



Connecticut DOT

Number: ECD-2019-4

Bureau of Engineering and Construction

Date: May 14, 2019

ENGINEERING & CONSTRUCTION DIRECTIVE

Chief Engineer

Bridge Design Standard Practice for Low Permeability Concrete, Revised Concrete Mix Classes, and New Pay Items for Cast-In-Place Concrete Bridge Components

Low Permeability Concrete for cast-in-place superstructures, Revised Concrete Mix Classifications and Item Names, and corresponding Owned Special Provisions shall be incorporated into all design projects as outlined below, effective immediately.

Changes to Portland Cement Concrete (PCC) mix classes are addressed in the [Owned Special Provisions](#) for *Sections 6.01 Concrete for Structures* and *M.03 Portland Cement Concrete* and *Notice to Contractor (NTC) – Portland Cement Concrete (PCC) Mix Classifications*.

For Projects in early stages of Design: Incorporate the documents above and follow the instructions under “**Description of Changes and Guidance for Implementation.**”

- **For Projects in late stages of Design:** Bridge Principal Engineers responsible for projects that are in late stages of design shall determine which stage the project is in and the corresponding action to take:
1. Before FDP:
 - a. If there is sufficient time, the Designer shall:
 - incorporate the owned special provisions and NTC
 - change item names
 - recalculate pay quantities
 - revise plan sheets and detailed estimate sheet
 - b. If there is insufficient time, refer to 2.b below
 2. After FDP:
 - a. If changes are simple, consider making the changes by addendum as outlined in 1.a above
 - b. If changes are not simple, take the following actions:

- i. incorporate, by addendum, the owned special provisions and NTC
 - ii. cast-in-place concrete item names will remain the same
 - iii. Class “F” Concrete for bridge superstructures shall be Low Permeability Concrete (PCC04462 classification) for the material, as noted in the NTC.
- c. If a delay to the bid opening is unacceptable, every attempt shall be made to incorporate Low Permeability Concrete by Change Order.

Description of Changes and Guidance for Implementation:

1. Sections 6.01 Concrete for Structures and M.03 Portland Cement Concrete:

Changes are as follows:

- 6.01.02 – Materials:
 - M.03.02 Mix Design Requirements: Concrete mix classes A, C, F, S, HP1 are replaced with PCC designations (PCCXXXYZ) and bridge pay items are revised as shown in Table 1 of this Directive.
 - Note that the new item names, “Surface Repair Concrete” and “Structural Repair Concrete,” shall replace the former special provision item Class “S” Concrete. A requirement for documentation of plastic properties on delivery tickets for such items was added
 - The PCC mix classification system now allows selection of a concrete mix based on environmental Exposure (see Table M.03.02-1a Exposure Factor per Application).
- 6.01.03 – Construction Methods:
 - Construction Methods has been divided into two sections: “New Construction” and “Surface Repairs and Structural Repairs.” Articles 6.01.03-1 through 6.01.03-13 pertain to new construction. Articles 6.01.03-14 through 6.01.03-24 pertain to repairs and replace the Special Provision for “Class “S” Concrete.” Structural Repair Concrete requires that concrete cylinders be made and tested for design compressive strength. This item shall be used where strength is critical to bridge components being repaired. Strength may be critical for repairs to elements like pier columns or caps, where repairs are performed sequentially. Where repairs are extremely minor, or not of a structural nature, such as repairs to the face of a wall or abutment, the item “Surface Repair Concrete” shall be used.
 - Penetrating Sealer Protective Compound shall be applied to repaired surfaces as specified in 6.01.03-24. (See ECD-2018-2)
 - If embedded galvanic anodes are included in the Contract, the owned special provision shall also be included.
- 6.03.05 Basis of Payment – pay items are added to reflect new item-naming conventions for cast-in-place concrete bridge components.

2. Low Permeability Concrete:

- All entirely new, cast-in-place concrete bridge superstructures shall be constructed with low-permeability concrete (specified as Class PCC04462). Should higher 28-day concrete compressive strengths be needed for design, or smaller aggregate be required, the designations for XXX and Y in the PCC classification may be modified with the approval of the Bridge Principal Engineer responsible for the Project.

- Concrete used for widened or expanded portions of existing superstructures shall be Low Permeability Concrete.
- Low-Permeability Concrete may be used to partially replace entire components of superstructures.
- Low-Permeability Concrete shall be coated with Penetrating Sealer Protective Compound as directed by the Bridge Principal Engineer and in accordance with [ECD-2018-2](#).

Class PCC04462 concrete shall not be used for repairing or patching deteriorated areas of existing concrete. Uses of low permeability concrete for other structural components will be determined by the Bridge Principal Engineer.

- 3. Bridge Pay Items for Cast-In-Place Concrete Components:** Cast-in-place concrete for bridge components has traditionally been paid for by the Class of concrete (Classes “A”, “C” and “F”). Basing unit bid prices on material alone does not allow consistency of bidding between projects. When other considerations, such as access, complexity, forming, placing, and finishing can be incorporated into the bid price, a better bid history will be established.

New bridge pay item names and numbers have been created in the Master Bid Item List. These items are shown in Table 1, along with the former pay item names and new concrete mix classifications. The new bridge pay item names describe the cast-in-place concrete bridge component being constructed instead of the material. Bridge components with similar characteristics shall be grouped together under a pay item. Should an item not be listed in the master bid item list that adequately describes a component, a new item may be requested using the [New Item Request](#) form. The need for a new item should be discussed with the Department’s liaison engineer and a copy of the request shall be distributed to the Bridge Principal Engineers.

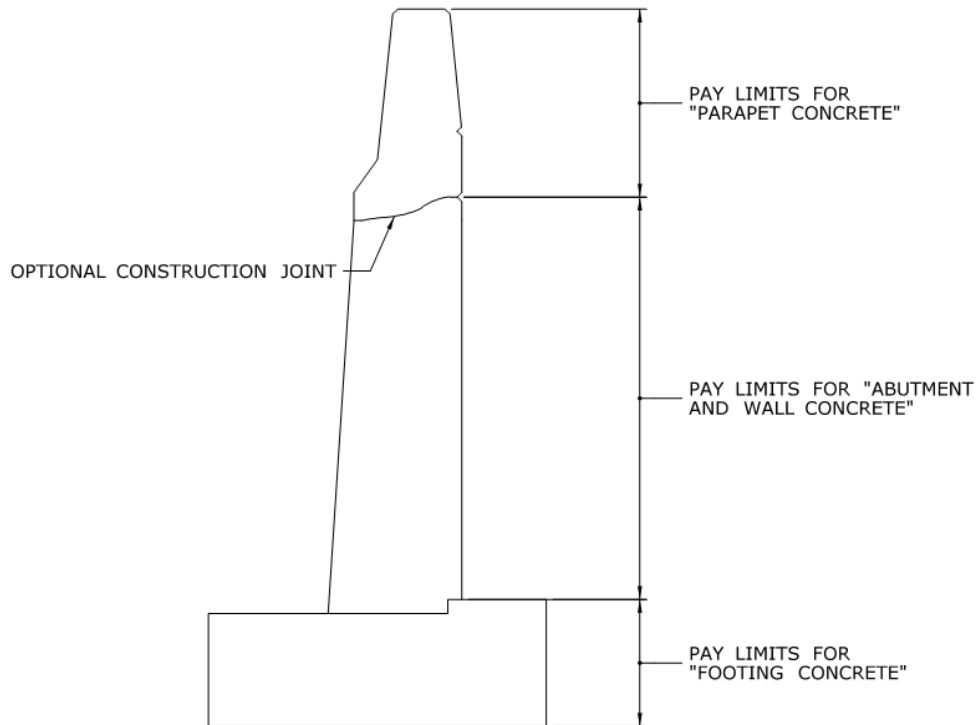
The pay items shall be listed in the General Notes, followed by a list of components that are measured for payment under that item, followed by the PCC Class of concrete specified for those components. Although components are grouped together under one pay item, the PCC class may vary among components within a pay item, since material cost does not vary significantly among concrete mixes.

An example of General Notes for cast-in-place concrete is provided below in the form of a table. These notes are to be used instead of Concrete Notes C5 to C11 in Division II of the Bridge Design Manual. Note in the example below that the item “Parapet Concrete” includes wingwall and bridge parapets that are constructed of different PCC Classes.

THE FOLLOWING PAY ITEMS AND CONCRETE CLASSES ARE REQUIRED FOR CAST-IN-PLACE CONCRETE BRIDGE COMPONENTS:

ITEM	BRIDGE COMPONENTS	PCC CLASS
FOOTING CONCRETE	ABUTMENT AND WINGWALL FOOTINGS	PCC03340
ABUTMENT AND WALL CONCRETE	ABUTMENT AND WINGWALL STEMS, CONCRETE BEARING PEDESTALS, KEEPER BLOCKS, CHEEKWALLS	PCC03340
BRIDGE DECK CONCRETE	BRIDGE DECK	PCC04462
PARAPET CONCRETE	WINGWALL PARAPET	PCC03340
	BRIDGE PARAPET	PCC04462

Where necessary, the plans shall include details to clarify the pay limits for cast-in-place concrete bridge components (See Figure 1).



**CONCRETE WALL WITH PARAPET
 PAY LIMITS**

NOT TO SCALE

FIGURE 1

Table 1 - Pay Items and Concrete Classification				
for Cast-in-Place Concrete Bridge Components (Item No. 0601XXXXA)				
Former	New	New	Component	Mix
Pay Item	Pay Item	Pay Item		Classification
Name	Number	Name		(Class PCCXXXYZ^{1,2})
Class "A" Concrete	0601062A	Footing Concrete	Footings, Pile Caps	PCC03340
	0601063A	Footing Concrete (Mass)*	Footings, Pile Caps	
	0601064A	Abutment and Wall Concrete	Abutments, Walls	
	0601065A	Abutment and Wall Concrete (Mass)*	Abutments, Walls	
	0601121A	Parapet Concrete	Wall Parapets	
Class "C" Concrete	Not applicable		Steps, Copings	PCC03360
Class "S" Concrete	0601072A	Surface Repair Concrete	Abutments, Walls, Columns, Caps, Parapets, Box Culverts	PCC04481, PCC05581
	0601074A	Structural Repair Concrete	Columns, Caps, Parapets, Box Culverts	
Class "F" Concrete	0601066A	Column and Cap Concrete	Columns, Caps	PCC04460
	0601067A	Column and Cap Concrete (Mass)*	Columns, Caps	
	0601123A	Approach Slab Concrete	Approach Slabs	
	0601124A	Barrier Wall Concrete	Barrier Walls	
		See "Low-Permeability Concrete" below for new item numbers and names		Decks, Parapets, Bridge Sidewalks
Class "HP1" Concrete (Low Permeability Concrete)	0601118A	Bridge Deck Concrete	Decks	PCC04462
	0601120A	Bridge Deck Concrete (SIP Forms)	Decks	
	0601121A	Parapet Concrete	Bridge Parapets	
	0601122A	Bridge Sidewalk Concrete	Bridge Sidewalks	

*(Mass) = Minimum dimensions of 5 feet in each of three directions, or 6 feet diameter and 5 feet high

Table footnotes:

- The New Mix Classification naming convention, as used in Section M.03, Table M.03.02-1, is as follows:
 PCCXXXYZ where:
 PCC = Portland Cement Concrete
 XXX = 28-day minimum compressive strength (psi/100)
 Y = Nominal Maximum Aggregate Size (See Table M.01.02-2)
 Z = Exposure Factor: 0 = Benign, 1 = Moderate or 2 = Severe (See Table M.03.02-1a)
- New Mix Classifications listed in the table reflect only those that have a direct correlation to Former Mix Classifications.