CHAPTER 8

GUIDELINES FOR PERFORMING RESURFACING AND PAVEMENT PRESERVATION TREATMENTS

8.1 PAVEMENT PRESERVATION AND RESURFACING METHODS

Preventive maintenance has been defined by AASHTO as a planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without substantially increasing structural capacity). In simplistic language, it is applying the right treatment to the right pavement at the right time.

The key to successful pavement preservation is to have a "toolbox" that includes various pavement surfacings and treatments that can achieve the most cost effective solution for a particular condition and time. The most common types of preservation treatments for asphalt concrete pavements are thin asphalt concrete overlay, surface seals, crack sealing, and rejuvenators. These treatments retard pavement deterioration, renew usefulness of the existing surface, and seal cracks to prevent surface water infiltration and retard crack deterioration. These treatments do not significantly increase the strength of the pavement, but benefit pavements by protecting the pavement structure from premature deterioration and by improving or restoring pavement surface condition including texture and ride quality. The net effect of such maintenance actions is to extend the pavement life while maintaining the desired level of service, including safety requirements, at minimum cost.

8.2 PURPOSE OF PAVEMENT PRESERVATION METHODS

The interest in pavement preservation has increased with the need for less expensive treatments, the growing importance of preventive maintenance, and the ongoing improvements in the technology and cost-effectiveness of thin surfacings, sealers, and rejuvenators. In addition, these treatments are more sustainable than traditional overlays because they use less material and less energy (e.g., surface seals and rejuvenators do not require heating), and their impact on other features of the roadway is minimal (e.g., reduction in curb height, and the need to increase thickness of shoulders and adjust height of guide rails). Rejuvenators and surface sealers have the potential to improve pavement surface condition, protect the pavement structure from moisture infiltration, and extend the service life on a cost-effective basis.

Pavement preservation treatments seal the pavement surface, improve the pavement profile (by reducing roughness and rutting), and improve pavement friction. Thin pavement surfacings do not substantially increase pavement structural strength and cannot effectively correct large surface distortions. Notable benefits of thin surfacings, rejuvenators, and sealers and the reasons for their selection as a pavement preservation decision are:

- **Protecting pavement structure.** Thin pavement surfacings, rejuvenators, and sealers can be used as preventive maintenance treatments to prevent premature deterioration of the pavement or to retard the progress of pavement defects. Rejuvenators add back oils lost from the AC surface to renew the flexibility of the weathered surface. Sealers apply a protective coating that will retard further oxidation and weathering. The objective is to slow down the rate of pavement deterioration and cost-effectively increase the useful life of the pavement. As a

preventive maintenance treatment, thin pavement surfacings and sealers are typically applied to a pavement that is in reasonably good condition.

- **Restoring or improving pavement surface.** Thin pavement surfacings, rejuvenators, and sealers are inexpensive methods to restore pavement serviceability to an acceptable level. Micro-milling can be used to restore pavement friction, eliminate wheel track rutting, and improve overall surface smoothness.
- **Improve riding surface.** Thin pavement surfacings can be used as a riding surface for new or rehabilitated pavements. Thin overlays can significantly improve road smoothness, increase friction, and reduce noise.
- **Holding pavement until a permanent treatment is applied.** Thin pavement surfacings, rejuvenators, and sealers can serve as temporary treatments, keeping the pavement at or above an acceptable condition, until a permanent treatment can be implemented. This situation may arise, for example, because of lack of funding, unexpected rapid deterioration of the pavement surface, or the need to extend pavement life-span by a few years.

8.3 PAVEMENT PRESERVATION AND PAVEMENT MANAGEMENT

This section explains how to incorporate the use of maintenance treatments into the pavement preservation planning and budgeting process, and provides guidelines for the selection of appropriate maintenance and repair.

8.3.1 MPW Preservation Program

MPW underwent a performance audit by Maximus in May 2002 that recommended MPW consider a new approach to pavement maintenance. Based on this review, MPW contracted for a pavement management study that surveyed the surface condition of the Metro roads, implemented a pavement management software, set criteria for prioritization of maintenance activities, established a series of test sections to evaluate potential surfacing and restoration materials, and consequently developed and implemented a pavement preservation and restoration program.

After the evaluation of a number of proprietary products in test sections on Metro streets, a product called Reclamite was selected to rejuvenate and protect pavements that are 2 to 3 years old (when OCI is greater than 80). An application of Reclamite is shown in Figure 8.1; note that the material is initially pink in color but cures to black within 24 hours.

Another product, PASS, emerged in the test sections as a good material to minimize raveling and extend lifetime of roadways that were last paved 8 to 9 years back. PASS is polymer modified asphalt surface sealer applied as a fog seal. Figure 8.2 shows the application of PASS on Metro roadways. PASS costs about $0.60 per sq yard as compared to traditional mill and overlay at about $6.00 per sq yard (1.5” overlay). PASS lets Metro Nashville extend a roadway’s lifetime by about 5 years before resurfacing is needed.

Figure 8.1. Application of Reclamite to Metro street.

Figure 8.2. Application of PASS surface sealer on Metro street.

MPW has also adopted a crack sealing program. Over time, sunlight oxidizes the oils in the asphalt causing it to become brittle and crack. Also, construction joints between paving lanes tend to develop cracks. Cracks in asphalt roadways provide an entrance for water into the pavement which ultimately leads to more deterioration. Figure 8.3 shows crack sealing of Metro streets.

Figure 8.3. Crack sealing of Metro streets.

Other treatment techniques are under evaluation by MPW. These include such materials as Joint Bond, NovaChip, and Warm Mix Asphalt. Other techniques and materials will be included in field trials as new candidates with potential for extending pavement life are identified. As new products and treatments are found to be beneficial and cost effective, they will be integrated into the MPW pavement management program.

8.3.2 Integrating Pavement Preservation Treatments into a PMS

The use of thin pavement surfacings, sealers, and rejuvenators should follow the principle of applying the Right Treatment on the Right Road at the Right Time. Consequently, the selection of the Right Treatment is not the task of choosing between different types of pavement surfacings; it is the task of choosing between all feasible pavement preservation treatments (including regular overlays, thin overlays, surface sealers, rejuvenators, sealing of cracks, cold-in-place recycling, etc). Similarly, the selection of the Right Road should consider not just one section of the network that may be suitable for maintenance treatment, but also the needs of the entire network. The Right Road involves distributing limited resources among the entire system. Finally, the Right Time must consider the consequences, including cost, of implementing the

treatments in different years. Consequently, the selection of the correct maintenance treatment should be part of pavement management process.

The process of preparing prioritized pavement preservation budgets is illustrated in Figure 8.4. The process consists of a yearly pavement management cycle of eight basic planning, budgeting, engineering and implementation activities. To be effective as preventive maintenance treatments, thin pavement surfacings, sealers, and rejuvenators must be applied during early stages of distress development. Crack sealing should be a continuous program that is conducted as a systematic process.

Currently, the only treatment approved for arterial roadways is resurfacing due to the safety aspects of sealers and rejuvenators. Most of these treatments reduce, at least temporarily, the surface friction.

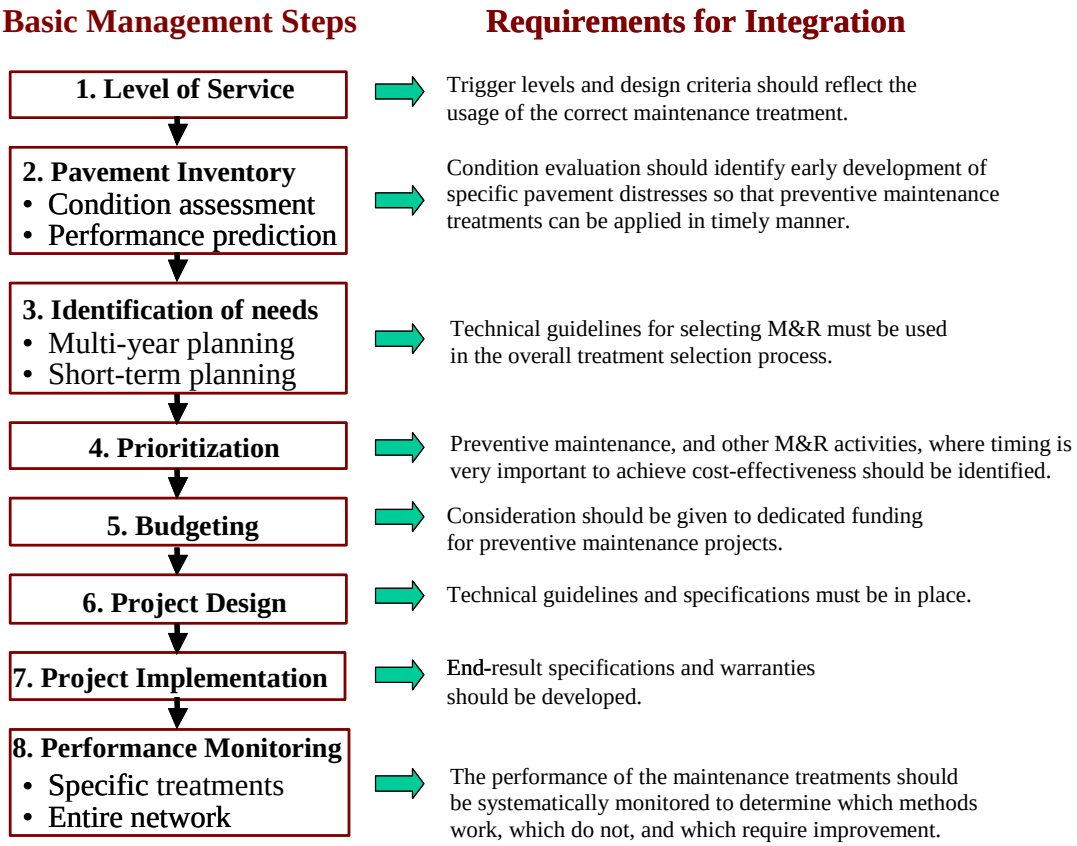

Figure 8.4. Integrating preventive maintenance into the management process.

8.3.3 Treatment Selection

Thin pavement surfacings, surface seals, and rejuvenators can play an important role in pavement preservation, particularly in the area of preventive maintenance. Guidance for the selection of these surfacings and treatments is summarized in Tables 8.1, 8.2, and 8.3.

Table 8.1. Preservation treatments to protect the pavement structure.

Type of Treatment	Protect AC Surfaces Against Factors Indicated							
	Penetration of water (*cracking and segregation*)		Loss of aggregate (*raveling)*		Hardening of Asphalt Binder		Overall Low Durability	
	Type of street							
	Local	Arterial	Local	Arterial	Local	Arterial	Local	Arterial
HMA Resurfacing	○	○	○	○	○	○	○	○
Thin overlay	○	●	○	●	○	○	✸	✸
HIP recycling			○	○			●	○
Surface treatment	○	○	○	○	○	○		●
Micro-surfacing	●	✸	●	✸	●	✸	✸	●
Slurry seal	✸	○	✸		✸	○	●	●
Surface seal	○		○	○	●	○	○	○
Rejuvenator	○	○	✸	✸	●	●	●	●
Surface abrasion							○	●
Crack Sealing	●	✸					●	✸
Fog Seal	○		○				○	

○ Can be used ● Should be considered ✸ Typical application

Table 8.2. Preservation treatments to restore or improve pavement surface.

Type of Treatment	Improve Pavement Surface Because of Factors Indicated									
	Roughness		Friction		Cross section		Pavement-Tire Noise		Aesthetics/ Delineation	
	Type of street									
	Local	Arterial	Local	Arterial	Local	Arterial	Local	Arterial	Local	Arterial
Thin overlay	●	●	○	●	●	●		✸		○
HIP recycling		●		○		●				
Surface treatment			○	○	○					
Micro-surfacing	○	○	○	●	●	○		○	●	●
Slurry seal			●	○	○			○	●	○
Surface seal									○	○
Surface abrasion	○	●	○	○	●	●				✸
Crack Sealing		○						○		

○ Can be used ● Should be considered ✸ Typical application

Table 8.3. Preservation treatments to provide riding surface.

Thin Pavement Surfacing	Addition of Wearing Surface Over Materials Indicated							
	Granular base		Surface treatment		Cold-in-place recycled mix		Hot-in-place recycled mix	
	Type of street							
	Local	Arterial	Local	Arterial	Local	Arterial	Local	Arterial
Thin overlay	●	○			●	●	●	●
HIP recycling								
Surface treatment	✸	✸	✸	✸	●	●	●	○
Micro-surfacing			○	●	○	○	●	●
Slurry seal			●	○	○		○	○
Surface seal						●		●

○ Can be used ● Should be considered ✸ Typical application

The treatments listed in Tables 8.1, 8.2, and 8.3 are described in Appendix D. Information on treatment selection in Tables 8.1 to 8.3 is general. For example, according to Table 8.1, pavement friction on arterial streets can be improved by using a thin overlay, surface treatment, micro-surfacing, slurry seal, or surface abrasion. The final selection of a specific treatment should be done by experienced personnel familiar with local conditions.

Typically, the selection of the preferred treatment is a two-step process. This process is mirrored by the treatment selection algorithms used in the PMS software. Specific treatment selection rules used by the software are discussed in Section 4.3. The first step is the selection of candidate treatments or alternatives, or the selection of generic treatments. The second step is a detailed evaluation of alternatives in terms of costs and benefits. The first step can be viewed as a network-level selection and the second step as a project-level selection. The steps are summarized below.

The selection of candidate treatments can be facilitated by using decision trees or tables. Candidate treatments can also be generated by a pavement management process as generic treatments. Considerations used to select alternatives include:

- Pavement type and pavement structure
- Roadway classification
- The type, extent, and severity of distresses
- Traffic volume, composition, and speed
- Policy of MPW regarding pavement preservation (e.g., preventive maintenance and type and timing of pavement preservation treatments)

Modern PMS software, such as Cartêgraph Pavementview Plus, is sophisticated enough to determine treatment alternatives for pavement preservation using a treatment selection matrix.

Determining the optimum treatment for a candidate project is more complex than suggesting technically appropriate treatments. Cartêgraph Pavementview Plus attempts to determine the optimum treatment based on economics and general engineering principles, but to select what is truly the right treatment at the right time requires specific local knowledge of conditions. The final say on pavement preservation treatment selection should be left to paving program engineers, not computer software. The evaluation of alternatives includes factors such as:

- Economic analysis of alternatives
- Initial construction costs
- Minimum desirable life-span of the treatment
- Future maintenance requirements; impact on future rehabilitation options
- Local experience of MPW or Tennessee Department of Transportation (TDOT) with long-term performance of the treatment
- Preferences of users and local residents
- Specific pavement surface properties such as pavement friction and pavement-tire noise
- Traffic restrictions during construction; duration of construction; delays during construction
- Weather requirements during construction
- Conservation of materials and energy
- Availability of local materials; availability of experienced contractors

8.3.4 Utility Cut Repairs

Utility cuts can have a significant impact on the life of a pavement. Recommendations regarding utility cut repair guidelines and specifications for the utility cut permitting are located in Appendix E.

8.4 COSTS AND BENEFITS

Typical costs and benefits of thin pavement surfacings, rejuvenators, and sealers are summarized in Table 8.4. These are average costs, and actual project costs may vary. Expected benefits of thin pavement surfacings are provided as a range of life-spans in years. Longer life-spans are typically associated with thicker or multiple treatments, higher-quality materials, improved construction quality, lower traffic volumes, and the application of treatments to pavements in better condition.

When a treatment is *applied to restore pavement surface* and is initiated as a remedy for a specific distress its benefit is expressed in terms of the life span of the treatment itself. For example, if slurry seal is used to restore pavement friction, its benefit is expressed as the time-span of the slurry seal.

Table 8.4. Expected benefits and typical cost of thin pavement surfacings.

Treatment	Expected Life (years)	Application/Benefits	Unit cost ($/yd² or $/ft)
Thin hot mix overlay (<1-1/2 in)	8 to 10	Adds new surface; levels rough pavements, improves friction	2.50 to 3.50
Hot-in-place recycling (<1-1/2 in)	5 to 7	Rework existing surfaces; recompacts mix; gives new riding surface	4.50 to 6.50
Micro-surfacing (1/2 to ¾ in)	5 to 9	Polymer-modified slurry seal; improves friction, seals surface against raveling and oxidation, fills ruts	3.00
Thin-bonded overlay (NovaChip)	6 to 8	Alternate to hot-mix overlay; open-graded	2.50 to 4.50
Slurry seal	3 to 7	Thin surface of asphalt emulsion, fine aggregate, and water; improves friction, seals and protects	1.50
Surface treatment (chip seal)	5 to 8	Seals existing surface, improves friction	2.00 to 2.50
Surface seal (Rejuvaseal, GSB-88)	1 to 3	Seals existing surface; applied to structurally sound pavements	0.75
Rejuvenator (Reclamite)	1 to 5	Penetrates into surface of existing AC; replenishes lighter oils; adds new life to weathered surfaces	0.65 to .85
Surface abrasion	1 to 5	Removes uneven surfaces; improves friction	1.00 to 2.00
Crack Sealing	3 to 5	Seals cracks to prevent water infiltration	1.50 to 3.00

8.5 IDENTIFICATION OF NEEDS AND PRIORITIZATION

The identification and prioritization of needs for larger municipalities such as Metro Nashville cannot effectively be accomplished without the aid of specialized computer software. MPW has purchased and installed a software package to implement the pavement management program and help the Public Works Department identify those pavements to be treated and the most cost effective and timely method of treatment.

There are two types of identification of needs:

- Short-term needs during the first year
- Multi-year needs
    - 1 - 5 years
    - 6 - 12 years

8.6 SHORT-TERM IDENTIFICATION OF NEEDS AND PRIORITIZATION

Because of the complexity of multi-year planning procedures, it is normally easier to implement a pavement management system based on short-term planning and prioritization. Figure 8.2 shows the connection between the levels of service, identification of needs, prioritization, and budgeting for short-term planning and prioritization.

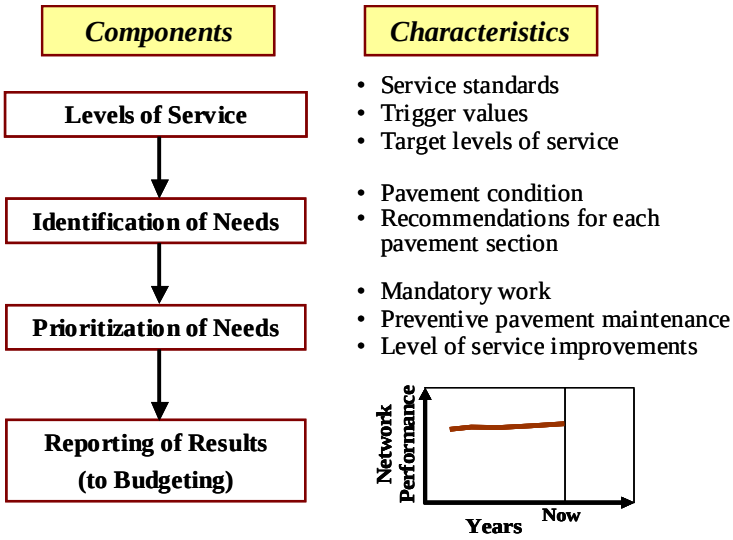

Figure 8.2. Short-term planning and prioritization.

8.6.1 Short-Term Identification of Needs

The process for identifying maintenance and rehabilitation actions combines all pavement preservation and resurfacing needs (maintenance as well as rehabilitation treatments). Some municipalities prepare separate budgets for maintenance (operating) and rehabilitation (capital) work. While this may be necessary for administrative reasons, it is preferable to have only one integrated process for the identification and prioritization of pavement preservation needs. The process of identifying the short-term needs includes the following:

1. The pavement inventory, including pavement condition, is updated; this has been accomplished for MPW.
2. A decision must be made as to what types of treatment should be included in the needs. In general, all roadway maintenance and rehabilitation activities that can be planned at least a year in advance should be included. Such activities may include, for example, ditching, repair or replacement of culverts, sealing cracks and joints, patching, asphalt concrete overlays, and full-depth repairs, utility cut repairs and other repairs. The treatments selected by MPW have been input into the PMS.
3. Each roadway section in the inventory is reviewed to determine if the section requires a pavement preservation treatment in the next few years. Many sections may not require any treatment, some sections may require a preventive maintenance treatment (e.g., crack sealing, rejuvenators, etc.), and some may require other types of maintenance or rehabilitation. MPW identifies the candidate treatments using PMS software programmed with agency-specific guidelines, impacts to other infrastructure issues, budget constraints, and legal and safety requirements.
4. The best treatment for the given section is selected. Typically, the selected treatments are generic (e.g., one-lift overlay or a multi-lift overlay), particularly if the software selects the treatments. The Pavement Manager selects the specific treatment for a given section. The selection of the treatments must be realistic and must consider the appropriate levels of service. It is important to realize that the identification of needs

is not a creation of a wish list, but a documentation of the needs that are necessary on the basis of approved and mandated standards and levels of service.

8.6.2 Prioritization of Short-Term Needs

If it is expected that some projects may not be funded because of limited funding, the list needs to be prioritized. Projects that address minimum safety-related levels of service are typically considered mandatory and are given the highest priority. Incomplete projects from previous years are also given high priority.

There are many ways to prioritize projects. The priority levels, together with roadway classes, already convey basic priorities. It is easier and preferable to prioritize projects that belong to the same priority level and roadway class than to prioritize projects across priority levels and roadway classes. Typical prioritization criteria include the following considerations that can be applied individually or in combination:

- pavement condition (in relation to the level of service)
- roadway class
- traffic volume and percentage of commercial vehicles
- cost effectiveness (benefit-cost ratio)

To be credible, the process of identification of needs and prioritization must be consistent, transparent, and logical. Each pavement section, and its recommended treatment, is described in terms of location (and road class), treatment type, recommended construction year, estimated cost and, very importantly, priority level. The priority level shows the main reason why the treatment is recommended for implementation. Priority levels assigned to each recommended pavement preservation treatments are:

1. Minimum safety-related levels of service need to be met.
2. Minimum acceptable levels of service need be met.
3. Cost effectiveness concerns (includes projects where timing is very important to achieve cost effectiveness).
4. Projects to achieve a target level of service.

The individual treatments are sorted by the overall condition rating, priority levels, and roadway classes. The resulting list represents the total documented needs for the preservation of the road system. The specific method used by MPW PMS software to prioritize pavement projects is discussed in Section 4.4.

8.7 MULTI-YEAR IDENTIFICATION OF NEEDS AND PRIORITIZATION

Multi-year identification of needs and prioritization can answer the following:

- What funding is required in future years to achieve target levels of service?
- What will be the future condition of the network given projected funding levels?
- How much additional funding will be required in the future to compensate for a budget cut now?

- How will the condition of the pavement network change if funds are diverted to preventive maintenance?

Multi-year planning also improves engineering and economic decision making because it considers the long-term impacts of accelerating or postponing projects from one year to another. Impacts considered include trade-offs between lower-cost treatments that have to be paid for now versus more expensive treatments that will need to be paid for later, or the impact of diverting funds to preventive maintenance. The basic components and characteristics of multi-year planning are shown in Figure 8.3 and are outlined in the following sections.

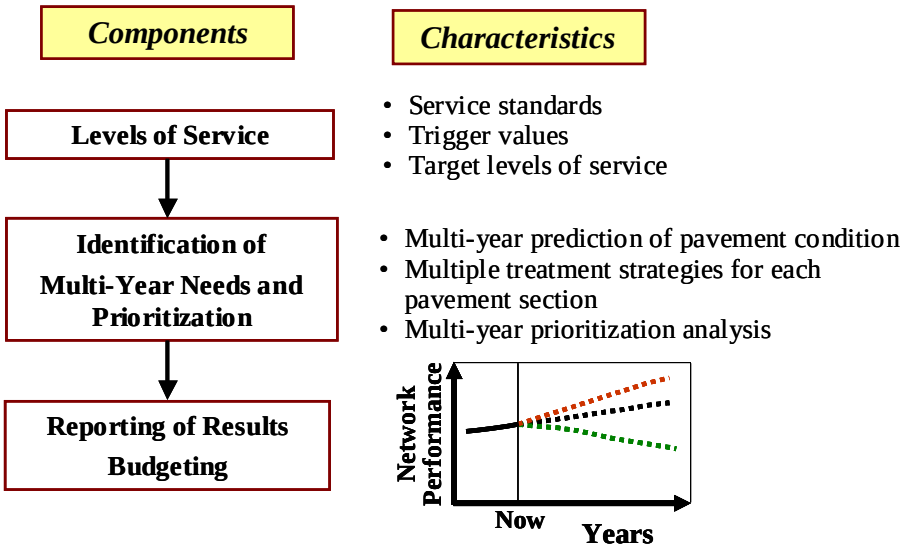

Figure 8.3. Multi-year planning and prioritization.

8.7.1 Generation of Feasible Alternatives

The success of multi-year planning and the accuracy of future funding requirements depend on multi-year predictions of pavement performance.

The prioritization analysis can consider several treatment options in each analysis year. The concept is illustrated in Figure 8.4 for one pavement section. For illustrative purposes, of the many options that can be generated for different years, only two alternatives are shown here. The first is a single lift resurfacing 3 years from now; the second is a two-lift resurfacing 9 years from now. With multi-year prioritization analysis, these two alternatives (pay now or pay later) can be evaluated on an equal footing, while still considering other projects.

8.7.2 Multi-Year Prioritization

An important feature of multi-year prioritization analysis is its ability to prioritize (or optimize) competing treatments using the cost effectiveness of individual treatments. To do this, each treatment is characterized by its cost and benefit. The cost aspect of the treatment should be based on its life cycle cost as much as possible. However, in practice, only the initial treatment costs, and perhaps routine maintenance costs, are used because the exact nature of the treatments is not known in the planning stage (at the network level).

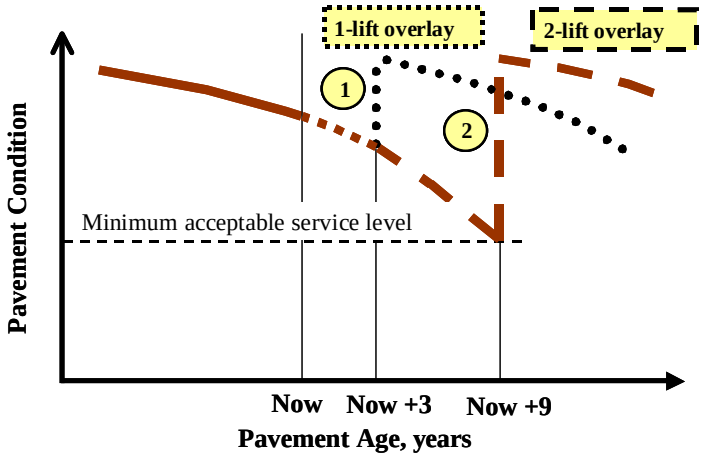

Figure 8.4. Alternative treatments and alternative timing of treatments.

Benefits, or effectiveness of the treatment, are based on the additional pavement life the treatment is expected to provide and may include the reduction in user costs. For example, if two projects provide the same benefit in terms of additional pavement life, the project on the roadway serving a higher traffic volume may be chosen first.

8.7.3 Integrating Preventive Maintenance with Multi-Year Prioritization

The candidate projects included in multi-year analysis should also include preventive and other maintenance activities. These activities have been incorporated into the analyses made by the PMS software implemented for Metro Nashville. The cost effectiveness of these activities can be compared with the cost effectiveness of activities recommended for other priority levels. Consequently, the distinction between funding for preventive maintenance and funding for target levels of service can be made directly through cost-effectiveness analysis.

8.7.4 Reporting Results and Consequences of Different Funding Levels

Depending on available funding, the projects not funded one year are considered for funding in the subsequent year (or years). By changing the amount of funding, the amount of work will change, and so will the condition of the pavement network. However, regardless of the funding, the list of prioritized projects still represents the best value for the money. The Cartêgraph Pavementview Plus software will produce the list of prioritized projects, expected costs, and consequences in terms of future condition.

The results of multi-year prioritization can show the relationship between the pavement investment and the resulting level of service provided to the community. An example of this type of analysis is illustrated in Figure 8.5, which shows the consequences of changes in proposed funding levels. In this example, a 10 percent growth in funding, sustained for several years, will result in achieving the desirable target level of service in some future year. Likewise, a decrease in funding can result in a more rapid reduction of overall pavement condition.

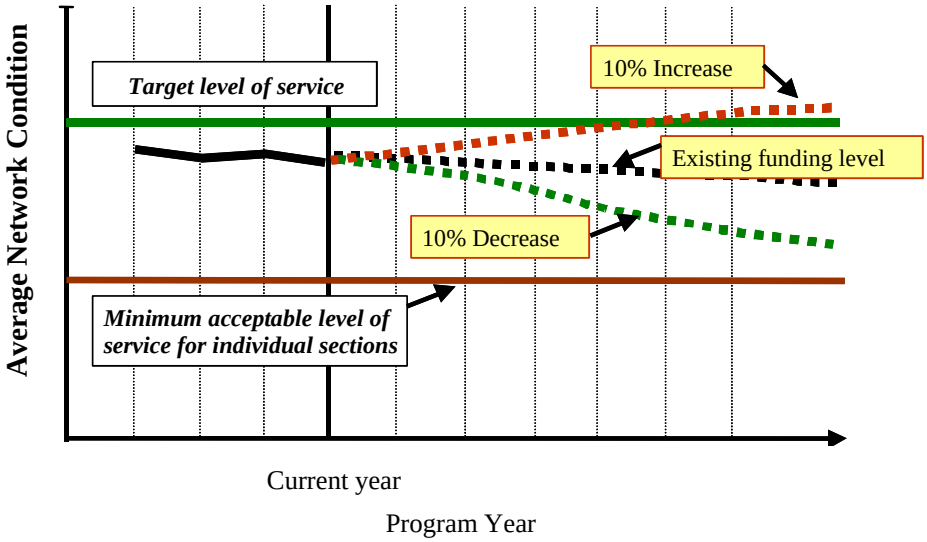

Figure 8.5. Consequences of different funding levels.

Prioritized pavement preservation needs provide important input for the preparation of annual and multi-year budgets. However, budgets must also consider many other funding needs and programming considerations.

Multi-year prioritization analysis is a powerful and useful decision support tool for managing pavement infrastructure. It requires a long-term commitment to succeed and must be supported by a computerized pavement management system, such as Cartêgraph Pavementview Plus.

Increases in the unit cost for hot-mix asphalt have caused significant increases in the cost of paving in the Metro. Table 8.5 shows this cost increase over the 5-year period since 2003; note that costs for 2007 and 2008 are projected costs.

Table 8.5. Metro paving budget increase due to asphalt prices.

Year	Budget	Paving Lane Miles	Cost of HMA per ton
2003	$9.2 M	283	$35.00
2004	$9.2 M	256	$38.00
2005	$9.2 M	196	$40.00
2006	$10.7 M	207	$60.00
2007	$13.9 M	225	$61.50

8.8 PRIORITIZED BUDGETING

Budgeting builds on the results of planning and prioritization activities and produces a financial document that determines how the money will be invested in the infrastructure. Budgeting combines technical and financial decision making as illustrated in Figure 8.6.

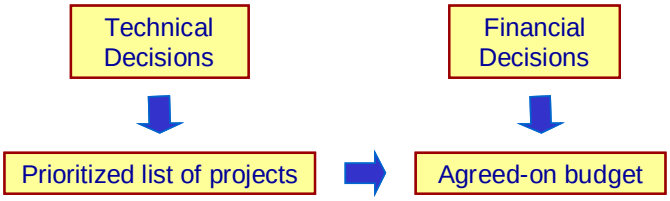

Figure 8.6. Budgeting as a combination of technical and financial decision making.

The annual MPW budget consists of many line items. Budgeting activities are schematically illustrated in Figure 8.7, where pavement preservation activities are a line-item input in the planning and budgeting operation. Programming and packaging of projects must take into account a number of needs and considerations.

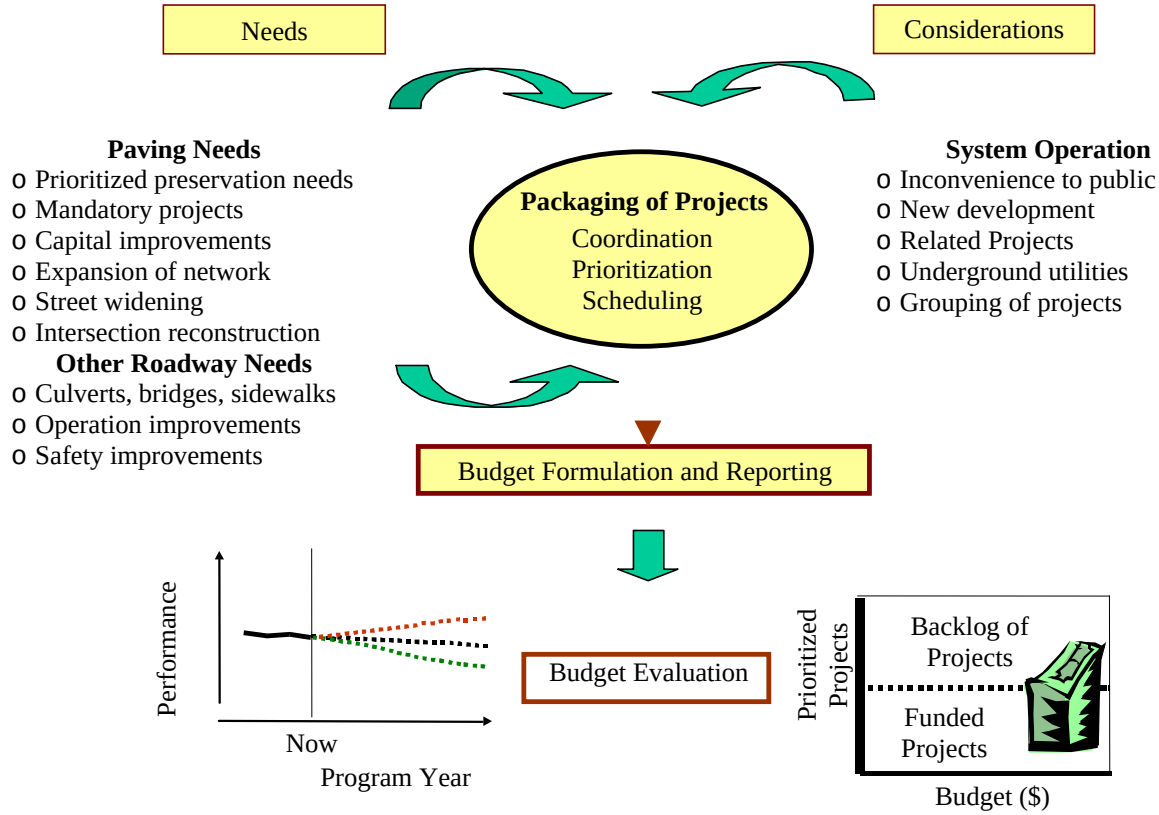

Figure 8.7. Key budgeting activities.

The needs include:

- *Prioritized pavement preservation and resurfacing* which are comprised of the preventative maintenance activities identified for each road segment.
- *Capital improvements* include expansion of the road network and major improvements such as street widening, intersection reconstruction, etc.

- *Other roadway needs* that include other roadway components (e.g., culverts, bridges, and sidewalks), operational improvements (e.g., widening at an intersection and system expansion), and safety improvements.

The considerations include:

- *System operation* which includes staging projects to minimize inconvenience to the traveling public and advancing projects because of new residential and industrial development.
- *Related projects*, such as work on underground utilities that should be coordinated to minimize disruption to the public.

The results of the budget allocation can be quantified and reported using the following means:

- Show the consequences of different budgets in terms of pavement condition.
- List the specific projects that will not be done because of funding limitations.
- Track the quantity of unfunded needs and the changes in unfunded needs from year to year.
- Monitor network performance trends.

8.9 PROJECT DESIGN AND IMPLEMENTATION

The priority planning and budgeting process recommends which sections should receive pavement preservation treatments and resurfacing during which year. These recommendations include the general treatment type (e.g., a thin overlay) and the estimated cost of the treatment. Project design determines the actual treatment type and provides additional details required for the construction of the project (such as the layer thickness, type of material, and construction methods). It often uses the results of physical tests of the existing pavement materials.

Two main concerns during the implementation of projects are whether to use in-house forces or contractors and what inspection and quality control procedures will be used during construction to ensure quality work. Many of the preservation applications use specialized equipment and products that may be more cost effective to rely on contractor equipment and forces.

In addition to quality control and quality assurance procedures, warranties can be used to ensure basic construction quality. Warranties are important for pavement preservation treatments where the construction procedures and the selection of materials are difficult to specify and enforce (e.g., for sealing cracks in asphalt concrete pavements and for micro-surfacing). The typical warranty period for "thin" paving jobs, rehabilitation, and reconstruction work is for one year.

Periodic pavement performance monitoring is important for both individual projects and for the entire pavement network. Performance monitoring can guide the Public Works Department in decisions to expand, change, or discontinue the use of a particular treatment based on the cost effectiveness of the treatment. Regular condition evaluation of all the pavement sections in the network can provide a clear indication of the long-term trend in the health of the

network. This does not mean that the entire road network needs to be surveyed during a given year; only a portion of the network can be surveyed each year of every few years

Metro Public Works surveys one-half of the network each year so that each pavement section is evaluated every 2 years as to its distress condition.

8.10 SHORT TERM PLAN FOR PAVEMENT RESURFACING AND PRESERVATION

The ultimate product from the PMS program is the plan for pavement preservation and resurfacing. The Cartêgraph Pavementview Plus software can provide a prioritized list of pavement sections with identified maintenance needs for each year of a multi-year plan. The plan is based on the decision matrix as described in Chapter 4 that provides the guidelines for selection of projects.

In order to create a practical paving plan for MPW, the recommended sections from Cartêgraph Pavementview Plus are combined into a logical paving and treatment sequence.

The short-term plan is based on the immediate needs as defined by the OCI. Projects are identified by street segments, costs are estimated and work packages are developed so that the maintenance and paving can be accomplished with in-house forces or handled through contracts.

The short-tem plan is available to the citizens of Nashville and Davidson County on the Metro web site, and this list of projects is kept current by the MPW PMO.

8.11 MULTI-YEAR PLAN FOR PAVEMENT RESURFACING AND PRESERVATION

The Cartêgraph Pavementview Plus software will be used to project future pavement condition and identify at what point in time a given street segment will meet the criteria for pavement preservation, maintenance, or resurfacing. The software will aid the Pavement Management Office in the preparation of the 5-year and 12-year plans described below.

8.11.1 Five-year Plan

Streets that fall below the target OCI value of 70 during the next 5 years and meet other requirements for resurfacing will be put in the 5-year plan.

8.11.2 Twelve-year Plan

Projects that go in the 12-year plan are those streets that currently are above the critical OCI of 70 but, based on the deterioration rate developed by the software, will become candidates for paving in the next 5 to 12 years. Factors that are considered in the selection and prioritization of the candidates streets are age, activity, and condition.

This plan gives the lane miles that will be resurfaced during each of the years but does not identify specific streets by name. The plan does describe the preservation and resurfacing that is recommended in terms of quantities and projected cost for each year.

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