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Pros, Cons and Characteristic of Precast Segmental Transit Bridge. Boxes vs. Channel Cross Sections.

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INTRODUCTION

- THE BOX / TRAPEZOIDAL CROSS-SECTION IS THE MOST COMMON SHAPE FOR THE SEGMENTAL RAIL BRIDGES APPLICATION IN THE NORTH AMERICAN.
- THE CHANNEL CROSS-SECTION HAS A SUCCESSFUL APPLICATION INTERNATIONALLY.



BOX / TRAPEZOIDAL CROSS-SECTION



CHANNEL CROSS-SECTION

BOX vs. CHANNEL CROSS SECTION | Design

STRUCTURAL EFFICIENCY

- BOX CROSS SECTIONS HAVE A LARGE TORSIONAL RIGIDITY.
(This rigidity allows them to be used effectively for curved bridges.)
- BOX CROSS SECTIONS HAVE A MORE EFFICIENT DISTRIBUTION OF THE RESISTING ELEMENTS.



BOX vs. CHANNEL CROSS SECTION | Design

SPAN LENGTH

- THERE IS NO TYPICAL SPAN LENGTH FOR BOX SECTION STRUCTURES.
 - a) Span Length depends on box section depth, which can be selected.
 - b) The continuous section of any side of the fixed supported span cannot be more than:
 - 90 m (295 ft) if no rail expansion joint is used.
 - 400 m (1312 ft) if rail expansion joint is used.
- SIMPLY SUPPORTED CHANNEL SECTIONS ARE WELL ADAPTED TO SEGMENTAL TRANSIT / RAIL BRIDGE (Light Rail). TYPICAL SPAN LENGTHS ARE IN THE RANGE OF 18 – 36 m (60 – 118 ft).
- IF DOUBLE CONTINUOUS SPANS ARE USED (Mainly at Stations), THE ABOVE SPAN LENGTH RANGE CAN BE INCREASED TO 50 m (165 ft).

BOX vs. CHANNEL CROSS SECTION | Design

DECK WIDTH

- BOX SECTIONS HAVE THE FLEXIBILITY IN MODIFYING WIDTH BY INCREASING WINGS.



BOX vs. CHANNEL CROSS SECTION | Design

EXTERNAL PT

- BOX SECTIONS ALLOW FOR EXTERNAL PT.
- BOX SECTIONS ALLOW FOR PT REPLACEMENT.
- BOX SECTIONS ALLOW FOR FUTURE PT INSTALLATION.



BOX vs. CHANNEL CROSS SECTION | Design

SUBSTRUCTURE DESIGN

- CHANNEL SECTION REQUIRES LARGER PIER HEAD.
- BOX SECTION TYPICALLY HAS LOWER MASS.



BOX vs. CHANNEL CROSS SECTION | Design

TRACK PLINTHS

- BOX SECTIONS ALLOW FOR TRACK PLINT CONSTANT HEIGHT.
(Channel Section cannot be twisted according to cross slope.)



BOX vs. CHANNEL CROSS SECTION | Design

NOISE RADIATION

- CHANNEL SECTIONS REDUCE NOISE IMPACT.
(Noise Barrier incorporated in the structural section).



BOX vs. CHANNEL CROSS SECTION | Design

AESTHETICS

- DEPENDENT UPON DESIGN.



BOX vs. CHANNEL CROSS SECTION | Construction

REBAR CAGE ASSEMBLY

- CHANNEL SECTION ON AVERAGE REQUIRES MORE TIME TOWARD THE ASSEMBLY OF THE REBAR CAGE.



BOX vs. CHANNEL CROSS SECTION | Construction

CASTING OPERATION

- CHANNEL SECTION HAS SIMPLER CASTING FORM.



BOX vs. CHANNEL CROSS SECTION | Construction

SEGMENT STORAGE & TRANSPORTATION

- CHANNEL SECTION IS MORE STABLE.



BOX vs. CHANNEL CROSS SECTION | Construction

SEGMENT HANGING

- CHANNEL SECTIONS DO NOT NEED LIFTING HOLES.
(Erection with Overslung Equipment).



BOX vs. CHANNEL CROSS SECTION | Construction

SEGMENT SUPPORTING

- WINGS OF THE BOX SECTION CAN BE USED TO SUPPORT THE SEGMENT AND LIMIT EQUIPMENT ENVELOPE.
(Erection with Underslung Equipment).



BOX vs. CHANNEL CROSS SECTION | Construction

TEMPORARY PT

- CHANNEL SECTION REQUIRES TEMPORARY BLISTER.



BOX vs. CHANNEL CROSS SECTION | Construction

ACCESS

- CHANNEL SECTION PROVIDES EASIER ACCESS DURING CONSTRUCTION.



BOX vs. CHANNEL CROSS SECTION | Construction

ERECTION CYCLE

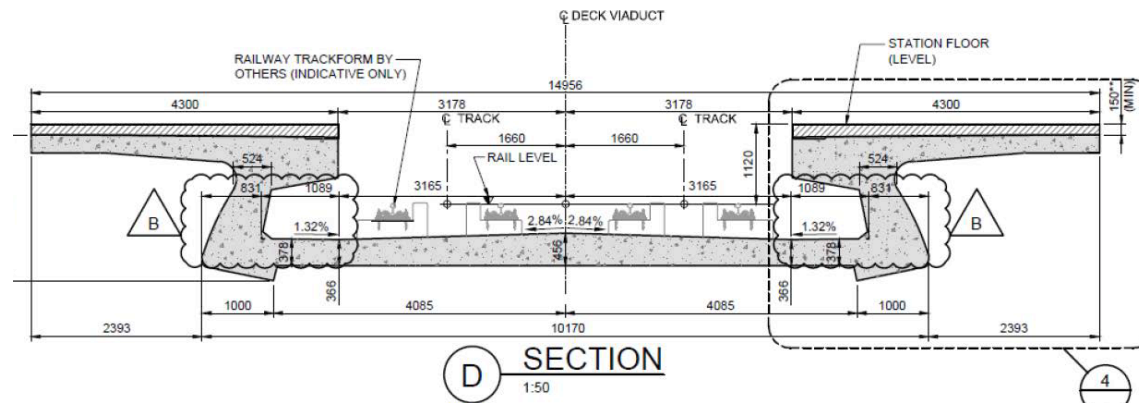
- BOX SECTION REQUIRES LESS PT WHICH RESULTS IN REDUCED PT INSTALLATION TIME.
- CHANNEL SECTION HAS EASIER ACCESS FOR TEMPORARY PT AND EPOXY INSTALLATION.



BOX vs. CHANNEL CROSS SECTION | Construction

WALKWAY INSTALLATION

- FOR THE CHANNEL SECTION, THE WALKWAY IS PART OF THE STRUCTURAL SECTION.



BOX vs. CHANNEL CROSS SECTION | Construction

- **SPAN BY SPAN ERECTION**
- BOTH BOX & CHANNEL SECTIONS ALLOW FOR SPAN BY SPAN ERECTION.



BOX vs. CHANNEL CROSS SECTION | Construction

- **BALANCED CANTILEVER ERECTION**
- CHANNEL SECTIONS DO NOT ALLOW FOR CANTILEVER ERECTION.



BOX vs. CHANNEL CROSS SECTION | Construction

- **BALANCED CANTILEVER ERECTION – BOX & CHANNEL COMB**
- MODIFIED CHANNEL SECTION CAN BE ADAPTED FOR CANTILEVER CONSTRUCTION.



BOX vs. CHANNEL CROSS SECTION | Construction

- **CABLE-SUPPORTED STRUCTURES**

- CHANNEL SECTIONS ARE DIFFICULT FOR CABLE SUPPORTED STRUCTURES.



CONSIDERATIONS & CONCLUSION

- BOX SECTIONS:
 - a) ARE MORE SUSTAINABLE (Less Material Demand).
 - b) ARE MORE DURABLE .
 - c) ARE MORE MAINTAINABLE.

- CHANNEL SECTIONS:
 - a) REDUCE NOISE-IMPACT.
 - b) HAVE BETTER ACCESS DURING CONSTRUCTION.

- COST:
 - a) BOX SECTIONS ARE GENERALLY CHEAPER, HOWEVER THE COST OF ADDITIONAL ELEMENTS SUCH AS WALKWAYS, NOISE BARRIERS, SAFETY BARRIERS AND STATIONS MAY REDUCE OR EVEN ELIMINATE THE OVERALL COST DIFFERENCE.

QUESTIONS?



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