Retrofit Measures for Abutments, Footings, and Foundations

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Components to be Retrofitted

- Abutments
- Footings
- Piles and Pile to Footing Connections

Open End Abutment Types

Diaphragm  Diaphragm  Seat
Closed End Abutment Types

- Cantilever
- Strutted
- Rigid Frame

Abutment Retrofit Measures

- Approach Slabs
- Anchor Slabs
- Diaphragm Walls
- Transverse Shear Keys
- Transverse Soil Anchors
- Soil and Gravity Anchors
California Settlement Slab

- Drill Hole and Grout in Anchor
- Concrete Settlement Slab
- Anchor Slab to Bridge

New Zealand Settlement Slab

- Remove and Replace Portion of Backwall
- Concrete Settlement Slab
- Existing Reinforcement Left in place
- Chip in Shear Key
Abutment Retrofit Measures

- Approach Slabs
- Anchor Slabs
- Diaphragm Walls
- Transverse Shear Keys
- Transverse Soil Anchors
- Soil and Gravity Anchors

"Waffle" Slab Retrofit

![Diagram showing "Waffle" Slab Retrofit with labels and sections A-A]
Anchor Slab Retrofit

Abutment Retrofit Measures

- Approach Slabs
- Anchor Slabs
- Diaphragm Walls
- Transverse Shear Keys
- Transverse Soil Anchors
- Soil and Gravity Anchors
Diaphragm Overlay

Abutment Retrofit Measures

- Approach Slabs
- Anchor Slabs
- Diaphragm Walls
- Transverse Shear Keys
- Transverse Soil Anchors
- Soil and Gravity Anchors
Transverse Shear Keys

Plan

Concrete Shear Keys

Existing Beam

Existing Bearing

Concrete Ca

and Shear

Section A - A
Concrete Shear Keys

Pipe Shear Key

Note: Adjustment of reinforcement may be necessary to shear pipe.
Abutment Retrofit Measures

- Approach Slabs
- Anchor Slabs
- Diaphragm Walls
- Transverse Shear Keys
- Transverse Soil Anchors
- Soil and Gravity Anchors

Abutment Soil Shear Keys

[Diagram showing a section of a bridge with labeled components such as Bridge, Embankment, Soil Shear Key, See Detail 1, and Superstructure.]
Abutment Shear Keys

Wingwall Overlay
Wingwall Cross-tie

CIDH Pile Shear Key
Abutment Retrofit Measures

- Approach Slabs
- Anchor Slabs
- Diaphragm Walls
- Transverse Shear Keys
- Transverse Soil Anchors
- Soil and Gravity Anchors

Deadman Anchor
Deadman Anchor

Soil Anchors

Note: Detail is also applicable to seat-type abutments
Modified Abutment Friction Anchor

Components to be Retrofitted

- Abutments
- Footings
- Piles and Pile to Footing Connections
Footing Retrofit Measures

- Footing Replacement
- Strengthening of Footings
- Limiting Forces Transmitted to Footings

Footing Replacement

LEGEND

A Lower bent (pier) cap retrofit
   - New prestressed concrete beam

B Column replacement
   - Remove existing columns and construct new reinforced concrete column

C New “super” girder (see Fig. 9-37)

D Footing retrofit or replacement

E Barrier replacement

F Upper bent cap retrofit
   - New prestressed concrete beam

G New concrete diaphragm overlays
Footing Retrofit Measures

- Footing Replacement
- Strengthening of Footings
- Limiting Forces Transmitted to Footings
Footing Strengthening

Footing Concrete Overlay
Reinforcing Splice Detail

Strengthening by Prestressing
Footing Retrofit Measures

- Footing Replacement
- Strengthening of Footings
- Limiting Forces Transmitted to Footings

Footing Link Beam
Components to be Retrofitted

- Abutments
- Footings
- Piles and Pile to Footing Connections

Prestressed Tie Down