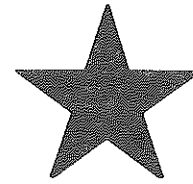


HE
147.6
.M5
v.19-A

Statewide



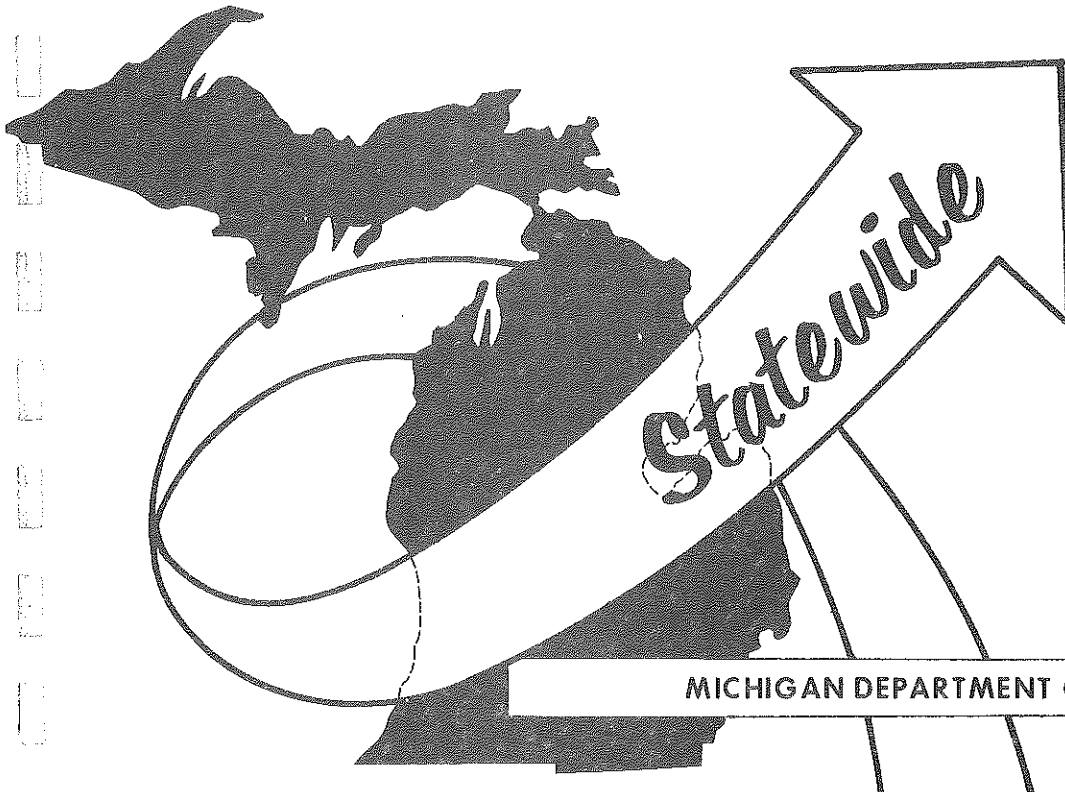
Transportation Analysis & Research

Michigan's Statewide Traffic
Forecasting Model

REVENUE VS. NEEDS:
AN ANALYTICAL APPROACH

Volume XIX-A

July 1982
Transportation Planning Procedures Section



MICHIGAN DEPARTMENT OF TRANSPORTATION

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Revenue vs. Needs: An Analytical Approach

by

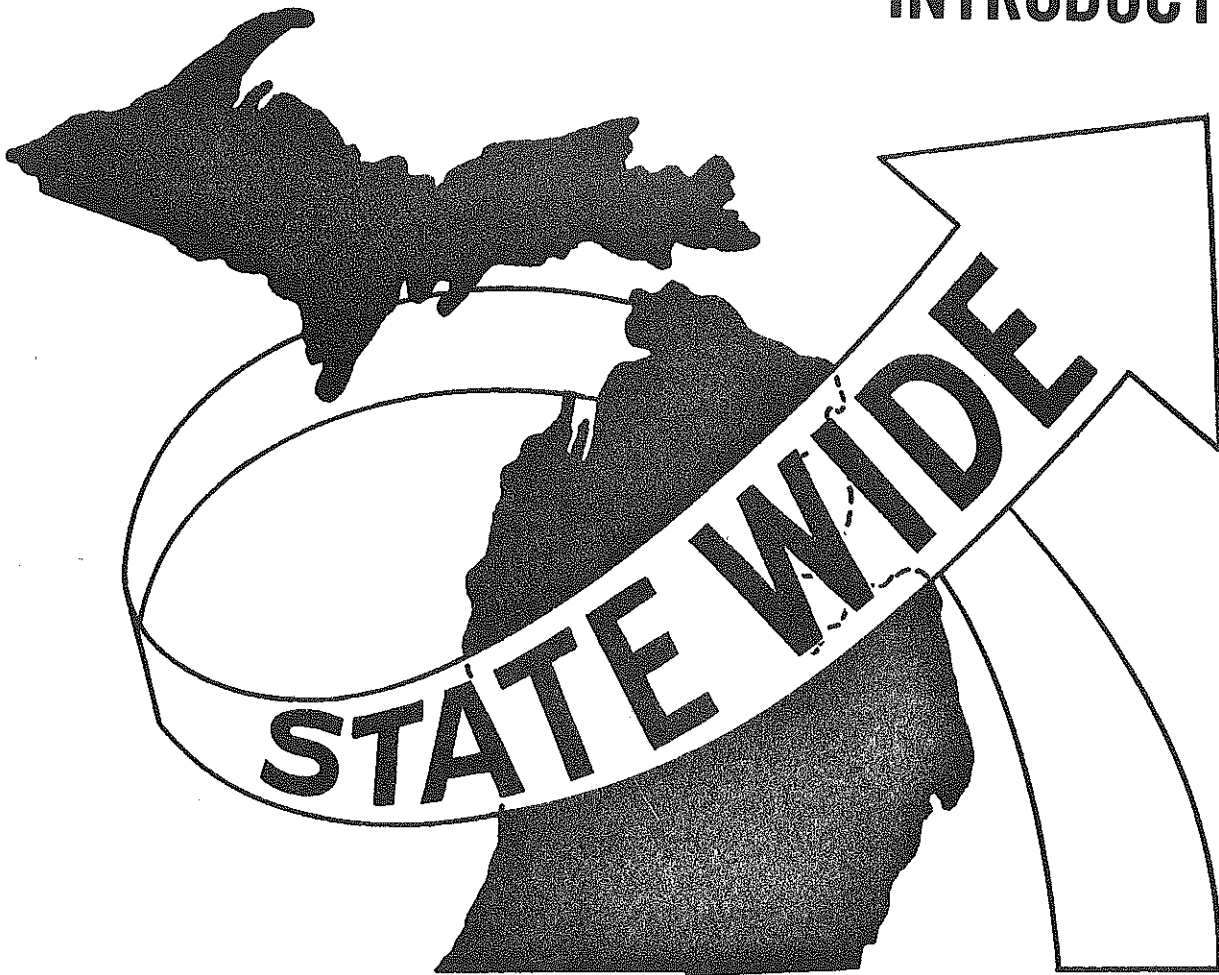
Karen R. Howe

&

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INTRODUCTION



INTRODUCTION

Growing transportation needs in Michigan have been evident for some time. Michigan's Transportation Needs: 1977-1989 (Needs Study) reported Michigan's needs to be \$30 billion. Falling transportation revenues in Michigan have become a reality the past few years. This combination of growing needs and falling revenues has made difficult choices for the people trying to provide the best transportation system possible in Michigan. To examine these choices, the Michigan Department of Transportation developed a comprehensive State Transportation Plan (see Figure 1). Within the Plan, available revenue is generated with a fiscal forecasting model. The fiscal model uses the current issues when generating revenue at the state, city, and county levels. An inventory of deficiencies is stored by transportation mode.

Matching available revenue with needs was accomplished within the Plan with a planning process called the Transportation Revenue Investment Plan (TRIP). TRIP has a twofold purpose within the Department of Transportation. The first use of TRIP was in the State Transportation Plan matching available revenues with needs. The process is also useful as an early warning system within the strategic planning process. In daily strategic planning analysis, it can help decision makers evaluate the effects of alternate revenue levels and spending patterns. Describing the Transportation Revenue Investment Plan is the purpose of this report.

FIGURE 1

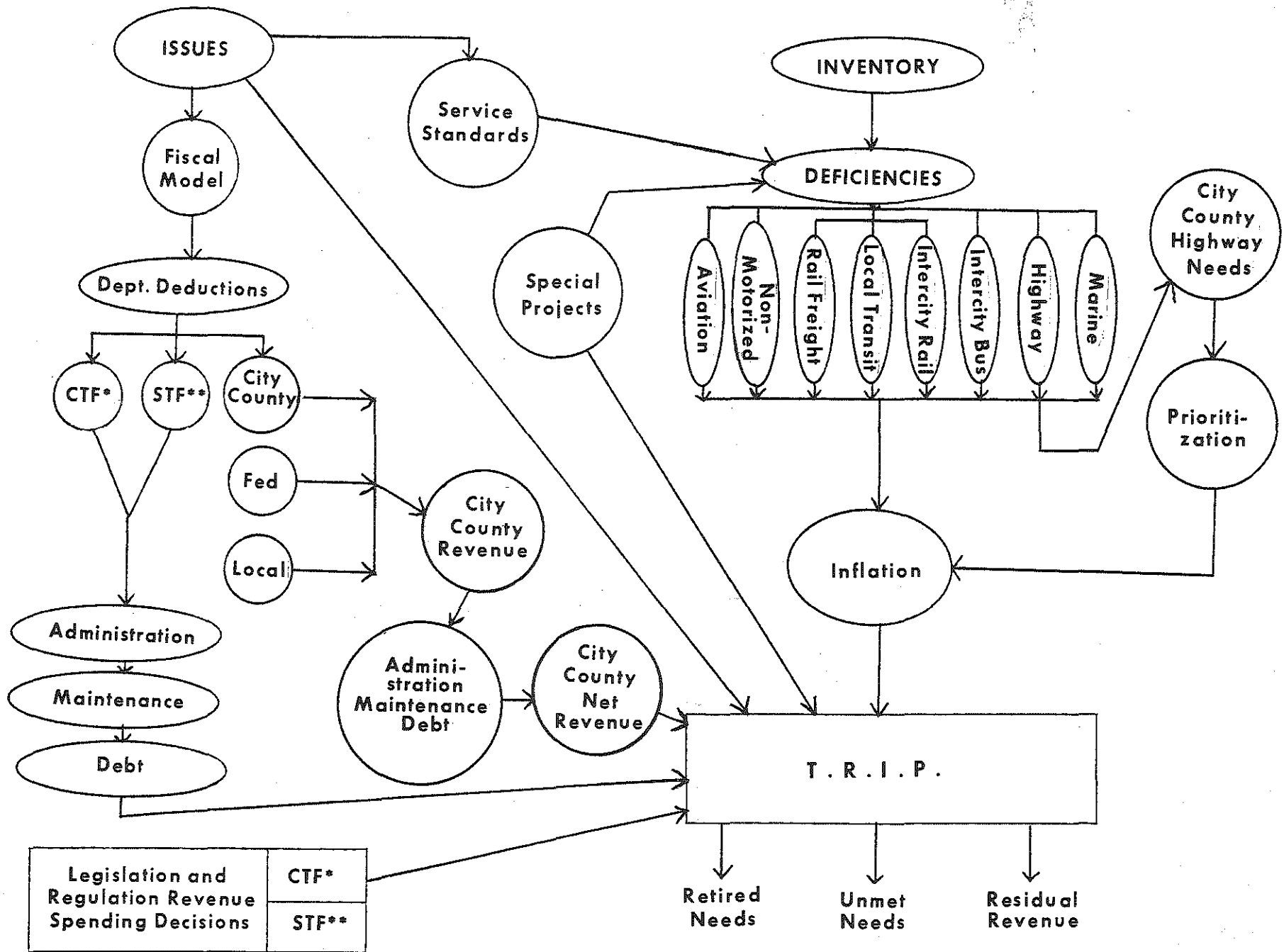
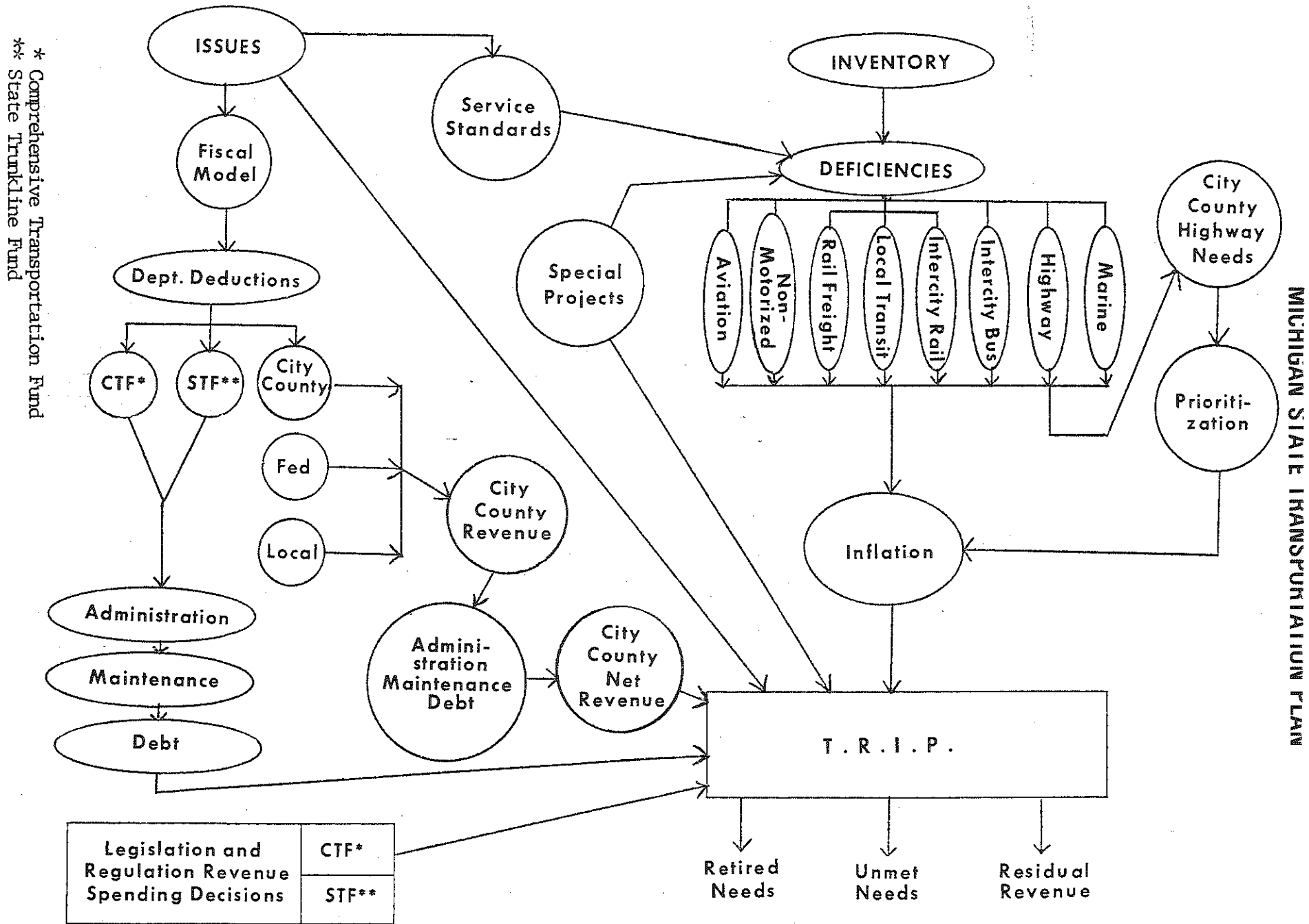


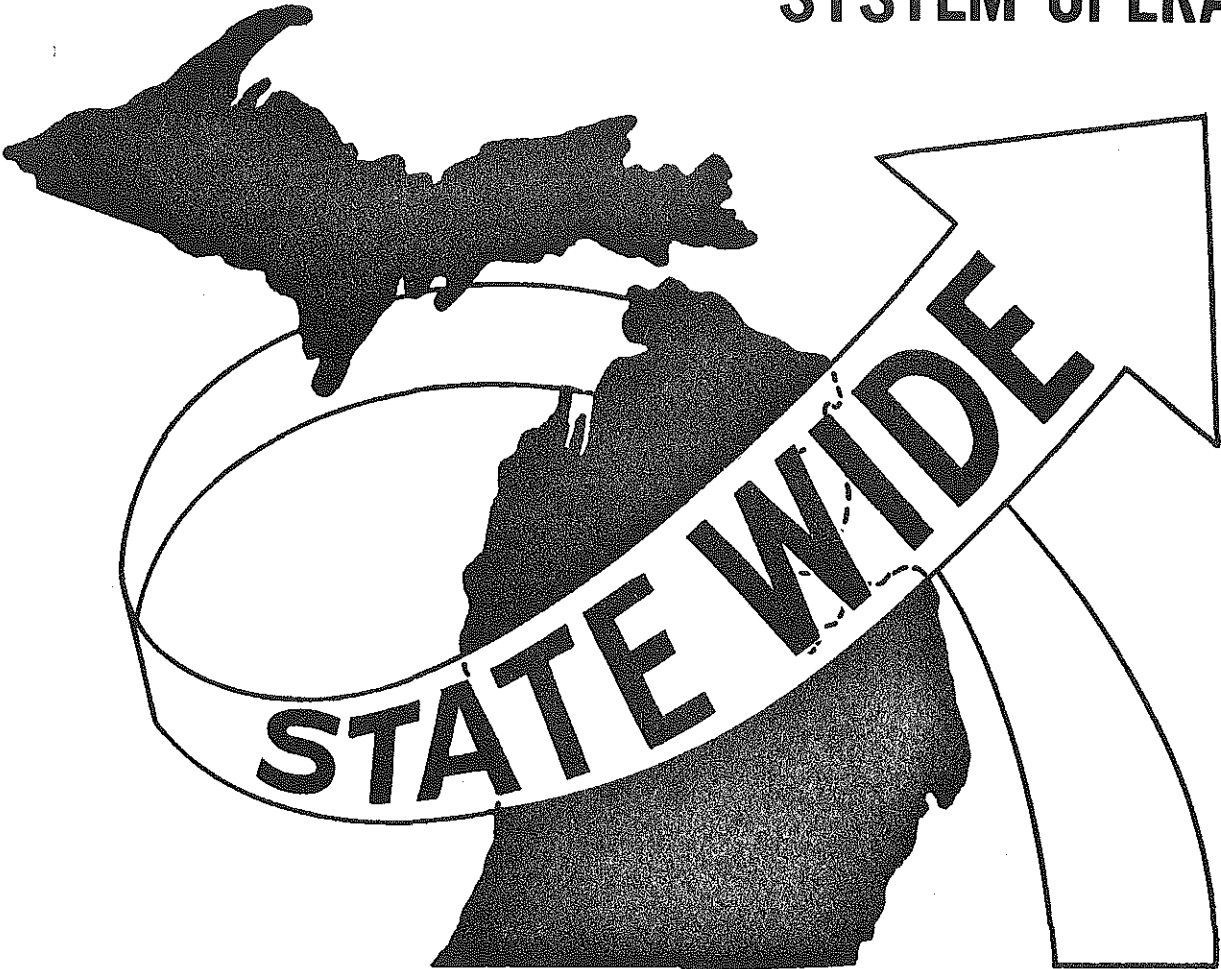
FIGURE 1



* Comprehensive Transportation Fund
 ** State Trunkline Fund

MICHIGAN STATE TRANSPORTATION PLAN

SYSTEM OPERATION



SYSTEM OPERATION

To begin describing the Transportation Revenue Investment Plan, a brief overview of its workings will be given (see Figure 2). The major driving force of the program is the revenues available and the identified needs. Computer files for each were created and both are categorized by mode and program element (see Figure 3). Revenue is assigned to the year in which it will become available. In a similar manner, the needs are identified by the year in which they will become deficient. Deficiencies are also prioritized within each mode and program element based on highest need. These files are taken into TRIP and matched by mode and program element. Beginning with the highest priority for a given mode and program element, needs are retired or "bought" until either all the allocated revenue is spent or all the needs are met. If there is not any state revenue remaining for a given year, TRIP will not attempt to buy any more needs that year.

Revenue for any given year can only be used to retire needs that are of the same year or backlogged. To determine an accurate cost of the need, base year costs are inflated to the year of the revenue that is attempting to retire it. Each mode also has its own set of decision rules that regulate the method by which a need may be retired. These rules are based on the type of need and the federal/state/local revenue split unique to that mode. After the first match of revenue and needs is completed, a second matching may be attempted adjusting the distribution of remaining revenue among program elements.

FIGURE 2

TRANSPORTATION REVENUE INVESTMENT PLAN

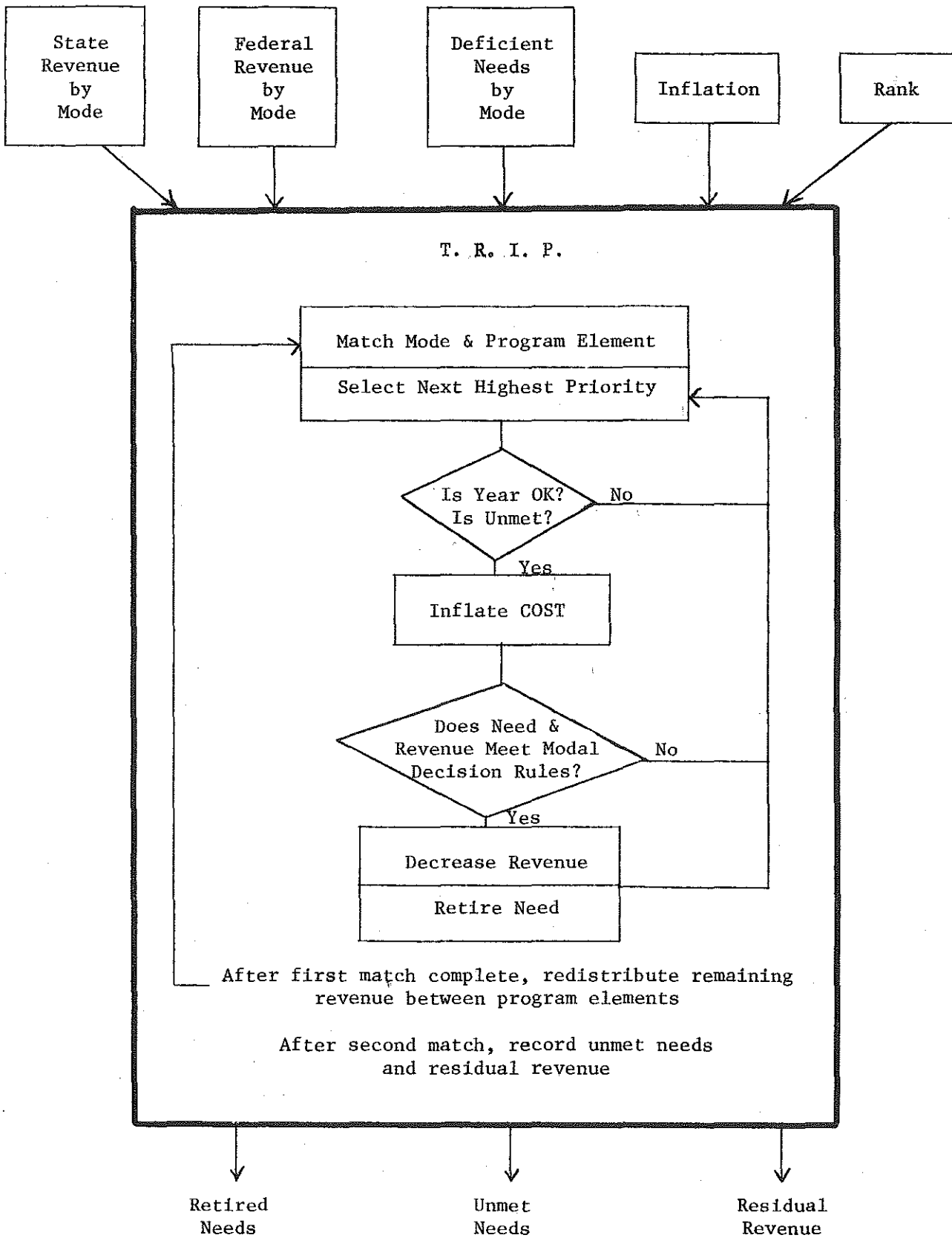


FIGURE 3

Modes

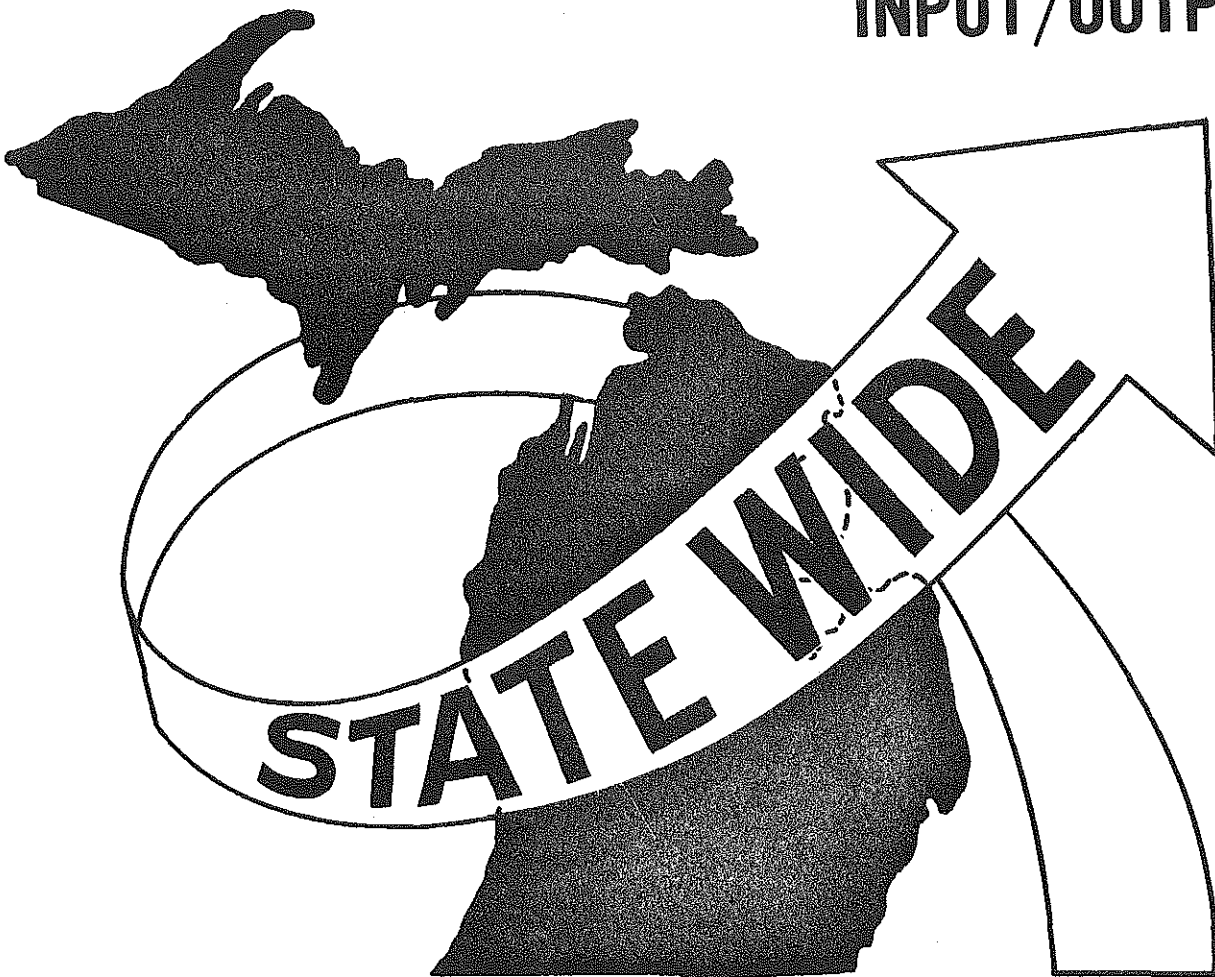
1. AVIATION
2. HIGHWAY
3. INTERCITY BUS
4. INTERCITY RAIL PASSENGER
5. LOCAL TRANSIT
6. MARINE
7. NON-MOTORIZED
8. RAIL FREIGHT

Program Elements

1. SERVICE CONTINUATION
2. SERVICE RELOCATION
3. SERVICE IMPROVEMENT
4. NEW SERVICE
5. MOBILITY DISADVANTAGED
6. ECONOMIC DEVELOPMENT
7. SAFETY
8. ENERGY CONSERVATION

When all matching is finished, the needs are reviewed to determine which have been retired and which were not met. TRIP can also be run for the "limit case". This is when needs are retired from one program element until all available have been met. If there is any revenue remaining, the procedure is repeated on the next program element. The order in which program elements are retired is based on a given ranking.

INPUT/OUTPUT



INPUT / OUTPUT

A list of the input and output files for TRIP follows with a short description of each. Figures 4-7 show a portion of the actual data for each file and their formats.

INPUT FILES

Needs: This file has each need entered as a separate record. The data on each record that is used by TRIP is mode, program element, subprogram element (Figure 7), cost (1980 \$'s), priority, year, and funding type. Other information about the need, such as identification and description, is also on the record. There is a separate file for each mode.

State Revenue: This file has a record for each year, program element, and funding source. The data on each record is mode, program element, year, funding source, and revenue available. There is a separate file for each mode.

Federal Revenue: This file has a record for each year, program element, and funding source. The data on each record is program element, year, funding source, and revenue available. There is a separate file for each mode.

Inflation: This file has a record for each mode/year combination. Each record contains mode, year, differential inflation rate for capital type projects, differential inflation rate for operation and maintenance type projects, and a base inflation rate. There is one file that is used for all modes.

FIGURE 4

Input Files

DEFICIENT NEEDS

2 09000010903500000010	01	05 01	294000 001	02	1982	000001000036000000130900000001000000000100
2 47000014706500000010	01	05 01	303000 001	02	1982	000002000036000000130900000001000000000100
2 58000015815100000012	01	05 01	2310000 001	12	1982	000003000036000000130400000001000000000100
2 58000015815100000011	01	05 01	2310000 001	12	1982	000004000036000000130400000001000000000100
2 58000015815100000010	01	05 01	9000 001	02	1982	000005000036000000130900000001000000000100
2 63000016302200000010	01	05 01	303000 001	12	1982	000006000036000000130900000001000000000100
2 82000018202200000013	01	05 01	605000 001	12	1982	000007000036000000130400000001000000000100
2 82000018202200000013	01	05 01	165000 001	12	1982	000008000036000000130400000001000000000100
2 82000018219100000010	01	01 01	26000 001	12	1982	000009000036000000130400000001000000000100
2 82000018219500000010	01	05 01	110000 001	12	1982	000010000036000000130900000001000000000100

STATE REVENUE

82	1	1244	1199
83	1	1240	1199
84	1	1218	1199
85	1	1195	1199
86	1	1160	1199
87	1	1129	1199
88	1	1099	1199
89	1	1070	1199
90	1	1041	1199
82	1	22	1299
83	1	22	1299
84	1	22	1299
85	1	21	1299
86	1	21	1299
87	1	20	1299
88	1	20	1299
89	1	19	1299
90	1	19	1299

FEDERAL REVENUE

4	3	82	48532
4	3	83	55000
4	3	84	53400
4	3	85	53400
4	3	86	55000
4	3	87	59900
4	3	88	59900
4	3	89	59000
4	3	90	59000
6	1	82	12349
5	1	82	15679
6	1	83	13177
5	1	83	18596
6	1	84	30202
5	1	84	6310
5	1	85	36511
5	1	86	42113
5	1	87	42113
5	1	88	42113
5	1	89	42113
5	1	90	42113
6	2	82	752

INFLATION

81	0	0.000	0.000	0.080
81	1	0.000	0.000	0.080
81	2	0.000	0.000	0.080
81	3	0.000	0.000	0.080
81	4	0.000	0.000	0.080
81	5	0.000	0.000	0.080
81	6	0.000	0.000	0.080
81	7	0.000	0.000	0.080
81	8	0.000	0.000	0.080
81	9	0.000	0.000	0.080
82	0	0.000	0.000	0.080
82	1	0.000	0.000	0.080
82	2	0.000	0.000	0.080
82	3	0.000	0.000	0.080
82	4	0.000	0.000	0.080
82	5	0.000	0.000	0.080
82	6	0.000	0.000	0.080
82	7	0.000	0.000	0.080
82	8	0.000	0.000	0.080
82	9	0.000	0.000	0.080
83	0	0.000	0.000	0.080
83	1	0.000	0.000	0.080
83	2	0.000	0.000	0.080

RANK

1	1	1
1	2	2
1	3	3
1	4	4
1	5	5
1	6	6
1	7	7
1	8	8
2	1	9
2	2	10
2	3	11
2	4	12
2	5	13
2	6	14
2	7	15
2	8	16
3	1	17
3	2	18
3	3	19
3	4	20

Output Files

FIGURE 5

STATE MONEY NOT SPENT

FUNDING SOURCE	YEAR	APPROPRIATION \$	RESIDUAL \$
2	82	8 74988000	321
2	83	8 114021000	43
2	84	8 135562000	36
2	85	8 164800000	456
2	86	8 199303000	889
2	87	8 63209000	1004
2	88	8 60303000	404
2	89	8 62735000	470
2	90	8 62884000	105
4	82	8 16472000	1431
4	83	8 15612000	12881633
4	84	8 14251000	17949
4	85	8 12842000	1371
4	86	8 11439000	155
4	87	8 10626000	2
4	88	8 9545000	602
4	89	8 8031000	1256
4	90	8 6548000	687

UNMET NEEDS

1 1	3	3 81	0	2500000	0	3
1 1	5	3 81	0	4000000	0	5
1 1	10	3 81	0	2500000	0	10
1 1	14	3 81	0	2500000	0	14
1 1	15	3 81	0	4000000	0	15
1 1	18	3 81	0	4000000	0	18
1 1	19	3 81	0	2500000	0	19
1 1	32	3 81	0	1500000	0	32
1 1	35	3 81	0	4000000	0	35
1 1	65	3 82	0	2500000	0	65
1 1	90	3 83	0	1500000	0	90
1 1	91	3 83	0	500000	0	91
1 1	92	3 83	0	1500000	0	92
1 1	93	3 83	0	500000	0	93
1 1	94	3 83	0	500000	0	94
1 1	95	3 83	0	500000	0	95

FEDERAL FUNDS NOT SPENT

FUNDING SOURCE	YEAR	APPROPRIATION \$	RESIDUAL \$
4	82	1 48532000.00	32894775.04
4	83	1 55000000.00	87880036.41
4	84	1 53400000.00	141280036.41
4	85	1 53400000.00	193848249.79
4	86	1 55000000.00	248841108.85
4	87	1 59900000.00	306789919.92
4	88	1 59900000.00	366689919.92
4	89	1 59000000.00	425675527.09
4	90	1 59000000.00	484659982.83
5	82	1 66951000.00	0.00
5	83	1 81424000.00	0.00
5	84	1 96247000.00	0.00

RESIDUAL REVENUE

RETIRED NEEDS

11	38	182	0	4691000	5471582	4924424	0	0	0	0	0	0	0	/
/	0	0	0	0	0	273579	273579	182	38	0	0	0	0	/
11	39	182	0	815000	950616	855554	0	0	0	0	0	0	0	/
/	0	0	0	0	0	47531	47531	182	39	0	0	0	0	/
11	40	182	0	1461000	1704110	1533699	0	0	0	0	0	0	0	/
/	0	0	0	0	0	85206	85206	182	40	0	0	0	0	/
11	41	182	0	1535000	1790424	1611382	0	0	0	0	0	0	0	/
/	0	0	0	0	0	89521	89521	182	41	0	0	0	0	/
11	42	182	0	67000	78149	70334	0	0	0	0	0	0	0	/
/	0	0	0	0	0	3907	3907	182	42	0	0	0	0	/
11	43	182	0	4395000	5126328	4613695	0	0	0	0	0	0	0	/
/	0	0	0	0	0	256316	256316	182	43	0	0	0	0	/
11	44	182	0	383000	446731	402058	0	0	0	0	0	0	0	/
/	0	0	0	0	0	22337	22337	182	44	0	0	0	0	/
11	45	182	0	871000	1015934	914341	0	0	0	0	0	0	0	/
/	0	0	0	0	0	50797	50797	182	45	0	0	0	0	/

FIGURE 6

File Formats

<u>FILE</u>	<u>DATA NAME</u>	<u>BEGINNING COLUMN</u>	<u>SIZE</u>
Needs:	1 - Mode Number	1	1
	2 - Subprogram Element	37	2
	3 - Program Element	40	2
	4 - 1980 Cost	43	9
	5 - Funding Type	53	3
	6 - Year (2 digit)	70	2
	7 - Priority	73	6
State Revenue:	1 - Year (2 digit)	1	2
	2 - Funding Source Code	4	2
	3 - Revenue (\$1,000)	7	12
	4 - Mode	20	1
	5 - Program Element	21	1
	6 - Subprogram Element*	22	2
	*99 - Indicates any subprogram or other		
Federal Revenue:	1 - Federal Source Code	1	2
	2 - Program Element	4	1
	3 - Year (2 digit)	6	2
	4 - Revenue (\$1,000)	9	7
Rank:	1 - Mode	1	2
	2 - Program Element	4	1
	3 - Rank	6	3
Inflation:	1 - Year (2 digit)	1	2
	2 - Mode	4	1
	3 - Differential Inflation-Capital	6	5
	4 - Differential Inflation-O&M	12	5
	5 - Base Inflation	18	5
Retired Needs:	1 - Mode	1	1
	2 - Program Element	2	1
	3 - Priority	3	4
	4 - Subprogram Element	7	2
	5 - Year-Need (2 digit)	9	2
	6 - Funding Type	11	3
	7 - 1980 Cost	14	9
	8 - Inflated Cost	23	9
	9 - Dollars by Federal, State, Local Split	32	135 (15 x 9)
	10 - Funding Source - Revenue	167	3
	11 - Year-Revenue (2 digit)	170	2
	12 - Deficient Need Record Pointer	172	7

Figure 6
(continued)

<u>FILE</u>	<u>DATA NAME</u>	<u>BEGINNING COLUMN</u>	<u>SIZE</u>
Unmet Needs:	1 - Mode	2	1
	2 - Program Element	4	1
	3 - Priority	6	6
	4 - Subprogram Element	13	2
	5 - Year (2 digit)	16	2
	6 - Funding Type	19	3
	7 - 1980 Cost	23	10
	8 - Deficient Need Record Pointer	35	5
Residual Revenue:	Data Header Cards		
	1 - Funding Code	4	2
	2 - Year (2 digit)	11	2
	3 - Program Element	14	2
	4 - Appropriation	17	10
	5 - Residual Revenue	32	10

Figure 7

Subprogram Element Codes

- | | |
|--------------------------------------|------------------------------------|
| 1. Facility Replacement In Kind | 29. New Rest Areas/Information |
| #*2. Service Subsidy | 30. Facility Construction |
| 3. Facility Acquisition | 31. Equestrian Access |
| 4. Precision Instrumentation | 32. New Dredging |
| 5. Roadside Amenities | *33. New Port Authorities |
| 6. Transportation Systems Management | 34. Site Access |
| 7. Turnbacks | 35. Federal Forest Highways |
| 8. Off-System Improvement | 36. Economic Growth Center Highway |
| 9. Vehicle Acquisition | 37. Rail/Land Banking |
| 10. Rural Small Bus | 38. Basic Ground Aids |
| *11. Facility Maintenance | 39. Upgrade to Standards |
| 12. Maintenance Dredging | 40. High Hazard Locations |
| 13. Vessel Acquisition | 41. Critical Bridges |
| *14. Port Authorities | 42. Railroad Crossings |
| #*15. Relocation Service Subsidy | 43. Pedestrian Access |
| 16. Facility Relocation In Kind | 44. Railroad Signalization |
| 17. Freight Transfer Facility | 45. Security Measures |
| 18. Facility Expansion | 46. User Information/Controls |
| #*19. Increased Service Subsidy | 47. Hazard Elimination |
| *20. Increased Facility Maintenance | 48. Minimal Track Safety |
| 21. Improvement Dredging | 49. Carpool Lots |
| 22. Improved Port Access | 50. Ridesharing |
| 23. Increased Load Capability | 51. Park Side Lots |
| 24. Increased Speed Capability | 52. Vanpool |
| 25. New Airport | 53. Commuter Facilities |
| #*26. New Service Subsidy | |
| 27. New Routes | * Operation and Maintenance |
| 28. New Interchanges | # Subsidy |

Rank: This file has a record for each mode/year combination. Each record contains mode, program element, and rank. This file is used when running the "limit case". The program elements are ranked within each mode.

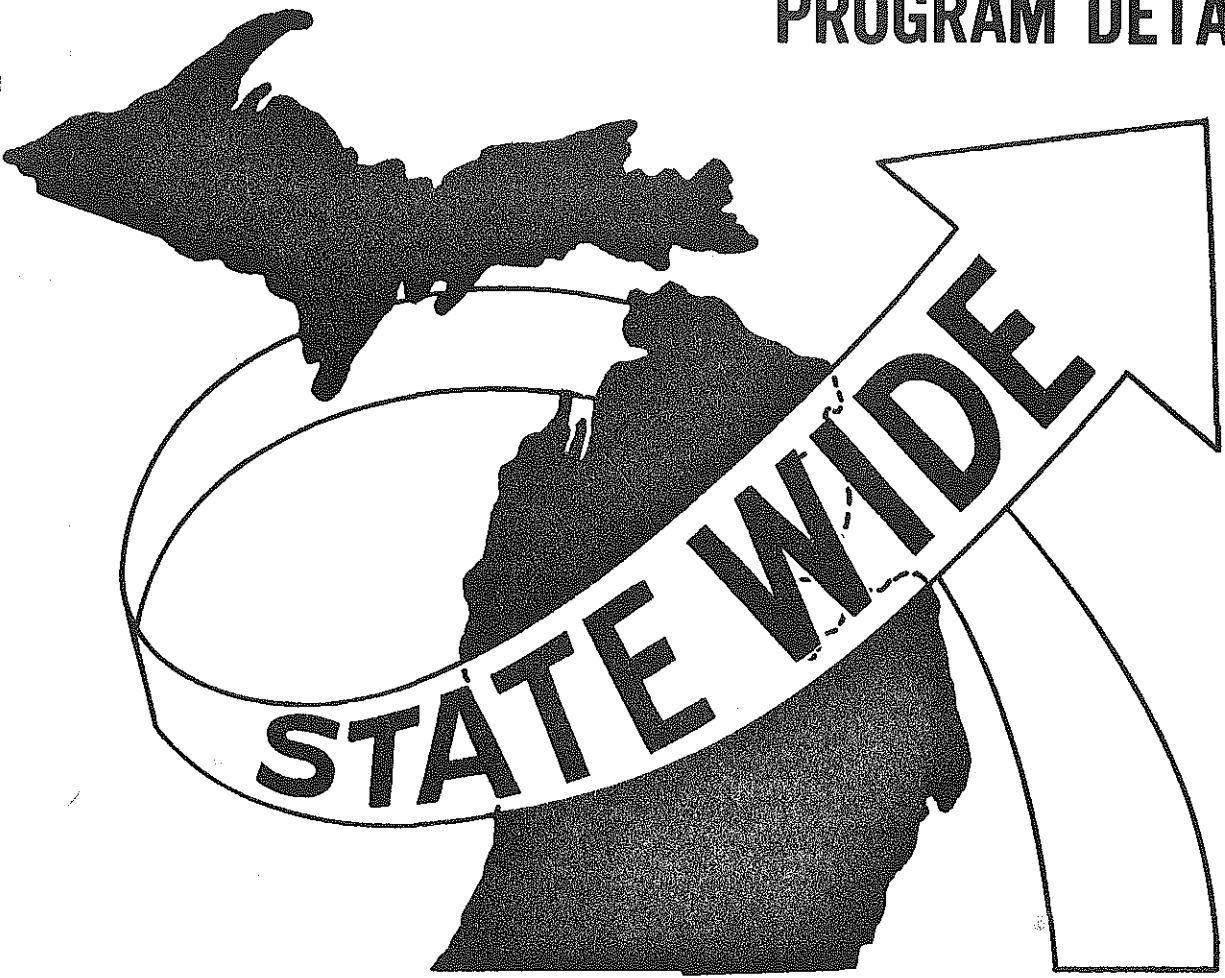
OUTPUT FILES

Retired Needs: This file has a separate record for each need. The data on each record is mode, program element priority, subprogram element, year in which the deficiency occurs, need funding type, cost in 1980 dollars, cost inflated to the year the need was retired, dollars used to retire the need by the federal/state/local split, money funding source, and money year. There is a separate file for each mode.

Unmet Needs: This file has a separate record for each need. The data on each record is mode, program element, subprogram element, year in which the deficiency occurs, need funding type, and cost in 1980 dollars. There is a separate file for each mode.

Residual Revenue: This file has a separate record for each funding source / year / program element combination. The data on each record is funding source, money year, program element, money appropriated, and residual money. There are records for both the state revenue and the federal revenue. Each mode has a separate file.

PROGRAM DETAILS



PROGRAM DETAILS

The TRIP program was written in FORTRAN programming language and run on a Burroughs 7700 computer. The details of the computer program decision rules follow.

Within TRIP, each mode has its own set of decision rules that determine whether a need may be retired based on the available revenue for that mode. Following is a brief description of the decision rules by mode. At the point where the decision rules begin, the program is attempting to buy the highest available priority need. It has already had its 1980 dollar cost inflated to the year of revenue which is attempting to retire it.

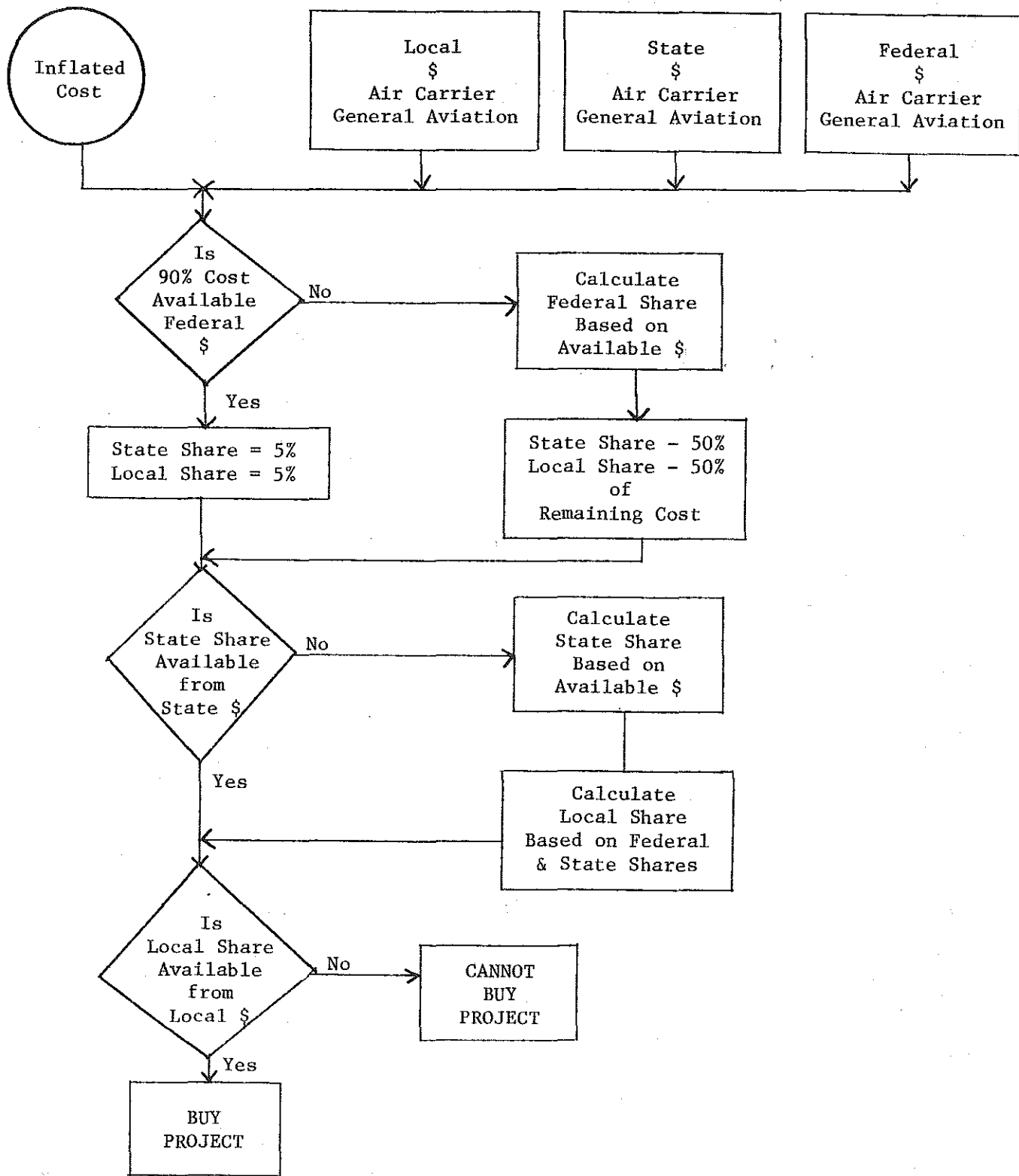
FLOWCHART A - Aviation:

The first check in retiring an aviation need (project) is on available federal revenue. TRIP determines if 90% of the cost of the project is available from the appropriate federal fund. If it is, the state and local shares are each set at 5% of the cost. If 90% of the cost is not available from the federal fund, a new federal share is calculated using the federal funds remaining. New state and local shares are then calculated. They are each 50% of the cost remaining after the initial cost has been reduced by the federal revenue.

The next check is on state revenue. TRIP determines if the state share of the cost is available from the appropriate state fund. If it

FLOWCHART A

AVIATION DECISION RULES



is not available, a new state share is calculated using the state funds remaining. A new local share is then calculated. It would be the residual left after the cost has been reduced by the federal and state shares.

The final check is on available local revenue. If the local share is available from the appropriate local fund, the project is retired (bought). If the local share is not available, TRIP cannot retire the project with that year's revenue. Aviation decision rules do not allow projects with subprogram elements 2, 15, 19, and 26 (see Figure 7) to be retired. This is because there is no funding for these types of projects. The revenue input is all assigned to program element 1, service continuation, for the first match of revenue and needs. This reflects the real life assignment of funds. These revenues are also separated into two groups: the share that funds air carrier needs and the share that goes to general aviation needs.

FLOWCHART B - Highways:

Highway mode has the most complex set of decision rules within TRIP. Donald C. Rush, Programming Engineer, Bureau of Highways, was instrumental in defining the rules for this mode. The different funding types within this mode have separate state and federal revenue allotments. The various funding types are linked with their revenue allotment through the funding source code. In order to simplify the discussion of highway decision rules, they will be described by funding type.

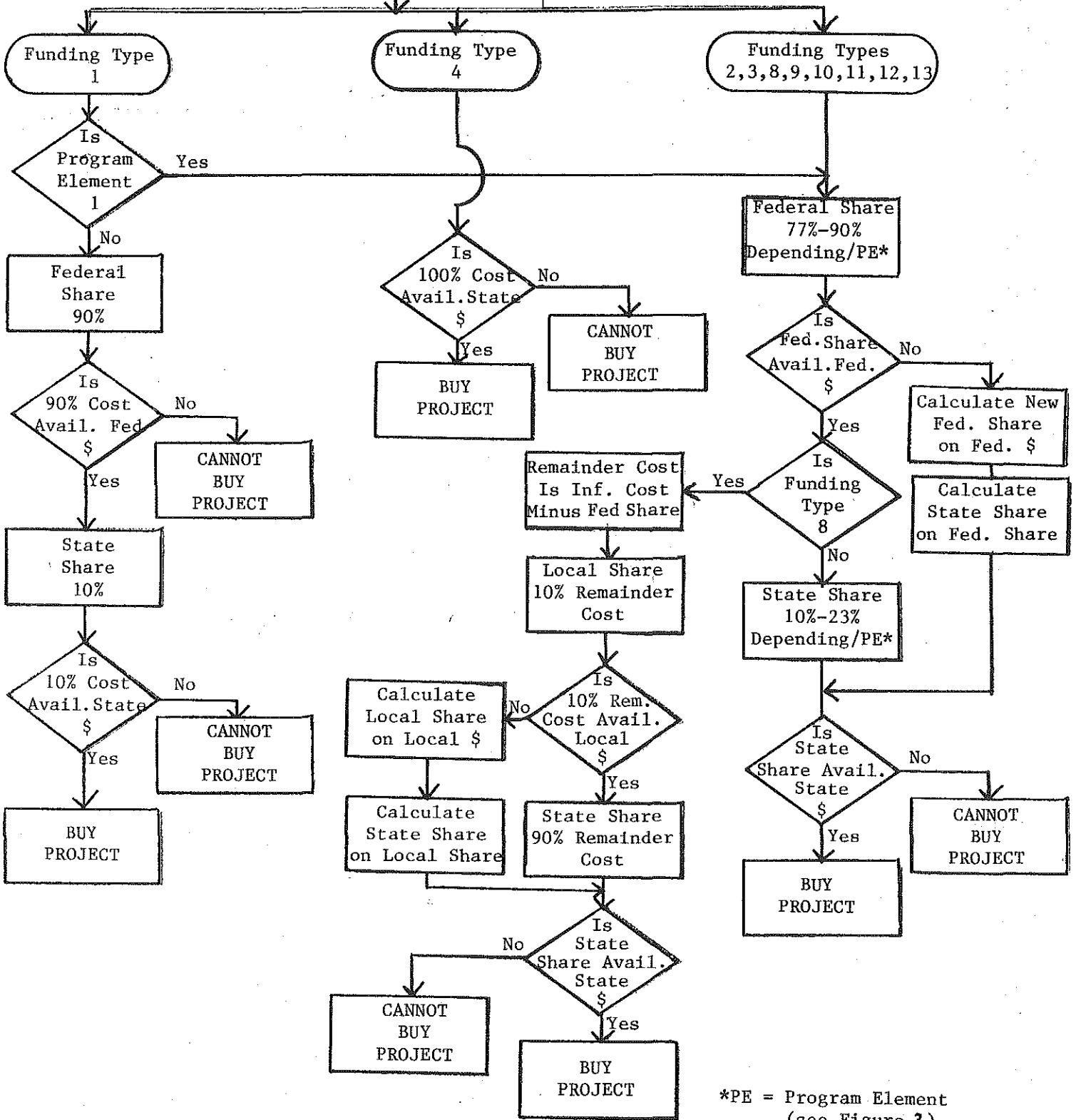
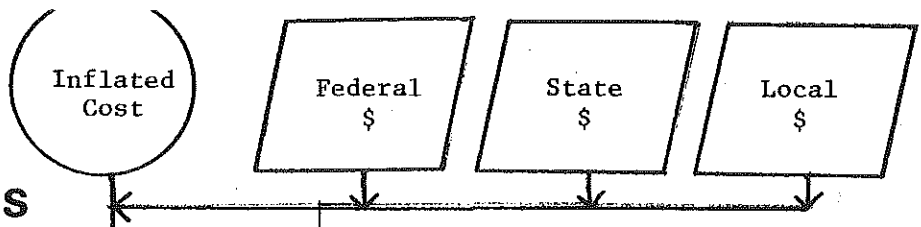
Funding Type 1 - Interstate: The first check for these projects is on program element. When the program element is service continuation, interstate projects are retired the same as funding types 2, 3, 8, 9, etc. The next check is on federal funds. The federal share is set at 90% of the cost. If 90% is not available from the appropriate federal fund, the project cannot be retired that year. If the federal share is available, the next check is on the state share. The state share is set at 10%. When 10% of the cost is not available from state revenue, the project cannot be retired that year. If the state share is available, the project is retired.

Funding Type 4 - Non-Federal Aid: There is only one check for funding type 4 projects. That check is on state revenue. If 100% of the cost is available from the appropriate state fund, the project is retired. When there is not enough state revenue to cover the state share, the project cannot be retired that year.

Funding Types 2 - Federal Aid Primary, 3 - Federal Aid Secondary, 8 - Federal Aid Urban, 9 - Structure Replacement, 10 - Structure Widen, 11 - Railroad Crossing Upgrade to Structure, 12 - Railroad Crossing at Grade, and 13 - Special Projects: The federal share for these funding types is 77% - 90% depending on the program element. If the federal share is available from federal revenue, the next check is for funding type 8, federal aid urban. When the federal share is not available, a new share is calculated based on remaining federal revenue. Then a state share is calculated based on the federal share.

FLOWCHART B

HIGHWAY
DECISION RULES



*PE = Program Element
(see Figure 3)

When the federal share is available and funding type is not 8, the state share is set at 10% - 23% depending on the program element. If the state share is not available, the project is not retired that year. When the state revenue is present, the project is retired.

If funding type is 8, a "remainder cost", which is the inflated cost minus the federal share, is calculated. The local share for funding type 8 is 10% of the remainder cost. If the local share is not available from local revenue, a new local share is calculated based on remaining revenue. A state share is then calculated based on the local share. When 10% of the cost is available from the local fund, the state share is 90% of the remainder cost. If the state share is not available from state revenue, the project cannot be retired that year. If the state share is available, the project is retired.

FLOWCHART C - Intercity Bus:

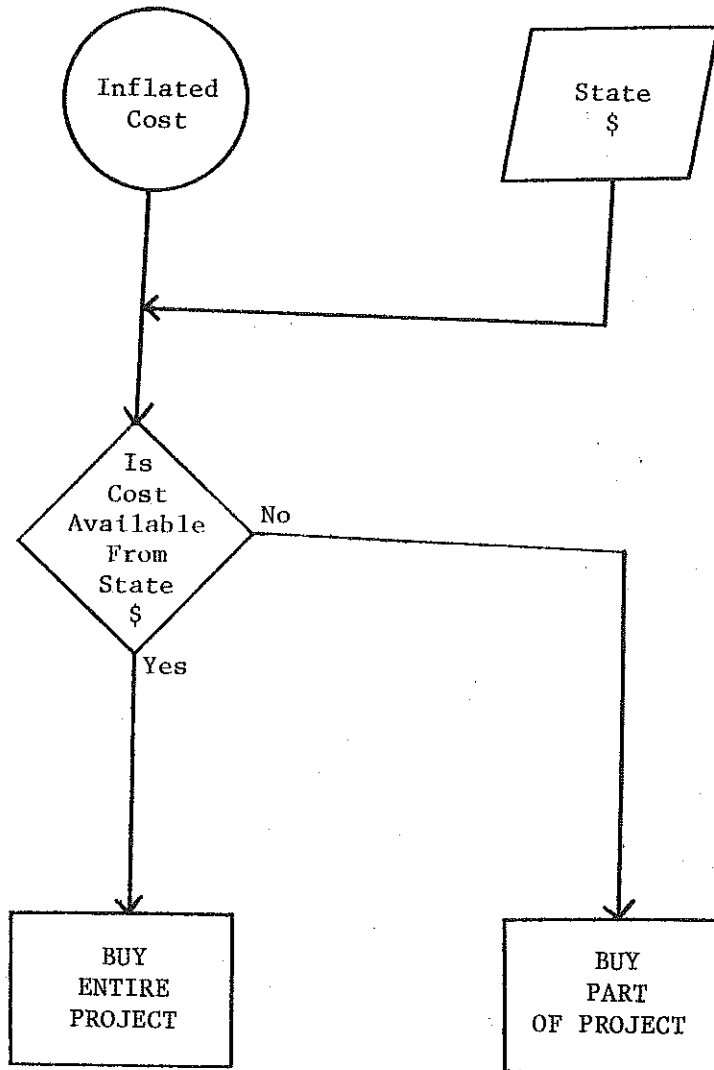
The only check in retiring an intercity bus need (project) is on state funds. If the entire cost of the project is available from the state fund, the project is retired. When only part of the cost is available, a partial buy is done using the remaining state funds for that year. Intercity bus projects cannot be backlogged.

FLOWCHART D - Intercity Rail Passenger:

Intercity rail has two sets of decision rules: one for capital needs (projects) and another for operation and maintenance needs (projects).

FLOWCHART C

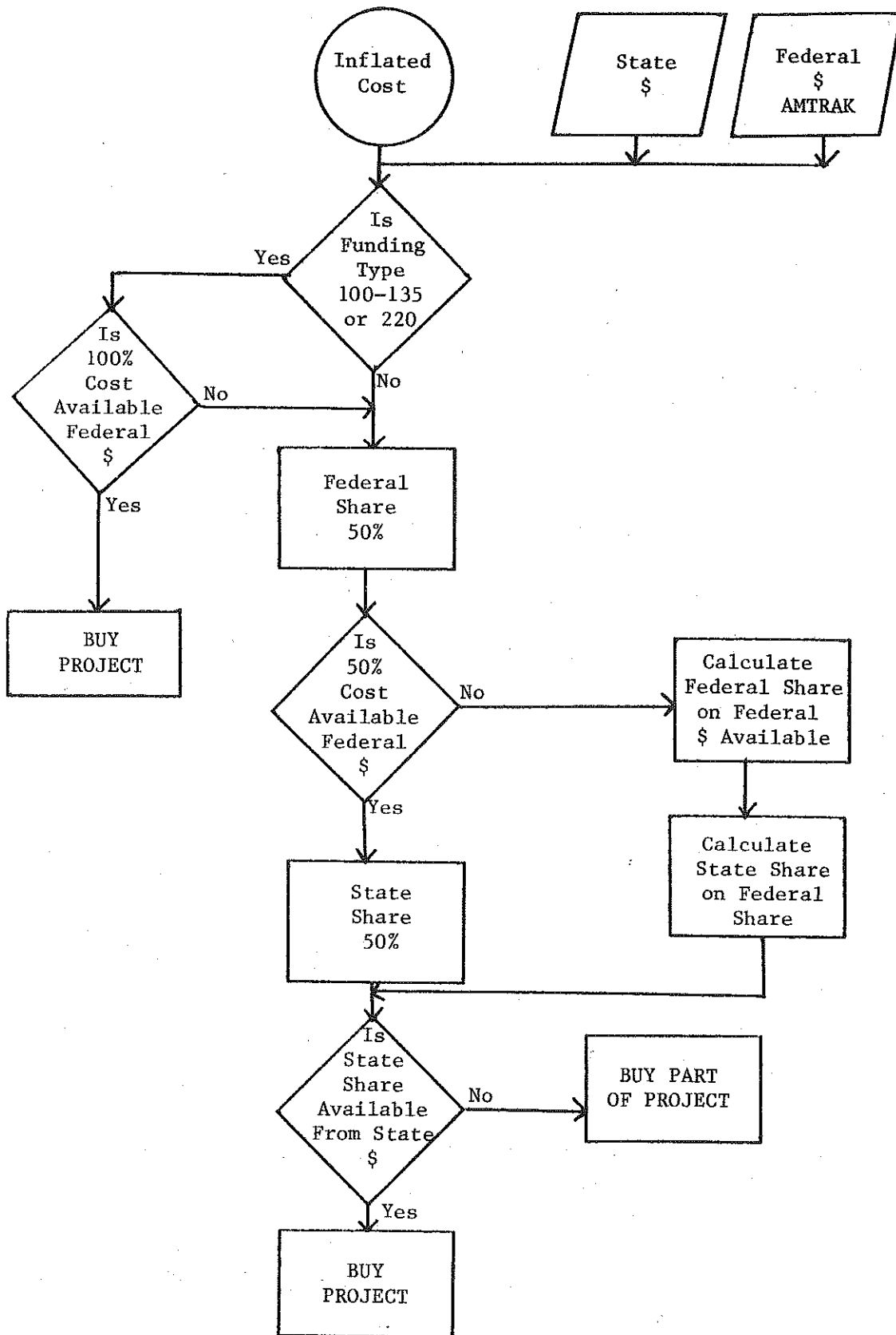
INTERCITY BUS DECISION RULES



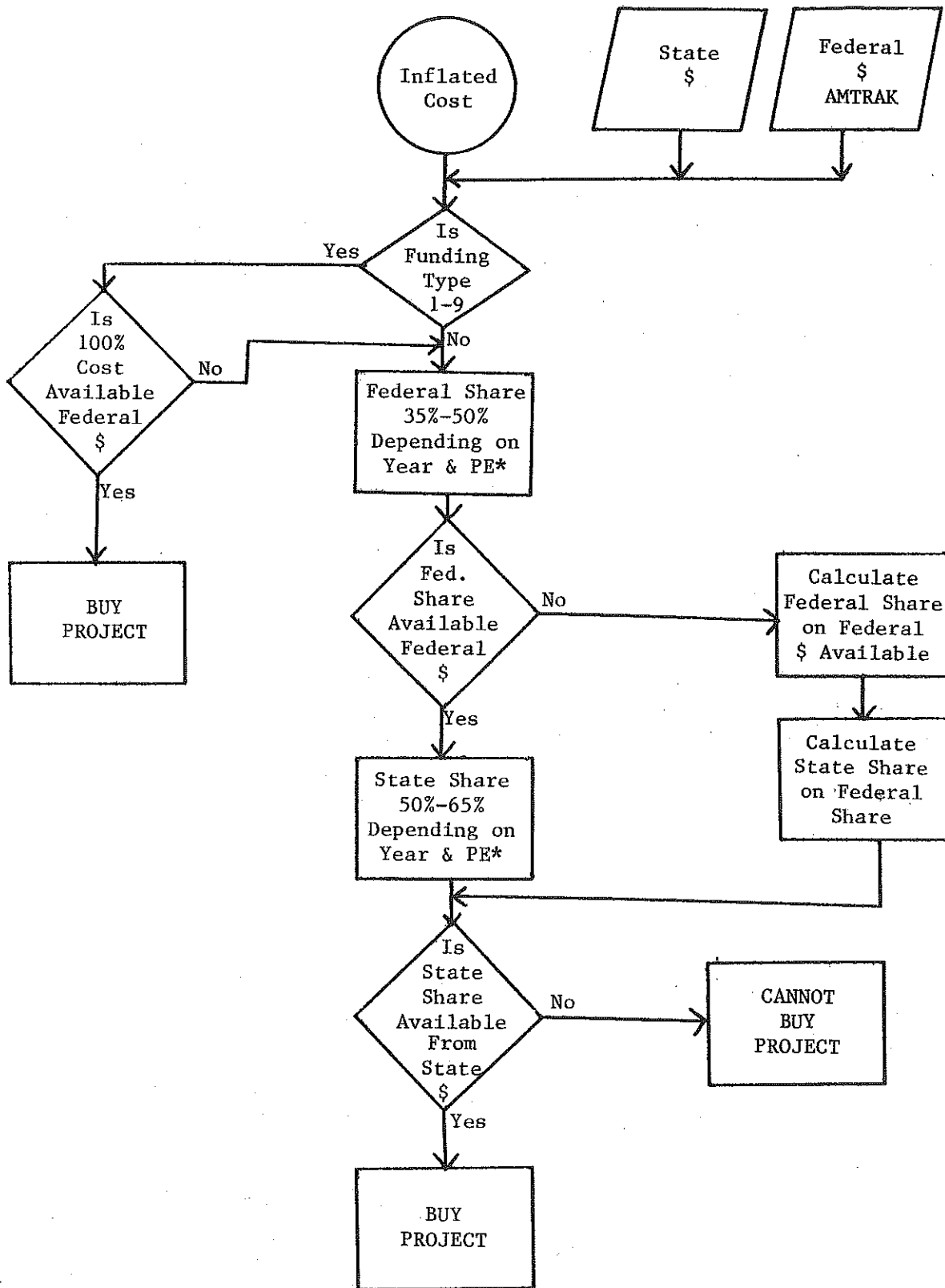
Capital Projects: The first check with capital projects is on funding type. If the funding type is 100 through 135 or 220 (Detroit to Chicago and Detroit to Toledo projects), TRIP attempts to buy the project with 100% federal funds. When 100% of the cost is not available from federal revenue for these type projects, they are handled the same as other capital projects. When the capital project is not funding type 100 through 135 or 220, or there is not 100% of the cost in federal funds, TRIP checks to see if 50% of the cost is available from federal revenue. If 50% of the cost is not available, a new federal share is calculated based on the remaining funds. Then a state share is calculated based on the federal share. If the federal share is 50% of the cost, the state share is set at 50%. The next check within TRIP, which is on state revenue available, is then performed. If the state share is available from the state fund, the project is retired. When the state does not have enough funds to meet the state share, the remaining state revenue is used to retire as much of the project as possible.

Operation and Maintenance Projects: Funding type is the first check for operation and maintenance projects. When funding type is 1 through 9 (Detroit to Chicago and Detroit to Toledo projects), TRIP attempts to buy the project with 100% federal funds. If 100% of the cost is not available from federal revenue for funding type 1 through 9 projects, they are handled the same as other operation and maintenance projects. Other projects have a federal share set at 35% to 50% depending on the revenue year and program element. If the federal

INTERCITY RAIL PASSENGER CAPITAL DECISION RULES



INTERCITY RAIL PASSENGER OPERATION & MAINTENANCE DECISION RULES



*PE = Program Element

share is not available from federal funds, a new federal share is calculated based on remaining revenue. A state share is calculated based on the federal share. The next check on state revenue available is then performed. If the state share is available from the state revenue, the project is retired. When the state does not have enough revenue to meet its share, the project is not retired and no more operation and maintenance projects are retired that year.

FLOWCHART E - Local Transit:

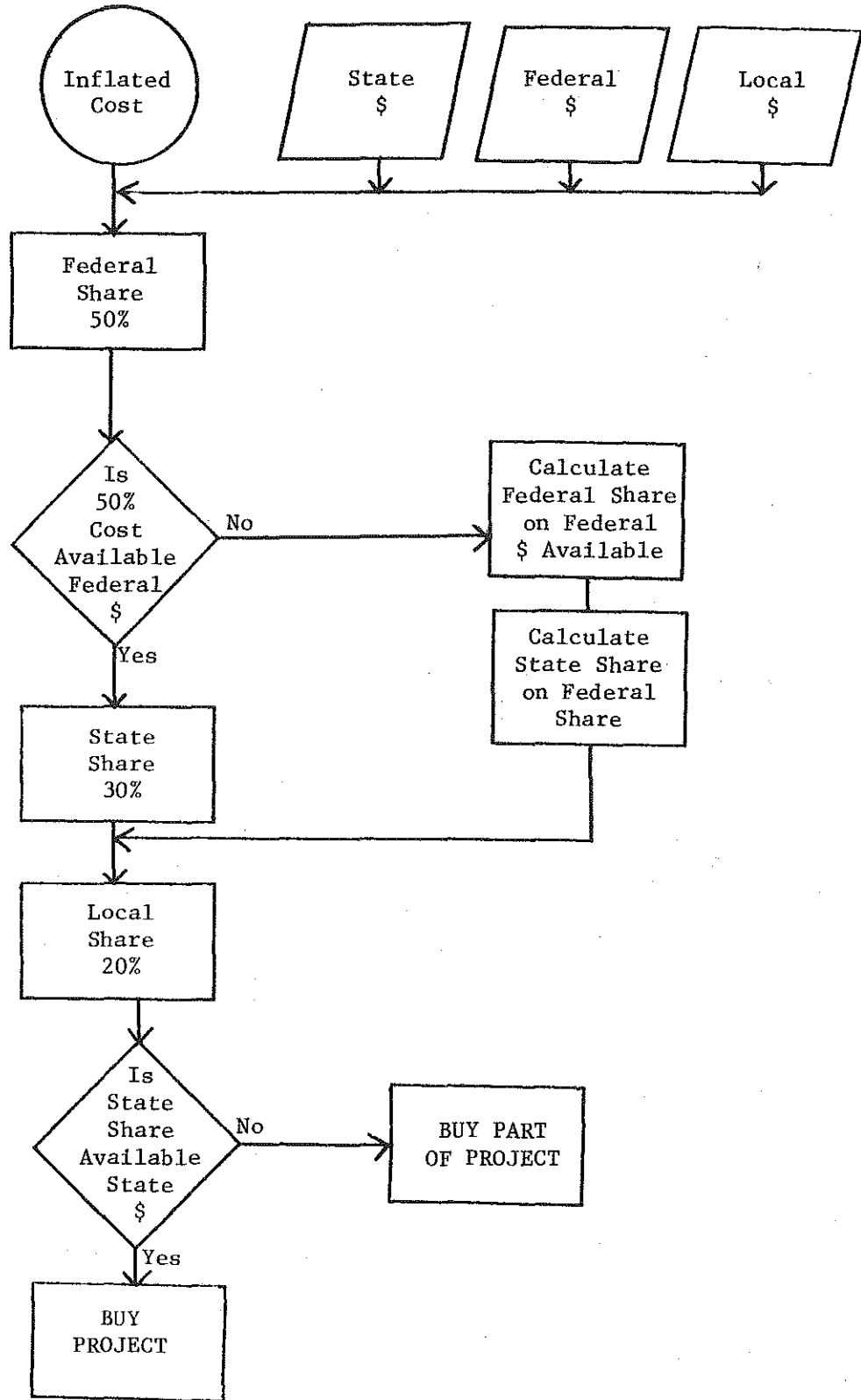
Local transit has two different sets of decision rules; one for capital needs (projects) and another for operation and maintenance needs (projects). (See Figure 7.)

Operation and Maintenance Projects: The first check for these projects is on federal revenue. If the federal share, 50%, is not available from the federal fund, a new share is calculated based on the remaining funds. Then a state share is calculated based on the federal share. If the 50% is available from the federal fund, the state share is set at 30% of the cost. The local share is set at 20% of the cost. The second check is on available state revenue. If the state share is available from the state fund, the project is retired. When the state does not have enough revenue to meet its share of the cost, the remaining state revenue is used to retire as much of that project as possible.

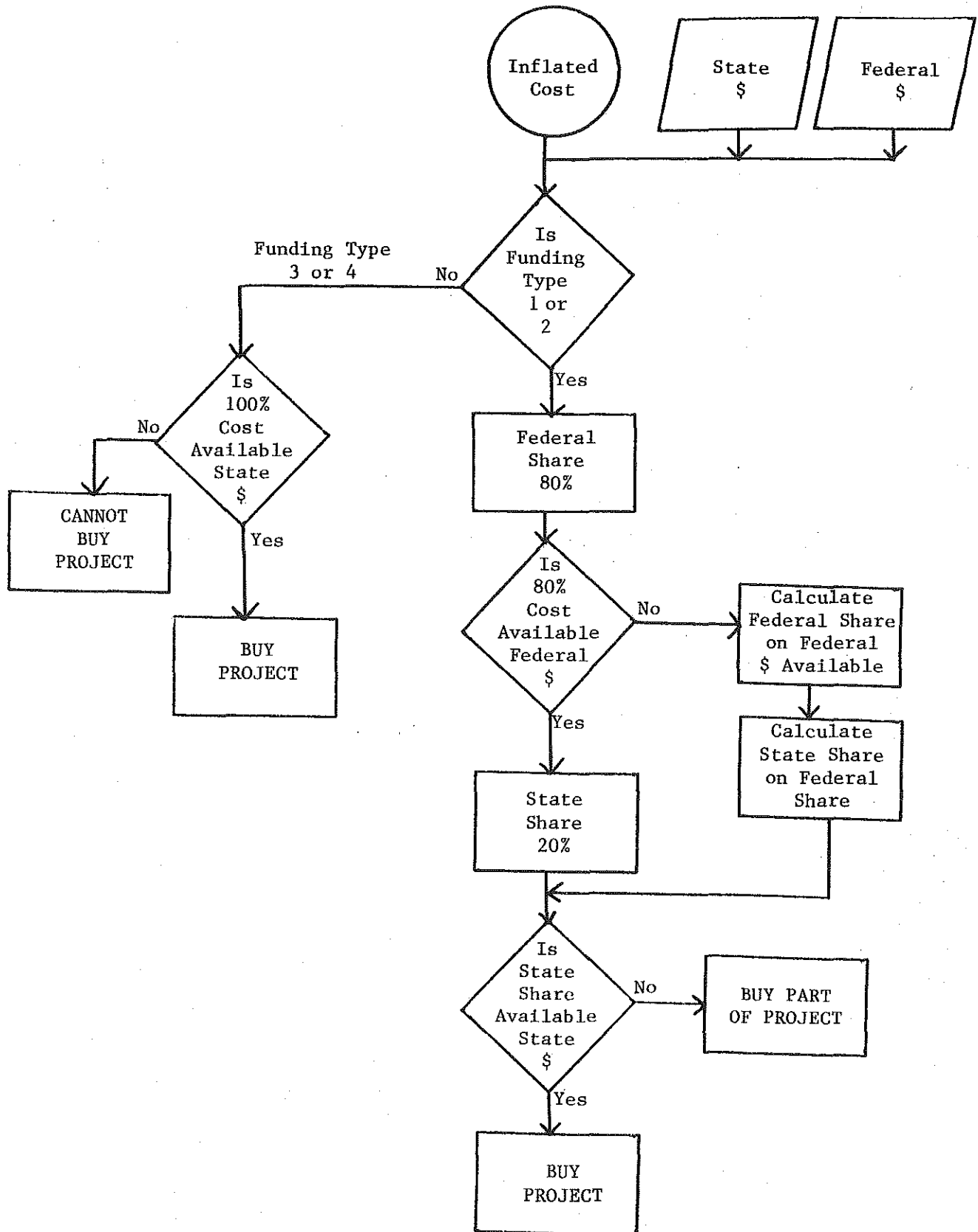
Capital Projects: Funding type is the first check with capital projects. If funding type is 3 or 4 (county incentive programs) and

FLOWCHART E(1)

LOCAL TRANSIT OPERATION & MAINTENANCE PROJECTS



LOCAL TRANSIT CAPITAL PROJECTS



there is not 100% of the cost available from state funds, the project cannot be retired. The federal share is set at 80% when funding type is 1 or 2 (urban programs). If the federal share is not available from federal funds, a new share is calculated based on the remaining federal revenue. Then a state share is calculated based on the federal share. If there is enough federal funds to cover 80% of the cost, the state share is set at 20% of the cost. The check on state revenue is then performed. If the state share is available from state revenue, the project is retired. When the state fund cannot cover the state share of the cost, the remaining state revenue is used to buy as much of the project as possible.

All local transit projects can be retired only with revenue of the year in which they become deficient.

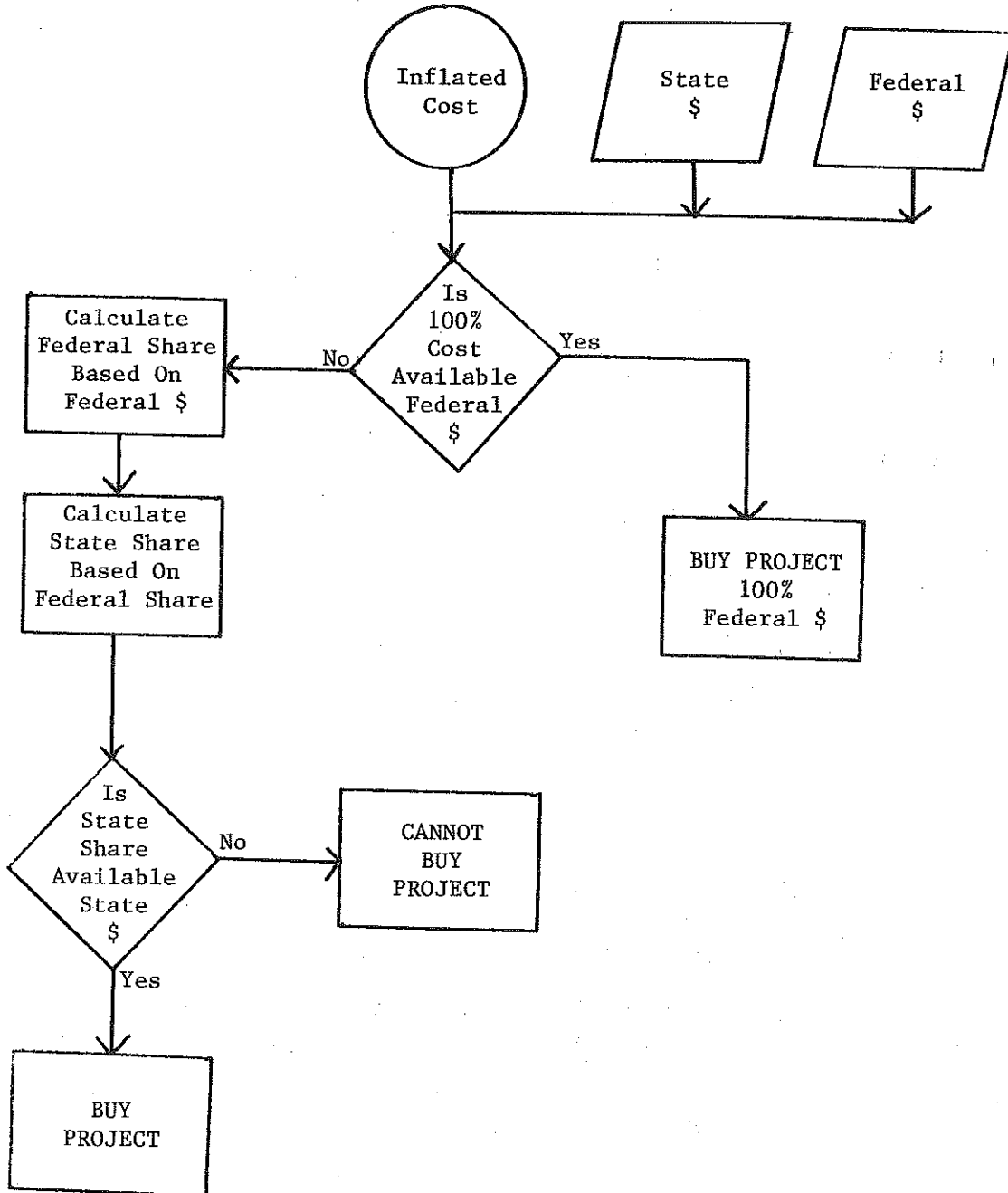
FLOWCHART F - Marine:

Ports have two sets of decision rules; one set is for dredging type needs (projects) and the other set is for all other types of needs (projects).

Dredging Projects: The first check in ports is on federal revenue. If 100% of the cost is available from federal funds, the project is retired entirely with federal revenue. If 100% is not available in federal money, a new federal share is calculated based on the remaining funds. A state share is then computed which picks up the remaining cost of the project. If the state fund does not have enough revenue for the state share, the project is not retired that year.

FLOWCHART F(1)

MARINE DREDGING DECISION RULES



Other Projects: There is only one check for these projects. If 100% of the cost is available from the state fund, the project is retired. If there is not enough revenue, the project is not retired that year.

FLOWCHART G - Non-Motorized:

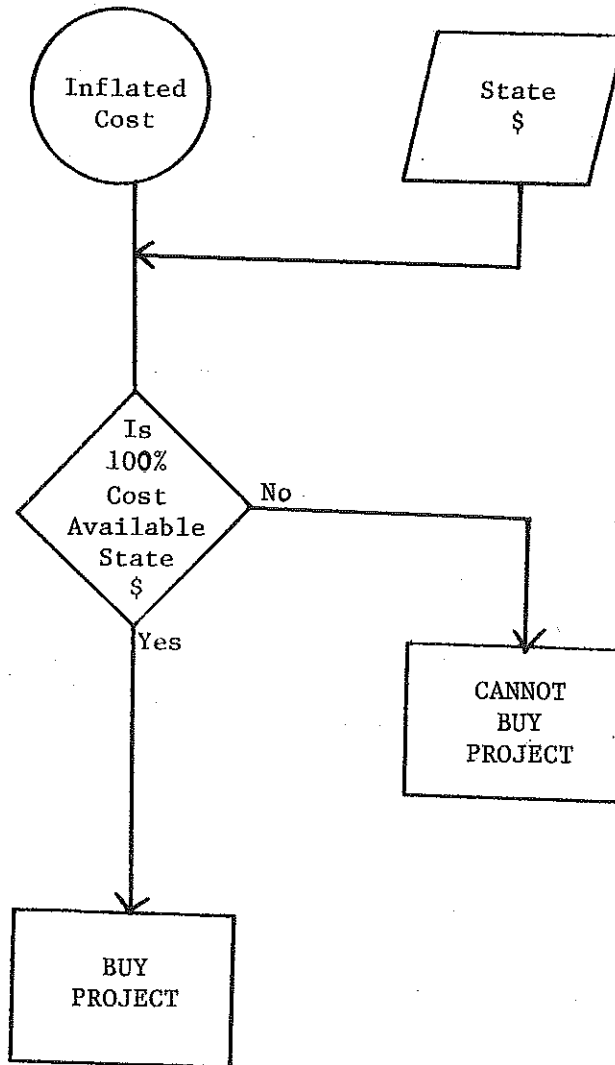
There is only one check in retiring a non-motorized need (project). If 100% of the cost is available from the state fund, the project is retired. If there is not enough revenue then the project is not retired that year.

FLOWCHART H - Rail Freight:

Rail freight has two different sets of decision rules; one for capital type needs (projects) and the other for operation and maintenance needs (projects). (See Figure 7.)

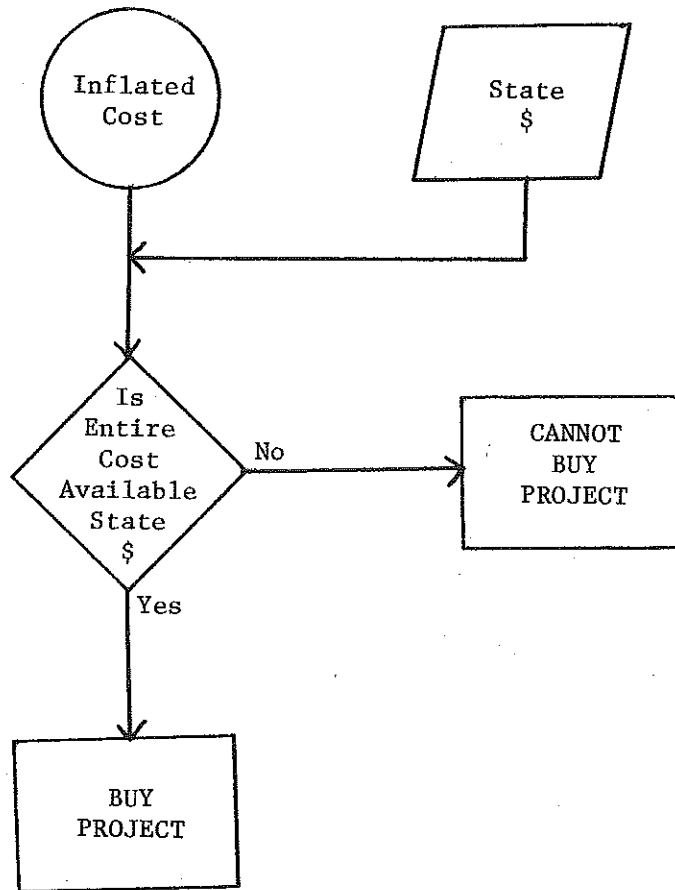
Capital Projects: The first check with capital projects is on federal revenue. If the federal share, 70%, is not available from the federal fund, a new share is calculated based on the remaining funds. Then a state share is calculated based on the federal share. If the 70% is available from the federal fund, the state share is set at 30% of the cost. The second check, which is on state revenue available, is then performed. If the state share is available from the state fund, the project is retired. If the state does not have enough revenue in the fund to meet the state share, the project is not retired that year.

**MARINE OPERATION & MAINTENANCE,
TERMINAL CONSTRUCTION,
& VESSEL ACQUISITION DECISION RULES**



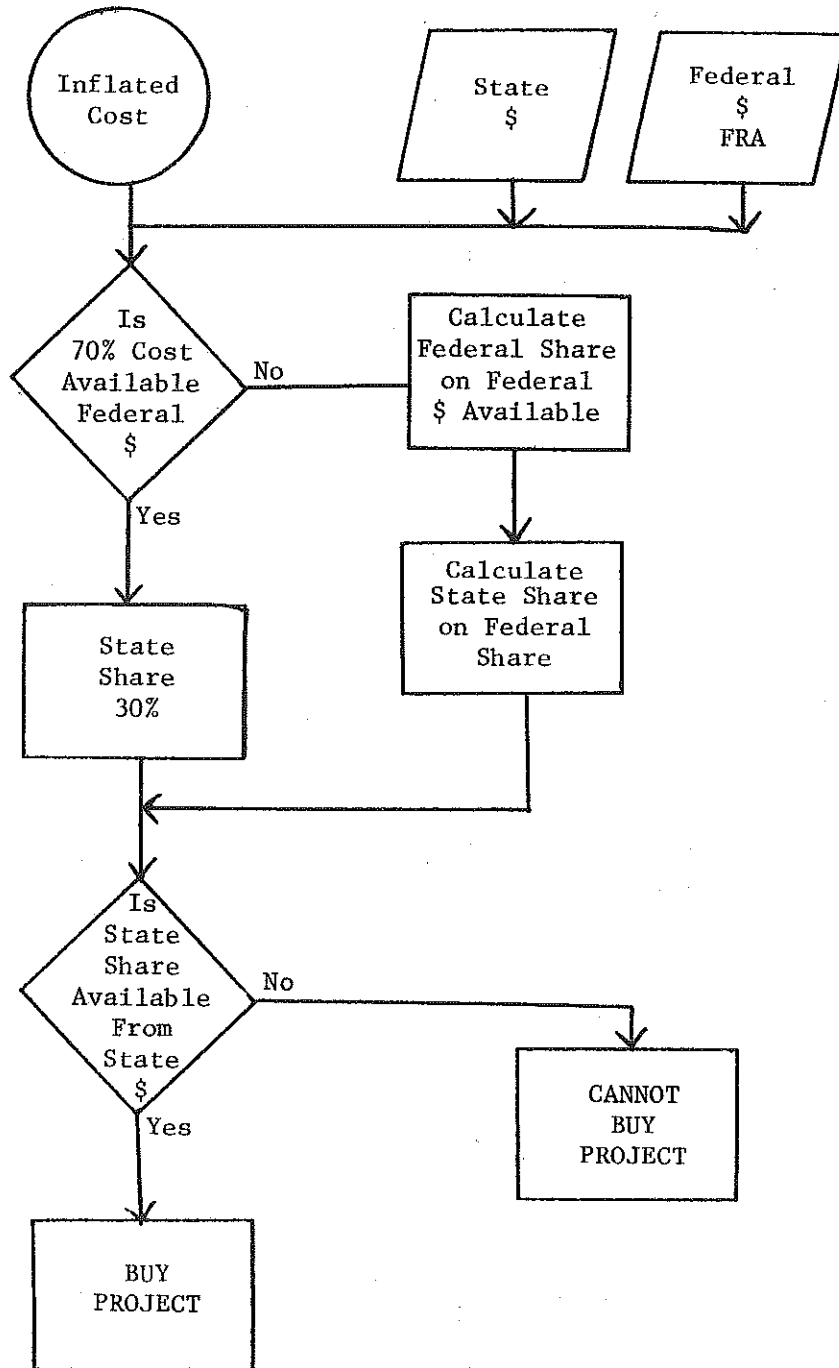
FLOWCHART G

NON-MOTORIZED DECISION RULES



FLOWCHART H(1)

RAIL FREIGHT CAPITAL DECISION RULES

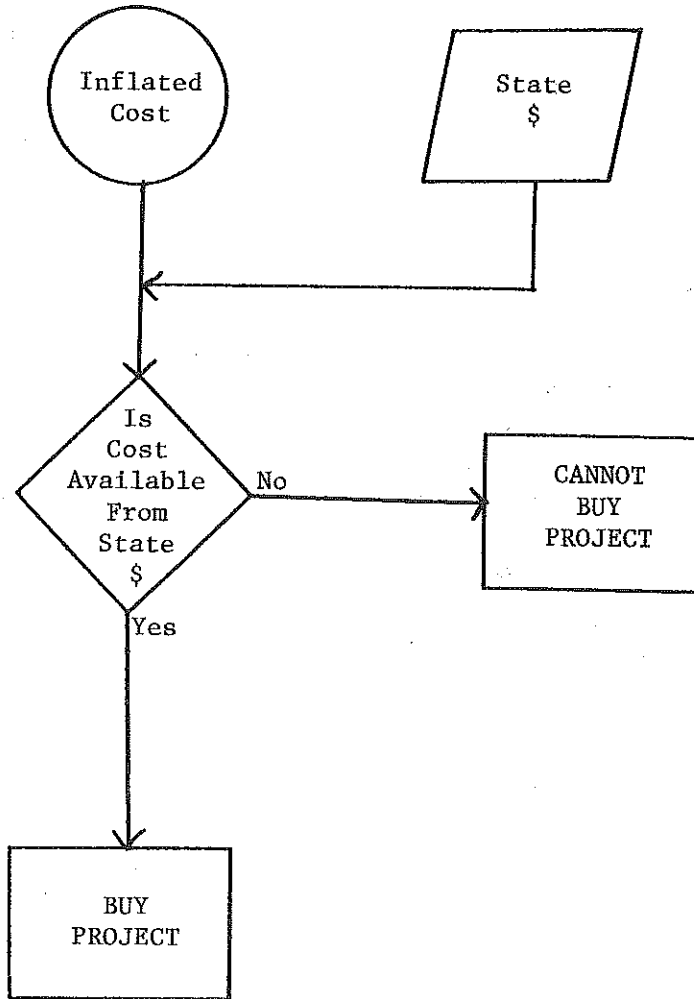


Operation and Maintenance Projects: Operation and maintenance projects are retired solely with state funds. If 100% of the cost is not available from the state fund, the project cannot be retired that year. If the cost is available, the project is retired.

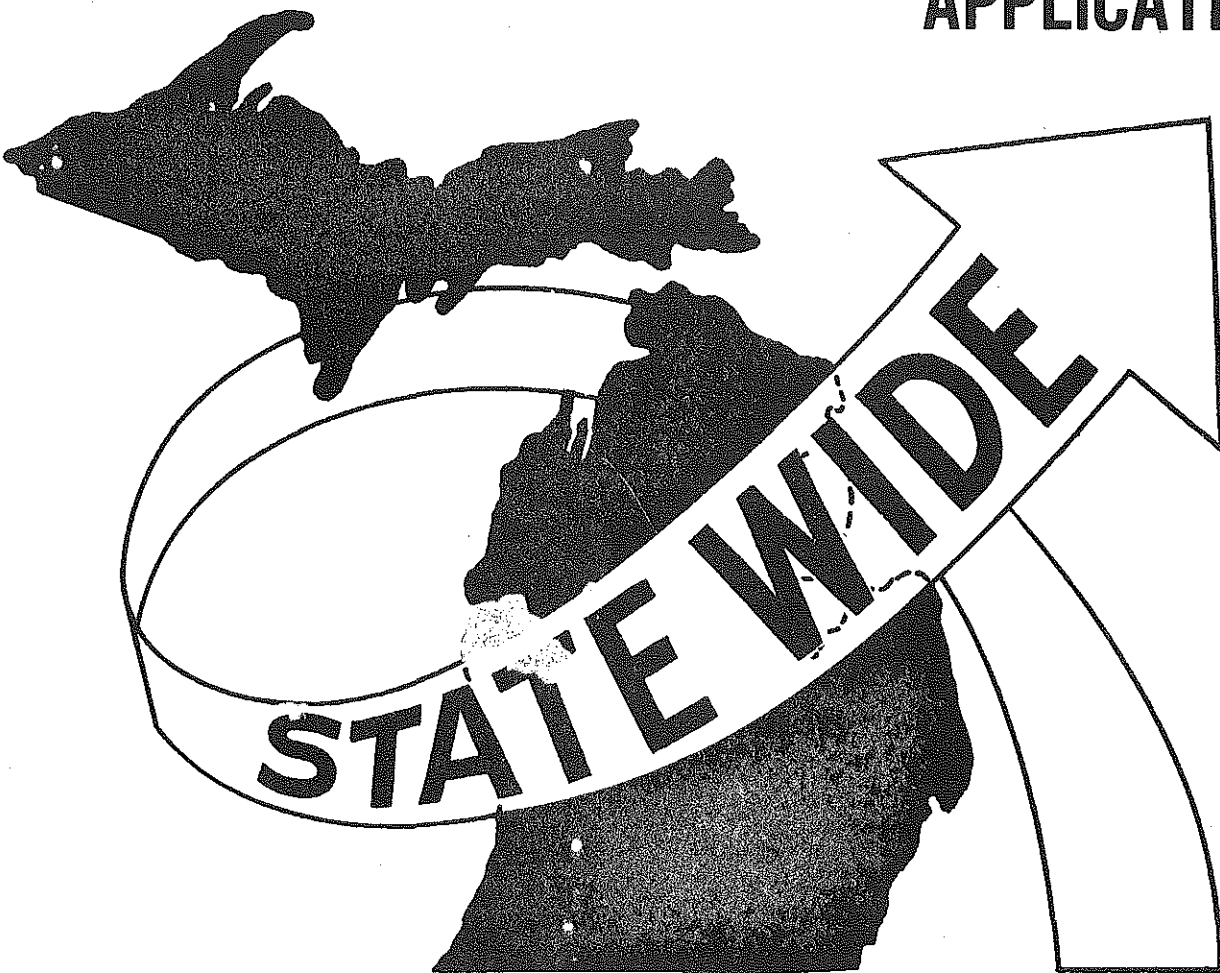
Service continuation projects--program element 1--capital or operation and maintenance type cannot be backlogged.

FLOWCHART H(2)

**RAIL FREIGHT OPERATION &
MAINTENANCE DECISION RULES**



APPLICATION



APPLICATION

The primary output of TRIP is computer files of needs: one containing retired needs and the other unmet needs. Computer listings of these files can be large and difficult to use. It is not easy to utilize these files in the daily decision making process. In order to make more use of TRIP, application reports were developed.

The first application report examined is TRIPSUM. This is a computer program which inputs TRIP output files and produces reports. The report shows dollars of retired deficiencies accumulated by mode and program element (see Figure 8). It also has the ability to report deficiencies by deficiency type and region. It can compare retired needs to total needs and produce results reports. TRIPSUM is a valuable tool in the initial assessment of TRIP output.

To analyze the location and distribution of TRIP output, CALFORM maps and network plotting are used. Using a code on the need record, the total dollars of retired deficiencies by county can be accumulated. These county totals are then displayed with shading in CALFORM maps (see Figures 9 and 10). The number of projects or selected subsets could also be displayed in a CALFORM map. In a similar manner, network plots are created. Using control section number, highway projects can be associated with its corresponding links in the highway network. Retired projects can be accumulated by number of projects or dollars. The magnitude can be displayed on the links using bandwidth plotting (see Figure 11). Selected program

FIGURE 8

MICHIGAN STATE TRANSPORTATION PLAN

**** SUMMARY ****

for Strategy 1 , REV= 1, OBJ= 1
ADD 3 ZEROES TO 1980 DOLLARS SHOWN

Mode ----	CONT.	RELOC.	Program Element		DISADV	EC DEV	SAFETY	ENERGY	ALL PE
			IMPROV	NEW S.					
CO	0	0	0	0	0	0	0	0	0
AV	146104	0	0	0	0	0	510	0	146614
HY	104164	6270	179903	20568	0	0	33821	34	344759
IB	7620	0	1695	1814	0	0	0	0	11128
IR	26531	0	44486	44388	0	0	0	0	115405
PT	217427	0	128829	484725	0	0	0	3234	834215
PO	39415	0	10600	5700	0	0	0	0	55715
NM	202	0	201	0	0	0	0	0	403
RF	42312	0	49386	2051	0	0	1623	0	95372
CT	0	0	0	0	0	0	0	0	0
AL	583775	6270	415099	559247	0	0	35953	3268	1603612

-36-

TRIPSUM

FIGURE 9

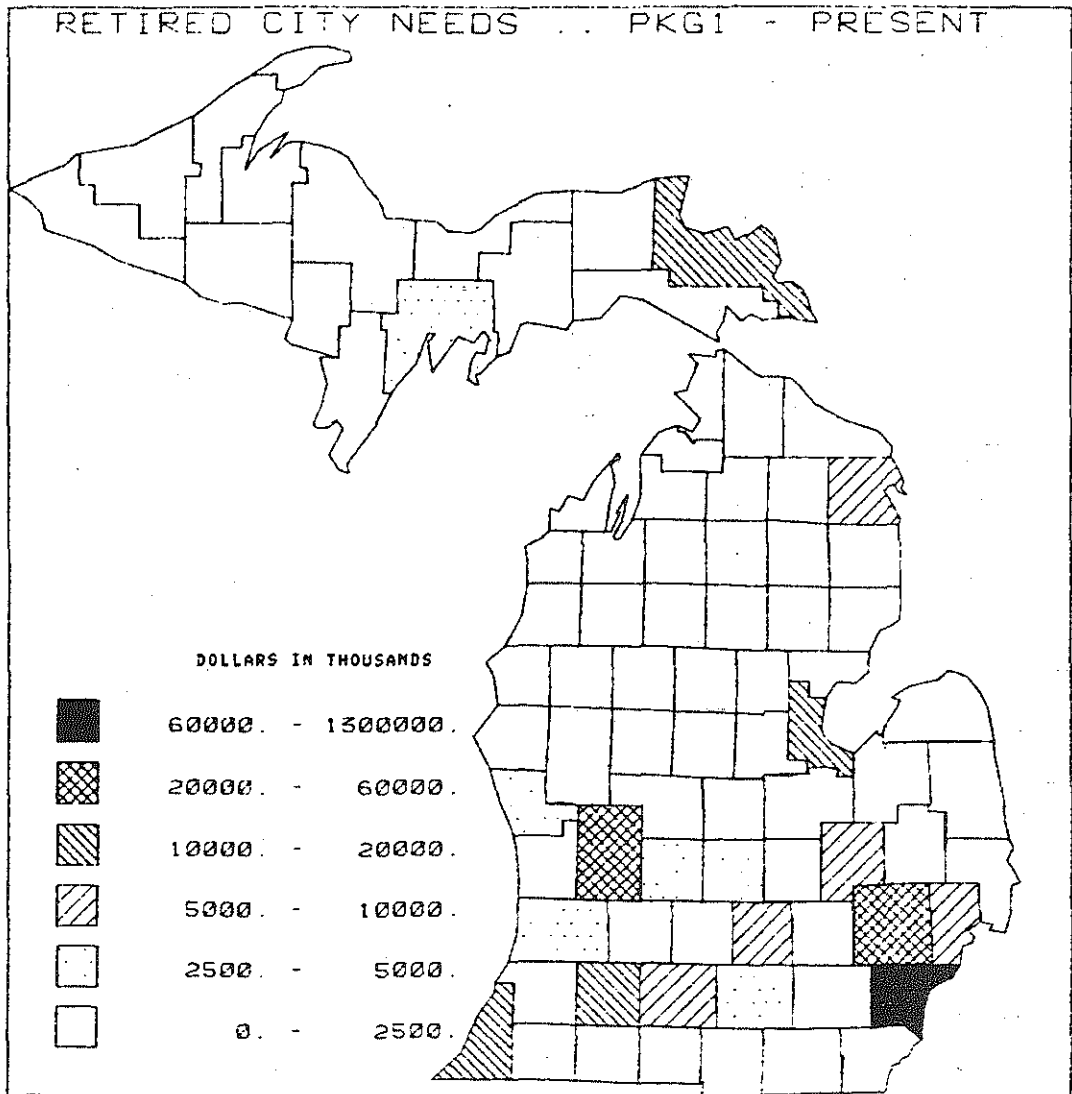


FIGURE 10

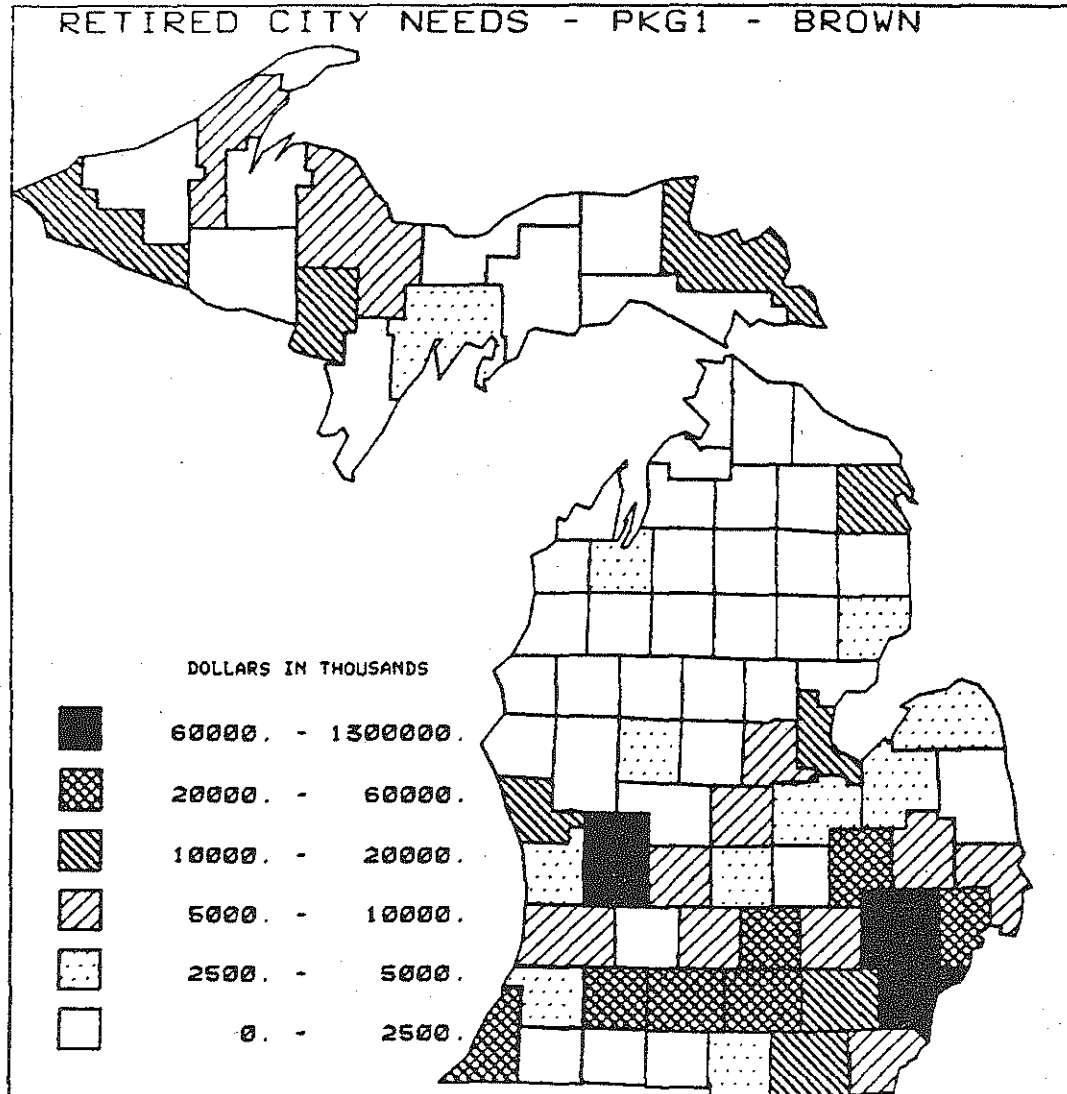
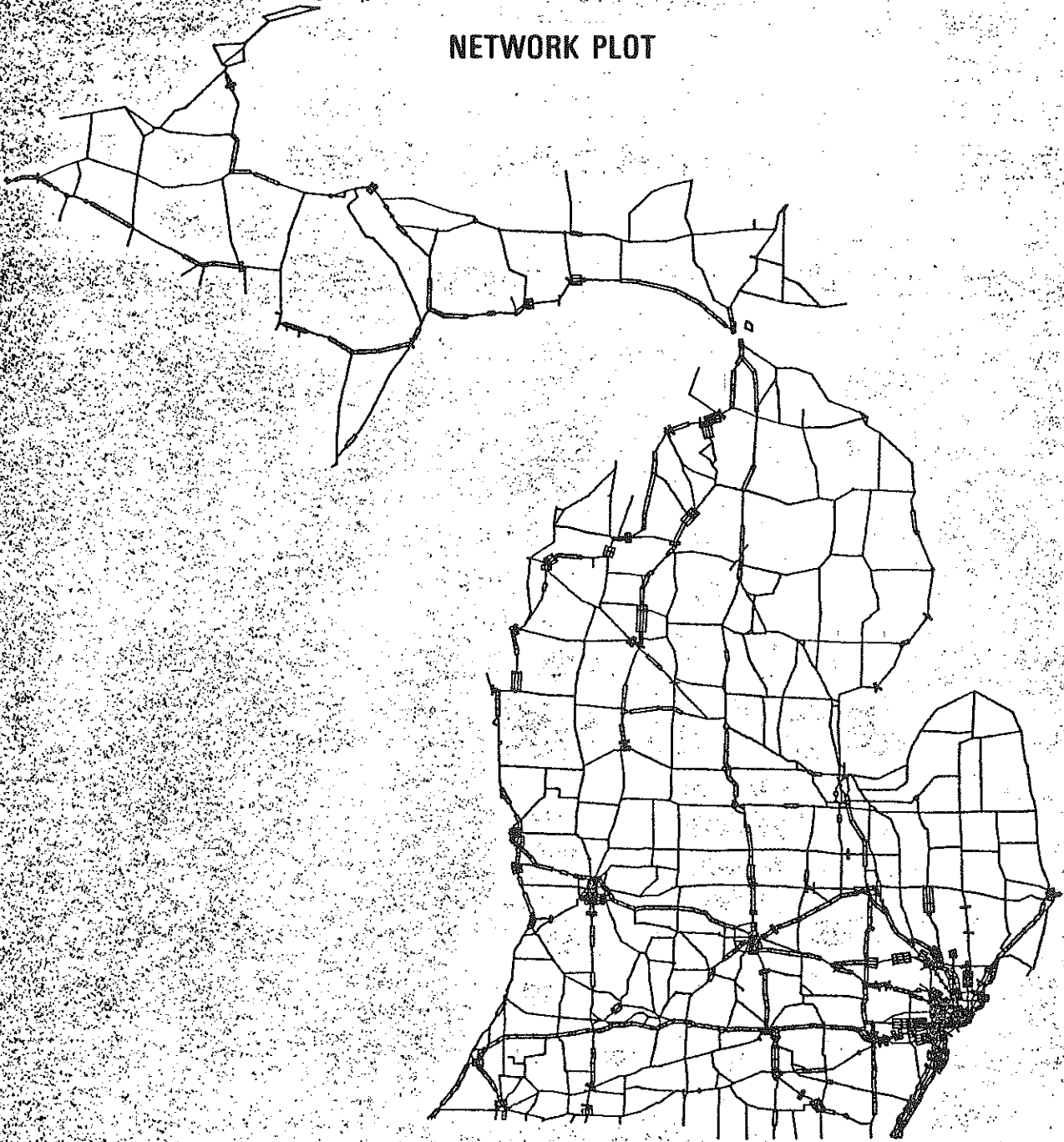


FIGURE 11

NETWORK PLOT



elements or years can also be displayed. CALFORM maps and network plots visually explain TRIP output easily and quickly.

Another way to look at TRIP output is with bar charts (see Figures 12 and 13). These bar charts show the total dollars of needs versus the retired needs by year for a given mode. These graphs could be used to look at particular program elements also.

All the applications shown could easily be run for different revenue package TRIP outputs. The CALFORM maps (see Figures 9 and 10) show an example of this. Figure 9 shows TRIP output for present tax revenue and Figure 10 shows TRIP output for Brown tax revenue*. The two maps point out quickly the implications in terms of needs retired for two different policy decisions. This is where TRIP can become a valuable tool in daily strategic planning analysis.

*Brown tax revenue - Proposed tax revenue package currently pending in the legislature.

FIGURE 12

MILLIONS

MARINE DEFICIENCIES - ALL PROG. ELEM. (1980 \$)
1981-1990 PRESENT / PLAN OBJ 3A / TOTAL NEEDS

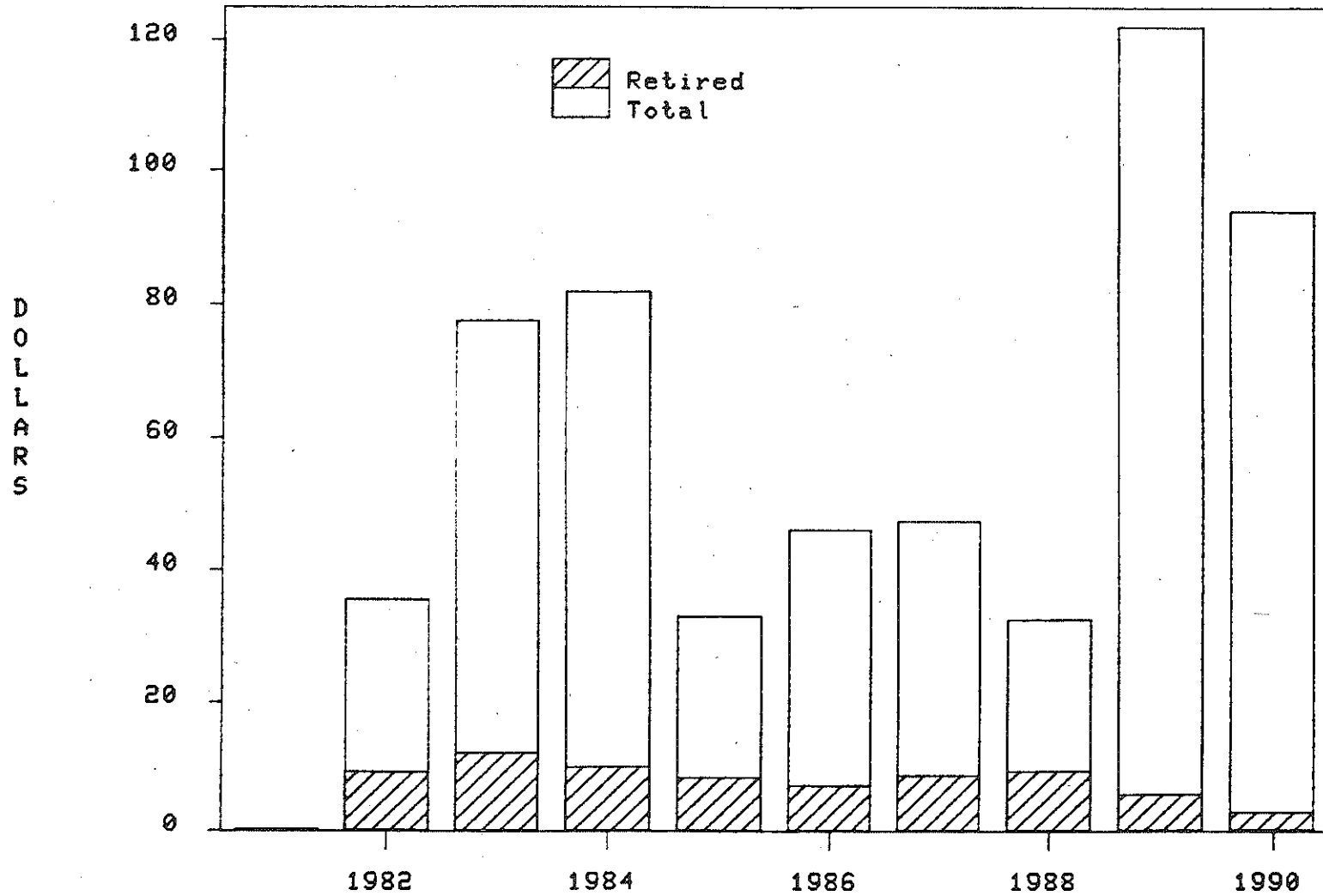
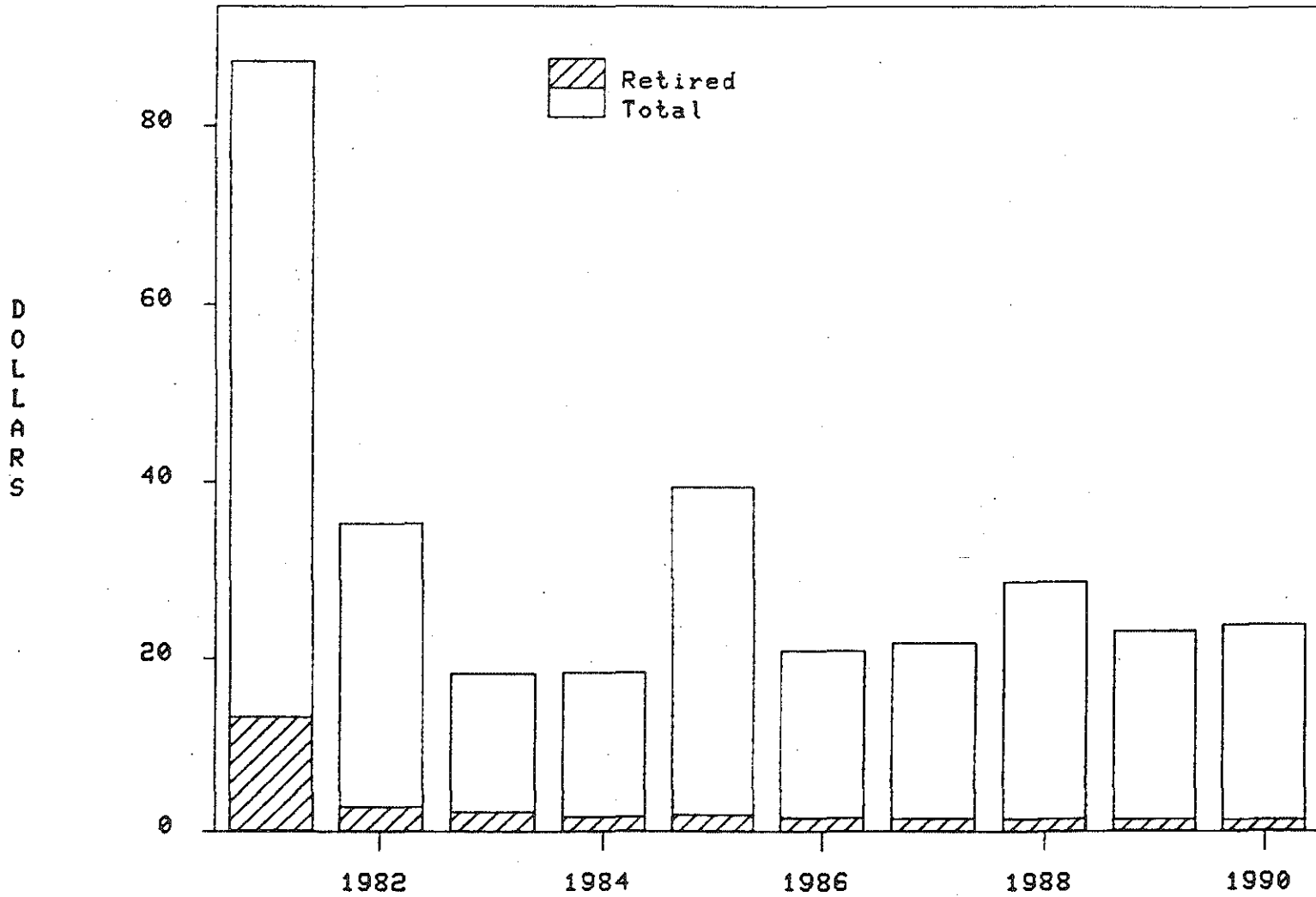


FIGURE 13

MILLIONS RR. FREIGHT DEFICIENCIES - ALL PROG. ELEM. (1980 \$)
1981-1990 PRESENT / PLAN OBJ 3A / TOTAL NEEDS



CONCLUSION

As transportation systems grow older and the number of transportation needs grow larger, deciding where to spend the limited revenue available becomes an ever more difficult question. TRIP helps decision makers address this question. Various revenue projections and different distributions of revenue among transportation modes can be input into the TRIP planning process. The output can be summarized and graphically displayed to enable analysis to be done quickly and easily. The utility of TRIP can assist decision makers in making more knowledgeable and informed choices.