DESIGN
STANDARDS
HIGHWAY DESIGN DIVISION
Texas Highway Department
HIGHWAY DESIGN STANDARDS

FOR

NON CONTROLLED ACCESS HIGHWAYS

HIGHWAY DESIGN DIVISION

TEXAS HIGHWAY DEPARTMENT
HIGHWAY CLASSIFICATION
STANDARDS FOR THE DESIGN
OF TWO LANE AND MULTI LANE HIGHWAYS

The following tables make it possible to arrive at reasonably accurate design standards for two and multi-lane highways based on traffic volumes existing at the time of the design determination. Existing conditions are given ample consideration since the tables provide for both new and existing locations and make allowances for the application of Tolerable Standards which allow the maximum use of material already available.

Since these determinations are based on traffic volumes existing at the time of the design, it was necessary to apply the statewide average traffic volume increase in the development of the tables. This figure will vary at individual locations around the State and the results arrived at through the use of these tables should be checked by traffic projections from the Highway Planning Survey.

IMPORTANT

The designer should enter the tables in the area bounded by the heavy rectangle with an existing traffic volume. In most cases, the possibility of accommodating the traffic on the Existing Location, possibly through the application of Tolerable Standards, should be investigated first. The designer should then determine which of the vertical columns is applicable to his particular situation. Once established in the vertical column, the other design criteria are listed below under the various headings at the side of the page.
# Standards of Design for Two Lane Rural Highways

<table>
<thead>
<tr>
<th>MAXIMUM PRACTICAL CAPACITY ADT</th>
<th>Class HV</th>
<th>Class MV</th>
<th>Class LV</th>
<th>Traffic Increase has been considered in the development of these standards. The designer should use present day traffic volumes.</th>
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</thead>
<tbody>
<tr>
<td>1. Tolerable Standards</td>
<td>4400 ±</td>
<td>6000 ±</td>
<td></td>
<td>Capacities for tolerable standards for Classes MV &amp; LV will depend upon passing opportunities, grades, climbing lanes, etc.</td>
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<tr>
<td>2. Full Standards</td>
<td>2600-4400</td>
<td>1300-2600</td>
<td></td>
<td>Where Tolerable Standards can not be achieved on existing ROW, requirements for new location should govern.</td>
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<tr>
<td><strong>DESIGN REQUIREMENTS FOR EXISTING ADT</strong></td>
<td></td>
<td></td>
<td></td>
<td>Design for tolerable standards shall conform to and become part of ultimate design.</td>
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<tr>
<td>Two Lane Tolerable Standards</td>
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<td></td>
<td>Projects on Primary System must meet class HV standards for design speed.</td>
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<tr>
<td>Two Lanes Full Standards</td>
<td></td>
<td></td>
<td></td>
<td><strong>Bridge widths measured to face of curb or rail whichever is narrower.</strong></td>
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<tr>
<td>ROW REQUIREMENTS FOR EXISTING ADT</td>
<td></td>
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<td></td>
<td>Bridge widths for bridges over 400' long shall be considered as Special Projects.</td>
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<tr>
<td>Two Lane Tolerable Standards On Existing ROW</td>
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<td></td>
<td></td>
<td>Minimum effective shoulder for primary Federal projects to be 18'. Slopes 8:1 or flatter will be considered shoulders. Effective shoulder width is distance between guard fence and edge of traffic lane. Bridges to be widened should meet desirable standards.</td>
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<tr>
<td>Two Lanes Full Standards</td>
<td>2600</td>
<td>1300</td>
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<td>Less than 600</td>
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<td>Multi Lane</td>
<td>4400</td>
<td>3500</td>
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<td>Lady Widths</td>
<td>Desirable</td>
<td>Tolerable</td>
<td>Minimum</td>
<td>Desirable</td>
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<td>Rolling</td>
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<td>Mountainous (like AASHO Standards)</td>
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<td>Lane Widths</td>
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<td>Bridge Widths **</td>
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<td>Shoulders</td>
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<td>Widths (Slopes 6:1 or flatter)</td>
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<td>8</td>
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<tr>
<td>Widths (Slopes steeper than 6:1)</td>
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<tr>
<td>Right of Way Widths (Basic Design)</td>
<td>120</td>
<td>100</td>
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</table>

HV - High Volume  
MV - Medium Volume  
LV - Low Volume
## Texas Highway Department

### Standards of Design for Non Controlled Access Highways

<table>
<thead>
<tr>
<th></th>
<th>Class 4L</th>
<th></th>
<th>Class 6L</th>
<th></th>
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<tr>
<td></td>
<td>Rural</td>
<td>Urban</td>
<td>Rural</td>
<td>Urban</td>
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<tr>
<td><strong>Maximum Practical Capacity ADT Full Standards</strong></td>
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<tr>
<td>Existing Location</td>
<td>15,000±</td>
<td>20,000±</td>
<td>25,000±</td>
<td>30,000±</td>
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<tr>
<td>New Location</td>
<td>15,000±</td>
<td>20,000±</td>
<td>25,000±</td>
<td>30,000±</td>
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</table>

| **Existing ADT Requiring Higher Design Than:** |
| Two Lanes Favorable Conditions |
| Four Lanes Favorable Conditions |
| Two Lanes Unfavorable Conditions |
| Four Lanes Unfavorable Conditions |
| 6,000 | 7,000 |
| 4,400 | 5,000 |

| **Existing ADT Justifying Expansion to Ultimate Right of Way Requirement** |
| Two Lanes In Place |
| Four Lanes In Place |
| 4,400 to 6,000 | 5,000 to 7,000 |
| 10,000 to 15,000 | 8,700 to 11,500 |

<table>
<thead>
<tr>
<th><strong>Design Speed</strong></th>
<th>Desirable</th>
<th>Minimum</th>
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<tbody>
<tr>
<td>Flat</td>
<td>70 40*</td>
<td>70 50</td>
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<tr>
<td>Rolling</td>
<td>60 40*</td>
<td>60 45</td>
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<tr>
<td>Mountainous (Use AASHTO Standards)</td>
<td>50 40*</td>
<td>60 45</td>
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</tbody>
</table>

| **Lane Widths** | 12 11* | 12 12  |
|                 | 12 11* | 12 12  |

| **Median Width** | 44 6 36 6 44 6 |

| **Shoulder Outside** | 10 10 10 10 10 10 10 10 10 10 |

| **Shoulder Inside** | 6 6 4 6 6 6 6 |

**Unfavorable Conditions may consist of the following, singularly or in combination:**
1. Numerous Traffic Crossings
2. Numerous Roadside Businesses
3. Numerous Turning Maneuvers
4. Restrictive Sight Distances
5. Restrictive Lateral Clearances
6. Restrictive Lane Widths
7. Restrictive Grades
8. Restrictive Passing Opportunities
9. Lack of left turn lanes reduces capacity.

4L - Four Lanes for moving traffic
6L - Six Lanes for moving traffic

* Use for heavy betterment

Minimum shoulder width may be reduced to 8' if desired. (10' minimum on Interstate)

* Use for heavy betterment

Inside shoulder not necessarily all paved.
II TYPICAL CROSS SECTIONS
STANDARD CROSS SECTIONS
FOR CURB AND GUTTER
SECTIONS

NOTES

1. The treatment of the narrow Median zone will be dependent on the conditions on
the particular project.
2. Where parking lanes are provided initially the pavement should be of such width
that the parking area can be converted to use as an efficient moving traffic
lane if future conditions warrant this.
3. Where severe traffic is anticipated a wider median and left turn lanes should be
provided at important intersections.

March, 1961
STANDARDS OF DESIGN FOR TWO LANE & MULTILANE RURAL HIGHWAYS

Full Standards (New Location)

Minimum R.O.W. Width 120'

CLASS LV
Existing ADT Under 600

Minimum R.O.W. Width 120'

CLASS MV
Existing ADT 600 - 1800

Minimum R.O.W. Width 120'

CLASS HV
Existing ADT 1800 - 3500

MULTILANE
Existing ADT 3500 And Over

*NOTE: Paved shoulders should be provided where A.D.T. exceeds 1000 V.P.D.

NOTE: Dimensions should be as shown on sheets 1-3 and 1-4.
In some cases a flush median area with a rough texture and outlined with paint lines will be permitted but usually is not recommended.
WARRANTS FOR MEDIANS

When these conditions exist in the design of a new arterial street or when an existing arterial street is to be improved, a median which forms a barrier that traffic will not cross intentionally should be included as a part of the design.

1. The average daily traffic for the design year (usually 20 years in the future) is 9,000 cars or more, regardless of the expected speeds; or
2. (a) Traffic volumes are such that a facility with four or more lanes are needed for moving traffic; and
   (b) The speed which traffic is expected to move during the off-peak periods is 35 miles per hour or higher (speed determination should be based on design operating speed values rather than posted values).

These conditions require a median wide enough to accommodate a lane for left turning traffic at intersections.

There may be locations where these conditions are not satisfied but where a median is desirable. These locations might be where there are a large number of points of access to the artery, where it is necessary to control unsafe movements, where a large number of pedestrians must cross the thoroughfare, where cross street traffic volumes are unusually high or where one or more other undesirable conditions which might be cured or partially cured by a median exist. These locations should be studied carefully to determine if a median would materially improve the situation.

These warrants were determined by the Texas Highway Department, Texas Municipal League Joint Committee, Median Practices on Highway Routes on City Streets. Copies of the report of this committee, "Why A Median?" are available from File D-16.

March, 1961
III GENERAL GEOMETRICS
### Design Values for Rate of Super-elevation (e) and Length Required to Attain Super-elevation

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<tr>
<th>D</th>
<th>R</th>
<th>e</th>
<th>Transition Length Lg</th>
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<th>R</th>
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</table>

**Symbols & Formulae**

- **A** = Super-elevation angle at any point
- **D** = Distance from edge of pavement to edge of super-elevation
- **e** = Rate of super-elevation
- **Lg** = Length of pavement beyond point of tangency
- **R** = Curve radius
- **T** = Tangent length
- **X** = Distance from edge of pavement to edge of super-elevation
- **Xg** = Length of pavement beyond point of tangency

**Details for Attaining Super-elevation**

- **CST 62**
- **Max e = 0.08 ft/ft**

**Notes**

1. **Change lane curves will be spiraled as shown here or as shown on plans.**
2. **Design for 3 speed limit at 65 mph.**
3. **Width of super-elevation is shown at 0.06 ft/ft.**
4. **Width of pavement may be changed as shown for spirals.**
5. **Width of pavement may be changed as shown for spirals.**

---

**Curve Super-elevation and Transition Standard**

<table>
<thead>
<tr>
<th>CST</th>
<th>62</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max e</td>
<td>0.08 ft/ft</td>
</tr>
</tbody>
</table>
STOPPING SIGHT DISTANCE ON VERTICAL CURVES

When $S > L$

$$L = 2S - \left( \frac{400 + 3.5S}{A} \right)$$

Where:
- $L$ = Length of vertical curve in feet
- $A$ = Algebraic difference of grades
- $S$ = Sight distance in feet
- $V$ = Design speed in M.P.H. for "S"

When $S < L$

$$L = \left( \frac{AS^2}{400 + 3.5S} \right)$$

Where:
- $L$ = Length of vertical curve in feet
- $A$ = Algebraic difference of grades in percent
- $S$ = Sight distance in feet
- $V$ = Design speed in M.P.H. for "S"

Design Speed | Sight Distance | $K_1$ | $K_2$
--- | --- | --- | ---
40 | 275 | 55 | 35
50 | 350 | 75 | 55
60 | 475 | 105 | 80
70 | 600 | 145 | 105

$K_1$ = Headlight Control
$K_2$ = Comfort Control

SAG

$K = \text{Length of vertical curve per unit of algebraic difference in grade}$

$L = KA$

CREST

Design Speed | Sight Distance | $K$
--- | --- | ---
40 | 275 | 55
50 | 350 | 85
60 | 475 | 160
70 | 600 | 255

Note:
- Height of eye = 3.75 feet
- Height of object = 0.5 feet

August 1962
STOPPING SIGHT DISTANCE ON HORIZONTAL CURVES

Sight distance (S) measured along this line.

S = Sight distance in feet.
R = Radius of inside lane in feet.
N = Distance from inside lane in feet.
V = Design speed for S in M.P.H.

Height of eye 3.75 feet. Height of object 0.5 feet.
At obstruction, line of sight is 2.12 feet above center of inside lane.

Formula applies only when S is equal to or less than length of curve.

### DESIGN SPEED M.P.H. | SIGHT DISTANCE FEET
---|---
40 | 275
50 | 350
60 | 475
70 | 600

### DESIGN SPEED IN MILES PER HOUR

August 1962
MINIMUM LENGTHS FOR CREST VERTICAL CURVES

\[ L = \frac{KA}{3.75 \text{ to } 0.5} \]

Based on stopping sight distance for curves with different speeds and critical points.

- \( V = 40 \text{ MPH} \), \( K = 0.55 \)
- \( V = 50 \text{ MPH} \), \( K = 0.66 \)
- \( V = 60 \text{ MPH} \), \( K = 1.00 \)
- \( V = 70 \text{ MPH} \), \( K = 1.55 \)
MINIMUM LENGTHS FOR SAG VERTICAL CURVES
FORMULAE
When $S > L$
$$S = \frac{700}{A} + \frac{L}{2}$$
When $S < L$
$$S = 37.4 \sqrt{L/A}$$
$L$ = Length of Curve in Feet
$S$ = Min. Stopping Sight Dist. in Ft.
Height of Eye = 3.75'
Height of Object = 0.5'

STopping SIGHT DISTANCE CHART
SHOWING LENGTH OF VERTICAL CURVES
FOR VARIOUS SIGHT DISTANCES
PASSING SIGHT DISTANCE CHART

SHOWING LENGTH OF VERTICAL CURVE FOR VARIOUS SIGHT DISTANCES
BASED ON EYE HEIGHT OF 3.75' AND VEHICLE HEIGHT OF 4.5'

FORMULAE:

\[ L = 2S - AH \]

Valid only where \( L < S \).

\[ L = \frac{AS^2}{8H} \]

Valid only where \( L > S \).

\( L \) = Length of vertical curve (Stas.).
\( S \) = Sight distance (Stas.).
\( A \) = Algebraic difference in grades.
\( H \) = Distance from ground to line of sight equals 4.1'.
CLASS HV HIGHWAYS - Provide climbing lane and parking shoulder.
CLASS MV HIGHWAYS - Desirable treatment same as for CLASS HV HIGHWAYS. Minimum treatment: convert shoulder to climbing lane.
CLASS LV HIGHWAYS - Make studies to determine feasibility of converting shoulder to a climbing lane, taking into account:

1. construction cost and,
2. volume of heavy trucks.

EXAMPLE OF USE OF CURVES

Area in which climbing lanes should be considered according to warrants.
Area in which climbing lanes are required according to warrants.

DECELERATION on grades indicated

ACCELERATION on grades indicated

SPEED DISTANCE CURVES
FROM ROAD TEST OF
A TYPICAL HEAVY TRUCK
OPERATING ON VARIOUS GRADES

NOTE:
Dashed lines on graph indicate steps taken in finding proper location for climbing lane shown on sketch.
# Airway - Highway Clearance Requirements

## Civil Airfields

<table>
<thead>
<tr>
<th>Class and Type of Service</th>
<th>Runway Length at Sea Level</th>
<th>a (Width of approach area)</th>
<th>b (Width of approach area)</th>
<th>c (Length of approach area)</th>
<th>d (Length of clear zone)</th>
<th>e (Elevation of approach surface above end of runway at distance &quot;a&quot;)</th>
<th>D&lt;sub&gt;X&lt;/sub&gt; (Minimum)</th>
<th>Non-Instrument Operations (Minimum)</th>
<th>Instrument Operations (Minimum)</th>
<th>V (Highway clearance, profile at pavement edge)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal</td>
<td>1500 - 2300</td>
<td>200</td>
<td>2,200</td>
<td>10,000</td>
<td>200</td>
<td>500 (Slope of approach surface)</td>
<td>200</td>
<td>150 (Minimum)</td>
<td>- (Minimum)</td>
<td>15 (Minimum)</td>
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<tr>
<td>Secondary</td>
<td>2301 - 3000</td>
<td>250</td>
<td>2,250</td>
<td>10,000</td>
<td>200</td>
<td>500 (Slope of approach surface)</td>
<td>200</td>
<td>200 (Minimum)</td>
<td>- (Minimum)</td>
<td>15 (Minimum)</td>
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<tr>
<td>Feeder</td>
<td>3001 - 3500</td>
<td>300</td>
<td>2,300</td>
<td>10,000</td>
<td>200</td>
<td>500 (Slope of approach surface)</td>
<td>250</td>
<td>300 (Minimum)</td>
<td>750 (Minimum)</td>
<td>15 (Minimum)</td>
</tr>
<tr>
<td>Trunk Line</td>
<td>3501 - 4200</td>
<td>300</td>
<td>2,400</td>
<td>10,000</td>
<td>200</td>
<td>500 (Slope of approach surface)</td>
<td>300</td>
<td>350 (Minimum)</td>
<td>750 (Minimum)</td>
<td>15 (Minimum)</td>
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<tr>
<td>Express</td>
<td>4201 - 5000</td>
<td>350</td>
<td>2,500</td>
<td>10,000</td>
<td>250</td>
<td>500 (Slope of approach surface)</td>
<td>300</td>
<td>425 (Minimum)</td>
<td>750 (Minimum)</td>
<td>15 (Minimum)</td>
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<tr>
<td>Continental</td>
<td>5001 - 5900</td>
<td>500</td>
<td>2,600</td>
<td>10,000</td>
<td>250</td>
<td>500 (Slope of approach surface)</td>
<td>300</td>
<td>500 (Minimum)</td>
<td>750 (Minimum)</td>
<td>15 (Minimum)</td>
</tr>
<tr>
<td>Intercontinental</td>
<td>5901 - 7000</td>
<td>500</td>
<td>2,700</td>
<td>10,000</td>
<td>250</td>
<td>500 (Slope of approach surface)</td>
<td>300</td>
<td>575 (Minimum)</td>
<td>750 (Minimum)</td>
<td>15 (Minimum)</td>
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<tr>
<td>Intercontinental Express</td>
<td>7001 - 8400</td>
<td>500</td>
<td>2,800</td>
<td>10,000</td>
<td>250</td>
<td>500 (Slope of approach surface)</td>
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<td>650 (Minimum)</td>
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<td>15 (Minimum)</td>
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<tr>
<td>Instrument Operations</td>
<td>1000</td>
<td>4,000</td>
<td>10,000</td>
<td>200</td>
<td>500</td>
<td>500 (Slope of approach surface)</td>
<td>300</td>
<td>- (Minimum)</td>
<td>750 (Minimum)</td>
<td>15 (Minimum)</td>
</tr>
</tbody>
</table>

### Notes:

1. All dimensions in feet.

---

**COURTESY OF**

U.S. BUREAU OF PUBLIC ROADS

March, 1961
IV PAVEMENT DESIGN
A shoulder surface will not be required where the shoulder material is relatively impervious and has sufficient resistance to wear.

PORTLAND CEMENT CONCRETE PAVEMENT:

Following are the design details currently recommended for the various types of Portland Cement concrete pavements.

CPJR(F)-62 Concrete Pavement, Jointed, Reinforced (Fabric) - 1962
CPJR(B)-62 Concrete Pavement, Jointed, Reinforced (Bar) - 1962
CPCD-61 Concrete Pavement, Contraction Design - 1961
CPCR(B)-62 Concrete Pavement, Continuously Reinforced (Bar) - 1962
TA(CPCR)-62 Terminal Anchorage, Concrete Pavement, Continuously Reinforced - 1962
TA(CPJ)-62 Terminal Anchorage, Concrete Pavement, Jointed - 1962

The supporting material used directly beneath the concrete pavement shall provide for uniform support throughout the life of the pavement. The supporting material shall be of such quality as to restrict pavement deflection such that the induced stress in the slab will be within the working range. Also this material shall be of a non-erosive type when subjected to the hydraulic pressures produced by the pavement deflections. If necessary, a stabilizing agent shall be used to accomplish these objectives.
FLEXIBLE AND SEMIFLEXIBLE PAVEMENT STRUCTURES:

Due to the wide variety of materials used, no standard details for flexible or semiflexible pavement structures are shown. The designer should, using the design criteria shown, develop a suitable pavement structure for the conditions encountered.

CRITERIA FOR MINIMUM LAYER THICKNESS

<table>
<thead>
<tr>
<th>LAYER DESIGNATION</th>
<th>Minimum Thickness (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HV</td>
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<tr>
<td>Flexible and Semiflexible Pavements:</td>
<td></td>
</tr>
<tr>
<td>Subgrade Treatment</td>
<td>4</td>
</tr>
<tr>
<td>Subbase</td>
<td>4</td>
</tr>
<tr>
<td>Base</td>
<td>8</td>
</tr>
<tr>
<td>Wearing Surface</td>
<td>1 2</td>
</tr>
<tr>
<td>Shoulder Base</td>
<td>8</td>
</tr>
<tr>
<td>Portland Cement Concrete Pavements:</td>
<td></td>
</tr>
<tr>
<td>Subgrade Treatment</td>
<td>4</td>
</tr>
<tr>
<td>Subbase</td>
<td>4</td>
</tr>
<tr>
<td>Pavement</td>
<td>*</td>
</tr>
<tr>
<td>Shoulder Base</td>
<td>**</td>
</tr>
</tbody>
</table>

1 Only when the layer is required
2 One Course Asphalt Surface Treatment
3 Two Course Asphalt Surface Treatment
4 When the layer is required to prevent pumping

*Based upon actual design wheel load encountered with minimum of 12 kips, 10 kips and 6 kips for the HV, MV, and LV highways respectively.

**The minimum shoulder base thickness shall be the selected pavement thickness.

PAVEMENT STRUCTURE DESIGN CRITERIA

The design procedures for the various types of pavement structures may be found in the Design Manual for Controlled Access Highways, published by the Texas Highway Department as follows:

Portland Cement Concrete Pavement Design Procedures Topic 3-300
Flexible and Semiflexible Base Design Procedures Topic 3-400
Evaluation of Existing Pavement Structure for Overlays Topic 3-600

March, 1961
GENERAL NOTES

1. ALL GROUNDED JOINTS SHALL BE FILLED WITH JOINT MATERIAL AND TRUE TO LINE BY AN APPROVED METHOD AND FILLED WITH JOINT SEALING COMPOUND.

2. CONSTRUCTION JOINTS MAY BE FORMED BY THE USE OF METAL OR WOOD FORMS EQUAL IN WIDTH TO THE NEARING WIDTHS OF THE JOINTS OR BY OTHER MEANS WHICH HAVE BEEN APPROVED BY THE ENGINEER PRIOR TO PAVING.

3. TREATMENT OF PAVEMENT ENDS AT STRUCTURES OR AT FIXED OBJECTS WILL BE SHOWN ELSWHERE IN THE PLANS.

4. FOR FURTHER INFORMATION REGARDING THE PLACEMENT OF CONCRETE AND REINFORCEMENT REFER TO THE GOVERNING SPECIFICATIONS FOR "CONCRETE PAVEMENTS".

5. DETAILS AS TO PAVEMENT MATERIAL, PLACING PROCEDURE, AND THE CROWN CROSS-SLOPE SHALL BE SHOWN ELSEWHERE IN THE PLANS.

6. THE MINIMUM NUMBER OF LAY OF THE WELDED WIRE FABRIC SHALL BE 2 IN SMOOTH - THE MINIMUM CROSSING LAY OF WIRE SHALL BE EQUAL TO THE CENTER TO CENTER SPACING OF THE LONGITUDINAL WIRE.

7. IT IS THE INTENT OF THIS DESIGN THAT THE CONSTRUCTION STEEL BE AT THE CENTER OF THE SLAB. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN ALL NECESSARY PROJECTIONS TO MAINTAIN THE CORRECT POSITION OF THE STEEL IN RELATION TO EACH OTHER.

8. CONCRETE SHALL NOT BE SEEN FROM THE WORK DIRECTLY ON TOP OF OR ON THE EDGE OF THE JOINT ASSEMBLY.

9. THE CONTRACTOR SHALL HOLD AMENABLE FOR THE STATE, ITS OFFICERS, ITS AGENTS, AND ITS EMPLOYEES HABILITABLE TO SURCHARGE OF ANY DAMAGES, DIRECT, INDIRECT, OR CONSEQUENTIAL RESULTING FROM ANY FAILURE OR團隊或 MENTION, WIRE OR APPLIANCE, MANUFACTURED OR USED, IN ACCORDANCE WITH THE DETAILS OF THESE PLANS.

TABLE OF VARYING DEPTHS

<table>
<thead>
<tr>
<th>Joint</th>
<th>Depth</th>
<th>Size</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>6</td>
<td>5.59</td>
<td>12</td>
<td>7.08</td>
</tr>
<tr>
<td>L</td>
<td>6</td>
<td>5.59</td>
<td>12</td>
<td>4.57</td>
</tr>
<tr>
<td>L</td>
<td>6</td>
<td>5.59</td>
<td>12</td>
<td>2.15</td>
</tr>
<tr>
<td>H</td>
<td>6</td>
<td>5.66</td>
<td>12</td>
<td>7.08</td>
</tr>
<tr>
<td>H</td>
<td>6</td>
<td>5.66</td>
<td>12</td>
<td>4.57</td>
</tr>
<tr>
<td>H</td>
<td>6</td>
<td>5.66</td>
<td>12</td>
<td>2.15</td>
</tr>
</tbody>
</table>

NOTES:

1. One of the element designs must be crossed out.

2. Concrete joints are to be placed with side bars having.

3. Longitudinal elements are shown in relation to the slab edges.

4. Edge weights are for construction information only.

5. Rules for welded wire fabric:

   - Width of concrete slab
   - Longitudinal wire spacing
   - Groove of longitudinal wire
   - Spacing of transverse wire
   - Spacing of longitudinal wire
**LONGITUDINAL JOINTS**

![Diagram of longitudinal joints with annotations]

**TRANSVERSE CONTRACTION JOINTS**

![Diagram of transverse contraction joints with annotations]

**NOTE**
- Flammable Fabrics recommended.
- The semicircular segment shall be connected at a common point by long edges to the vertical side of the point or by a segment not exceeding one half of the radius (1) in length or right angles to and symmetrical with the vertical side of the point.

**TABLE OF FORM HEIGHTS (in)**

<table>
<thead>
<tr>
<th>Slab Thickness (in)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

**GENERAL NOTES**

1. Green, permanent, and permanent thickness shall be as shown on typical sections in place. Where more than two layers of concrete are used, the thickness of the area between the level of the horizontal joint beam will be determined in accordance with Table 1.
2. The use of Type 2 or Type 3 expansion joints is optional. Other forms of joint transfer may be used where approved by the Engineer. Where Type 2 and Type 3 expansion joints are used with Type 2, 3 or 4 transverse joints, the expansion joint shall be formed by a metal expansion joint. Where Type 2 and Type 3 transverse joints are used with Type 4 expansion joints, the expansion joint shall be formed by a metal expansion joint which is not provided with a means of transfer of joint transfer by one of the types listed above. Where Type 2 or Type 3 transverse joints are used with Type 1 expansion joints, the expansion joint shall be formed by a metal expansion joint which is not provided with a means of transfer of joint transfer by one of the types listed above.
3. The expansion joint shall be formed by a metal expansion joint. Where Type 2 or Type 3 transverse joints are used with Type 4 expansion joints, the expansion joint shall be formed by a metal expansion joint which is not provided with a means of transfer of joint transfer by one of the types listed above. Where Type 2 or Type 3 transverse joints are used with Type 1 expansion joints, the expansion joint shall be formed by a metal expansion joint which is not provided with a means of transfer of joint transfer by one of the types listed above.

**SECTION SHOWING BACKING PLATE AND SHIM TO BE PROVIDED IF CORRUGATED METAL CONTRACTION JOINT FORM IS INSTALLED BY VIBRATING MACHINE.**

![Diagram showing backing plate and shim for installation by vibrating machine]
THREE LANE PAVEMENT PLAN

TWO LANE PAVEMENT PLAN

TYPICAL SECTION

SUGGESTED CHAIR DETAILS

GROOVED LONGITUDINAL JOINT

LONGITUDINAL CONSTRUCTION JOINT

TRANSVERSE CONSTRUCTION JOINT

TABLE OF EQUIVALENT LONGITUDINAL REINFORCEMENT

GENERAL NOTES

1. NO EXPANSION JOINTS WILL BE USED EXCEPT AT STRUCTURAL CHANGES OR FIXED OBJECTS AS SHOWN ELEVATED IN THE PLAN.
2. FOR FURTHER INFORMATION REGARDING THE PLACEMENT OF CONCRETE AND REINFORCEMENT REFER TO THE GOVERNMENT SPECIFICATIONS FOR CONCRETE PAVEMENT.
3. DETAILS AT ST PAVEMENT MELTS, PAVEMENT TRANSITIONS AND THE CROWN CROSS SLOPES SHALL BE AS SHOWN ELEVATED IN THE PLAN.
4. WITHIN ANY AREA BOUNDED BY TWO FEET OF PAVEMENT LENGTH, MEASURED PARALLEL TO THE CENTERLINE AND FIELD OF PAVEMENT WIDTH, MAXIMUM REINFORCEMENT TO THE CENTERLINE, NOT OVER 20% OF THE REGULAR LONGITUDINAL STEEL SHALL BE SPACED.
5. MINIMUM SPACING REQUIREMENTS:
   - HOGL-STEEL MINIMUM 6000 PSI YIELD
   - 24 TIMES THE NOMINAL DIAMETER OF THE BAR.
   - HARDENED STEEL MINIMUM 15,000 PSI YIELD
   - 20 TIMES THE NOMINAL DIAMETER OF THE BAR.
6. AT TRANSVERSE CONSTRUCTION JOINTS THE REGULAR LONGITUDINAL BAR SHALL EXTEND BEYOND THE JOINT SUCH THAT THE BAR PLACES FOR THE REGULAR LONGITUDINAL BAR SHALL BE A MINIMUM OF 0.6 TIMES THE STRENGTH OF THE CONNECTING JOINT, IF THE CONTRACTOR DESIRES TO COMPLY WITH THE REGULAR LONGITUDINAL BAR PLACEMENT THE JOINT SHALL BE AS SHOWN HAPIS MAY BE SPACED. HARDENED LONGITUDINAL STEEL JOINTS WILL BE REQUIRED AT ALL TRANSVERSE CONSTRUCTION JOINTS.
7. CHAIR DETAILS SHOWN HEREIN ARE EXAMPLES ONLY, OTHER ARRANGEMENTS WHICH SATISFY THE REQUIREMENTS NOTED HEREIN WILL BE PERMITTED. CHAIR BAR SPACING SHALL NOT BE GREATER THAN 0.015 EQUILATERAL AND 0.010 TRANSVERSE. ADDITIONAL CHAIRS MAY BE USED IF NECESSARY TO MEET THE STEEL PLACEMENT REQUIREMENTS.
GENERAL NOTES

1. THE REQUIREMENTS OF THE BEIDE APPROACH SUB DESIGN AND THICKNESS SHALL BE AS SHOWN ELSEWHERE IN THIS PLAN.

2. FOR FURTHER INFORMATION REGARDING THE PLACEMENT OF CONCRETE AND REINFORCING STEEL REFER TO THE SHEET "TERMINAL ANCHORAGE (DETAILS IN PRESENCE OF joint).

3. DETAILS AS TO ANCHOR SLEEPS, THE USE OF CUSHION JAMB, AND LOCATION AND TYPE OF LONGITUDINAL JOINTS SHALL BE AS SHOWN ELSEWHERE IN THIS PLAN.

4. ALL CONCRETE, REINFORCING STEEL, AND REINFORCING DETAILS FOR THE SUPER TMA, LUG ANCHORS, AND ANCHOR SLABS SHALL BE AS PLACED AND FINISHED UNDER THE "TERMINAL ANCHORAGE (CONCRETE PAVEMENT)" EXCEPT THAT ANY WALL REINFORCEMENT MAY BE USED IN BOTH PLAIN OR EMBEDDED AMONG LUG ANCHORS OR SLEEPER SLABS.

5. THE LAYOUT OF THIS DESIGN INVOLVES THE MODIFICATION OF THE BEIDE APPROACH SUB DETAIL AS SHOWN HEREIN.

6. THE CONTRACTOR SHALL HOLD AND DELIVER TO THE STATE ITS ORIGINS, ITS AGENTS, AND ITS EMPLOYEES HERETO KNOWLEDGE OF ANY NATURE OR KIND, INCLUDING COSTS, OF ANY MATERIALS, IN ANY MANNER WHATSOEVER, AliFICED IN ACCORDANCE WITH THE DETAILS OF THESE PLANS.

7. THE LOCATION OF THE TERMINAL ANCHORAGE SYSTEM SHALL BE AS SHOWN ELSEWHERE IN THIS PLAN.

8. REINFORCING STEEL SHALL BE OF THE T22 AND SHALL BE AS PLACED AND FINISHED UNDER THE "TERMINAL ANCHORAGE (CONCRETE PAVEMENT)" EXCEPT THAT ANY WALL REINFORCEMENT MAY BE USED IN BOTH PLAIN OR EMBEDDED AMONG LUG ANCHORS OR SLEEPER SLABS.

9. WITHIN FIVE ANS TOLLED BY TWO FEET OF PAVEMENT LENGTHS, MEASURED PARALLEL TO THE CENTER LINE AND TO BE CENTERED FROM THE CENTER LINE, NOT OVER 3% OF THE BULKY CONSTRUCTION SLEEPS SHALL BE SHOWN.

10. MINIMUM SPACE REQUIREMENT: 30 TIMES THE MINIMUM DIAMETER OF THE BAR.

11. TRANSVERSE CONSTRUCTION JOINTS IN THE ANCHOR SLEEPS SHALL BE ALLOWED EXCEPT IN AN IN-HOLED JOINT IN THE CONCRETE PLACEMENT LINE WITH THE APPROVAL OF THE SUPERVISOR AND IN THE CASE OF A 30' LONG SLEEPER SLAB EXTENDING BEYOND THE JOINT LINES: THAT THE BAR BRIDGE FOR THE REINFORCING STEEL IS NOT TO BE EXTENDED OR INTERSECTED IN ANY JOINTS, BUT MUST BE CUT OR THE JOINT DELETED.

12. AT CONSTRUCTION JOINTS, IN THE CONTRACTOR'S ERECTS TO CONTINUE THE REINFORCEMENT STEEL THROUGH THE JOINT, IT MAY BE BROKEN SHORTLY AND MAY BE DELETED.

13. ANY APPROACH Ditr OF THIS SPECIFICATION WHICH WILL NOT ENTER THE REQUIREMENTS NOTED HEREIN, WILL BE PROMPTED. THESE REQUIREMENTS SHALL NOT BE GREATER THAN 25% OF THE COST OF SUPPLEMENT." CUSHION JAMB OR A WALL." WHERE THIS JOINT 7]-SLEEPER SLAB, THE CONTRACTOR MAY USE A WALL WITHOUT THE USE OF A CUSHION JAMB IF NECESSARY TO COMPLY WITH THE STEEL PLACEMENT REQUIREMENTS.

14. FOR EMBEDDED ANCHORS, THE APPROACH SLEEPS AND ANCHOR SLABS SHALL BE SHOWN AS PER BEIDE, CONSTRUCTION DETAILS OF ANCHOR SLEEPS, ANCHOR SLAB, AND ANCHOR LUGS SHALL BE SHOWN ALONG THE CENTER LINE OF PAVEMENT.

ESTIMATED QUANTITIES FOR ONE 24 FOOT WIDE TERMINAL ANCHORAGE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PAVEMENT</th>
<th>CONCRETE</th>
<th>STEEL</th>
<th>EXCAVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>THICKNESS</td>
<td>(G.U. YD)</td>
<td>(L.B.S)</td>
<td>(C.U. YD)</td>
</tr>
<tr>
<td>SLEEPER SLEEPS 7</td>
<td>1.67</td>
<td>4.54</td>
<td>1.67</td>
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</tr>
<tr>
<td>SLEEPER SLEEPS 9</td>
<td>1.67</td>
<td>5.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LUG ANCHORS 7</td>
<td>27.6</td>
<td>3.11</td>
<td>27.6</td>
<td></td>
</tr>
<tr>
<td>LUG ANCHORS 9</td>
<td>27.6</td>
<td>22.2</td>
<td></td>
<td></td>
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<td>LUG ANCHORS 9</td>
<td>2.22</td>
<td>20.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LUG ANCHORS 9</td>
<td>2.22</td>
<td>5.00</td>
<td></td>
<td></td>
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<tr>
<td>ANCHOR SLAB 7</td>
<td>46.71</td>
<td>5.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANCHOR SLAB 9</td>
<td>5.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Five lag bolts required.
9. Four lag bolts required.
10. For pavement terminus with existing flexible pavement structure, the concrete quantity should be increased by 0.2 CY to include the thickened and added.
**GENERAL NOTES**

1. THE REQUIREMENTS OF THIS BRIEF APPROACH SLAB DESIGN AND THICKNESS SHALL BE AS SHOWN ELSEWHERE IN THE PLANS.

2. FOR FURTHER INFORMATION REGARDING THE PLACEMENT OF CONCRETE AND REINFORCING STEEL REFER TO THE "TYPICAL TERMINAL ANCHORAGE CONCRETE PAVEMENT".

3. DETAILS AS TO SLEEPER SLAB WIDTH, THICKNESS, CROWN DRAWS, ETC. AND LOCATION AND TYPE OF LONGITUDINAL JOINTS SHALL BE AS SHOWN ELSEWHERE ON THE PLANS.

4. ALL CONCRETE REINFORCING STEEL AND REQUIRED ORIENTATION FOR THE SUPER SLAB, LUG ANCHORS, AND ANCHOR SLAB SHALL BE MEASURED AND FULLY FOR UNDER THE TERMINAL ANCHORAGE CONCRETE PAVEMENT CONSTRUCTION, SUBJECT TO CHANGES TO MEET THE REQUIREMENTS OF THE CONTRACTOR AND SUPERVISING ENGINEER. ALL CONSTRUCTION WORKMEN SHALL BE AWARE OF THE DEVELOPMENTAL CHANGES TO THE CONTRACTOR AND SUPERVISING ENGINEER.

5. THE USE OF THIS DESIGN INVOLVES THE MODIFICATION OF THE BRIEF APPROACH SLAB DETAILS AS SHOWN HEREIN.


7. THE LOCATION OF THE TERMINAL ANCHORAGE SYSTEM SHALL BE AS SHOWN ELSEWHERE IN THE PLANS.

8. REINFORCING STEEL MARCH SHALL BE OF THE SIZE AND SPACING AS SHOWN THEREIN, AND MAY BE EXTENDED TO THE END OF THE JOINT THE DESIGN AS SHOWN. THE TERMINAL ANCHORAGE CONCRETE PAVEMENT SHALL BE PACKED WITH THE MATERIALS THAT REQUIRE FIELD BONDING SHALL BE OF STRONG OR INTERMEDIATE TYPE.


10. AT CONSTRUCTION JOINTS, IF THE CONTRACTOR ELETS TO CONDUIT HUMIDITY THROUGH THE JOINT, THE FPL TO BE SHOWN HEREBY.

11. ALL APPROVED DETAIL SLAB TYPE OR DETAIL, WHICH WILL SATISFY THE REQUIREMENTS OF THIS BRIEF APPROACH SLAB DETAILS, SHALL BE PLACED. ALL DETAIL JOINTS SHALL NOT BE BENEFICIAL THAN 47/16 IN. (MINIMIZED FOR USE IN THE PAVEMENT CENTER LINE AND 20 IN. MINIMUM PERMISSIBLE TO THE PAVEMENT CENTER LINE). ADDITIONAL DOWNSHALL BE USED IF NEEDED TO SATISFY THE SLAB PLACEMENT REQUIREMENTS.

12. FOR SLEEPER JOINTS, THE APPROACH SLAB AND SLEEPER SLAB, WITH APPROPRIATE JOINTS WAS IS TO BE SHOWN HEREBY. DETAILS OF JOINTS FOR CONCRETE PAVEMENT jointed.

---

**TEXAS HIGHWAY DEPARTMENT TERMINAL ANCHORAGE FOR CONCRETE PAVEMENT JOINTED**

**TACP0-62**

<table>
<thead>
<tr>
<th>Item</th>
<th>Pavement Thickness</th>
<th>Concrete</th>
<th>Steel</th>
<th>Excavation</th>
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<tr>
<td>SLEEPER SLAB</td>
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<td>ANCHOR SLAB</td>
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*For pavement terminus with existing flexible pavement structure, the concrete quantity should be increased by 0.2 CY to include the thickened detail.
V ROADWAY ILLUMINATION
GENERAL NOTES:
1. ALL WORK, MATERIALS, AND SERVICES MUST BE SHOWN ON THE PLANS WHICH MAY BE NARROWED FOR CONSTRUCTION AND PERFORMANCE. DETAILS, SPECIFICATIONS, AND PROCEDURES SHALL BE PROVIDED BY THE CONTRACTOR.
2. THE DESIGN AND DIMENSIONS AS ILLUSTRATED ON THIS SHEET ARE INTENDED TO BE ACCURATE WITHIN THE LIMITS OF MANUFACTURING TOLERANCES.
3. ALL REFERENCES TO SIZE OR SIZE OF MATERIALS ARE TO BE SHOWN ON THE PLANS.
4. THE LOCATIONS OF INSULATING BOLT, INSULATION NUT, TRANSFORMER STANDARDS, AND INSULATION SHAFTS ARE TO BE SHOWN ON THE PLANS.
5. THE BALLAST SHALL BE DESIGNED TO OPERATE AT MAXIMUM PLUS OR MINUS 5% VOLTAGE LATENT.
6. THE BALLAST SHALL BE DESIGNED TO CONTAIN A POWER FACTOR OF NOT LESS THAN 95%.
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VI GUARD FENCE, POST AND FENCE STANDARDS
SECTION THRU RAIL ELEMENT
NOTE: All dimensions subject to manufacturing tolerances.

SECTION THRU RAIL ELEMENT
NOTE: All dimensions subject to manufacturing tolerances.
### TABLE OF MINIMUM SIZES & WEIGHTS

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VIII MISCELLANEOUS STANDARDS
FEDERAL AID MARKER

Markers shall be placed as directed.

The symbols shall be furnished to the Contractor without charge or obligation to the Texas Highway Department through the Resident Engineer.

Posts shall be: 300 mm concrete with all corners sharpened 1/8". All reinforcing bars shall be 1/2" in diameter. Mark and materials involved in forming and placing posts and bases and existing bronze markers shall be considered as subsidiary to the various sub items of the contract, and no direct compensation will be made therefor.

RIGHT-OF-WAY MARKER - TYPE I

Type I Right-of-Way Markers shall be poured in place concrete, and bronze disks shall be set in correct line and grade as directed by the Engineer.

Bronze disks shall be of Architectural Bronze having the following composition: Copper 80.5%, Tin 1.5%, Lead 6.0%, and 3%, Copper 85.5% and 10% as required.

Shaded areas to be polished.

RIGHT-OF-WAY MARKER - TYPE II

Type II Right-of-Way Markers shall be poured in place concrete, and bronze disks shall be set in correct line and grade as directed by the Engineer.

Bronze disks shall be of Architectural Bronze having the following composition: Copper 80.5%, Tin 1.5%, Lead 6.0%, and 3%, Copper 85.5% and 10% as required.

Shaded areas to be polished.

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Shaded areas to be polished.

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Type II Right-of-Way Markers shall be poured in place concrete, and bronze disks shall be set in correct line and grade as directed by the Engineer.

Bronze disks shall be of Architectural Bronze having the following composition: Copper 80.5%, Tin 1.5%, Lead 6.0%, and 3%, Copper 85.5% and 10% as required.

Shaded areas to be polished.

GENERAL NOTES

The requirements for the absolute volume mix design and the weighing of ingredients for the concrete in all Markers will be waived. Mixing of concrete may be performed in the plant or in the field.

The work performed and materials furnished in constructing Right-of-Way Markers, measured as provided in the Specifications, shall be paid for at contract unit price bid for "Right-of-Way Markers (Type I)," or "Right-of-Way Markers (Type II)," Federal Project Markers will not be paid for directly, but shall be considered subsidiary to the various sub items of the contract.
NOTE:
SPEED POSTED ON W-35 SIGN
SHALL BE DETERMINED ON THE
BASIS OF A TRAFFIC AND ENGIN­
EERING INVESTIGATION MADE BY
THE HIGHWAY DEPARTMENT.

GENERAL NOTES
Barricade "H" shall be used only in conjunction with
Barricade "a" and accompanying signs, see BW 54(1) B (2)
Barricade "H" shall be used at each end of the actual
construction operations. Barricades "H" shall be placed prior
to beginning work each day and shall be removed when the
day's work is terminated.

Workmanship and materials for Barricade "H" shall conform
to General Notes of BW 54 (2).

Texas Highway Department
BARRICADES & WARNING SIGNS
SHEET 1 OF 1

March 1961