MASH – TTI Recent Research Experiences

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Skid Mounted Temporary Large Guide Sign Supports
Skid Mounted Large Guide Sign Supports

• Research Problem

  • Providing Temporary Signage for Construction zones
    • Larger guide signs are being requested (Large “Give Us A Break”)
    • Need skid mounted option

  • Expand Maximum Sign Area by Testing Larger and Multiple Supports
Skid Mounted Large Guide Sign Supports

Assembly Parts

<table>
<thead>
<tr>
<th>#</th>
<th>Part Name</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Panel Assembly</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Frame Assembly</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Cable Assembly</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>40lb Sandbag</td>
<td>44</td>
</tr>
<tr>
<td>5</td>
<td>Clamp Plate</td>
<td>36</td>
</tr>
<tr>
<td>6</td>
<td>Bolt, 3/8 x 6-1/2 hex</td>
<td>72</td>
</tr>
<tr>
<td>7</td>
<td>Washer, 3/8 lock</td>
<td>72</td>
</tr>
<tr>
<td>8</td>
<td>Nut, 3/8 hex</td>
<td>72</td>
</tr>
</tbody>
</table>

Isometric Views

Clamp Plate
Sheet Steel, 1 1/2" x 11 gauge (1/8"
Scale 1:3

Sandbags 1/2 front and 1/2 back, evenly distributed

5 1/2" 4 7/8" 5 1/8" 0"

Detail A
Scale 1:10

Roger Bligh: 2014-05-21
Skid Mounted Large Guide Sign Supports
Skid Mounted Large Guide Sign Supports
Direct Embedded Wood Supports for Temporary Guide Signs
Temporary Wood Sign Supports

- Research Problem
  - Providing Temporary Signage for Construction zones
    - Larger guide signs are being requested (13.5’ x 25”)
    - 6”x8” Wood Supports tested under 0-6782 will not allow for mounting of some requested signs
  - Expand Maximum Sign Area by Testing Larger Support
Temporary Wood Sign Supports

Test Installation
6' x 10' Timber Posts

12" Aluminum Sign Panel
(see TxDOT Drawing SMD (2-1) -08)

Bolt, 3/8 x 3/4 hex - grade 2
with two SAE Flat Washers and
Hex Nut, spaced at 24" at each
joint between panels.

Sign Clip
with Square Head Bolt and Flange Nut
(see TxDOT Drawing SMD (2-1) -08)
at 12" spacing, both sides of Posts
(see inset above)

Section A-A

Elevation View

Post spacing is symmetric about .

Post Assembly
(see next sheet)
Temporary Wood Sign Supports
Temporary Wood Sign Supports

Test 3-60

Test 3-61
Temporary Wood Sign Supports

**Results**

- Develop and evaluate a temporary wood support for a 13.5’ x 25’ sign

**MASH TL-3 Evaluation Criteria**

- **Test 3-60 (PASS OIV – 16.1 ft/sec, OCD - 2.5”)**
  - 1100C Slow speed
  - Verifies Occupant Risk for activation of support

- **Test 3-61 (PASS OIV – 9.8 ft/sec, OCD - 0”)**
  - 1100C High Speed
  - Maximizes risk to occupant compartment intrusion
Temporary Wood Sign Supports

WEAKENING HOLE SIZES

<table>
<thead>
<tr>
<th>Support Size</th>
<th>Near Ground level (inches)</th>
<th>Near Bottom of Sign (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-inches × 10-inches</td>
<td>3 5/8</td>
<td>4</td>
</tr>
<tr>
<td>6-inches × 8-inches</td>
<td>3 5/8</td>
<td>4</td>
</tr>
<tr>
<td>4-inches × 6-inches</td>
<td>1 1/2</td>
<td>2</td>
</tr>
<tr>
<td>4-inches × 4-inches</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

See Plate Details previous sheet

φ 3-5/8" Typ x 2
φ 1/2" Typ x 2
φ 4/" Typ x 2
## Temporary Wood Sign Supports

<table>
<thead>
<tr>
<th>Timber Grade</th>
<th>Embedment Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4\times4 Grade 1</td>
<td>2.5</td>
</tr>
<tr>
<td>6\times4 Grade 1</td>
<td>3.0</td>
</tr>
<tr>
<td>6\times8 Grade 1</td>
<td>4.0</td>
</tr>
<tr>
<td>6\times10 Grade 1</td>
<td>5.0</td>
</tr>
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</table>
## Temporary Wood Sign Supports

<table>
<thead>
<tr>
<th>Hs (ft)</th>
<th>16</th>
<th>13</th>
<th>10</th>
<th>7</th>
</tr>
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<tbody>
<tr>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
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</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 7.1. Design Chart for Temporary Wood Sign Support System for Large Guide Signs for 70-mi/h Design Wind Speed.
Design and Evaluation of Multiple Secure Mailbox Support
Design and Evaluation of Multiple Secure Mailbox Support

- Research Problem
  - Concerns about mail-identity theft → demand for locking mailboxes;
  - Products offering enhanced security for mail;
    - 16 and 14-gauge galvanized steel;
    - 15” H x 11.5” W x 18” D
    - 22.6 lbs
  - Significantly larger (4–5 times heavier than standard mailboxes);
  - 2013: TxDOT requested crashworthiness evaluation;
  - Previous TxDOT project: locking mailboxes testing on multiple-mount support posts unsuccessful (windshield deformation & intrusion)
Design and Evaluation of Multiple Secure Mailbox Support

- Past Research
  - Locking Architectural mailbox on Multiple-Mount Post;
  - MASH 3-61: FAIL

Mailbox: 15” H x 11.5” W x 18” D; 22.6 lbs
Mailbox: 83/4” H x 63/4” W x 201/8” D; 4.4 lbs
Galvanized steel post: 2” O.D., 0.065” t, 18 lbs
Support post has outwardly sloping sides
Design and Evaluation of Multiple Secure Mailbox Support

1a. Outside mailboxes are standard lightweight mailboxes, approximately 6" wide x 8" tall x 19" long. Inside mailboxes are Architectural Mailboxes® Oasis Junior 1b. All bolts are grade 5 with two USS flat washers, one hex nut, and one lock washer under the nut.
Design and Evaluation of Multiple Secure Mailbox Support

MASH TL 3-61

62 mph
0-degree
Design and Evaluation of Multiple Secure Mailbox Support

MASH TL 3-61 62 mph, 0-degree

Occupant Impact Velocity (ft/sec)
- Long.: 3.94
- Lat.: 0.66

Ridedown Acceleration (g)
- Long.: -0.2
- Lat.: -0.3

Max. Angular Displacements (Deg.)
- Roll: 2.7
- Pitch: -2.2
- Yaw: -5.3

No Occupant Compartment Deformation
No Windshield Contact
## Design and Evaluation of Multiple Secure Mailbox Support

<table>
<thead>
<tr>
<th>Performance</th>
<th>11-Gauge Steel Tube, 4-inch Embedment</th>
<th>16-Gauge Steel Tube, ¾-inch Wire Rope, 6-inch Embedment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>readily activated by yielding to vehicle and lifting out of foundation socket</td>
<td>readily activated by yielding to vehicle and lifting out of foundation socket</td>
</tr>
<tr>
<td></td>
<td>limited support deformation &amp; no buckling</td>
<td>substantial deformation &amp; buckling</td>
</tr>
<tr>
<td></td>
<td>no occupant compartment deformation</td>
<td>occupant compartment deformation</td>
</tr>
<tr>
<td></td>
<td>better stable function (better for heavier mailboxes)</td>
<td>stable function, still not as much as with the 11-gauge support</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Needed</th>
<th>11-gauge steel tube</th>
<th>16-gauge steel tube -- $32.40</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>¾-inch wire rope</td>
<td>¼-inch wire rope clip (No. 2) &amp; swaged end (No. 1)</td>
</tr>
<tr>
<td></td>
<td>¾-inch wire rope clip (No. 4) -- $2.56</td>
<td>¼-inch wire rope clip (No. 2) -- $1.28</td>
</tr>
<tr>
<td></td>
<td>washers (No. 2)</td>
<td>washers (No. 2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Cost</th>
<th>11-gauge steel tube -- $48.60</th>
<th>16-gauge steel tube -- $32.40</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>¾-inch wire rope -- $5.25</td>
<td>¼-inch wire rope w/swaged end -- $52</td>
</tr>
<tr>
<td></td>
<td>¾-inch wire rope clip (No. 4) -- $2.56</td>
<td>¼-inch wire rope clip (No. 2) -- $1.28</td>
</tr>
<tr>
<td></td>
<td>washers -- $4.00</td>
<td>washers -- $4.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost per Installation</th>
<th>$48.60 Plus:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bolt tubes together at top;</td>
</tr>
<tr>
<td></td>
<td>Labor to install cable and clamp it into support – difficulty feeding cable through post;</td>
</tr>
<tr>
<td></td>
<td>Labor to install support into wedge &amp; socket</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost per Installation</th>
<th>$39.68 Plus:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bolt tubes together at top;</td>
</tr>
<tr>
<td></td>
<td>Labor to install cable and clamp it into support – difficulty feeding cable through post;</td>
</tr>
<tr>
<td></td>
<td>Labor to install support into wedge &amp; socket</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inventory</th>
<th>11-gauge supports;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>different inventory from the existing 16-gauge support if still in use for standard mailboxes</td>
</tr>
<tr>
<td></td>
<td>16-gauge supports;</td>
</tr>
<tr>
<td></td>
<td>wire ropes or wire rope with swaged ends;</td>
</tr>
<tr>
<td></td>
<td>wire rope clips, washers, and extra bolt for top telescopic connection;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application</th>
<th>11-gauge support would be used as lockable mailboxes support, but it can also be adopted for use with exclusively standard mailboxes.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The 16-gauge support would be used as lockable mailboxes support only when included wire rope and modified embedment to 6 inches. In this case, however, it would require cutting of the support end to allow for only 6 inches embedment and maintain the required mailboxes installation height. The same 16-gauge support will still be used for supporting only standards mailboxes, and no wire rope and modified embedment would be required.</td>
</tr>
</tbody>
</table>
Low-Mounted Height Sign for Wrong-Way Driving Applications
Low-Mounted Height Sign for Wrong-Way Driving Applications

• Background
  • A low-mounted height “wrong way” sign support is needed to alert impaired drivers
  • MUTCD has provision for a 3-ft sign mounting height
    • No existing system tested under MASH criteria

• Objective
  • Test a 3-ft mounted height sign support system
Low-Mounted Height Sign for Wrong-Way Driving Applications

- Test Installation
  - 3-ft. x 3-ft. aluminum sign
  - Mounted at 3-ft height
  - 2” 13 BWG pipe support
  - Wedge anchored support

- MASH Tests 3-60 & 3-61 performed

- Test 3-62 with pickup not needed due to low height

- Impact from back of sign
Low-Mounted Height Sign for Wrong-Way Driving Applications

• Test 3-61 (62 mi/h)
Low-Mounted Height Sign for Wrong-Way Driving Applications

Test 3-61

- No occupant contact
- No Holes or Tears in Windshield
- Passed MASH
TXDOT T224 TL-5 Bridge Rail
TXDOT T224 Bridge Rail

- **Objective**
  - To develop a new crashworthy concrete post and rail bridge rail that meets the crash requirements of MASH TL-5
  - Incorporate this new T224 design into the TXDOT Bridge Rail Standards
TXDOT T224 TL-5 Bridge Rail

Test Installation
(Rebar not shown for clarity)

Plan View

new moment slab
existing moment slab
10'-0" between Posts - Typical

Elevation View

Detail D
Scale 1:50

Section A-A
Scale 1:20

1a. 3/4" Chamfer all exposed horizontal edges.
1b. Deck concrete is TxDOT Class S (4000psi), and Curb and Rail concrete is TxDOT Class C (3600 psi).
TXDOT T224 TL-5 Bridge Rail
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Questions?

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