Anejo 6

Documentación del Proyecto Sustainable bridges
<table>
<thead>
<tr>
<th>Topic</th>
<th>NR (Reino Unido)</th>
<th>BV (Francia)</th>
<th>SNCF (Suecia)</th>
<th>DB (Alemania)</th>
<th>Finish Railways (Finlandia)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not inclusion of composite and encased beams</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>No iron bridges</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
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<tr>
<td>Only concrete bridges L &lt; 40 m</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
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<tr>
<td>Concrete bridges &lt; 10 m</td>
<td>Reinforced precast slabs</td>
<td>Reinforced concrete slabs, frames and throughs</td>
<td>No answer</td>
<td>Reinforced concrete slabs and frames</td>
<td>Reinforced concrete slabs, frames and throughs</td>
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<tr>
<td>Concrete bridges 10m &lt; L &lt; 40 m</td>
<td>Reinforced and prestressed precast slabs</td>
<td>Reinforced slabs and throughs</td>
<td>No answer</td>
<td>Prestressed concrete slabs</td>
<td>Cast in situ reinforced and prestressed single-span and continuous slabs</td>
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<td>Only metallic bridges &lt; 40 m</td>
<td>OK</td>
<td>No. Raise the limit to 60 m to include more through bridges</td>
<td>OK</td>
<td>OK</td>
<td>No. Raise the limit to 60 m to include truss bridges</td>
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<tr>
<td>Metallic bridges &lt; 10 m</td>
<td>Plate girders “semi through” and through bridges</td>
<td>Simply supported 4-beam type (see figure)</td>
<td>Similar to NR 2 additional bridge types(see pictures)</td>
<td>Plate girders through bridges</td>
<td>Plate girders riveted or welded</td>
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<tr>
<td>Metallic bridges 10m &lt; L &lt; 40 m</td>
<td>Truss or lattice bridges</td>
<td>Plate girders through bridges</td>
<td>Truss bridges</td>
<td>Plate girders through bridges</td>
<td>Plate girders (spans &lt; 30 m )</td>
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<tr>
<td>Only arches &lt; 10 m</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
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<tr>
<td>Type of arch bridge</td>
<td>Multi ring brick</td>
<td>Granite stone</td>
<td>Stone</td>
<td>Brick</td>
<td>Granite stone</td>
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</table>
CONCLUSIONS

1.- No composite, encased beams and iron bridges considered in the study

2.- Study a reinforced concrete solid slab with span less than 10 m (Priority 1)

3.- Study a prestressed concrete voided or solid slab with span around 30 m (Priority 1)

4.- Study a reinforced concrete solid/voided slab with span around 20 m (Priority 2)

5.- Study a reinforced concrete beams with upper slab with span around 20 m (Priority 3)

6.- Study a plate girder (through or under track) with span around 30 m (Priority 1)

7.- Study a truss bridge with span around 50 m (Priority 1)

8.- Study an arch bridge (material type to decide) with span less than 10 m (Priority 1)
Examples of some common railway bridge types in Sweden

Concrete bridges

1950s, 2-5 m spans, RC simply supported slab (drawing no 2447-15)

1995, 4.4 m span, RC frame (Kvistgårds Road, no 3937, 574102-2)

1970, 21.5 m span, RC frame (Salsmästare Street, no 4934, B9147-1)

1994, 20 m span, RC continuous slab (Bridge over Genevads River NSP, no 4144, 524004/022)
1999, 19.5 m span, RC continuous slab (Söderleden, no 4994, 524329-101)

1950s, 5 m span, RC simply supported trough (drawing no 2447-4)

1961, 17.5 m span, RC trough frame (Bridge over Kvisslan River, no 1586, B1297-1)
1969, 15 m span, Continuous RC trough (Bridge in Brunna, no 3416, B9078-1)

1989, 14 m span, Continuous RC trough (Bridge over Solna Road, no , 509480-101)

1987, 28 m span, RC continuous beam (Bridge over Tuna River, no 3428, 509497-1)
1988, 35 m span, Pre-stressed continuous beam (Bridge over Ljusnan, no 2460, 513877-20)

1994, 39 m span, Pre-stressed continuous box-girder (Bridge over E20, no 4252, 556602-25)

2005, 15-45 m, RC and pre-stressed examples (Botnia Line)
Composite bridges

1993, 40 m span, Continuous composite plate girder RC trough (Bridge over Iggesund River, no 2479, 574064-1)

1999, 28.5 m span, Simply supported composite steel plate girder and RC trough (Tokebacka Bridge over Säve River, no 572, B378-13)

2005, 27-45 m, Continuous composite steel box-girder and RC trough (Botnia Line)
1921, 52 m span, simply supported through truss (Motala River, no 122, B184)

1938, 21 m span, (Kinda Canal, no 158, B3404)

1951, 16 m span, Simply supported plate girder (Bridge over Hagge River, no 2978, B5011-5)
1954, 24 m span, continuous half-through plate girder (Bridge over South Målarstrand, no 11, B1209)

1900, 3.5 m span, Simply supported 4-beam type (Bridge over Kvarn Creek, no 3404, B6452-1)

1982, 24 m span, Simply supported 4-beam type (Bridge over Stång River, no 4342, B197-102)

1993, 20 m span, Simply supported steel trough (Bridge over Mellansundet, no 3509, 513833-21)
1995, 21.5 m span, Steel trough (Bridge over En River in Rättvik, no 3441, B6494)

**Masonry arch bridges**

1863 & 1918, 2.9 m span, Stone arch (Bjännesby Bridge, no 1186, B266-1)

1900, 8 m span, Stone arch (Bridge over Stång River, no 159, B3405-1)
1921, 6 m span, Stone arch with mortar jointing (Solberga Bridge, no 1175, B227-1)
Prestressed concrete slab with cantilevers span of 21 m. Piled substructures. Casted on site and slid under track during one overnight double track traffic break. (built 2001)

Reinforced concrete slab with cantilevers span of 18 m. Piled concrete substructures. Casted on site and slid under track in 4-8 hour traffic breaks. (built 2001)

Typical continuous concrete through spans of 16-24 m. Piled substructures. Casted on site and slid under track in 4-10 hour traffic breaks. (built 2003)

Prestressed continuous concrete box-girder with maximum span-length of 28,5 meters. Built on new track beside the 1979

Upper concrete slab on prestressed girders with span-length of 26,10 m. Concrete through for new highway built under temporary bridges. Slab and girders casted without casting breaks next to the track and slid under track during over night traffic break. (built 2003)
Ballastless truss bridge, span of 52 m. Wooden rails on secondary girders. (Typical bridge for 30...80 m spans)

Ballastless girder bridge, span of 24 m. Wooden rails on main girders. (Typical bridge for 10...30 m spans).

Steel bridge with concrete slab. Old steel bridge was lifted out and new steel members lifted into place. Concrete element slabs (width 2 m) were installed. On single track lines all work are done during weekend break, on double track lines one line is effectively used for work as traffic is on the other line.
Picture 10. Groined girder bridge, span 7.0 m

Picture 11. Stone bridge, span 6.0 m.