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Statewide Transportation Analysis & Research

MICHIGAN'S STATEWIDE
TRANSPORTATION MODELING SYSTEM

PROJECT PRIORITIZATION PROCESS

VOLUME 1-S
NOVEMBER 1987

TRANSPORTATION PLANNING PROCEDURES SECTION



MICHIGAN DEPARTMENT OF TRANSPORTATION

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BUREAU OF TRANSPORTATION PLANNING

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STATE TRANSPORTATION COMMISSION

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PROJECT PRIORITIZATION PROCESS

by

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INTRODUCTION

Project prioritization is a computerized process which will calculate a rating (score) for each project based on a user specified set of variables and assigned weights for these variables. This process was developed to more efficiently prioritize projects and provide the ability to use data from different types of files. Previously, each time a request was received in the procedures section to prioritize projects a custom program was written to do the job. Any changes to variables, weights, or files required changes to the program. Also, it was very difficult or impossible to use information from more than one type of file. Using a sufficiency or needs network as a base (these networks are derived from the 547 Zone Network) provided the ability to use data from different types of files.

The variables now used in the project prioritization process can be from the required project file , optional inventory and socio-economic data files, or a required network (usually a sufficiency or needs network). The project, inventory and network files must have control section, beginning mile point and ending mile point (or distance) data for each record. The socio-economic data file must have zone numbers for each record.

The program, based on user choice; will calculate an average, weighted average, low or high value for each variable to use in calculating the score; do any special mapping of variables; and normalize values. The program will then calculate a score for each project and sufficiency segment. Output are three files which can be used to produce reports, graphs and plots.

The process is very useful in ranking projects based on any criteria (set of variables) the user chooses. The advantages of this process are :

1. It is easy to change variables and/or weights and re-run the program.
2. Variables from different files can be used.
3. Scores can be plotted on the network.
4. Input files do not need to be reformatted to be used in the process. The format of the file is specified by the user.
5. Variables from a socio-economic data file can be used without needing control section information on the file.

The process has been used to rank core projects, the "call for projects", long range projects, non-motorized and bridge data. Core projects are improve or expand projects which are selected by the Steering Committee to be added to the construction

program. The "call for projects" is an annual solicitation by the Project Programming Section of primarily preserve projects from the districts and other divisions in the Department. The result of this solicitation is a set of projects that these various agencies feel should be added to the construction program.

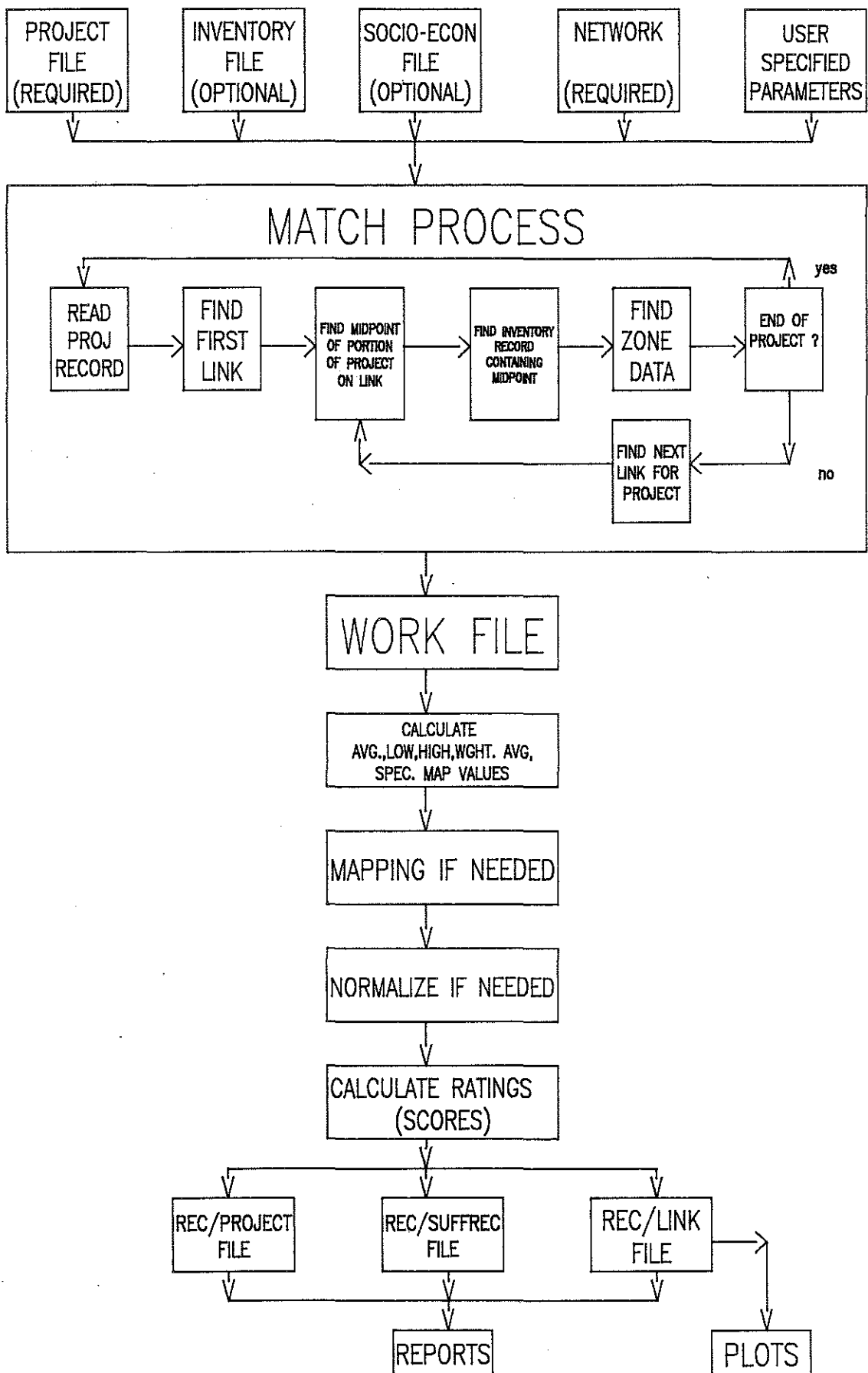
PROJECT PRIORITIZATION SYSTEM OPERATION

The following flow chart shows how the process works. The top row of boxes indicate that the user must specify what files will be input, the format of these files, and parameters (number of variables, weights for each variable, type of mapping, normalization, etc).

The program will then go through a "match process" which will get the data for all specified variables from all of the input files and put the needed data on one file ("work file"). The program will then use this work file to calculate for each project and variable an average, low, high, and distance weighted average values. If needed, values from user specified mapping will also be calculated. The next step is to do all standard mapping for those variables which need it. Standard mapping is reversing the value of variables (ie make large values small and small values large) since higher values for variables result in a higher rating (score). Normalization will convert all values for different variables to a common scale so that they can be used to calculate a meaningful rating (score) for each project.

After ratings (scores) are calculated the program will create three output files which are used to create reports and plots. The three output files are record/project, record/sufficiency record, and record/network link.

PROJECT PRIORITIZATION PROCESS



PARAMETERS AND OPTIONS

This section lists and explains all of the parameters and options the user must specify to run the program.

FILE IN CARD: These are parameters that give general file information.

PROJ: = T => Will input a project file (1)
INVEN: = T => Will input an inventory file (2)
SECON: = T => Will input a socio-economic file (3)
NPROJ: = # of variables needed from project file
NINVEN: = # of variables needed from inventory file
NSECON: = # of variables needed from socio-economic file
NNET: = # of variables needed from network file
PEMP: = T => Project file has ending mile points
 F => Project file has distance
IEMP: = T => Inventory file has ending mile points
 F => Inventory file has distance
NEMP: = T => Network file has ending mile points
 F => Network file has distance
NZON: = # of volume field on network containing zone
 number
IDIREC: = T => Inventory file has directional data
XALT: = 'XXXXXX' => Alternate number

PROJECT FORMAT CARD : This card tells the program where the data the program needs is located on the project file. It is needed only if PROJ = T. Repeat counts in the format can not be used (ie use I5,I5 instead of 2I5) for items preceding the variable fields. Six items (2 for route name) are required before variables. The project file must be in sort with all records for a given project together sorted by beginning mile point within control section.

PROJECT: project ID (A6), route name (2 alpha A5 variables), control section, beginning mile point, ending mile point (or distance if PEMP = T), variable locations for 'NPROJ' variables.

INVENTORY FORMAT CARD : This card tells the program where the data the program needs is located on the inventory file. It is needed only if INVEN = T. Repeat counts in the format, as in the project format card, can not be used (ie use I5, I5 instead of 2I5) for items preceding the variable fields. Three items are required (four (4) if IDIREC = T) before the variables.

INVEN : control section, beginning mile point, ending mile point (or distance if IEMP = T), direction (if IDIREC = T), variable locations for 'NINVEN ' variables.

SOCIO-ECONOMIC FORMAT CARD : This card tells the program where the data the program needs is located on the socio-economic file. It is needed only if SECON = T.

S-ECON : zone number, variable locations for 'NSECON' variables.

NETWORK FORMAT CARD : This is not a format card . It consists of volume field locations for the variables separated by commas. It is always needed. If pavement type is needed for special mapping of PMS# then it must be the first variable following the distance field.

Enter volume fields for control section, beginning mile point, ending mile point (or distance if NEMP = T) followed by volume fields for 'NNET' variables separated by commas.

PARAMP CARD : These are parameters for the project file.

PALH (I) = -1 => for the Ith variable, use minimum value
 0 => " " " , use average value
 1 => " " " , use maximum value
 2 => " " " , use dist. wt. avg
XPWGHT (I) = # => for the Ith variable, the desired weight
PZ (I) = T => for the Ith variable, zero value is ok
 F => " " " , zero value not ok
PNORM (I) = T => for the Ith variable, normalize values
 F => " " " , do not normalize
PMAP (I) = 0 => for the Ith variable, no mapping needed
 1 => " " " , stand.inverse map
 2 => " " " , spec. mapping needed
PDEC = # => number of decimal places in dist,bmp,emp

PARAMI CARD : These are parameters for the inventory file.

IALH (I) = -1 => for the Ith variable, use minimum value
 0 => " " " , use average value
 1 => " " " , use maximum value
 2 => " " " , use dist. wt. avg
XIWGHT (I) = # => for the Ith variable, the desired weight
IZ (I) = T => for the Ith variable, zero value is ok
 F => " " " , zero value not ok
INORM (I) = T => for the Ith variable, normalize values
 F => " " " , do not normalize
IMAP (I) = 0 => for the Ith variable, no mapping needed
 1 => " " " , stand. inverse map
 2 => " " " , spec. mapping needed
IDEC = # => number of decimal places in dist,bmp,emp

PARAMS CARD : These are parameters for the socio-economic file.

SALH (I) = -1 => for the Ith variable, use minimum value
 0 => " " " , use average value
 1 => " " " , use maximum value
 2 => " " " , use dist. wt. avg
XSWGHT(I) = # => for the Ith variable, the desired weight
SZ (I) = T => for the Ith variable, zero value is ok
 F => " " " , zero value not ok
SNORM (I) = T => for the Ith variable, normalize values
 F => " " " , do not normalize
SMAP (I) = 0 => for the Ith variable, no mapping needed
 1 => " " " , stand. inverse map
 2 => " " " , spec. mapping needed

PARAMN CARD : These are parameters for the network file.

NALH (I) = -1 => for the Ith variable, use minimum value
 0 => " " " , use average value
 1 => " " " , use maximum value
 2 => " " " , use dist. wt.average
XNWGHT (I) = # => for the Ith variable, the desired weight
NZ (I) = T => for the Ith variable, zero value is ok
 F => " " " , zero value not ok
NNORM (I) = T => for the Ith variable, normalize values
 F => " " " , do not normalize
NMAP (I) = 0 => for the Ith variable, no mapping needed
 1 => " " " , stand. inverse map
 2 => " " " , spec. mapping needed
NDEC = # => number of decimal places in dist,bmp,emp

MAP CARDS: These are needed only if PMAP, IMAP, SMAP, or NMAP > 1.

COL 1 - 5	MAP :
COL 6 - 6	P => map for project file variable
	I => map for inventory file variable
	S => map for socio-economic file variable
	N => map for network file variable
COL 15 - 16	# of variable to be mapped
COL 17 - 24	low end of range to map, I=F8.2, A= A6,2X
COL 25 - 32	high end of range to map, I= F8.2, A= A6,2X
COL 40 - 40	arithmetic operation (+,-,*,/), or A, 1-9 for alpha maps, blank for integer mapping
COL 41 - 48	constant, "min", or "max" to use with arithmetic operation
COL 49 - 56	new value to be used, F8.2 format

OPTION CARD :

SHORT = T => bypass match routine and change weights only

F => new run - do not bypass match routine

APPLICATION

This section contains outputs of a run to prioritize core projects. Core projects are improve or expand projects which are selected by the Steering Committee to be added to the construction program. The prioritization process was used to rank the projects based on a set of variables and weights assigned to each of these variables. Various weights for the variables can be used to determine which set gives the best ranking for the projects.

The first page of this section illustrates the documentation that the program prints out for the user. It shows the run date, alternate number, parameters and options that were specified by the user, weights for each variable, and file information. If special mapping was done a listing of the mapped variables and related information would also be printed out as documentation for the user.

The remaining pages contain the listing of the projects sorted by project score. The listing shows project number (P NUM), county, route, control section (C SEC), rating section (R SEC), direction (DIR), beginning mile point (BMP), distance (DIST), project score (P SC), rating section score (RS SC), work type (WK TYPE), safety ,public agency support. (PUB AG), economic impact (ECON DEV), local plans (LOC), highway impact analysis program (HIAP), condition data (COND), existing level of service (EX LOS), future level of service (F LOS), pcn, and vehicle miles of travel (VMT).

ALTERNATE NUMBER CORE7

****FILE INFORMATION****

PARAMS

PROJ = T	INVEN = T	SECON = F	NZON = 6
NPROJ = 6	NINVEN = 1	NSECON = 0	NNET = 4
PEMP = T	ICMP = F	IDIREC = T	NEMP = F
PDEC = 1	IDEC = 1	XALT = CORE7	NDEC = 2

PROJECT FILE

NAME : (STWD)PVC/PROJECT/PPF/CORE/082187/SORTED ON STATEWIDE.
 FORMAT : (A3,A5,A2,T51,I5,I3,I3,T45,I3,T68,I1,T69,4I1)

DATE CREATED : SEP 2, 1987 LAST RECORD = 83
 DESCRIPTION :

INVENTORY FILE

NAME : (STWD)PVC/SUFF/86/070187C/COREPRIOR ON STATEWIDE.
 FORMAT : (T10,I5,T118,I3,T123,I3,T15,I1,T185,I2)

DATE CREATED : AUG 27, 1987 LAST RECORD = 6368
 DESCRIPTION :

NETWORK FILE

NAME : (STWD)PVC/SUFF/070387/PCNVMT/1 ON STATEWIDE.
 VOLUME FIELDS : 3, 4,54,13,18,15,23,

DATE CREATED : SEP 24, 1987
 DESCRIPTION :

****VARIABLE INFORMATION****

VAR #	FILE	ALH	WEIGHT	ZERO	NORM	MAP	IMIN / CMIN	IMAX / CMAX	VARIAB NAME
1 - 1	P	2	0.00	T	F	0	*****/0	0/320	<u>WIRI TYPE</u>
2 - 2	P	2	200.00	T	F	0	*****/0	0/9	<u>CAPACIT</u>
3 - 3	P	2	140.00	T	F	0	*****/0	0/9	<u>PIPE RADIUS</u>
4 - 4	P	2	160.00	T	F	0	*****/0	0/6	<u>FLOW DEV</u>
5 - 5	P	2	90.00	T	F	0	*****/0	0/9	<u>LOCAL PLANS</u>
6 - 6	P	2	110.00	T	F	0	*****/1	0/9	<u>HIAP</u>
7 - 1	I	2	6.00	T	F	0	*****/0	0/90	<u>CONDITION</u>
8 - 1	N	2	120.00	T	F	0	*****/0	0/9	<u>EX LOS</u>
9 - 2	N	2	50.00	T	F	0	*****/0	0/9	<u>INT LOS</u>
10 - 3	N	2	80.00	T	F	0	*****/0	0/9	<u>REN</u>
11 - 4	N	2	40.00	T	F	0	*****/0	0/9	<u>WWT</u>

****COMMENTS****

ALTERNATE CORE 7 ALL VARIABLES WEIGHTED
SEPTEMBER 29, 1987

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P NUM	COUNTY	ROUTE	C SEC	R SEC	DIR	BMP	DIST	P SC	RS SC	MK TYPE	SAFETY	PUB AG	ECON DEV	LOC	HIAP	COND	EX LOS	F LOS	PCN	VMT
* 029	HASHTENAM	US23	81074		1	.30	.00	9.28	4.64	230	4	6	1	6	2	4.5	3	7	9	9
* 029	HASHTENAM	US23	81074		2	.30	.00	9.28	4.64	230	4	6	1	6	2	4.5	3	7	9	9
* 006	INGHAM	I96BL	33032		9	4.70	1.00	7.23	7.23	210	4	6	6	9	6	9.0	9	9	9	9
* 005	INGHAM	I96BL	33032		9	3.80	.80	7.03	7.03	210	4	6	6	9	4	9.0	9	9	9	9
* 018	MACOMB	M59	50052		9	.00	3.40	6.93	7.04	320	4	9	6	9	4	9.0	9	9	9	7
018	MACOMB	M59	50022		9	.00	2.20	6.93	6.86	320	4	9	6	9	4	2.0	9	9	9	8
018	MACOMB	M59	50021		3	.00	1.00	6.93	6.86	320	4	9	6	9	2	4.5	9	9	9	6
018	MACOMB	M59	50021		4	.00	1.00	6.93	6.86	320	4	9	6	9	2	4.5	9	9	9	6
018	MACOMB	M59	50022		9	3.00	1.40	6.93	6.91	320	4	9	6	9	4	.0	9	9	9	9
* 022	OAKLAND	US10	63053		9	.20	3.00	6.93	6.93	210	9	6	1	9	4	4.0	9	9	9	9
* 014	SAGINAW	M46	73062		9	5.20	.80	6.89	6.89	210	4	9	1	9	9	4.5	9	9	9	8
016	MACOMB	M53	50011		9	5.20	2.00	6.89	6.23	212	4	9	6	9	3	2.0	9	9	9	9
016	SHIawassee	M52	76012		9	.40	.00	6.89	5.48	210	4	6	6	6	4	6.5	7	9	9	5
016	MACOMB	M53	50011		1	7.20	3.00	6.89	7.12	212	4	9	6	9	3	6.5	9	9	9	9
* 016	MACOMB	M53	50011		2	7.20	2.00	6.89	7.17	212	4	9	6	9	3	6.5	9	9	9	9
* 020	MACOMB	M53	50011		9	4.20	3.00	6.75	6.83	160	4	9	6	9	4	2.0	9	9	9	8
020	MACOMB	M53	50011		1	4.90	.30	6.75	5.94	160	4	9	6	9	4	4.5	1	6	9	6
* 003	KENT	I19685	41042		9	2.10	1.00	6.66	6.66	143	4	9	1	6	9	6.5	9	9	9	6
004	CALHOUN	I948L	13061		9	7.20	5.50	6.44	6.42	160	9	9	6	9	2	9.0				2
004	CALHOUN	I948L	13032		9	.00	.50	6.44	6.14	160	9	9	6	9	2	6.5	6	6		3
031	WEXFORD	US131	83031		9	4.30	1.70	6.23	4.59	212	4	9	6	9	2	2.0			9	5
031	WEXFORD	US131	83032		9	.00	11.40	6.23	6.48	212	4	9	6	9	4	2.0	9	9	9	6
054	HILLSDALE	US127	30091		9	.00	.80	6.18	4.89	210	4	9	1	9	8	2.0			9	3
054	LENAHEE	US127	46011		9	5.40	.50	6.18	5.01	210	4	9	1	9	1	4.0	9	9	9	4
* 054	JACKSON	US127	38111		9	.00	8.10	6.18	6.35	210	4	9	1	9	8	2.0	7	9	9	8
040	MASON	US10&31	53032		9	.00	1.80	6.14	6.14	210	4	6	6	6	3	9.0	9	9	9	5
* 062	DICKINSON	US2	22021		9	.80	6.10	6.14	6.14	6.14	4	6	6	9	4	4.5			9	3
* 056	LAPEER	M24	44011		9	4.20	.80	6.03	6.03	210	4	6	6	6	4	9.0	9	9	9	9
* 009	OAKLAND	M15	63071		9	.00	.40	5.99	5.99	210	4	9	6	6	5	4.0	9	9	9	5
* 013	KENT	M44	41051		9	4.20	5.70	5.88	5.88		4	9	1	9	9	4.0	9	9	9	6
036	CLINTON	US27	19031		9	2.90	4.70	5.82	5.81	320	4	9	3	9	4	.0	9	9	9	7
036	CLINTON	US27	19031		9	3.00	.60	5.82	5.91	320	4	9	3	9	4	.0	9	9		2
* 024	KENT	US131	41131		1	6.90	3.30	5.71	5.71	160	4	9	6	6	1	.5			9	8
* 024	KENT	US131	41131		2	6.90	3.30	5.71	5.71	160	4	9	6	6	1	4.5			9	8
* 017	GENESEE	M54	25072		9	6.60	1.20	5.64	5.64	210	4	6	1	9	6	9.0	9	9	9	7
* 051	BERRIEN	US31REL	11052		9	.00	12.40	5.60	5.60		4	9	3	9	4	6.5	9	9	9	5
* 038	MASON	US31	53031		9	7.50	9.80	5.48	5.48	320	4	9	3	9	3	9.0		3	9	8
* 034	ARENAC	US23	6072		9	.00	9.50	5.41	5.41	210	4	9	6	9	1	6.5			9	3
* 066	KENT	M11	41062		9	.00	3.50	5.35	6.46		4	9	5	4	4	4.0	9	9	9	7
066	KENT	M11	41061		9	.00	7.90	5.35	4.86		4	9	5	4	4	6.5			9	3
039	MASON	US31REL	53032		9	6.30	.50	5.26	4.11		4	6	1	6	1	2.0	4	4	9	3
039	MASON	US31REL	53033		9	.00	.50	5.26	3.65	210	4	6	1	6	1	6.5			9	2
* 039	MASON	US10&31	53032		9	1.70	4.50	5.26	5.27	210	4	6	6	6	1	9.0	4	4	9	9
* 068	OTTAWA	M45	70041		9	11.60	5.70	5.26	5.26	159	4	9	6	9	1	2.0			9	6
* 010	OAKLAND	M150TB	63132		9	2.10	.60	5.03	5.03	220	4	3	1	9	9	.0	9	9		7
* 042	MONTMORENCY	M32	60021		9	11.50	20.90	4.91	5.00	320	4	6	6	9	4	9.0			9	5
042	MONTMORENCY	M32	60022		9	.00	10.60	4.91	4.73	160	4	9	1	9	2	9.0			9	7
* 028	HASHTENAM	US23BR	81073		9	.60	.00	4.72	4.72	171	4	9	1	6	3	2.0	7	9		5
* 058	MACOMB	M53	50013		1	.00	8.10	4.68	4.68	320	4	6	3	9	5	2.0			9	7
* 058	MACOMB	M53	50013		2	.00	8.10	4.68	4.68	320	4	6	3	9	5	2.0			9	7
007	OAKLAND	M1	63051		3	.00	3.70	4.64	4.52	143	4	9	1	9	7	4.5				7
007	OAKLAND	M1	63051		4	.00	3.70	4.64	4.52	143	4	9	1	9	7	4.5				7
* 007	OAKLAND	M1	63151		1	.00	.80	4.64	5.21	143	4	9	1	9	7	6.5			9	7
* 007	OAKLAND	M1	63151		2	.00	.80	4.64	5.21	143	4	9	1	9	7	6.5			9	7
* 065	KALAMAZOO	M43	39082		9	.00	1.10	4.55	4.55		4	6	1	1	4	6.5	9	9		7
* 055	LENAHEE	US12	46101		9	.00	7.60	4.52	4.52	210	4	6	1	9	3	6.5			9	
043	GD TRAVERSE	US131	28091		9	.00	1.00	4.37	4.50	159	4	9	3	6	4	2.0			9	3
043	WEXFORD	US131	83032		9	11.40	7.20	4.37	3.90	212	9	3	6	4	6.5			9	9	
* 043	GD TRAVERSE	US131	28091		9	1.00	4.30	4.37	5.12	159	4	9	3	6	9	2.0			9	5
* 049	OSCODA	M33/72	68012		9	.00	.30	4.36	4.36	210	4	3	6	6	2	.0	3	4	9	3
059	ST JOSEPH	US131	78031		9	.00	2.90	4.34	4.83	159	4	3	3	9	4	6.5	3	3	9	6
* 059	ST JOSEPH	US131	78012		1	9.60	.90	4.34	4.84	159	4	3	3	9	4	4.5	6	6	9	
* 059	ST JOSEPH	US131	78012		2	9.60	.90	4.34	4.84	159	4	3	3	9	4	4.5	6	6	9	
059	KALAMAZOO	US131	39011		1	.00	5.00	4.34	4.11	210	4	3	3	9	4	2.0			9	8
059	KALAMAZOO	US131	39011		2	.00	5.00	4.34	4.11	210	4	3	3	9	4	2.0			9	8
* 019	HAYNE	M85	82211		1	13.90	1.20	4.20	4.20	210	4	9	1	9	3	9.0				7
* 019	HAYNE	M85	82211		2	13.90	1.20	4.20	4.20	210	4	9	1	9	3	9.0				7

ALTERNATE CORE 7 ALL VARIABLES WEIGHTED
 SEPTEMBER 29, 1987

P NUM	COUNTY	ROUTE	C SEC	R SEC	DIR	BHP	DIST	P SC	RS SC	WK TYPE	SAFETY	PUB AG	ECON DEV	LOC	HTAP	COND	EX LOS	F LOS	PCN	VMT
* 050	BERRIEN	US31	11057		9	3.10	.40	3.81	3.81	320	4	9	3	9	4	.0				
061	TUSCOLA	M24EXT	79051		9	13.90	.40	3.81	3.81	210	4	9	1	9	4	4.0				2
* 027	MONROE	US24	58052		9	8.80	.50	3.31	3.48	160		3	1	6	4	4.0	9	9		3
027	MONROE	US24	58051		9	6.00	.10	3.31	2.48	160		3	1	6	4	6.5		4		8
060	OTTAWA	US31	70014		1	.00	7.60	3.08	2.18		4				1	4.5			9	8
060	OTTAWA	US31	70014		2	.00	7.60	3.08	2.10		4				1	4.0			9	8
* 060	OTTAWA	US31	70013		1	.00	13.20	3.08	3.69			9	1	9	1	4.5			9	5
060	OTTAWA	US31	70013		2	.00	13.20	3.08	3.55			9	1	9	1	4.5			9	5