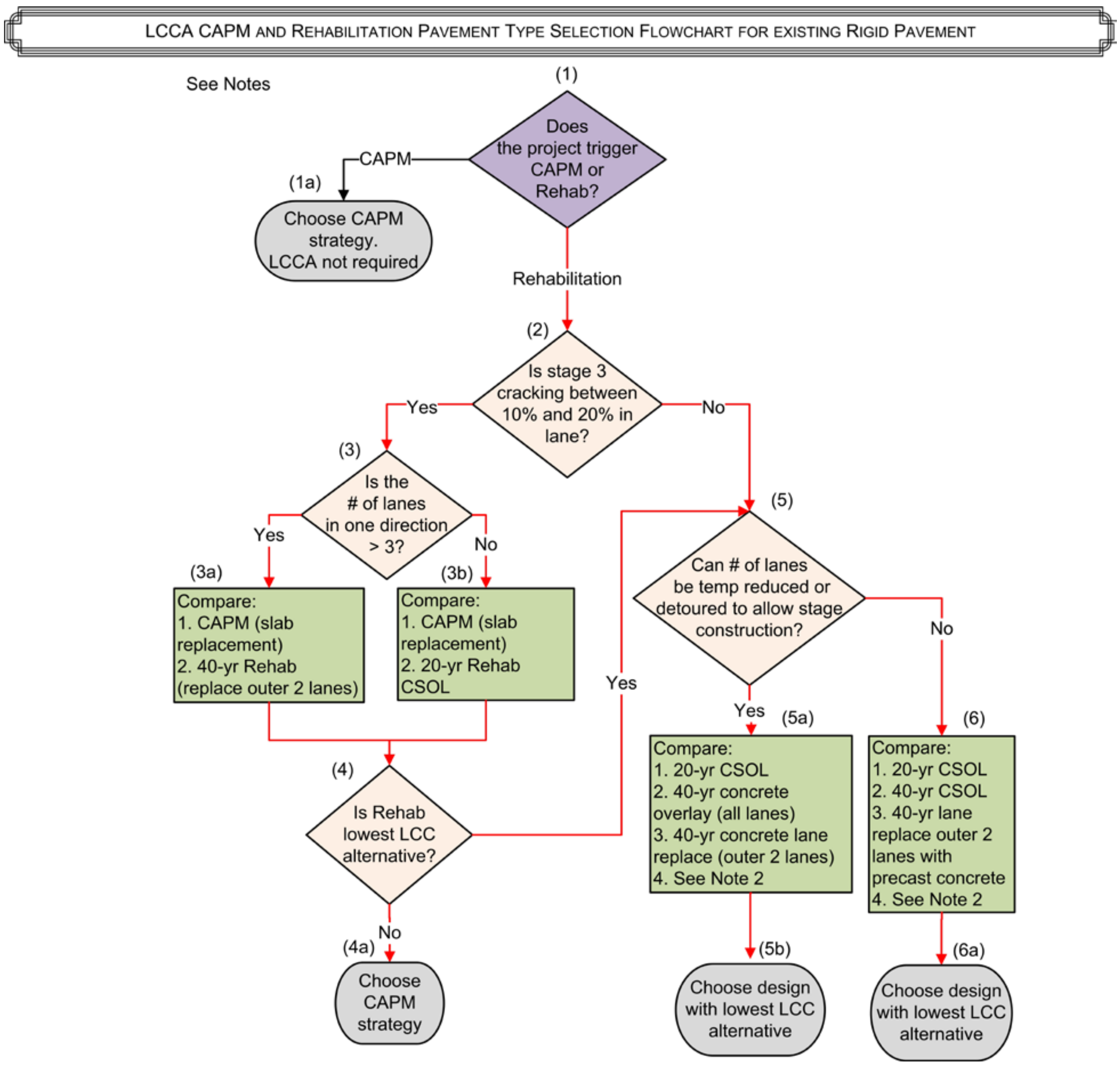


Acronyms:	Notes:
CAPM Capital Preventive Maintenance CSOL Crack, Seat, and Overlay FDR Full Depth Reclamation LCC Life-Cycle Cost LCCA Life-Cycle Cost Analysis	1. This flowchart provides general guidance to help determine which strategies to develop and analyze for pavement projects. This flowchart provides the minimum alternatives to consider. For questions, consult with HQ Pavement Reviewer or HQ LCCA Coordinator. 2. Where constraints exist, such as sound walls or floodplains, consult with HQ Pavement Reviewer or HQ LCCA Coordinator. 3. RHMA must be one of the competing alternatives when flexible pavement is being considered, unless RHMA is not viable for the project.

Figure 2-5 CAPM and Rehabilitation Pavement Alternatives Selection for Existing Rigid Pavement Flowchart

Instructions for Using CAPM and Rehabilitation Flowchart for Existing Rigid Pavement:

Using Figure 2-5:

(1) Begin here and determine if the project is a CAPM or rehabilitation. Go to (1a) or (2).

(1a) If it is a CAPM, LCCA is not required.

(2) If the project qualifies for rehabilitation determine if there is 10% to 20% stage 3 cracking. Refer to the Pavement Condition Report. Go to (3) or (5). Note: if the project has less than 10% stage 3 cracking, it is considered a CAPM project (refer to Design Information Bulletin 81).

(3) If the pavement condition falls between 10% to 20% stage 3 cracking, determine if the number of lanes in one direction is greater than 3. Go to (3a) or (3b).

(3a) If the number of lanes in one direction is greater than 3, compare a CAPM slab replacement and a 40-year rehabilitation in which the outer two lanes being replaced with concrete. Go to (4).

(3b) If the number of lanes in one direction is 3 or less, compare a CAPM slab replacement with a 20-year crack, seat, and overlay (CSOL) rehabilitation. Go to (4).

(4) If the CAPM strategy prevails as the lowest LCC, choose a CAPM strategy for your project (4a). If the CAPM does not give the lowest LCC, and the rehabilitation strategy is lower, go to (5) and run additional LCCA for further analysis.

(4a) Choose CAPM strategy.

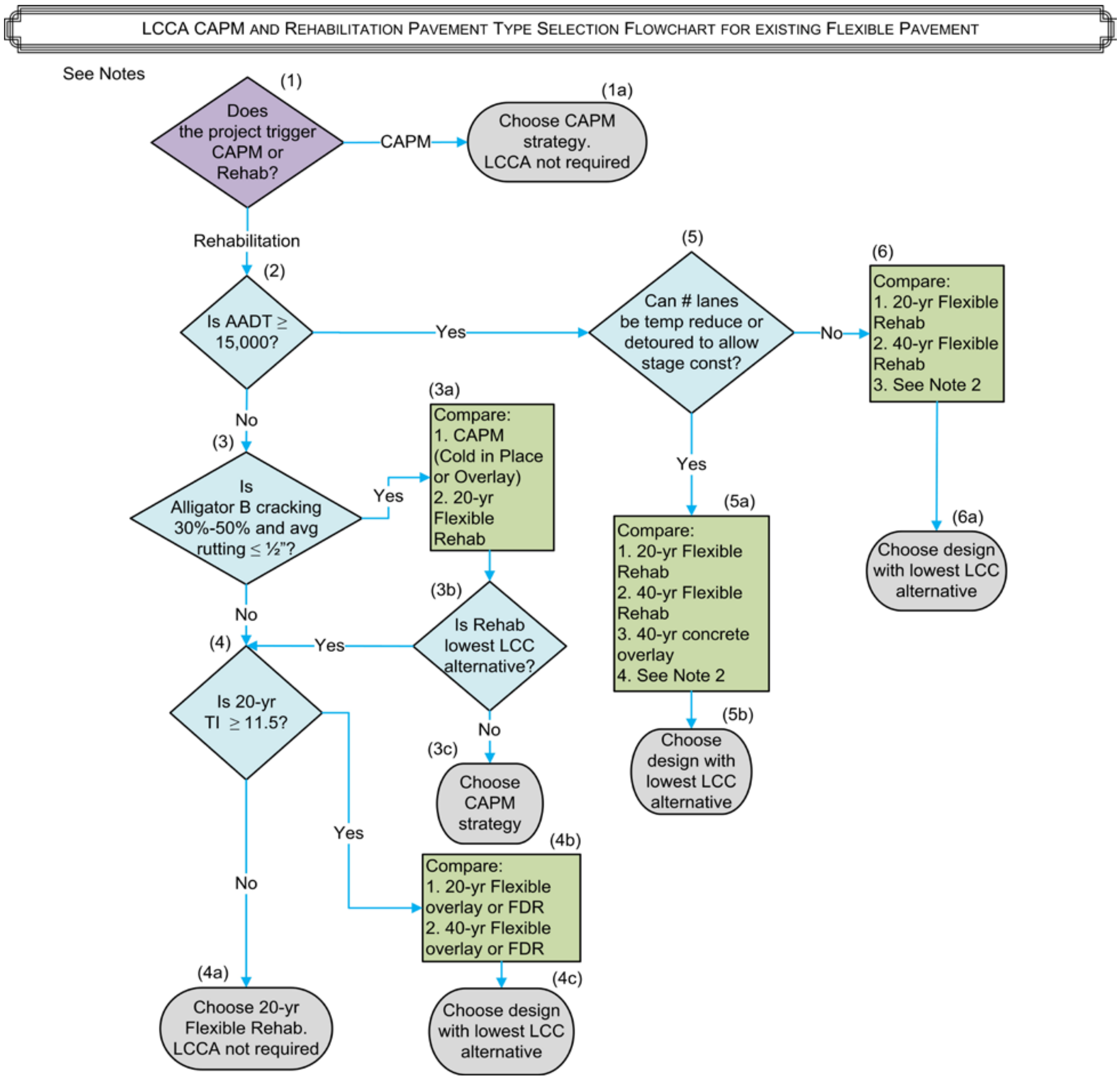
(5) Determine if stage construction can allow for lane reduction or detouring traffic. Go to (5a) or (6).

(5a) If the decision is "yes", compare 20-year crack, seat, and overlay (CSOL), 40-year concrete overlay (white topping), and 40-year concrete lane replacement of the outer 2-lanes. Go to (5b).

(5b) If there constrains such as sound walls or floodplains which make these alternatives unviable, contact the HQ LCCA Coordinator, otherwise choose the rehabilitation strategy with the lowest LCC.

(6) If you are unable to temporarily reduce the number of traffic lanes or detour the traffic, then compare 20-year CSOL, 40-year CSOL, and 40-year precast concrete lane replacement of the outer two lanes. Go to (6a).

(6a) If there constrains such as sound walls or floodplains which make these alternatives unviable, contact the HQ LCCA Coordinator, otherwise choose the rehabilitation strategy with the lowest LCC.



Acronyms:	**Notes:**
CAPM Capital Preventive Maintenance **CSOL** Crack, Seat, and Overlay **FDR** Full Depth Reclamation **LCC** Life-Cycle Cost **LCCA** Life-Cycle Cost Analysis	**1. This flowchart provides general guidance to help determine which strategies to develop and analyze for pavement projects. This flowchart provides the minimum alternatives to consider. For questions, consult with HQ Pavement Reviewer or HQ LCCA Coordinator.** **2. Where constraints exist, such as sound walls or floodplains, consult with HQ Pavement Reviewer or HQ LCCA Coordinator.** **3. RHMA must be one of the competing alternatives when flexible pavement is being considered, unless RHMA is not viable for the project.**

Figure 2-6 CAPM and Rehabilitation
Pavement Alternatives Selection for Existing Flexible Pavement Flowchart

Instructions for CAPM and Rehabilitation Flowchart for Existing Flexible Pavement:

Using Figure 2-6:

(1) Begin here and determine if the project is a CAPM or rehabilitation. Go to (1a) or (2).

(1a) If it is a CAPM, LCCA is not required.

(2) If the existing pavement is qualifies for rehabilitation, determine if the current year AADT is greater than or equal to 15,000. Go to (3) or (5).

(3) If the AADT is less than 15,000, determine if alligator B cracking is between 30% to 50% and average rutting is less than or equal to ½". Go to (3a) or (4).

(3a) If the alligator B cracking is between 30% and 50% and average rutting is less than or equal to ½", compare CAPM (cold in place) or overlay strategy and a 20-year flexible rehabilitation strategy. Go to (3b). (Note: if the project has less than 30% alligator B cracking, it is considered a CAPM project (refer to Design Information Bulletin 81).

(3b) Decide if the rehabilitation is the lowest LCC. If no, go to (3c). If yes, go to (4).

(3c) If the rehabilitation is not the lowest LCC, then choose the CAPM strategy.

(4) If alligator B cracking is greater than 50% or average rutting is greater than ½" check to see if the 20-year TI is greater than or equal to 11.5. Go to (4a) or (4b).

(4a) If the TI is less than 11.5, then choose a 20-year flexible rehabilitation. LCCA is not required.

(4b) If the TI is greater than or equal to 11.5, compare 20-year flexible overlay or full depth reclamation (FDR) with 40-year flexible overlay or FDR. Go to step (4c).

(4c) Choose the alternative with the lowest LCC alternative.

(5) If the AADT is greater than 15,000, determine if the number of lanes can be temporarily reduced or if there is a viable detour to allow construction staging. If yes, go to step (5a). If no, go to step (6).

(5a) If stage construction allows for lane reduction or detour, compare 20-year flexible rehabilitation, 40-year flexible rehabilitation, and 40-year concrete overlay (white topping). Go to step (5b).

(5b) If there constrains such as sound walls or floodplains which make these alternatives unviable, contact the LCCA coordinator, otherwise choose the rehabilitation strategy with the lowest LCC.

(6) If lanes cannot be reduced or detoured, compare 20-year flexible rehabilitation with a 40-year rehabilitation. If these pavement alternatives are not feasible, refer the issues to the Pavement Reviewer or the LCCA Coordinator. Go to step (6a)

(6a) Choose the alternative with the lowest LLC.

Additional Provisions for Selecting Alternatives

The pavement selection flowcharts provide guidance on what pavement alternatives to compare. As a reminder, the following provisions were incorporated into the flow charts development:

1. Rubberized Hot Mix Asphalt (RHMA) must be one of the competing alternatives when flexible pavement is being considered unless RHMA is not viable for the project. If RHMA is not a viable alternative, justification must be included in the Project Initiation Document (PID) or the Project Report (PR). For further information on when and how to use RHMA, see HDM Index 631.3 and the Asphalt Rubber Usage Guide.

2. The alternatives being evaluated should provide equivalent improvements or benefits. For example, comparison of 20-year and 40-year rehabilitation alternatives or comparison of new construction of flexible or rigid pavement alternatives is valid because the alternatives offer equivalent improvements. Conversely, comparing alternatives such as pavement rehabilitation to adding lanes, or overlay to drainage repair, do not result in equivalent benefits. Projects that provide different benefits should be analyzed using a Benefit-Cost Analysis (BCA), which considers the overall benefits (safety, environmental, social, etc.) of an alternative as well as the costs. For further information on BCA, refer to the Life-Cycle/Benefit-Cost Model (Cal-B/C) user manuals and technical supplements, which are available from the Division of Transportation Planning website at http://www.dot.ca.gov/hq/tpp/tools.html.

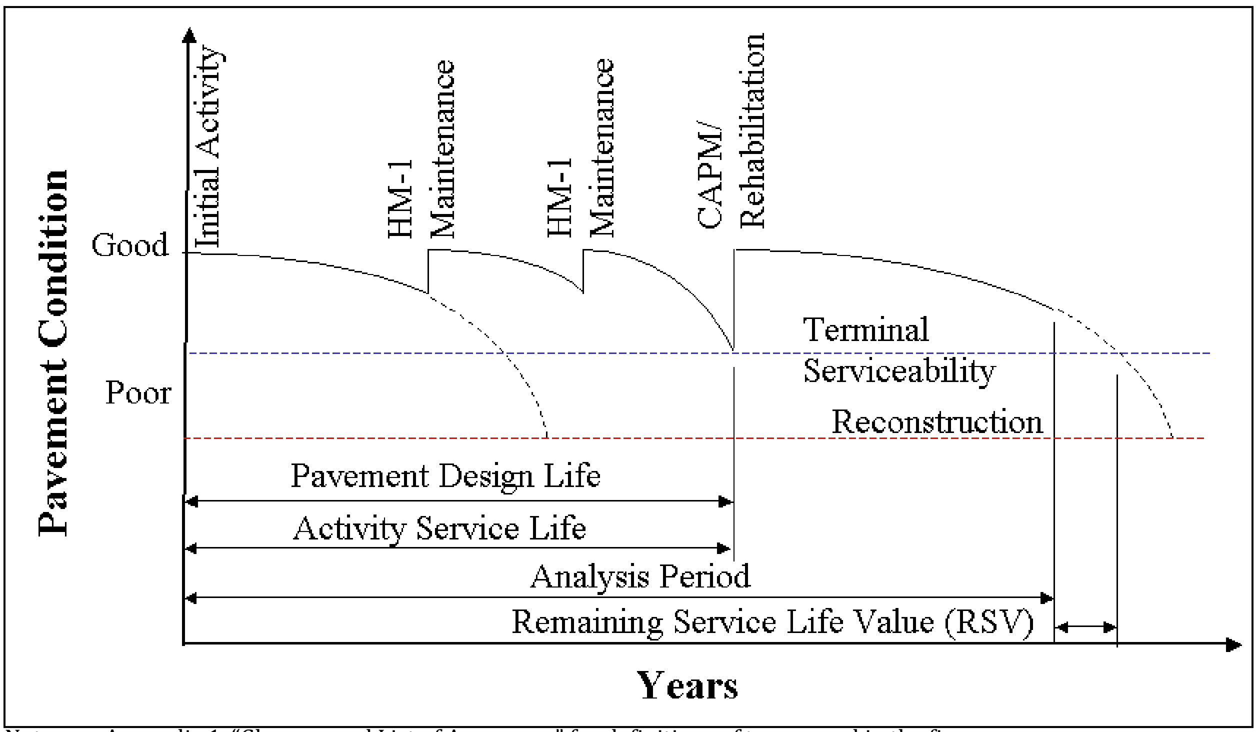
2.4 Analysis Period

The *analysis period* is the period of time during which the initial and any future costs for the project pavement alternatives will be evaluated. Table 2-1 provides the common analysis periods to be used when comparing alternatives of a given design life or lives. When comparing two or more alternatives, determine the analysis period based on the longest design life. For example, an analysis period of 35 years should be used if CAPM and 20-year design life alternatives are compared; and an analysis period of 55 years if 20-year and 40-year design lives are compared.

Table 2-1 LCCA Anaysis Periods

Alternative Life	CAPM	20-Yr	More than 20 years
CAPM	20 years	35 years	55 years
20-Yr	35 years	35 years	55 years
More than 20 years	55 years	55 years	55 years

LCCA assumes that the pavement will be properly maintained and rehabilitated to carry the projected traffic over the specified analysis period. As the pavement ages, its condition will gradually deteriorate to a point where some type of maintenance or rehabilitation treatment is warranted. Thus, after the initial construction, reasonable maintenance and rehabilitation (M&R) strategies must be established for the analysis period. Figure 2-7 shows the typical relationship between pavement condition and pavement life when appropriate maintenance and rehabilitation strategies are applied in a timely manner.



Note: see Appendix 1, "Glossary and List of Acronyms," for definitions of terms used in the figure.

Figure 2-7 Pavement Condition vs. Years

Additional information about M&R strategies for various types of pavements can be found in Section 2.7, "Maintenance and Rehabilitation Sequences."