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Railroad Subsidy: County Share

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CONTENTS

LIST OF TABLES , Formats

CONTENTS (continued)

1. INTRODUCTION

Assistant Commissioner Peter E. Stangl requested that the Division of Research and Development investigate and develop a methodology to distribute a portion of the New Jersey Railroad passenger subsidy cost between the counties.

Initially three weeks were allocated for conduction of a literature search and suggestion of various methodologies for subsidy allocation. The literature search was conducted. Contacts were made with department personnel, various Transportation Authorities, Departments of Transportation, Consultants, Federal Railroad Administration, Planning Commissioners, University Personnel and County Transportation Representatives. The 1974 New Jersey Passenger Origin and Destination Survey was evaluated as a source of information for passenger mile calculations and a per rider county of origin allocation. Various reports were received including one on taxation support of Transportation Authorities and four reports on the WMATA subsidy distribution formulations. A memorandum outlining seven methodologies along with a potential ridership estimation was prepared. A synopsis was forwarded to Commuter Services on September 1.

In a meeting with Commuter Service personnel On October 27 an allocation model was decided upon. The model is based equally upon car miles and the latest survey of 1976 eastbound on passengers weighted by the 1974 O & D survey.

Initially work was started on November 8 with obtaining copies and interpretation of the 684 pages of the 1974 origin codes of the eastbound passengers that answered the survey questionaires. The effort continued with obtaining train consists, summarized on-off May 1976 passenger counts, on-off counts by trains, latest schedules, 180 day subsidy costs for all divisions except the Erie Lackawanna and receipt on December 2 of the L.E. Peabody & Associates 5 year projections of the low and high deficit estimates by division

Terms are defined and the Procedure and Results are qualified by the Notes of Qualification and Definitions in Section 3. Data intrepretation, calculations, and tabulations were in accordance with the procedures outlined in Section 4.

2. SUMMARY OF RESULTS

The five year projection of New Jersey Rail Service deficits - dollars by Fiscal Year for all lines - distributed among all 27 counties are as defined in Tables 11 (high deficit projection) and Table 12 (low deficit projection) pages 31 to 34 . These tables are for 100% distribution of the deficits, without UMPTA Section 17 funds, to the counties.

Distribution of deficits among seven southern New Jersey counties, not distinguised between in the 1974 O & D Survey, is suggested by a gravity gradient model, where the variable is the straight line distance between the most utilized of the stations, Trenton, and the distance to the respective county seats. These distributions are listed on the second pages of each of the Tables 11 and 12 pages 32 and 34

The distribution factors for the Princeton Spur deficit is listed in Table 8 page 27 for the counties as (to 3 decimal places)

Mercer	-	.986
Somerset	-	.004
Hunterdon	-	.007
Middlesex	-	.003

In addition, the factors were determined on the basis of the distribution to the townships affected and the City of Trenton. The factor for Princeton Township is .953 Values for other townships are as listed in Table 9 page 29.

Dollar values attributable to the Princeton Spur are not included in any tables.

3. NOTES OF QUALIFICATION AND DEFINITIONS

3.1 Car Miles

Schedules are as listed in Table 1 page 12. Numbers were assigned to each schedule for ease of identification.

- Cars, type, size, age, express, local, etc. are not distinguished in the calculation. All cars are considered the same.
- There is a requirement for a train to stop at a station in a county for the cars of that train to be considered as part of the car miles in that county.
- State boundaries and county boundaries, in addition to the distance that a car travels is a county determined county miles.

- Track miles and cars traveling that track are dependent. Cars and track miles must correspond. This dependency was maintained by track segment identification where each segment is defined by the county boundary, state boundary and the first station stop. Within a county and for all counties on that line track segments are determined by the first station stop if that car did not travel across two county boundaries of the same county. Track segments, defined by the closest station name or names, are as defined in Table 2 pages 13 to 16.
- Total car miles used for the car miles factor calculation includes only stops, no pass thru miles are included.
- In determining car miles the distances between stations listed in the schedules was utilized along with two plates (the political subdivision plate and the rail line and station plate) of the 57 plates of the 1976 New Jersey Highway Map and Guidein order to determine the divisions of track miles between the two stations on the same line each located in different but adjacent counties.
- Cars traveling eastbound and westbound and on Saturdays, Sundays and Holidays were included in the car mile determination.
- The number of cars per train were obtained fron consists provided by Commuter Services.

3.2 Passengers - County of Origin

- The determination of the number of people boarding a station from a particular county was determined by utilizing the 1974 New Jersey Railroad Passenger Survey. Survey Books 1 and 2, tabulation 2 were utilized for determining the origins of the passengers boarding a

railroad station in New Jersey and heading east for a 24 hour period in May (Summation time period 1-8).

- Since the O & D Survey was made only for eastbound passengers on a weekday, the application of this data was to the latest 1976 eastbound on passenger survey by station, by train, and to the summary by station.
- Passengers from the same stations or different stations in the same county but different lines were kept separate.
- In the 1974 Survey, the passengers of the Penn Reading Seashore line were not surveyed. Therefore, the "ons" of the latest on count were considered to reside in the county of the boarding station.
- The basis for the division of passengers per line was on N.J. residents only. While out of state residents boarding trains at N.J. stations were tabulated from the 1974 survey and the appropriate percentages for out of state passengers were determined from the 1976 survey, these were excluded fron any passenger factor determination.

3.3 SUBSIDIES

- Initially the dollar values to be utilized in the distribution were to be on a basis of the offer of financial assistance to divisions of ConRail. However, data on the Erie Lackawanna was not abailable in the same form as for the other Divisions. Mr. Herkner offered the L.E. Peabody & Associates, Inc., report as the best source of deficit data for projection and comparison. This data is for fiscal years 77 to 81 and excludes any UMPTA section 17 funds. See Table 7 page
- The L.E. Peabody & Associates, Inc. projection was for the Divisions of ConRail. Apportioning the deficits among the various lines of a division was by equal weighting of car miles and passengers, county of origin.

- Since passengers, county of origin, and car miles enter into the formulation independently, all calculations on passengers or car miles are segregated and come together only for subsidy division amongst lines and determination of the county factor per line.
- The subsidy factors were determined for the Princeton Spur according to the equal weighting of the car miles and passengers, county of origin. However, subsidy factors were also determined on the equivalent basis on the political subdivision of origin. These factors are listed in Table 9 page 29.
- In the 1974 O & D Survey passengers from seven southern New Jersey counties without major ConRail divisions were listed in the data bank under one 5 digit code. A method of distribution of these passengers among the seven counties is offered by the gravity gradient model, where the variable is the straight line distance between the most utilized of the stations, Trenton, and the distance to the respective county seats. These factors are listed in Table 10 page 30.

3.4 TABLES AND FORMATS

Traceability of all data and calculations is maintained by the utilization of various formats. This arrangement allows for ease of calculation, and verification before proceeding.

For the purposes of this report the tables are identified at the top of the page and if the table corresponds to a format the format number is listed at the bottom, right side.

4. PROCEDURE

An outline of the procedure followed in arriving at the final results is defined below in steps 1 to 16. A flow chart and an abbreviated

Definitive descriptions of each of the formats are contained in Table 3, pages 19 to 22.

1. The schedules (Table 1, page 12) were obtained, along with consists, from Commuter Services. Copies of the schedule were made, the cars per train were inserted on the Xerox copied schedule at the top near each train number. The stations on the schedule were divided with red horizontal lines across the schedule according to the counties in which the stations were located. Cars were summed for each condition: eastbound, westbound, Saturdays, Sundays, Holidays and track segment and recorded on a work sheet where the appropriate factor for the weekdays, Saturdays, Sundays and holidays per year were applied to the cars.

   Cars traveling the same track segment (Table 2 pages 13 to 16) were summed and recorded on Format 1. Format 1 consists of tract segments listed down the left side of a sheet of a columnar pad with county names across the top. Recorded are total cars per track segment per year.
2. Using the track miles listed in the schedule and the special map, the track miles per tract segment were determined and were recorded on Format 2. Format 2 consists of track segments listed down the left side of a sheet of a columnar pad with county names across the top.
3. Format 3 consists of track segments listed down the left side of a sheet of a colunnar pad with county names across the top. Recorded are total car miles per track segment. Format 3 results from the multipication of Formal 1 - cars per track segment by Format 2 - total miles per corresponding track segment. The data from Format 3 is used in Formats 8 and 12.

4. The 684 pages of computer printout of the 1974 O & D Survey, train stations codes, political subdivision codes and the special map were utilized to determine the number of passengers who replied to the survey from the various counties and boarding a N.J. rail station. Format 4 consists of N.J. counties, replies but of unknown origin and out of state areas listed down the left side of a sheet of a columnar pad with the names of the boarding stations listed across the top. Recorded on this format are the 1974 passengers, county of origin, for each boarding station. The percentage of passengers boarding a station from each of the counties and the combination - the total unknown and out of state regions - to the total boarding at that station was determined and listed next to passengers on this format.

5. The 1976 eastbound on passengers from the latest survey (by train, by station and summary), the percentages of passengers from each county, and the combined out of state and unknowns for each station from Format 4, were utilized to distribute the 1976 passengers among counties of origin.

   Format 5 consists of N.J. counties, unknowns and out of state areas listed down the left side of a sheet of a columnar pad with the names of the boarding stations listed across the top. Passengers from a N.J. county boarding a set of stations in a county (a track segment) were summed.

6. Format 6 consists of track segments listed down the left side of a sheet of a columnar pad with county names listed across the top. Passengers (1976 modified by the 1974 O & D Survey) from a N.J. county boarding a set of stations in a county (a track segment) summed on Format 5 are recorded on Format 6, Passengers, county of origin, riding all track segments on a line are summed. This sum is utilized in all further calculations.

7. Format 7 (Table 4, page 23) is taken from the October 13,1976 L.E. Peabody & Associates report on the rail deficit projections.

8. In Format 8 the car miles (from Format 3) are summed for the track segments comprising a line. The percentage of a line's car miles to the total car miles for a division is determined. This percentage is multiplied by the wieghting factor, 0.5.

9. In Format 9 the passengers boarding stations in a track segment are summed with passengers from all the track segments comprising a line. The percentages of a line's passengers to the total for a division is determined. The percentage is multiplied by the weighting factor, 0.5.

10. Format 10 (Table 5, page 24) contains the factors for distribution of a Division's deficit among the line comprising that division (Format 8 + Format 9 = Format 10)

11. Format 11 (Tables 6 and 7, pages 25 and 26) contains the projected deficit (5 year, high and low estimate) for each line of a division. (Format 7 - deficit by Division) x(Format 10 - line subsidy factor) = Format 11.

12. Format 12 contains the county car mile factor. Data from Format 3 (car miles/track segment) is utilized to determine the percentage of car miles in a county to the total for a line. The percentage is multiplied by the weighting factor, 0.5.

13. Format 13 contains the passenger county of origin factor. Data from Format 6 (passengers county of origin/track segment) is utilized to determine the percentage of passengers per track segment in a county to the total passengers for a line. The percentage is multiplied by the weighting factor 0.5. The appropriate count car mile factor from Format 12 is added to the passenger county of origin factor.

14. The results of the sum in Format 13 is recorded on Format 14 (Table 8, pages 27 and 28). In addition to the determination of the subsidy factors for the Princeton Spur by county, the factors were also determined by township and by the City of Trenton. Table 9, page 29, contains these factors.

15. Format 15 consists of the names of the various lines listed down the left side of a sheet of a columnar pad with 5 fiscal years - low estimate and 5 fiscal years - high estimate listed across the top. There are 18 sheets of Format 15, one per county or set of counties. Data recorded on Format 15 results from the multiplication of the subsidy factor for a county for a line (Format 14) by the projected low and high deficit projections for each line for the 5 fiscal years (Format 11). The deficit projections for the low and high estimates for each of the fiscal years for each of the lines are summed. This sum represents the dollars that a county would be requested to pay were 100% of the deficits distributed to the counties.

16. Format 16 (Table 11 and 12, pages 31 to 34) represents 100% distribution of the L.E. Peabody & Associates projected deficits for all Divisions to each of the counties, ie. the sums from Format 15. Distribution of the deficits among the seven southern counties is offered by the gravity gradient factors listed in Table 10, page 30.

TABLE 1 - SCHEDULES

SCHEDULE NO.	DESCRIPTION	EFFECTIVE DATE
1	Trenton, New Brunswick, New York - Main	April 25, 1976
2	Pascack Valley Line	July 1, 1976
3	Main Line - Bergen County Line	October 1, 1976
4	Boonton Line	October 1, 1976
5	Philadelphia, Atlantic City, Cape May - Penn Reading Sea Shore	June 18, 1976
6	Raritan, Phillipsburg, Philadelphia, N.Y., Newark, Bayonne - CNJ	April 25, 1976
7	Morristown, Montclair, Gladstone	July 1, 1976
8	North Jersey Coast	June 27, 1976

TABLE 2 - TRACK SEGMENT IDENTIFICATION

SCHEDULE NO.	DIVISION OR LINE	TRACK SEGMENT NOS.	STATIONS
1	Penn Central	1	Princeton to Princeton Jct.
		2	Trenton to Princeton Jct.
		3	Jersey Ave. to Metro Park
		4	Rahway to N. Elizabeth
		5	Arrive Newark
2	Pascack Valley	6	Montvale to Woodbridge
		7	Arrive Hoboken
3	E. L. Main	8	Mahwah to Waldwick
		9	Waldwick to Passaic Line
		10	Hawthorne to Delawanna
		11	Lyndhurst to Kingsland
		12	Arrive Hoboken
4	E. L. Bergen Co.	13	Mahwah to Waldwick
		14	Waldwick to Rutherford
		15	Arrive Hoboken
4	E. L. Boonton	16	Netcong to Dover
		17	Dover to Lincoln Park
		18	Lincoln Park
		19	Mt. View to Great Notch
		20	Mt. Heights to Rowe St.
		21	N. Newark to Hoboken

SCHEDULE NO.	DIVISION OR LINE	TRACK SEGMENT NOS.	STATIONS
5	Penn Reading Sea Shore	22	Lindenwold to Co. Line (Hammon
		23	Lindenwold to Co. Line (Tuck-a Hoe)
		24	Hammonton to Atlantic City
		25	Tuck-A-Hoe to Ocean City 10t St.
		26	Tuck-A-Hoe to Cape May
6	Reading	27	West Trenton to Hopewell
		28	Belle Mead to Bound Brook
		29	Arrive Newark
6	Central of New Jersey	30	Raritan to Bound Brook
		31-1	Dunellen
		32-1	Grant Ave. to Cranford-Roselle Park
		33-1	Arrive Newark
		34	Cranford to Roselle Park
		33-2	Arrive Newark
		35	Plainfield to Roselle Park
		33-3	Arrive Newark
		36	Phillipsburg to Bloomsburg
		37	Hampton to Lebanon
		38	White House to Bound Brook
		31-2	Dunellen
		32-2	Westfield

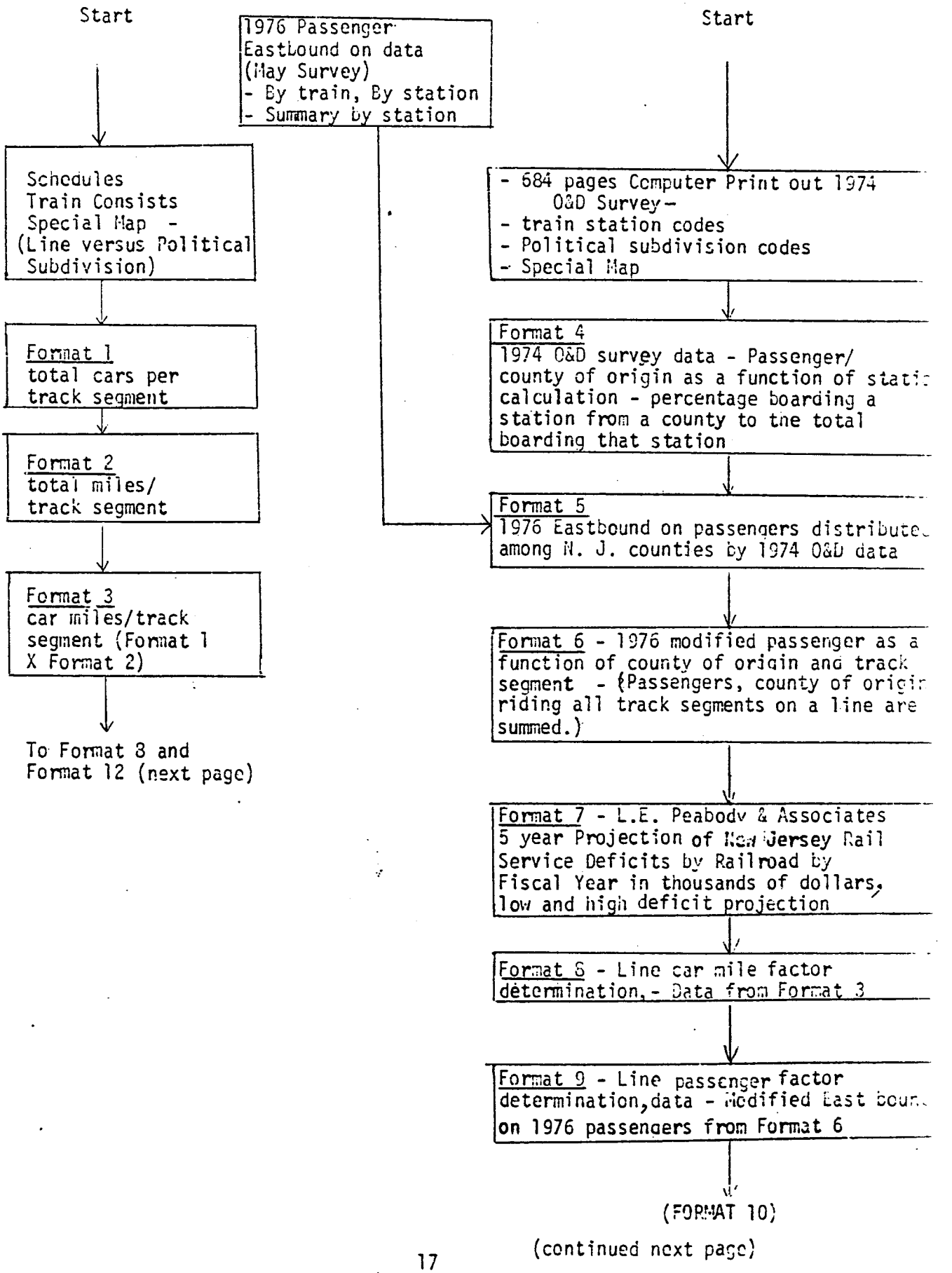
TABLE 2 - continued

SCHEDULE NO.	DIVISION OR LINE	TRACK SEGMENT NOS.	STATIONS
6		40	Raritan to Bound Brook
		31-3	Dunellen
		41	Grant Ave. to Elizabeth Port
		42-1	W. 8th St. to E. 33th St. (Bayonne)
		43	Cranford to Elizabeth Port
		42-2	W. 8th St. to E. 33th St. (Bayonne)
7	Morristown	44	Netcong to Dover
		45	Dover to Denville
		46	Denville to Chatham
		47-1	Summit
7	Montclair	48-1	Shorthills to Newark
		49-1	Harrison to Hoboken
		50	Montclair to Newark
		49-2	Harrison to Hoboken
7	Morristown	51	Summit
		48-2	Shorthills to Newark
		49-3	Harrison to Hoboken
7	Gladstone	52	Bernardsville to Lyons
		53-1	Millington to Gillette
		54-1	Berkly Hts. to Summit

TABLE 2 - continued

SCHEDULE NO.	DIVISION OR LINE	TRACK SEGMENT NOS.	STATIONS
7	Gladstone (cont.)	48-3	Shorthills to Newark
		49-4	Harrison to Hoboken
7	Morristown	55	Morristown to Chatham
		47-2	Summit
		48-4	Shorthills to Newark
		49-5	Hoboken
7	Gladstone	56	Gladstone to Lyons
		53-2	Millington to Gillette
		54-2	Berkly Hts. to Summit
		48-5	Shorthills to Newark
		49-6	Harrison to Hoboken
8	Penn Central	PC 57-1	Bayhead to Pt. Pleasant
		PC 58-1	Manasquan to Matawan
		PC 59-1	St. Amboy to Avenel
		PC 60-1	Rahway to Elizabeth
		PC 61-1	Newark
8	Penn Central	PC 59-2	St. Amboy to Avenel
		PC 60-2	Rahway to Elizabeth
		PC 61-2	Newark
8	Central New Jersey	CNJ 57-1	Bayhead to Pt. Pleasant
		CNJ 58-1	Manasquan to Matawan
		CNJ 59-1	St. Amboy to Perth Amboy
		CNJ 61-1	Newark

Figure 1 - Procedure Flow Chart



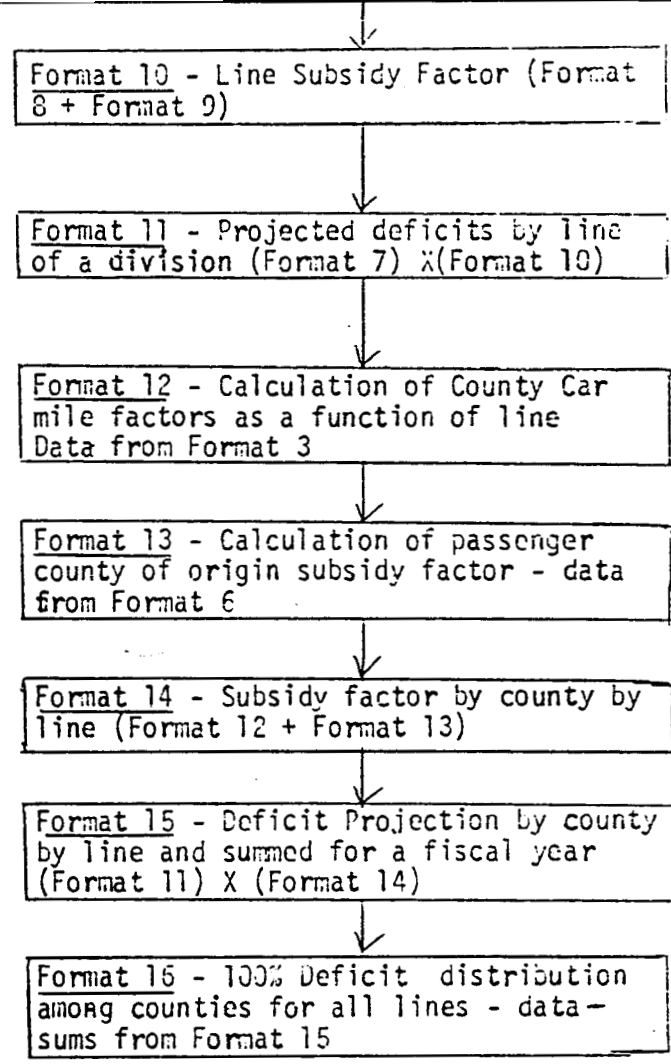


Figure 1 - continued

FORMAT LAYOUT

:T	DESCRIPTION	Column Names down left side	Column Names across the top	DATA RECORDED	DATA FROM PREVIOUS FORMATS UTILIZED	CALCULATIONS ON FORMAT
	Railroad Cars by line, by county as a function of track segment	Track segments	Names of the counties	Total yearly cars/track segments	None	None
	Railroad tracks mileage line, by county as a function of track segmen	Track Segments	Names of the Counties	Total miles/ track segment	None	None
	Car miles/track segment	Track segment	Names of the counties	Total yearly car miles/ track segment	Format 1 x Format 2	None
	1974 O & D Eastbound Passengers by county of origin (by region for out-of-state) by line, by boarding station for each schedule	Names of counties, unknowns, out-of-state regions	Names of boarding stations	1974 Eastbound Passengers who responded to O & D Survey	None	Passengers, percentage from each county or sum of out-of-state regions and unknowns to the total boarding at a station.
	1976 Eastbound on passengers distributed among N.J. counties by 1974 O & D Data	Names of counties and others - unknown and out-of-state regions	Names of boarding stations	a. 1976 eastbound on passengers from the latest survey listed across at the top of each column. b. Percentages from Format 4 x (a).	Percentages from Format 4	Passengers, county of origin, riding each track segment on a line are summed.

(continued)

FORMAT LAYOUT

AT	DESCRIPTION	Column Names down left side	Column Names across the top	DATA RECORDED	DATA FROM PREVIOUS FORMATS UTILIZED	CALCULATIONS ON FORMAT
	1976 eastbound ons modified by 1974 O & D study	Track segments	Names of the counties	Passengers, county of origin, riding each track segment on a line	Sums From Format 5	a. Passengers county of origin, riding all track segments on a line are summed. b. Passengers from all counties on a line are summed. c. Passengers from all counties riding a track segment are summed
	L.E. Peabody & Associates 5 year Projection of New Jersey Rail Service Deficits by Fiscal Year in thousands of dollars (See Table 4 page 23)	ConRail Divisions	Fiscal Years 77-81 low & high estimate	Projected Deficit Dollars	None	None
	Line Car Mile Factor	Rail lines as a function of ConRail Divisions	a. Track segments in a line. b. car miles/ set of track segments (line) c. Car miles/ division d. ratio $\frac{b}{c}$ e. ratio x .5	Car Miles per set of track segments (a line)	Format 3	a. sum car miles per division. b. ratio car miles / line to total/ division c. ratio from b x 0.5 (line car mile factor)

(continued)

FORMAT LAYOUT

MAT	DESCRIPTION	Column Names down left side	Column Names across the top	DATA RECORDED	DATA FROM PREVIOUS FORMATS UTILIZED	CALCULATIONS ON FORMAT
	Line, Passenger, county of origin, factor	Rail lines as a function of ConRail Divisions	a. track segments in a line b. passengers/set of track segments (line) c. passengers/division d. ratio $\frac{b}{c}$ e. ratio x .5	sum of passengers, county of origin per set of track segments (a line)	Format 6	a. sum passengers per division. b. ratio passengers/line to total/division c. ratio from b. x0.5-line passenger Factor.
	Line Subsidy Factor (See Table 5 page 24)	Rail Lines as a function of ConRail Divisions	Line Subsidy Factor	Subsidy Factor	Format 8 + Format 9	None
	Projected deficits by line of a Division (See Tables 6 & 7 pages 25 and 26)	Rail lines as a function of ConRail Divisions	Low estimate Fiscal years 77-81, High Estimate Fiscal Years 77-81	Projected Deficits	Format 7 x Format 10	None
	County Car Mile Factor, as a function of Line	Rail Lines	Name of Counties	Car miles per county/line	Format 3	a. Ratio car miles/county to line total b. Ratio x .5

TABLE, 3 - FORMATS
(continued)

FORMAT LAYOUT

\T	DESCRIPTION	Column Names down left side	Column Names across the top	DATA RECORDED	DATA FROM PREVIOUS FORMATS UTILIZED	CALCULATIONS ON FORMAT
	Passenger, County of Origin Factor	Rail Lines	Names of Counties	Passengers, County of Origin/ Line	Format 6	a. ratio passengers, county of origin, to line total b. ratio x .5
	Subsidy Factor by County by Line (See Table 8 pages 27 and 28)	Rail Lines as function of ConRail Division	Names of Counties	Subsidy Factor	Format 12 · + Format 13	None
	Deficit Projection by County by Line	Rail lines as a function of ConRail Divisions along with subsidy Factor for a particular county	Names of a Particular County -Low Estimate Fiscal years 77-81 -High Estimate Fiscal Years 77-81	Projected Deficits for a particular county as a function of line	Format 11 x Format 14	Deficits for a fiscal year are summed
	100% Deficit Distribution among counties for all lines (See tables 11 and 12, pages 31 to 34)	Names of counties and 7 counties	-Low Estimate Fiscal Years 77-81 - High Estimate Fiscal Years 77-81	Projected Deficits for all lines as a function of Fiscal Year for each county.	Sums from Format 15	None

Table 4

FIVE YEAR PROJECTION OF NEW JERSEY RAIL SERVICE DEFICITS BY RAILROAD BY FISCAL YEAR IN THOUSANDS OF DOLLARS*

Schedule Nos.	Railroad	Low Estimate FY 77	FY 78	FY 79	FY 80	FY 81	High Estimate FY 77	FY 78	FY 79	FY 80	FY
1, 2	Penn Central	17,964	21,256	24,940	28,181	31,142	23,140	26,879	31,077	34,775	38,
2,3,4,7	Erie Lackawanna	18,021	22,223	24,875	28,058	30,946	19,104	23,428	26,209	29,488	32,
6	Reading	248	292	341	385	426	248	292	341	385	
6, 8	Central of N. J.	12,259	13,852	15,647	17,252	18,697	15,675	17,565	19,697	21,607	23,
5	Penn Reading Sea Shore Line	1,344	1,483	1,644	1,788	1,914	1,344	1,483	1,644	1,788	1,
	TOTALS	49,836	59,106	67,447	75,664	83,125	59,511	69,647	78,968	88,043	96

*Exhibit 2 of

L. E. Peabody & Associates, Inc. Report - from William W. Whiteburst, Jr. to Mr. Richard J. Anderson, Director, Division of Commuter Services, October 13, 1976

Conditions - level of service remains unchanged from pre ConRail assumption throughout the 5 year projection period

- fares remain unchanged

- ridership remains unchanged

- UMPTA Section 17 funds are not included

- all changes are directly attributable to:
  (1) the impact of RSPO Standards for determining Commuter Rail Continuation Subsidies
  (2) changes in cost levels

(FORMAT 7)

Table 5

FACTORS FOR DETERMINATION OF SUBSIDY PROJECTION BY LINE

Divisions	Rail Lines	Sch. No.	Composed of Track Segment (s) (No. (s) included per line)	.5 (Car Mile factor) +.5 (Passenger County of Origin Factor
Penn Central -	Princeton Spur	1	1	.5 + .5 = 1.0
	Main	1	2, 3, 4, 5	.286345 + .275697 = .562042
	South Amboy	8	PC 59-2, PC 60-2, PC 61-2	.036086 + .086486 = .122572
	Coast	8	PC 57-1,PC 58-1, PC 59-1,PC 60-1,PC 61-1	.177569 + .137816 = .315385
Erie Lackawana-	Pascack Valley	2	6, 7	.026730 + .042190 = .068920
	Main Line	3	8, 9, 10, 11, 12	.039652 + .048590 = .088242
	Bergen	3	13, 14, 15	.059765 + .085456 = .145221
	Boonton	4	16, 17, 18, 19 20, 21	.046994 + .052226 = .099220
	Morristown	7	(44,45,46,47-1,48-1,49-1),(51,48-2,49-3), (55,47-2,48-4,49-5)	.227554 + .188046 = .415600
	Montclair	7	50, 49-2	.010408 + .012562 = .022970
	Gladstone	7	(52,53-1,54-1,48-3,49-4)(66,53-2,54-2,48-5, 49-6)	.088898 + .070931 = .159829
C.N.J.	Reading	6	27, 28, 29	.5 + .5 = 1.0
	Main	6	(30,31-1,32-1,33-1),(34,33-2),(35,33-3), (36,37,38,31-2,32-1,33-4),(40,31-3,41,42-1), (43,42-2)	.293709 + .3312165 = .6249255
	Coast	8	(CNJ 57-1, CNJ 58-1, CNJ 59-1, CNJ 61-1)	.206291 + .1687835 = .3750745
Penn Reading		5	22,23,24,25,26	.5 + .5 = 1.0

(FORMAT 10)

SUBSIDY PROJECTION BY LINE

HIGH ESTIMATE

Rail Lines	FY 77	FY 78	FY 79	FY 80	Fy 81
Penn Central					
Princeton Spur					
Main	13,005,651.88	15,107,126.92	17,466,579.23	19,545,010.55	21,435,157.80
South Amboy	2,836,316.08	3,294,612.79	3,809,170.04	4,262,441.30	4,674,650.94
Coast	7,298,008.90	8,477,233.42	9,801,219.64	10,967,513.38	12,028,153.13
Erie Lackawanna					
Passack Valley	1,316,647.58	1,614,657.76	1,806,324.08	2,032,312.96	2,238,039.16
Main Line	1,685,775.17	2,067,333.58	2,312,734.58	2,602,080.10	2,865,482.47
Bergen	2,774,301.98	3,402,237.59	3,806,097.19	4,282,276.85	4,715,761.53
Boonton	1,895,498.88	2,324,526.16	2,600,456.98	2,925,799.36	3,221,971.06
Morristown	7,939,622.40	9,735,676.80	10,892,460.40	12,255,212.80	13,495,778.80
Montclair	438,818.88	538,141.16	602,020.73	677,339.36	745,904.81
Gladstone	3,053,373.22	3,744,473.81	4,188,958.26	4,713,037.55	5,190,127.12
C.N.J.					
Reading	248,000	292,000	341,000	385,000	426,000
Main	9,795,707.21	10,976,816.41	12,309,157.57	13,502,765.29	14,572,012.81
Coast	5,879,292.79	6,588,183.59	7,387,842.43	8,104,234.72	8,745,987.19
Penn Reading	1,344,000.00	1,483,000.00	1,644,000.00	1,788,000.00	1,914,000.00

(FORMAT 11)

SUBSIDY PROJECTION BY LINE

LOW ESTIMATE

Rail Lines	FY 77	FY 78	FY 79	FY 80	FY 81
Penn Central					
Princeton Spur					
Main	10,096,522.49	11,946,764.75	14,017,327.48	15,838,905.60	17,503,111.96
South Amboy	2,201,883.41	2,605,390.43	3,056,945.70	3,454,201.53	3,817,137.22
Coast	5,665,574.14	6,703,823.56	7,865,201.90	8,887,864.69	9,821,719.67
Erie Lackawanna					
Passack Valley	1,242,007.32	1,531,609.16	1,714,385.00	1,933,757.36	2,132,798.32
Main Line	1,590,209.82	1,961,001.97	2,195,019.75	2,475,894.04	2,730,736.93
Bergen	2,617,027.64	3,227,246.28	3,612,372.38	4,074,610.82	4,494,009.07
Boonton	1,788,043.62	2,204,966.06	2,468,097.50	2,783,914.76	3,070,462.12
Morristown	7,489,527.60	9,235,878.80	10,338,050.00	11,660,904.80	12,861,157.60
Montclair	413,942.37	510,462.31	571,378.75	644,492.26	710,829.62
Gladstone	2,880,278.41	3,551,879.87	3,975,746.38	4,484,482.08	4,946,068.23
C.N.J.					
Reading	248,000.00	292,000.00	341,000.00	385,000.00	426,000.00
Main	7,660,961.70	8,656,468.03	9,778,209.30	10,781,214.73	11,684,232.07
Coast	4,598,038.30	5,195,531.97	5,868,790.70	6,470,785.27	7,012,767.93
Penn Reading	1,344,000.00	1,483,000.00	1,644,000.00	1,788,000.00	1,914,000.00

(FORMAT 11)

Table 8

SUBSIDY FACTOR BY COUNTY BY LINE = .5 (car mile factor) + .5 (passengers, county of origin factor)

Rail Lines	1 Warren	2 Morris	3 Passaic	4 Bergen	5 Hunterdon	6 Somerset	7 Union	8 Essex	9 Hudson	10 Mercer
Penn Central										
Princeton - P. Jct.	----	----	----	----	.006757	.003785	----	----	----	.9864865
Main	.000389	.0005055	.000389	.0001165	.000847	.0262195	.20043	.115279	.001245	.136675
South Amboy	----	.000992	.015873	----	----	----	.3794435	.1731095	----	----
Coast	.0006225	.0002335	----	.0001555	.000311	----	.073465	.06346	.0001555	.0002335
Erie Lackawanna										
Pascack Valley	----	.000202	----	.88429	----	----	----	----	.112474	----
Main Line	----	.000351	.347247	.5476085	.0001755	----	.001756	.0165085	.086177	----
Bergen to Line	----	----	.0174755	.8697115	.000599	----	----	----	.111215	----
Boonton	.002451	.383571	.1833315	.001144	.000327	.000490	----	.2813575	.115138	----
Morristown	.0003175	.494860	.0001815	.000136	.0001815	.0010435	.1183645	.278982	.104027	----
Montclair	----	.0006795	.008152	.002038	----	----	----	.7042465	.2848835	----
Gladstone	.000842	.1045415	----	----	.0134745	.32451	.3128225	.153563	.039645	----
C.N.J.										
Reading	----	----	----	----	.0827815	.4225465	----	.063422	----	.431250
Main	.0097945	.000516	.000221	.001032	.0603435	.184487	.570760	.058081	.0111645	----
Coast	.0002895	----	----	----	----	----	---	.044278	----	----
Penn Reading Sea Shore Line	----	----	----	----	----	----	----	----	----	----

Table 8

SUBSIDY FACTOR BY COUNTY BY LINE = .5 (car mile factor) + .5 (passengers, county of origin factor)

Rail Lines	11 Middlesex	12 Monmouth	13 Ocean	14 Camden	15 Atlantic	16 Cape May	17 7 Counties	18 Sussex
Penn Central								
Princeton - P. Jct.	.0033785	---	---	---	---	---	---	---
Main	.5084425	.0025675	.001595	---	---	---	.0049795	.000350
South Amboy	.4219015	.0080605	---	---	---	---	.000620	---
Coast	.1330955	.677274	.050138	---	---	---	.000856	---
Erie Lackawanna								
Pascack Valley	---	---	---	---	---	---	.003034	---
Main Line	---	.0001755	---	---	----	---	---	---
Bergen to Line	---	.0003995	---	---	----	---	.000599	---
Boonton	.000490	---	.0014705	---	---	---	---	.030229
Morristown	.0001815	----	---	---	---	---	---	.0017245
Montclair	---	---	---	---	---	---	---	---
Gladstone	---	.000481	.0001205	---	---	---	---	---
C.N.J.								
Reading	---	---	---	---	----	---	---	---
Main	.102862	.000221	.0001475	---	----	---	.0003685	---
Coast	.148579	.754397	.051877	---	---	---	.000579	---
Penn Reading Sea Shore Line	---	---	---	.2040325	.4083515	.387616	---	---

FORMAT 14

- PRINCETON SPUR

Subsidy Factor by Political Subdivision

	.5 (Car Mile Factor)	+	.5 (Passengers political subdivision of origin)	=	Subsidy Factor
Mercer					
Trenton			.0084		.0084
Princeton Township	.5		.453		.953
Hopewell Township			.0084		.0084
East Windsor & Washington Twp.			.0084		.0084
Lawrence Township			.0084		.0084
Hunterdon					
West Amwell Township & East Amwell Township			.0067		.0067
Middlesex					
Plainsboro Township			.00335		.00335
Somerset					
Branchburg Township			.00335		.00335

GRAVITY GRADIENT FACTOR

COUNTY	COUNTY SEAT	STRAIGHT LINE DISTANCE FROM TRENTON TO COUNTY SEAT IN MILES	d^2	$\frac{1}{d^2} \times 10^{-4}$	Gravity Gradient Factor
Burlington	Mount Holly	16.75	280.5625	35.64	51.70
Camden	Camden	27	729	13.72	19.90
Atlantic	May's Landing	53.5	2862.25	3.49	5.06
Glouchester	Woodbury	33.5	1122.25	8.91	12.92
Salem	Salem	59	3481	2.87	4.16
Cumberland	Bridgeton	60.5	3560.25	2.73	3.96
Cape May	Cape May Court House	79.5	6320.25	1.58	2.29
				68.94	99.99%

$$\text{Gravity Gradient Factor} = \frac{\frac{1}{d_c^2}}{\sum_{c=1}^{7} \frac{1}{d_c^2}}$$

$$= \frac{\frac{1}{d_c^2}}{68.94}$$

*"The Gravity Model"

"The gravity method is based on the fact that the distribution of trips to different zones varies directly with the numbers of trips originating from that given zone, the attractiveness (size) of the origin zone and inversely as the distance to the opposite (destination) zone increases."

Table 11

FIVE YEAR PROJECTION OF NEW JERSEY RAIL SERVICE DEFICITS ($) BY FISCAL YEAR
FOR ALL LINES - (100% DISTRIBUTION AMONG COUNTIES)

HIGH DEFICIT PROJECTION

	FY 77	FY 78	FY 79	FY 80	FY 81
1. Warren	116,986	132,515	148,956	164,060	177,636
2. Morris	4,992,567	6,121,331	6,848,457	7,704,995	8,484,725
3. Passaic	1,038,631	1,270,349	1,423,212	1,600,781	1,762,419
4. Bergen	4,517,187	5,538,367	6,195,939	6,970,732	7,676,038
5. Hunterdon	669,694	756,914	850,282	935,763	1,012,610
6. Somerset	3,253,038	3,770,983	4,244,932	4,709,875	5,130,281
7. Union	11,707,984	13,493,411	15,295,555	16,976,825	18,496,826
8. Essex	6,852,416	8,156,109	9,234,471	10,340,405	11,345,409
9. Hudson	2,171,519	2,650,320	2,966,006	3,333,073	3,667,031
10. Mercer (Princeton Spur) not included	1,886,202	2,192,671	2,536,590	2,839,906	3,116,171
11. Middlesex	10,664,120	12,310,258	14,159,418	15,792,270	17,274,085
12. Monmouth	9,439,364	10,782,809	12,293,688	13,633,780	14,845,120
13. Ocean	696,252	796,391	903,676	1,008,349	1,098,485
14. Camden (Sea Shore Line)	274,220	302,530	335,429	364,810	390,518
15. Atlantic (Sea Shore Line)	548,824	605,585	671,330	730,132	781,585
16. Cape May (Sea Shore Line)	520,956	574,835	637,241	693,057	741,897
17. 7 Counties	85,438	99,321	114,300	127,755	139,979
18. Sussex	75.543	92,347	103,507	116,419	128,173
TOTALS to the nearest thousand	59,511,000	69,647,000	78,908,000	88,043,000	96,269,000

(FORMAT 16)

FIVE YEAR PROJECTION OF NEW JERSEY RAIL SERVICE DEFICITS ($) BY FISCAL YEAR FOR ALL LINES - (100% DISTRIBUTION AMONG COUNTIES)

HIGH DEFICIT PROJECTION

	FY 77	FY 78	FY 79	FY 80	FY 81
17. 7 Counties:					
1. Burlington (51.7*)	44,171	51,349	59,093	66,049	72,369
2. Camden (19.9)	17,002	19,765	22,746	25,423	27,856
3. Gloucester (12.92)	11,039	12,832	14,768	16,506	18,085
4. Atlantic (5.06)	4,323	5,026	5,784	6,464	7,083
5. Salem (4.16)	3,554	4,132	4,755	5,315	5,823
6. Cumberland (3.96)	3,383	3,933	4,526	5,059	5,543
7. Cape May (2.29)	1,957	2,274	2,617	2,926	3,206

*Gravity Gradient Factor In Percent

(FORMAT 16)

Table 12

FIVE YEAR PROJECTION OF NEW JERSEY RAIL SERVICE DEFICITS ($) BY FISCAL YEAR
FOR ALL LINES - (100% DISTRIBUTION AMONG COUNTIES)
LOW DEFICIT PROJECTION

	FY 77	FY 78	FY 79	FY 80	FY 81
1. Warren	93,006	106,438	120,500	133,466	145,165
2. Morris	4,706,872	5,803,547	6,496,714	7,327,928	8,082,111
3. Passaic	971,039	1,195,343	1,340,493	1,512,075	1,667,797
4. Bergen	4,259,037	5,251,208	5,878,088	6,629,996	7,312,213
5. Hunterdon	535,431	610,914	690,982	764,480	830,842
6. Somerset	2,726,236	3,196,966	3,617,735	4,035,754	4,414,490
7. Union	9,438,231	11,024,103	12,599,511	14,079,131	15,421,323
8. Essex	5,921,494	7,139,321	8,121,364	9,144,850	10,075,113
9. Hudson	2,027,881	2,491,226	2,790,368	3,144,689	3,466,036
10. Mercer (Princeton Spur) not included	1,488,215	1,760,314	2,064,711	2,332,889	2,578,244
11. Middlesex	8,289,971	9,730,835	11,344,495	12,767,321	14,064,661
12. Monmouth	7,353,967	8,516,748	9,821,165	10,976,172	12,025,350
13. Ocean	542,803	629,647	726,734	812,792	890,995
14. Camden (Sea Shore Line)	274,220	302,580	335,429	364,810	390,518
15. Atlantic (Sea Shore Line)	548,824	605,585	671,330	730,132	781,585
16. Cape May (Sea Shore Line)	520,956	574,835	637,241	693,057	741,897
17. 7 Counties	67,312	79,621	92,794	104,647	115,460
18. Sussex	70,500	86,763	97,342	109,808	121,122
TOTALS to the nearest thousand dollars	49,836,000	59,106,000	67,447,000	75,664,000	83,125,000

(FORMAT 16)

Table 12 - continued

FIVE YEAR PROJECTION OF NEW JERSEY RAIL SERVICE DEFICITS ($) BY FISCAL YEAR FOR ALL LINES - (100% DISTRIBUTION AMONG COUNTIES)

LOW DEFICIT PROJECTION

	FY 77	FY 78	FY 79	FY 80	FY 81
17. 7 Counties:					
1. Burlington (51.7*)	34,800	41,164	47,974	54,103	59,693
2. Camden (19.9)	13,395	15,845	18,466	20,825	22,977
3. Gloucester (12.92)	8,697	10,287	11,989	13,520	14,917
4. Atlantic (5.06)	3,406	4,029	4,695	5,295	5,842
5. Salem (4.16)	2,800	3,312	3,860	4,353	4,803
6. Cumberland (3.96)	2,666	3,153	3,675	4,144	4,572
7. Cape May (2.29)	1,541	1,823	2,125	2,396	2,644

*Gravity Gradient Factor In Percent

(FORMAT 16)

APPENDIX - MEMORANDUMS

MEMORANDUM

TO Gene Reilly

FROM Peter E. Stangl

SUBJECT Railroad Subsidies: County Share

DATE July 7, 1976

Your division was instrumental in developing a formula for county participation in the bus subsidy program. We would now like to develop a similar mechanism to allocate rail costs to counties along an appropriate formula type basis.

Please develop an allocation mechanism, whether it be based on passenger counts, station stops, miles of track, etc., which could be used and enforced through COA regulation. I would also like to know how long you estimate it will take to develop such a formula and some alternates.

P.E.S.

P.S. Work with Bill Harbert on this.

Peter Stangl

Mr. G. William Herkner

Mr. Eugene F. Reilly

County Share in Railroad Subsidy

September 1, 1976

In response to a memorandum from Peter Stangl requesting the Division of Research and Development to study a possible methodology on referenced subject, we offer the attached paper in the hope of determining how the Division of Research and Development's resources should be more appropriately spent on this subject. This paper may serve as a starting point for more detailed analysis of the referenced subject. After you have had a chance to consider the points that have been raised, we wish to have a meeting with you to continue our efforts. Mr. Karl Brodtman will be in contact with your office for a meeting on September 10, 1976.

One of the questions raised in Peter's memorandum was relative to the enforcement capabilities of the COA. In lieu of the legislation giving the COA authority in this area (27:1A-28.5), the enforcement alternatives could be the capital investment of transportation funds in the affected counties.

The methodologies that are outlined below do not suggest alternative means of defining subsidies but only list methodologies of distributing this subsidy by the subsidized rail line among the counties affected by the rail line.

Basic to any subsidy is the incentive for the subsidized company to improve its operation to the point where either its ridership increases or its operational costs are reduced, or both. We have given very limited thought to the determination of what constitutes profitable rail lines in terms of a county's share toward this profitability. For instance, if a rail line is used by passengers from three counties, it is difficult to decide what portion of this fixed system should be distributed to each of these counties, even though we may realize revenues from each of these counties. A rail line may never enter a county but revenues could be realized by the transit company from passengers from that county. Surely this latter county must share in the operational costs of the rail line. However, the vast question of determining those costs of a rail company attributable to passenger operations and the methodology of equitably distributing these costs among the governmental jurisdictions that are "affected" by the rail line's passenger operations must be considered prior to selecting some of the following alternatives.

Incentives are further complicated by the inflexibility of the specific rail route, even though service may be altered both in distance (to the limits of a line) and in time. Service cannot be altered by location without inducing large capital expenditures. Where a bus company has the option of "following" its demand, a rail is fixed. The use of inverse proportions of passenger use may well be advisable incentives to bus operations but they surface as punitive measures to rail operations. The location of rail service cannot change with the development of land use as easily as bus transit lines.

The following generalized list of methods can be considered in determining a formulation to distribute a rail line's deficits among affected counties. The estimates of manpower required to develop the data in the following list is based on the 1974 New Jersey Railroad Passenger Survey.

1. The supply of service of a rail line can be measured by the car miles of service afforded to the various counties. However, this measure of supply does not take into account the use of service made by adjoining county residents. In essence, this measure should be qualified by county use. It is estimated that it would take approximately five man months to determine the car miles of service for each passenger rail line in the state.

2. Demand for rail service can be measured by the county's proportion of its residents' use of a rail line to the total use of a rail line within the state. The estimate of time to determine this information is one man month. The 1974 Railroad Passenger Survey information, that will be used for this measure, could be qualified on the basis of up-to-date station information for each rail line, on the assumption that the distribution of passengers boarding at a station is in proportion to the 1974 county of origin for those station passengers.

3. The combined effect of supply and demand can be introduced by using the measure of passenger miles by county by rail line. Again, using the 1974 Survey, it is estimated that it would require two man years of resources to manually develop this data. However, this estimate may be reduced if data processing techniques can be used.

4. WMATA uses a method which is based on costs, supply and demand, in the form of four factors using a future rail plan. These factors include projected capital costs by county, projected service costs by county (based on train miles and numbers of stations), projected population and projected ridership. Input for these factors would be required from the Division of Transportation Systems Planning, if it is to be given serious consideration.

Eugene F. Reilly
Director of Research

EFR:ls

cc: Asst. Comr. P. Stangl
Messrs. R. Anderson, K. Rosser, W. Moore, K. Brodtman

MEMORANDUM

TO ASST. COMR. PETER E. STANGL

FROM MR. RICHARD J. ANDERSON

cc: Reilly Herkner 11/21

SUBJECT ALLOCATION OF RAIL COSTS TO COUNTIES

DATE OCTOBER 27, 1976

On Wednesday, October 27, 1976, I met with Messers. Reilly, Brodtman, and Herkner to discuss the assignment to do research of the memo subject.

In order to provide appropriate order of magnitude numbers for policy discussion, it was agreed that research would use the division subsidy costs as described in our offer of financial assistance to ConRail, coupled with revenue and ridership information to develop an allocation model based on an equal weighting of car miles and station on-off counts within each county of origin.

For those rail patrons traveling from one county of origin to another to board the train, the 1974 Port Authority O&D Study will be used.

Mr. Reilly estimates that considering his current work load the task should be completed in about three months.

Your concurrence is requested.

Richard J. Anderson

RJA:mfs

cc. Mr. Eugene Reilly
Mr. G. W. Herkner

11/17

5503
OCT 29 1976