Bridges along highway ring road of Wroclaw

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Abstract

The highway ring road of Wroclaw is a very important part of urban communication network being now under modernization work (Fig. 1). It will begin near the village named Nowa Wieś (with connection to the A4 highway and the temporary connection to the route no. 8 to Prague) and it will reach the north border of Wroclaw, where it will be continued as S8 highway to Warsaw (temporarily it will be connected to the existing route no. 8). It will be 26.765 km long.

The ring road will pass through the west part of Wroclaw, along the border of tight urban area. It crosses the Odra River near Rędzin and goes through irrigation fields, where sewage were previously circulated.

Fifty of the bridge structures were designed along the ring road or over it (Table 1). The total length of highway bridges and viaducts is more than 6 km, which is equivalent to 22% whole route. The longest bridge is a concrete cable-stayed structure crossing the Odra River. It has two main spans 256 m long and the total length 1742 m. Both separated decks are to be connected to a single concrete H-shaped pylon 122 m high.

All of the design large bridge structures (Table 1) will be made of prestressed concrete (the largest structures of C50/60 concrete with 6% addition of silica fume).

The total width of structures along ring road is 17.72 m for each carriageway with exception to the cable stayed bridge where it is 19.24 m. All bridges are designed as two parallel independent structures for each of the carriageways.

Table 1 Large bridges and viaducts along highway ring road.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of the bridge or viaduct</th>
<th>Total length [m]</th>
<th>Main structure material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Viaduct (WA17) over Żernicka street</td>
<td>301.98</td>
<td>Prestressed concrete</td>
</tr>
<tr>
<td>2.</td>
<td>Viaduct (WA19) over Kosmonautów street</td>
<td>751.98</td>
<td>Prestressed concrete</td>
</tr>
<tr>
<td>3.</td>
<td>Viaduct (WA20) over Królewiecka, Rolna and Maslicka streets</td>
<td>369.24</td>
<td>Prestressed concrete</td>
</tr>
<tr>
<td>4.</td>
<td>Bridge (MA21’) over the Odra River near Rędzin stage of fall</td>
<td>1744.10</td>
<td>Prestressed concrete</td>
</tr>
<tr>
<td>5.</td>
<td>Viaduct (WA22’A) over „pola iązgracyjne”, railways and Pelczynska street</td>
<td>1597.20</td>
<td>Prestressed concrete</td>
</tr>
<tr>
<td>6.</td>
<td>Viaduct (WA25.2) over Kamieńskiego street</td>
<td>171.25</td>
<td>Prestressed concrete</td>
</tr>
<tr>
<td>7.</td>
<td>Bridge (WA26) over the Widawa River</td>
<td>302.78</td>
<td>Prestressed concrete</td>
</tr>
</tbody>
</table>

The largest bridge of the highway ring road of Wroclaw will be a cable stayed bridge over the Odra River near Rędzin stage of fall. The river flows there in its main bed, while inland navigation uses
additional channel with two locks (Fig. 1). An island with several residential buildings is located between the river and the channel. It has its own connections with mainland over the lock gates in inland navigation channel. The pylon of the new highway bridge will be placed on the island.

![Computer image of a designed new highway bridge over the Odra River.](image)

The designed bridge is 1742 m long and consists of:
- south flyover 610 m long (40+2x52+56+6x60+50 m). It is a continuous eleven span prestressed concrete box structure,
- main bridge 612 m long (50+2x256+50 m) with two separate decks connected to a single concrete H-shaped pylon,
- north flyover 520 m long (50+7x60+50 m), continuous girders made of prestressed concrete.

Longitudinal axis of the bridge in horizontal plane is changing. It is: straight for south flyover and main bridge; curved for north flyover. In vertical plane formation line of the highway is circular with radius 25 000 m and has its apex in the middle of the main bridge (where the pylon is located). The shipping clearance under the bridge is 15.5 m high.

The superstructure of the main bridge consists of two separate box girders made of prestressed concrete, one for each carriageway of highway. The box girders are supported by cables connected to a H-shaped pylon made of reinforced concrete. The height of girders is 2.50 m, it is 1/100 of span length. The H-shaped pylon is made of reinforced concrete and is mutual for both girders (carriageways of highway). Such solution was chosen because of a very narrow area provided for the highway ring road project. The pylon is 122.00 m high. Arms of the pylon have variable dimensions: from 6.00x7.00 m at base; 4.00x4.00 m near the horizontal beam which connects the arms; to 4.00x6.00 m at the top. There is a steel core to carry horizontal tensile stress in the pylon where cables are anchored. Both girders are supported by 80 pairs of cables connected to the pylon. Cables are anchored in the deck every 12.00 m and in pylon every 1.80 m. Passive anchorages are located in the arms of pylon.