

Zack Stewart
Northern District Commissioner

Wayne O. Burkes
Central District Commissioner

Konnie Shows
Southern District Commissioner



Dr. Robert L. Robinson
Executive Director

Kenneth I. Warren
Deputy Executive Director/
Chief Engineer

RECEIVED
OCT 09 1997

Mississippi Department of Transportation / P.O. Box 1850 / Jackson, Mississippi 39215-1850 / FAX (601) 359-7418

ROADWAY DESIGN

October 8, 1997

MEMORANDUM

TO: Assistant Chief Engineer - Operations
Mr. Jim Kopf

FROM: State Traffic Engineer
Edward A. Bailey

SUBJECT: Delineators policy on Interstates and Controlled Access routes

NOT APPROVED YET.

The Manual on Uniform Traffic Control Devices, (MUTCD), Section 3D-4, page 3D-2 states that "Roadside delineators shall be optional on tangent sections of expressway and freeways when all of the following conditions are met:

1. Raised pavement markers are used continuously on lane lines throughout all curves and on all tangents to supplement pavement markings.
2. Where whole routes or substantial portions of routes have large sections of tangent alignment. Where, if roadside delineators were not required on tangents, only short sections of curved alignment would need delineators.
3. Roadside delineators are used to lead into all curves as shown in Table III-1."

A Policy For Placing Raised Pavement Markers was approved by the Chief Engineer on August 18, 1997, (copy attached), thus satisfying criteria number 1. Mississippi controlled access routes and interstates certainly comply with criteria number 2. Table III-1 as referenced in criteria number 3 is attached (page 3D-3 from MUTCD) which indicates any curve with a radius greater than 1,000 feet does not require delineators. Also, Sheet 188.1 (working number SN-9A) in MDOT's **ROADWAY DESIGN STANDARDS** expands on the MUTCD curve spacings requirements. Very few, if any, curves on the interstates or controlled access highways have radii which will require delineators. However, it is proposed that the table on sheet 188.1 remain in the standard.

Mr. Jim Kopf
Page 2
October 8, 1997

It is recommended that standard drawing sheet number 188.1 (working number SN-9A) be revised to eliminate the requirement for delineators on tangent sections. It is further recommended that delineators shall be placed on horizontal curves as required by the MUTCD and this Roadway drawing, and/or as determined by an engineering study due to a combination of horizontal and vertical curvature. Also, delineators shall continue to be required at interchanges per Sheet 188.1.

By copy of this memo the Federal Highway Administration's concurrence is requested in regard to this recommendation.

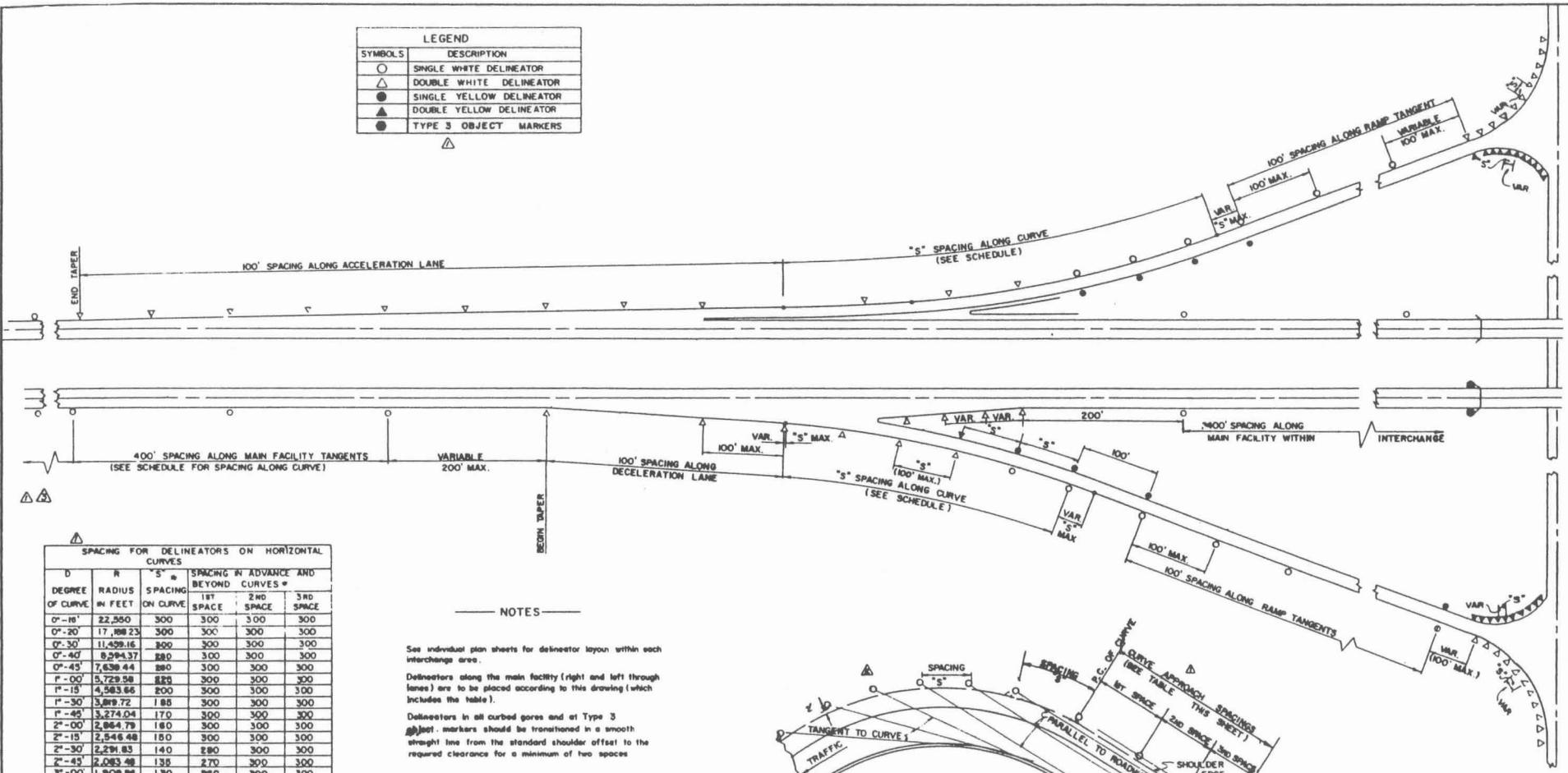
Please advise if you wish to discuss this recommendation.

EAB:clm

Attachments

pc: Mr. Joe Conway, FHWA
Mr. Wilmer James, State Maintenance Engineer
Mr. Wendell Ruff, Roadway Design Engineer ✓
Mr. Steven McMahan, State Construction Engineer

LEGEND	
SYMBOLS	DESCRIPTION
○	SINGLE WHITE DELINEATOR
△	DOUBLE WHITE DELINEATOR
●	SINGLE YELLOW DELINEATOR
▲	DOUBLE YELLOW DELINEATOR
●	TYPE 3 OBJECT MARKERS



SPACING FOR DELINEATORS ON HORIZONTAL CURVES

DEGREE OF CURVE	RADIUS IN FEET	SPACING ON CURVE	SPACING IN ADVANCE AND BEYOND CURVES *		
			1ST SPACE	2ND SPACE	3RD SPACE
0°-10'	22,560	300	300	300	300
0°-20'	17,882.3	300	300	300	300
0°-30'	11,428.16	300	300	300	300
0°-40'	8,294.37	300	300	300	300
0°-45'	7,638.44	300	300	300	300
1°-00'	5,729.58	300	300	300	300
1°-15'	4,583.66	200	300	300	300
1°-30'	3,889.72	188	300	300	300
1°-45'	3,274.04	170	300	300	300
2°-00'	2,864.79	180	300	300	300
2°-15'	2,546.48	180	300	300	300
2°-30'	2,291.83	140	300	300	300
2°-45'	2,083.48	135	270	300	300
3°-00'	1,909.88	130	300	300	300
3°-30'	1,637.02	120	240	300	300
4°-00'	1,432.39	110	220	300	300
6°-00'	954.93	90	180	270	300
8°-00'	716.20	75	150	225	300
100.00	65	130	130	300	
350.00	80	100	150	300	
300.00	45	80	135	270	
250.00	40	80	120	240	
200.00	35	70	105	210	
150.00	30	60	90	180	

NOTES

See individual plan sheets for delineator layout within each interchange area.
 Delineators along the main facility (right and left through lanes) are to be placed according to this drawing (which includes the table).
 Delineators in all curved gore and at Type 3 object markers should be transitioned in a smooth straight line from the standard shoulder offset to the required clearance for a minimum of two spaces.

* The spacing "S" on the curve is found from the formula $S = 3 \sqrt{R/50}$, where R is the radius of the curve in feet. The spacing to the first delineator in advance of and beyond the curve is $2.0 \times S$, to the next delineator $3 \times S$, and to the next $6 \times S$, but not to exceed 300' along the main facility and 100' along the ramps. Minimum spacing = 20'.



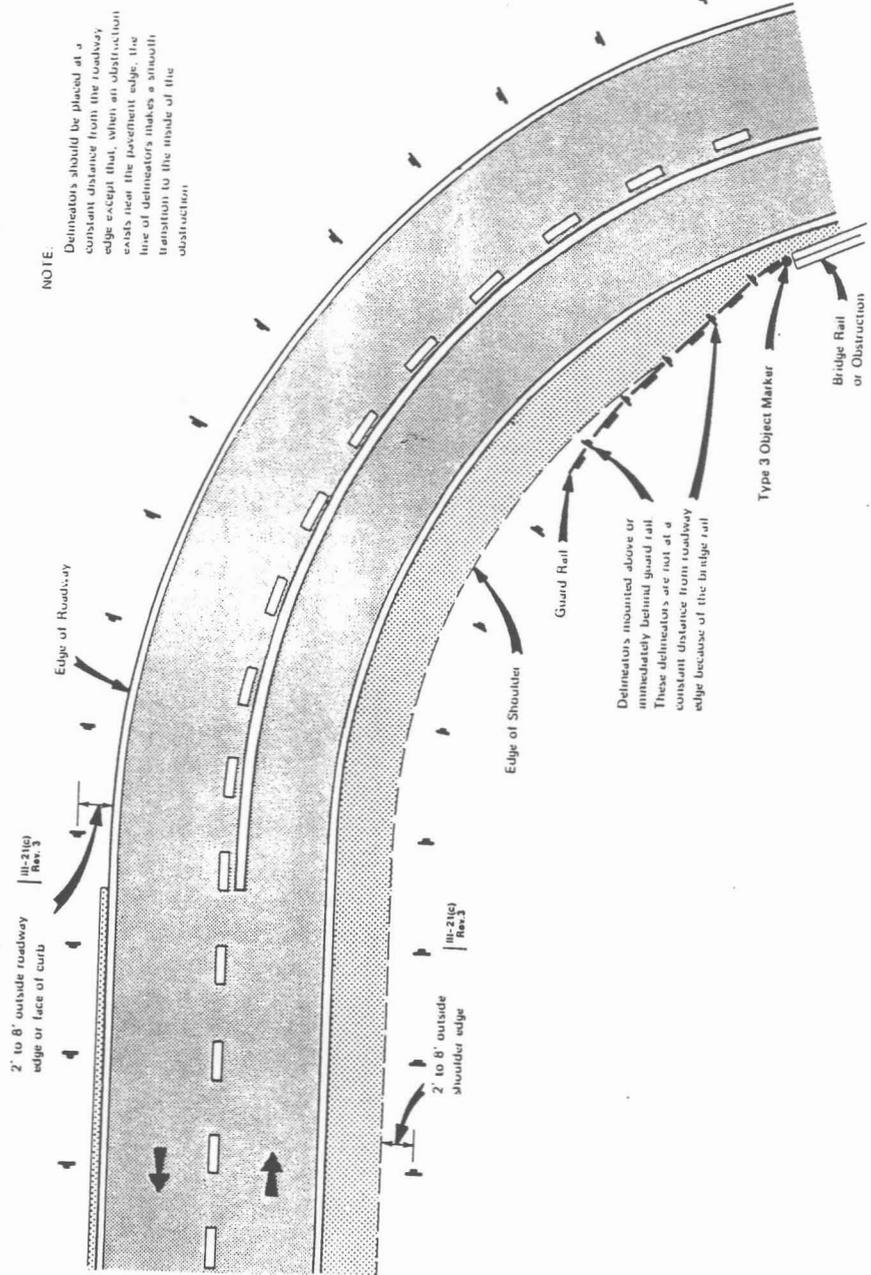
PLACEMENT OF DELINEATORS ON CURVED SECTIONS

MISSISSIPPI STATE HIGHWAY DEPARTMENT

TYP. INSTALLATION OF DELINEATORS

DATE	BY	CHECKED	DATE

WORKSHEET NUMBER SN-9A
 SHEET NUMBER 188.1



Rev. 3/86

3C-4

Figure 3-20. Typical delineator installation.

D. DELINEATION

3D-1 Delineators

Road delineators are light-retroreflecting devices mounted at the side of the roadway, in series, to indicate the roadway alignment. Delineators are effective aids for night driving and are to be considered as guidance devices rather than warning devices. Delineators may be used on long continuous sections of highway or through short stretches where there are changes in horizontal alignment, particularly where the alignment might be confusing, or at pavement width transitions. An important advantage of delineators, in certain areas, is that they remain visible when the roadway is wet or snow-covered.

3D-2 Design

Delineators shall consist of reflector units capable of clearly reflecting light under normal atmospheric conditions from a distance of 1,000 feet when illuminated by the upper beam of standard automobile lights. Reflective elements for delineators shall have a minimum dimension of approximately 3 inches. Elongated reflective units of appropriate size may be used in place of two reflectors mounted as a unit.

3D-3 Curb Markings for Delineation

Reflectorized solid yellow should be placed on the curbs of islands located in the line of traffic flow where the curb serves to channel traffic to the right of the obstruction. Reflectorized solid white should be used when traffic may pass on either side of the island.

Where the curbs of the islands become parallel to the direction of traffic flow it is not necessary to mark the curbs unless a study indicates the need for this type of delineation. Where these curbs are marked, the colors shall conform to the general principles of markings (sec. 3A-5).

Curbs at openings in a continuous median island need not be marked unless individual study indicates the need for this type of marking.

3D-4 Delineator Application

Delineation is intended to be a guide to the vehicle operator as to the alignment of the highway; whatever is needed to provide that guidance in a clear and simple way should be installed.

The color of delineators shall, in all cases, conform to the color of edgelines stipulated in section 3B-6.

Single delineators shall be provided on the right side of expressway and freeway roadways and on at least one side of interchange ramps. They may be provided on other classes of roads.

Single delineators may be provided on the left side of roadways and should be provided on the outside of curves on interchange ramps.

Where median crossovers are provided for official or emergency use on divided highways and where these crossovers are to be marked, a double yellow delineator should be placed on the left side of the through roadway on the far side of the crossover for each roadway.

Double or vertically elongated delineators should be installed at 100-foot intervals along acceleration and deceleration lanes.

Red delineators may be used on the reverse side of any delineator whenever it would be viewed by a motorist traveling in the wrong direction on that particular ramp or roadway.

Delineators of the appropriate color may be used to indicate the narrowing of the pavement where either an outside or inside lane merges into an adjacent lane. The delineators should be used adjacent to the lane affected for the full length of the convergence and should be so placed and spaced to show the width reduction (fig. 3-10, page 3B-13). Delineation is not necessary for the traffic moving in the direction of a wider pavement or on the side of the roadway where the alignment is not affected by the convergence. On a highway with continuous delineation on either or both sides, delineators should be carried through the transition and a closer spacing may be warranted.

(Delineation shall be optional on sections of roadway between interchanges where fixed-source lighting is in operation.)

When used, delineators shall be red in color and should normally be placed on both sides of truck escape ramps. The delineators should be spaced at 50 feet intervals for a distance sufficient to identify the ramp entrance. Delineator spacing beyond the ramp entrance should be adequate for guidance in accordance with the length and design of the escape ramp. Roadside delineators shall be optional on tangent sections of expressway and freeway roadways when all of the following conditions are met:

1. Raised pavement markers are used continuously on lane lines throughout all curves and on all tangents to supplement pavement markings.

2. Where whole routes or substantial portions of routes have large sections of tangent alignment. Where, if roadside delineators were not required on tangents, only short sections of curved alignment would need delineators.

3. Roadside delineators are used to lead into all curves as shown in Table III-1.

III-24 (c)
Rev. 3

III-2 (c)
Rev. 5

3D-5 Delineator Placement and Spacing

Delineators, if used, shall be mounted on suitable supports so that the top of the reflecting head is about 4 feet above the near roadway edge. They may be placed 2 to 8 feet outside the outer edge of the shoulder, or if appropriate, in line with the roadside barrier that is 8 feet or less outside the outer edge of the shoulder.

III-21 (c)
Rev. 3
Editorial
Change
Rev. 4
III-39 (c)
Rev. 5

Delineators should be placed at a constant distance from the edge of the roadway except that, where a guardrail or other obstruction intrudes into the space between the pavement edge and the extension of the line of delineators, the delineators should be in line with or inside the innermost edge of the obstruction. Typical delineator installations are shown in figure 3-20 (page 3C-4).

Normally, delineators should be spaced 200 to 528 feet. When normal uniform spacing is interrupted by driveways, cross roads, etc., delineators falling within such areas may be moved in either direction, a distance not exceeding one-quarter of the normal spacing. Delineators still falling within such areas should be eliminated.

Spacing should be adjusted on approaches and throughout horizontal curves so that several delineators are always visible to the driver. Table III-1 shows suggested spacing for delineators at horizontal curves.

Table III-1 Suggested Spacing for Highway Delineators on Horizontal Curves

(Distance in Feet Rounded to the Nearest 5 Feet)

Radius of Curve (in feet)	Spacing on Curve (in feet) (S)
50	20
150	30
200	35
250	40
300	50
400	55
500	65
600	70
700	75
800	80
900	85
1,000	90

Spacing for specific radii not shown may be interpolated from table. The minimum spacing should be 20 feet. The spacing on curves should not exceed 300 feet. In advance of or beyond a curve, and proceeding away from the end of the curve, the spacing of the first delineator is 2S, the second 3S, and the third 6S but not to exceed 300 feet. S refers to the delineator spacing for specific radii computed from the formula $S = 3 \sqrt{R-50}$.

Zack Stewart
Northern District Commissioner

Wayne O. Burkes
Central District Commissioner

Luie Shows
Southern District Commissioner



7601
Dr. Robert L. Robinson
Executive Director

Kenneth I. Warren
Deputy Executive Director/
Chief Engineer

Mississippi Department of Transportation / P. O. Box 1850 / Jackson, MS 39215-1850 / FAX (601) 359-7110

August 22, 1997

MEMORANDUM

TO: Roadway Design Engineer
State Construction Engineer
District Engineers
District Maintenance Engineers
District Construction Engineers
State Traffic Engineer
FHWA

FROM: State Maintenance Engineer
Wilmer James

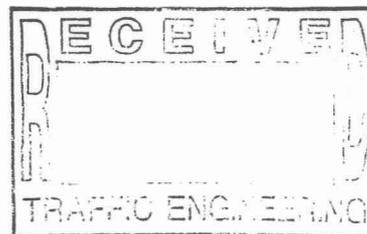
RE: Raised Pavement Markers

Attached for your review is a copy of the commission order revising the Department's policy requiring the installation and maintenance of raised pavement markers on all state maintained roads to include those with Double Bituminous Surface Treatment (DBST).

Also attached is the policy for placing raised pavement markers approved by the Chief Engineer dated August 18, 1997, which sets forth guidelines for placing raised pavement markers on roads with DBST surfaces, for replacement of markers, and for temporary and permanent placement of markers.

The implementation of the policy for placing temporary markers on construction projects will be coordinated between the Roadway Design Division, the Construction Division and this office.

WJJ/we
Attachments
pc: Central Records (via 71-01/81-01)
File (625 & MND Policy)



EXCERPT FROM THE MINUTES OF THE MEETING OF THE
MISSISSIPPI TRANSPORTATION COMMISSION, AUGUST 12, 1997

Upon motion duly made and seconded, and Commissioners Zack Stewart, Wayne O. Burkes and Ronald Shows each voting yes, under the authority of the Commission, in conformity with and as spread on its minutes, Commission Order dated December 13, 1994, recorded in Minute Book 2, Page 996, concerning placement of raised pavement markers on all state maintained roads except those having Double Bituminous Surface Treatment (D.B.S.T) is hereby amended to authorize placement of raised pavement markers on all state maintained roads including those having D.B.S.T. to increase safety for the traveling public.

STATE OF MISSISSIPPI

COUNTY OF HINDS

I, Linda O. Ferrell, Secretary, Mississippi Transportation Commission, do hereby certify that the above and foregoing is a true and correct copy of an Order of the Mississippi Transportation Commission of record in Minute Book 5, Page 747, of the Official Minutes of said Commission on file in its offices in the City of Jackson, Mississippi, duly adopted on the 12th day of August, A.D., 1997.

Witness my hand and official seal this the 18th day of August, A.D., 1997.

Linda O. Ferrell
LINDA O. FERRELL, SECRETARY
TRANSPORTATION COMMISSION
STATE OF MISSISSIPPI

EXCERPT FROM THE MINUTES OF THE MEETING OF THE
MISSISSIPPI TRANSPORTATION COMMISSION, DECEMBER 13, 1994

There came before the Commission the matter of placing raised pavement markers on all state maintained roads except those having Double Bituminous Surface Treatment (D.B.S.T.) to increase safety for the traveling public, and upon recommendation of the Department's Staff and after discussion, Commissioner Ronald Shows made a motion, seconded by Commissioner Zack Stewart, with Commissioner Wayne O. Burkes voting yes, under the authority of the Commission, in conformity with and as spread on its minutes, that raised pavement markers be placed on all state maintained roads except those having Double Bituminous Surface Treatment (D.B.S.T.) and that the markers would be properly maintained.

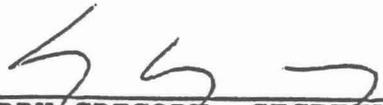
* * * * *

STATE OF MISSISSIPPI

COUNTY OF HINDS

I, Larry Gregory, Secretary, Mississippi Transportation Commission, do hereby certify that the above and foregoing is a true and correct copy of an Order of the Mississippi Transportation Commission of record in Minute Book 2, Page 996, of the Official Minutes of said Commission on file in its offices in the City of Jackson, Mississippi, duly adopted on the 13th day of December, 1994.

Witness my hand and official seal this the 27th day
of December, A.D., 1994.


LARRY GREGORY, SECRETARY
TRANSPORTATION COMMISSION
STATE OF MISSISSIPPI

Policy For Placing Raised Pavement Markers

Raised pavement markers shall be placed on all state maintained roads including sealed roads (SBST, DBST, slurry, etc.), except those sealed less than one year. For those roads sealed less than one year, the District shall inspect the surface to determine whether the markers will survive. If it is decided that satisfactory results can be obtained, then markers can also be placed on those roadways.

The implementation of this policy is:

Replacement

The Districts will annually inventory by a visual estimation all roads and routes on which markers have been placed to determine the survival rate. Each mile will have two 500-foot counting zones, beginning at 3/10 and 7/10 of that mile. The survival rate will be recorded in 20% increments, i.e. 80-100%, 60-80%, 40-60%, etc. The inventory will be reported by March 1 of each year with the original filed in each District office and a copy submitted to the State Maintenance Engineer. (See attached example No. 1.)

On any routes or sections of highway where the inventory shows that the survival rate is less than 60%, all the markers will be removed and replaced by one of the following:

1. District forces where manpower and resources will allow.
2. Contract

It is intended each year to let a district wide replacement project with all counties to be considered. Therefore, each district will review the number of markers to be replaced and determine whether the replacement will be by district forces or by contract. If the contract method is recommended, the district will furnish the State Construction Engineer, by March 1 of each year, a set of county maps indicating markers to be placed/replaced. The set will include all counties in the district with each map indicating the number of markers to be placed/replaced. (See attached example No. 2.)

Placement

1. Temporary Markings

Raised pavement markers shall be placed on all hard surfaces where the traffic is to remain on that surface and in the same alignment at least three months. This policy is applicable to all construction projects. The spacing of the temporary markers shall be at the minimum as shown on the plans and standard drawings for placement of permanent raised markers. All temporary markers shall be removed prior to placing the next pavement course.

2. Permanent Markings

Raised Pavement Markers shall be placed on all final pavement course on construction projects according to plans and specifications.

Markers

All raised pavement markers referenced above shall be high performance markers.

APPROVED: *Ronald W. Warden* 8/18/97
Chief Engineer Date
Book 5, Page 742
87

Example #1
 For Section 120 only.
 Chickasaw County

2 of 2

Section 120 9.13 miles

2 Way - Yellow

Counting Zone	Location (mile)	Markers Required	Markers In place
1	3	6	5
2	7	6	4
3	1.3	12	10
4	1.7	6	6
5	2.3	13	11
6	2.7	8	7
7	3.3	13	10
	3.7	10	8
9	4.3	13	11
10	4.7	12	7
11	5.3	6	6
12	5.7	6	5
13	6.3	10	8
14	6.7	9	8
15	7.3	6	4
16	7.7	6	5
17	8.3	6	6
18	8.7	6	5

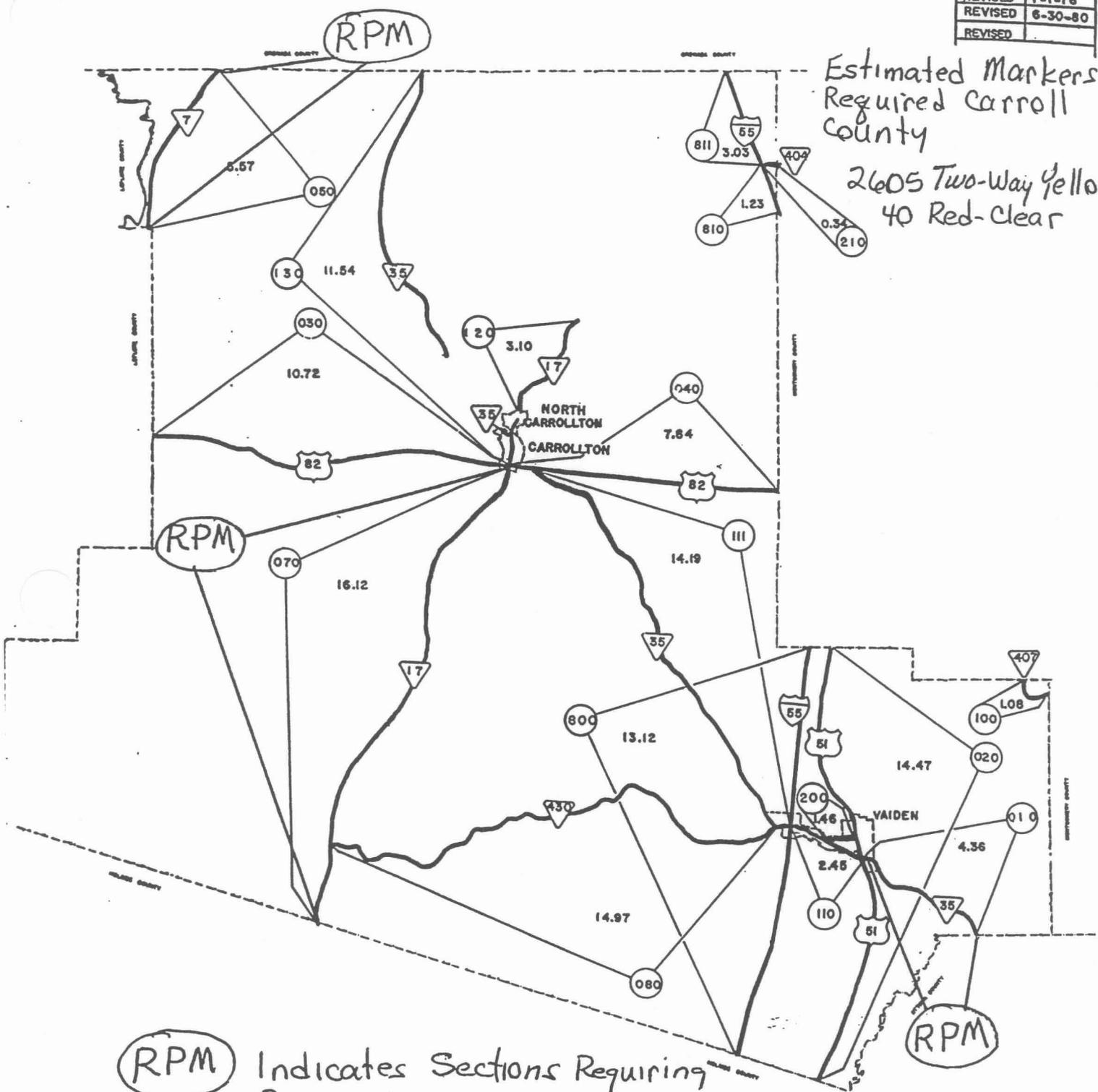
Σ: 154 126

Survival Rate $126/154 = 82\%$ Report as 80-100%

Example #2

REVISED	10-27-71
REVISED	2-1-73
REVISED	11-21-74
REVISED	7-1-76
REVISED	6-30-80
REVISED	

Estimated Markers
Required Carroll
County
2605 Two-Way Yellow
40 Red-Clear



RPM Indicates Sections Requiring
Removal and Replacement of
Raised Pavement Markers

CARROLL COUNTY MISSISSIPPI

Prepared by the
MISSISSIPPI STATE HIGHWAY DEPARTMENT
TRANSPORTATION PLANNING DIVISION
In Cooperation with the
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
July 1, 1978