Chapter 3: Approach Slabs

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3-1 Introduction

Structure approach pavement systems are used on all Portland cement concrete pavements and on multi-lane (2 or more lanes in one direction) asphalt concrete pavements located within urbanized areas. The structure approach provides a smooth transition between the highway pavement and the bridge superstructure; see Figure 3-1 for an illustration. They help to reduce the effects of differential settlement between the roadway pavement and the bridge structure.

Figure 3-1. Approach Slab Is Shown Here Within a Red Dashed Border

3-2 Pre-Job Planning and Contract Requirements

The following contract documents and guidance need to be reviewed before the start of the project: project plans, standard specifications, special provisions, standard plans, as-builts, applicable Bridge Construction Memos (BCMs), and the *Outline of Field Construction Practices*. In Section 1-3.01, *Understanding Project Documents and Requirements*, general requirements common to most rehabilitation projects were discussed. In this section, contract requirements specific to approach slab replacement will be addressed. SC staff with limited experience should review any unfamiliar procedures with other SC staff who have done this type of work.

The *Standard Specifications* Section 51-5, *Concrete Structures – Approach Slabs*, describes contract requirements for several different types of approach slabs. This manual, however, will only cover the installation of Type R approach slabs, which are most commonly used in rehabilitation projects. Please refer to the *Reinforced Concrete Construction Manual* for other types of approach slabs. Type R approaches are installed

at existing bridges where no approach slabs exist, or where a previously installed approach slab is obsolete or has failed. These slabs are typically installed in a single shift using rapid strength concrete (RSC).

Before the start of the project, SC staff should make a site visit as well as review the as-built plans in BIRIS or BView[1]. The existing field conditions need to be verified and documented with pre-construction photos. When reviewing the as-builts, check for any prestressing blocks and impacts to new reinforcement. In the past, some prestressing blocks were constructed outside the limits of the bridge deck, and protruded into the approach slab or roadway pavement slab limits, as illustrated in Figure 3-2. Additional reinforcement and work might be needed to accommodate the prestressing blocks, as illustrated in Figure 3-3. The as-builts will also show if any previous reinforced slabs need to be removed or if a paving notch extension is needed to install the new Type R approach slab. These old reinforced slabs may not show up on the bridge as-builts, so SC staff should also look at the District pavement as-builts. These slabs are typically 10 feet long. A field visit may also give SC staff an indication that these slabs are present; there will be a joint in the pavement 10 feet from the bridge joint. Note that projects with asphalt concrete overlay may create challenges in determining the limits of approach slabs.

On older projects, the approach slab details will be in the project plans. For newer projects, they will be in the standard plans. Sometimes there are utilities within the approach slab limits. They should be noted and addressed during the removal of the old pavement.

Figure 3-2. Prestressing Blocks

[1] Caltrans internal use only

Figure 3-3. Reinforcement to Account for Prestressing Blocks

Several possible submittals may be required for approach slab work, including:

1. Form CEM-3101, *Notice of Materials to be Used*, as outlined in *Standard Specifications (SS)* Section 6-1.01, *Control of Materials – General.*
2. A concrete mix design as outlined in *SS* Section 51-5.01C, *Concrete Structures – Approach Slabs – General – Submittal,* if rapid strength concrete (RSC) is used. For concrete other than RSC, a mix design as outlined in *SS* Section 90-1.01C(6), *Concrete – General – Submittals – Mix Design.*
3. Bonding material, as outlined in *SS* 51-1.01C(3), *Concrete Structures – General – General – Submittals – Bonding Materials.*
4. A work plan (approach slab and paving notch extensions).
5. A contingency plan, as outlined in *SS* Section 12-4.02A(3)(c), *Temporary Traffic Control –Traffic Control Systems – General – Submittals – Contingency Plans for Closures* (approach slab and paving notch extensions).
6. A trial slab (for RSC) as outlined in *SS* Section 51-5.01D(2)(b), *Concrete Structures – Approach Slabs – General – Quality Assurance – Quality Control – Rapid Strength Concrete.*

In Chapter 1, Form CEM-3101, *Notice of Materials to be Used*, and mix designs were introduced. Bonding material may be previously authorized by the Department; if not, the intended product will need to be submitted for authorization. SC staff need to allow 45 days for testing of the bonding material. Many contractors choose to use the rapid strength concrete submitted for the approach slabs as their bonding material.

When a work plan is submitted, it needs to show enough detail of how the work will be completed within the work windows of the project. The plan should indicate if the Contractor will be using an aggregate base or if they will use RSC to fill any voids that are below the limits of the approach slab. Contingency plans should be included in case the Contractor is unable to replace the approach slab within the closure times. If required, paving notch extensions should also be a part of the work plan. Typical items to verify in the work plan may include:

1. Disposal location for material removed.
2. Methods to prevent damage to existing facilities which are to remain in service.
3. Approach slab layout to accommodate existing pavement joints. Layout plays a critical role when ordering and fabricating reinforcing bar mats.
4. Coordination of timely inspection for reinforcing bar mats assembled off-site.
5. Contractor's method to fill voids between the new structure approach slab and the base material remaining in place; voids may be caused by removal of subsealing material or cement treated base.
6. Methods of grading the approach slabs.
7. Method of forming the paving notch.
8. Type of epoxy and equipment for drill and bond dowels.
9. Curing time for concrete, including:
    a. Provisions for accommodating adverse temperatures.
    b. Confirmation that proposed cure time matches trial batch results plus 1 hour.
10. Contingency plan.

The work plan should also cover when the Contractor will determine if they have enough time to complete the work or if they need to install a temporary roadway section. In practice, the work plan should also include a timeline of scheduled construction activities to be performed prior to opening the approach slab to traffic. A timeline will allow the onsite Engineer to determine if the Contractor is falling behind their proposed schedule for opening the traveled way on time. The work plan should include what type of material will be placed and the duration that the temporary section will remain in place. SC staff should discuss with the Contractor who will be responsible for determining whether a temporary section is needed, and to establish the timeline for that decision.

The trial slab is for the Contractor to show that they can replace the approach slabs under similar conditions as the actual work.

The details for approach slab construction in rehabilitation projects are mainly found on Standard Plan B9-2, *Structure Approach Type R (30)*. However, further details for the placement of smooth dowel bars at the transverse construction joints may be found in Standard Plan P30, *Concrete Pavement End Panel Pavement Transitions*, and P31A, *Continuously Reinforced Concrete Pavement Terminal Joint Details*; see Figure 3-4.

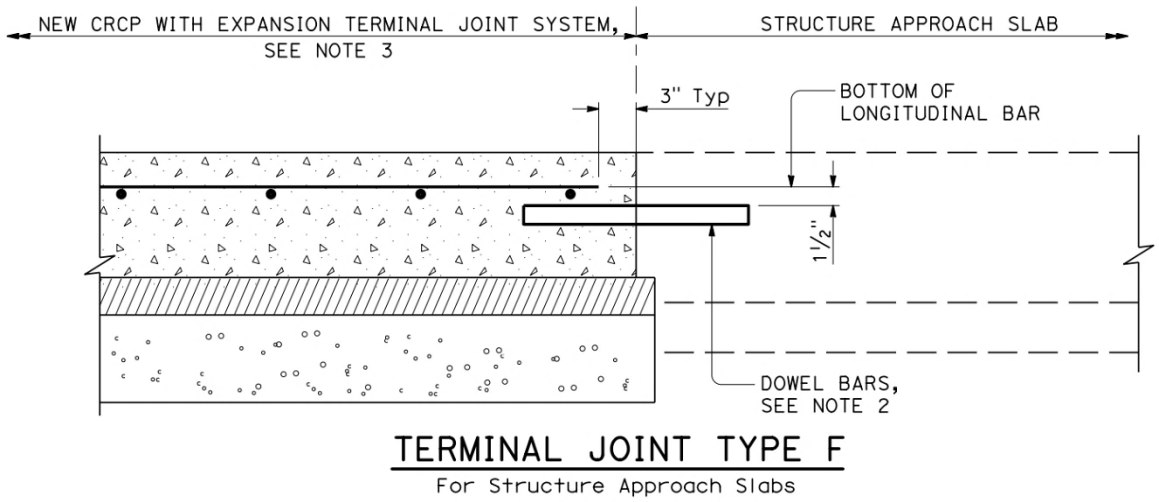

Figure 3-4. Example of Smooth Dowel Bars Placement Requirement

3-3 Approach Slab Replacement Project Administration and Field Inspection

The depth of removal of existing approach slab or pavement will vary depending on what is encountered. At a minimum, the depth will be the thickness of the new approach slab. Some of the existing structural sections to be removed may consist of pavement and base, approach slabs, asphalt concrete surfacing, concrete pavement, subsealing material, and cement-treated base. The extent of removal must be determined by the Engineer.

Per *Standard Specifications* Section 51-5.03D, *Concrete Structures – Approach Slabs – Construction – Type R Approach Slabs*, the only saw cutting allowed before the removal is the outline of the concrete pavement to be removed. The one exception is when a paving notch needs to be installed before the complete removal of the existing approach slab. The removed paving notch working area is then replaced with a temporary patch, which is usually asphalt concrete. Other transverse saw cuts should not be allowed. If a transverse cut is made, there is a possibility that the remaining pavement will settle. This can result in a vertical lip of concrete in the direction of travel, which would be a potential hazard to the traveling public. Settling of the pavement could result from the unseen loss of material under the pavement.

After the existing facilities are removed, the remaining material needs to be compacted. There are no specified requirements for how much compaction needs to be done; it is left to the Engineer's judgment.

There are two pay items for the new approach slab and aggregate base. Those items are STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R), and AGGREGATE BASE (APPROACH SLAB). The contract item for the approach slab's aggregate base is a measured item. The approach slab structural concrete is the theoretical value of the volume of the approach slab. The aggregate base is what needs to be replaced below the limits of the approach slab. This area may be filled with the approach slab concrete, but it is paid as aggregate base; it is necessary to take measurements to determine this quantity. If subbase material or RSC is placed due to over-excavation, no additional compensation is provided.

One way to measure the required amount of aggregate base is with the string line method. This method takes three people. Two people pull a string line across the excavated area transverse to the approach slab. The third person measures the depth of the excavation at several points along the string. This is repeated at several locations along the length of the approach slab removal area. The number of measurements taken will depend on how uniform the bottom of the excavation is. A more uneven surface means that more locations will need to be measured. Use these measurements to get an average depth of the removal. Calculate the total volume, then subtract the theoretical volume of the approach slab. The remainder is the amount of aggregate base that is to be paid to the Contractor. While there are other ways that this information can be obtained, the string line method requires minimal equipment and can be done very quickly. Regardless of the method used, the information should be recorded in the daily report.

Establishing the grade for the new approach slab can be simple if the adjacent pavement is near the correct grade. If this is the case, the existing pavement can be used as a guide to screed the new concrete. If the existing pavement is depressed due to settlement, other measures will need to be taken to get the correct grade. This may include placing a temporary bulkhead along the long side of the approach slab and using cold mix to create a temporary transition between the new and existing pavement. In addition, account for any overlay which may be placed under the same contract. If additional grade controls will be needed at some locations, they should be discussed with the Contractor. The method of providing the correct grade could be a part of their work plan (such as using string lines to control grades). Good judgment from the Engineer is necessary to obtain the best grade possible for the new approach slab.

RSC may not allow the Contractor enough time to finish the concrete to the required smoothness specifications before it sets up. In some cases, the approach slab will need to be ground and grooved. The ground and groove surface also needs to provide a

coefficient of friction of 0.35 or greater when tested per California Test 342, *Method of Test for Surface Skid Resistance with the California Portable Skid Test*. Skid testing of an approach slab replacement may be waived if the Structure Representative makes a visual inspection of the approach slab surface and determines that the surface may reasonably be expected to have a coefficient of friction of 0.35 or greater. A skid test of the trial slab that meets the coefficient of friction of 0.35 can serve as the basis for visual inspection and acceptance of the production slab. This inspection must be documented and included in the job records.

The standard specifications state that concrete for the paving notch extension is to be placed 12 hours prior to the approach slab concrete. Per *Standard Specifications* Section 51-5.03E, *Concrete Structures – Approach Slabs – Construction – Paving Notch Extensions*, there may be exceptions to this requirement. If the working windows are long enough and the Contractor uses the right concrete mix, the paving notch and approach slab may be done in the same work window. The forming of the paving notch may be left in place depending on the material used, such as expanded metal lath. The Contractors' work plan should describe how they will do this.

As-built project plans are the main contract administration procedural output. Sometimes, two to four bridges can be shown on the same plan sheet for approach slab projects. If more than one bridge is on a plan sheet, SC staff will need to submit a separate copy of as-built project plan sheets for each bridge. SC staff would need to include the plan view sheet for the bridge, along with any sheet that is common to all of the bridges.