* INTRODUCTION
Proven on the race track and now installed on highways all over the world, the unique protection offered by the corrugated steel beam system of guardrail is used to save lives and property. Guardrail conforms to save the American Association of State Highway and Transportation Officials (AASHTO) standard and to the standards required of the Malaysia Public Works Departments (JKR).

* APPLICATIONS
Guardrail has an application wherever life or property requires protection. On expressways, Guardrail protects trouble sports by preventing vehicles from running off the road. As a median barrier it prevents head-on collisions. Readily visible, its pleasing appearance make it suitable for boundary markings and protective barriers in parking areas.

* DAMAGE REDUCTION
Controlled flexibility enables guardrail to deflect out-to-control vehicles back onto the road parallel to the direction of traffic flow - and not back into oncoming traffic. Damage is minimised through round bolt heads, beam laps facing away from the traffic direction, and specially designed end section which prevent vehicles striking end of a run of guardrail.

* DURABILITY
Guardrail is hot dip galvanized after fabrication to ensure corrosion resistance. Galvanizing is in accordance with ISO, BS or ASTM Standards. Bolts, nuts, washers and all accessories are also galvanized.

* STRENGTH
Continuous beam design of guardrail ensures that an impact load on any one section beyond its elastic limit will be transferred through the high strength joint to adjacent sections. All joints are made with eight specially designed bolts which have rounded heads. At each joint the rail section overlap by 3 18mm thereby guaranteeing a positive splice.
GUARDRAIL

* CURVES
Guardrail can be installed on curves without lessening of strength or safety. No special attachments are needed. guardrail sections can be supplied to fit any radius from two (2) metres to forty-five (45) metres. Longer radius curves in excess of 45 meters can be obtained using standard straight section. The guardrail may be curved either with traffic face concave or convex.

* CURVES DETAILS

![Diagram of Guardrail Curves]

* CALCULATING GUARDRAIL QUANTITIES

A. GUARDRAIL  
Divide length of barrier (meters) by four (4) to determine the number of rails required.

B. POSTS  
Add one (1) unit per run to the number of rails.

C. BLOCKS  
Number of blocks is equal to the number of posts.

D. TERMINAL ENDS  
Provide one (1) terminal end at each end of barrier.

E. SPLICE BOLTS M16 X 32  
Multiply the number of rails by eight (8) and then add eight (8) units per length of run.

F. BLOCK BOLTS M16 x 40  
Multiply the number of block by two (2).

G. RAIL BOLTS M16 X 50  
Same quantity as posts.

H. RECTANGULAR WASHERS  
Same quantity as posts.

I. REFLECTOR STRIP  
Number of reflector strip is equal to the number of rails.

J. ROUND WASHER  
As required.

* EXAMPLE
Calculation of materials requirements for 1km long barrier rail (Single run).

<table>
<thead>
<tr>
<th>GUARDRAIL</th>
<th>1000 ÷ 4</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSTS</td>
<td>250 + 1</td>
<td>251</td>
</tr>
<tr>
<td>BLOCKS</td>
<td>250 + 1</td>
<td>251</td>
</tr>
<tr>
<td>TERMINAL ENDS</td>
<td>250 + 1</td>
<td>2</td>
</tr>
<tr>
<td>SPLICE BOLTS M16 X 32</td>
<td>250 x 8 + 8</td>
<td>2008</td>
</tr>
<tr>
<td>BLOCK BOLTS M16 X 50</td>
<td>250 x 2 + 2</td>
<td>502</td>
</tr>
<tr>
<td>RAIL BOLTS</td>
<td>250 + 1</td>
<td>251</td>
</tr>
<tr>
<td>RECTANGULAR WASHERS</td>
<td>250 + 1</td>
<td>251</td>
</tr>
<tr>
<td>REFLECTOR STRIP</td>
<td>250 + 1</td>
<td>251</td>
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**SPECIFICATION & TECHNICAL DATA - BEAMS**

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>AASHTO M 180 - 89 (Class A Type 2)</th>
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<tbody>
<tr>
<td></td>
<td>PRODUCT CODE</td>
</tr>
<tr>
<td>IG03</td>
<td>3810</td>
</tr>
<tr>
<td>IG04</td>
<td>4000</td>
</tr>
<tr>
<td>GALVANIZING</td>
<td>Minimum Single-Spot test : 1,100 g/m² (3.603 oz/ft²)</td>
</tr>
<tr>
<td></td>
<td>Minimum Triple-Spot Test : 1,220 g/m² (4.603 oz/ft²)</td>
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<tr>
<td>MECHANICAL PROPERTIES</td>
<td>Minimum Yield point : 345 MPs (50,000 psi)</td>
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<tr>
<td></td>
<td>Minimum Tensile Strength : 490 MPs (70,000 psi)</td>
</tr>
<tr>
<td></td>
<td>Minimum Elongation : 12 %</td>
</tr>
</tbody>
</table>

**GUARDRAIL**

**STANDARD PANEL**

**SECTION THROUGH BEAM**

**BEAM SPICE, BEAM WASHER, SPLICE BOLT & NUT**

![Diagram of guardrail and beam section](image)
* POST & BLOCK ATTACHMENT

- **Standard Post**
  - 6mm (t) galvanized
  - 4 holes - 18mm Ø
  - 1 Slot 20 x 25mm

- **Block**
  - 6mm (t) galvanized
  - 4 holes - 18mm Ø
  - 1 Slot 20 x 25mm

* END SECTION & BUFFER

- **END SECTION**

- **BUFFER END**
GUARDRAIL

NJB (Type 5)

<table>
<thead>
<tr>
<th>TYPE</th>
<th>H x W x t1 x t2(mm)</th>
<th>Unit Weight Kg/m</th>
<th>Section Area (cm²)</th>
<th>Moment of Inertia</th>
<th>Section Modulus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lx (cm⁴)</td>
<td>Ly (cm⁴)</td>
</tr>
<tr>
<td>A</td>
<td>C178 x 76 x 6 x 6</td>
<td>14.3</td>
<td>19.08</td>
<td>903.5</td>
<td>102.5</td>
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<tr>
<td>B</td>
<td>C150 x 76 x 6 x 6</td>
<td>13.2</td>
<td>17.5</td>
<td>610.0</td>
<td>98.0</td>
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<tr>
<td>C</td>
<td>C125 x 65 x 6 x 6</td>
<td>13.4</td>
<td>17.11</td>
<td>425</td>
<td>65.5</td>
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</tbody>
</table>

* FISH TAILS TERMINAL UNIT (TYPE1)

DETAIL 'A' END WING PLAN

ELEVATION

Plan

Post Bolt Slot

Terminal section lapped on traffic face

Finished Ground Level

1905/2000

3810/4000

Spacing of post beyond terminal shall be 3810/4000 unless otherwise stated

Pages 5
**GUARDRAIL**

* TERMINAL ANCHORAGE UNIT (TYPE2)

BUFFER RETURN
DETAIL 'B'

![Terinal Anchorage Unit Type 2 Diagram]

![Plan View Diagram]

![Elevation View Diagram]

* 90 DEGREE TWISTED TERMINAL UNIT (TYPE 3)

![90 Degree Twisted Terminal Unit Type 3 Diagram]

**Terinal Anchorage Unit Type 2 Diagram**

**Plan View Diagram**

**Elevation View Diagram**

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**Spacing of post beyond terminal shall be 3810/4000 unless otherwise stated.**
* TERMINAL UNIT (TYPE 4)