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OCA PAD INITIATION - PROJECT HEADER INFORMATION

12/08/95

Active

Project #: E-24-X98 Cost share #: Rev #: 0
Center #: 10/24-6-R8758-0A0 Center shr #: OCA file #:
Contract#: AGMT DTD 951205 Mod #: Work type : RES
Prime #: Document : AGR
Contract entity: GTRC

Subprojects ? : N CFDA:
Main project #: PE #:

Project unit: ISYE Unit code: 02.010.124
Project director(s):
CLARKE L W ISYE (404)894-2325

Sponsor/division names: ATLANTA PUBLIC SCHOOLS / ATLANTA, GA
Sponsor/division codes: 300 / 161

Award period: 951205 to 961204 (performance) 961204 (reports)

Sponsor amount	New this change	Total to date
Contract value	14,947.00	14,947.00
Funded	14,947.00	14,947.00
Cost sharing amount		0.00

Does subcontracting plan apply ? : N

Title: TRANSPORTATION PROJECT FOR ATLANTA PUBLIC SCHOOL SYSTEM

PROJECT ADMINISTRATION DATA

OCA contact: Brian J. Lindberg 894-4820

Sponsor technical contact Sponsor issuing office

JOHN O. NORTHROP JOHN O. NORTHROP
(404)827-8250 (404)827-8250

ATLANTA PUBLIC SCHOOLS ATLANTA PUBLIC SCHOOLS
ASSISTANT SUPERINTENDENT ASSISTANT SUPERINTENDENT
210 PRYOR STREET, S.W. 210 PRYOR STREET, S.W.
ATLANTA, GA 30335 ATLANTA, GA 30335

Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : N/A N/A supplemental sheet
Equipment title vests with: Sponsor GIT
NONE PROPOSED OR ANTICIPATED.
Administrative comments -
INITIATION OF PROJECT E-24-X98.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 01/29/97

Project No. E-24-X98 _____ Center No. 10/24-6-R8758-0A0_

Project Director CLARKE L W _____ School/Lab ISYE _____

Sponsor ATLANTA PUBLIC SCHOOLS/ATLANTA, GA _____

Contract/Grant No. AGMT DTD 951205 _____ Contract Entity GTRC

Prime Contract No. _____

Title TRANSPORTATION PROJECT FOR ATLANTA PUBLIC SCHOOL SYSTEM _____

Effective Completion Date 961204 (Performance) 961204 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	_____
Final Report of Inventions and/or Subcontracts	Y	_____
Government Property Inventory & Related Certificate	N	_____
Classified Material Certificate	N	_____
Release and Assignment	N	_____
Other _____	N	_____
Comments _____		

Subproject Under Main Project No. _____

Continues Project No. _____

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Management	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other _____	N
_____	N

NOTE: Final Patent Questionnaire sent to PDPI.

Final Report

**A Transportation Project for
Atlanta Public Schools System**

September, 1996

**Lloyd W. Clarke
The Logistics Institute
Industrial & Systems Engineering
Georgia Institute of Technology**

Pupil Pick-up Route Analysis

We present here an analysis of the routing that has been developed by the transportation department of the Atlanta Public Schools System. These routes have been used to pick-up public school students for the 1995-96 school year. APS has 421 regular routes. This does not include VTP, ESSOL, and special education routes. Here we use the term route to represent a series of stops for delivery to one school. We started with these 421 routes. For each of these routes we received

1. school
2. location of stops
3. sequence of stops
4. number of students at each stop

This data was provided mainly under the supervision of Dr. Robert Collins and Otis Moon. The analysis provided is dependent on the quality of this data. We did have trouble with receiving proper descriptors of the stops. An acceptable descriptor would be an address number and street or a street and cross street. Many locations were described with landmarks, which is not acceptable. After several months of effort to resolve the problems, we decided to do the analysis on 75% of the routes. We were able to find 324 routes that did not have any problems. Our analysis is on 324 of the 421 regular routes that are run by APS.

There are two characteristics of the delivery system that are worth noting here.

- School start times are separated by 30 minutes. This suggests a route length in the neighborhood of 30 minutes.
- Buses in use have capacity of 66, 72, and 89 students. Transportation would like to move toward full use of 72 buses for efficiency and maneuverability. This suggests route sizes of 89 or less, preferably 72 or less.

These expectations are violated often. There are several routes that are approximately one hour in length. There are also routes that have 100 or more students. Table 1 shows a summary of the original routes that we were provided. The data summarized is the length of routes in time, miles and the number of stops. The average route is 22 minutes and almost 9 miles. At the high end are routes over an hour in length and 26 miles. A one-hour commute is very undesirable. The majority of the very long routes occur in the northern part of the city. There appears to be a perception that these are better schools. Students are willing to travel long distances to go to these schools. APS may want to consider having these students provide their own transportation if they are attending a school out of zone. Graph 1 shows the distribution route time. The label "0:20" indicates the number of routes between 15 and 20 minutes in length. Graph 2 shows the distribution of ridership. A common efficiency measure is operating full vehicles. This measure identifies several buses that are operating with a very low volume.

The first change we made was to re-sequence the original routes. What we did here was only to change the order of the stops in the route. Everything else remained the same. The total miles traveled decreased by 5.6%. This is small improvement for a small effort. The summary of these results is in Table 1 and Graph 3.

The majority of the effort was placed in developing completely new routes. The summary of data on the new buses is found in Table 1. The total miles traveled were reduced by 18%. The objective in the new routes was to minimize the total number of miles traveled and the total number of routes used. We reduced the number of routes from 324 to 285. This is a saving of 39 routes. Since a bus can service 1-3 routes, this saving translates to 13 or more buses. This number depends on how the routes are assigned to buses. Since the start times of different schools levels are separated by 30 minutes, routes less than 30 minutes can possibly be serviced by the same bus. To reduce the number of total buses in the system we tried to make all our routes less than 30 minutes. In Graph 4 we see that most routes are at this limit. There are a few buses (usually serving north schools) that require more time due to their service region. We tried to make most of our routes suitable for 72 size buses. Looking at Graph 5, you can see that most of the buses are packed to capacity, in part due to the objective of reducing the number of routes and

There are two major things that APS needs to do to improve the operations of their transportation department. They need organization in the operations and review of the operations.

When we began this project we were not able to get accurate route information from the transportation department. There was not a uniform manner to store the information. Routes were the responsibility of different people that worked very differently with little interaction. Currently, APS is moving to a computerized route development system. This will force the matter of organization. We expect that the transportation department will be able to find solutions that will reduce their transportation miles by 20%. I also believe that they need to reexamine the hiring practices. They may be better serviced with fewer transportation employees involved in the route development if they hire people with some experience in transportation or computer decision support systems. Their operations will begin to revolve around their new computer system. Other school districts that have worked with computerized transportation systems for a while operate with very small departments.

The Atlanta Public School System also needs to initiate a system of review for transportation. They need to develop objectives and criteria for efficient operations. Possible goals can be

- reduce the total miles traveled
- reduce the total routes served
- reduce the total buses employed

This can happen slowly over the next several years. The easiest way to achieve an improvement is to not service students that attend a school outside of their district.

Overall APS has significant opportunity for improvement. They also have the power to make these improvements happen. We hope that this study can give them some guidance as to where the improvements can occur.

Lloyd W. Clarke, Ph.D.
Industrial & Systems Engineering
Georgia Institute of Technology

Table 1

Summary of Data

Original Routes (324)

Time

Total (All Routes)	Avg (Per Route)	Max (Single Route)
121:35	0:22	1:14

Mileage

Total (All Routes)	Avg (Per Route)	Max (Single Route)
2884.91	8.85	26.48

Stops

Total (All Routes)	Avg (Per Route)	Max (Single Route)
2394	7.34	32

Resequenced Routes

Time

Total (All Routes)	Avg (Per Route)	Max (Single Route)
115:30	0:21	1:08

Mileage

Total (All Routes)	Avg (Per Route)	Max (Single Route)
2730.57	8.38	26.48

Stops

Total (All Routes)	Avg (Per Route)	Max (Single Route)
2394	7.34	32

New Routes (285)

Time

Total (All Routes)	Avg (Per Route)	Max (Single Route)
111:28	0:23	0:59

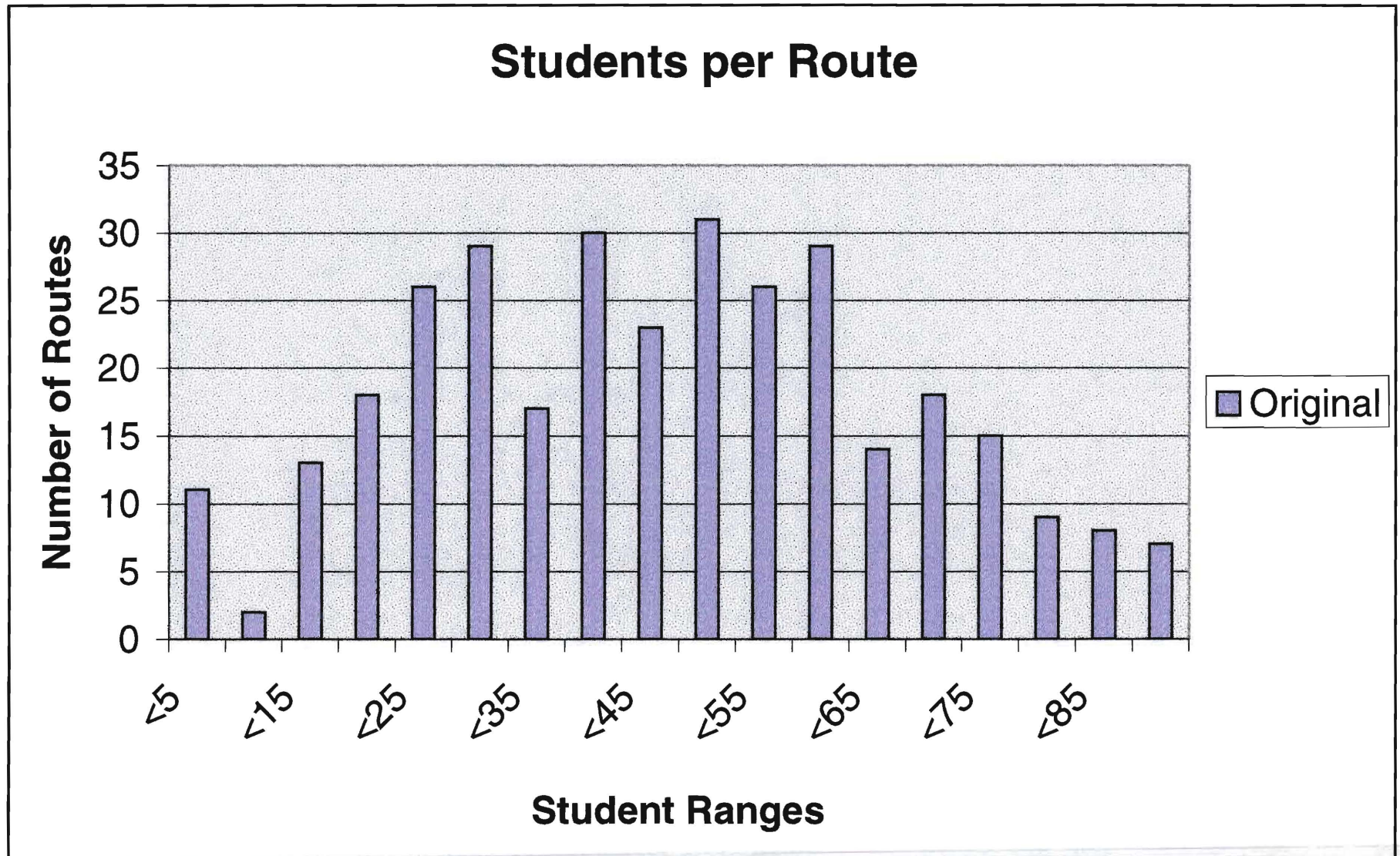
Mileage

Total (All Routes)	Avg (Per Route)	Max (Single Route)
2436.72	8.52	24.23

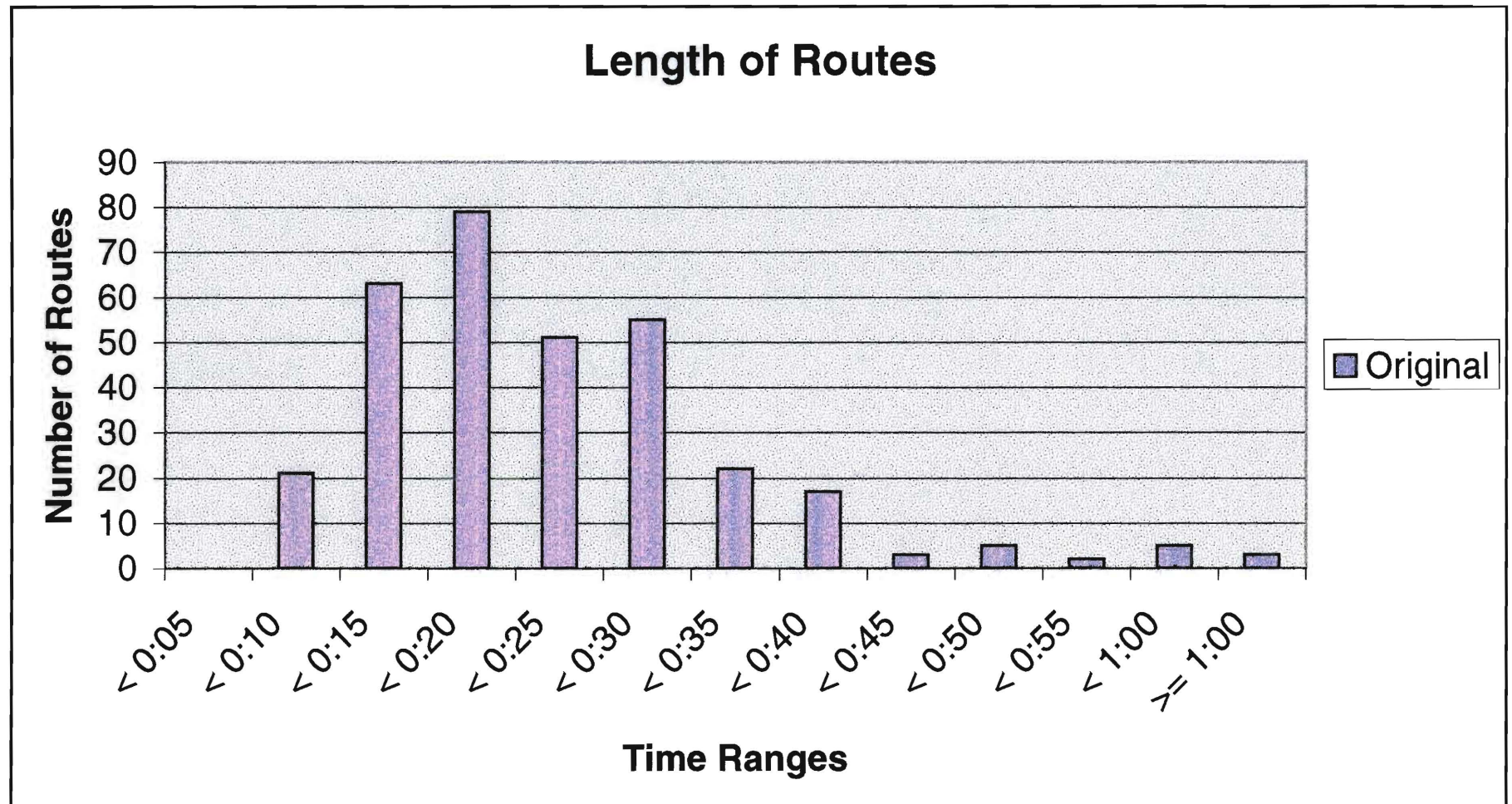
Stops

Total (All Routes)	Avg (Per Route)	Max (Single Route)
2326	8.13	28

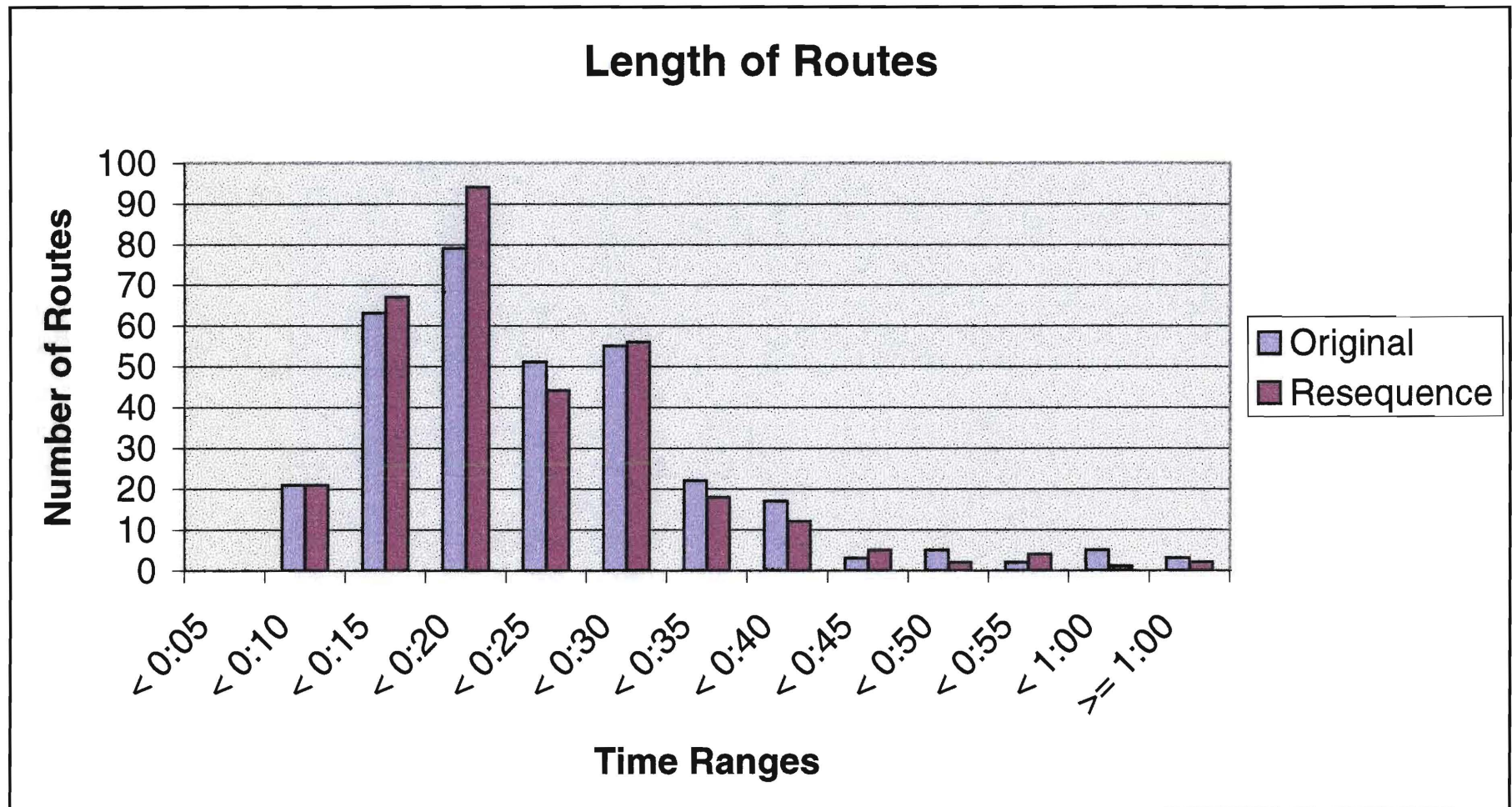
Graph 1



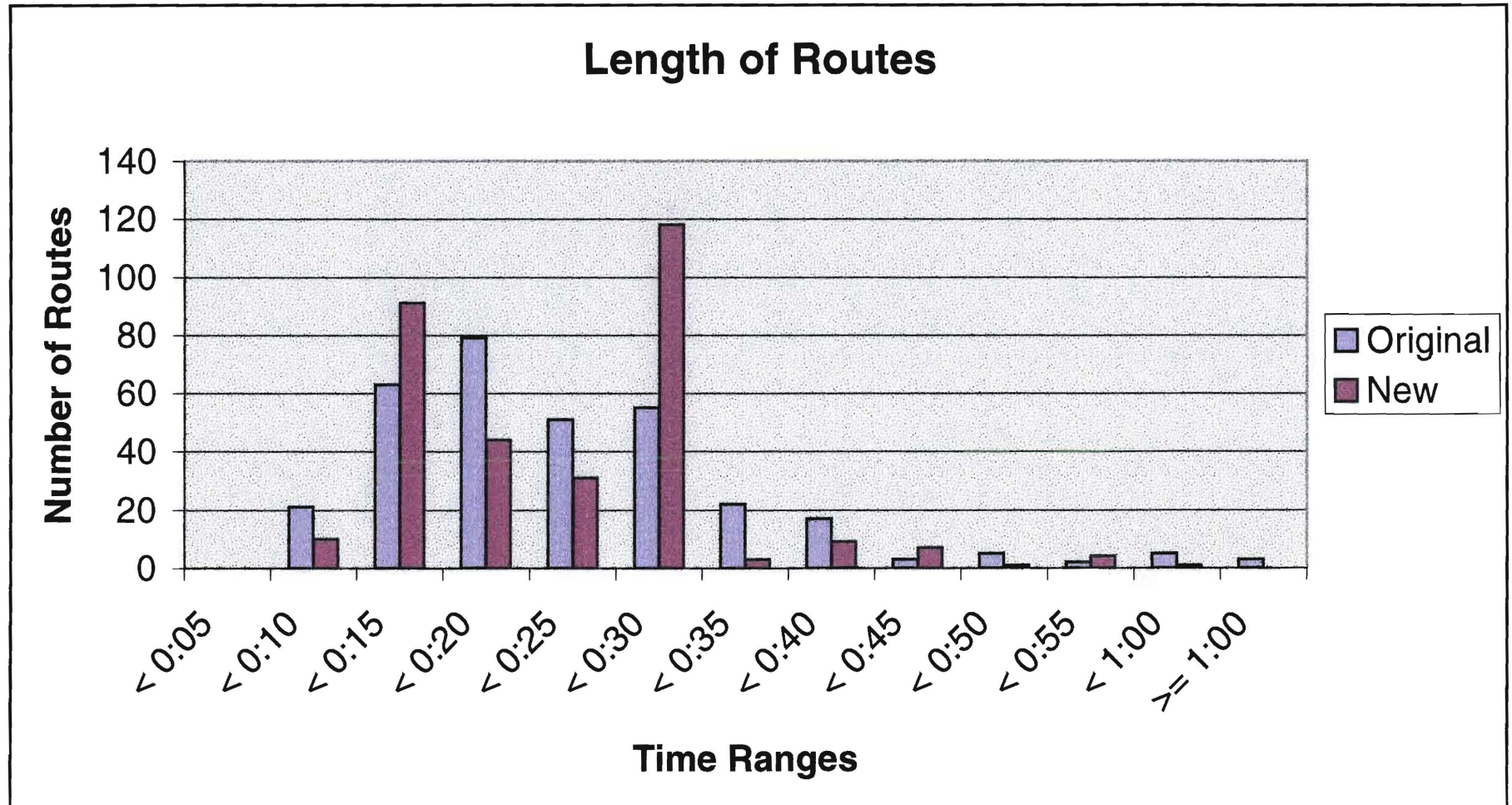
Graph 2



Graph 3



Graph 4



Graph 5

