

The Going-to-the-Sun Road, a National Historic Landmark, is in dire need of rehabilitation. The deterioration of the roadway, drainage features, retaining walls, and guard-walls continues and needs to be slowed or stopped as soon as possible. It is critical to improve drainage now to slow the deterioration. Designs for the most critical areas must advance as soon as possible to assure rehabilitation efforts will be cost effective and within the criteria established.

Well over two hundred individual sites were investigated and analyzed on the Road. The criteria for engineering, design, historic preservation, construction techniques, material handling, long-term maintenance, traffic and visitor management, and risk management established in *Chapter 3: Development of Rehabilitation Alternatives*, were applied at each of the sites. At most sites, the analysis was reduced to the historical, engineering, and traffic control opportunities that could meet the other established criteria. For those sites, the engineering alternative that was advanced to the cost and schedule estimates (Appendix B and C) was based on the following:

- the selection of the historical treatment that would provide for preservation and rehabilitation of the contributing elements of the Road
- the traffic control method that would provide for a moderate impact on visitors, and
- a prudent life cycle that would require a low to moderate level of long-term maintenance.

A matrix of elements used for this process is presented in Table 1.

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*In developing alternatives for the Road rehabilitation, traffic management is the most critical criterion to consider, as it directly affects construction costs and duration, visitor impacts, and economic impacts. The most prudent selection of options for engineering, preservation of natural and historic resources, and visitor management has been carried through the rehabilitation alternatives.*

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Table 1: Process for Selecting the Most Prudent Engineering Alternatives

Considerations	Opportunities	Most Prudent Engineering Opportunity
Historic / Cultural	Historic restoration Historic preservation Historic rehabilitation Non-historic	Provide historic preservation or rehabilitation. If not historic, provide rehabilitation similar in appearance to historic.
Traffic Management	Least visitor impact Moderate visitor impact Most visitor impact	Provide moderate visitor impact using alternating one-ways and intermittent stops for most of the work, and two-way stops and closures where necessary.
Engineering	Long life cycle - low O&M Prudent life cycle -mod O&M Short life cycle - high O&M	Provide for a prudent life cycle with low to moderate O&M

Five Road Rehabilitation Alternatives were generated from the prudent engineering alternatives that were advanced to the cost and schedule estimates. The Road Rehabilitation Alternatives are expressed in terms of the overall range of cost and schedule for the rehabilitation of the Road. The ranges for cost and schedule in the Road Rehabilitation Alternatives provide the basic sensitivity for the range of historical, traffic control, and engineering criteria.

Each alternative assumes that innovative rehabilitation techniques, along with considerations for historical, cultural, environmental and natural resource preservation, and long-term maintenance, are integral components of the work. The alternatives presented in this chapter represent general strategies that can be applied to the overall rehabilitation of the Road, and include:

- Repair as Needed
- Priority Rehabilitations
- Comprehensive Shared Use
- Extended Rehabilitation Season
- Road Segment Closures

The Road Rehabilitation Alternatives presented herein, and if desired, additional alternatives developed from elements of these five, can be moved to the next phase of the process, the Environmental Impact Statement. Once impact mitigation efforts and specific project controls and constraints are identified in the EIS, and the project advances into preliminary design, specific design details and cost estimates can be developed for each of the sites in need of rehabilitation.

### **Alternative 1: Repair As Needed**

The Repair As Needed alternative provides for basic operations and maintenance of the Road based on available funding. As the Road and its structures approach failure, the best possible repairs are made within the constraints of available funding and resources. Repairs are conducted in a manner that minimizes delays to visitors. Essentially, these are considered as reactionary or emergency repairs.

This alternative assumes there would be no immediate capital improvement funds available. Maintenance is expanded as a stop-gap measure until adequate resources become available for proper roadway rehabilitation work.

Repairs are made without substantial pre-planning or design, and are based upon the needs of the Road and the priorities established by the park's operations and maintenance personnel. When repairs are necessary, work forces are engaged to provide the best repair available using the funding available. A fast-track design and traffic management plan is established for the specific repair site, and the repair is completed. Repairs generally proceed as quickly as possible to minimize visitor delays. There is little opportunity for utilizing specialized techniques such as prefabrication, because establishment of a prefabrication facility would not be cost or time-effective for small amounts of material. Construction staging is most effective at the work site. There is minimal opportunity to mitigate socioeconomic impacts associated with the repairs; as there is little time to plan for emergency repairs. Little opportunity exists for optimal contract packaging to improve cost and time effectiveness. The costs and associated problems with repairing failed sections of roadway on a piecemeal or emergency basis are exorbitantly high when compared with normal roadway rehabilitation or construction operations. The Repair As Needed alternative does not provide a means for establishing an effective long-term maintenance program. Further, the current deterioration rate of the Road is not addressed using this alternative. Work would occur while the Road is open from mid-June through mid-October. Of the alternatives evaluated, Alternative 1 will have, by far, the longest duration.

**Figure 111: Summary of Alternative 1  
Repair As Needed**

*Traffic control requirements, and consequently, traffic delays,  
are dictated by the problem and repairs needed*

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Rehabilitation Cost Estimate (2001 dollars) .....	\$ 97.7 to \$ 117.2 million
Rehabilitation Duration .....	Approximately 50 years
Rehabilitation Cost (3% escalation per year).....	\$ 237 to \$ 284 million

The use of the Repair As Needed alternative for the overall rehabilitation of the Going-to-the-Sun Road is less than desirable from any perspective. This alternative has the highest cost and duration, potential for major failures and significant delays, and unplanned road closures. It is included in the rehabilitation alternatives largely as a comparison to other alternatives.

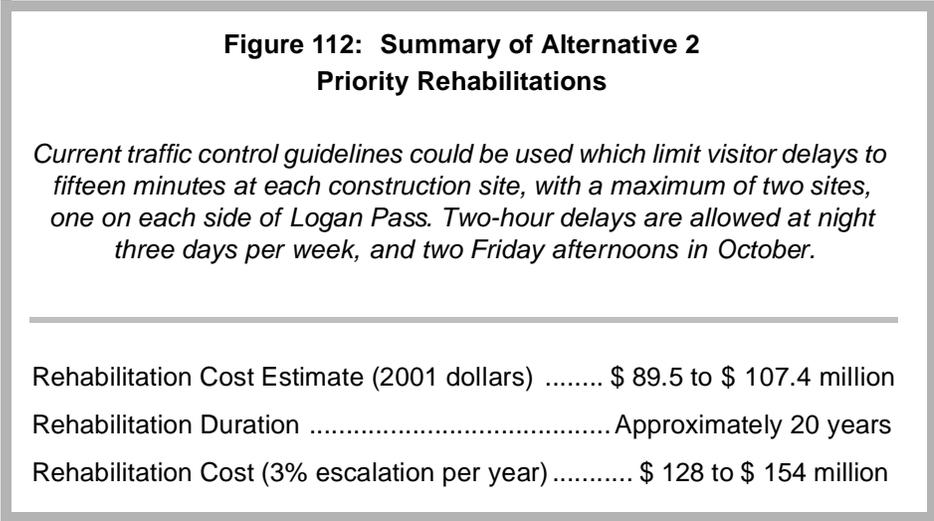
## **Alternative 2: Priority Rehabilitations**

The Priority Rehabilitations Alternative differs from Repair As Needed in that the planning and design of the work is completed ahead of time, addressing historical, cultural, environmental, socioeconomic, and long-term maintenance issues. A site-specific traffic management plan, similar to those currently used for critical repairs, is included in the design to minimize visitor delays while the work is underway. Rehabilitation work is then conducted with some cost and time effectiveness while ensuring that the completed work addresses the issues outlined above.

The Priority Rehabilitations alternative requires that individual site rehabilitation designs and traffic management plans be prepared using an established list of priorities based upon the Road's needs. The designs and plans are implemented based upon their priority or as emergency situations arise, and as funding is appropriated and resources allow.

Rehabilitating the Road in this manner allows for more planning and impact mitigation than the Repair As Needed alternative. Some opportunity exists for utilizing

specialized techniques such as prefabrication, if enough work can be scheduled that includes enough material to effectively establish a prefabrication facility. Likewise, construction staging may be feasible outside the park, provided delivery of materials can be made efficient. Some opportunity exists for optimal contract packaging, providing some cost and time-effectiveness. Work would occur while the Road is open from mid-June through mid-October. This alternative requires the second longest schedule for rehabilitation. Even though this alternative establishes a plan for rehabilitation, there is still a significant potential for major failures, delays and road closures.



### **Alternative 3: Comprehensive Shared Use**

The approach to the Comprehensive Shared Use alternative lies in balancing the needs of rehabilitation with visitor use. With careful planning, the rehabilitation designs can address all of the engineering, historical, cultural, environmental, socio-economic, and long-term maintenance considerations.

The traffic management plan requires that rehabilitation be scheduled to minimize the overall visitor impact. By balancing the need of the rehabilitation contractor to have good access and realistic work schedules with the need to minimize visitor impact, this strategy provides a good opportunity for a fairly efficient rehabilitation. The basic concept of this balance is to execute the work that requires two-way traffic stops and closures during periods of lowest visitor usage.

A suggested schedule includes minimal interference (delays of five minute or less) using alternating one-ways during peak visitor hours during the day and on weekends and holidays. Traffic delays of up to 30 minutes would occur on the shoulders of these peaks during the day. Longer delays of up to four hours could be scheduled during the low seasons, in the evenings, and at night. Some work may require closures of segments of the Road, and if possible, should be scheduled late in the season. Work would occur while the Road is open from mid-June through mid-October.

To minimize the delays associated with the rehabilitation, variable message signs and other information systems should be utilized throughout the park to inform visitors of specific locations and times they should anticipate delays. All of this is ultimately dependent on the actual design for the rehabilitation, but could be effectively scheduled as has been done in other environmentally sensitive, recreational areas in the country.

**Figure 113: Summary of Alternative 3  
Comprehensive Shared Use**

- *Five-minute delays, 10 a.m. to 2 p.m. Mon-Thu, 10 a.m. Friday to 7 p.m. Sun*
- *Five-minute delays on holidays, and from 10 a.m. to midnight on the day preceding a holiday*
- *30-minute delays, 7 a.m. to 10 a.m. and 2 p.m. to 7 p.m. Mon-Thu*
- *Delays of four hours or less, 7 p.m. to 7 a.m. Mon-Thu*
- *Approximately 20 work days requiring closure of the Road in September and October of each year*

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Rehabilitation Cost Estimate (2001 dollars) .....	\$ 81.4 to \$ 97.7 million
Rehabilitation Duration .....	8 to 9 years
Rehabilitation Cost (3% escalation per year).....	\$ 98 to \$ 118 million

This alternative provides a tremendous opportunity for both time and cost-effective rehabilitation. The work could be packaged in contracts for each year, to incorporate effective and innovative construction and traffic management techniques.

## Alternative 4: Extended Rehabilitation Season

The Extended Rehabilitation Season alternative builds on the Comprehensive Shared Use alternative. It has all of the same considerations and attributes as the Comprehensive Shared Use alternative; however, by extending the rehabilitation season, it provides a shorter overall schedule for rehabilitation.

In the Comprehensive Shared Use alternative, the visitor season is approximately mid-June through mid-October, and all of the concepts for traffic management are implemented during the visitor season. The Extended Rehabilitation Season alternative extends the effective rehabilitation season as much as possible on both ends of the season. This alternative allows visitor use on the Road from July 1 through October 1. A week or two is gained to mobilize and stage work at the beginning of each season, and four or more weeks are gained at the end of the season, all without the need for traffic control. Rehabilitation can proceed very efficiently for approximately six weeks each year, unimpeded by visitor traffic, and work which would normally require extended two-way traffic stops and closures can be completed.

Rehabilitation in the shoulder seasons comes with a high cost, as access and weather conditions can considerably reduce overall productivity. Additional resources may be needed for snow removal during the extended seasons. This strategy will work best for rehabilitation at lower elevations.

**Figure 114: Summary of Alternative 4  
Extended Rehabilitation Season**

- *Road open to visitors July 1 to October 1*
- *Five-minute delays, 10 a.m. to 2 p.m. Mon-Thu, 10 a.m. Friday to 7 p.m. Sun*
- *Five-minute delays on holidays, and from 10 a.m. to midnight on the day preceding a holiday*
- *30-minute delays, 7 a.m. to 10 a.m. and 2 p.m. to 7 p.m. Mon-Thu*
- *Delays of four hours or less, 7 p.m. to 7 a.m. Mon-Thu*
- *Approximately 10 work days requiring closure of the Road in September*

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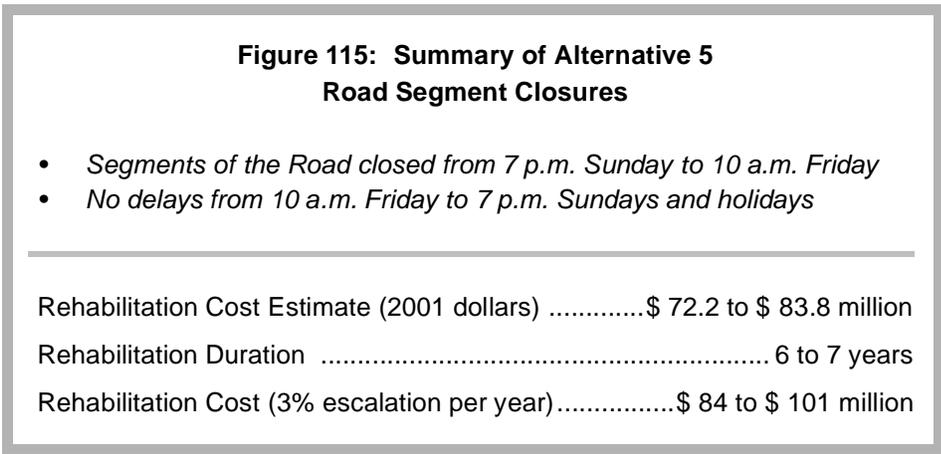
Rehabilitation Cost Estimate (2001 dollars) .....	\$ 90.2 to \$ 108.2 million
Rehabilitation Duration .....	7 to 8 years
Rehabilitation Cost (3% escalation per year) .....	\$ 106 to \$ 127 million

As with the Comprehensive Shared Use alternative, the opportunity exists for overall scheduling and cost effectiveness. Major rehabilitation work can be accomplished efficiently, within a schedule that is shorter overall, when visitors are not present and the work can proceed unimpeded.

### Alternative 5: Road Segment Closures

The Road Segment Closures alternative requires that rehabilitation be scheduled so that the Road is open to two-way traffic without interference on weekends and holidays. Segments of the road would be closed to visitors during rehabilitation efforts through the week. For purposes of this study, the times for road segment closures are identified as 7 pm Sunday to 10 am Friday.

As with other alternatives, the key to making this alternative work well is a proactive visitor management plan and public relations program that communicates the purpose and need for the rehabilitation to visitors and potential visitors.



Work would occur while the Road is open from mid-June through mid-October. Of the alternatives investigated, it provides the overall lowest cost and shortest schedule of rehabilitation.

For information purposes only, if the Road were totally closed to visitors for the rehabilitation between Avalanche and Sun Point, the estimated cost of rehabilitation would be in the range of \$65 to \$78 million in constant 2001 dollars (\$75 to \$90 million if escalated three percent per year), and would take approximately five years. Due to the tremendous visitor, social, and economic impacts, a full closure of the Going-to-the-Sun Road may not be a viable alternative for the rehabilitation.

## Comparison and Evaluation of Road Rehabilitation Alternatives

**Historic Preservation.** All rehabilitation alternatives must be in accordance with the criteria set forth for preservation of National Historic Landmarks. The alternatives presented, except for Repair as Needed, include historic preservation under the established standards. The Repair as Needed alternative, considered as a reactionary or emergency repair, has the least opportunity for adherence to the criteria.

**Cost Effectiveness.** From a pure rehabilitation perspective, cost effectiveness of the alternatives is based upon the cost and schedule for the work. Consideration of the cost of mitigating impacts must be added to develop a true evaluation.

For the purposes of comparison, estimated cost and duration ranges for the rehabilitation are expressed as if all work were undertaken using one alternative (see Table 2). Details of the calculations for cost and duration estimates are found in Appendix A and Appendix B.

**Table 2: Estimated Costs and Duration by Alternative**

Alternative	Estimated Cost Range (Millions)		Duration Range
	Constant 2001 dollars	Escalated	
Repair As Needed*	\$ 97.7 - \$ 117.2 *	\$ 237 - \$ 284	Approx. 50 years
Priority Rehabilitations*	\$ 89.5 - \$107.4 *	\$ 128 - \$ 154	Approx. 20 years
Comprehensive Shared Use	\$ 81.4 - \$ 97.7	\$ 98 - \$ 118	8 - 9 years
Extended Rehabilitation Season	\$ 90.2 - \$ 108.2	\$ 106 - \$ 127	7 to 8 years
Road Segment Closures	\$ 72.2 - \$ 83.8	\$ 84 - \$ 101	6 to 8 years

\* Repair As Needed and Priority Rehabilitations Alternatives costs and durations are funding-dependent. Each will take considerably longer and be considerably costlier than the other alternatives. For the purposes of comparison, funding is assumed at \$2 million per year for Repair As Needed and \$5 million per year for Priority Rehabilitations.

Table 3 shows the relative cost effectiveness of the alternatives, based upon rehabilitation cost, rehabilitation schedule, operations cost, and maintenance cost. Alternatives are rated on a scale from one to five, five being the highest cost and longest duration.

Table 3: Comparison of Alternatives

Alternative	Construction		Operations Cost	Maintenance Cost
	Duration	Cost		
Repair As Needed	5	5	5	5
Priority Rehabilitations	4	4	4	4
Comprehensive Shared Use	3	2	2	3
Extended Rehabilitation Season	2	3	3	2
Road Segment Closures	1	1	1	1

**Restoration Condition.** All rehabilitation alternatives, except for Repair As Needed, provide for a long life cycle and minimal long-term maintenance needs, and thus, the restoration condition will be the same for all. The Repair as Needed alternative, considered a reactionary or emergency alternative, provides the least opportunity for including elements in the work to ensure minimal long-term maintenance.

**Impact on Natural, Cultural and Scenic Resources.** During the rehabilitation of the Road, all of the alternatives will have impact on natural, cultural, and scenic resources to some degree. The forthcoming Environmental Impact Statement will address these and other impacts to a level of detail beyond the scope of this study. It appears at this time that in most cases, the Comprehensive Shared Use and the Extended Rehabilitation Season will provide the least impact overall; however, different perspectives may produce differing conclusions.

**Visitor Experience.** During the rehabilitation of the Road, all of the alternatives will have some degree of impact on the visitor experience. The *Transportation and Visitor Use Study* details the issues and provides concepts for mitigation. From an unmitigated perspective, the least impact on visitor experience would be the Extended Rehabilitation Season, or Comprehensive Shared Use, followed by Priority Rehabilitations. The Road Segment Closures alternative would have the most impact. The Repair as Needed alternative has an undefined schedule and, therefore, provides no opportunity for proper mitigation while performing reactionary or emergency repairs.

**Stimulation of Economic Growth.** Comparison of the alternatives with respect to stimulation of economic growth is discussed at length in the *Socioeconomic Study* on the rehabilitation.