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CONCRETE PAVEMENT GUIDE

PART 4: REHABILITATION STRATEGIES

CHAPTER 400 LANE REPLACEMENT

400.1 PURPOSE AND DESCRIPTION

Lane replacement is a pavement rehabilitation or reconstruction strategy used for concrete pavement when preservation is no longer practical or cost effective. Lane replacement involves the full depth, full lane-width removal of consecutive concrete pavement slabs, potential removal or partial removal of underlying layers (including base, subbase, and subgrade), and replacement with a new concrete pavement structure (see Figure 400-1). Lane replacements are designed and constructed as new pavement sections with design lives of 20 or 40 years (see Highway Design Manual [HDM] Topic 612).

Figure 400-1: Lane replacement [1]

400.1.1 Application

Lane replacement is considered when more than 10% of the slabs in a pavement segment have 3rd stage cracking or were previously replaced. Lane replacement should also be considered when spalling combined with corner, longitudinal, and transverse cracking distresses exceed 15% over a pavement segment length. Recommendations for determining when to do lane replacement are summarized in Table 400-1.

Table 400-1: Lane Replacement Selection Criteria

Existing Condition	Extent	Action	Reference
3rd stage cracking Previously replaced slabs	< 10%	Consider individual slab replacement with rapid strength concrete	Ch. 320 Individual Slab Replacement
	10 – 20%	Use life cycle cost analysis to determine if individual slab replacement preservation or rehabilitation is more cost effective.	Life-Cycle Cost Analysis Procedures Manual
	> 20%	Consider rehabilitation strategies: lane replacement, crack, seat, and overlay (CSOL), or unbonded concrete overlay	▪ Ch. 400 Lane Replacement ▪ Ch. 410 Crack, Seat, HMA Overlay ▪ Ch. 420 Unbonded Concrete Overlay
Corner, longitudinal, & transverse cracking Spalling	> 15%		

400.1.2 Limitations

Potential limitations associated with lane replacements may include:

- Traffic considerations: the existing traffic level can pose significant challenges during lane replacement construction. In these instances, traffic control requirements that use innovative techniques such as partial-lane closure, full-lane closure, continuous closures, weekend closures, or continuous dynamic lane configuration (e.g., using movable barriers) should be considered (see Section 120.3.4).
- Cost: lane replacement includes removing and replacing the existing pavement structure with significant construction costs and traffic control requirements.

Conducting a life-cycle cost analysis to compare lane replacement with CAPM slab replacement, or crack, seat, and HMA overlay will provide assistance in the selection of a cost-effective solution. In addition, the evaluation of highway construction time and traffic impacts can be further evaluated using the *Construction Analysis for Pavement Rehabilitation Strategies* (CA4PRS) software. Details and software download can be accessed from the Division of Research and Innovation webpage.

400.1.3 Concrete Pavement Type Selection

Lane replacements can use continuously reinforced concrete pavement (CRCP), jointed plane concrete pavement, or precast panel concrete pavement (PPCP). Some potential pavement type considerations are listed in Table 400-2:

Table 400-2: Concrete Pavement Type Selection

Pavement Type	Benefit	Limitations
CRCP	• Long life pavement	• Adds significant lane closure time for placement of bar reinforcement compare to JPCP or PPCP • Moderately increased cost compared to JPCP
JPCP	• Lower initial cost • Efficient construction	• Increased future maintenance potential compared to CRCP and PPCP
Precast panels (PPCP)	• No curing time for the panel, only for the grout. • Reduced user delay • Less susceptible to construction and material variability • Less testing during installation	• Requires accurate measurement and production of slab dimensions • Highest cost • Requires slab staging area • Requires use of a heavy mobile crane

400.2 MATERIALS SELECTION

400.2.1 Pavement Structure Materials

Pavement structure materials for a lane replacement project are selected based on strength, available curing time, prevailing climatic conditions, cost, equipment requirements, mixing and placing time, and desired service life. Table 400-3 provides a summary of the benefits and limitations of materials (both surfacing and base layers) used in lane replacement projects.

Table 400-3: Materials Selection

Pavement Structure Layer	Material	Benefits	Limitations
Surface	Concrete (conventional mix)	• Lowest cost • Known performance • Contractor experience	• Slower setting times (> 3 days)
	Rapid Strength Concrete (RSC)	• Faster setting times (< 3 days)	• Increased potential for shrinkage cracking • Complex mixes are more prone to durability problems and shorter life • High cost • Requires special handling
Base	Lean Concrete Base	• Minimal time constraints	• Requires placement of a bond breaker • More expensive than aggregate base
	Aggregate Base	• Low cost	• Slow production rate to allow for placement and compaction
	HMA Base	• Low cost • Known performance • Contractor experience	• Requires cooling to 120 °F prior to placement of concrete layer • More expensive than aggregate base
	Roller Compacted Concrete (RCC)[1]	• Concrete comparable strength • Simplified construction as compared to concrete • Low cost	• Use on shoulders and base layers only

[1]Contact Headquarters Maintenance Pavement Program – Office of Concrete Pavement and Pavement Foundations for details.

Although virtually any opening time requirement can be met using either conventional cementitious or rapid strength materials, conventional concrete materials should be utilized as much as possible (see Section 120.2.3).

400.2.2 Dowel Bars and Tie Bars

According to Standard Specification Section 40 Concrete Pavement, dowel and tie bars must be epoxy-coated carbon steel, stainless steel, or a low carbon, chromium steel bar depending on the project's climate region. Bar selection is ultimately up to the contractor and largely dependent on cost. Table 400-4 provides a summary of material selection criteria for tie bars and dowel bars based on Standard Specification Section 40-1.02C:

Table 400-4: Dowel and Tie Bar Characteristics

Material	Benefit	Limitation	Climate Region
Epoxy-coated carbon steel	Lower cost	Long-term corrosion potential	All
Stainless steel	Long-term performance	Higher cost	All
Low carbon, chromium steel	Long-term performance	Higher cost	Any except High Desert or mountainous

400.3 DESIGN

400.3.1 Replacement Locations and Boundaries

Lane replacement boundaries should extend the full transverse width between adjacent longitudinal joints. Limits will typically extend between natural breaks points such as pavement type changes or structures, and, lane replacement construction should begin and end at an existing transverse joint. Many individual slabs or segments may be in good condition within the lane replacement limits, but if more than 20% of slabs exhibit 3rd stage cracking, it is more cost effective to remove all slabs regardless of condition than to construct individual slab replacements.

Similarly, if the outside through lane of a multilane roadway needs replacement, the adjacent lane should also be considered for replacement regardless of the existing pavement condition using life-cycle cost analysis. Concrete pavers can be most productive when constructing multiple lanes simultaneously, and replacing both outer lanes where truck traffic is permitted is typically more cost effective pavement management than replacing lanes at separate times.

Existing Shoulders

Full-width shoulder replacement is not always required when the adjacent outside lane is replaced. Only a few situations such as existing shoulder widths ≤ 5’ require full-width shoulder replacement (see HDM Topic 613.5(2)). However, partial width removal of at least 2’ of the outside shoulder or 1’ of the inside shoulder is required for paving equipment access. Overcutting into the adjacent shoulder may also be required to allow for existing lane and edge drain removal.

The removal of an outside lane and replacement with a 14’ widened concrete slab will provide for improved performance by reducing slab stresses, deflections, and cracking and faulting potential. The traffic lane should be striped for a standard 12’ width, so if the resulting shoulder cross slope does not meet geometric or drainage requirements (see Design Information Bulletin 79-03), a design exception or grinding may be required (see HDM Index 302.2).

Replaced shoulders must be selected based on the standards in HDM Topic 626.2 and designed to meet the design life requirements in HDM Topic 612. See HDM Topic 613.5(2) for further information on pavement structure requirements for replaced shoulders and strategies for maintaining existing shoulders.

Longitudinal Construction Joint Locations

With lane replacement, a longitudinal construction joint will typically be required. When the longitudinal construction joint is between outside lanes where trucks are permitted and inside lanes where trucks are not permitted, remove 6” of the adjacent existing lane as part of the lane replacement. This provides both lateral support for the truck permitted lanes and a joint clean of existing spalls and undulations. For all other cases, remove 2” of the adjacent existing lane to provide a clean construction joint.

400.3.2 Pavement Structure Design

Lane replacement pavement structures are considered new designs. The materials and required pavement, base, and subbase layer thicknesses are designed based on pavement climate region, subgrade, and traffic index according to the tables in HDM Topic 623.

The pavement structure of the new lane will likely be thicker than the existing layers. Typically, removal and replacement of the existing base layers will be required either to accommodate the new, thicker pavement structure design or due to deterioration. Most existing concrete pavement was originally constructed from 8” to 9” thick over CTB. New concrete pavement layers are typically 10” to 14” because of higher traffic volumes and longer-life designs. Additionally, CTB and other treated bases are often deteriorated from traffic loading and erosion (see Section 110.2). If treated permeable base layers are removed for a lane replacement, continuous transverse drainage must be provided throughout the pavement substructure.

If preliminary pavement structure design thicknesses indicate existing base can remain in place, district materials personnel should conduct an assessment of underlying base condition (see Sections 110.2 and 320.2). Evaluation of the underlying base materials may include deflection testing using a falling weight deflectometer (FWD) and pavement coring. FWD testing may be helpful for indicating variability of underlying support, in-situ material properties, and the overall structural adequacy of the pavement. Although destructive to the existing pavement structure, coring can also be used as a more definitive means of assessing the underlying base layer condition through visual inspection and material sampling. Information from the iGPR website can also be utilized.

Lane replacement designs are intended to provide extended service life, and there are limited opportunities to access existing pavement substructure layers. Any underlying base that is cracked, in poor condition, and does not provide a uniform, compacted, and non-disturbed supporting layer should be removed and replaced with LCB or HMA Type A base. The thickness of the new base material may be adjusted depending on how much of the existing base or subbase material will remain in place.

Untreated aggregate base layers generally only need replacement if the remaining thickness of base or subbase is less than 0.40’ or there has been deterioration due to pumping or other mechanisms. AB layers may also be removed if the existing subgrade is Type II or III and requires special engineering consideration to improve material properties (see Section 120.1.3). This could be indicated if more than 25% of existing slabs have settlement > ½”.

Although not recommended for final design, the following general guidelines may be used for quantity and cost estimating purposes during project planning if a base investigation was not performed:

- Assume removal and replacement of the existing treated base with LCB, HMA Type A, or concrete base.
- Assume existing aggregate bases or subbases will remain in place unless one of the above conditions applies.

Whether or not a base investigation has been performed, designers should provide adequate information and flexibility in the RE file to ensure that the resident engineer understands the project expectations and has the tools to make adjustments in the field, particularly for identifying and replacing isolated locations of base and subbase.

400.3.3 Dowel Bars

Drill and bond dowel bars are required at all construction joints with existing concrete pavement or structure approach slabs, as shown in Standard Plan P10. For lane replacements with jointed plain concrete pavement (JPCP), dowel bars are required at all transverse contraction joints (see Standard Plan P1).

400.3.4 Tie Bars

Tie bars are typically required at JPCP longitudinal joints (see Standard Plan P1) unless an isolation joint is required. If the transverse joints in the new lane do not match the transverse joint orientation in the adjacent existing lane, an isolation joint should be used instead (see Figure 400-2 and Standard Plan P18). Note that the new transverse joint spacing patterns should match what is shown in Standard Plan P1.

Also, if the adjacent lane shows cracking, faulting, or spalling distress, tie bars should not be used across the JPCP longitudinal joint and an isolation joint should be used instead.

For CRCP, tie bars are placed perpendicular to the longitudinal construction joint or between an edge joint and shoulder.

Figure 400-2: Isolation joint

In instances where the new concrete pavement thickness is greater than the adjacent existing concrete pavement, tie bars should be placed within the middle third depth of each slab (see Figure 400-3).

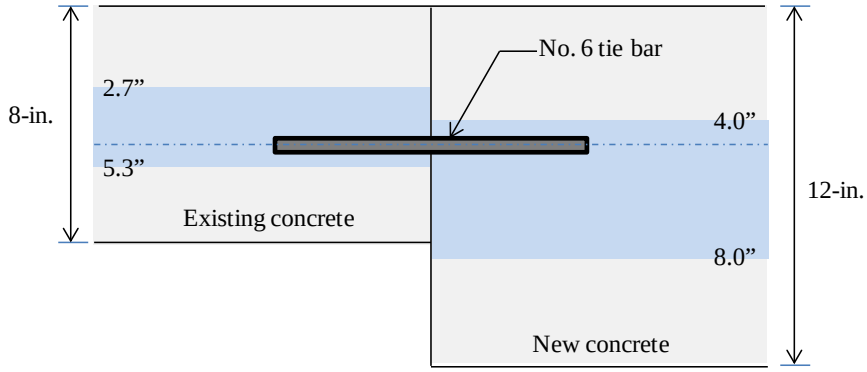


Figure 400-3: Example tie bar placement

Recommended depths for tie bar placement are shown in Table 400-5:

Table 400-5: Recommended Tie Bar Depth*

New Concrete Thickness (inches)	Existing Concrete Thickness (inches)				
	8	**9**	**10**	**11**	**12**
9	3.0 – 5.4	4.5			
10	3.3 – 5.4	3.3 – 6.0	5.0		
11	3.7 – 5.4	3.7 – 6.0	3.7 – 6.6	5.5	
12	4.0 – 5.4	4.0 – 6.0	4.0 – 6.6	4.0 – 7.4	6.0
13	4.3 – 5.4	4.3 – 6.0	4.3 – 6.6	4.3 – 7.4	4.3 – 8.0
14	4.7 – 5.4	4.7 – 6.0	4.7 – 6.6	4.7 – 7.4	4.7 – 8.0

*All dimensions measured in inches from existing pavement surface

400.4 OTHER CONSIDERATIONS

400.4.1 Combination Pavement Strategies

Existing lanes, shoulders, and interchange ramps remaining in place should also be considered for pavement work. The type of strategy and available funding will depend on the existing pavement condition. Pavement preservation, including preventive maintenance (HM program) and CAPM strategies, may be appropriate when the distress levels match the criteria for these funding programs. Possible strategies include:

- Replace distressed individual slabs and diamond grind adjacent lanes prior to lane replacement construction to provide a smooth paving platform for improved concrete surface smoothness. An International Roughness Index (IRI) of 60 inches/mile is the standard threshold for new construction.
- Existing asphalt shoulders can be fog or slurry sealed if no distress is observed. For minor cracking, shoulders should be considered for a mill and HMA overlay strategy. Consider more seriously distressed shoulders for reconstruction using hot mix asphalt (HMA), concrete, or RCC. Shoulders should be designed in accordance with HDM Topic 613.5.2a.
- Ramps and auxiliary lanes should be evaluated and preserved, rehabilitated, or reconstructed as needed. Mainline preservation, rehabilitation, or reconstruction requirements should be used for determining pavement strategies in these lanes.

400.4.2 Edge Drain Replacement

Existing edge drains can conflict with outside lane replacement strategies. When the existing JPCP slab is removed, the treated permeable base material and adjacent slotted edge drain pipe must also be removed. PVC pipe with no slots is spliced in to reconnect the edge drain system. During construction, care must be taken to prevent clogging existing edge drain systems.

If treated permeable base layers are removed for a lane replacement, continuous subsurface drainage must be provided transversely throughout the pavement structure. Refer to HDM Chapter 650 for more information about pavement drainage and HDM Chapter 840 for subsurface drainage.

400.4.3 Sequence of Work

The sequence of work is very important for project quality and workmanship, especially when using various pavement strategy combinations. The project special provisions should specify the order of work requirements for applicable operations. Any repair work in the adjacent lane should be completed first using the work sequence listed in Section 120.3.4. For lane replacement, the sequence of work depends on inside or outside lane position and existing project conditions.

<u>Inside Lane Replacement</u>

1. Demolish and remove the existing lane.
2. Repair or remove and replace base or subbase layers.
3. Construct new concrete pavement.
4. Cleanup roadway.
5. Replace traffic delineation.

<u>Outside Lane Replacement</u>

The sequence of work for outside lane replacement is based on 3 project conditions:

I. Existing edge drain removal and replacement
II. Existing asphalt concrete shoulder rehabilitation or reconstruction
III. Lane and shoulder replacement using:
   A. Widened 14’ concrete lane and 8’ concrete shoulder
   B. 12’ concrete lane width with 10’ tied concrete shoulder

I. Removal and replacement of existing edge drain
   1. Demolish and remove the existing lane and shoulder.
   2. Repair or remove and replace base and subbase layers.
   3. Remove existing edge drains.
   4. Place and finish (texturing, curing, sawing, sealing) new concrete pavement.
   5. Replace edge drains.
   6. Place HMA or treat asphalt concrete shoulder.
   7. Clean project site and place pavement delineation.

II. Rehabilitation or reconstruction of existing asphalt concrete shoulder
   1. Demolition and removal of existing lane(s) and shoulder.
   2. Removal and replacement of base and subbase layers as needed.
   3. Rehabilitation or reconstruction of asphalt concrete shoulder.
   4. Placement and finishing of new concrete pavement.
   5. Clean project site and place pavement delineation.

III. A-Lane replacement with widened 14’ concrete lane and concrete shoulder
   1. Demolish and remove existing lane and shoulder.
   2. Remove and replace base and subbase layers as needed.
   3. Place and finish new widened concrete pavement lane.
   4. Place and finish new concrete shoulder.
   5. Clean project site and place pavement delineation.

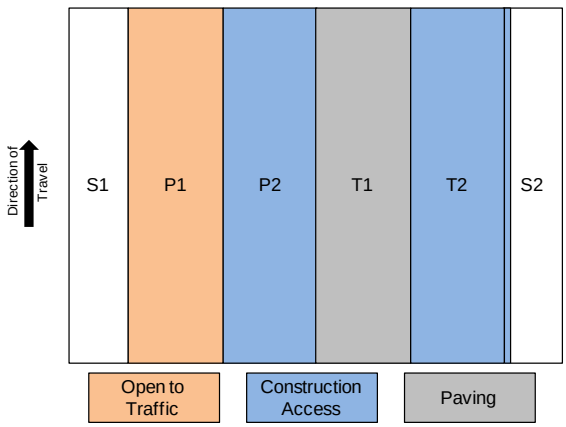
III. B-Lane replacement with 12' wide concrete lane and tied concrete shoulder
   1. Demolish and remove existing lane and shoulder.
   2. Remove and replace base and subbase layers as needed.
   3. Place and finish new concrete pavement and tied concrete shoulder.
   4. Clean project site and place pavement delineation.

400.4.4 Construction Staging

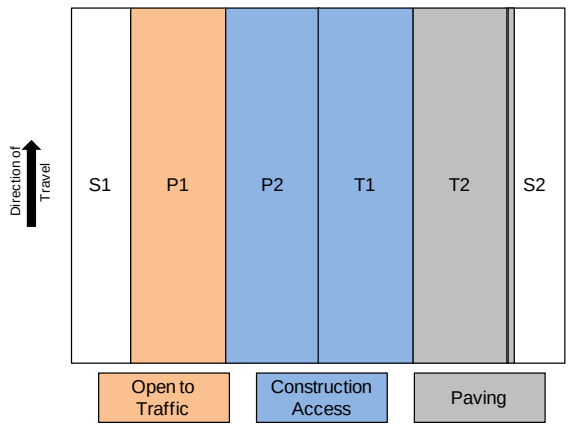
In general, construction staging includes 2 basic methods for conducting lane replacements: concurrent and sequential. Both methods can accommodate single or double lane replacements depending on traffic restrictions. The basic distinction is production, based on whether demolition and paving can proceed simultaneously (concurrent) or if the paving cannot begin until the demolition is complete (sequential).

<u>Concurrent Method</u>

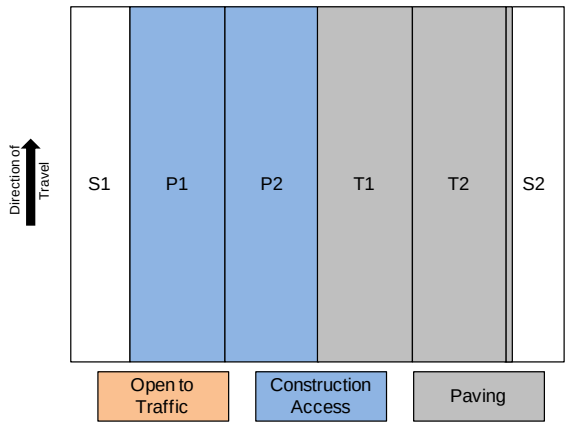
In the concurrent method, demolition and paving can be performed in parallel because each has its own construction access lanes (see Figure 400-4). Paving can also be delayed after demolition begins to minimize potential conflicts between the activities, such as when the paving operation catches up with the demolition operation.



a. Single inside lane replacement in T1 lane.



b. Single outside lane replacement in T2 lane.



c. Double lane replacement in the T1 and T2 lanes (directional traffic closure).

Figure 400-4: Concurrent working method example for 8-lane roadway [4]

Concurrent paving requires closing 3 lanes for single lane replacement on an 8-lane roadway (Figure 400-4a and 4b). One lane is rebuilt concurrently with the adjacent lanes or shoulder on either side providing access for demolition and paving.

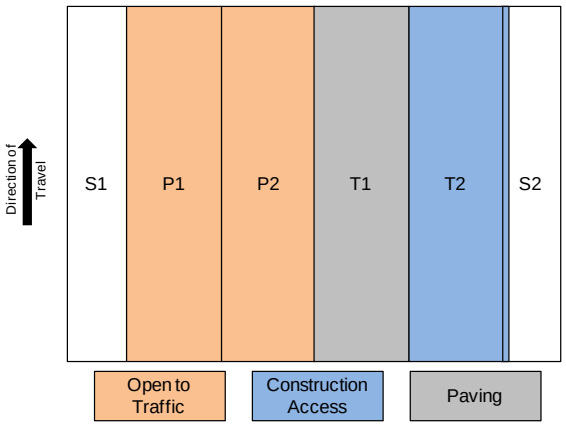
Another option is increasing production by rebuilding adjacent lanes together using concurrent double lane paving (see Figure 400-4c). This setup requires closing all 4 lanes to traffic, which results in one side of the roadway being closed. Advantages of concurrent double lane replacement paving include:

1. Higher paver production. If the paving machine speed is a major constraint limiting the production capability for single lane paving, double lane paving can achieve more production since the paver needs to run only half of the distance of a single lane operation to achieve an equivalent production length.
2. Simplified tie bar installation. The installation of tie bars between the longitudinal contraction joint can be done during the paving operation when 2 lanes are constructed simultaneously. With single lane paving, tie bars have to be drilled and grouted into the newly paved lane prior to reconstructing the adjacent lane.
3. Better longitudinal joint quality. The quality of the longitudinal contraction joint between the 2 lanes is likely to be much higher and the potential for damaging a newly constructed lane during demolition of the adjacent lane is avoided if they are constructed simultaneously. The risk of damaging the new lane by drilling and grouting tie bars is also avoided and a longitudinal contraction joint should perform better than a longitudinal construction joint due to the aggregate interlock between lanes.

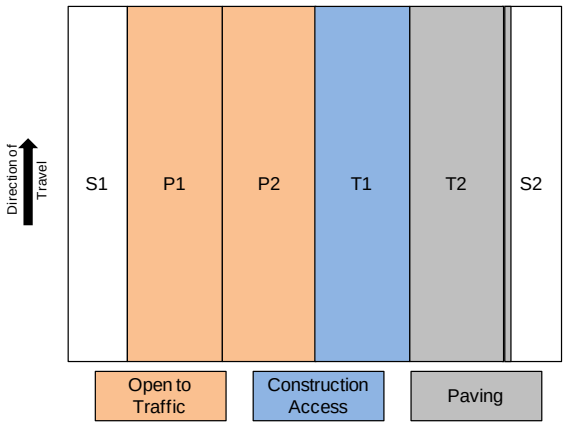
For roadways with 6 lanes or less, conducting concurrent double lane paving is more restrictive. A 12’ access lane on either side of the replacement lane is required to aid the movement of construction vehicles in the work zone. The existing shoulder may be used as an access lane but may require strengthening or widening to at least 12’ for construction traffic. Construction of a temporary lane or detour may also assist in movement of vehicles or construction equipment through the work zone.

<u>Sequential Method</u>

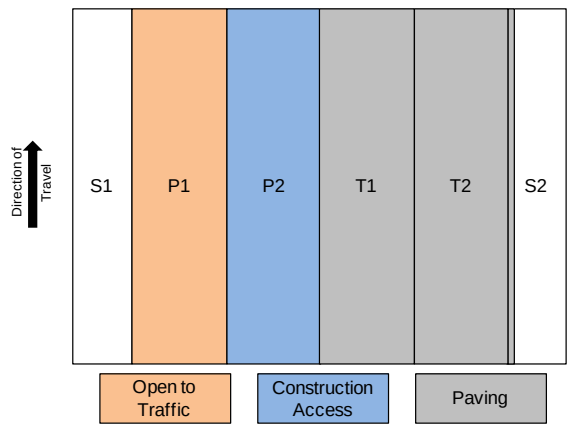
The sequential working method is used when interruptions to regular traffic must be avoided (see Figure 400-5). Demolition and paving cannot take place simultaneously because construction access is limited. Production with the sequential working method is hindered since paving can only start after demolition and base layer repair or construction is completed.



a. Single inside lane replacement in T1 lane.



b. Single outside lane replacement in T2 lane



c. Double lane replacement in the T1 and T2 lanes.

Figure 400-5: Sequential working method example for 8-lane roadway [4]

400.4.5 Traffic Handling

District traffic management personnel typically determine construction zone lane availability requirements for a route segment based on time of the year, day of the week, current hourly traffic volumes, type of construction work, and estimates of reduced work zone capacity.

For lane replacement work, the project location, size, amount of concrete replacement work, lateral clearance, and availability of detours and alternate routes are also important considerations. For JPCP, a minimum lateral clearance of 2' should be provided between the temporary barrier and the lane being replaced. For CRCP, 12' minimum lateral clearance is needed to provide access for concrete material transfer.

Some typical traffic handling alternatives for lane replacement include:

- Complete Closures/ Detours: If construction work includes roadway widening or reconstruction, consider designing the area to facilitate a traffic detour for staging lane replacement operations. If alternative routes are available, maximum safety, productivity, quality, and economy result when the roadway can be completely closed during the entire construction period.
- Continuous Lane Closures: Since the outside truck lanes generally suffer the greatest pavement damage, lane replacement can sometimes be accomplished by complete closure of these lanes during construction. Medians and temporarily narrowed lanes can be used to minimize lane closures. Any temporary median paving should be designed to handle traffic loading during the construction period.

  When an inside lane is closed for use as a workspace, an adjacent lane should also be closed if possible for access. This procedure provides additional space for vehicles and materials and facilitates the movement of construction equipment within the workspace. On multilane undivided roads and streets where the left lane is closed, the additional space can be obtained by also closing the left lane in the opposing direction. Existing concrete barrier in the median may prohibit this option.
- Weekend Closures should be considered to increase production in high-volume traffic areas where lane closures may cause severe congestion, resulting in accidents and significant delays to motorists. RSC or precast concrete may be required during the final weekend shift to permit rapid reopening to Monday morning commute traffic.

- Weekday Closures are similar to weekend closures except that they occur from Monday until Friday morning. They are typically viable on rural routes that have higher traffic volumes on the weekends.
- Nighttime Closures are not recommended for lane replacement projects due to the extended traffic impacts, drastically reduced construction quality and productivity, and increased costs. Nighttime closures typically require the use of RSC or precast concrete.

Traffic Closure Case Study

Alternative construction closures and potential work zone traffic impacts can be analyzed using the CA4PRS software program, which was developed by the Department and FHWA to help districts select effective and economical pavement and traffic control strategies. The software uses alternative strategies for pavement designs, lane-closure tactics, and contractor logistics to estimate the total number of closures during project construction and quantify the impact to the traveling public in terms of user cost and queue time.

To illustrate the difference in traffic control methods on construction schedules, CA4PRS was used to evaluate the Devore project on Interstate 15. The project consisted of an outer truck lane replacement and individual slab replacements in the inner lane. Continuous closures, 72-hour weekday closures, 55-hour weekend closures, and 10-hour night-time closures were analyzed and the results are shown in Table 400-6:

Table 400-6: I-15 Devore Project Lane Closure Analysis

Closure Method	Total Closures	Total Closure Time (hours)	Cost (millions)			Maximum Delay (minutes)
			User Delay Cost	Agency Cost	Total Cost	
Continuous (24/7)	2	400	$5	$15	$20	80
72-hour weekday	8	512	$5	$16	$21	50
55-hour weekend	14	770	$14	$17	$31	80
10-hour nighttime	220	2200	$7	$21	$28	30

For the Devore project, continuous closures were selected because they resulted in the lowest number of closure hours and the lowest total cost. Ten-hour nighttime closures had the lowest maximum delay time, but also the most required closures, highest total closure time, and the lowest contractor production rate. For more information about traffic control alternatives and the CA4PRS software, refer to Section 120.3.4.

400.5 PLANS, SPECIFICATIONS, AND ESTIMATING

400.5.1 Plans

Lane replacements are usually shown in the same manner as widening and new construction on the typical cross section and layout sheets. Table 400-7 lists the Standard Plans typically used for lane replacement projects.

Table 400-7: Standard Plans Used for Lane Replacement Projects

Standard Plan	Sheet	Comments
JPCP-New Construction	P1	For lane replacements with dowel bars and tie bars.
JPCP-Widened Slab Details	P2	For widened slab and lane replacements in the adjacent shoulders.
JPCP Lane & Shoulder Addition or Replacement	P3A	For if you have shoulder addition or replacement
JPCP (Widened Lane) Lane & Shoulder Addition or Replacement	P3B	For if you have (widened lane) and shoulder addition or replacement
CRCP	P4	For lane replacements with reinforcing steel and no transverse joints.
CRCP (Widened Lane)	P5A	For lane replacements (widened lane) with reinforcing steel and no transverse joints.
CRCP (Widened Lane) Lane & Shoulder Addition or Replacement	P5B	For widened lane with reinforcing steel and shoulder addition or replacement.
Dowel Bar Details	P10	For all lane replacements using Standard Plan P1, P2, P3A, or P3B.
Dowel Bar Basket Details	P12	For all lane replacements using Standard Plan P1.
CRCP Transverse Construction Joint	P14	For all CRCP
Concrete Pavement Tie Bar Details	P15	For all JPCP
CRCP Tie Bars and Joint Details	P16	For 2 adjacent CRCP lanes
Tie Bar Basket Details	P17	For lane replacements where adjacent lanes or shoulders are being replaced.
Lane Schematics and Isolation Joints Detail	P18	• Use when transverse joints in replacement lanes are not aligned with existing adjacent slabs. • Use when an existing isolation joint needs to be replaced.
Concrete Pavement–Joint Details	P20	For lane replacements using Standard Plan P1, P2, P3A or P3B.
JPCP-End Panel Pavement Transition	P30	For when lane replacement abuts a hot mix asphalt pavement or approach or sleeper slab.
CRCP-Terminal Joint and Anchor Details	P31A & P31B	For constructing CRCP.
CRCP-Wide Flange Beam Terminals	P32A, & P32B	For constructing CRCP.
Safety Edge Treatments	P74, P75 & P76	For all pavement projects.
Drainage Inlets	P45 & P46	As needed when drainage inlets are placed within the limits of the concrete pavement.

400.5.2 Specifications

Standard Specifications, Standard Special Provisions (SSP), and Standard Plans used for lane replacement work are online at the Office Engineer intranet site for construction contract standards. For projects where nonstandard modifications may be required, contact the Division of Maintenance Pavement Program or refer to the website for information about developing and obtaining concurrence for nonstandard special provisions (nSSPs). Table 400-8 lists some applicable specifications for lane replacement work.

400.5.3 Cost Estimating

It is important to make a reasonable estimate in the Project Report (PR) or Project Scope Study Report (PSSR) to adequately fund lane replacement projects. Underfunded projects can delay development, resulting in shortened limits, revised work items, or requests for additional funding from the California Transportation Commission.

The unit cost of lane replacement work items will vary depending on the type of materials used, project location, and traffic handling methods. Concrete materials are selected based on the length of the construction window negotiated with district traffic management, with shorter construction windows generally leading to higher costs. Contractor production rates will increase if longer construction windows are provided. In many cases, an incentive/ disincentive clause should also be considered if construction work is highly dependent on traffic conditions.

Additional details and guidance for cost estimating can be found at the Division of Design Cost Estimating website.

Table 400-8: 2010 Standards Related to Lane Replacement

Section	Bid Item	Description	Unit	Comments
15-2	150847	Remove Concrete Pavement and Base	CY	Includes removal of concrete pavement structure layers, including underlying base and subgrade, to dimensions shown on the typical cross sections
15-2	150853 150854	Remove Concrete Pavement	SQYD CY	Includes removal of concrete pavement structure layers
19-2	190101	Roadway Excavation	CY	Use for removal of subgrade layers below the concrete pavement structure. Should not be used for removing concrete pavement
25	250201	Class 2 Aggregate Subbase (AS)	CY	Subbase is not required with Type I subgrade
26	260202 260203	Class 2 Aggregate Base (Ton) Class 2 Aggregate Base (CY)	Ton CY	Optional use for base layers with JPCP, Type I subgrade, and TI ≤ 11
28	280000	Lean Concrete Base (LCB)	CY	Typically used for base layers with JPCP.
SSP 28-4	280015	Lean Concrete Base Rapid Setting	CY	Typically used for base layers with JPCP constructed under short traffic closure windows.
29	290301	Cement Treated Permeable Base	CY	Use CTPB instead of ATPB regardless of adjacent material
39	390132	HMA (Type A)	Ton	Use for base with CRCP
40-2	400050	CRCP	CY	Use with general provisions in Section 40-1. Refer to Ch. 200 for usage guidance.
40-4	401050	JPCP	CY	Use with general provisions in Section 40-1. Refer to Ch. 210 for usage guidance.
SSP 40-5	401055	JPCP-RSC	CY	Use when constructing JPCP-RSC for short traffic closure windows
41-5	Various	Joint Seal	LF	Refer to Chapter 360 for usage guidance
41-10	Not Used	Drill and Bond Bar	Not Used	Section 41-10 specifies work requirements but payment is included in the JPCP or CRCP bid item
90	---	Concrete	---	Specifies concrete material requirements

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