



# INDIANA DEPARTMENT OF TRANSPORTATION

*Driving Indiana's Economic Growth*

## Design Memorandum No. 23-20

November 15, 2023

**TO:** All Design, Operations, and District Personnel, and Consultants

**FROM:** /s/ Stephanie Wagner  
Stephanie Wagner  
Director of Bridge Engineering

**SUBJECT:** Extended Pile Bents and Wall Pier on Single Row of Piles

**REVISES:** *Indiana Design Manual Sections 409-6.01(01), 409-6.03(05), 409-6.04(01), 409-6.04(02), 409-6.04(04), Figures 409-6B and 409-6C*

**EFFECTIVE:** Stage 1 submittals on or after January 1, 2024

Design guidance on the use of extended pile bents and wall piers on a single row of piles has been revised. Revisions are a result of field observations and research findings from JTRP 4512: *Pile Stability Analysis in Soft or Loose Soils: Guidance on Foundation Design Assumptions with Respect To Loose or Soft Soil Effects on Pile Lateral Capacity and Stability*. The revisions have been incorporated into the referenced sections of IDM [Chapter 409](#). A summary of revisions is included on the next page.

For questions related to this design memo, please contact the Bridge Engineering Division at [Bridgedesignoffice@indot.in.gov](mailto:Bridgedesignoffice@indot.in.gov)

IDM Section	Revision	Notes
409-6.01(01), 2a. – Wall Pier	Increased height recommendation for wall piers from 20 ft to 25 ft.	
409-6.03(05) - Column Reinforcement	Updated LRFD code references and added seismic zone parameters.	
409-6.04(01) - Extended Pile Bent	Preventive maintenance costs should be included in life cycle cost.  Added consideration for wall piers on a single row of piles in lieu of extended pile bents.	INDOT has observed steel pipe pile deterioration on exposed surfaces and at shallow depths below ground level on many in-service bridges with extended pile bents. This increases the risk of the substructure deteriorating prior to other components and triggering the need for a full structure replacement prior to the 75-year design life. Preventive maintenance such as pile painting is an added cost that should be considered in a life cycle cost evaluation when determining the most cost-effective substructure type.
409-6.04(02) – Hammerhead Pier <i>and</i>  Figure 409-6C, Hammerhead Pier	Clarified effective-length factor (K)  Removed rounding at pier cap	K = 1.5 for an expansion pier with beams on a single row of neoprene pad <i>without other longitudinal restraint</i> .  K = 1.2 for <del>prestressed</del> beams on semi-fixed bearings. <del>on a fixed pier.</del>
409-6.04(04) - Wall Pier <i>and</i>  Figure 409-6B, Wall Pier on Single Row of Piles	Revised heading from Compression to Wall Pier  Deleted compression guidance. Added Wall Geometry and Constructability subsections.  Increased minimum width from 2'-0" to 2'-6".  Established 9-in. minimum edge distance from edge of pile to face of pile.  Added constructability guidance for use of single row of piles in soft soils.	A single row of piles should not be used at locations where the SPT blow count is less than 7 within a region bound by the bottom of pier to 5 times the pile diameter below the bottom of pier (JTRP 4512, <i>Pile Stability Analysis in Soft or Loose Soils: Guidance on Foundation Design Assumptions with Respect to Loose or Soft Soil Effects on Pile Lateral Capacity and Stability</i> ).  INDOT has observed tilting of wall piers supported by a single row of piles during construction, especially when the upper layers of the foundation soils have low stiffness. A wall pier on a single row of piles offers relatively low stiffness perpendicular to the face of pier. This is not a significant in-service concern for an integral or semi-integral bridge since the superstructure can transfer longitudinal forces to the end bents. During initial construction or a subsequent superstructure replacement (when the superstructure is not in place) low stiffness can result in constructability concerns.