Bridge Design for Constructability and Ease of Maintenance

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Constructability

- Geometry
- Design/Detailing
- General Notes & Plan Notes

We only hear about “problems”
Most of the following examples are BRG projects
Geometry

• List super-elevation transitions by type: Type I (Linear) or Type III (Parabolic)
• Practical limit for hauling: 150’ (steel or PS beams)
• Watch F-E conditions – is it really “fixed”?
• Elevated Intersections
• OSB’s >20’
F-E Conditions

Ht = 42’

H = 36’

6’ *

* Depth of fixity = 2 x Dia

36” dia. Cols
F-E Condition – con’t

• Assume standard design for 90’ span, 28’ rdwy, no skew

• Standards used are: SIG-28; BIG-28
F – E Conditions, cont’d

\[ R_{DL} = 172 \text{ k/col} \]
\[ R_H = 0.04 \times R_{DL} = 6.9 \text{ k} \]
\[ Ht = 42' \]
\[ \Delta = 1.0'' \]
Joint “growth” on direct connectors
Measured over 3” of movement
Elevated Intersections

788,524 lbs  Eng Est: $1.45  Low Bid: $5.07

$4M for steel
Total Project: $24.6M

FC members not identified
Overhead Sign Bridges >20’

80,000+ OD Permits each year
Design/Detailing

- Diaphragm conn. plates for plate girders
- Double Stirrups
- Cap-Column Connections
- Rehabilitation notes
- General/Plan Notes
Diaphragm Conn. Plate

Must have at least 7” wide plate for welding
Double Stirrups
Cap to Column Connections
“Note: Field verify all measurements before ordering new materials”

“Contractor shall verify all elevations and dimensions in the field”
* Determine in field

L 4 x 6 x ½” x *
General Notes/Plan Notes

- Still seeing portions of specs repeated in notes (usually for “emphasis”)
- Check TxDOT web site for plan requirements for various specs
- Make sure notes are in correct location
Notes for Drilled Shafts

Don’t put a note stating that slurry methods or casing are required – let the specs handle that

There are rare exceptions to this
Misc

- Lightweight Aggregate Concrete
- Special Surfaces Finishes for Concrete
LWA (light weight aggregate) Concrete

- No specs for LWA at this time
- SP would be required
- Few sources in Tx
- No real structural need for it
- Handling issues in field
- Performance issues
Special Surface Finishes – Item 427

• Blast Finish
  – Difficult to perform this operation in some cities
  – depends on lots of factors

• Rub Finish (and Two Rub finish)
  – Very time consuming and expensive – save for small areas with close pedestrian access
Ease of Maintenance

• Enemy #1: WATER
  - Joints
  - Drain systems
  - Riprap/Channel protection
Joints

- Minimize # of Joints but don’t go jointless
- No perfect joints
  1. SEJ Up to 5”
  2. Armor Joint
  3. Header Joint
  4. Asphalt Plug

1. Finger joints (un-sealed)
2. Modular
Drain Systems

• Simple, Simple, Simple
• Avoid running pipes in concrete
• Drain locations
Drains:

What seems to work best?
4 x 6 tube works, too
Riprap

- Avoid concrete for stream crossings ($3.90/sf)
- Use flexible systems:
  1. Stone protection ($3.70/sf)(can use crushed concrete)
  2. Gabion Mattresses ($11.00/sf)
  3. Interlocking articulated blocks ($10.00/sf)
  4. Concrete Armor Units
  5. Gabions
- Provide adequate shoulder drains
Articulated Blocks

Gabion Mattresses
Bridge Construction & Maintenance Branch

- 6 PE’s + 1 EIT
- 4 Structural Steel Field Inspectors
- Serve as in-house consultant to districts, divisions, and consultants on bridge construction & maintenance issues
- Contact Brian Merrill (512) 416-2232 or bmerrill@dot.state.tx.us