

Tuesday to Friday, SCHEDULE

APPROVED

MANAGER SCHEDULE DIVISION

RELIEF POINTS IN

OUT

EARLY RUNS

RUN NUMBERS (H)	TRAIN NUMBER TIME ON (I)	WORKED AND OFF (J)	(K)	HOURS ACTUAL (L)	ALLOWED (M)	PAY (N)	SPREAD HOURS (O)	PAY (P)
1 A	1 436		1244					
1 B				808 ✓	(D)			
2 A	18 456		1238					
2 B				742 ✓				
3 A	8 526		113					
3 B				747 ✓				
4 A	3 556		204					
4 B	(C)			808 ✓				
5 A	15 610	(507)	1117½					
5 B	12 out 839	(346)	635 in	753 ✓			1215	.50
6 A	20 622	(325)	947 in					
6 B	10 out 217	(406)	683 in	731 ✓			1201	.50
7 A	6 637	(324)	1001 in					
7 B	15 203½	(439)	63. in	753 ✓			1154	.30
8 A	13 646	(556)	1242					
8 B	19 out 851	(245)	436 in	841 ✓			1150	.30
9 A	16 653	(326)	1019 in					
9 B	3 204	(442)	646 in	808 ✓			1153	.30
10 A	19 659	(208)	907 in					
10 B	1 1244	(557)	641 in	805 ✓			1142	.30
11 A	8 708	(424)	883 in					
11 B								
12 A	5 713	(208)	921 in					
12 B	13 1242	(624)	706 in	832 ✓	(E)		1153	.30
13 A	2 708	(424)	847 in					
13 B								
14 A	14 726	(424)	856 in					
14 B								
15 A	17 733	(51)	824 in					
15 B								
16								
17 A	15 1117½	(245)	203½					
17 B	2 out 319	(502)	821½	747 ✓			904	—
18 A								
18 B	18 1238		835 in	747 ✓				
19 A								
19 B	8 113		852 in	739 ✓				
20				2.50				
21 A								
21 B								

LATE RUNS

RUN NUMBERS (Q)	TRAIN NUMBER TIME ON (R)	WORKED AND OFF (S)	(T)	HOURS ACTUAL (U)	ALLOWED (V)	PAY (W)	SPREAD HOURS (X)	PAY (Y)
1 A								
1 B	5 out 248	1105 in		817 ✓				
2 A								
2 B	9 out 333	1157 in		824 ✓				
3 A								
3 B	6 out 406	1224 in		818 ✓				
4 A								
4 B	20 out 431	113 in		842 ✓				
5 A								
5 B	2 821½	440 in		819				
6								
7								
8								
9								
10								
11								
12	a. m. Trippers							
13 A								
13 B	2 708	837 in		129				
14 A								
14 B	7 718	847 in		129				
15 A								
15 B	14 726	856 in		129				
16 A								
16 B	17 733	824 in		51				
17				518				
18								
19	p. m. Trippers							
20 A								
20 B	11 out 455	545 in		50				
21 A								
21 B	4 out 440	609 in		129				3:48
22 A								
22 B	7 out 447	616 in		129				
23 A								
23 B	14 out 422	629 in		207				
24				555				
25								
26								
27								
28								
29								

NOTE = VERTICAL DASHED LINES ——— ———
AND HORIZONTAL DASHED LINES - - - - - -
AS WELL AS CAPITAL LETTERS IN CIRCLES
(M), ADDED TO FACILITATE EXPLANATION
OF THE METHOD. THESE MARKINGS DO
NOT APPEAR ON THE FORM AS USED BY
THE SAMPLE COMPANY.

RECAPITULATION OF RUNS

TYPE OF RUNS	KIND OF RUNS	NUMBER OF RUNS	MOTORMEN AND CONDUCTORS ACTUAL HOURS	ALLOWED TIME TO 8 HOURS	ALLOWED TIME TIME AND ½	ALLOWED TIME TOTAL	PAY HOURS	TOTAL SPREAD PAY	(COND. ONLY) JOURNEY TIME
EARLY	STRAIGHT								
	TWO PIECE								
	TRIPPERS								
LATE	STRAIGHT								
	TWO PIECE								
	TRIPPERS								
TOTAL									

FIGURE 42.
(PRELIMINARY) RUN CUT SHEET—
SAMPLE COMPANY UNDER STUDY.

E. The Run Cut Sheet

The Run Cut Sheet used by the company in its schedule work is shown in Figure 42.

The sheet provides for the following information in the heading:

Schedule number
Date effective
Superseded schedule number
Station (name)
Name of line
Type of schedule (weekday, Saturday, etc.)
Approval
Relief points, inbound and outbound

The form is divided vertically into a left-hand (Early Runs) and a right-hand (Late Runs)portion. Each of these portions is further sub-divided into columns for the following data:

Run numbers
Time on, time worked and time off
Hours - actual, allowed and pay
Spread-hours and pay ($).

In the lower right-hand corner of the sheet is a form for the Recapitulation of Runs, which provides for a summary of the results of the run cut. The data are divided horizontally into Types of Runs (Early, Late and Total), and Kinds of Runs (Straight, Two-piece and Trippers). They are divided vertically as follows:

Number of runs
Actual hours
Allowed time - to 8 hours, time and $\frac{1}{2}$, total
Pay hours
Total spread pay
Journey time

In order to simplify the process of explaining the preparation of the Run Cut Sheet - an involved process at best - certain dashed lines and circled letters have been added to the form temporarily. These markings do not appear on the form as used by the sample company. By means of these lines and letters, the various spaces on the form have been subdivided and identified; for example, the designation on the "Early Runs" side of the sheet of "21-B-J" would refer to row 21 B and Column J - the area or space cross-hatched.

As previously explained, the Subdivision Sheet is the schedule maker's primary source of information in setting up the Run Cut Sheet. An auxiliary Subdivision Sheet has been provided in Figure 43. This form will be "marked up" from time to time as the run cutting process unfolds. This sheet is started "clean" - no check marks (✓) and no time markings. As the schedule maker proceeds, he continually marks up the "pieces" of time of each train which he uses on Figure 43, and checks back against the total time as, he progresses and uses all pieces up.

When he begins the run cutting process the schedule maker does not know, aside from his preliminary inspection and shifting of the terminal sheet,

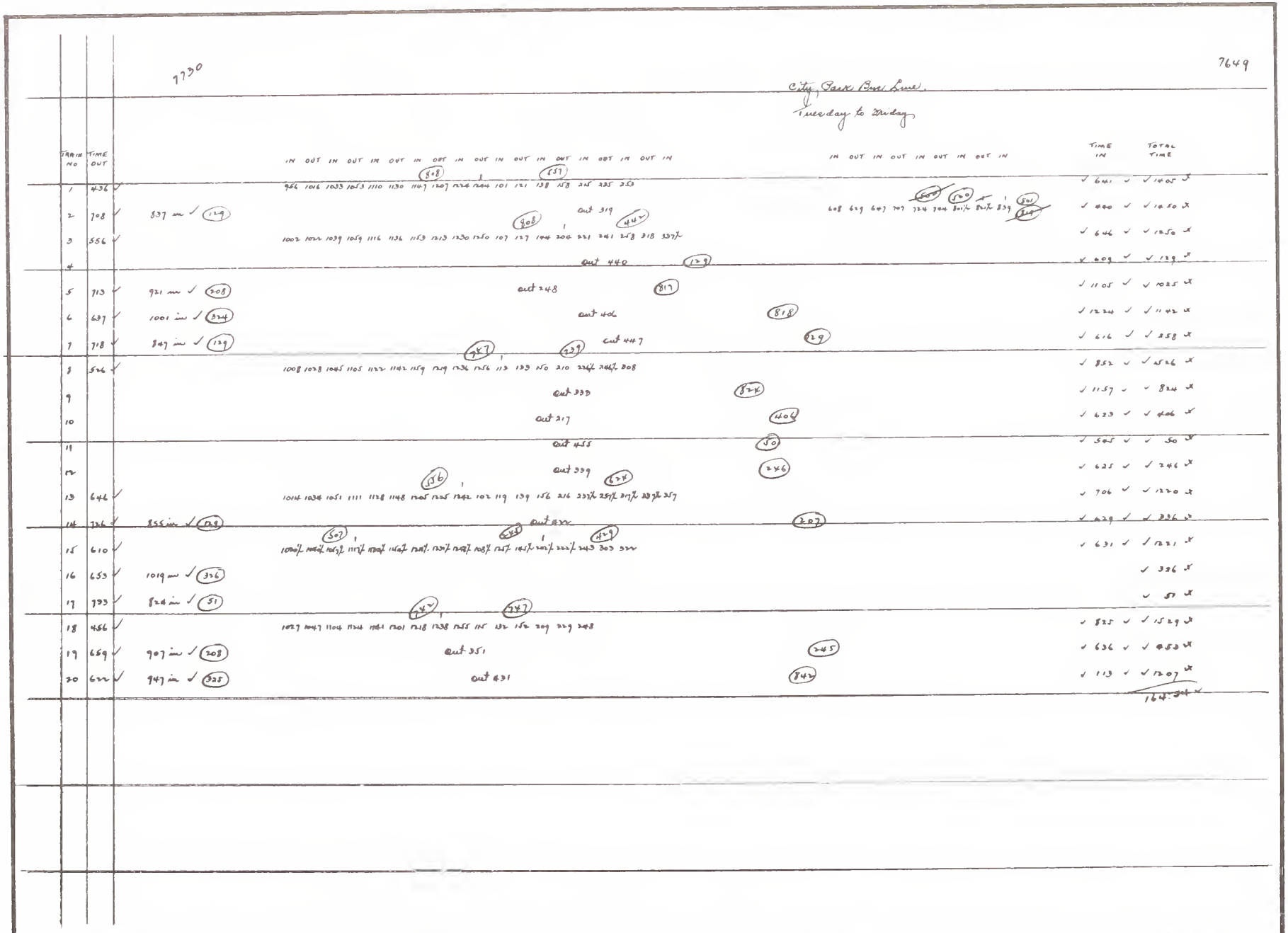

FIGURE 43.
(AUXILIARY) SUBDIVISION SHEET -
SAMPLE COMPANY UNDER STUDY.

just how many runs of various types and kinds he will have. It is customary to strive for an average length of regular runs of 8 hours or better when starting to cut. A little more than 8 hours is desired at the start, so that the schedule maker can balance against his number of trippers and come out with an average length of regular runs of about 8 hours.

The total train time (actual hours) shown on the completed terminal sheet (Figure 29) is 164:54. Assuming 19 regular runs, the average time per run would be 164:54 divided by 19, or 8:42, which is too high. Assuming 20 regular runs, the average time per run would be 164:54 divided by 20, or 8:15, which the schedule maker considers not too high for a start. Twenty (20) regular runs averaging 8:15 hours each are, therefore, his temporary objective. This figure of 20 is marked in a circle at the top of his run cut sheet.

The schedule maker turns his attention to the left-hand or "Early Runs" half of the Run Cut Sheet, and begins to enter from the Subdivision Sheet the early buses as they leave the station. These entries for early schedule are made in the upper half of each run space - the half-rows marked "A". This leaves room for the later runs and pieces to be entered in the lower half of each run space - the half-rows marked "B". Nothing is entered on the left-hand (early) side of the sheet which pulls into the station after 9:00 P.M.

Left-hand or "Early" Side of Sheet

Beginning this process - the first bus out of the garage is Train No. 1 at 4:36 A.M. This entry is made in space 1-A-I. A check mark is placed behind the 4:36 time on the Subdivision Sheet to indicate that this entry has been made on the Run Cut Sheet.

The second bus out of the garage is Train No. 18 at 4:56 A.M. This entry is made in space 2-A-I, and the 4:56 time is checked on the Subdivision Sheet. Similar entries are made for other trains in time order as they pull out - No. 8 at 5:26 (Space 3-A-I), No. 3 at 5:56 (Space 4-A-I), and No. 15 at 6:10 (Space 5-A-I). In each instance a check mark is placed behind the "time out" on the Subdivision Sheet to show that the entry has been made.

The next vehicle out of the garage is Train No. 20 at 6:22 A.M. This is the early portion of a two-part train. The train number (20) and "time out" (6:22 A.M.) are entered on the Run Cut Sheet in space 6-A-I, and checked off on the Subdivision Sheet. The "time in" of this morning portion of the train (9:47 A.M.) is entered in space 6-A-K, and checked off on the Subdivision Sheet. The elapsed time (time worked) for this piece is determined by subtraction (9:47 minus 6:22 equals 3:25 hours) and entered on the Run Cut Sheet in space 6-A-J. The time worked is also entered behind the A.M. portion of Train No. 20 on the Subdivision Sheet for future reference and checking. The schedule maker knows that eventually he must find a piece of $4\frac{1}{2}$ hours (approximate) duration to add to the A.M. portion of Train No. 20 in order to make a regular run of approximately eight hours duration.

The next entry is for Train No. 6, which leaves the bus garage at 6:37 A.M. and returns at 10:01 A.M., an elapsed time of 3:24 hours. These data are entered in spaces 7-A-I, 7-A-K, and 7-A-J, respectively, of the Run Cut Sheet. The times out and in are checked on the Subdivision Sheet, and the time worked is entered on this sheet behind the "time in".

It should be noted that the word "IN" follows the "time in" the garage on the Run Cut Sheet in the case of these morning parts of trains. This contrasts with later entries involving "reliefs", where the vehicle

operator changes, but the vehicle remains on the road.

The above processes are repeated until all the A.M. peak buses have been listed on the Run Cut Sheet. These entries are for Trains Nos. 13, 16, 19, 2, 5, 7, 14, and 17. They are placed in spaces 8-A-I, 9-A-I, J & K, 10-A-I, J & K, and so forth through space 15-A-I, J & K. Note that all except Train No. 13 are A.M. trains which return to the bus garage. In the case of Train No. 13 spaces 8-A-J and K are open at this point until the "relief" calculation is made. In each instance appropriate check marks are placed on the Subdivision Sheet (Figure 43), and the elapsed times for portions of trains used are also entered on this sheet for future reference and checking.

At this point the entries on the Run Cut Sheet and the vehicles checked on the Subdivision Sheet are counted. Both counts equal fifteen (15) - the number of scheduled A.M. Peak buses. This shows that the proper number of entries has been made up to this point.

In the discussion of the Terminal Sheet it was indicated that the existing schedule has four (4) early straight runs, and that at least this number (or possibly one more) should be striven for on the new schedule. As a reminder that he should not encroach upon the present number of early straight runs (four), the schedule maker counts down four spaces from the top of his list of early runs, and places a heavy pencil mark across the column line (designated by the letter (C). If one of the entries above that line is encroached upon in the process of cutting runs, the early straight run so destroyed must be replaced.

The schedule maker next turns his attention to the right-hand, or "late" side of the Run Cut Sheet, and lists all of the vehicles which pull into the garage at 9:00 P.M. or later, placing them on the sheet in time order. These entries are placed in the "lower" or "B" half-rows of the individual run spaces to allow for the early portions of any late two-piece runs which may develop.

Right-hand or "Late" Side of Sheet

Referring to the Subdivision Sheet (Figure 43), he finds that the first bus pulls into the garage at 11:05 P.M. This is Train No. 5, out of the station at 2:48 A.M. The elapsed time ("actual") for this bus is 8:17 hours. These entries are made in spaces 1 B-R, 1 B-T and 1 B-U on the "late" side of the Run Cut Sheet. All "times out" of station (Column R) are preceded by the Train Number and the word "OUT". The "time in" is checked on the Subdivision Sheet, the elapsed time (8:17) is written in on the Subdivision Sheet following the "out" time of 2:48 P.M., and this time (8:17) is added to the 2:08-hour elapsed time of the early portion of this same train to give a total time of 10:25 hours, which checks the "total time" of 10:25 on the Subdivision Sheet. The 10:25 entry in the "total time" column of the Subdivision Sheet is checked off to indicate that the two portions of this train as entered on the Run Cut Sheet add up correctly, and use up all the time as shown for Train No. 5 on the Subdivision Sheet.

Further reference is made to the Subdivision Sheet, and successive entries are made on the "late" side of the Run Cut Sheet for Trains Nos. 9, 6, and 20. In each instance the "in" times are checked on the Subdivision Sheet, the "actual" times are entered on the Subdivision Sheet, and totaled to see that the "total time" of the train has been utilized. The total time entries are then checked.

The next entry to be placed on the "late" side of the Run Cut Sheet is the "Owl" - Train No. 2 which goes in the garage at 4:40 A.M. The 4:40 A.M. time is listed first in space 5-B-T. Knowing that he is seeking for **regular** runs averaging 8 hours, the schedule maker "backs up" from the 4:40 A.M. time by approximately 8 hours to find a suitable relief time for this train. Referring to the Subdivision Sheet, Train No. 2, he temporarily selects the 8:21½ outbound relief time and enters it in space 5-B-R on the "late" side of the Run Cut Sheet. Note that the word "OUT" is not entered in this space, indicating a "relief" as opposed to a bus just pulled cutof the station. The elapsed time between the relief time of 8:21½ P.M. and the "in" time of 4:40 A.M. - 8:19 hours, is entered in space 5-B-U. A small vertical mark (') is placed over the 8:21½ relief time on the Subdivision Sheet, and the time worked (8:19 hours) is entered on this sheet behind the 8:39 relief time entry to indicate how much of the time of this Train has been transferred to the Run Cut Sheet. The 4:40 "in" time is checked off on the Subdivision Sheet.

The 8:21½ relief time on the "owl" is now to be treated as though it was a "pull in" time in listing buses on the Run Cut Sheet. This applies, of course, to the listing of the earlier portion of Train No. 2.

At this point the schedule maker decided to check up on the number of runs which he had listed so far. This count revealed 20 runs. He decided to continue listing for awhile, in excess of his objective of 20 runs, and then to come back and remove some of the tripper runs to the "extra board" at a little later time.

Listing Remaining Trains

He then returned to the left-hand (early) side of the Run Cut Sheet and began to list every vehicle pulling in before 9:00 P.M. which had not yet been listed. A study of the Subdivision Sheet in search of these other trains revealed, including the earlier "unused" portion of the "owl", 15 more trains to list. Inspection of the Run Cut Sheet reveals that he might possibly "tie up" 10 or 11 of these 15 trains with the early pieces listed on the left-hand side of the sheet in spaces 5 through 15. Fifteen (trains yet to be entered) minus eleven (maximum possible "tie-ups") leaves four - he counts down four spaces (to space 19) below space 15 (the last entry) to begin the next step.

Turning his attention to the Subdivision Sheet, he finds that the latest "in" time before the 9:00 P.M. limit is the 8:52 P.M. time associated with Train No. 8. As this train has a total length of 15:26 hours, it may be possible to eventually make an early straight run and a late straight run from it. The entry for this train is made in space 19 B-K; that is, "8:52 IN". The "in" time only is checked off on the Subdivision Sheet.

The next train to be listed, moving "backwards" from 9:00 P.M., is the 8:25 P.M. "in" time of Train No. 18. This entry is made in space 18 B-K. This "in" time is checked on the Subdivision Sheet.

The next time to be entered is the 8:21½ P.M. relief time of the "owl" (Train No. 2), which the schedule maker must treat as though it were an "in" time (See the fifth paragraph preceding). This time is entered in space 17-B-K. The word "IN" is omitted, however, as this is really a "relief" time. The "out" time of 3:19 P.M. for this train is entered in space 17-B-I. The alapsed time of 8:21½ minus 3:19, or 5:02 hours to the "whole" minute, is entered in space 17-B-J, as well as above this portion of Train No. 2 on the Subdivision Sheet. Adding together the three portions of this train which have been transferred to the Run Cut Sheet -- 1:29 plus 5:02 plus 8:19 hours, the check total of 14:50 hours is obtained. The "total time" entry on the Subdivision Sheet of 14:50 for Train No. 2 is then checked.

"Trippers"

As indicated at the outset, the schedule maker was seeking for 20 regular runs. He has listed on the sheet 23 runs so far, or three more than needed. This would run his average way down -- 164:54 total scheduled time divided by 23 runs would be just a little over 7 hours, against the average of 8 hours plus, which is his temporary objective. He, therefore, stops listing trains and begins to "pull off" some his A.M. trippers -- transferring them to the "extra board -- to reduce his number of runs. The objective, over all, at this point is to remove about 8 hours of tripper time, beginning with the shortest trippers first. He finds that the four shortest trippers are:

Train No. 17	7:33 - 8:24 A.M.	0:51 hours
Train No. 2	7:08 - 8:37 A.M.	1:29 hours
Train No. 7	7:18 - 8:47 A.M.	1:29 hours
Train No. 14	7:26 - 8:55 A.M.	1:29 hours
	TOTAL	5:18 hours

If he removes these four A.M. tripper runs to the extra board, he will have 23 minus 4, or 19, regular runs remaining; and in this adjustment of his objective from an initial 20 to a now 19 runs, he should transfer the equivalent of a run -- 8 hours to the extra board. So far, with these four A.M. trippers, he has moved only 5:18 hours over. He still has 3 hours (approximately) in P.M. tripper time to move to the extra board to compensate for this revision in his objective. The circled figure at the top of the Run Cut Sheet is changed from 20 to 19 as being his new objective total number of regular runs.

At this point a "test" of his average length of run is made:

Total time scheduled	164:54
Minus A.M. Trippers to extra board.	5:18
Leaves a remainder of	159:36

for 19 runs, or $\frac{159:36}{19}$ = 8:11 hours.

This average is now a little high, indicating the need to transfer more time from regular runs to tripper runs in the P.M. Peak.

The schedule maker next transfers the four tripper runs described

above to the middle right-hand side of the sheet. In actual practice he erases these runs and enters them in the new position. For purposes of illustration in this report, these trippers will be simply crossed out and entered in their new locations, as indicated by arrows. In this transfer the elapsed times are entered as "actual" time in Column U.

A re-count of regular runs after this shift shows 14 on the early side and 5 on the late side, a total of 19 - the objective number of runs. There must, therefore, be no separate entries from this point forward. All other trains and portions of trains to be transferred from the Subdivision Sheet must be combined in some manner with the 19 runs already listed.

"Matching" Trains

Reference back to the Subdivision Sheet shows Train No. 2 - "relief" time of 8:21½ P.M. - to be the last train listed. The next train in the garage is No. 13 at 7:06 P.M., which represents a total time of 12:20 hours. The schedule maker tries to find something in the A.M. of about 4 hours duration which, when added to Train No. 13, would total roughly 16 hours, or two runs. No. 13 as listed in space 8 A is an "open" run. For the moment the schedule maker assumes that he may be able to hook the final portion of Train No. 13 up with Train No. 5 to advantage. He, therefore, enters the "in" time of No. 13 (7:06 P.M.) in space 12 B-K and lets it remain there temporarily. The 7:06 P.M. "in" time is "checked off" on the Subdivision Sheet.

The next "in" bus in decreasing time order is Train No. 3, in the garage at 6:46 P.M. The total time of this train is 12:50 hours. The schedule maker is now seeking a 3-hour (approximate) piece which, when added to the 12:50 time of Train No. 3, will give two 8-hour runs. Such a possibility is Train No. 16 in the morning, with a total time of 3:26 hours -- 12:50 plus 3:26 equals 15:76, or 16 hours and 16 minutes, the equivalent of two eight-hour runs. The "in" time of Train No. 3 (6:46 P.M.) is entered on the Run Cut Sheet in space 9 B-K. The 6:46 P.M. "in" time is checked on the Subdivision Sheet.

Consideration is next given to Train No. 1, which goes into the garage at 6:41 P.M., and has a total time of 14:05 hours. If this could be combined with Train No. 19 (A.M. portion of 2:08 hours length), the result would be 16:13 hours, or two possible 8-hour runs. The "in" time of Train No. 1 (6:41 P.M.) is entered in space 10-B-K. The 6:41 "in" time is checked on the Subdivision Sheet.

The next "in" time in decreasing order is Train No. 19 (P.M. portion) at 6:36 P.M. This has a length of 2:45 hours. Turning consideration to Train No. 13, space 12 B-K, it is found that there is a move in progress to tie Train No. 13 in with Train No. 5 (12:20 plus 2:08 equals 14:28). If the 2:45 hour part of Train No. 19 could be added to this total, an overall combination of 17:13 hours would result -- a little more than two 8-hour runs. So, the schedule maker tries temporarily to combine the P.M. portion of Train No. 19 with a portion of Train No. 13. The three entries for Train No. 19 (P.M. portion) are entered in spaces 8 B-I, J and K. The time used is entered on the Subdivision Sheet, added to the time used of the A.M. portion of Train No. 19, checked against the total time of Train No. 19, and appropriate check marks are made.

The next bus pulls into the garage at 6:31 P.M. This is Train No. 15, with a total elapsed time of 12:21 hours. The schedule maker needs about $3\frac{1}{2}$ hours to turn this into two 8-hour runs. The A.M. portion of Train No. 6 (space 7A) is 3:24 hours long. This, plus 12:21 for Train No. 15, would give 15:45 hours, or nearly two 8-hour runs. The "in" time for Train No. 15 is entered in space 7 B-K, and checked off the Subdivision Sheet.

Train No. 14 (P.M. portion) is the next "in", at 6:29 P.M. The schedule maker knows that he has to put more tripper time to the extra board in order to balance out -- about 3 more hours, based upon the earlier discussion in this chapter. Since Train No. 14 is quite short (2:07 hours), he pauses at this point to ponder the P.M. tripper problem a little. He feels that it is time for him to study the remaining evening runs and to transfer the remaining 3 hours of time to the "board" in terms of the shortest tripper buses.

The shortest P.M. tripper appears to be Train No. 11, of 50 minutes duration. This bus is listed on the extra board as a P.M. tripper in spaces 20 B-R, T and U. The elapsed time is entered on the Subdivision Sheet, and the "in" time and total time are checked off.

Inspection of the Subdivision Sheet reveals two other P.M. trippers -- Trains Nos. 4 and 7, each of 1:29 hours duration. These are entered in spaces 21 B-R, T and U and 22 B-R, T and U, respectively, and checked off the Subdivision Sheet.

These three P.M. trippers - Trains Nos. 11, 4 and 7 - total 3 hours and 48 minutes, approximately the 3 hours sought for transfer to the extra board.

Allowing for the four early straights (spaces 1,2, 3 and 4) which cannot be touched without reducing the number of early straights below those in the existing schedule, there are only two remaining "openings", on the present objective of 19 runs. These are Trains Nos. 15 and 20. There are, however, three remaining buses to be transferred from the Subdivision Sheet - Trains Nos. 10, 12 and the P.M. portion of Train No. 14, where a temporary halt was called in adding regular runs to the Run Cut Sheet. At least one of these will have to go to the extra board under the present schedule "objective". Therefore, there will be at least four (4) P.M. trippers.

Looking now at the Run Cut Sheet rather than the Subdivision Sheet, the schedule maker studies Train No. 20 (Space No. 6). This is a piece 3:25 hours long. Between 4 and $4\frac{1}{2}$ hours are required to combine with Train No. 20 to make an 8-hour run. Train No. 10, "out" at 2:17 and "in" at 6:23, has a length of 4:06 hours. Thus, No. 10 is hooked up with Train No. 20 in space 6 to give a run of 7:31 hours in length. (See entries in spaces 6 B-I, J, K and L). The appropriate entries and checks are made for Train No. 10 on the Subdivision Sheet.

There now remain two P.M. buses, Trains Nos. 12 and 14, only one of which can be linked with a remaining early A.M. vehicle. The schedule maker now takes the shortest of these -- No. 14 with a length of 2:07 hours, and adds it to the P.M. trippers on the extra board. (See spaces 23 B-R, T and U). Appropriate entries and checks are placed on the Subdivision Sheet (2:07 this entry plus 1:29 A.M. tripper uses up Train No. 14 completely -- 3:36 hours total).

The remaining train, No. 12, is entered on the "early" portion of the sheet in spaces 5 B-I, J, and K, and checked off the Subdivision Sheet. A check is now made of the Subdivision Sheet to see that all P.M. trains have been properly transferred to the Run Cut Sheet.

It was stated at the outset that the schedule maker was striving for an objective of 8:15 average hours per regular run. Along the way this figure was revised to an average of 8:11 or less. A check may now be made to determine the "actual" average at this point:

Add the A.M. tripper time	5:18	(space 17 U)
Add the P.M. tripper time	5:55	(space 24 U)
Total tripper time	11:13	
Total time from terminal sheet	164:54	
minus total tripper time	11:13	
Equals "regular run" time	153:41	

153:41 divided by 19 runs = 8.1 or 8:06 hours

against the original objective of 8:15 hours.

The trains are now all listed on the run cut sheet, and the schedule maker is ready to "make the cut". He is free to use his own judgment, and to start anywhere on the sheet that he wants to.

"Making" the "Cut"

The schedule maker elected to start the cut with Train No. 1. This is a 14:05 hour train. If "hooked up" with a 2-hour piece in the A.M., it would give an early straight run and another regular run (two-piece) of 8 hours duration. The possible A.M. piece is Train No. 19 (space 10A), which is 2:08 hours long. 2:08 plus 14:05 equals 16:13, which would "do the trick". Train No. 1 would, therefore, be cut into two pieces - an early straight run of 8 hours duration and a later piece of 6 hours length to tie in with Train No. 19. Reference is made to the Subdivision Sheet to find the closest relief time which will give an early straight run. Train No. 1 comes out of the garage at 4:36 A.M. He can be relieved at 12:44 on the outbound trip -- which would give a length of 8:08 hours. A small vertical mark (') is placed above 12:44 on the Subdivision Sheet, and the elapsed time of 8:08 hours is written in on the sheet above the relief times of Train No. 1 and to the left of the vertical mark. The entry

on the Run Cut Sheet for Train No. 1 (space 1A-K and L) is completed by filling in the relief time (12:44) and the actual vehicle time (time worked - 8:08).

The alert schedule maker assumes that everything on the Run Cut Sheet is "in motion"; that is, that nothing entered so far is "fixed", and that he must be prepared to make as many changes as necessary in order to get the best over-all result from his run cut.

He can now complete Train No. 19 (space 10), as the relief time of Train No. 1 is (at least temporarily) known. This relief time of Train No. 1 (12:44 P.M.) is entered in space 10 B-I, and the elapsed time between the relief time (12:44) and the "in" time (6:41) for the train is calculated (5:57 hours). This time is entered in space 10 B-J, and added to the 2:08 time of Train No. 19 to produce a total actual time of 8:05 hours which is entered in space 10 B-L. The time for this piece of Train No. 1 (5:57) is entered on the Subdivision Sheet to the right of the vertical line ('), added to the 8:08 early piece of Train No. 1 to give 14:05 hours, and the total time, which checks, is "checked off" on the Subdivision Sheet.

Reference to the Run Cut Sheet, "early" side, space 2A, shows Train No. 18, which is of 15:29 hours duration and susceptible of being made into an early straight run. Since there are no pieces available which might readily combine with this train to increase its length slightly, it perhaps can be broken into two straight runs of 7:45 hours length (approximate) each, or as near that as practicable. Reference is made to the Subdivision Sheet for relief times, and a relief time of 12:38 P.M. on the outbound leg is selected temporarily as a breaking point. This gives a total time of 7:42 hours (from 4:56 A.M. to 12:38 P.M.). A vertical line is placed above the 12:38 time on the Subdivision Sheet, and the elapsed time of 7:42 is written in above the relief times for this train to the left of the vertical mark. The 12:38 relief time is entered in space 2A-K, and the actual time of 7:42 hours is entered in space 2A-L to complete the entry.

The remaining portion of Train No. 18 is entered in space 18 B, where the IN time (8:25 P.M.) is already shown. The relief time (12:38) is entered in space 18 B-I, and the length of run (7:47 hours from 12:38 to 8:25 is entered in space 18 B-L. The 7:47 time is also entered on the Subdivision Sheet to the right of the vertical mark ('), added to the 7:42 time for the early portion of Train No. 18 to give 15:29 hours, the total time shown on the Subdivision Sheet. This total time is checked off.

Train No. 8 is handled in the same manner as Train No. 18, breaking it into two 7-hour plus pieces, and entering the relief times and elapsed times in spaces 3 A-K and L and 19 B-I and L. The Subdivision Sheet is treated in the usual fashion, appropriate times and check marks being entered on this sheet.

The schedule maker, it is recalled, is working towards not less

than four early straight runs in order to have as many preferable runs as there are in the existing schedule. His fourth early straight run appears as Train No. 3 in space 4. If this train can be coupled with the P.M. portion of Train No. 16, a total time of 12:50 plus 3:26, or 16:16 hours, will result. This will give two 8-hour runs. The Subdivision Sheet is consulted for an appropriate relief time, and the customary notations and checks are made on that sheet. The relief time (2:04 P.M.) is entered in spaces 4 A-K and 9 B-I. The elapsed time for the evening piece of Train No. 3 (4:42) is entered in space 9 B-J. The actual hours for these runs are entered in spaces 3 B-L and 9 B-L, respectively.

Dropping down to space 5 -- Train No. 15 -- the total time of this train as indicated on the Subdivision Sheet is 12:21. Combined with the P.M. portion of Train No. 12 (2:46 hours) and the A.M. portion of Train No. 6 (3:24), this would total 18:31 hours, which is too long. The schedule maker must search further for a combination which will keep him on his 8--hour average. Space 17 - Train No. 2, shows a piece 5:02 hours long. If a piece 2½ hours long could be removed from a combination of Trains 15, 12 and 6 to build up Train No. 2 to somewhere near an 8-hour run, perhaps this combination could be reduced to something nearer two 8-hour runs. Looking further, the schedule maker notices that Train No. 12 (space 5 B-J) is a P.M. piece of 2:46 hours duration. If 5 hours can be taken off the A.M. portion of Train No. 15 to combine with this, an 8-hour (approximate) run can be produced. Consulting the Subdivision Sheet, he picks a relief time of 11:17½, which gives a length of 5:07 hours for this piece. These figures are entered in spaces 5 A-K and 5 A-J, respectively. The total time for the run - 5:07 plus 2:46 equals 7:53 - is entered in space 5 B-L. Appropriate marks and time entries are made on the Subdivision Sheet to indicate this transaction with Train No. 15.

Continuing with the "partition" of Train No. 15, the schedule maker again considers space 17 -- Train No. 2, the 5:02 hour piece. He enters Train No. 15 and its relief time (11:17½) as discussed in the paragraph next above in space 17 A-I. He then consults the Subdivision Sheet for another relief time which will give him a piece about 3 hours long. The inbound relief time at 2:02½ P.M. will yield a piece 2:45 hours long, which, when combined with the 5:02 hour piece of Train No. 2, will total 7:47 hours. The new relief time for Train No. 15 (2:02½) is entered in space 17 A-K, the elapsed time (2:45) is entered in space 17 A-J, and the total run time of 7:47 hours is entered in space 17 A-L. Appropriate markings and time entries are made on the Subdivision Sheet.

Proceeding with the "splitting" of Train No. 15, the schedule maker eyes space 7 A - Train No. 6, as a possibility. There remains of Train No. 15 (2:02½ relief time to 6:31 P.M. "in" time) a piece 4:29 hours long. This, when added to the 3:24 hour A.M. portion of Train No. 6, would give a regular run 7 hours and 53 minutes long. These entries are made on the Run Cut Sheet (spaces 7 B-I, J and L. The corresponding notations are made on the Subdivision Sheet.

Train No. 15, instead of being used as an early straight run

(as it might have been used) was broken into three parts in this particular cut to fill out Trains Nos. 12, 6, and 2, and to help build them up into regular two-piece runs of approximately 8-hours length each. The three portions of Train No. 15 as noted on the Subdivision Sheet:

	5:07 hours	(combined with Train No. 12)
	4:29 hours	(combined with Train No. 6)
and	2:45 hours	(combined with Train No. 2)
	12:21 total hours	(see Subdivision Sheet)

combine to give the 12:21 hours shown for this train on this sheet, and the total time entry may now be checked off.

Stopping momentarily to check on his progress, the schedule maker finds that he has taken care of 17 of the 19 regular runs which he has been striving to attain. This leaves spaces 8 and 12 (two parts of Train No. 13 coupled with Trains Nos. 19 and 5) as yet undetermined as to relief time and length.

Train No. 13 is 12:20 hours in length, Train No. 19 is 2:45 hours in length, and Train No. 5 is 2:08 hours in length. This combination of trains totals 17:13 hours, or two runs of 8:36 (approximately) each. A relief time of 12:42 inbound is selected for Train No. 13. Appropriate notations are made on the Subdivision Sheet, and the corresponding entries are made in spaces 8 A-J, K and L, and 12 B-I, J and L, of the Run Cut Sheet. Both runs produced by this cut are of desirable lengths.

This last step completes the cutting of the schedule into runs.

Calculation of Spread Time and Pay

The schedule maker's next step is to calculate the elapsed time of all regular two-piece runs from the first time of the A.M. portion to the last time of the P.M. portion in order that the "bonus" or spread pay time may be known.

The spread pay provisions have been set forth in detail elsewhere, but will be repeated here for convenience:

Spread Time	Spread Pay (per Day)
Eleven hours and over, but under eleven hours and thirty minutes	15¢
Eleven hours and thirty minutes and over, but under twelve hours	30¢
Twelve hours and over, but under twelve hours and thirty minutes	50¢

Spread Time (con't)	Spread Pay (per Day)
Twelve hours and thirty minutes and over, but under thirteen hours	70¢
Thirteen hours and over, but under thirteen hours and thirty minutes	95¢
Thirteen hours and thirty minutes and over, but not over fourteen hours	$1.10

Columns are provided on the Run Cut Sheet (Columns "O" and "P" of Figure 42) for the Spread Hours and Spread Pay.

The calculation is made as follows:

Space 5 A-I	starting time	6:10 A.M.
Space 5 B-K	ending time	6:25 P.M.

Total spread time 12:15 hours.

Total spread pay (from table above) - 50¢

These data are entered in spaces 5-O and 5-P. The process is continued for all two-piece runs, with corresponding entries being made on the Run Cut Sheet. (See spaces 6,7,8,9, 10, 12 and 17, Columns O and P.) In the case of space 17 the spread time is 9 hours and 4 minutes, which does not involve additional pay, being less than eleven hours. A dash (-) is placed in the "spread pay" column in this case.

The spread pay column is now added ($2.50), and the total entered temporarily in space 20, Column "P".

Swapping of "Pieces" to Reduce Spread Pay and to Decrease "Allowed" Time

The schedule maker's next step is to try to reduce the spread pay, and to decrease the amount of time "allowed" to 8 hours, by trying a different combination of pieces than that which he now has on the Run Cut Sheet.

To do this he starts with the last run on the "early" side of the sheet which pays a spread -- in this instance the combination of runs in space 12.

The schedule maker goes through a mental process in which he notes the length and amount of spread of the combination under consideration, and tries to find an (approximately) equivalent - lengthened piece which would bring the first OUT and last IN times closer together so as to reduce the spread hours and spread pay.

Referring to the Run Cut Sheet, Figure 42, he compares space 12 B with the Train in space 10 B. 12 B is a 6:24 piece, and 10 B is a 5:57 piece. The "in" time of 10 B is 6:41 P.M., as against 7:06 P.M. for space 12 B. If he, therefore, moved Train No. 13 from 12 B up to 10 B to join with Train No. 19 which pulls out at 6:59 A.M. (space 10 A-I), the spread would become 12:07 instead of the present 11:42, and would raise the spread pay of space 10 to 50 cents instead of 30 cents, a loss of 20 cents per day. In this same move Train No. 1 would drop from space 10 B to space 12 B to link up with Train No. 5, with an "out" time of 7:13 A.M. The new spread would figure from 7:13 A.M. to 6:41 P.M., or 11:28 instead of 11:53 as at present. This would drop the spread pay on space 12 from 30¢ to 15¢, a gain of 15¢. On the whole swap the company would lose 20¢ on the first move and gain 15¢ on the second move, a net loss of 5¢ per day on the whole transaction.

It is also necessary, before reaching a conclusion as to the swap, to check the change which it would produce in the amount of "time allowed to 8 hours." Since both A.M. pieces in spaces 10 and 12 are of 2:08 length, the total time worked by the entire combination would be the same in any case. Therefore, there would be no change in allowed time as a result of the swap. The net loss of 5¢ per day on spread time would not be offset, and, therefore, there would be no advantage to the company in such a swap. Under the circumstances, this swap would not be made.

Continuing with the P.M. portion of Train No. 13 (space 12), it is checked successively against spaces 9 B, 8 B, 7 B, 6 B and 5 B in a search for possible "swaps". In each case it is found that these P.M. pieces are all too short for interchange with the P.M. portion of Train No. 13 as entered in space 12 B. Therefore, no swaps are made.

Moving up to space 10 on the "early" side, the schedule maker continues his search for possible opportunities to reduce the spread or decrease the allowed time. Comparing 10 B (5:57 piece) with 9 B (4:42) and 8 B (2:45), he finds them too short for interchange. The same is true of spaces 7 B (4:29), 6 B (4:06) and 5 B (2:46).

Taking next space 9 B, the process is continued. This train, No. 3, has a length of 4:42. Space 8 B (2:45) is too short for interchange. Space 7 B (4:29) has possibilities. By moving Train No. 3 from 9 B to 7 B, the spread (6:37 A.M. to 6:46 P.M.) becomes 12:09, and the spread pay becomes 50¢, instead of 30¢, a loss to the company of 20¢ per day. In moving 7 B (Train No. 15) to 9 B, the spread becomes (6:53 A.M. to 6:31 P.M.) 11:38, or 30¢, which is no change. So far, there would be a loss to the company of 20¢ per day in spread pay for the swap.

This transaction must next be checked for its effects upon "allowed" time. If 9 B were combined with 7 A, the total actual hours would be 3:24 plus 4:42, or 8:06 total. If 9 A were combined with 7 B, the total actual hours would be 3:26 plus 4:29, or 7:55 total. The present allowed time to 8 hours in spaces 7 and 9 is 7 minutes (7:53). After the "swap" under consideration, the allowed time for spaces 7 and 9 would be 5 minutes (7:55). Therefore, 7 minus 5, or 2 minutes in allowed time would be saved

FORM 742-0006 6-43 2M

SCHEDULE No.
DATE EFFECTIVE
SUP. SCH. No.
STATION

RUN CUT SHEET

SCHEDULE DEPARTMENT

APPROVED
MANAGER SCHEDULE DIVISION.

RELIEF POINTS { IN OUT

City Park Line — LINE — Tuesday to Friday — SCHEDULE

EARLY RUNS

RUN NUMBERS		TIME ON, WORKED AND OFF			HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
1									
2									
3									
4									
	A	15 610	(607)	1117½					
5	B	12 out 339	(502)	635 in	753			1215	.50
	A	16 653	(346)	1019 in					
6	B	10 out 217	(446)	633 in	732			1180	.30
	A	6 637	(326)	1001 in					
7	B	15 202½	(457)	681 in	753			1156	.30
	A	13 646	(516)	1162					
8	B	19 out 351	(385)	614 in	841			1150	.30
	A	20 632	(334)	967 in					
9	B	3 204	(442)	646 in	807			1324	.50
	A	19 659	(308)	907 in					
10	B	1 1304	(567)	641 in	805			1162	.30
11									
	A	5 713	(408)	921 in					
12	B	13 1242	(624)	706 in	832			1153	.30
13									
14									
15									
16									
	A	15 1117½	(345)	203½					
17	B	2 out 219	(520)	~~839~~ 839	~~749~~ 805			904	–
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									

LATE RUNS

RUN NUMBERS		TIME ON, WORKED AND OFF	HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
1							
2							
3							
4							
5	B	~~839~~ 839 2 ~~out~~ 440 in	~~801~~ 801				
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							

RECAPITULATION OF RUNS

TYPE OF RUNS	KIND OF RUNS	NUMBER OF RUNS	MOTORMEN AND CONDUCTORS — ACTUAL HOURS	ALLOWED TIME — TO 4 HOURS	ALLOWED TIME — TIME AND ½	ALLOWED TIME — TOTAL	PAY HOURS	TOTAL SPREAD PAY	(COND. ONLY) JOURNEY TIME
EARLY	STRAIGHT								
	TWO-PIECE								
	TRIPPERS								
LATE	STRAIGHT								
	TWO-PIECE								
	TRIPPERS								
TOTAL									

FIGURE 44.
(AUXILIARY) RUN CUT SHEET -
SAMPLE COMPANY UNDER STUDY.

by the swap. At the present wage rate for bus operators, this 2 minute saving would be worth about 3.6¢ per day to the company. Stacked against a loss of 20¢ per day in spread pay, the net loss of 16.4¢ per day would discourage the schedule maker from making this swap. (NOTE - There are many instances every day on the sample property in cutting runs where the saving in allowed time will more than offset any increase in spread, to the advantage of the company.)

In comparing space 9-B with space 6-B, it was found that the spread would remain the same after the "swap", but that one minute in allowed time could be saved by swapping. Despite the small gain to the company, which is involved (1.8¢ per day), the schedule maker decided to make the swap to save this minute. This involves the interchange of the entries in space 6-A with these in space 9-A.

In every day practice the schedule maker would simply use his eraser and pencil to make this interchange. In order to keep the steps intact for the student of this report, however, a second "auxiliary" Run Cut Sheet (Figure 44) has been included. On this sheet the student will find spaces 5, 7, 8, 10, 12 and 17 basically as they are in Figure 42, but spaces 6 and 9 have been "swapped" in accordance with the moves described in the paragraph immediately above. The position of the spread changes, but it is still 50 plus 30 cents in the one case, and 30 plus 50 cents in the other case -- a stand off. On Figure 42, space 6 showed an allowed time to 8 hours of 29 minutes (from 7:31 actual), while on Figure 44 space 6 shows an allowed time of 28 minutes (from 7:32 actual).

This may seem to the student of the report to be a lot of trouble for a negligible saving, but it serves to illustrate a principle which, as followed by the sample company, has resulted in savings of many thousands of dollars annually. The saving in allowed time in such "swaps" is frequently as high as 30 minutes per swap.

Now that space 9-B has been changed (Figure 44), it must again be compared with all the two-piece runs ahead of it in the list. Space 8-B is too short for interchange; a change might be made with space 7-B, but this would lose 20¢ per day on spread pay; 9-B and 6-B have already been swapped to save a minute in allowed time; and 5-B is too short for interchange.

Similarly, 8-B is compared with 7-B (too long), 6-B (too long), and 5-B. In the latter case the spreads would still be 50¢ and 30¢ - no saving, and a minute in allowed time would be lost in the interchange. This change would not be made.

7-B is next checked against 6-B. If a swap were made the spread pay would be the same, and the allowed time would balance out. There is no advantage to the "swap". 5-B is too short for interchange.

When 6-B is compared with 5-B, the latter is found to be too short for interchange.

This completes the process of "swapping pieces" to reduce spread pay, and to decrease the "allowed" time.

Equalization of Runs

After checking through the spread time and allowed time as described above, the schedule maker next examines the Run Cut Sheet in an attempt to "equalize" the runs; that is, to see that each trainman gets his fair share of the work to be performed. The "allowed" time is also reviewed in this process.

The schedule maker returns to the Subdivision Sheet (Figure 41) and begins his examination with Train No. 1. He also follows the trains in order on the Run Cut Sheet (Figures 42-44). The first entry on the "early" side - space 1-A - shows an early straight run of 8:08 hours length. This is a normal and satisfactory length of run, so that a check mark is placed behind the "actual" time on the Run Cut Sheet (see step "D").

The remainder of Train No. 1 may be found in space 10-B where, as part of a two-piece run, the total time is 8:05. Looking at the Subdivision Sheet, he selects an earlier relief time (12:24 P.M.) for this train. This relief time would cut space 1 from 8:08 hours to 7:48 hours, and would raise space 10 from 8:05 hours to 8:25 hours. Such a move would cause space 1 to drop below 8 hours, thereby causing "allowed" time, and would cause an unbalance of work. So, the change would not be made, and a check mark would be placed behind the 8:05 "actual" time of space 10 (see step "E").

Continuing this process, Train No. 18 (spaces 2-A and 18-B) is in two parts (7:42 and 7:47 "actual" hours), both nearly equal and under 8 hours. This entry is checked off. The same is true of Train No. 8 (spaces 3-A and 19-B). Train No. 3 (spaces 4 and 9 is found to be in exact balance, and is checked off.

In following this procedure through, a train must be traced through all of its "pieces" against later trains until the last piece (which goes to the garage) is reached, to see that runs are equalized.

Train No. 15 (spaces 5-A and 7-B) is checked. It is in balance (7:53 vs. 7:53), so that no interchange is made. Trains Nos. 20 and 10 (spaces 6-A and B) are both "in and out of station" pieces, so no change can be made. Spaces 8 and 12, which include parts of Train No. 13, are checked for possible interchange. There being only a 9 minute difference between them (8:41 vs. 8:32), no swap is made.

Space 17 on the early side includes Train No. 15 which, it may be recalled, was cut into three parts to make two-piece runs. Train No. 15 will also be found in spaces 5-A and 7-B. The lengths of runs in which Train No. 15 is involved are 7:53, 7:53 and 7:47 - all under 8 hours and of approximately equal length. No swap is made.

Turning to the right-hand or "late" side of the sheet, the schedule maker looks at space 1 - Train No. 5. This is an "out and in" piece with which nothing can be done, so the 8:17 time entry is checked off. The same is true of Trains Nos. 9, 6 and 20 in spaces 2, 3 and 4.

The next entry, is "late" space 5 - the late portion of the "owl", designated as Train No. 2. The early portion of this train is shown on the "early" side of the sheet in space 17-B, where it combines with another piece to give a run of 7:47 hours. The schedule maker refers to the Subdivision Sheet to select a new relief time for Train No. 2. He finds that the last relief time calculated is the 8:21½ outbound relief time which he has already used. He, therefore, calculates a new inbound relief time -- leaving Dumaine and Alexander at 8:33 P.M. (see Terminal Sheet) plus 6 minutes running time to the inbound relief point at Orleans and Broad (see Running Time sheet) equals 8:39 P.M., which he enters on the Subdivision Sheet behind the 8:21½ time. He erases (NOTE - shown as crossed out to preserve the continuity of the exhibit) the vertical mark (') formerly placed over 8:21½ and the lengths of the two former pieces of this train (5:02 and 8:19) from the Subdivision Sheet, and places his new vertical mark over the newly entered 8:39 time. The run is now cut into two pieces 5:20 long (entered to the left of the new vertical mark) and 8:01 long (entered to the right of the new vertical mark).

Turning from the Subdivision Sheet to the Run Cut Sheet, space 17-B on the "early" side, he changes the relief time from 8:21½ to 8:39, and the actual time from 7:47 to 8:05. This move saves 13 minutes (23¢) in time allowed to 8 hours. Moving over to space 5-B on the "late" side, the relief time for Train No. 2 is changed from 8:21½ to 8:39, and the actual time is dropped from 8:19 to 8:01. This run is still above 8 hours, so the gross saving of 23¢ in time allowed to 8 hours becomes also a net saving of 23¢ in allowed time.

The trippers are also re-checked, for if there were a tripper on the right-hand side which was longer than some portion of a two-piece run, it may pay to "swap" it unless the change were offset by an increase in spread time as another result. The advantage, of course, in such a move, when practicable, lies in the fact that tripper time is figured at time and one-half, whereas two-piece runs under 8:45 hours are paid at straight time. Furthermore, such a move might mean a reduction in "allowed" time. Offsetting these advantages, as mentioned above, might be an increase in spread pay.

Just before he recopied his Run Cut Sheet in proper form for the typist, the schedule maker noticed a long or "high" run which might be susceptible of correction. This is the combination shown in space 8, "early"

side of Figure 42. This involves two trains - Nos. 13 and 19.

Working first with Train No. 19, the schedule maker turns to the Terminal Sheet (Figure 40) to see whether additional "shifts" can be made. If he drops the first trip of the P.M. portion of Train No. 19 down to Train No. 20, he will make the P.M. portion of Train No. 20, already 8:42 hours, too long (see "late" side of Run Cut Sheet, space 4). He cannot "raise" a trip from Train No. 19 to Train No. 18, as No. 18 is a long train which "out-spans" No. 19.

Considering next Train No. 13, the early portion of space 8, the schedule maker studies the Terminal Sheet and finds that if he should "drop" a trip down to Train No. 14, he would increase the length of that A.M. tripper by a round trip, thereby adding to his "time and one-half".

The schedule maker concludes therefore that he will leave the 8:41 hour run of space 8, "early" side, stand as it is.

Completion of the Run Cut Sheet

The rearranged Run Cut Sheet may now be recopied in proper form for the schedule typist. This is done by arranging the runs in accordance with the order of the times at which they are relieved or pull into the garage. The recopied Run Cut Sheet is shown in Figure 45.

The following steps leading toward the completion of the Run Cut Sheet are now taken (see Figure 45):

Step #1. The "time allowed to 8 hours" is computed for each run.

Step #2. The "pay hours" are computed for each run. "Actual" hours plus "allowed" hours equal "pay" hours.

Step #3. Lines are drawn and the totals of these columns are computed.

Step #4. The "allowed" time (extra "half" time) for trippers is computed for each tripper run. In this case the company "takes" the odd half-minute.

Example: space 12, "late" side:

1:29 = 89 minutes

$\frac{1}{2}$ x 89 = 44 minutes

1:29 plus 0:44 = 2:13

SCHEDULE NO. 7790
DATE EFFECTIVE 5 28 46
SUP. SCH. NO. 7649
STATION Canal Rm

RUN CUT SHEET

SCHEDULE DEPARTMENT

LINE Tuesday to Friday, SCHEDULE

APPROVED A. E. Kane
MANAGER OF HOURS DIVISION

RELIEF POINTS IN Delaware & Broad
OUT Dunvale & Broad

EARLY RUNS

RUN NUMBERS	TIME ON, WORKED AND OFF			HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
780	18 456		1238	7:42	1:8	8:00		
781	1 436		1544	8:08		8:08		
782	8 636		113	7:47	1:9	8:00		
783	9 556		204	8:08		8:08	11:30	.30
784	16 613	326	1019 m	7:22	1:8	8:00	12:15	.50
	10 out 217	406	623 m					
	15 610	307	1117½					
785	12 out 939	246	625 m	7:53	0:7	8:00	11:54	.30
	6 637	354	001 m					
786	15 203½	459	621 m	7:53	0:7	8:00	11:50	.30
	13 646	336	1002					
787	19 out 951	245	636 m	8:41		8:41	11:42	.30
	19 659	208	907 m					
788	1 1244	557	641 m	8:05		8:05	12:24	.50
	20 622	358	947 m					
789	3 704	462	646 m	8:07		8:07	11:53	.30
	5 713	208	921 m					
790	13 1241	624	706 m	8:32		8:32		
791	18 1238		835 m	7:47	1:3	8:00		
	15 1117½	245	202½					
792	2 out 219	330	839	8:05		8:05	9:22	
793	8 113		852 m	7:39	2:1	8:00		
				111:59	1:47	113:46	2.50	

LATE RUNS

RUN NUMBERS	TIME ON, WORKED AND OFF		HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
794	5 out 648	1105 m	8:17		8:17		
795	9 out 333	1163 m	8:24		8:24		
796	6 out 406	1224 m	8:18		8:18		
797	20 out 431	113 m	8:42		8:42		
798	2 839	440 m	8:01		8:01		
			41:42		41:42		
			20	21	22		
	a. m. Trippers			4	6		
799	17 733	824 m	5:1	3:9	1:30		
800	2 708	837 m	1:29	0:44	2:13		
801	7 718	847 m	1:29	0:44	2:13		
802	14 726	855 m	1:29	0:44	2:13		
			5:18	3:51	8:09		
			23	23	23		
	a. m. Trippers						
803	11 out 455	545 m	5:0	4:0	1:30		
804	4 out 440	609 m	1:29	0:44	2:13		
805	7 out 447	616 m	1:29	0:44	2:13		
806	14 out 422	629 m	2:07	1:03	3:10		
			5:55	3:11	9:06		
			24	24	24		

RECAPITULATION OF RUNS

TYPE OF RUNS	KIND OF RUNS	NUMBER OF RUNS	MOTORMEN AND CONDUCTORS ACTUAL HOURS	ALLOWED TIME TO R HOURS	ALLOWED TIME TIME AND ½	ALLOWED TIME TOTAL	PAY HOURS	TOTAL SPREAD PAY	(CORD ONLY) JOURNEY TIME
EARLY	STRAIGHT	6							
	TWO-PIECE	8	111:59	1:47		1:47	113:46	2.50	1:35
	TRIPPERS	4	5:18		2:51	2:51	8:09		
LATE	STRAIGHT	5							
	TWO-PIECE	0	41:42	1:00		1:00	41:42	—	—
	TRIPPERS	4	5:55		3:11	3:11	9:06		
TOTAL		19.8	164:54	1:47	6:02	7:49	172:43	2.50	1:35

FIGURE 45.
COMPLETED RUN CUT SHEET-
SAMPLE COMPANY UNDER STUDY.

Step #5. Where the tripper involves less than "one hour at time and one-half", enough "allowed" time must be figured to bring the pay hours up to 1:30.

Example: space 18, "late" side:

50 minutes x $\frac{1}{2}$ = 25 minutes

50 plus 25 = 75 minutes,

or 1:15 hours.

Since the minimum tripper is 1:30 straight time, the entry in the "allowed" column must be

90 minus 50, or 40 minutes,

in order to meet the contract.

See also space 11, "late" side.

Step #6. The total pay hours for trippers are determined for each run. "Actual" hours plus "allowed" hours equal "pay" hours.

Step #7. Lines are drawn and the A.M. and P.M. tripper totals are computed.

Step #8. The spread times are computed for each run, as previously discussed in some detail.

Step #9. The spread pay is entered in the appropriate column for each run.

Step #10. The spread pay column is totaled.

Step #11. The Run Cut Sheet is checked back against the Terminal Sheet and the Running Time Sheet for accuracy of the relief, "in" and "out" times. The schedule maker places a heavy dot (.) behind each relief time or "IN" time as he checks it.

Step #12. All times are re-calculated by machine to detect any compensating errors.

Step #13. The Run Cut Sheet is then re-checked by schedule maker other than the one who originally made it.

Step #14. The time between relief points is checked to see that the operator has ample opportunity to get to his relief point, to get something to eat, etc. In this process the "in" or "relief" time of a given A.M. piece is checked with the "out" time or "relief" time

of the corresponding P.M. piece. The minimum time between reliefs for the sample line would be 25 minutes.

Step #15. The entire Run Cut Sheet is re-checked on a machine. The actual and allowed hours, as well as the spread time, is rechecked on a "tape" machine. (Cases have been detected, through careful and repeated re-checking, of errors in a single schedule which might have run contrary to the labor contract and caused an entire new "pick" of runs by the trainmen.)

Step #16. The total actual hours on the "early" side are re-determined by machine (111:59).

Step #17. The total allowed hours are re-calculated by machine (1:47).

Step #18. The total pay hours are re-computed by machine and cross-checked (113:46).

Step #19. The spread pay is re-added by machine for a check.

Step #20. The total actual hours on the "late" side are re-calculated by machine (41:42).

Step #21. (There are no allowed hours on the "late" side.)

Step #22. The total pay hours are re-computed by machine (41:42), and cross-checked.

Step #23. The three time columns for the A.M. trippers are re-added by machine. (5:18)(2:51) (8:09).

Step #24. The three time columns for the P.M. trippers are re-added by machine. (5:55) (3:11) (9:06).

Step #25. The "Recapitulation of Runs" in the lower right-hand corner of the sheet is completely filled out from the data appearing and derived elsewhere on the sheet. This "re-cap" is added and checked. The actual hours (164:54) in this summary must check the actual hours (164:54) shown on the Terminal Sheet.

Step #26. The "Journey Time" is computed. This is a time allowance provided for in the contract to allow an operator who is "relieved on the road" after his final piece of work to get to the bus garage to turn in his trip sheets, transfers, etc. On the sample line this allowance is 7 minutes. This time is not allowed where the operator brings his vehicle out of or into the garage, or on relief between pieces of a run. An examination of the Run Cut Sheet shows such reliefs on the runs

COPY

RUN SHEET

SCHEDULE No. 7730

DATE EFFECTIVE MAY 28th, 1946

SUPERSEDING SCHEDULE No. 7649

STATION CANAL BUS — CITY PARK BUS — LINE — TUESDAY TO FRIDAY — SCHEDULE

SCHEDULE DIVISION

RELIEF POINT — IN ORLEANS & BROAD — OUT DUMAINE & BROAD

EARLY RUNS

	RUN NO.	TRAIN NO.	TIME ON	TIME OFF		TIME ON	TIME OFF		HOURS ACTUAL	HOURS ALLOWER	HOURS PAY	BONUS 8-PIECE RUNS	BONUS 9-PIECE RUNS
1	780	18	456	1238					742		800*		
2	781	1	436	1244					808		808*		
3	782	8	526	113					747		800*		
4	783	3	556	204					808		808*		
5	784	16 10	653	1019	IN OUT	217	623	IN	732		800	.30	
6	785	15 12	610	1117½	OUT	339	625	IN	753		800	.50	
7	786	6 15	637	1001	IN	202½	631	IN	753		800	.30	
8	787	13 19	646	1242	OUT	351	636	IN	841		841	.30	
9	788	19 1	659	907	IN	1244	641	IN	805		805	.30	
10	789	20 3	622	947	IN	204	646	IN	807		807	.50	
11	790	5 13	713	921	IN	1242	706	IN	832		832	.30	
12	791	18				1238	825	IN	747		800		
13	792	15 2	1117½	202½	OUT	319	839		805		805*		
14	793	8				113	852	IN	739		800		
15									111:59		113:46	$2.50	
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													

LATE RUNS

	RUN NO.	TRAIN NO.	TIME ON		TIME OFF			HOURS ACTUAL	HOURS ALLOWER	HOURS PAY	BONUS 8-PIECE RUNS	BONUS 9-PIECE RUNS
1	794	5		OUT	248	1105	IN	817		817		
2	795	9		OUT	333	1157	IN	824		824		
3	796	6		OUT	406	1224	IN	818		818		
4	797	20		OUT	431	113	IN	842		842		
5	798	2			839	440	IN	801		801		
6								41:42		41:42		
7			A.M. TRIPPERS									
8	799	17	733	824	IN			51		130		
	800	2	708	837	IN			129		213		
	801	7	718	847	IN			129		213		
9	802	14	726	855	IN			129		213		
10								5:18		8:09		
11			P.M. TRIPPERS									
12	803	11		OUT	455	545	IN	50		130		
	804	4		OUT	440	609	IN	129		213		
	805	7		OUT	447	616	IN	129		213		
13	806	14		OUT	422	629	IN	207		310		
14								5:55		9:06		
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												

RECAPITULATION OF RUNS

*MOTORMEN AND CONDUCTORS

TYPE OF RUNS	KIND OF RUNS	NUMBER OF RUNS	ACTUAL HOURS	ALLOWED TIME: TO 8 HOURS	ALLOWED TIME: TIME AND ½	ALLOWED TIME: TOTAL	PAY HOURS	BONUS: 8-PIECE RUNS	BONUS: 9-PIECE RUNS	COND. ONLY: 1.07 MIN. JOURNEY TIME
EARLY	STRAIGHT	6								
	TWO-PIECE	8	111:59	1:47		1:47	113:46	$2.50		:35
	THREE-PIECE	0								
	TRIPPERS	4	5:18		2:51	2:51	8:09			
LATE	STRAIGHT	5								
	TWO-PIECE	0	41:42	:00		:00	41:42			
	THREE-PIECE	0								
	TRIPPERS	4	5:55		3:11	3:11	9:06			
TOTAL		19-8	164:54	1:47	6:02	7:49	172:43	$2.50		:35

*NOTE: TIME GIVEN UNDER "MOTORMEN AND CONDUCTORS" IS CREW TIME ONLY, AND MUST BE DOUBLED TO OBTAIN TOTAL MAN-HOURS.

FIGURE 46.
TYPED RUN SHEET—
SAMPLE COMPANY UNDER STUDY.

in "early" spaces 1, 2, 3, 4 and 13. All other "final pieces", early and late, and trippers pull into the bus garage. The runs which merit journey time are marked with an asterisk (*). The five runs multiplied by an allowance of 0:07 per run equal 0:35 hours, or 35 minutes, of journey time. This is entered on the "Recapitulation of Runs".

Step #27. The "run numbers" are now entered on the Run Cut Sheet, placing them in the order in which the runs pull into the garage or are relieved on the road. A series of numbers starting with "780" has been assigned to this line. The regular runs are numbered 780-798, and the trippers are numbered 799-806.

Step #28. The Run Cut Sheet is again completely re-checked by the schedule maker and his checker, and "O'Keyed" by the checker.

Step #29. The sheet is properly "headed" with all pertinent information.

As a final step, the schedule maker calculates the average length of his 19 regular runs to see how closely he has approached his objective of 8:11 hours length. The actual time of the early runs is 111:59. The actual time of the late runs is 41:42. This is a total of 153:41 actual hours represented by regular runs. 153:41 divided by 19 equals 8:06 hours, which is a satisfactory outcome as against the "revised" objective of 8:11 hours.

The schedule maker is now ready to turn the Run Cut Sheet over to the schedule typist, who sets it up in final form.

The typed Run Sheet is shown in Figure 46. It contains all the essential information of the pencil Run Cut Sheet, but in simplified and rearranged form. The uses of the Run Sheet will be discussed in a succeeding chapter.

F. Graphic Illustration of Run Cutting

Figure 47 has been developed as a graphic illustration of the manner in which "trains" are cut into "runs" on the sample property. It is a pictorial representation of the "run cut" set forth in Figure 45. Such charts are not customarily made by the Schedule Department, but this one has been included so that the student of the report may visualize the process described in so many words in the preceding section.

Train No. 1, for example, has been divided into two pieces - an early straight run (8:08 hours length) and a later piece of 5:57 hours length.

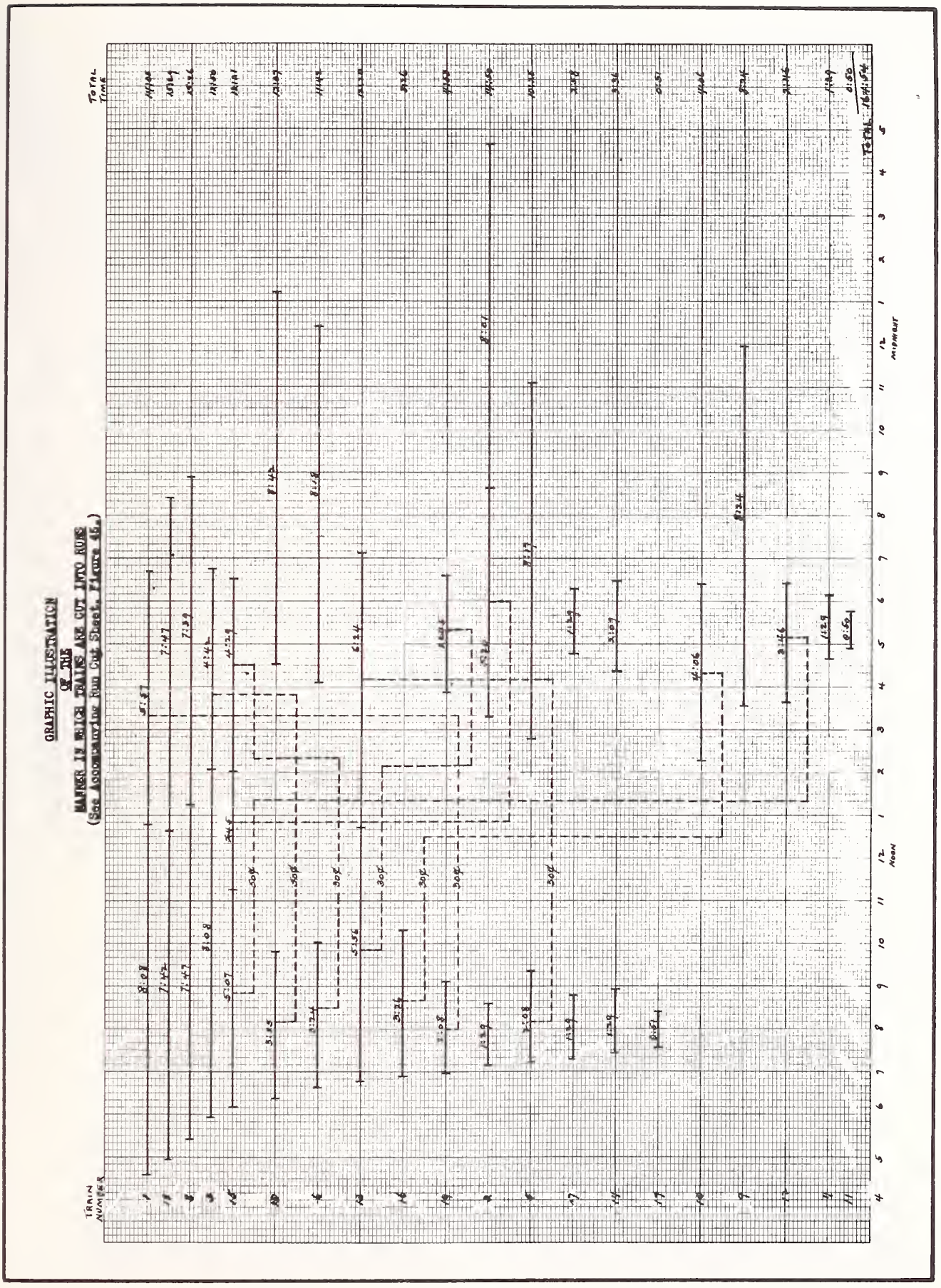

FIGURE 47.
GRAPHIC ILLUSTRATION OF RUN CUT—
SAMPLE COMPANY UNDER STUDY.

This latter portion was connected in the run cutting process, with the A.M. portion of Train No. 19 (2:08 hours length) to form a two-piece run. Note the connecting dashed line (representing a 30¢ spread "link") between these two pieces.

The "split" of Train No. 15 into three pieces as discussed in the step-by-step description of the run cutting process, may be easily visualized from Figure 47. The "early piece" is connected by a 50¢ spread to Train No. 12. The "middle piece" is connected with no spread penalty to the first P.M. portion of Train No. 2. The "late piece" of Train No. 15 is connected by a 30¢ spread to the A.M. portion of Train No. 6.

A further picture of the run cut of Figure 45 is shown in Figure 48. In this illustration bands are shown for the various runs, beginning with the earliest A.M. pull out bus. Each band is divided by symbols into:

Actual time worked,
Time allowed to 8 hours,
Time and $\frac{1}{2}$, and
Journey time.

Spread pay "links" between portions of two-piece regular runs are shown by means of dotted lines. The table to the right of the graph shows the "pay" for the day in "dollars", subdivided according to the break-down given above, for each individual run.

The total pay for the Tuesday - Friday schedule of the sample bus line is $189.67, divided as follows:

	Amount	Per Cent
Actual hours worked	$ 178.10	93.90
Allowed to 8 hours	1.92	1.01
Time and $\frac{1}{2}$	6.50	3.43
Spread	2.50	1.32
Journey time	0.65	0.34
TOTAL	$ 189.67	100.00

This is considered to be a reasonably high proportion of actual hours to total pay hours on the sample property under present-day policies and working practices.

G. Comparison of the Run Cut Described Above with Other Cuts of the Same Schedule

The run cut depicted in Figure 45 includes four (4) early straight runs and seven (7) late straight runs, the same number as in the existing schedule. It will be recalled that, in the process of "shifting" the terminal sheet (Figure 38), the schedule maker set the stage for five (5) early straight runs and seven (7) late straight runs or two more straight runs than in the existing schedule.

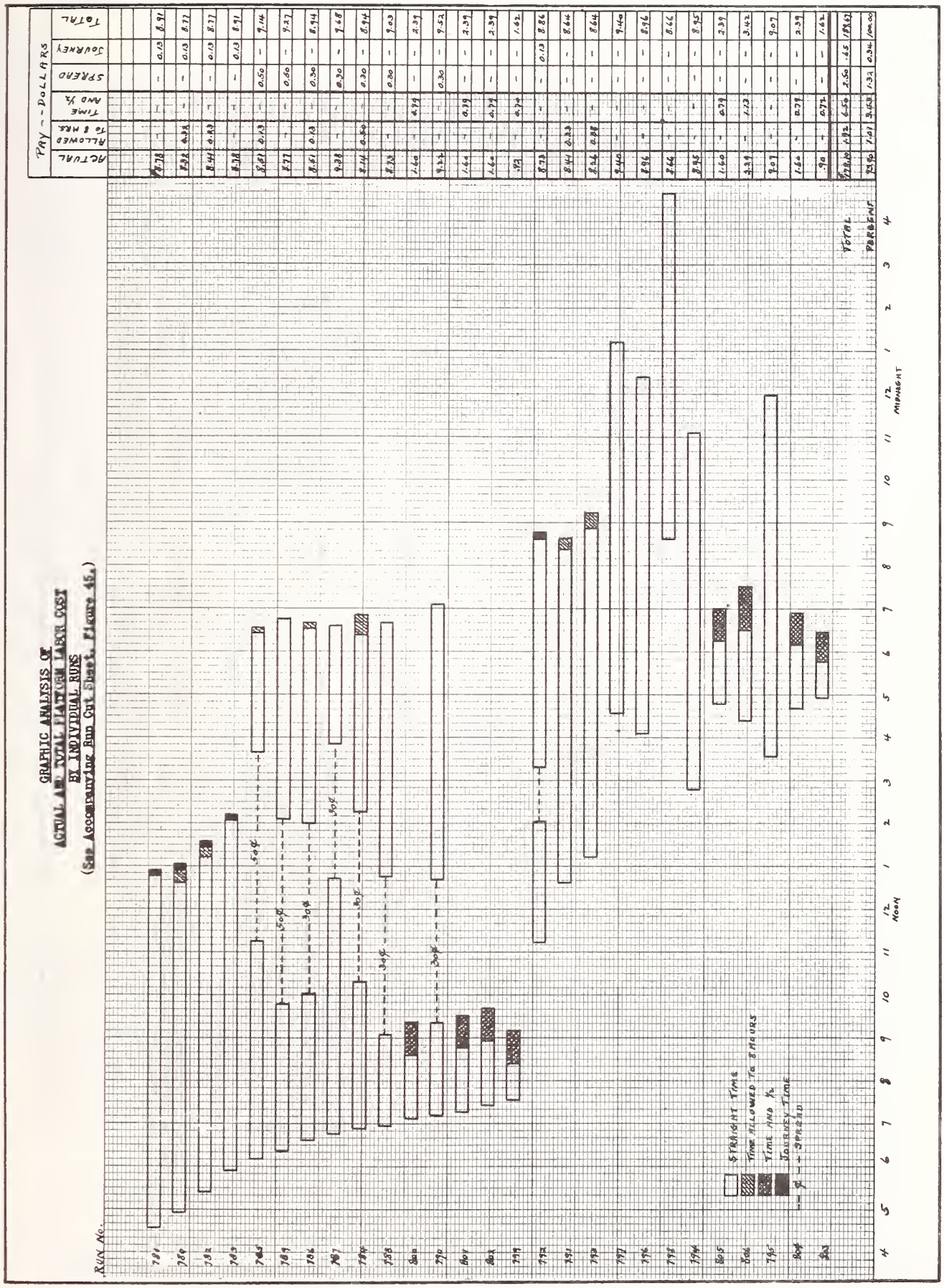

FIGURE 48.
GRAPHIC ANALYSIS OF INDIVIDUAL RUNS—
SAMPLE COMPANY UNDER STUDY.

Form 142-0006 6-45 5M

SCHEDULE No. 7730
DATE EFFECTIVE 5-28-46
SUP SCH NO. 7649
STATION Canal Pier

RUN CUT SHEET

Old Basis

SCHEDULE DEPARTMENT

APPROVED A E Kerr
MANAGER SCHEDULE DIVISION

RELIEF POINTS IN Albany and Broad
OUT Delaware and Broad

City Park Run LINE Tuesday to Friday SCHEDULE

EARLY RUNS

RUN NUMBERS	TIME ON WORKED AND OFF			HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
1 780	18 456		1238 .	7:42	1:8	8:00 *	✓	
2 781	1 436		1244 .	8:08		8:08 *	✓	
3 782	8 526		1256 .	7:30	0:30	8:00 *	✓	
4 783	15 610		2028 .	7:52	0:8	8:00 *	✓	
5 784	3 656		204 .	8:08		8:08 *	✓	
6 785	20 622	(325)	947 in .	7:31	2:9	8:00	12:01	.50
	10 out 217	(406)	633 in .					
	13 646	(442)	1128 .					
7 786	12 out 339	(246)	635 in .	7:28	0:32	8:00	11:39	.30
	6 637	(334)	1001 in .					
8 787	15 303½	(429)	631 in .	7:53	0:7	8:00	11:54	.30
	19 659	(608)	907 in .					
9 788	1 1244	(557)	641 in .	8:05		8:05	11:42	.30
	16 653	(346)	1019 in .					
10 789	3 204	(462)	646 in .	8:08		8:08	11:53	.30
11 790	13 1128		706 in .	7:38	0:22	8:00		
12 791	18 1238		825 in .	7:47	0:13	8:00		
13 792	8 1256		864 in .	7:56	0:04	8:00		
	5 713	(208)	921 in .					
14 793	2 out 319	(539)	858 .	7:47	0:13	8:00 *	12:45	1.10
				109:33	2:56	112:29		$2.80
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								

LATE RUNS

RUN NUMBERS	TIME ON WORKED AND OFF		HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
1 794	5 out 248	1105 in .	8:17		8:17	✓	
2 795	9 out 333	1157 in .	8:24		8:24	✓	
3 796	6 out 406	1234 in .	8:18		8:18	✓	
4 797	20 out 431	113 in .	8:42		8:42	✓	
5 798	2 858	440 in .	7:42	1:8	8:00	✓	
			44:33	1:18	41:41		
6							
7							
8							
9							
10	A M Tryggve						
11 799	17 733	824 in .	5:1	3:9	1:30	✓	
12 800	2 708	837 in .	1:29	4:4	2:13	✓	
13 801	7 718	847 in .	1:29	4:4	2:13	✓	
14 802	14 726	855 in .	1:29	4:4	2:13	✓	
			5:18	2:51	8:09		
15							
16							
17	P M Tryggve						
18 803	11 out 455	545 in .	5:0	4:0	1:30	✓	
19 804	4 out 440	609 in .	1:29	4:4	2:13	✓	
20 805	7 out 447	616 in .	1:29	4:4	2:13	✓	
21 806	14 out 455	629 in .	2:07	10:3	3:10	✓	
22 807	19 out 351	636 in .	2:43	1:22	4:07	✓	
			8:40	4:33	13:13		
23							
24							
25							
26							
27							
28							
29							

RECAPITULATION OF RUNS

TYPE OF RUNS	KIND OF RUNS	NUMBER OF RUNS	MOTORMEN AND CONDUCTORS ACTUAL HOURS	ALLOWED TIME TO 8 HOURS	ALLOWED TIME TIME AND ½	ALLOWED TIME TOTAL	PAY HOURS	TOTAL SPREAD PAY	(COND ONLY) JOURNEY TIME
									1:07
EARLY	STRAIGHT	8						$2.80	
	TWO-PIECE	6	109:33	2:56		2:56	112:29		1:42
	TRIPPERS	4	5:18		2:51	2:51	8:09		
LATE	STRAIGHT	5							
	TWO-PIECE	0	41:33	1:18		1:18	41:41	-	
	TRIPPERS	5	8:40		4:33	4:33	13:13		
TOTAL		19-9	164:54	3:14	7:24	10:38	175:32	$2.80	1:42

FIGURE 49

COMPARATIVE RUN CUT SHEET # 1 (FIGURE 49 VS. 45) - SAMPLE COMPANY UNDER STUDY.

Figure 49 is a Run Cut Sheet prepared from the same terminal sheet as that used in setting up Figure 45. In the case of Figure 49, however, the schedule maker has succeeded in obtaining five (5) early straight runs and eight (8) late straight runs. (Early straight runs 780, 781, 782, 783, 784 and late straight runs 790, 791, 792, 794, 795, 796, 797, and 798.)

In obtaining a greater number of straight runs, an additional cost to the company has been incurred, as set forth in the following comparative tabulation:

	Figure 45	Figure 49	Increase or Decrease
Number of Runs			
Early straight*	4	5	+ 1
Late straight *	7	8	- 1
Actual hours	164:54	164:54	-
Allowed time to 8 hours	1:47	3:14	+ 1:27
Time and ½	6:02	7:24	+ 1:22
Total allowed time	7:49	10:38	+ 2:49
Pay hours	172:43	175:32	+ 2:49
Spread pay	$ 2.50	$ 2.80	+ 0.30
Journey time	0:35	0:42	+ 0:07

(*) The definitions of "early" and "late" straight runs for purposes of this classification differ slightly from those shown in the "recapitulation" blocks of the Run Cut Sheets. Here they are "early" and "late" as based upon their general position on the time chart, rather than whether they pull into the bus garage before or after 9:00 P.M.

As mentioned above, these run cuts are based upon the same "shifted" terminal sheet. The same degree of skill and care was used in their preparation. In the one case (Figure 45) maximum economy to the company under the existing labor contract was the governing factor. In the other case (Figure 49) the maximum number of preferable runs from the standpoint of the operating personnel was the governing factor. The company can give its operators a chance at two more preferable runs for an additional expenditure of 2:49 pay hours ($3.04) plus 30¢ additional spread pay and 7¢ additional journey time, or $3.41 per day in all.

The question is, "Which schedule shall the company post in its pick?" The answer depends almost wholly upon "company policy", or the results of managerial decision. If the company desires maximum economy, it can obtain this by using the run cut of Figure 45 without reducing the number of preferable

SCHEDULE No. 7730
DATE EFFECTIVE 4-28-46
SUP SCH No. 1243
STATION Canada Ave

RUN CUT SHEET

SCHEDULE DEPARTMENT
City Coach Line
Tuesday to Sunday SCHEDULE

APPROVED a. E. Kent
MANAGER SCHEDULE DIVISION
RELIEF POINTS IN Odessa & Broad
OUT Emerald & Broad

EARLY RUNS

RUN NUMBERS	TIME ON WORKED AND OFF			HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
	18 456		1238 .					
1 780 ✓				742	18	800 *		
	1 436		1244 .					
2 781 ✓				808		808 *		
	8 526		113 .					
3 782 ✓				747	18	800 *		
	3 566		1444 .					
4 783 ✓				748	12	800 *		
	20 632	(305)	747 m .					
5 784 ✓	10 out 217	(406)	603 m .	731	29	800	1201	.50 ✓
	15 610	(507)	1117½ .					
6 785 ✓	12 out 339	(306)	625 m .	758	07	802	1215	.50 ✓
	13 644	(529)	1225 .					
7 786 ✓	14 out 432	(207)	637 m .	756	14	800	1143	.30 ✓
	16 653	(306)	1019 m .					
8 787 ✓	15 203½	(459)	681 m .	755	05	800	1138	.80 ✓
	19 659	(548)	907 m .					
9 788 ✓	1 1244	(557)	641 m .	805		805	1162	.80 ✓
	6 637	(324)	1001 m .					
10 789 ✓	3 1444	(502)	646 m .	826		826	1209	.50 ✓
	5 713	(328)	961 m .					
11 790 ✓	13 1225	(641)	706 m .	849	(02)	851	1153	.30 ✓
	15 1117½	(345)	202½ .					
12 791 ✓	2 out 319	(502)	821/2 .	747	13	800 *	904	— ✓
13 792 ✓	18 1238		826 m .	747	13	800		
14 793 ✓	8 113		852 m .	739	21	800		
				111:03	2:37 (2)	113:30		2.70
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								

LATE RUNS

RUN NUMBERS	TIME ON WORKED AND OFF		HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
1 794 ✓	5 out 348	1105 m .	8:17		8:17		
2 795 ✓	9 out 333	1157 m .	8:24		8:24		
3 796 ✓	6 out 406	1234 m .	8:18		8:18		
4 797 ✓	20 out 431	113 m .	8:42		8:42		
5 798 ✓	2 821/2	440 m .	8:19		8:19		
			42:00	:00	43:00		
6							
7							
8							
9							
10							
11							
12							
13	A M Trippers						
14 799 ✓	17 733	824 m .	5:1	3:9	13:0		
15 800 ✓	2 708	837 m .	12:9	4:4	21:3		
16 801 ✓	7 718	807 m .	12:9	4:4	21:3		
17 802 ✓	14 726	855 m .	12:9	4:4	21:3		
			5:18	2:51	8:09		
18							
19							
20	P M Trippers						
21 803 ✓	11 out 455	545 m .	5:0	4:0	13:0		
22 804 ✓	4 out 440	609 m .	12:9	4:4	21:3		
23 805 ✓	7 out 447	616 m .	12:9	4:4	21:3		
24 806 ✓	19 out 351	636 m .	24:5	12:2	40:7		
			6:33	3:30	10:03		
25							
26							
27							
28							
29							

RECAPITULATION OF RUNS

TYPE OF RUNS	KIND OF RUNS	NUMBER OF RUNS	MOTORMEN AND CONDUCTORS ACTUAL HOURS	ALLOWED TIME TO B HOURS	ALLOWED TIME TIME AND ½	ALLOWED TIME TOTAL	PAY HOURS	TOTAL SPREAD PAY	(CORD ONLY) JOURNEY TIME .07
EARLY	STRAIGHT	6 ✓							
	TWO PIECE	8 ✓	111:03	A 2:25	1:02	3:27	113:30	$ 2.70	1.35 ✓
	TRIPPERS	4 ✓	5:18		3:51	3:51	8:09		
LATE	STRAIGHT	8 ✓							
	TWO PIECE	0 ✓	42:00	:00		:00	43:00		
	TRIPPERS	4 ✓	6:33		3:30	3:30	10:03		
TOTAL		19.8 ✓	166:186	2:25	6:83	8:48	173:42	$ 2.70 ✓	1.85 ✓

FIGURE 50.
COMPARATIVE RUN CUT SHEET #2 (FIGURE 50 VS. 45) -
SAMPLE COMPANY UNDER STUDY.

runs below that of the existing schedule. If the company desires to increase the number of preferable runs, it can do so by using the run cut of Figure 49.

As a matter of policy at the present time the company would probably use the run cut of Figure 49 and give the men the benefit of the two extra straight runs. Revenues are high and labor is seeking to better its position. It would be good employee relations to give the extra preferable runs. At another time, when revenues are on the downgrade and maximum economy of scheduling is of paramount importance to both the company and its employees from the long-range point of view, the run cut typified by Figure 45 would be selected. The saving of ($3.41 x 209) $713 per year due the latter selection would be most helpful to company earnings and to the stability of employment in time of stress.

Another Run Cut Sheet is shown in Figure 50. This cut is based upon the same terminal sheet as Figure 45, and upon the same objective of four (4) early straight runs and seven (7) late straight runs. The schedule maker did not in this case, however, exercise as much care in the run cut as he might have done. He has made a good run cut, but has not carried his work nearly as far as he should have. The comparison in this case is set forth below:

	Figure 45	Figure 50	Increase or Decrease
Number of Runs			
Early straight*	4	4	-
Late straight *	7	7	-
Actual hours	164:54	164:54	-
Allowed time to 8 hours	1:47	2:25	+ 0:38
Time and ½	6:02	6:23	+ 0:21
Total allowed time	7:49	8:48	+ 0:59
Pay hours	172:43	173:42	+ 0:59
Spread pay	$ 2.50	$ 2.70	+$0:20
Journey time	0:35	0:35	-

(*) See note under tabulation on page 151.

As mentioned above, these run cuts are based upon the same "shifted" terminal sheet. The same number of early and late straight runs is involved. The difference lies in a slightly less skilful cut in Figure 50 as compared with Figure 45. The additional cost to the company for the lack of perseverance on the schedule maker's part in the second case is 0:59 pay hours ($1.06) plus 20¢ additional spread pay, or $1.26 per day in all. This would be equivalent to a loss of ($1.26 x 209) $263 per year due to not carrying the run cut to its final conclusion.

RUN CUT SHEET

SCHEDULE DEPARTMENT

SCHEDULE NO 7730
DATE EFFECTIVE 5-28-46
SUP SCH NO 7449
STATION Canal Car

APPROVED A. E. Kerns
MANAGER SCHEDULE DIVISION

RELIEF POINTS IN Belmont & Broad
OUT Belmont & Broad

City Park Bus LINE Tuesday to Friday SCHEDULE

EARLY RUNS

RUN NUMBERS	TIME ON WORKED AND OFF			HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
	1 936		101 .					
1 780 ✓				825		825 *		
	8 826		133 .					
2 781 ✓				807		807 *		
	4 656		204 .					
3 782 ✓				808		808 *		
	6 637	(324)	1001 m .					
4 783 ✓	8 133	(684)	609 m .	800		800	1132	.30 ✓
	19 610	(647)	1257 m .					
5 784 ✓	11 out 409	(207)	615 m .	808		808	1206	.60 ✓
	24 622	(214)	1151 .					
6 785 ✓	13 out 333	(347)	620 m .	806		806	1158	.30 ✓
	23 659	(308)	907 m .					
7 786 ✓	16 1242	(603)	645 m .	751	09	800	1126	.15 ✓
	6 713	(208)	914 m .					
8 787 ✓	19 1251	(688)	631 m .	808		808	1118	.15 ✓
	32 456	(468)	944 m .					
9 788 ✓	25 out 351	(361)	636 m .	733	27	800	1240	1.10 ✓
	20 653	(325)	1019 m .					
10 789 ✓	4 209	(482)	646 m .	808		808	1153	.30 ✓
	16 626	(422)	1111 .					
11 790 ✓	17 out 362	(814)	706 m .	749	11	800	1220	.50 ✓
	18 726	(134)	885 m .					
12 791 ✓	24 209	(616)	826 m .	745	15	800	1259	.70 ✓
	24 1181	(228)	209 .					
13 792 ✓	3 out 319	(820)	839 .	748	12	800 *	858	—
				104:16	1:14	105:30		$4.00

LATE RUNS

RUN NUMBERS	TIME ON WORKED AND OFF			HOURS ACTUAL	HOURS ALLOWED	HOURS PAY	SPREAD HOURS	SPREAD PAY
1 793 ✓	1 101		926 .	805		825 *		
	16 1111	(101)	1242 .					
2 794 ✓	9 out 443	(632)	1105 m .	753	07	800	1154	.30
Ⓡ 3 795 ✓	14 333		1157 m .	824		824		
Ⓡ 4 796 ✓	10 421		1324 m .	803		803		
	12 out 449	(403)	853 m .					
5 797 ✓	1 926	(347)	113 m .	760	10	800	824	
6 798 ✓	3 829		440 m .	801		801		
7				48:36	1:17	48:53		$.30
8								
9								
10	A. M. Trippers							
11 799 ✓	21 733		824 m .	51	39	130		
12 800 ✓	3 708		837 m .	129	44	213		
13 801 ✓	7 718		897 m .	129	44	213		
14				3:49	2:07	5:56		
15								
16	P. M. Relief Trippers to be Worked by Regular men.							
Ⓡ 17 795 ✓	14 out 217		333 REL.	116	38	154		
Ⓡ 18 796 ✓	10 out 253		421 REL.	128	44	212		
19								
20	P. M. Trippers							
21 802 ✓	15 out 455		545 m .	50	40	130		
22 803 ✓	18 out 432		629 m .	207	103	310		
23 804 ✓	2 out 434		641 m .	207	103	310		
24				7:48	6:08	11:56		
25								
26	Ⓡ Trippers to be Worked by regular men carrying same run numbers.							
27								
28								
29								

RECAPITULATION OF RUNS

TYPE OF RUNS	KIND OF RUNS	NUMBER OF RUNS	MOTORMEN AND CONDUCTORS ACTUAL HOURS	ALLOWED TIME TO 8 HOURS	ALLOWED TIME TIME AND ½	ALLOWED TIME TOTAL	PAY HOURS	TOTAL SPREAD PAY	(COND ORLY) JOURNEY TIME
EARLY	STRAIGHT	3 ✓							
	TWO PIECE	10 ✓	104:16	1:14		1:14	105:30	$4.00	1:28 ✓
	TRIPPERS	3 ✓	3:49		2:07	3:07	5:56		
LATE	STRAIGHT	4 ✓							
	TWO PIECE	7 ✓	48:36	1:17		1:17	48:53	.30	1:07 ✓
	TRIPPERS	5 ✓	7:48		4:08	4:08	11:56		
TOTAL		17-8 ✓	166:29	1:31	6:15	7:46	172:15	$4.30	2:35 ✓

FIGURE 51.
COMPARATIVE RUN CUT SHEET #3 (FIGURE 51 VS. 45)-
SAMPLE COMPANY UNDER STUDY.

The difference cited above is slight because the two jobs of run cutting were almost, though not quite, comparable. It is included to illustrate a principle. Actually such differences grow perceptibly with the mediocrity of the schedule maker and the size of the line, and may well amount to many thousands of dollars per year -- enough to mean the difference between success and failure of the company during the lean years. For this reason the company believes that the expenditure of funds for traffic checking and schedule preparation on a regular, systematic basis, and the employment of technicians who are skillful, patient and careful in the process of cutting runs, pays incalculable dividends in operating efficiency and operating cost performance.

A final Run Cut Sheet is shown in Figure 51. This one is based upon the "unshifted" terminal sheet of Figure 37, and shows what may result from lack of attention to this process. The comparison of this run cut with that of Figure 45 is set forth in the following tabulation:

	Figure 45	Figure 51	Increase or Decrease
Number of Runs			
Early straight*	4	3	- 1
Late straight *	7	4	- 3
Actual hours	164:54	164:29	- 0:25
Allowed time to 8 hours	1:47	1:31	- 0:16
Time and ½	6:02	6:15	+ 0:13
Total allowed time	7:49	7:46	- 0:03
Pay hours	172:43	172:15	- 0:28
Spread pay	$ 2.50	$ 4.30	+$1.80
Journey time	0:35	0:35	-

(*) See note under tabulation on page 151.

This run cut, based on the "unshifted" terminal sheet, represents an increased cost to the company of $1.80 in spread pay minus $0.50 (0:28 pay hours) in straight time, or a net increased cost of $1.30 per day. This is equivalent to $272 per year. Of greater significance, however, is the reduction in the number of early straight runs from 4 to 3, and the reduction in the number of late straight runs from 7 to 4. A precipitous change of this sort at this time would have an extremely adverse effect upon employee relations. It would be beyond the pale of sound managerial practice, in the opinion of the company, to suddenly place such a run cut as that shown in Figure 51 in effect.

A final comparison of interest is that between the run cut shown

BUS GARAGE

RUNS PICKED ACCORDING TO SENIORITY BY GROUPS OF 10 MEN

MARCH 27, 1946

		CUMULATIVE MEN PICKING	EARLY STRAIGHT	110¢ 2-PIECE	95¢ 2-PIECE	70¢ 2-PIECE	50¢ 2-PIECE	30¢ 2-PIECE	15¢ 2-PIECE	STRAIGHT DAY (off before 9:00 P.M.)	EARLY 2-PIECE (off before 9:00 P.M.)	LATE STRAIGHT	LATE 2-PIECE	ALL AMERICAN 2-PIECE	OWL
1st	10 men	10	8			1				1					
2nd	10 men	20	8	1	1										
3rd	10 men	30	8							1		1			
4th	10 men	40	7			1						2			
5th	10 men	50	7							2		1			
6th	10 men	60	8	1											1
7th	10 men	70	9	1											
8th	10 men	80	9							1					
9th	10 men	90	9			1									
10th	10 men	100	4		2		1			1		1			1
11th	10 men	110	3			4					2	1			
12th	10 men	120	1		1	1	3		2	1	1				
13th	10 men	130				2			4		1	1			2
14th	10 men	140			2	3	2	1		2					
15th	10 men	150		1		2		2	1	2		2			
16th	10 men	160	1	2	1	2	1	1				2			
17th	10 men	170		1		2	1	2		2		2			
18th	10 men	180	1			3	1		1		1	1	1		1
19th	10 men	190	1			2		2	2			2			1
20th	10 men	200				2	3		1	1	1	2			
21st	10 men	210	2			1	2		1	2		2			
22nd	10 men	220					1	2	1	2	1	2			1
23rd	10 men	230	1					2		1	1	4	1		
24th	10 men	240				1			1		3	4	1		
25th	10 men	250						1	1	1	2	5			
26th	10 men	260	1							1	1	7			
27th	10 men	270	1						3			5	1		
28th	10 men	280									2	8			
29th	10 men	290										8	2		
30th	10 men	300										8	2		
31st	10 men	310										7	3		
32nd	10 men	320										7	3		
33rd	10 men	330										7	3		
34th	10 men	340										3	6		
35th	10 men	350													

(NOTE :3-Piece Runs are provided for in the company's contract with its platform personnel, but no 3-piece runs are scheduled at the present time.)

FIGURE 52.
BUS OPERATORS' PREFERENCES FOR VARIOUS TYPES OF RUNS-
SAMPLE COMPANY UNDER STUDY.

in Figure 49 and that in Figure 51:

	Figure 49 (Based on "shifted" terminal sheet)	Figure 51 (Based on "unshifted" terminal sheet)	Increase or Decrease
Number of runs			
Early straight*	5	3	- 2
Late straight *	8	4	- 4
Total cost per day	$ 193.14	$ 190.96	-$2.18

(*) See note under tabulation on page 151.

This table shows the range between the best and worst of the run cuts, from the standpoint of "preferable" runs, and serves to re-emphasize the importance of shifting the terminal sheet before beginning the run cutting process.

H. General Observations on the Cutting of Runs as Practiced by the Sample Company

The sample company, as indicated in the foregoing descriptive passages, endeavors to give its platform personnel the greatest number of "preferable" runs consistent with sound economics. The preference of its trainmen for various types and kinds of runs is determined by a periodic analysis of the runs picked according to seniority by groups of ten men. The final summary sheet from such an analysis is shown in Figure 52.

A study of this sheet reveals many interesting facts, not all of which will be commented upon in this volume.

Consider the runs picked by the ten men having highest seniority (first preference) at the bus garage. Of the ten, eight picked early straight runs, one picked a straight run a little later in the day, and one picked a 70¢ spread pay 2-piece run.

The first ninety men in order of choice picked as follows:

	Number	Per Cent
Early straight runs	73	
Straight day (off before 9 P.M.)	5	
Total straight runs	78	86.7
$1.10 2-piece runs	3	
$0.95 2-piece runs	1	
$0.70 2-piece runs	3	
Total 2-piece runs	7	7.8
Late straight runs	4	4.4
Owl runs	1	1.1
Grand total runs	90	100.0

COMPARING TYPES OF ASSIGNMENT RUNS

WINTER SCHEDULES

AS OF MARCH 27, 1946

	TYPES OF RUNS	REGULAR MEN					PERCENTAGE				
		ARABELLA	CANAL	CARROLLTON	BUS GARAGE	TOTAL	ARABELLA	CANAL	CARROLLTON	BUS GARAGE	TOTAL
PREFERABLE RUNS	EARLY STRAIGHT	91	80	60	81	312	28.0	24.0	25.0	25.9	25.2
	STRAIGHT DAY (OFF BEFORE 9 PM)	20	38	30	31	119	6.2	11.4	12.5	9.1	9.6
	LATE STRAIGHT	97	88	62	85	332	29.8	26.3	25.8	25.0	26.8
	EARLY 5 STRAIGHT	-	-	-	-	-	-	-	-	-	-
	LATE 5 STRAIGHT	16 224	18 224	6 158	19 216	59 822	4.9 68.9	5.4 67.1	2.5 65.8	5.6 65.7	4.8 66.4
	110¢ 2-PIECE	3	-	-	7	10	.9	-	-	2.1	.8
	95¢ 2-PIECE	2	-	-	7	9	.6	-	-	2.1	.7
	70¢ 2-PIECE	7	10	2	29	48	2.2	3.0	.7	8.5	3.9
	50¢ 2-PIECE	24 36	8 18	2 4	16 59	50 117	7.4 4.1	2.4 5.4	.8 1.7	4.7 17.4	4.0 9.4
	TOTALS	260	242	162	275	959	80.0	72.5	67.5	81.1	75.8
OTHER RUNS	50¢ 2-PIECE	10	16	12	14	52	3.1	4.8	5.0	4.1	4.2
	15¢ 2-PIECE	10	16	16	14	56	3.1	4.8	6.7	4.1	4.5
	EARLY 2-PIECE (OFF BEFORE 9PM)	17	26	28	7	78	5.2	7.7	11.6	2.1	6.3
	LATE 2-PIECE	28	34	22	29	113	8.6	10.2	9.2	8.6	9.2
	TOTALS	65	92	78	64	299	20.0	27.5	32.5	18.9	24.2
	SYSTEM	325	334	240	339	1258	100.0	100.0	100.0	100.0	100.0

(NOTE: 5-PIECE RUNS are provided for in the company's contract with its platform personnel, but no 5-piece runs are scheduled at the present time.)

FIGURE 53. NUMBER AND PERCENTAGE OF "PREFERABLE" RUNS - SAMPLE COMPANY UNDER STUDY.

An examination of the picks made by the ninety men ranging from 101 through 190 in seniority reveals the following preferences:

	Number	Per Cent
Early straight runs	7	
Straight day (off before 9 P.M.)	7	
Total straight runs	14	15.5
$1.10 2-piece runs	4	
$0.95 2-piece runs	4	
$0.70 2-piece runs	21	
$0.50 2-piece runs	8	
$0.30 2-piece runs	8	
$0.15 2-piece runs	10	
Total spread pay runs	55	61.3
Early 2-piece (Off before 9 P.M.)	5	5.5
Late straight runs	11	12.2
Late 2-piece runs	1	1.1
Owl runs	4	4.4
Grand total runs	90	100.0

A study of the eighty-nine men having least seniority and preference on the bus system (Numbers 251-339) shows that they are "left" with the following "choices":

	Number	Per Cent
Early straight runs	2	
Straight day (Off before 9 P.M.)	1	
Total straight runs	3	3.3
$0.15 2-piece runs	3	3.3
Early 2-piece (Off before 9 P.M.)	3	3.3
Late straight runs	60	67.6
Late 2-piece runs	20	22.5
Grand total runs	89	100.0

This analysis reveals an unmistakable preference on the part of the older men towards an early straight run -- to get at the day's work early, to get it over with, and to have daylight hours free for themselves. It shows a tendency for the middle group to take the "money runs" -- two-piece runs with the larger spread bonuses. It further shows that the late runs, whether straight or two-piece, are the least desirable, and must be worked by the younger men with least seniority.

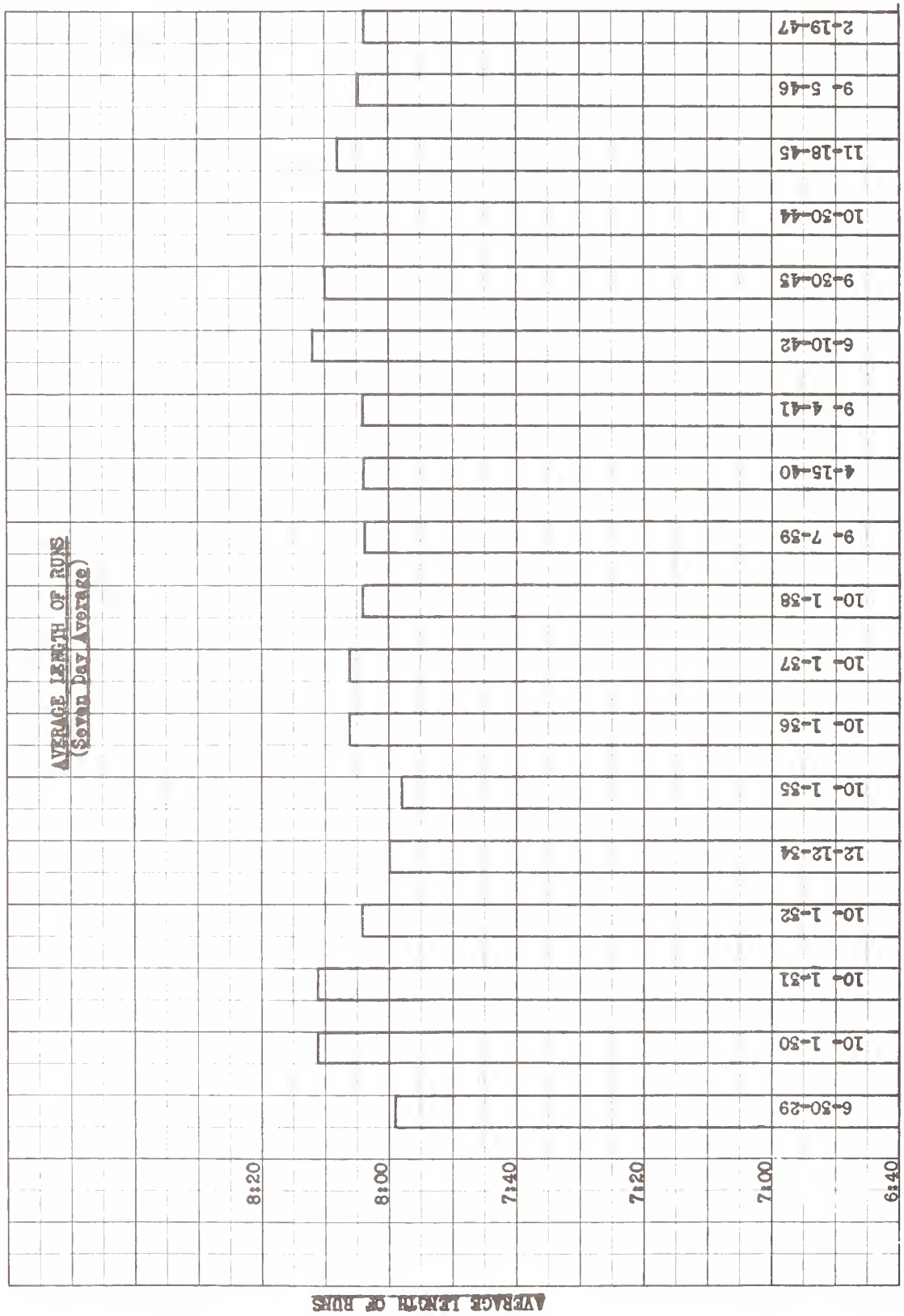

FIGURE 54.
AVERAGE LENGTH OF RUNS -
SAMPLE COMPANY UNDER STUDY.

Information of this type is of considerable value to the Schedule Department in tempering its "economic" considerations with an "employee relations" aspect to the extent that the earnings position of the company will permit. It also serves to promote understanding between the Trainmen's Association's Schedule Committee and the Schedule Department in their discussions of the run cut and the Assignment Sheet. "Guesses" on the Committee's part as to the preference for certain kinds of runs is replaced by factual data showing just what the men really desire as expressed in terms of their "pick preference" in order of seniority. Meetings between the Committee and the Chief Schedule Maker to discuss such matters have been conducive of much good.

Figure 53 is a table showing the number and percentage of "preferable" runs on the sample property in relation to the total runs for the Spring of 1946. In this compilation the "contract" rather than the "pick" is used to define "preferable" runs, and all straight runs are included as preferable runs along with 2-piece runs paying a "spread" of 50¢ per day or more, because this agreement specifies that "there shall be as many straight runs as economically possible". On this basis, the sample company shows a system-wide percentage of 75.8 "preferable" runs. The bus system alone shows 81.1 per cent "preferable" runs. This statement is a valuable guide to the Schedule Department in shaping its run cut policies.

The chart in Figure 54 depicts the average length of runs over a period of 18 years. This shows the extent to which the schedule makers of the sample company have been able to hold regular runs to an approximately 8-hour working day. It serves as a gross measure of the ability of the Schedule Department to avoid the payment of "allowed time" on the one hand, and "overtime" on the other hand.

Figure 55 shows the percentage of straight runs to total runs for the property over a period of 17 years. This percentage has grown from a low of 47 per cent to a present value of 72.5 per cent. It serves as a gross index of the degree to which the sample company has been able to meet the desires of its operators for straight runs, and the degree to which it has been able to reduce the percentage of 2-piece runs involving the payment of a spread "bonus".

The chart shown in Figure 56 expresses the relationship between the number of "preferable" runs and the number of total runs over the last 15 years. In this exhibit all straight runs and 2-piece runs with a spread pay of 50¢ and over are considered to be "preferable" runs as in Figure 53. The various kinds of runs are indicated by an appropriate legend. The percentage of preferable runs has grown from 46 in 1934 to 74 at the present time. (NOTE: 3-Piece Runs are provided for in the company's contract with its platform personnel, but no 3-piece runs are scheduled at the present time.) It is apparent from this chart that there has been a relatively greater growth in the percentage of straight runs within the growth in the number of regular runs.

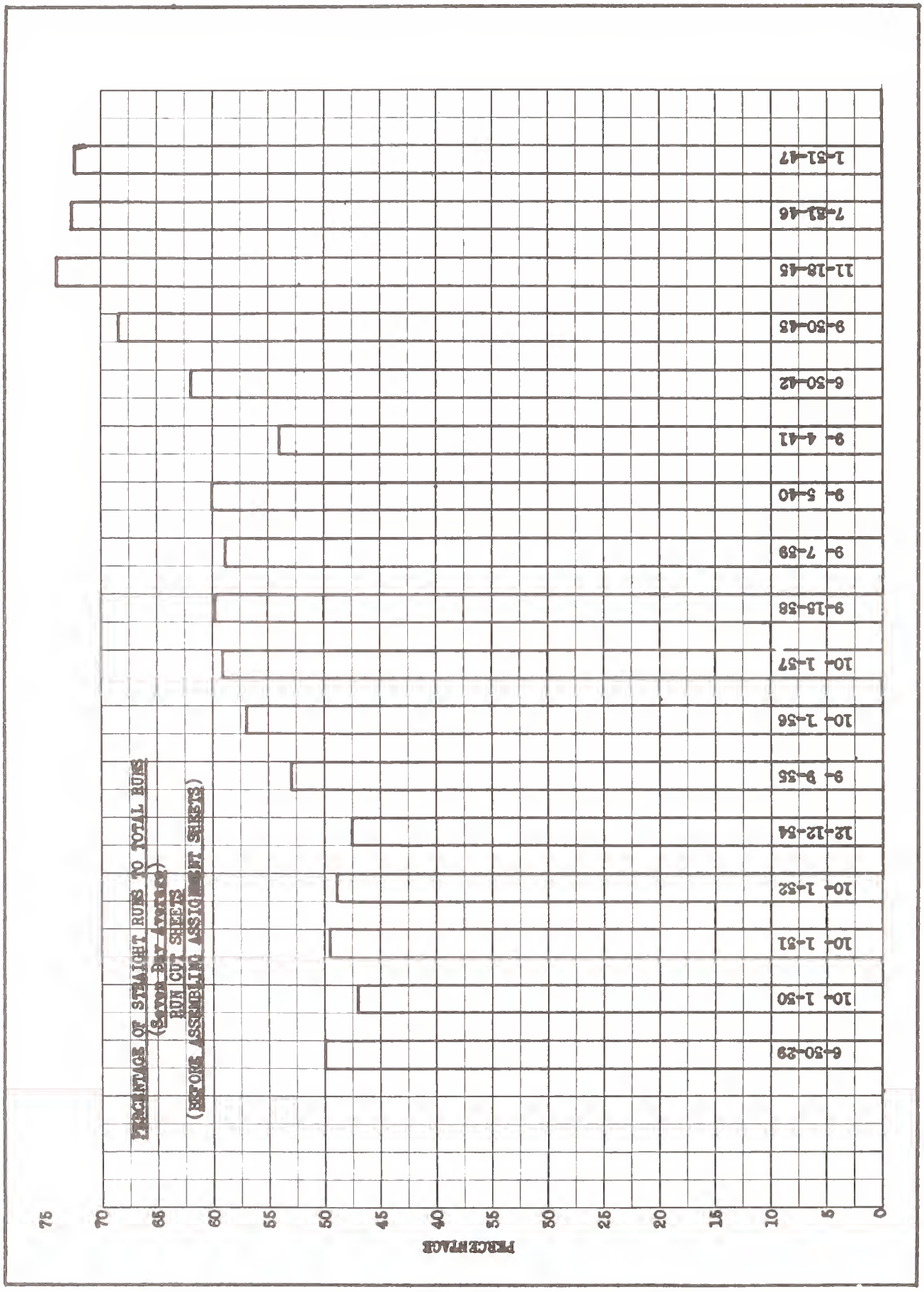

FIGURE 55.
PERCENTAGE OF STRAIGHT RUNS—
SAMPLE COMPANY UNDER STUDY.

Other forms and methods utilized in the cutting of runs will be discussed in Parts II and III of this report, which will provide a compendium of industry practices and viewpoints on this phase of the schedule making process.

The schedule making procedure on the sample property has now been described and illustrated in considerable detail. Consideration will next be given to the methods used by the company in the distribution of schedule information to its operators, its supervisory employees and officials, and the general public.

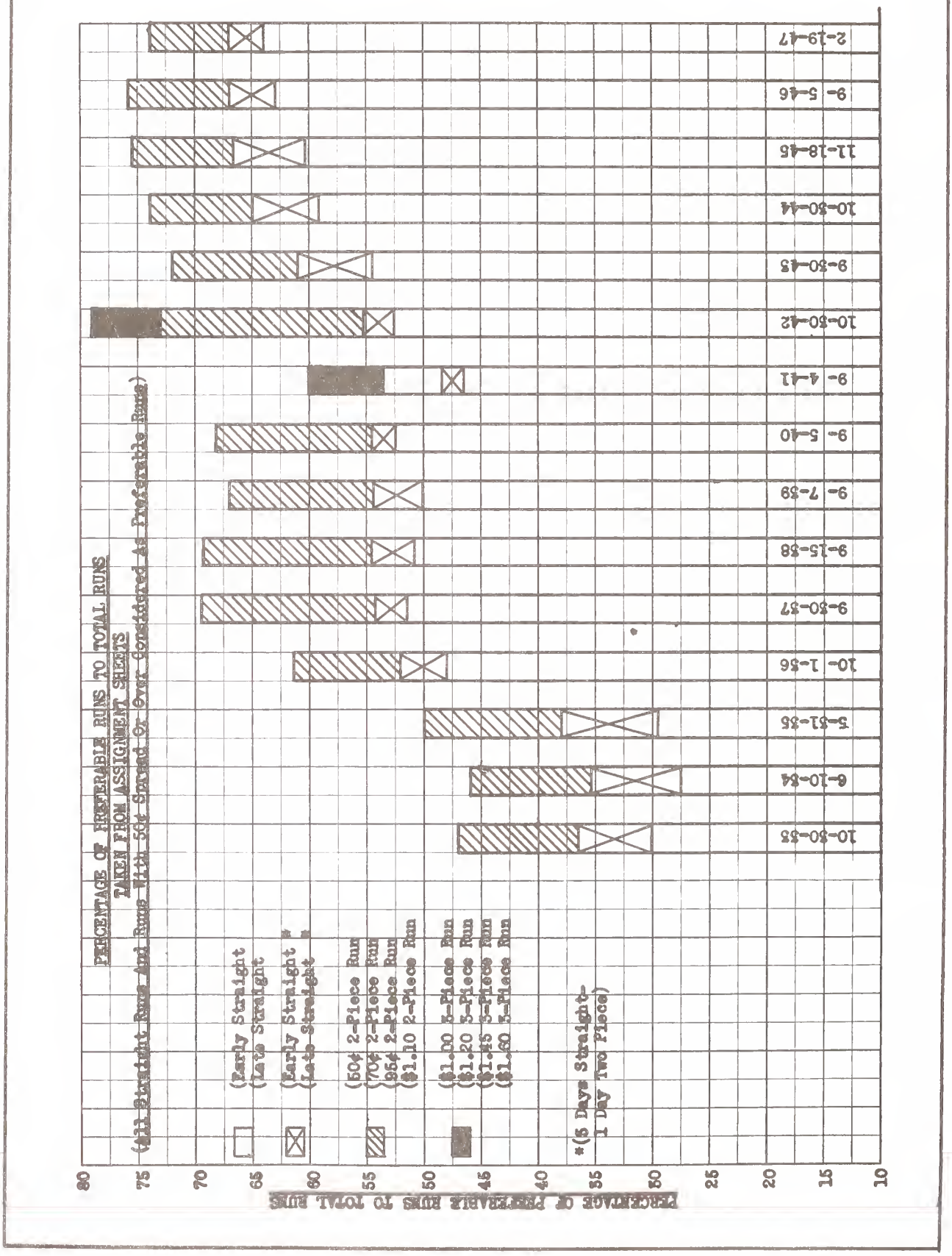

FIGURE 56.
PERCENTAGE OF PREFERABLE RUNS TO TOTAL RUNS—
SAMPLE COMPANY UNDER STUDY.

CHAPTER VII

DISTRIBUTION OF SCHEDULE INFORMATION

Having completed the component parts of a transit schedule, the next problem confronting a Schedule Department is that of making the basic information concerning the schedule available to the interested parties. Clarity, conciseness, and the use of effective methods for duplicating a sufficient number of copies are the basic essentials to be considered.

There are many views as to the best methods of setting up and duplicating schedule data, and an attempt will be made to set some of these ideas forth in Parts II and III of this study. Following along with the basic premise for Part I, at this point an exposition will be included covering the practices followed by the company under study.

The media to be discussed in this chapter are:

1. Run Sheet
2. Assignment Sheet
3. Terminal Sheet
4. Run Guide Sheet
5. Comparative Statement
6. Recapitulation of Schedules in Effect
7. Published Schedule Data

A. The Run Sheet

The typed Run Sheet has previously been shown in the chapter on Run Cutting as Figure 46. It contains all the essential information of the run cut sheet, but in simplified and rearranged form.

Three copies of the Run Sheet are prepared by the Schedule Department -- an original and two carbon copies.

The original copy is placed in the department's Schedule Book for ready reference in a multiplicity of uses. It furnishes, for example, a basis for the comparison of all essential information on runs when building a new schedule for the line, or in making up comparative statements, and so on.

One carbon copy is sent to the station master of the division out

of which the line operates. He uses it for general information concerning runs, and the station clerks use it specifically in the task of preparing in advance for the issuance of transfers to the trainmen. The numbers of runs, their lengths, etc., serve as guides to the number of "blocks" of transfers to be set up for issuance and the quantities in each block.

The second carbon copy is sent to the paymaster, who uses it to obtain payroll information for the tripper runs, as these do not appear on the Assignment Sheet. The paymaster also uses the Run Sheet as a check on the times of regular runs, to see that he has set up the pay time correctly.

B. The Assignment Sheet

The Assignment Sheet, Figure 57, is essentially a medium for grouping runs into six-day assignments for selection by the trainmen in accordance with their seniority. In its finally typed form, Figure 58, it serves as information to the trainmen in their "picking" of runs, and as a place where they may "sign" for the runs selected.

The source of information for preparing the Assignment Sheet is the run cut sheet shown in Figure 45.

Picking of Runs

The following general provisions of the agreement between the company and its operating personnel govern the picking of runs:

1. Motormen, conductors and bus operators shall be entitled to the runs they consider best, in accordance with the length of time that they shall have been in continuous service of the Company, employed in the position of motorman, conductor or bus operator.

2. Motormen, conductors and bus operators shall be allowed to select runs, or groups of runs, they consider the best on the lines at the division where they are working when they are entitled to such choice.

3. Motormen, conductors and bus operators who are allowed to select runs in accordance with (these provisions) shall select runs according to their respective position only -- that is to say, motormen shall be allowed to select motormen's runs only, conductors shall be allowed to select conductor's runs only, bus operators shall be allowed to select bus runs only.

4. Such assignments will remain in force for a period of sixty (60) or more days, except when the schedule or schedules are changed.

5. If schedule or schedules are changed and regular runs are decreased, a general pick will be held.

6. If schedule or schedules are changed and regular runs are added and the general pick has not been in effect for sixty (60) days, then line picks will be held. It is agreed that a line pick shall not remain in force for a period of more than sixty (60) days.

7. It is further agreed that motormen, conductors and bus operators shall be allowed a general pick of runs at the division where they are working at intervals not to exceed five (5) months.

8. It is further agreed that when five (5) or more runs become vacant (such is usually caused by men leaving the service) on any one work board a general pick at that division will be held, provided, however, that the general pick being worked at the time the five (5) runs become vacant has been in effect sixty (60) or more days.

9. The proviso that general picks remain in effect for a period of at least sixty (60) days before a general pick is held shall not apply when changing from winter to summer or from summer to winter schedules.

10. It is further understood that when line picks are held that there will be no decrease in the number of regular runs scheduled. It is also agreed that when line picks are held that the types of runs on the new schedules, will be as near the same as the old schedules as possible.

11. By a schedule change is meant when one or more regular runs have been added, or when the schedule time picked of a regular run has been increased by more than twenty-five (25) minutes.

12. It is agreed that when the schedule time picked of a regular run has been increased by more than twenty-five (25) minutes, all added time in excess of schedule time picked shall be paid for at the rate of time and one-half, and there shall be no limit to the amount of time that a run may be decreased, provided that no deduction in pay hours shall be made for time decreased.

13. When a part trip is added to a regular run the regular man operating this run will have preference of working the additional time at time and one-half pay provided the extra time added does not exceed one hour and thirty minutes. If the added time exceeds one hour and thirty minutes, the extra man will be given the preference.

14. If any emergency schedule remains in effect for more than seven (7) days the trainmen or bus operators of that line will be allowed a general pick or a line pick,

depending upon the length of time the general pick then being worked has been in effect.

15. Regular men who are deprived of a run by reason of an emergency schedule or line pick shall be given an open run, if there be any, or shall be paid for all time lost during the period in which the schedules are being picked.

16. General picks shall be allowed on special schedules that are effective on such days as Good Friday, Christmas, etc. Regular schedules in effect just preceding such special schedule will be reinstated on the day following the special schedule without any further selection of runs being allowed, unless some change in the regular schedule has been made that will warrant a general pick.

17. All schedules except emergency schedules, shall be posted in the lobby of the station where the men are working at least forty-eight hours before commencement of selection of runs.

There are other provisions pertaining to the picking of runs, but these are the ones of special interest in connection with the discussion of the Assignment Sheet.

Grouping Runs into Six-Day Assignments

The agreement between the company and its trainmen specifies that "schedules shall be so arranged as to allow regular trainmen and bus operators six days per week and approximately eight hours per day". Once a company adopts the policy of limiting the number of days per week that a regular trainman shall work, it becomes necessary to work out some plan for systematically controlling the number of regular men who shall be "off" during each day of the week.

Under the plan used a regular man may select the day of the week he wishes to be "off" according to his seniority. Thus, men with a high seniority can select Sunday as their "off" day if they so desire.

The Schedule Department assembles the runs of a schedule into "blocks" of work, each of which constitutes a week's work for a regular trainman. One advantage of this plan is that trained schedule men can usually work out a grouping of runs which is more equitable for all concerned than that which would result from permitting a man to first select the day of the week which he wishes to be "off", and then to select those runs which he wishes to work on the remaining days. Another advantage is that all or practically all of the regular runs on the Monday, Tuesday to Friday, Saturday

and Sunday schedules can be grouped into "blocks" to be picked and operated by regular men, thereby holding to a minimum the number of extra men required for the operation of schedules. A third advantage of the plan is that the manner in which the schedule men group runs can be discussed and agreed to before hand by the trainmen through the Trainmen's Association's Schedule Committee. A final advantage is that the time required to complete a "pick" is materially reduced. A disadvantage of the plan is that it puts more work on the Schedule Department.

Procedure for Determining "Days Off"

The procedure for grouping runs will be explained in terms of the sample bus line for which a Tuesday to Friday schedule has been developed in this report.

The Run Cut Sheet for this Tuesday to Friday schedule is shown in Figure 45. The Run Cut Sheets for Monday, Saturday and Sunday schedules have not been included, although pertinent data from them have been recorded on the Assignment Sheet (Figures 57 and 58).

An examination of these Run Cut Sheets shows that the following numbers of scheduled runs are to be operated by regular men:

	Monday Schedule	Tuesday to Friday Schedule	Saturday Schedule	Sunday Schedule
Regular runs to be operated	20	19	21	16
Number of days per week	1	4	1	1
Pieces of work	20	76	21	16

Total number of pieces of work for regular men for 1 Monday	20
Total number of pieces of work for regular men for 4 weekdays	76
Total number of pieces of work for regular men for 1 Saturday	21
Total number of pieces of work for regular men for 1 Sunday	16
Total number of pieces of work for regular men for seven days	133

When this total of 133 pieces of work is grouped into blocks of six days work per man, there will be

$$\frac{\text{133 pieces of work (7 days)}}{\text{6 days work per man}} = \text{22 "blocks" and 1 piece.}$$

The next step is to determine how many regular men can be "off" during each day of the week. This is done in the following manner:

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Total number of "blocks"	22	22	22	22	22	22	22
Runs shown on Run Cut	20	19	19	19	19	21	16
Number regular men "off"	2	3	3	3	3	1	6

or a total of 21 men off. Consideration must now be given to the 1 piece of work left over in the division by 6 days performed above. This is a regular run which, on the property under study, is worked by an extra man. Since the regular men have shown a preference for getting "off" on Saturdays and Sundays, it is company policy to arrange for as many of them to do so as possible. By placing the one piece of work left over on Sunday, the total number of regular men who can get off each day of the week becomes:

Monday	2
Tuesday	3
Wednesday	3
Thursday	3
Friday	3
Saturday	1
Sunday (6-1)	7
TOTAL	22

It would be possible to place this extra piece anywhere in the week where it would best fit. This the schedule maker must determine in line with current policies.

Policies to be Observed in Assembling Assignment Sheets

The next step is to assemble the regular runs from the run cut sheets into "blocks". This process will be described in detail below. In general, it consists in setting up the "off" days in each block, and then placing the more preferable runs on the Assignment Sheet, starting with the first block. As previously indicated, the trainmen consider the early straight runs to be the most preferable. Following these are the "high-spread" morning two-piece runs, and so on.

In order to produce Assignment Sheets which will be acceptable to its operators, the company has a verbal agreement with them, effected through the Trainmen's Association's Schedule Committee, which meets frequently with the Chief Schedule Maker. This verbal agreement covers the following major points:

1. The "straight day" runs, the "$1.10 spread" runs, the "95¢ spread" runs, the "70¢ spread" runs and the "50¢ spread" runs will be considered as preferable runs,

and should be off on Sunday wherever possible.

2. The "off" days on Sunday should be divided between the "early straight" runs, the "$1.10 spread" runs, the "95¢ spread" runs, the "70¢ spread" runs and the "50¢ spread" runs.

3. When not possible to let all of the preferable runs off on Sunday, they should be off on Saturday, followed by a "straight day" run on Sunday.

4. The "70¢ and 50¢ spread" runs should be the same (have spread) on Saturday as weekday, but in the case where spread runs are not available on Saturday, they should have a straight day. A "50¢ spread" run on Saturday should not be coupled with a "$1.10, 95¢ or 70¢ spread" run on weekdays.

5. All of the preferable runs should go to work each day (including Saturday) at the same time as nearly as practicable; where not practicable, the Saturday and Sunday run should get off as early as possible.

6. The "30¢ and 15¢ spread" runs will be off on Saturday if possible, providing that all of the "straight" runs, "$1.10, 95¢, 70¢ and 50¢ spread" runs are taken care of first.

7. The early "two-piece" runs (off before 7:30 P.M.) will be given a straight run on Saturday and Sunday wherever possible, even at the expense of breaking a 6-day late straight run on the Assignment Sheet.

8. In assembling the "late straight" runs (off between 7:30 P.M. and 1:00 A.M.) six (6) day straight runs should be given wherever possible, regardless of the time the day's work is finished. In this connection the finishing time of each day's work will be kept as near the same time as practicable.

9. In assembling the "late" runs, the maximum possible time should be allowed between the finish of the day's work and the start of the next day's work.

10. On those lines which operate two "owls", the two pieces left over should be placed on an "All American" run and be worked on consecutive days. (See "Glossary" for definition of "All American").

11. On the "All American" runs the "day off" should not follow the morning that the "owl" is worked.

12. The "All American" runs should not include "spread" unless of the 30¢ or 15¢ variety.

13. Spread runs should not be worked as "extra assignments".

14. In general, assignments should be given preference in the following order:

    a. (Straight day run
       ($1.10 spread run
       (95¢ spread run
       (70¢ spread run
       (50¢ spread run

    b. 30¢ spread run

    c. 15¢ spread run

    d. Early two-piece run

    e. Late straight run

    f. Late two-piece run

    g. Owl run

    h. "All American"

15. Six (6) hours or more should be allowed between the completion of the day's work and the start of the following day's work.

These "policies" are, of course, subject to constant revision in the light of experience and as the result of discussion with the Trainmen's Association's Schedule Committee.

Procedure for Setting Up the Assignment Sheet

The schedule maker (caller) and an assistant (recorder) work together in setting up the Assignment Sheet. A blank assignment sheet form and the Monday, Tuesday to Friday, Saturday and Sunday run cut sheets are the materials required.

The Assignment Sheet is properly headed, and "Block Numbers" are filled in the extreme left hand column. Twenty-two (22) numbers and one "Ex" (for "extra") are entered, in accordance with the previous calculation.

Since there are to be 7 Sundays off, the word "OFF" is written

ASSIGNMENT SHEET

SCHEDULE Nos. 7723-7730-7731-7732

DATE EFFECTIVE May 28th 1944

SUPERSEDING SCHEDULE NO. 6982-7629-6980-6984

STATION Canal Bar — City Park Bar — LINE — SCHEDULE DIVISION Monday only / Tuesday to Friday / Saturday and Sunday only

APPROVED OK D.P.D. — MANAGER SCHEDULE DIVISION

RELIEF POINT — IN Odessa Rel Board — OUT Damiano Rel Board

BLOCK No.	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	ASSIGNMENT
75	Run 781 SP PAY On 1- 636a Off 1233P On Off Actual 746 Pay 800R	Run 781 SP PAY On 1- 636a Off 1233P On Off Actual 746 Pay 800R	Run 781 SP PAY On Off On Off Actual Pay	Run 781 SP PAY On Off On Off Actual Pay	Run 781 SP PAY On Off On Off Actual Pay	Run 780 SP PAY On 1 636 a Off 1233P On Off Actual 763 Pay 800R	Run OFF SP PAY On Off On Off Actual Pay	CONDUCTOR MOTORMAN
76	Run 780 SP PAY On 15- 636a Off 1231P On Off Actual 738 Pay 800R	Run 780 SP PAY On 15 636a Off 1233P On Off Actual 792 Pay 800R	Run 780 SP PAY On Off On Off Actual Pay	Run 780 SP PAY On Off On Off Actual Pay	Run 780 SP PAY On Off On Off Actual Pay	Run 781 SP PAY On 11- 636a Off 1233P On Off Actual 803 Pay 803R	Run OFF SP PAY On Off On Off Actual Pay	CONDUCTOR MOTORMAN
77	Run 782 SP PAY On 7- 636a Off 1067P On Off Actual 788 Pay 800R	Run 782 SP PAY On 7- 636a Off 1137P On Off Actual 797 Pay 800R	Run 782 SP PAY On Off On Off Actual Pay	Run 782 SP PAY On Off On Off Actual Pay	Run 782 SP PAY On Off On Off Actual Pay	Run 782 SP PAY On 7 536 a Off 1067P On Off Actual 769 Pay 800R	Run OFF SP PAY On Off On Off Actual Pay	CONDUCTOR MOTORMAN
78	Run 783 SP PAY On 3- 636a Off 1167P On Off Actual 739 Pay 800R	Run 783 SP PAY On 3- 536a Off 1206P On Off Actual 801 Pay 801R	Run 783 SP PAY On Off On Off Actual Pay	Run 783 SP PAY On Off On Off Actual Pay	Run 783 SP PAY On Off On Off Actual Pay	Run 783 SP PAY On 5- 536 a Off 1417P On Off Actual 746 Pay 800R	Run OFF SP PAY On Off On Off Actual Pay	CONDUCTOR MOTORMAN
79	Run 784 SP PAY On 12- 6.12a Off 2317P On Off Actual 821 Pay 821R	Run 785 SP PAY .60 On 15- 6.12a Off 1117a On 12- 339P Off 648P Actual 762 Pay 800	Run 785 SP PAY On Off On Off Actual Pay	Run 785 SP PAY On Off On Off Actual Pay	Run 785 SP PAY On Off On Off Actual Pay	Run 784 SP PAY On 9- 6.12a Off 2317P On Off Actual 819 Pay 819R	Run OFF SP PAY On Off On Off Actual Pay	CONDUCTOR MOTORMAN
80	Run 785 SP PAY .15 On 17- 6.22a Off 1149a On 21- 358P Off 841P Actual 816 Pay 816	Run 789 SP PAY .50 On 20- 6.22a Off 907a On 3- 306P Off 646P Actual 807 Pay 807	Run 789 SP PAY On Off On Off Actual Pay	Run 789 SP PAY On Off On Off Actual Pay	Run 789 SP PAY On Off On Off Actual Pay	Run 785 SP PAY On 10- 6.55a Off 235P On Off Actual 760 Pay 800R	Run OFF SP PAY On Off On Off Actual Pay	CONDUCTOR MOTORMAN
81	Run 783 SP PAY .45 On 18- 6.33a Off 933a On 1- 1332P Off 632P Actual 820 Pay 820	Run 784 SP PAY .30 On 16- 6.33a Off 1019a On 10- 217P Off 628P Actual 784 Pay 800	Run 784 SP PAY On Off On Off Actual Pay	Run 784 SP PAY On Off On Off Actual Pay	Run 784 SP PAY On Off On Off Actual Pay	Run 786 SP PAY On 8- 6.46a Off 307P On Off Actual 821 Pay 821R	Run OFF SP PAY On Off On Off Actual Pay	CONDUCTOR MOTORMAN
82	Run 787 SP PAY .30 On 3- 6.32a Off 1021a On 19- 2.10P Off 611P Actual 788 Pay 800	Run 786 SP PAY .30 On 6- 6.37a Off 1001a On 15- 2.02P Off 631P Actual 758 Pay 800	Run 786 SP PAY On Off On Off Actual Pay	Run 786 SP PAY On Off On Off Actual Pay	Run 786 SP PAY On Off On Off Actual Pay	Run OFF SP PAY On Off On Off Actual Pay	Run 780 SP PAY On 1- 638a Off 1289P On Off Actual 801 Pay 801	CONDUCTOR MOTORMAN
83	Run 790 SP PAY .30 On 16- 6.59a Off 1008a On 17- 1637P Off 660P Actual 818 Pay 818	Run 788 SP PAY .30 On 19- 6.39a Off 907a On 1- 1240P Off 641P Actual 805 Pay 805	Run 788 SP PAY On Off On Off Actual Pay	Run 788 (B) SP PAY On Off On Off Actual Pay	Run 788 (B) SP PAY .80 On 19- 6.39a Off 907a On 1- 1240P Off 641P Actual 805 Pay 805	Run 787 SP PAY .15 On 4- 6.31a Off 1116a On 10- 335P Off 556P Actual 800 Pay 800R	Run 781 SP PAY On 4- 5.34a Off 1137P On Off Actual 749 Pay 800R	CONDUCTOR MOTORMAN
84	Run 786 SP PAY .15 On 10- 6.46a Off 1153a On 13- 381P Off 601P Actual 827 Pay 827	Run 787 SP PAY .30 On 13- 6.46a Off 1203P On 19- 841P Off 636P Actual 781 Pay 781	Run 787 SP PAY On Off On Off Actual Pay	Run 787 SP PAY On Off On Off Actual Pay	Run OFF (C) SP PAY On Off On Off Actual Pay	Run 788 SP PAY On 3- 707a Off 1017a On 7- 1067P Off 546P Actual 710 Pay 710	Run 782 SP PAY On 7- 638a Off 1216P On Off Actual 731 Pay 731	CONDUCTOR MOTORMAN
85	Run 791 SP PAY .30 On 9- 733a Off 886a On 10- 1133a Off 703P Actual 828 Pay 828	Run 790 SP PAY .30 On 5- 713a Off 931a On 13- 1206P Off 706P Actual 822 Pay 822	Run OFF (A) SP PAY On Off On Off Actual Pay	Run 790 (A) SP PAY .30 On 5- 713a Off 931a On 12- 1248P Off 706P Actual 822 Pay 822	Run 790 (A) SP PAY On Off On Off Actual Pay	Run 789 SP PAY On 6- 718a Off 944a On 1- 1239P Off 618P Actual 814 Pay 814	Run 783 SP PAY On 2- 737a Off 954P On Off Actual 817 Pay 817	CONDUCTOR MOTORMAN
86	Run 793 SP PAY On 19- 1231P Off 865P On Off Actual 796 Pay 800	Run 791 SP PAY On 18- 1234P Off 835P On Off Actual 797 Pay 800	Run 791 SP PAY On Off On Off Actual Pay	Run 791 (G) SP PAY On 18- 1238P Off 835P On Off Actual 797 Pay 800	Run OFF (G) SP PAY On Off On Off Actual Pay	Run 791 SP PAY On 12- 1131a Off 737P On Off Actual 806 Pay 806R	Run 785 (L) SP PAY On 8- 11.42a Off 807P On Off Actual 825 Pay 825R	CONDUCTOR MOTORMAN
87	Run 794 SP PAY On 8- 1147 Off 908P On Off Actual 732 Pay 800	Run 790 SP PAY On 8- 1137P Off 858P On Off Actual 799 Pay 800	Run OFF (E) SP PAY On Off On Off Actual Pay	Run 793 (E) SP PAY On 8- 1137P Off 858P On Off Actual 729 Pay 800	Run 793 SP PAY On Off On Off Actual Pay	Run 792 SP PAY On 4- 1116a Off 747P On Off Actual 821 Pay 821	Run 786 SP PAY On 5- 1341P Off 833P On Off Actual 751 Pay 800R	CONDUCTOR MOTORMAN
88	Run 792 SP PAY On 17- 11.49a Off 1143P On 11- 238P Off 861P Actual 808 Pay 808R	Run 792 SP PAY On 15- 1117a Off 1027P On 2- 317P Off 889P Actual 808 Pay 808R	Run 792 SP PAY On Off On Off Actual Pay	Run OFF SP PAY On Off On Off Actual Pay	Run 792 (F) SP PAY On 15- 1117a Off 1027P On 2- 317P Off 889P Actual 808 Pay 808R	Run 793 SP PAY On 3- 1134P Off 903P On Off Actual 808 Pay 808R	Run 787 SP PAY On 4- 1139P Off 903P On Off Actual 750 Pay 800	CONDUCTOR MOTORMAN
89	Run 795 SP PAY On 13- 317P Off 1108P On Off Actual 823 Pay 823	Run OFF (D) SP PAY On Off On Off Actual Pay	Run 794 (D) SP PAY On 2- 248P Off 1108P On Off Actual 823 Pay 823	Run 794 SP PAY On Off On Off Actual Pay	Run 794 SP PAY On Off On Off Actual Pay	Run 795 SP PAY On 11- 1259P Off 934P On Off Actual 825 Pay 825	Run 789 (M) SP PAY On 7- 1241P Off 933P On Off Actual 849 Pay 849	CONDUCTOR MOTORMAN
90	Run 796 SP PAY On 20- 329P Off 1139P On Off Actual 834 Pay 834	Run 795 SP PAY On 9- 333P Off 1151P On Off Actual 834 Pay 834	Run OFF (K) SP PAY On Off On Off Actual Pay	Run 795 (K) SP PAY On Off On Off Actual Pay	Run OFF (K) SP PAY On Off On Off Actual Pay	Run 796 SP PAY On 8- 307P Off 1144P On Off Actual 787 Pay 827	Run 790 SP PAY On 9- 303P Off 1046P On Off Actual 814 Pay 814	CONDUCTOR MOTORMAN
91	Run 797 SP PAY On 18- 446P Off 1214a On Off Actual 818 Pay 818	Run 796 SP PAY On 6- 446P Off 1224a On Off Actual 818 Pay 818	Run OFF (J) SP PAY On Off On Off Actual Pay	Run OFF (J) SP PAY On Off On Off Actual Pay	Run 796 (J) SP PAY On 6- 406P Off 1224a On Off Actual 818 Pay 818	Run 798 SP PAY On 6- 502P Off 1255a On Off Actual 753 Pay 800	Run 793 SP PAY On 6- 433P Off 1235a On Off Actual 753 Pay 800	CONDUCTOR MOTORMAN
92	Run 798 SP PAY On 4- 624P Off 1134a On Off Actual 803 Pay 803	Run 797 (J) SP PAY On 20- 431P Off 1134a On Off Actual 803 Pay 803	Run OFF (I) SP PAY On Off On Off Actual Pay	Run 797 (I) SP PAY On 20- 431P Off 1134a On Off Actual 803 Pay 803	Run 797 SP PAY On Off On Off Actual Pay	Run 799 SP PAY On 10- 360P Off 1234a On Off Actual 833 Pay 833	Run 794 SP PAY On 1- 306P Off 1134a On Off Actual 807 Pay 807	CONDUCTOR MOTORMAN
93	Run 799 SP PAY On 11- 841P Off 1140a On Off Actual 789 Pay 800	Run OFF SP PAY On Off On Off Actual Pay	Run 798 SP PAY On 2- 839P Off 1140a On Off Actual 801 Pay 801	Run 798 SP PAY On Off On Off Actual Pay	Run 798 SP PAY On Off On Off Actual Pay	Run 800 SP PAY On 2- 902P Off 1140a On Off Actual 738 Pay 800	Run 795 SP PAY On 5- 853P Off 1140a On Off Actual 808 Pay 808	CONDUCTOR MOTORMAN
94	Run 789 SP PAY .15 On 6- 718a Off 908a On 7- 1047P Off 628P Actual 788 Pay 800	Run OFF SP PAY On Off On Off Actual Pay	Run 790 (A) SP PAY .30 On 6- 713a Off 931a On 13- 1206P Off 706P Actual 822 Pay 822	Run 788 (B) SP PAY .30 On 19- 639a Off 907a On 1- 1240P Off 641P Actual 805 Pay 805	Run 787 (C) SP PAY .30 On 13- 646a Off 1203P On 19- 841P Off 636P Actual 841 Pay 841	Run 790 SP PAY On 3- 1017a Off 1254P On 5- 1015P Off 710P Actual 806 Pay 806	Run 784 SP PAY On 6- 706a Off 932P On Off Actual 736 Pay 800R	CONDUCTOR MOTORMAN
96	Run OFF SP PAY On Off On Off Actual Pay	Run 794 (D) SP PAY On 2- 248P Off 1108P On Off Actual 817 Pay 817	Run 799 (E) SP PAY On 8- 1137P Off 858P On Off Actual 789 Pay 800	Run 792 (F) SP PAY On 13- 1117a Off 1027P On 2- 317P Off 889P Actual 808 Pay 808R	Run 791 (G) SP PAY On 18- 1238P Off 835P On Off Actual 747 Pay 800	Run 794 SP PAY On 3- 1203P Off 902P On Off Actual 803 Pay 803R	Run 788 SP PAY On 7- 1238P Off 938P On Off Actual 837 Pay 837	CONDUCTOR MOTORMAN
96	Run OFF (H) SP PAY On 2- 847P Off 1140a On Off Actual 821 Pay 821	Run 798 (H) SP PAY On 2- 847P Off 1140a On Off Actual 821 Pay 821	Run 797 (I) SP PAY On 20- 431P Off 1134a On Off Actual 842 Pay 842	Run 796 (J) SP PAY On 6- 406P Off 1224a On Off Actual 818 Pay 818	Run 794 (K) SP PAY On 7- 333P Off 1107P On Off Actual 824 Pay 824	Run 797 SP PAY On 9- 331P Off 1027P On 12- 1231P Off 1236a Actual 829 Pay 829	Run 792 SP PAY On 8- 334P Off 1029a On Off Actual 810 Pay 810	CONDUCTOR MOTORMAN
84	Run SP PAY On Off On Off Actual Pay	Run SP PAY On Off On Off Actual Pay	Run SP PAY On Off On Off Actual Pay	Run SP PAY On Off On Off Actual Pay	Run SP PAY On Off On Off Actual Pay	Run SP PAY On Off On Off Actual Pay	Run 791 SP PAY .15 On 1- 1239P Off 506P On 8- 807P Off 1124P Actual 814 Pay 814	CONDUCTOR MOTORMAN

ALL AMERICAN

FIGURE 57.

PREPARATION OF ASSIGNMENT SHEET—
SAMPLE COMPANY UNDER STUDY.

under "Sunday" in the seven block numbers 75 through 81. The Saturday off is listed opposite Block No. 82. The three Fridays off are entered opposite Block Nos. 83-85, the three Thursdays opposite Block Nos. 86-88, and so on. The total number of entries is checked to see that 22 spaces have been utilized.

Tuesday-Friday Schedule

The schedule maker calls, and the recorder enters, the runs for the Tuesday-Friday schedule. He begins at Block No. 75 and lists the most preferable runs. There are 7 Sunday runs off. Against these he has 4 early straight runs and 2 "high spread" (50¢) runs. This gives him Sundays enough to cover all high preference runs, plus one over to apply against the best 30¢ spread run. He then calls the preferable runs in the order in which they pull out of the bus garage; for example, Run 781 (Block No. 75), Run 780 (Block No. 76), Run 782 (Block No. 77), Run 783 (Block No. 78), and so on, through Block No. 81. In each case the full data describing the run are entered under "Tuesday", and the Run Number is carried across the sheet under "Wednesday", "Thursday" and "Friday". The runs are checked off the Run Cut Sheet as they are entered on the Assignment Sheet.

In deciding on the best 30¢ spread run to place against the seventh Sunday, the length of run and "time off" were both taken into account. On this basis, Run 784 was selected.

Attention is next given to the one Saturday off. The "second best" 30¢ spread run (in the opinion of the schedule maker as governed by the verbal agreement), No. 786, is entered under Tuesday -- Friday opposite Block No. 82.

The next days "off" are the three Fridays (Block Nos. 83-85). The next most preferable runs are the three remaining 30¢ spread runs. They are entered in the following order of preference -- Run No. 788 (shortest of the three) -- Block No. 83; Run No. 787 (gets off the earlier of the two remaining) -- Block No. 84; and Run No. 790 (latest of the three) -- Block No. 85. The listing of these runs in order of preference paves the way for entering the best Sunday runs in order when they are called.

At the beginning of entering runs on the Assignment Sheet for the "blocks" in which "weekdays" are off, the schedule maker sets up a rough "tally sheet" on which he enters a brief description of the runs as the recorder places them on the Assignment Sheet (for example, 788-2-piece-"off" 6:41 P.M. - spread 30¢). Since "Friday" is the day off, no entry is made at the outset under the Friday column opposite Block Nos. 83-85.

With the listing of the last 30¢ spread run, all the "preferable" runs have been used up, and the schedule maker has left the late 2-piece runs and the late straight runs.

The next three blocks (Nos. 86-88) are those for which (tentatively) Thursday is "off". The schedule maker examines the remaining runs for order of preference. There are three runs which get off at approximately the same time - 791, a straight run, off at 8:25 P.M.; 792, a two-piece run, off at 8:39 P.M.; and 793, a straight run, off at 8:52 P.M. Since all get off at the same time, he considered either straight run to be better than the two-piece run. Of the two "straights", he chose the earliest "in" time as the best. Accordingly, Runs Nos. 791, 793 and 792 were entered on the Assignment Sheet in Block Nos. 86, 87 and 88 respectively, entered on the "tally sheet" for future reference, and checked off the Run Cut Sheet. On the Assignment Sheet, Thursday showed "off", and the number of the runs were entered under "Friday".

Run No. 792 is the last run on the "early" side of the Run Cut Sheet. Its 8:39 P.M. "off" time is far superior to anything on the "late" side of the sheet (earliest time "in" - 11:05 P.M.) This double checks the schedule maker's judgment in using Run No. 792 in Block No. 88 in preference to a late straight run.

The next three blocks (Nos. 89-91) are those with Wednesdays (tentatively) off. The schedule maker studies the "late" side of the Run Cut Sheet, and finds the runs to be all of about the same length. He lists them, therefore, in an order of preference based on the earliest time "off". Run 794 is placed in Block No. 89, and Run 795 in Block No. 90. Since the "owl" is always off on a Tuesday, the recorder warns the caller that there is "only one more OFF before the 'owl'". There are three runs left unchecked on the Run Cut Sheet - Nos. 796, 797, and 798 (the "owl"), and one more Wednesday off to be handled before getting to Tuesday off and the "owl". The "owl" automatically falls to Tuesday, leaving Run No. 796 as the more preferable of the two remaining runs as to time "off" to be entered in Block No. 91. Runs 794, 795 and 796 are entered on the tally sheet, checked off the Run Cut Sheet, and appropriately entered on the Assignment Sheet as Run Numbers in the Thursday and Friday columns, as well as the full description entered under Tuesday.

Since Run No. 797, "off" at 1:13 A.M., is preferable to the "owl", it is entered in Block No. 92, while Run No. 798 is entered in Block No. 93. Both are checked off the Run Cut Sheet, entered on the tally sheet, and appropriately noted on the Assignment Sheet under "Wednesday", "Thursday" and "Friday".

The schedule maker has now listed all nineteen (19) regular Tuesday - Friday runs on the Assignment Sheet, which checks against the "recapitulation of runs" on the Run Cut Sheet. He is now ready to list the "All American" runs, which, at the request of the trainmen, are dropped a space below the so-called "regular" blocks of work on the Assignment Sheet. To do this, all entries are erased from the blocks tentatively numbered No. 94 and below, a "block space" (formerly No. 94) is left open, and the numbers "94, 95, 96 & Ex." are entered below the "skipped" space.

(NOTE: The term "All American" run is a purely local term used to designate a "block" made up of regular runs not worked by regular men on their days off. These runs appear on the lower portion of the Assignment Sheet under the heading "All American". They represent assembled blocks of 6 day's work, as pieces over and above this are "dropped" to the extra board.)

The initial objective was 22 6-day runs. Since all regular runs have been "used up" in 19 blocks, there must be 22 minus 19, or 3 "All American" blocks to be listed at the bottom of the sheet. To list these runs, the schedule maker refers to his "tally sheet" of runs listed for blocks other than Saturday, Sunday and Monday off.

Since the first "All American" space (Block No. 94 calls for "Tuesday" off, the observer can handle 4 (Tuesday-Friday) minus 1 (Tuesday), or 3 runs in this block. The schedule maker trys to give him three runs of just about the same characteristics, and refers to the tally sheet to find them. The three 30¢ spread runs (Nos. 790, 788, and 787) are somewhat similar as to "off" time and length. The first one, in decreasing order of "time off", is No. 790, which is called to the recorder and crossed off the tally sheet. It is recorded in Block No. 94 - Wednesday. An examination of the Wednesday column shows this run to have been entered in Block No. 85 - Wednesday in a previous step. Since it cannot be operated twice in one day, Run No. 790 is erased from Block No. 85 - Wednesday, the word "OFF" substituted in lieu thereof, and Run No. 790 entered in Block No. 85 - Friday to make the fourth day in that block. The full description of Run No. 790 is also entered in Block No. 85 - Thursday, following Wednesday "off". (See steps marked "A" in lieu of erasures for this transaction).

Similarly, when Run No. 788 is entered in "All American" Block No. 94 - Thursday, the entry in Block No. 83 - Thursday must be shifted to Block No. 83 - Friday. (See steps marked "B").

In the case of Run No. 787 (Block No. 94 - Friday) as entered in Block 94 - Friday, no "swap" was needed, as No. 787 was already the Friday "day off". (See steps marked "C").

There are now a total of 20 blocks listed on the Assignment Sheet.

The next "All American" block (No. 95) can take 4 Tuesday - Friday runs, since Monday is the day off. The schedule maker looks for the four "next best" runs which will go well together, and settles upon Nos. 794 (off 11:05 P.M.), 793 (off 8:52 P.M.), 792 (off 8:39 P.M.) and 791 (off 8:25 P.M.) These are entered in decreasing time order in space 95 - Tuesday, 95 - Wednesday, 95 - Thursday and 95 - Friday, respectively, and checked off the tally sheet. The shifts or entries designated by the letters

"D", "E", "F" and "G" are required in this process.

The schedule maker has one more block and four spaces (No. 96 - Tuesday through Friday) in which to enter the four remaining runs on the tally sheet. Starting with the "owl" ("in" 4:40 A.M.), they are listed in decreasing time order across the sheet. No change is needed for the "owl" (H), which is normally off on Tuesday. This run is checked off the tally sheet. Numbers 797, 796, and 795 are entered and crossed off the tally sheet. The "swaps" or entries indicated by the latters "I", "J" and "K" are required in order to complete these entries.

Having completed the transactions listed above, all Tuesday - Friday runs have been placed on the Assignment Sheet, which may now be double - checked to see that the right number of "days off" of each kind remain on the sheet after all "swaps" have been made.

Monday Schedule

The data for the Monday schedules are obtained from the Monday run sheet, and entered on the Assignment Sheet, following the general procedure described above.

Since regular trainmen like to arise at the same time each morning, an effort is made to match the "starting" times of the morning runs for Monday with those of the Tuesday - Friday schedule. The recorder advises the caller that the first Tuesday - Friday straight day run goes to work at 4:36 A.M. The schedule maker seeks a similar run on the Monday schedule and finds that Run No. 781, Train No. 1, meets this specification. This run is, accordingly, entered in Block No. 75 - Monday.

Similarly, early straight runs 780, 782 and 783 are entered in Block Nos. 76, 77,78 - Monday.

The recorder advises the schedule maker that he is looking for a Monday 50¢ spread run starting about 6:10 A.M. to match with the Block No. 79 Tuesday - Friday schedule. There are no 50¢ spread runs on the Monday run sheet, so the schedule maker selects an early straight run with the same "out" time - Run No. 784, Train No. 12, out at 6:10 A.M. This is entered in Block No. 79 - Monday.

To meet Block No. 80 - Tuesday, a 30¢ spread run on Monday getting off at 6:17 P.M. is available, but the schedule maker chose instead the 15¢ spread run No. 785, starting at the same time in the morning (6:22 A.M.) and getting off at 5:41 P.M. This temporary selection is subject to a possible later shift.

The next requirement is for a 30¢ spread run leaving the station at 6:53 A.M. The nearest available Monday run is No. 788, a 15¢ spread run leaving the garage at 6:53 A.M., the same starting time. Following this, a 30¢ spread run starting at 6:37 A.M. would be required to match with Block No. 82 - Tuesday. An examination shows no exact matching time available, but there is a 30¢ spread Monday run leaving the garage at 6:32 A.M., just 5 minutes earlier than the Tuesday - Friday schedule.

To give the schedule maker an indication of what is "coming up" on the Assignment Sheet, the recorder calls for two runs -- one a 30¢ spread "out" at 6:59 A.M.; the other a 30¢ spread "out" at 6:46 A.M. The schedule maker can match the 6:59 time with a 30¢ spread run, which is entered in Block No. 83 - Monday. He can also match the 6:46 time, but with a 15¢ spread run instead of a 30¢ spread. This run is entered in Block No. 84 - Monday.

The next matching requirement is for a 30¢ spread run leaving the garage at 7:13 A.M. There is a 15¢ spread run on the Monday run cut sheet -- Run No. 789, Trains Nos. 6 & 7, "out" at 7:18 A.M., just 5 minutes off the Tuesday - Friday starting time. Before deciding to enter this run in Block No. 85 - Monday, however, the schedule maker decides to stop, and "take stock" of what is required on the Assignment Sheet and what he has available on the Monday run sheet. He finds on the "early" side of the run sheet three (3) remaining runs - No. 791, 2-piece, in station at 7:13 P.M.; No. 792, 2-piece, in station at 8:41 P.M.; and No. 793, a straight run, in station at 8:45 P.M.

The schedule maker wants to give Block No. 85 the same type of run on Monday as on Tuesday - Friday, but he must also look after Blocks Nos. 86, 87, and 88 and "All American" Block No. 94 to see what they need. "All American" Block No. 94 - Wednesday shows a 30¢ spread run "off" at 7:06 P.M. This is a better run, from the standpoint of "off" time, than those listed for Tuesday - Friday schedule in Blocks Nos. 86, 87 and 88. The 2-piece run No. 791, "in" at 7:13 P.M., is a possibility for filling out the All American run in Block No. 94. It does, however, have a 30¢ spread, and in accordance with the verbal agreement an effort should be made to match it with some 30¢ spread run further up the sheet, all other conditions being equal. It was decided, therefore, to put Run No. 789 on the All American, and to put Run No. 791 in Block No. 85. This puts the "money" to the top of the sheet. The resulting "in" and "out" times are not too badly off, as an examination of the Assignment Sheet will show.

Since the two remaining All American runs are "off" on Mondays, the lower portion of the Monday column has been completed. Attention is next directed to Block No. 86, and to the remaining runs on the early side of the Monday run cut sheet, namely, Nos 792 and 793. No. 792 (Monday) is a 2-piece run "off" at 8:41 P.M. and No. 793 (Monday) is a straight run "off" at 8:45 P.M. It was decided to put No. 792 in Block No. 88 to match the 2-piece Tuesday - Friday run "off" at 8:39 P.M., and to put No. 793 in Block

No. 86 to fill out the straight run in that block. Block No. 87 at this point is still open.

It becomes necessary to move to the "late" side of the run cut sheet for a run to fill out Block No. 87 - Monday. There is available a straight run "off" at 9:08 P.M., which matches fairly well with the 8:52 P.M. "off" time of Block No. 87 - Tuesday. This run is entered in Block No. 87 - Monday.

The schedule maker now drops down to the "owl", Block No. 93, and begins to build the remaining blocks up in "reverse" order -- that is, Nos. 93, 92, 91, 90 and 89 in that order. A check shows that there are five remaining runs for these five openings.

The "owl" is entered in Block No. 93 ("off" time identical). Run No. 798 is entered in Block No. 92 ("off" time identical). Run No. 797 is entered in Block No. 91 ("off" time identical). Run No. 796 is entered in Block No. 90 ("off" time within two (2) minutes of "off" time for Tuesday - Friday schedule). Run No. 795 is entered in Block No. 89 ("off" time within 40 minutes of Tuesday - Friday schedule) All the Monday runs in these blocks, like the Tuesday - Friday runs, are "straight" runs, so that no straight run blocks have been broken up in the process.

Saturday Schedule

Having completed the placing of the Monday runs on the Assignment Sheet as described above, the process is repeated with the Saturday runs, using the Tuesday - Friday entries as a guide.

Straight runs with matching, or nearly matching, starting times are entered in Saturday Blocks Nos. 75-79. Since there are no 50¢ spread runs available, the shortest and earliest "off" remaining straight run is entered in Block No. 80. The last early straight run is placed in Block No. 81 Block No. 82 has Saturday "off".

The first Tuesday - Friday 2-piece run occurs in Block No. 83. The schedule maker studies the runs in Block No. 83 and following blocks, comparing them with All American blocks Nos. 94, 95 and 96. Blocks Nos. 83, 84 and 85 are better runs than the All American runs from the standpoint of "getting off" time, so that a mark is placed across the column line between Saturday and Sunday and between Blocks Nos. 85 and 86 on Figure 57. This is the place where the schedule maker will "jump" to the All American in making his entires (see step "L", Figure 57). The next three 2-piece runs, in order of "earliest time off", are entered in Blocks Nos. 83, 84 and 85.

Having reached the "jump" mark ("L"), attention is directed to the

first All American block. The Tuesday - Friday schedule calls for a 2-piece run "off" at 6:36 P.M. (Block No. 94 - Friday). With this is matched Run No. 790, a 2-piece run "off" at 7:10 P.M.

The next All American block (No. 95) is checked against Blocks 86, 87, and 88, and it was decided that, in general, these blocks were better than the second "All American" from the standpoint of "getting off" time. A second "jump" mark was placed at the point marked "M" on the Assignment Sheet, Figure 57. These three upper spaces should be filled with more preferable "time off" runs than the next All American.

In order to preserve as many straight blocks as possible, Runs Nos. 791 and 792 were entered in Blocks Nos. 86 and 87. A straight run with a roughly equivalent "time off" was entered in Block No. 88. The schedule maker then "jumped" down to the second All-American block (No. 95) and entered Run No. 794, Train No. 2, "off" at 9:02 P.M.

A check of the Assignment Sheet and the Saturday run sheet at this point revealed 6 open blocks on the one, and 6 available runs on the other. The open blocks call for 6 straight runs on the Assignment Sheet, while there are only 5 straight runs with one 2-piece run on the run sheet. The question is, "Which straight block can best be broken?" Perhaps the one to be operated by the last All-American man since he is at the tail-end of the seniority list and has least right to exercise a preference. Therefore, Run No. 797, a 2-piece run off at 12:35 A.M., is entered in Block No. 96 - Saturday. This completes the entering of All American runs for Saturdays.

Blocks Nos. 93, 92, 91, 90 and 89 are then filled from the bottom up, listing the 5 straight runs left on the run sheet in reverse order of "time off". A study of the sheet shows that most of these entries register with the Tuesday - Friday runs fairly well.

This completes the Saturday schedule.

Sunday Schedule

The first seven blocks (Nos. 75-81) are "skipped" on Sunday, as these represent days off.

Since the objective on Sunday is to let the men off as early as possible, and since the first seven blocks are "OFF", it is useless to try to match starting times on this day. The early straight runs are simply listed in increasing order of "time off", beginning with Block No. 82, and running through Block No. 85, the "jumping off" place ("L" of Figure 57).

There is only one 2-piece run on the Sunday run sheet. This run is dropped, to the "Extra" (Ex.) space under "Sunday" to take care of the extra left-over piece resulting from the division of the total pieces of work for the week by 6 working days (22 "blocks" and 1 piece left over). This is Run No. 791. This removes this run from circulation.

On reaching the column mark "L", the schedule maker seeks to place the next preferable run on the first All American (Block No. 94), since this is a more preferable block than Nos. 86 and following blocks on Tuesday-Friday and Saturday. This is Run No. 784.

The schedule maker returns to the top of the sheet and fills three more straight runs, in increasing order of "time off", in Blocks Nos. 86, 87 and 88. These are Run Nos. 785, 786 and 787, respectively. Having reached "jump" mark "M" of Figure 57, he drops to the second All American block (No. 95) and lists Run No. 788 under "Sunday".

There remain to be filled one remaining All American block (No. 96) and five regular blocks (Nos. 93, 92, 91, 90 and 89 in reverse order). The "owl" (Run No. 795) automatically falls to Block No. 93. The run which finishes at 1:13 A.M. (No. 794) is matched with the similar run on Monday and Tuesday - Friday, and entered in Block No. 92.

This leaves four Sunday runs -- No. 789, "off" 9:55 P.M.; No. 790, "off" 10:56 P.M.; No. 792, "off" 12:09 A.M.; and No. 793, "off" 12:25 A.M.

The 12:25 A.M. "off" run (No. 793) is entered in Block No. 91, as it matches these "off" times best. The 12:09 A.M. "off" run (No. 792) is entered in Block No. 96, the last All American, along with the miscellaneous group of runs falling to the "last man". This completes the All American blocks for Sunday.

The last remaining runs are entered in Blocks Nos. 90 and 89 in reverse order of "time off" to complete the Assignment Sheet.

Checking the Assignment Sheet

Since the Assignment Sheet can be a source of disturbance in employee relations as well as an instrument of good, considerable care is taken after its preparation to "check and double-check" it.

The first check consists in comparing the Assignment sheet back against the run sheets for the four periods of the week. The second check is a thorough review to see that the blocks line up in accordance with policy

ASSIGNMENT SHEET

SCHEDULE Nos 7752-7782-7781-7782

DATE EFFECTIVE May 20th, 1946

SUPERSEDING SCHEDULE NO 6982-7649-8005-8084

STATION CANAL BUS — CITY PARK BUS — LINE — SCHEDULE

SCHEDULE DIVISION: MONDAY ONLY, TUESDAY TO FRIDAY, SATURDAY & SUNDAY

APPROVED _____ MANAGER SCHEDULE DIVISION

RELIEF POINT: IN ORLEANS & BROAD; OUT DAUPHIN & BROAD

BLOCK No.	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	ASSIGNMENT
75	Run 781 SP PAT On 1 456a OFF 1252p On OFF ACTUAL 796 PAY 800°	Run 781 SP PAT On 1 456a OFF 1246p On OFF ACTUAL 808 PAY 808°	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 780 SP PAT On 1 456a OFF 1229p On OFF ACTUAL 765 PAY 800°	Run OFF SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
76	Run 780 SP PAT On 15 456a OFF 1221p On OFF ACTUAL 726 PAY 800°	Run 780 SP PAT On 15 456a OFF 1256p On OFF ACTUAL 742 PAY 800°	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 781 SP PAT On 11 456a OFF 1259p On OFF ACTUAL 805 PAY 805°	Run OFF SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
77	Run 782 SP PAT On 7 526a OFF 104p On OFF ACTUAL 758 PAY 800°	Run 782 SP PAT On 8 526a OFF 118p On OFF ACTUAL 747 PAY 800°	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 782 SP PAT On 7 526a OFF 106p On OFF ACTUAL 740 PAY 800°	Run OFF SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
78	Run 783 SP PAT On 5 556a OFF 116p On OFA ACTUAL 720 PAY 800°	Run 785 SP PAT On 5 556a OFF 204p On OFF ACTUAL 808 PAY 808°	Run SAME SP PAT On OFA On OFF ACTUAL PAY	Run SAME SP PAT On OFA On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 785 SP PAT On 6 556a OFF 141p On OFF ACTUAL 745 PAY 800°	Run OFF SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
79	Run 784 SP PAT On 12 610a OFF 231p On OFA ACTUAL 821 PAY 821°	Run 785 SP PAT .50 On 15 610a OFF 1117a On 12 535p OFF 628p ACTUAL 755 PAY 800	Run SAME SP PAT On OFF On OFA ACTUAL PAY	Run SAME SP PAT On OFF On OFA ACTUAL PAY	Run SAME SP PAT On OFF On OFA ACTUAL PAY	Run 784 SP PAT On 9 612a OFA 231p On OFF ACTUAL 819 PAY 819°	Run OFF SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
80	Run 785 SP PAT .15 On 17 622a OFF 1148a On 21 252p OFA 641p ACTUAL 816 PAY 816	Run 789 SP PAT .50 On 20 622a OFA 947a On 5 206p OFF 646p ACTUAL 807 PAY 807	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFA On OFF ACTUAL PAY	Run 785 SP PAT On 10 655a OFF 255p On OFF ACTUAL 740 PAY 800°	Run OFF SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
81	Run 786 SP PAT .15 On 15 653a OFF 832a On 1 1232p OFA 622p ACTUAL 820 PAY 820	Run 784 SP PAT .50 On 16 653a OFF 1019a On 10 217p OFF 625p ACTUAL 752 PAY 800	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 786 SP PAT On 8 646a OFF 307p On OFF ACTUAL 821 PAY 821°	Run OFF SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
82	Run 787 SP PAT .50 On 5 632a OFA 1021a On 19 210p OFA 617p ACTUAL 756 PAY 800	Run 786 SP PAT .50 On 5 657a OFF 1001a On 15 202p OFF 631p ACTUAL 755 PAY 800	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFA ACTUAL PAY	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 780 SP PAT On 1 458a OFF 1259p On OFF ACTUAL 801 PAY 801°	CONDUCTOR MOTORMAN
83	Run 780 SP PAT .50 On 18 559a OFF 1008a On 17 142p OFA 650p ACTUAL 816 PAY 816	Run 789 SP PAT .50 On 18 558a OFA 907a On 1 1244p OFF 641p ACTUAL 806 PAY 806	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 788 SP PAT .50 On 19 659a OFF 907a On 1 1244p OFF 641p ACTUAL 806 PAY 806	Run 787 SP PAT .15 On 4 651a OFF 1116a On 10 235p OFA 550p ACTUAL 800 PAY 800°	Run 781 SP PAT On 4 524a OFF 115p On OFA ACTUAL 748 PAY 800°	CONDUCTOR MOTORMAN
84	Run 786 SP PAT .15 On 10 646a OFF 1155a On 12 251p OFA 601p ACTUAL 857 PAY 857	Run 787 SP PAT .50 On 15 646a OFF 1242p On 19 551p OFA 656p ACTUAL 841 PAY 841	Run SAME SP PAT On OFF On OFA ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 788 SP PAT On 5 707a OFF 1017a On 7 106p OFF 558p ACTUAL 800 PAY 800	Run 782 SP PAT On 7 458a OFF 126p On OFF ACTUAL 828 PAY 828°	CONDUCTOR MOTORMAN
85	Run 791 SP PAT .50 On 9 722a OFA 858a On 10 1153a OFA 715p ACTUAL 853 PAY 853	Run 790 SP PAT .50 On 5 713a OFF 921a On 15 1242p OFF 706p ACTUAL 802 PAY 802	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 790 SP PAT .50 On 5 718a OFF 921a On 15 1242p OFF 706p ACTUAL 802 PAY 802	Run SAME SP PAT On OFA On OFF ACTUAL PAY	Run 789 SP PAT On 6 718a OFF 846a On 1 1228p OFA 615p ACTUAL 814 PAY 814	Run 785 SP PAT On 2 757a OFF 554p On OFF ACTUAL 817 PAY 817°	CONDUCTOR MOTORMAN
86	Run 795 SP PAT On 16 1221p OFA 845p On OFA ACTUAL 824 PAY 824	Run 791 SP PAT On 18 1256p OFF 626p On OFA ACTUAL 747 PAY 800	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run OFF SP PAT On OFA On OFF ACTUAL PAY	Run 791 SP PAT On 12 1151a OFF 757p On OFF ACTUAL 806 PAY 806°	Run 785 SP PAT On 8 1142a OFF 807p On OFF ACTUAL 825 PAY 825°	CONDUCTOR MOTORMAN
87	Run 794 SP PAT On 5 115p OFF 802p On OFF ACTUAL 752 PAY 800	Run 793 SP PAT On 6 115p OFA 852p On OFF ACTUAL 789 PAY 800	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 796 SP PAT On 8 115p OFF 852p On OFF ACTUAL 759 PAY 800	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 792 SP PAT On 4 1118a OFF 747p On OFF ACTUAL 851 PAY 851	Run 796 SP PAT On 5 1241p OFF 852p On OFF ACTUAL 751 PAY 800°	CONDUCTOR MOTORMAN
88	Run 792 SP PAT On 17 1148a OFF 145p On 11 252p OFA 841p ACTUAL 805 PAY 805°	Run 792 SP PAT On 15 1117a OFF 202p On 2 519p OFA 859p ACTUAL 806 PAY 806°	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 792 SP PAT On 15 1117a OFF 202p On 2 519p OFA 859p ACTUAL 806 PAY 806°	Run OFF SP PAT On OFA On OFF ACTUAL PAY	Run 795 SP PAT On 5 1254p OFF 902p On OFF ACTUAL 808 PAY 808	Run 787 SP PAT On 4 115p OFF 905p On OFF ACTUAL 750 PAY 800	CONDUCTOR MOTORMAN
89	Run 796 SP PAT On 15 517p OFF 1145p On OFA ACTUAL 828 PAY 828	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 794 SP PAT On 5 248p OFF 1105p On OFF ACTUAL 817 PAY 817	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFA ACTUAL PAY	Run 795 SP PAT On 11 1259p OFF 924p On OFF ACTUAL 825 PAY 825	Run 789 SP PAT On 7 126p OFF 955p On OFF ACTUAL 829 PAY 829	CONDUCTOR MOTORMAN
90	Run 796 SP PAT On 20 529p OFA 1159p On OFA ACTUAL 850 PAY 850	Run 795 SP PAT On 9 535p OFF 1157p On OFF ACTUAL 824 PAY 824	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 796 SP PAT On 8 507p OFF 1144p On OFF ACTUAL 857 PAY 857	Run 790 SP PAT On 5 242p OFF 1056p On OFF ACTUAL 814 PAY 814	CONDUCTOR MOTORMAN
91	Run 797 SP PAT On 19 454p OFF 1226a On OFF ACTUAL 750 PAY 800	Run 796 SP PAT On 8 403p OFF 1224a On OFF ACTUAL 818 PAY 818	Run SAME SP PAT On OFF On OFA ACTUAL PAY	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 796 SP PAT On 6 406p OFF 1224a On OFF ACTUAL 818 PAY 818	Run 796 SP PAT On 6 502p OFF 1255a On OFF ACTUAL 755 PAY 800	Run 795 SP PAT On 8 452p OFF 1225a On OFF ACTUAL 755 PAY 800	CONDUCTOR MOTORMAN
92	Run 793 SP PAT On 4 429p OFF 1152a On OFA ACTUAL 847 PAY 848	Run 797 SP PAT On 20 451p OFF 1152a On OFA ACTUAL 842 PAY 842	Run OFF SP PAT On OFA On OFA ACTUAL PAY	Run 797 SP PAT On 20 481p OFF 1152a On OFA ACTUAL 842 PAY 842	Run SAME SP PAT On OFF On OFF ACTUAL PAY	Run 799 SP PAT On 10 530p OFF 223a On OFF ACTUAL 855 PAY 855	Run 794 SP PAT On 1 506p OFF 1152a On OFF ACTUAL 807 PAY 807	CONDUCTOR MOTORMAN
93	Run 799 SP PAT On 11 841p OFF 1440a On OFA ACTUAL 759 PAY 800	Run OFF SP PAT On OFA On OFA ACTUAL PAY	Run 798 SP PAT On 2 859p OFA 1440a On OFA ACTUAL 801 PAY 801	Run SAME SP PAT On OFA On OFA ACTUAL PAY	Run SAME SP PAT On OFA On OFA ACTUAL PAY	Run 800 SP PAT On 2 902p OFF 1440a On OFF ACTUAL 758 PAY 800	Run 796 SP PAT On 5 852p OFA 1440a On OFF ACTUAL 808 PAY 808	CONDUCTOR MOTORMAN
	Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFF On OFF ACTUAL PAY	"ALL-AMERICAN ROAD" Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFF On OFF ACTUAL PAY	CONDUCTOR MOTORMAN
94	Run 799 SP PAT .15 On 6 718a OFF 948a On 7 104p OFA 852p ACTUAL 759 PAY 800	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 790 SP PAT .50 On 5 713a OFF 921a On 15 1242p OFF 706p ACTUAL 802 PAY 802	Run 788 SP PAT .50 On 19 659a OFF 907a On 1 1244p OFF 641p ACTUAL 806 PAY 806	Run 787 SP PAT .50 On 15 646a OFF 1242p On 19 551p OFF 656p ACTUAL 841 PAY 841	Run 790 SP PAT On 6 1017a OFF 1244p On 6 141p OFF 710p ACTUAL 806 PAY 806	Run 786 SP PAT On 6 906a OFF 452p On OFF ACTUAL 728 PAY 800°	CONDUCTOR MOTORMAN
95	Run OFF SP PAT On OFF On OFA ACTUAL PAY	Run 794 SP PAT On 6 248p OFA 1108p On OFF ACTUAL 817 PAY 817	Run 796 SP PAT On 9 115p OFF 852p On OFF ACTUAL 759 PAY 800	Run 792 SP PAT On 15 1117a OFA 202p On 2 519p OFF 859p ACTUAL 805 PAY 805°	Run 791 SP PAT On 19 1238p OFF 825p On OFF ACTUAL 747 PAY 800	Run 794 SP PAT On 2 1255p OFF 902p On OFF ACTUAL 807 PAY 807°	Run 789 SP PAT On 9 1248p OFF 925p On OFF ACTUAL 827 PAY 827	CONDUCTOR MOTORMAN
96	Run OFF SP PAT On OFF On OFF ACTUAL PAY	Run 795 SP PAT On 2 859p OFF 1440a On OFF ACTUAL 801 PAY 801	Run 797 SP PAT On 20 451p OFF 1152a On OFF ACTUAL 842 PAY 842	Run 796 SP PAT On 6 406p OFF 1224a On OFF ACTUAL 818 PAY 818	Run 795 SP PAT On 9 585p OFF 1157p On OFF ACTUAL 824 PAY 824	Run 797 SP PAT On 9 231p OFF 902p On 12 757p OFF 1234a ACTUAL 859 PAY 859	Run 782 SP PAT On 2 584p OFF 1208a On OFA ACTUAL 818 PAY 818	CONDUCTOR MOTORMAN
	Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFF On OFF ACTUAL PAY	Run SP PAT On OFF On OFF ACTUAL PAY	Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFA On OFF ACTUAL PAY	Run SP PAT On OFF On OFF ACTUAL PAY	Run 791 SP PAT .15 On 1 1238p OFF 850p On 9 907p OFF 1154p ACTUAL 814 PAY 814	CONDUCTOR MOTORMAN

EXTRA

FIGURE 58.

TYPED ASSIGNMENT SHEET—
SAMPLE COMPANY UNDER STUDY.

and the verbal agreement. Following these checks, the sheet is sent to the typist for preparation of copies.

In the first check, each Run Number on the Assignment sheet is checked back against the typed run sheet. Care is taken to see that no "matching" pull-out times nor similar spread pieces have been overlooked in completing the blocks. For the later runs, from Block No. 86 down, the "off" times are checked for the best matches.

In the second check the Assignment Sheet is "scanned" across each block to see that the same type of run has been included all the way through. If so, the block is checked off with a red pencil. A re-check is made to see that proper "preference" has been given the Saturday and Sunday runs as between the "regular" blocks and the "All American" blocks. It is then checked again to see that each man has a day off in each block, and that the number of "off" days of each name check the originally calculated pattern.

A final re-check is made against the run sheets for the week through the use of an auxiliary "tally sheet". On this tally sheet the run numbers for each schedule are shown, putting the greatest number of numbers from the longest schedule down the left-hand side. A column is ruled for each day of the week beside the list of numbers, and the spaces in those days on which certain run numbers do not apply are "blocked out" on the tally sheet. This leaves an open space for each applicable number.

The recorder next calls each entry on the Assignment Sheet back against the respective run sheets in full detail. The schedule maker crosses out each space on the tally sheet as it is checked, thereby making certain that every run number is used, and that no run number is used more than once in any day. This completes the checking process. The Assignment Sheet is then typed (Figure 58).

Copies of Assignment Sheet

Sixteen (16) copies of the Assignment Sheet, or enough for two "picks", are prepared in "ditto".

The initial distribution for each pick consists of six copies:

One retained in schedule office for record.

Three issued to the car station or bus garage. One of these is "posted" for the "pick". The other two are for division office information and record.

Two copies are sent to the payroll department. These

COPY

RUN GUIDE

SCHEDULE No. 7730
DATE EFFECTIVE MAY 28th, 194 6
SUPERSEDING SCHEDULE No. 7649
STATION CANAL BUS — CITY PARK BUS — LINE — SCHEDULE

SCHEDULE DIVISION

APPROVED A. C. Kern, Manager Suburban Division

RELIEF POINT
IN ORLEANS & BROAD
OUT DAUPHINE & BROAD

JOURNEY TIME 107 MIN.

Bus No.	Train No	Time Out Station	TERMINALS	TERMINAL LEAVING TIME																		Hours Actual	Hours Pay	Bonus Pay
			EARLY RUNS																					
780	18	456	DUMAINE & ALEX. DAUPH.& CANAL.	504 520	546 602	624 642	704 722	744 802	822 840	902 919½	943 1000	1020 1037	1057 1114	1134 1151	1211 1228	(1238)							742	800	
781	1	436	DUMAINE & ALEX. DAUPH.& CANAL.	444 500	519 535	556 612	635 653	713 731	752 810	831½ 849½	910½ 927½	949 1006	1026 1043	1103 1120	1140 1157	1217 1234	(1744)						808	808	
782	8	526	DUMAINE & ALEX. DAUPH.& CANAL.	534 550	611 629	649½ 707½	729 747	808 826	846 904	924 941	1001 1018	1038 1055	1115 1132	1152 1209	1229 1246	106	(113)						747	800	
783	3	556	DUMAINE & ALEX. DAUPH.& CANAL.	604 621	640 658	719 737	757 815	835 853	915 932	955 1012	1032 1049	1109 1126	1146 1203	1223 1240	100 117	137 154	(204)						808	808	
			TR NO. 3 LEAVING DUMAINE & ALEXANDER AT 6:04 A.M. USE "A" RUNNING TIME TO ORLEANS & CLAIBORNE & "B" RUNNING TIME TO DAUPHINE & CANAL.																					
784	16	653	DUMAINE & ALEX. DAUPH.& CANAL.	701 719	739 757	819 837	858 916	938 955	1011	IN	1019													
	10		DUMAINE & ALEX. DAUPH.& CANAL								OUT	217	225 242	306 323	344 401	423 440	501 518	540½ 557½	615	IN	623	732	800	.30
785	15	610	DUMAINE & ALEX. DAUPH.& CANAL	618 636	658 716	736½ 754½	816 834	854 912	933 950	1013½ 1030½	1050½ 1107½	(1117½)												
	12		DUMAINE & ALEX. DAUPH.& CANAL								OUT		339	347 404	426 443	505 522	543 600	617	IN	625		753	800	.50
786	6	637	DUMAINE & ALEX. DAUPH.& CANAL	645 703	724 742	802½ 820½	842 900	919½ 936½	953	IN	1001													
	15		DUMAINE & ALEX. DAUPH.& CANAL								(202½)	212½	236 253	315 332	353 410	433 450	511 528	549 606	623	IN	631	753	800	.30
787	13	646	DUMAINE & ALEX. DAUPH.& CANAL	654 712	731½ 749½	810½ 828½	850 908	928½ 945½	1007 1024	1044 1101	1121 1138	1158 1215	1235	(1242)										
	19		DUMAINE & ALEX. DAUPH.& CANAL								OUT	351	359 416	437½ 454½	515½ 532½	553½ 610½	628	IN	636	841	841	.30
788	19	659	DUMAINE & ALEX. DAUPH.& CANAL	707 725	746½ 804½	825 843	859	IN	907															
	1		DUMAINE & ALEX. DAUPH.& CANAL							(1244)	1254 111	131 148	208 225	246 303	323 340	402 419	442 459	520 537	558½ 615½	633	IN	641	805	805	.30
789	20	622	DUMAINE & ALEX. DAUPH.& CANAL	630 648	710 728	749 807	828 846	906 923	939	IN	947													
	3		DUMAINE & ALEX. DAUPH.& CANAL.								(204)	214 231	251 308	330½ 347½	408 425	446½ 503½	524½ 541½	604 621	638	IN	646	807	807	.50
790	5	713	DUMAINE & ALEX. DAUPH.& CANAL	721½ 739½	800 818	838½ 856½	913	IN	921															
	13		DUMAINE & ALEX. DAUPH.& CANAL					(1242)	1252	112 129	149 206	230½ 247½	310½ 327½	350 407	428½ 445½	507 524	545 602	625 642	658	IN	706	832	832	.30
791	18		DUMAINE & ALEX. DAUPH.& CANAL	(1238)	1248 105	125 142	202 219	241 258	319 336	356 413	435 452	513 530	551 608	630 647	707 724	744 801	817	IN	825			747	800	
792	15		DUMAINE & ALEX. DAUPH.& CANAL	(1117½)	1127½ 1144½	1204½ 1221½	1241½ 1258½	118½ 135½	155½	(202½)														
	2		DUMAINE & ALEX. DAUPH.& CANAL								DUT	319	327 344	405 422	444 501	522 539	601 618	640 657	717 734	754½ 811½	833	(839)	805	805	
793	8		DUMAINE & ALEX. DAUPH.& CANAL	(113)	123	143 200	219½ 236½	301 318	337½ 354½	417 434	457 514	535½ 552½	615 632	656 713	733 750	811 828	844	IN	852				739	800	
			LATE RUNS																					
794	5		DUMAINE & ALEX. DAUPH.& CANAL	DUT	248	256 313	334 351	411 428	451 508	529 546	607½ 624½	645½ 702½	722½ 739½	800 817	840 855	915 930	950 1005	1026 1041	1057	IN	1105	817	817	
795	9		DUMAINE & ALEX. DAUPH.& CANAL	DUT	333	341 358	420 437	459 516	538 555	620 637	701½ 718½	738½ 755½	818 834	854 909	929 944	1004 1019	1042½ 1057½	1117½ 1132½	1149	IN	1157	824	824	
			TR.NO. 9 LEAVING DUMAINE & ALEXANDER AT 8:18 P.M. USE "C" RUNNING TIME TO ORLEANS & CLAIBORNE & "E" RUNNING TIME TO DAUPHINE & CANAL.																					
796	6		DUMAINE & ALEX. DAUPH.& CANAL	DUT	406	414 431	453 510	531 548	611 628	651 708	728 745	805½ 822½	847 902	922 937	957 1012	1034 1049	1109 1124	1145 1200	1216	IN	1224	818	818	
797	20		DUMAINE & ALEX. DAUPH. & CANAL	OUT	431	439½ 456½	517½ 534½	556 613	635 652	712 729	749 806	826 841	901 916	936 951	1011 1026	1051 1106	1126 1141	1201 1215	1237 1250	105	IN	113	842	842	
798	2		DUMAINE & ALEX. DAUPH.& CANAL.	(839)	848	908 923	943 958	1018½ 1033½	1100 1115	1135 1150	1217 1230	101 117	201 217	301 317	401 417	432	IN	440				801	801	
			A.M. TRIPPERS																					
799	17	733	DUMAINE & ALEX. DAUPH.& CANAL.	741½ 759½	816	IN	824															51	130	
800	2	708	DUMAINE & ALEX. DAUPH.& CANAL.	716 734	754½ 812½	829	IN	837														129	213	
801	7	718	DUMAINE & ALEX. DAUPH.& CANAL	726½ 744½	805 823	839	IN	847														129	213	
802	14	726	DUMAINE & ALEX. DAUPH.& CANAL	734 752	813 831	847	IN	855														129	213	
			P.M. TRIPPERS																					
803	11		DUMAINE & ALEX. DAUPH.& CANAL	OUT	455	503 520	537	IN	545													50	130	
804	4		DUMAINE & ALEX. DAUPH.& CANAL	DUT	440	448½ 505½	526½ 543½	601	IN	609												129	213	
805	7		DUMAINE & ALEX. DAUPH.& CANAL	OUT	447	455 512	533½ 550½	608	IN	616												129	213	
806	14		DUMAINE & ALEX. DAUPH.& CANAL	DUT	422	430½ 447½	509 526	547 604	621	IN	629											207	310	

TIME POINTS AND RUNNING TIME

		A.		B.		C.		D.		E.		F.	
		444 AM to 556 AM		604 AM to 658 AM		902 AM TO 841 PM		344 PM to 611 PM		818 PM to 1145 PM		1201 AM to 401 AM	
TO	DUMAINE & ALEXANDER	4		4		615 PM TO 811 PM		4		4		3	
TO	ORLEANS & MOSS	-		3		4	3		3		2	-	
TO	ORLEANS & BROAD (REL).	6		4		6	3	6	3	5	3	5	
TO	ORLEANS & CLAIBORNE	6		4		7		7		6		5	
TO	DAUPHINE & CANAL	16		18		17		17		15		13	

		A.		B.		C.		D.		E.		F.	
		500 AM to 629 AM		630 AM to 859 AM		900 AM TO 859 PM		400 PM to 629 PM		830 PM to 1230 AM		1230 AM to 417 AM	
TO	DAUPHINE & CANAL	6		6		630 PM TO 829 PM		7		6		5	
TO	DUMAINE & CLAIBORNE	3		4		6		4		4		4	
TO	DUMAINE & BROAD (REL).					4							

FIGURE 59.
RUN GUIDE SHEET –
SAMPLE COMPANY UNDER STUDY.

are used to figure the wages associated with the week's work for each man, including all allowances, journey time, and etcetera.

C. The Terminal Sheet

The terminal sheet has been discussed in detail in Chapter V, and a copy of the form used by the company shown in Figure 29. The sources of information from which this sheet is prepared are the Headway Order and the Running Time Sheet.

The original typed copy of the Terminal Sheet is filed in the office Schedule Book for ready reference, and for use in the preparation of new schedules or schedule changes.

About twenty-five (25) "ditto" copies of each Terminal Sheet are made when the new schedule is issued. Ten (10) of these are sent to the station for the use of the street supervisors, who usually copy the terminal times from these copies into their pocket note books.

One copy goes to the Equipment Division of the station, where it serves to advise mechanical department employees as to the numbers of vehicles needed and the times at which they will be needed. It also shows, by difference, how many vehicles will be available to the mechanical department for inspection, cleaning, etc. at different times of the day.

One copy goes to the Railway Earnings Department, where it serves as the basis on which mileage statistics are set up for the individual vehicles, lines, and the system as a whole.

A copy of each Terminal Sheet goes to the Division Superintendent as a matter of record. In the case of two lines having "salient" terminals in the business district, two copies of each terminal sheet are given to the starters in these locations.

D. The Run Guide

The typed Run Guide Sheet is shown in Figure 59. This sheet is based upon information obtained from:

1. The Running Time Sheet.
2. The Terminal Sheet.
3. The Run Cut Sheet

The purpose of the Run Guide is to fully inform the trainmen concerning their runs, so that the operation of each individual unit in the public streets may be conducted in accordance with the official schedule.

The original Run Guide and one copy are prepared. The original is posted conspicuously in the station lobby for the convenience of the trainmen. The copy is sent to the Inspection Department.

This form contains full information on regular and tripper runs for the platform employee, such as:

Effective date of schedule

Relief points

Run numbers

Train Numbers

Names of terminals

Terminal leaving times

Time points and running time

Time out of station

Time in station

Actual hours

Pay hours

Bonus (spread) pay

On the sample property trainmen are required to copy the data pertaining to their individual runs from the posted copy of the Run Guide. They must pick their terminal times and running times, and calculate for themselves the times at which they are due at time their points.

This practice has been adopted because of the frequency and regularity with which new schedules and schedule changes are made by the sample company. It would take a battery of typists, clerks or draftsmen, as the case may be, to keep the men in typed, handwritten or blueprinted copies of their individual schedule data, a cost which the Schedule Department does not feel is justified when weighed against the little time required by one man in copying his own schedule from the Run Guide.

Opinions and practices in this regard vary widely from property

SCH. No. 7730
EFFECTIVE 5-18-46
SUP. SCHED. No. 7649
STATION Canoe Bay

COMPARATIVE STATEMENT

SCHEDULE DIVISION

O Denotes decrease.

City Park Bus LINE — Tuesday to Friday SCHEDULE

MILEAGE: Old 1561.9 — New 1613.9

		Old Sch. No. 7649					New Sch. No. 7730					Increase or Decrease				
		A. M.	Basic	P. M.	Night	Owl	A. M.	Basic	P. M.	Night	Owl	A. M.	Basic	P. M.	Night	Owl
GENERAL	Cars	14	6	17	5	1	15	6	18	5	1	1		1		
	Headway	2½-3	6-6½	2-2½	7-7½	60	2½-3	6-6½	2-2½	7-7½	60					
	Actual Running Time	34	34	35	32	28	34	33	34	31	28		(1)	(1)	(1)	
	Headway Adjustment	4	4	4	4	32	4	4	4	4	32					
	Total Trip Time	38	38	39	36	60	38	37	38	35	60		(1)	(1)	(1)	
	Actual Running Speed	10.8	10.8	10.5	11.5	13.1	10.8	11.1	10.8	11.8	13.1		.3	.3	.3	
	Over-All Trip Speed	9.7	9.7	9.4	10.2	6.1	9.7	9.9	9.7	10.5	6.1		.2	.3	.3	
REGULAR RUNS	Early Straight			5					6					1		
	Late Straight			6					5					(1)		
	Two-Piece			8					8					-		
	Three-Piece			-					-					-		
	Total Regular Runs			19 (Assignment) 22					19 (Assignment) 22					- (Assignment) -		
TRIPPER RUNS	Early Tripper			3					4					1		
	Late Tripper			3					4					1		
	Total Tripper			6 (Open) 1					8 (Open) 1					2 (Open) -		
HOURS	Regular Run			152:12					153:41					1:29		
	Tripper			10:50					11:13					:23		
	Total Schedule			163:02					164:54					1:52		
ALLOWED	To 8:00			2:41					1:47					(:54)		
	Time and One-Half			5:24					6:02					:38		
	Journey (Equivalent Two-Man)			:35					:35					-		
	Total			8:40					8:24					(:16)		
	Total Schedule and Allowed			171:42					173:18					1:36		
COST	Total Schedule and Allowed Hours			$185.44					$187.17					$1.73		
	Bonus Two-Piece Runs			2.65					2.50					(.15)		
	Bonus Three-Piece Runs			-					-					-		
	Total			$188.09					$189.67					$1.58		

FIGURE 60.
COMPARATIVE SCHEDULE STATEMENT — SAMPLE COMPANY UNDER STUDY.

MILEAGE RECORD

SCHEDULE No. 7730 LINE City Park Bus

EFFECTIVE May 28th 1946 CARS A. M. P. M.

TRAIN No.	Station To Sunnaire & Alexander 1.581	Sunnaire & Alexander To Station 1.539	Round Trip 6.119								TOTAL
1	1	1	22								
2	1 2	1 2	21								
3	1	1	20								
4	1	1	2								
5	2 2	2 2	16								
6	2 2	2 2	18								
7	2	2	4								
8	1	1	24								
9	1	1	13								
10	1	1	6								
11	1	1	1								
12	1	1	4								
13	1	1	19								
14	2	2	5								
15	1	1	19								
16	1	1	5								
17	1	1	1								
18	1	1	24								
19	2 2	2 2	7								
20	2	2	19								
21											
22											
23											
24											
25	27	27	250								
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37	42.687										
38		41.553									
39			1529.750								
40				1613.990 Miles							
41					164:54 Hours						
42						9.79 Speed					
43											
44											
45											
46											
47											Car Hours 164:54
48											
49											
50											

FIGURE 61.
MILEAGE RECORD SHEET—
SAMPLE COMPANY UNDER STUDY.

to property. Some companies issue blueprinted copies of schedule data to each man. Others provide their operator with printed card forms onto which they may copy their schedule data. For current industry views and practices in this regard, the student of this report is referred to Parts II and III of this project.

E. Comparative Statement

The Comparative Statement, Figure 60, is a very handy condensed comparison between the schedule most recently superseded and the newest schedule in effect. It lists in full for both schedules the following information, together with the increase or decrease resulting from the change:

A. For each of the five principal daily periods

1. Number of vehicles
2. Headways in minutes
3. Actual running time
4. Headway adjustment time
5. Total trip time
6. Actual running speed
7. Overall trip speed

B. Number of regular runs

1. Early straight
2. Late straight
3. Two-piece
4. Three-piece (where applicable)
5. Total regular runs

C. Tripper runs

1. Early trippers
2. Late trippers
3. Total tripper runs

D. Hours

1. Regular run
2. Tripper
3. Total schedule hours
4. Allowed hours
   a. To 8:00 hours
   b. Time and one-half
   c. Journey time
   d. Total allowed hours
5. Total schedule and allowed hours

RECAPITULATION OF SCHEDULES

Schedule Division

Tuesday to Friday — SCHEDULES — EFFECTIVE April 30, 1946

LINE	Station	Line No.	Date Effective	Units Operated: A.M. Peak	Units Operated: Basic	Units Operated: P.M. Peak	Units Operated: Night	Units Operated: Owl	Headway (Min.): A.M. Peak	Headway (Min.): Basic	Headway (Min.): P.M. Peak	Headway (Min.): Night	Headway (Min.): Owl	Hours: Actual	Hours: Allowed	Platform Cost: Actual	Platform Cost: Allowed	Platform Cost: Total	Mileage	Speed	Regular Runs: Early Straight	Regular Runs: Late Straight	Regular Runs: Two Piece	Regular Runs: Three Piece	Tripper Runs
Canal	Can.	7657	3-19-46	31	23	34	16	2	1½-2	2½-3	1½-2	4	30	462 32	10 52	758 56	21 72	780 28	4261 5	9.2	23	18	14		6
Desire	Can.	7641	3-18-46	8	7	9	5	1	6	6½-7	5-5½	9	45	145 26	3 57	238 51	7 08	245 59	1334 1	9.2	9	5	4		-
Freret	Arc.	7631	3-14-46	18	12	20	7	1	3-3½	4-4½	2½-3	7½-8	60	267 02	7 09	437 93	17 83	455 76	2437 4	9.1	12	11	9		3
Gentilly	Can.	7638B	3-19-46	14	8	15	9	1	4-4½	7-7½	3½-4	6-6½	60	220 19	13 02	561 31	26 88	388 19	2105 6	9.5	9	9	7		6
Jackson	Arc.	7623	3-14-46	11	10	11	5	1	3½-4	4-4½	4-4½	8	40	181 13	4 55	297 20	8 56	305 56	1411 2	7.8	11	8	3		1
Magazine	Arc.	7627	3-14-46	30	16	28	11	2	1½-2	3½-4	2-2½	5-5½	30	364 09	15 23	597 21	32 93	630 14	3650 0	10.0	17	11	15		7
Napoleon	Arc.	7074	6-13-44	4	3	4	3	1	9	11-11½	9	11-11½	60	69 48	1 37	114 47	4 85	119 32	557 1	8.0	3	4	1		1
S. Claiborne	Arc.	7635	3-14-46	20	11	20	7	1	2½-3	5-5½	2½-3	8	60	271 07	10 16	444 63	24 74	469 37	2526 2	9.3	10	12	10		4
St. Charles	Carr.	7660	3-20-46	30	20	31	12	2	2-2½	2½-3	1½-2	4½-5	30	399 13	11 40	654 72	22 73	677 45	4027 0	10.1	20	13	15		6
St. Claude	Can.	7645	3-19-46	28	16	24	15	2	2-2½	4	2½-3	4-4½	30	389 29	8 38	638 75	21 76	660 51	3982 3	10.2	16	13	19		1
Tulane	Carr.	7664	3-20-46	37	22	36	15	2	1½-2	3-3½	2-2½	4½-5	30	482 52	18 33	791 90	35 22	827 12	4464 1	9.2	24	14	19		7
Total Car Operation (TWO MAN)				251	148	232	105	16						3253 10	106 02	5335 19	224 10	5559 29	30756 5	9.5	154	118	116		42
Broadway	Arc.	7247	1-29-45	6	3	3	3	1	5½-6	10-10½	6-6½	9½-10	30	82 23	1 21	73 32	3 00	76 32	833 7	10.1	3	4	3		-
Total Electric Coach Operation				6	3	3	3	1						82 23	1 21	73 32	3 00	76 32	833 7	10.1	3	4	3		-
*Canal Blvd	Can.	7384	7-18-45	5	2	4	2	-	9½	15	7½	15	-	51 12	9 30	158 32	9 31	167 63	610 5	11.9	10	7	5		2
*Carrollton	Can.	7269	4- 2-45	1	1	1	1	-	22	22	22	24	-	18 31					185 2	10.0					
Pontchartrain Beach	Can.	7572	3-26-46	3	2	5	4	-	8	10	4½-5	6	-	66 08	11 10	110 40	10 79	121 19	765 1	11.6	4	4	4		7
*Robt. E. Lee	Can.	7270	4- 2-45	1	1	1	1	-	20	20	20	20	-	20 36					286 1	13.9					
*St. Claude	Can.	7272	4- 2-45	1	1	2	1	-	15	15	8	15	-	28 31					293 1	10.3					
*S. Claiborne	Can.	7271	4- 2-45	1	1	1	1	-	12	12	12	12	-	20 44					160 7	7.8					
Jefferson Parish	Can.	7692	3-26-46	5	3	6	2	-	7-7½	12	6	16½	-	79 18	4 35	70 58	5 48	76 06	1085 9	13.6	5	3	2		1
Louisiana	Can.	7677	3-26-46	31	10	23	10	1	2-2½	5½-6	2½-3	5½-6	60	315 11	21 09	280 52	24 27	304 79	3267 2	10.4	12	14	9		18
City Park	Can.	7649	3-26-46	14	6	17	5	1	2½-3	6-6½	2-2½	7-7½	60	162 52	8 35	144 95	10 29	155 24	1561 9	10.2	5	6	8		6
Nashville	Can.	7689	3-26-46	10	3	6	2	-	3-3½	10	5-5½	15	-	84 50	8 29	75 50	8 80	84 30	887 5	10.5	4	3	2		7
Gentilly Broad	Can.	7683	3-26-46	33	14	30	11	1	2-2½	5-5½	2-2½	6-6½	60	405 16	21 12	424 54	28 22	452 76	4319 1	10.7	21	16	19		12
Route 90	Can.	7686	3-26-46	5	3	5	2	-	6	10	6	15	-	71 45	(Combined with Gentilly-Broad)				975 8	13.6					
Leonidas	Can.	7680	3-26-46	7	4	9	4	-	4-4½	7-7½	3½-4	7½	-	108 18	3 38	96 39	5 53	101 92	1085 3	10.0	6	3	4		1
Laurel	Can.	7671	3-26-46	15	4	13	4	1	2-2½	9-9½	3-3½	8½-9	60	138 05	13 53	122 89	16 11	139 00	1406 7	10.2	5	4	6		9
Metairie	Can.	7690	3-26-46	13	6	16	5	1	3½-4	7½-8	3-3½	8½-9	60	171 43	8 59	152 82	12 70	165 52	2249 8	13.1	8	5	7		5
Esplanade	Can.	7653	3-26-46	17	7	15	4	1	2-2½	5-5½	2½-3	8½-9	60	171 24	7 16	152 54	9 12	161 66	1684 5	9.8	6	4	10		5
Frenchmen	Can.	7668	3-26-46	22	7	21	6	-	1½-2	6	2-2½	6½-7	-	219 49	20 32	195 63	25 08	220 71	2353 2	10.7	8	5	10		14
[illegible]	Can.	7674	3-26-46	15	8	14	6	-	3-3½	6-6½	3½-4	8-8½	-	196 45	4 21	175 11	7 32	182 43	1898 6	9.6	8	8	7		2
[illegible]	Can.	7619	2-26-46	17	9	19	7	1	2-2½	4-4½	1½-2	5-5½	60	215 46	8 46	192 04	9 95	201 99	2067 2	9.6	9	7	9		4
Bomber Base	Can.	7694	3-26-46	6	2	4	2	-	4	15	6	12	-	57 55	(Combined with Pontchartrain Beach)				1026 4	17.6					
*Airport	Can.	7387	7-18-45	1	-	1	1	-	15	-	15	15	-	14 28					166 1	11.5					
*Desaix	Can.	7582	1-27-46	1	-	1	1	-	12	12	12	12	-	19 12					155 0	8.1					
*Shipyard	Can.	7367	6-18-46	1	-	1	-	-	12	-	12	-	-	4 40					41 9	8.9					
Pont. Beach Shuttle	Can.	7695	4-22-46	-	-	-	2	-	-	-	-	8	-	13 26	6 43	11 96	5 98	17 94	207 8	15.5					
Total Bus Operation				**223	95	215	84	7						2656 25	158 48	2364 19	188 95	2553 14	28740 6	10.8	111	89	102		93
GRAND TOTAL				460	246	452	192	24						5991 58	266 11	7772 70	416 05	8188 75	60330 8	10.1	268	211	221		135

* DENOTES COMBINED PLATFORM LABOR COST.
** MINUS TEN (10) BUSES THAT DOUBLE UP IN A.M. PEAK TO GIVE ACTUAL NUMBER OF BUSES OPERATED.

SUMMARY OF ALLOWANCES

		Hours: Street Cars	Hours: Buses	Hours: Coaches	Cost: Street Cars	Cost: Buses	Cost: Coaches
Allowed to 8:00 Hour		49:35	47:20	:51	$ 81.31	$ 42.13	$ .75
Allowed for Time and One-half		45:57	92:32	-	75.37	82.37	-
Journey Time (one-man equivalent)	(40:26)	10:30	18:56	:30	17.22	16.85	.45
Bonus Two-Piece Run					50.20	47.60	1.80
Bonus Three-Piece Run					-	-	-
Totals		106:02	158:48	1:21	$ 224.10	$ 188.95	$ 3.00
Total Allowance			266:11			$ 416.05	

FIGURE 62.
RECAPITULATION OF SCHEDULES-
SAMPLE COMPANY UNDER STUDY.

E. Cost

1. Total schedule and allowed hours
2. Bonus, two-piece runs
3. Bonus, three-piece runs (where applicable)
4. Total platform labor cost.

F. Vehicle Mileage

1. Old schedule
2. New schedule

An auxiliary sheet, Figure 61, is used in computing the mileage figures for the Comparative Statement. It is based upon the multiplication of trips by distances, and "in" and "out" movements by the corresponding distances.

An original and two carbon copies of the Comparative Statement are made in pencil. The original is sent to the Vice President in Charge of Operations as advice as to the nature of the schedule change made and its effects upon headways, costs, and so on. It is filed in a binder in his office for ready reference as to the basic fundamentals of the schedule in effect.

Of the two pencil carbon copies, one is sent to the Transportation Department for information and reference, and one is retained in the Schedule Department for the record.

F. Recapitulation of Schedules

A final valuable reference record for the information of schedule, planning and transportation officials and the management, is the Recapitulation of Schedules in effect, Figure 62.

The information upon which this sheet is based is drawn from current schedules.

The recapitulation shows for the system, by lines and types of vehicles, the following pertinent data:

1. Line name
2. Name of station
3. Schedule number
4. Effective date
5. Units Operated

    a. A.M. Peak

b. Basic
c. P.M. Peak
d. Night
e. Owl

6. Headway (Minutes)

a. A.M. Peak
b. Basic
c. P.M. Peak
d. Night
e. Owl

7. Hours

a. Actual
b. Allowed

8. Platform Cost

a. Actual
b. Allowed
c. Total

9. Mileage

10. Speed

11. Regular runs

a. Early straight
b. Late straight
c. Two-piece
d. Three-piece (where applicable)

12. Tripper runs

A summary of schedule allowances, in time and money, is placed at the bottom of the sheet.

The Recapitulation of Schedules is prepared monthly, reflecting conditions as of the end of the month. Nine copies are made of the Monday schedule, and eight copies each are made of the Tuesday through Friday, Saturday and Sunday schedules. These copies are distributed as follows:

1. President.
2. Vice President in charge of Operations.
3. General Auditor (Monday schedule only).
4. General Superintendent of Railways.
5. Chief Clerk of Planning Unit.
6. Superintendent of Transportation.

7. Superintendent of Equipment.
8. Schedule Department - working copy.
9. Schedule Department - record copy.

G. Schedule Information for the Riding Public

The company does not make a practice of printing schedule data and distributing it to the general public.

An examination of the Recapitulation of Schedules, shows the following headway classifications (see Figure 62).

Peak Headways

	1-2 Min.	2-3 Min.	3-5 Min.	5-10 Min.	10-15 Min.	15-20 Min.	Over 20 Min.	TOTAL
Street Car Lines	4	3	2	2				11
Trolley Coach Lines				1				1
Motor Bus Lines	2	5	6	4	4	1	1	23
TOTAL	6	8	8	7	4	1	1	35

Basic Headways

	2-3 Min.	3-5 Min.	5-10 Min.	10-15 Min.	15-20 Min.	Over 20 Min.	TOTAL
Street Car Lines	2	5	3	1			11
Trolley Coach Lines				1			1
Motor Bus Lines		1	12	6	1	1	21
TOTAL	2	6	15	8	1	1	33

Night Headways

	2-3 Min.	3-5 Min.	5-10 Min.	10-15 Min.	15-20 Min.	Over 20 Min.	TOTAL
Street Car Lines		4	6	1			11
Trolley Coach Lines			1				1
Motor Bus Lines			12	8	2	1	23
TOTAL		4	19	9	2	1	35

From the above tabulations, it is apparent that the bulk of the service operated is at headway intervals which are sufficiently close as not to require printed time-tables.

The company does duplicate terminal sheets for the long-headway outlying lines by the "ditto" process and distributes them to residents of these areas upon request. Information concerning the transit lines may also be obtained from the Schedule Department by telephone, and from the Information Booth on the ground floor of the company's main office building.

In addition to having close headway intervals on most lines, the company changes schedules many times each year (see page 9). Such frequent changes would "void" schedules continuously, resulting in confusion and unnecessary expense.

The reader is referred to Parts II and III of this project for current industry practices with reference to the distribution of Schedule information to the riding public.

CHAPTER VIII

MEASUREMENT OF SCHEDULE EFFICIENCY BY THE SAMPLE COMPANY

It has been pointed out in the Introduction, Chapter I, that the question of "What constitutes a good schedule?" has apparently not yet been answered to the complete satisfaction of the transit industry.

Because of the importance of this question of tests of a good schedule and managerial measurements of schedule efficiency, the Administrative Committee of the Operations Division specified, when undertaking the sponsorship of this project, that it include, in addition to traffic checking and schedule preparation, a study of methods for checking the efficiency of schedules. Provision has been made for the appointment of a Research Project Committee on this subject in the near future, such Committee to investigate measures of the efficiency of schedules and the schedule making process.

The findings of this Research Project Committee will be reported upon at an appropriate time during the progress of this study. In the meantime, the views of the sample company have been explored and discussed, and some of them will be set forth below.

At the outset it must be recognized that schedules must meet the requirements of three groups whose interests may appear at first glance to differ widely, namely, (1) the public, (2) company employees, and (3) the company management. A superficial examination of the problem may lead one to believe that a schedule which best meets the desires of the public or the trainmen will not meet the need of the company, or vice-versa. Careful consideration will reveal the fact that in the long run, however, the community of interests is best served by a sound and efficient schedule. The real test question may prove to be: "Is the company carrying the volume of traffic with the minimum expenditure for platform labor which is consistent with an attractive service to the public and adequate compensation and working conditions for its employees?"

The Schedule Department of the sample company points out that there are certain phases of management activity which are beyond its control, and that therefore, the efficiency of the department's operations must be gauged with due regard for these factors. These items are:

1. The selection of transit vehicles, with a view towards using the vehicle which is best fitted to and can be most efficiently utilized on each route. This selection process and the modernization program associated therewith are the result of research and planning activities which fall beyond the scope of routine schedule processes.

2. The limitations imposed by the agreement between the management and the operating personnel as to wages and working conditions. Opportunities for real increases in efficiency are often removed or diminished by the number and nature of the requirements set forth in the labor agreement.

It must be assumed, therefore, in any momentary examination of schedule efficiency, that the vehicle on the line is temporarily, at least, the vehicle best suited to it, and that the labor agreement is the very best possible agreement, temporarily at least, which could have been reached by the parties thereto as of its effective date. The Schedule Department must begin at this point to do the very best possible job that it can within the existing framework of equipment, wages and working conditions.

The company feels that overall efficiency in a schedule can result only from building it up from the most efficient combination of the elements which go to make it. That is, from the standpoints of both the public and the company, there should be constant checks of passenger loads and running time, performed as frequently as necessary and as carefully as possible, as a measure of the efficiency of existing schedules and an indication of desirable schedule changes. These processes, if properly followed by attention to schedule changes, will insure the efficiency of the schedule from the standpoint of fitting the service to the load in the right places at the right times, and from the standpoint of operating the fastest schedule consistent with economy and safety, and without undue hardship on vehicle operators.

If the above processes are also followed by skill and perserverence in cutting runs for the maximum efficiency consistent with good employee relations, the resulting schedule should be an efficient one. If a line treated as indicated above cannot be made to show a return, or cannot handle the volume of business with a reasonable expenditure for platform labor, the indications are that further study may show some justification for turn-back service, or perhaps the desirability of making a change in vehicle size or type.

The best measure of the effectiveness of the Schedule Department in building schedules from the standpoint of employee relations is perhaps the periodic "inventories" which are taken of the men's "preferences" for certain types of runs, and of the manner in which the numbers of such runs are reflected on the company's Assignment Sheets. Any attempt to short-cut or short-circuit these preferences for the ultimate in "dollar" efficiency might prove more expensive to the company in the long run by bringing into future labor negotiations demands for more drastic provisions than those which currently exist.

The Schedule Department considers that its "Control Data" - the various tables and charts discussed in the Introduction - are in a sense measures of the efficiency of the schedule-making process. One of these measures - the "earnings per vehicle hour" or passenger revenue per

vehicle hour - seems to be the favorite measuring stick of the company management in discussing schedule efficiency with the Schedule Department.

The "earnings per vehicle hour" figure does not have much significance in comparisons between lines, due to the great variation in riding characteristics, transfer ratios, and etc., from line to line. It does have considerable significance on any one line, however, and can be followed as a rough measure of efficiency in schedule performance if an efficient schedule is assumed at some point and the subsequent fluctuations in the figure with the passage of time are studied. It must be looked upon, however, as a variable rather than as a constant measure, as the figure is automatically "distorted" on the high side by the equipment limitations of the era of wartime prosperity and on the low side by the limiting headway considerations characteristic of the depression 30's.

If the "earnings per vehicle hour" from month to month on a given line remains high and "in line", the Schedule Department hears relatively little about routine schedule matters from the management. When this figure for a line or series of lines starts to fall, however, the management begins to talk schedule efficiency with the Schedule Department. For this reason, the Schedule Department watches this measure rather closely, charting it by lines as shown in Figure 5, Chapter I.

The "switching" report and other reports of the Transportation Division serve as "indicators" rather than "measures" of the efficiency of a schedule from the standpoint of "schedule adherence" in actual operation, and point the way towards a re-examination of conditions through the load check and riding check.

The company considers it rather difficult to set up criteria which would serve as measures of efficiency applicable to all lines of the system generally. The ratio of base to peak riding, for example, would vary widely due to the many factors which influence the riding characteristics of a line. On the other hand, the ratio of "pay" hours to "actual" hours, if studied as a trend, might reflect the efficiency of the run cutting process as a part of the overall schedule job. The figure of "vehicle miles per revenue passenger" by years might be of considerable significance with a constant system pattern and a constant vehicle size and type, but would lose that significance in the face of any radical change in these items.

In closing its discussion of measures of schedule efficiency, the Schedule Department re-emphasized its opinion that the basis for building efficient schedules lies in building efficiency into each step of the process. The public relations, employee relations and management aspects must all be taken into account continually. Otherwise, a schedule which is most efficient as to "earnings per vehicle hour" may be built which, while it would carry the people for the least expenditure for platform labor, might discourage riding or give rise to a loss in efficiency by stimulating potential labor difficulty. Each company will undoubtedly have its own peculiar local conditions to face in this respect.

The student of this report is referred to Parts II and III of this project, as well as to the work of the Research Project Committee to be appointed for this subject, for other viewpoints regarding measures of the efficiency of schedules and the schedule making process. These later reports will be distributed to the member companies of the Association as soon as they have been completed.

APPENDIX A

GLOSSARY OF SCHEDULE TERMS

USED BY

SAMPLE COMPANY UNDER STUDY

GROUP I - GENERAL

Control Data. Basic statistics and derived statistics regarding line and system operations, sometimes referred to as "secondary" data, used in conjunction with the "primary" data on passenger loads and required running times in "controlling" the schedule making process.

Headway. The time interval between any two vehicles operating in the same direction on a route.

Limiting Headway. A headway dictated by policy considerations rather than by the volume of traffic to be carried.

Line. A route or combination of routes.

Loading Standard. The load (in passengers) to be used for a given size and type of vehicle during different periods of the day in determining the headways to be operated during those periods. The loading standard is sometimes expressed as the ratio of the "schedule" load to the seating capacity of the vehicle.

Maximum Load Point. That point along a transit route at which the maximum loads on vehicles tend to accumulate.

Operating Station. See "Station".

Passenger Load. The number of passengers carried on each vehicle past the point or points of heaviest load.

Passenger Load Check. A check conducted for the purpose of obtaining data on passenger loads. (See Chapter II).

Platform Labor Cost. The total cost for the services of trainmen or bus operators, including all bonuses, allowances, etc.

Relief Point. — A designated point on the route where operators or crews may be scheduled to begin or terminate the whole or some part of their runs.

Riding Check. — See "Running Time Check".

Round Trip. — The two-way operation of a vehicle from a specified terminus back to that same terminus.

Route. — The established course between two terminals.

Running Time Check. — A check made for the purpose of ascertaining and setting up the proper running time for a schedule. (See Chapter III).

Running Time Periods. — The division of a day into two or more periods for the purpose of assigning definite running, layover and trip times to these periods. (See page 49).

Schedule. — The written information associated with the mass transportation of people, in which is specified the route to be used; the type and number of vehicles to be operated during all periods of the day and night; the location at which these vehicles are to be stored when not in use; the time at which they should depart from and return to the point of storage; the time they should arrive at and leave some specified point on the route; the time they should arrive at and depart from each terminus and time point on each trip; the time and place each motorman, conductor or operator is to start and complete each day's work; and the total time plus allowances for which he is to be paid.

Shifting. — A process of adjusting the terminal layout sheet prior to its completion in preparation for the run cutting procedure. (See Chapter V).

Standing Check. — See "Passenger Load Check".

Station. — The place at which vehicles are stored and from which they are dispatched for scheduled service.

Switched Vehicle. — A vehicle turned back short of its normal terminus, due to schedule or other causes.

Terminal. — See "Terminus".

Terminus. — Either end of a route.

Time Point. — A designated point on a route established for the control or equalization of headways.

Traffic. — As used in a schedule sense, the word "traffic" refers to the volume of passenger business.

Train Number. — A number shown on a transit vehicle to identify it with a specific piece of work to be performed by the vehicle, as indicated on the Terminal Sheet.

Trip. — The one-way operation of a vehicle between the two terminals of a route. (i.e. - inbound trip; outbound trip).

Try-Out Schedule. — A schedule for some currently non-existent situation, such as a projected future route or projected future size and type of vehicle, which has been constructed with all the care and attention given the preparation of an "actual" schedule, including the most economical run-cut possible under the existing (or a contemplated future) labor contract.

Vehicle. — Any piece of transit equipment used for the movement of passengers, such as a street car, trolley coach or motor bus.

GROUP II - SCHEDULE FORMS

Assignment Sheet. — A form used for grouping runs into six-day assignments for selection by trainmen in accordance with their seniority. (See Figure 58).

Comparative Statement. — A sheet giving a condensed comparison of major schedule data between the most recently superseded schedule and the newest schedule in affect. (See Figure 60).

Headway Order. — A form used by the Superintendent of Schedules or the Chief Schedule Maker for prescribing the "headways" or amounts of service to be included in a new schedule. (See Figure 25 A & B).

Passenger Load Summary. — A form, also called "Recapitulation of Passenger Checks", for the summarization and analysis of passenger load data. (See Figure 14).

Recapitulation of Schedules. — An information sheet containing basic schedule data for each line of the system, as well as system totals and a summary of schedule allowances in "time" and "money". (See Figure 62).

Run Cut Sheet. — A form used for the performance of all steps in the procedure of "run cutting". (See Figure 45).

Run Guide. — A typed form, posted at the station, which furnishes operators with all data essential to the performance of their scheduled runs. (See Figure 59).

Run Sheet. — A typed copy of the Run Cut Sheet, used for both information and record. (See Figure 46).

Running Time Sheet. — A form used for setting up running time data by time points and running time periods for the guidance of schedule makers. (See Figure 22).

Running Time Summary. — A form or forms used for the summarization and analysis of running time data. (See Figure 18 and 21.)

Subdivision Sheet. — An auxiliary form showing "in", "out", "total", and "relief" times for trains, utilized in the process of run cutting. (See Figure 41.)

Terminal Layout Sheet. — A form on which the scheduled departure times of trains from the line terminals are laid out prior to final adjustment. (See Figure 37.)

Terminal Sheet. — The final "timetable" of vehicle departures from the line terminals which is used, in conjunction with the time points and running time, to govern the operation of vehicles over the public streets. (See Figure 29.)

GROUP III - TIME

Allowed Time. — Bonus time paid for hours not worked in order that the total time paid for a run may be equal to the minimum time guaranteed; such as "time allowed to eight hours" on a regular run, time allowed to $1\frac{1}{2}$ hours on a minimum tripper run, and time and one-half on a tripper run.

Bonus Time.	See "Allowed Time"; see also "Overtime", "Spread Time" and "Spread Pay".
Drop Back Time.	See "Layover Time".
Headway Adjustment Time.	See "Layover Time".
Journey Time.	A time allowance, paid for at the straight time rate, which permits a conductor or operator who is relieved at the end of his day's work at a point distant from his station to return to the station to turn in his trip sheets, transfers, etc.
Layover Time.	The elapsed time between vehicle arriving and leaving times at a terminus.
Overtime.	Bonus time paid for hours worked in excess of those specified for any given regular run, paid for at time and one-half.
Pull-out Time.	The time assigned for the movement of a vehicle from the station to its first scheduled terminus.
Pull-in Time.	The time assigned for the movement of a vehicle from its last scheduled terminus to the station.
Recovery Time.	See "Layover" Time.
Relief Time.	The times, specified on the Run Guide, at which operators or crews relieve and are relieved at specified relief points.
Round Trip Time.	The time required for a vehicle to make a complete round trip, including layover time.
Running Time.	The time assigned for the movement of a vehicle over a route. (Layover time not included.)
Spread Time.	The elapsed time between the beginning and end of a two - (or three -) piece run.
Swing Time.	The elapsed time between the portions of a two - (or three -) piece run.
Trip Time.	The running time required to complete a one-way trip.

GROUP IV - SPEED

Speed.	The distance moved per unit of time. (Distance in miles divided by time in hours equals speed in miles per hour.)
Running Speed.	The average speed maintained between terminals, exclusive of layover time. It may be calculated by individual trips, by running time periods, or for the entire schedule.
Overall Trip Speed.	The average speed maintained per round trip, including layover time. It may be calculated by individual trips, by running time periods, or for the entire schedule.

GROUP V - RUNS

"All American" Run.	A "block" of 6 days' work on the Assignment Sheet made up of regular runs not worked by regular men on their days off.
A.M. Part Trip.	Any part trip occurring in the A.M. period.
A.M. Tripper.	A tripper operated for some portion of the period (in general) between 6:00 A.M. and 9:00 A.M.
Block Number.	A number associated with the six pieces of work to be performed by a trainman or operator during a specific week, as indicated on the Assignment Sheet.
Early Straight Run.	A straight run which operates during the morning hours, with "time off" not later (in general) than 3:00 P.M.
Early Two-Piece Run.	A two-piece run which finishes work before 9:00 P.M.
Extra Run.	A trip or combination of trips which is not scheduled. (NOTE - There are relatively few such trips on the sample property. Practically every vehicle movement is scheduled.)
Late Straight Run.	A straight run which operates during the late after-

noon and the night hours, with "time off" not later (in general) than 2:00 A.M.

Late Two-Piece Run. — A two-piece run which finishes work at 9:00 P.M. or later.

Owl Run. — A run which operates during the late night and early morning hours, until the resumption of regular service with the next day's schedule.

Part Trip. — A trip added to the beginning or end of a regular run to correct a situation, and which the regular man has preference in working at time and one-half, unless the extra time added exceeds one hour and thirty minutes.

P.M. Part Trip. — Any part trip occurring in the P.M. period.

P.M. Tripper. — A tripper operated for some portion of the period (in general) between 3:30 P.M. and 6:30 P.M.

Regular Run. — A scheduled combination of trips whose total time will equal, exceed or guarantee payment for the number of hours specified as a day's work.

Run Cutting. — The process of cutting a terminal sheet into "runs" for assembly into "blocks" of work for the operating personnel.

Run Number. — A number associated with the piece of work to be performed by a trainman or operator on a specific day, as indicated on the Run Guide.

Spread Pay. — The extra or "bonus" pay associated with various amounts of spread time for two - (or three -) piece runs having a "spread" of more than eleven and less than fourteen hours.

Spread Bonus. — See "Spread Pay"; see also "Spread Time".

Straight Day Run. — A straight run which operates during the late morning and the afternoon hours, with "time off" not later (in general) than 9:00 P.M.

Straight Run. — A regular run in which the trips follow one another without interruption.

Swing Run.	See "Two-Piece Run"; see also "Three-Piece Run".
Three-Piece Run.	A regular run in which the work is not continuous, but is divided into three parts with two intervals between them which are not paid for except as provided for as "spread pay".
Tripper Run.	A scheduled combination of trips whose total time is less than that specified as constituting a regular run.
Two-Piece Run.	A regular run in which the work is not continuous, but is divided into two parts with an interval between them which is not paid for except as provided for as "spread pay".

GROUP VI-COMPARATIVE TERMS

Revenue Passengers.	Passengers who pay the specified cash fare upon boarding a vehicle.
Transfer Passengers.	Passengers who surrender a transfer upon boarding a vehicle.
Total Passengers.	All passengers carried, including "free" passengers.
Route Mile.	A one-way distance of one mile measured between the two terminals of a route.
Vehicle Mile.	The operation of a transportation vehicle over a distance of one mile.
Vehicle Hour.	The operation of a transportation vehicle for a period of one hour.
Earnings per Vehicle Hour.	A derived statistic obtained by dividing the passenger revenue for a line (or the system) by the corresponding number of vehicle (actual) hours.

APPENDIX B

METHOD OF MAKING SCHEDULE "CHANGES"

SAMPLE COMPANY UNDER STUDY

In the main text of this report, page 9, it was indicated that the sample company made 575 minor changes in its schedules during the calendar year 1946, in addition to the preparation of 479 entire new schedules.

The development of a new schedule from start to finish was traced in the body of the report. In this appendix the method of making a minor change in an existing schedule will be described.

It is customary for the Chief Schedule Maker to review, at intervals of two weeks, all the Passenger Load Summary Sheets for the system. Such a review was made of the summary for the City Park bus line immediately after the April 25th load check was entered. A study of the summary sheets indicated the need of additional service in the A.M. and P.M. Peak periods, as well as a reduction in service in the late afternoon just preceding the peak. An examination of the running time summary sheets indicated the possibilities of saving a minute in the running time in each of several daily periods. The schedule maker decided to build a complete new schedule just as soon as possible to correct the bad conditions and to take advantage of the good conditions which had developed. The situation developing in the P.M. Peak period between 5:08 and 5:38 was so acute, however, as to warrant immediate correction pending construction of the new schedule. A minor schedule change in the P.M. Peak period was, therefore, decided upon.

The need for a schedule change might also have been called to the attention of the Chief Schedule Maker between his review periods by special reports or "complaints" from the Transportation Division.

Consider the segment of the Passenger Load Summary shown in Figure 63. The loads between 5:17 and 5:29 P.M. are particularly heavy, averaging 57 - 68 - 63 on the first three days recorded (the schedule maker is studying this sheet at noon of April 26, 1946). He decides to add a P.M. Tripper to the schedule so that it will relieve the heavy spot just after 5:15, thereby taking care of the situation temporarily until the new schedule can be placed in effect.

Examining the load summary and utilizing a column off to the right to record his proposed headways, the schedule maker makes the following tentative decisions:

1. To leave the 5:08 and 5:10 P.M. inner terminal times as they are.

OF PASSENGER CHECKS

EDULE DIVISION — TUESDAY TO FRIDAY — SCHEDULE

SCHEDULE TIME AT DAUPHINE & CANAL (OUT BOUND) CHECKED AT DUMAINE & CLAIBORNE

PRO-POSED HEAD-WAY	TRAIN No	SCHED-ULE TIME	DATE OF CHECK: TUES. 4-2 LOAD	WED. 4-10 LOAD	THUR. 4-25 LOAD	TUES. 5-14 LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	PRO-POSED HEAD-WAY
	8	445½	45	38	52	36									
	9	447½	41	46	21	36									
	10	450	(61) 50	(62) 44	43 44	(64) 42									
	11	452	(59)	42	42	41									
	12	454½	50	16	52	28									
	13	456½	38	44	(54)	43									
	14	459	(63) 351	(67) 309	42 306	43 291									
	15	501	(57)	(72)	40	35								Proposed Headway	
	16	503½	45	(58)	46	(62)									
	17	505½	34 52	52 63	43 56	38 52									
	18	508	(65)	50	(67)	(57)								508	
	7	510	52	(71)	(65)	(54)								510	
	1	512½	(61)	(65)	(67)	49								512	
	2	514½	49 363	(75) 441	(63) 391	(70) 345								514	
	4	517	(55)	(58)	(71)	(57)								516	
	5	519½	(61)	(67)	(72)	(61)							X	518 520	
	6	521½	53 57	(74) 68	49 63	(56) 58								522	
	8	524	50	(71)	(69)	(60)								524	
	9	526½	(59)	(76)	(63)	(61)								526	
	10	529	(62) 340	(63) 409	(54) 378	(54) 349								528	
	11	531	(57)	49	40	49								530½	
	12	533½	51	(58)	(56)	34								533	
	13	535½	41 51	52 49	49 49	49 46								535½	
	14	538	49	51	(55)	51								538	
	15	540	53	40	39	45									
	16	542½	(65)	49	51	40									
	17	544½	44 360	41 340	50 340	53 321									
	18	547	49	(59)	33	41									
	7	549	52	38	34	32									
	1	551½	30 41	41 46	27 38	39 44									
	2	553½	51	43	48	(59)									
	4	556	39	43	43	53									
	5	558½	34 245	53 277	44 229	40 264									

FIGURE 63.
SEGMENT OF PASSENGER LOAD SUMMARY—
SAMPLE COMPANY UNDER STUDY

2. To reduce the next headway interval from $2\frac{1}{2}$ to 2 minutes, with an inner terminal time of 5:12 instead of $5:12\frac{1}{2}$. This will tend to lighten the load on this trip.

3. To hold the next 2 minute interval, which neither helps nor hurts the situation, giving an inner terminal time of 5:14.

4. To cut the next headway interval from $2\frac{1}{2}$ to 2 minutes, thereby relieving the pressure on that vehicle, and resulting in a new terminal time of 5:16 instead of 5:17.

5. To reduce the next headway interval from $2\frac{1}{2}$ minutes to 2 minutes, resulting in a new terminal time of 5:18 P.M. This might be achieved in one of two ways- either by changing the inner terminal time of Train No. 5 from $5:19\frac{1}{2}$ to 5:18 for that trip, a cut of $1\frac{1}{2}$ minutes in running time; or, by introducing the new tripper bus at that point. Since, in the light of his experience, the Chief Schedule Maker considers a cut of $1\frac{1}{2}$ minutes at that time of day too drastic, he introduces an additional vehicle with terminal time ("x") 5:18 P.M. into the line of vehicles.

6. To hold the next headway interval to 2 minutes or a terminal time of 5:20.

7. To change the next headway interval from $2\frac{1}{2}$ to 2 minutes, or a terminal time of 5:22.

8. To change the next headway interval from $2\frac{1}{2}$ to 2 minutes, or a terminal time of 5:24. At this point the present and proposed inner terminal times are identical (5:24 P.M.), indicating that the effect of the extra bus has been "used up" and that the line of cars is "back on time".

At this point an examination of the load summary shows that there are still two heavy loads, followed by a series of loads which are just about right, or, perhaps, a little "light". These two heavy loads are both on $2\frac{1}{2}$ minute headways, and they have not been helped by the extra tripper. They are followed by some buses operating on 2 minute headways with lighter loads (terminal times 5:31 P.M. and $5:35\frac{1}{2}$ P.M.) The Chief Schedule Maker, therefore, makes the following additional decisions:

9. To make the next two headway intervals following 5:24 2 minute intervals, or terminal times of 5:26 and 5:28. This involves "cuts" in running time of $\frac{1}{2}$ minute and 1 minute respectively, which the schedule maker believes to be possible of attainment on those trips.

10. To add $\frac{1}{2}$ minute to the next headway interval, resulting

in a terminal time of 5:30½ instead of 5:31.

11. To hold the next headway interval at 2½ minutes, giving a terminal time of 5:33 instead of 5:33½

12. To add ½ minute to the next headway interval, resulting in a terminal time of 5:35½ P.M., which is identical with the present terminal time.

13. To leave the next terminal time (5:38 P.M.) and succeeding terminal times exactly as they are in the present schedule.

The Chief Schedule Maker then turns the Load Summary Sheets marked with the proposed headways over to a schedule maker with instructions to work the extra P.M. tripper into the schedule. To perform this duty, the schedule maker to whom the task is assigned obtains copies of the existing Terminal Sheet, Running Time Sheet, and Run Sheet.

Schedule Change "Work Sheet"

The Schedule maker takes a blank sheet of paper and heads it up with the existing schedule number, the line name, type of schedule, and effective date of the change. The abbreviation "P.M." is placed on the sheet to qualify the "times" to be listed. Columns are provided for the run number, train number, "out" time, the times at each terminal (outer and inner", the "in" time, and the new elapsed "times" for each train affected by the schedule change. (See Figure 64).

It is customary to list on the work sheet one time at the beginning of the series which is to remain identical after the schedule change, and one time at the end of the series which is to remain unchanged. Care is taken in setting up the series of terminal times to see that each trip gets the right time at each end of the line, with due consideration for the running time.

The schedule maker starts to consider the 5:08 P.M. time, Train No. 18, but does not list it because it will not be changed. The 5:10 P.M. time, Train No. 7, is listed because it immediately precedes the first changed time. This time is placed in the inner terminal column (Dauphine and Canal) and its time at the outer terminal at the beginning of this inbound trip is figured back from the inner terminal time and the inbound running time (5:12 minus 17 minutes equals 4:55, which checks) and is entered in the Dumaine and Alexander column of the work sheet. Train No. 2, (5:14) is entered next, and it is found necessary to decrease the outer terminal time by ½ minute (4:57 instead of 4:57½ P.M.) to correspond with the new inner terminal time and the running time.

The next entry is Train No. 4, 5:16 at Dauphine and Canal. It is necessary to cut the outer terminal time a full minute (from 5:00 to 4:59) in

CITY PARK LINE
TUESDAY TO FRIDAY
EEF. 4-26-46

P.M.

RUN	TRAIN	OUT	DUM. & ALEX.	DAUPH. & CANAL	IN	TIME
794	7		453	~~532~~ 510		
784	1		455	~~534~~ 512		
797	2		457	~~536~~ 514		
785	4		459	~~538~~ 516		
805	X 19	453	501 536✓	~~540~~ 518	544	51
795	5		503	~~542~~ 520		
790	6		505	~~544~~ 522		
786	8		507	~~546~~ 524		
791	9		509	~~548~~ 526		
787	10		511	~~550~~ 528		
804	11		513½	~~552½~~ 530½		
793	12		516	~~555~~ 533		
788	13		518½	~~559½~~ 535½		

P.M. TRIPPER ADDED

RUN	TRAIN	TERMINALS				IN	ACT	PAY
805	19	DUM.- ALEXANDER	OUT	453	501 636✓	544		
		DAUPH.- CANAL			518		51	130

TOTAL TIME 166:26

FIGURE 64.
SCHEDULE CHANGE "WORK SHEET" -
SAMPLE COMPANY UNDER STUDY.

order to meet the running time and new inner terminal time. A check of the previous outbound trip reveals the following: This previous trip leaves the inner terminal at 4:37 P.M. and requires 22 minutes running time plus layover time in order to be ready for his next trip. This makes him available at 4:37 plus 0:22, or 4:59 P.M., which is identical with the new outer terminal time required. The outer terminal time for the trip in question can, therefore, be cut a full minute without cutting the running time and layover time of the previous trip.

A similar examination of Train No. 5, shows that this vehicle could not reach the inner terminal at 5:18 ($1\frac{1}{2}$ minutes sooner than the present 5:19$\frac{1}{2}$) without cutting into his running time and layover time by a full minute. This the schedule maker considers to be too drastic a cut at the height of the peak, which checks the judgment of the Chief Schedule Maker in inserting the additional tripper at this point. So a new vehicle (designated as Train No. 19, the next "unused" number on the terminal sheet) is pulled out of the bus garage to meet the 5:18 Dauphine and Canal time. This vehicle must leave the outer terminal at 5:01 P.M., as a running time of 17 minutes inbound is required.

This process of building up the outer terminal times to match the new inner terminal times which go with the proposed headways is continued through the entire range of proposed new headways as noted on the load summary. In each case the change in outer terminal time and the "cut" necessary to make this change are carefully studied to see whether the needed reduction in "running time plus layover time outbound" is practicable. The list ends with Train No. 13, which does not require a change from the existing schedule.

The first check of the work sheet (Figure 64) consists in rechecking to see that all vehicles listed have a running time of 17 minutes between the outer terminal and the inner terminal.

The second check of the work sheet consists in checking the inner terminal column of times back against the "proposed headways" column on the load summary sheet.

The third check is to put in the "margin times" for the next inbound trip to see whether the vehicles get back to the outer terminal in sufficient time (plus layover) to meet the next inbound trips without being cut too much. This column of "margin times" is noted temporarily to the left of the new column of inner terminal times.

Train No. 7, for example, requires 18 minutes running time plus 4 minutes layover, or 22 minutes in all, to be ready for its next inbound trip from the outer terminal. 5:10 P.M. plus 0:22 equals 5:32 P.M., which is noted in the "margin time" column. A study of the terminal sheet (Figure 16) shows that the next trip of this train leaves the outer terminal at exactly 5:32 P.M. Since the vehicle is ready for this trip right on time, no "cut" in time is necessary. Similarly, Train No. 1 is available at 5:34, actually

leaves at 5:34½ - no cut; Train No. 2 is available at 5:36, actually leaves at 5:36½ - no cut; Train No. 4 - available 5:38, leaves 5:39 - no cut. Train No. 19, the added tripper, gets back to the outer terminal at (5:18 plus 0:18 running time without layover) 5:36 P.M. and is ready to return to the bus garage. This time (5:36) is noted on the work sheet to the right of the outer terminal time entry for Train No. 19. Train No. 5 - available at 5:42, leaves 5:41½ - a ½ minute cut deemed practicable by the schedule maker; Train No. 6 - available and actual times of 5:44 - no cut; Train No. 8 - available 5:46, leaves 5:46½ - no cut; and so forth. All trains on the work sheet meet this test O.K.

The next step is to place the "in" and "out" times for the new tripper on the work sheet. The "in" and "out" times required are both 8 minutes, which requires the extra tripper to pull out of the station at 4:53 P.M. to be ready for its 5:01 P.M. inbound trip, and permits it to pull into the station at 5:44 P.M., after its 5:36 arrival back at the outer terminal. The total time of the tripper - 5:44 minus 4:53, or 51 minutes, is entered in the "time" column of the work sheet opposite Train No. 19.

A check is next made to see whether the pull out times of any of the regular vehicles have to be adjusted to meet the new outer terminal times imposed by the new headways. The nearest possible chance for change is presented by Train No. 2, which is scheduled to leave Dumaine and Alexander Streets at 4:57 P.M. instead of 4:57½ P.M., an apparent cut of ½ minute. The original pull-out time for this vehicle was 4:49, which, plus 0:08, gave a terminal "available" time of 4:57 against a terminal leaving time of 4:57½, or ½ minute "leeway" was given the operator so that he could leave the bus garage on the even minute. The new terminal leaving time is 4:57, which allows a full 8 minutes from the station to the outer terminal without changing the "out" time of 4:49 P.M. All other pull-out times checked out O.K.

A check of the "pull in" times shows that the first one occurs at 5:56 P.M., which is beyond the span of the proposed schedule change. No changes in pull in times are, therefore, necessary.

A new run number, No. 805, (the next consecutive number after the last one used on the Run Cut Sheet), is assigned the extra tripper, and the run numbers are listed on the work sheet. A Check is made of the "relief times" shown on the Run Cut Sheet as the run numbers are entered on the work sheet to determine whether any of them need to be changed. An examination, run by run, reveals the fact that all runs completely "span" the time of the proposed schedule change, so that there are no changes in relief times necessary as the result of the proposed new headways and terminal times.

The new P.M. tripper is now listed on the work sheet as a "P.M. Tripper Added", and the following pertinent data -- based upon Run Guide

April 25, 1946

Mr. Leo Peyret,
Station Master,
Canal Bus Station.

Dear Sir:-

Please make the following changes on the City Park Bus Line, Tuesday to Friday Schedule, No. 7649, Effective April 26, 1946.

P.M.

Run	Tr.	Out	Dumaine & Alexander	Dauphine & Canal	In	Time
794	7		453	510		
784	1		455	512		
797	2		457	514		
785	4		459	516		
805	19	453	501 536 IN	518	544	51
795	5		503	520		
790	6		505	522		
786	8		507	524		
791	9		509	526		
787	10		511	528		
804	11		513½	530½		
793	12		516	533		
788	13		518½	535½		

P.M. TRIPPER ADDED

Run	Tr.	Terminals						In	Act.	Pay
805	19	Dumaine & Alexander	OUT	453	501	536	IN	544		
		Dauphine & Canal			518				51	130

TOTAL TIME 166:26

Yours very truly,

Manager, Schedule Division

FIGURE 65.
TYPED NOTICE OF SCHEDULE CHANGE -
SAMPLE COMPANY UNDER STUDY.

and Run Sheet headings - are shown below the list of terminal times:

"P.M. TRIPPER ADDED

RUN	TRAIN	TERMINALS						IN	ACTUAL TIME	PAY TIME
805	19	DUMAINE-ALEXANDER	OUT	453	501	536		544		
		DAUPHINE-CANAL			518				0:51	1:30

TOTAL TIME 166:26"

The pay time of 1:30 hours shown above is, of course, based upon the minimum tripper pay time of one hour and 30 minutes.

The work sheet is then recopied by the schedule typist in the form of a notification of change (See figure 65). Seventeen copies are usually made, and these are distributed as follows:

Division Superintendent	1
Station Master	1
Supervisors	6
Paymaster	1
Mileage Clerk (Railway Earnings Department)	1
Equipment Department	1
Inspection Department	1
Extras	5

The typist corrects the Terminal Sheet and the typed Run Sheet of the schedule in effect in accordance with the change, and notes the nature and effective date of the change on these record forms.

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NOTICE

DOT-I-82-23

DOT-I-82-23

TECHNOLOGY SHARING

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