

Appendix D: Forestwide Economic Analysis

The Forest Service's (FS) objective for road operation and maintenance is to operate and maintain National Forest Roads (FR) in a manner that meets road management objectives (RMOs) and that provides for:

1. Safe and efficient travel;
2. Access for the administration, utilization, and protection of its lands; and
3. Protection of the environment, adjacent resources, and public investment (FSM 7730.2).

The Forest Service is responsible for maintenance of FRs resulting from traffic associated with:

1. Administration of FS lands,
2. Noncommercial uses and activities,
3. Incidental noncommercial use related to ownership or occupancy of isolated parcels of private land served by a National Forest System road,
4. Commercial road use that is not subject to cost recovery, and
5. Incidental public use.

The amount and frequency of maintenance is subject to the availability of funding and obligations under agreements, and protecting the FS's investment.

Road Maintenance Levels

Road Maintenance Levels are defined by the Forest Service Handbook (FSH) 7709.59. The Forest Line Officer determines a route's maintenance level through the consideration of several factors:

- Resource program needs
- Environmental and resource protection requirements
- Visual quality objectives
- Recreation spectrum classes
- Road investment protection requirements
- Service life and current operational status
- User safety
- Volume, type, class, and composition of traffic.

FSH 7709.59 – Road System Operations and Maintenance Handbook (effective date: 02/05/2009)

Chapter 60 – Road Maintenance

62.32 - Maintenance Level Descriptions

Maintenance levels 1 through 5 (operational and objective) are described in the following paragraphs:

Level 1. These are roads that have been placed in storage between intermittent uses. The period of storage must exceed one year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies

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are "prohibit" and "eliminate" all traffic. These roads are not shown on motor vehicle use maps.

Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be available and suitable for non-motorized uses.

Level 2. Assigned to roads open for use by high clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Warning signs and traffic control devices are not provided with the exception that some signing, such as W-18-1 "No Traffic Signs," may be posted at intersections. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to:

- a. Discourage or prohibit passenger cars, or
- b. Accept or discourage high clearance vehicles.

Level 3. Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. *The Manual on Uniform Traffic Control Devices* (MUTCD) is applicable. Warning signs and traffic control devices are provided to alert motorists of situations that may violate expectations.

Roads in this maintenance level are typically low speed with single lanes and turnouts. Appropriate traffic management strategies are either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users.

Level 4. Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced; however, some roads may be single lane. Some roads may be paved and/or dust abated. *Manual on Uniform Traffic Control Devices* is applicable. The most appropriate traffic management strategy is "encourage;" however, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times.

Level 5. Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated. *Manual on Uniform Traffic Control Devices* is applicable. The appropriate traffic management strategy is "encourage."

Road Maintenance Frequency

The Forest Service (FS) is responsible for the maintenance of National Forest Roads. This responsibility is extended to roads with traffic associated with:

- a. Administration of FS lands
- b. Noncommercial uses and activities
- c. Incidental noncommercial uses related to ownership or occupancy of isolated parcels of private land served by a FS road,

- d. Commercial road use that is not subject to cost recovery, and
- e. Incidental public use.

The amount and frequency of maintenance is subject to availability of funding and obligations under agreements, and protecting the Forest’s investment.

Maintenance occurs on ML 1 and ML 2 roads when needed. ML 3 through 5 roads receive annual maintenance with the highest level road receiving the most maintenance (table 1).

Road Maintenance Costs

The current and foreseeable Tonto National Forest (Tonto NF) road maintenance budget is insufficient for supporting the Forest’s current route network annual maintenance needs [per information obtained from Tonto NF Supervisor’s Office (SO), documents, analysis worksheets (i.e., Southwestern Region 3 Fiscal Year (FY) 2006 Budget Estimator), and staff communication]. Actions need to be taken in order to adequately meet the RMOs. This can occur by reducing road mileage and or maintenance levels; augmenting the road maintenance budget; or a combination of the above. A failure to meet RMOs, including maintenance, will result in losses to route network infrastructure (i.e., surfacing, drainage, and structure) and Forest investment.

Resources for Accomplishing Maintenance Activities

Maintenance of Forest roads currently occurs in one of three ways; FS Road Maintenance Crew, cooperative agreements, and contracts to the public sector. Each of these resources has its benefits.

Table 1. Existing road maintenance costs by road maintenance level

Maintenance Level	# of Miles Tonto National Forest (Objective Maintenance Level Infra, August 2009)	Tonto NF Annual Maintenance Needs per mile (July 2006)	Annual Cost
5	67	\$12,303	\$824,301
4	94	\$9,029	\$848,726
3	316	\$3,357	\$1,060,812
2	2,170	\$1,949	\$4,229,330
1	1,615	-	-
Totals	4,262		\$6,963,169

The average annual road maintenance budget is \$1,601,000 (data provided by Tonto NF SO Engineering Department dated July 2, 2008). The current and foreseeable Tonto NF road maintenance budget can only support a portion of the annual road maintenance needs [per information obtained from Tonto NF SO, documents, analysis worksheets (i.e., Southwestern Region 3 FY06 Budget Estimator), and staff communication). In order to avoid incremental deterioration of the roadway infrastructure (surfacing, drainage, etc.) changes to the budget for road maintenance are necessary. Unless the budget for road maintenance is augmented, reduction strategies will need to occur. Some options are presented in Cost Reduction Strategies (following).

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Cost Reduction Strategies

Some possible strategies to reduce road maintenance costs include:

- Closing or decommissioning roads;
- Converting open and/or closed roads to motorized trails or hiking trails;
- Transferring jurisdiction to other maintenance entities;
- Decreasing maintenance levels on roads;
- Researching and employing methods to decrease road maintenance costs;
- Increase intervals for scheduled maintenance; and/or
- Combinations of the above strategies.

Closing or Decommissioning Roads

Operating within the Forest's budget might allow for the maintenance of 414 miles, if the Maintenance Levels were reduced as displayed in table 2 (below). Various road mile and maintenance level combinations generate different opportunities for viable road systems. As a result of higher levels of maintenance costing more money to maintain, greater miles of roads are affordable, if maintenance levels are kept low. Presently there are 4,262 miles of roads, which make up the Tonto NF route network (I-Web obtained by Tonto NF SO staff dated August 5, 2009). These roads are comprised of ML 1 through 5 roads with ML 5 roads being the most expensive to maintain.

Table 2. Reduction of road system miles

Maintenance Level	Hypothetical # of Road System Miles	Tonto NF Annual Maintenance Needs per mile (July 2006)	Annual Cost
5	50	\$12,303	\$417,441
4	40	\$ 9,029	\$314,213
3	60	\$ 3,357	\$304,127
2	144	\$ 1,949	\$549,588
1	120	-0-	\$15,239
Totals	414		\$1,600,626

Conversion of Roads to Trails

The conversion of roads to trails would reduce the number of miles of roads (fixed costs) within the Forest and minimize maintenance needs for roads. Converting roads to trails maintains access, while reducing road costs and limiting resource impacts.

Similarly converting open and/or closed roads to hiking trails maintains non-motorized user access and virtually eliminates road maintenance costs.

Decrease Maintenance Levels

Maintenance levels (ML) are determined by considering a variety of factors including; resource program needs (recreation, timber, etc), environmental and resource protection requirements, user safety, composition of traffic (volume, type, and class), surface type, and user comfort and

convenience. The higher the maintenance level the higher the user comfort and required costs for upkeep.

Reducing maintenance levels is one way to reduce the cost of the current system of roads. Table 3 (below) illustrates two alternatives utilizing ML reductions in an attempt to achieve a financially sustainable system of roads using the typical road maintenance budget.

Table 3: Reduction of Maintenance Levels on Roads

Maintenance Level	Current # of Miles Tonto NF (Objective Maintenance Level Infra August 2009)	Tonto NF Annual Maintenance Needs per mile (July 2006)	Annual Cost	#1		#2	
				Proposed miles	Annual Maintenance impact to forest using region average	Proposed miles	Annual Mtc impact to NF using region average
5	67	\$12,303	\$ 824,301	-	-		
4	94	\$ 9,029	\$ 848,726	-	-		
3	316	\$ 3,357	\$1,060,812	161	816,075		
2	2,170	\$ 1,949	\$4,229,330	2,486	9,488,029	1,647	6,285,915
1	1,615	-		1,615	205,087	2,615	332,075
Totals	4,262		\$6,963,169	4,262	10,509,191	4,262	6,617,990

Option 1 reduces the ML 5 and 4 roads to ML 3. ML 3 roads are reduced to ML 2. In this option the Forest's budget can only support 30 percent of the road system (annual maintenance needs only - does not take into account deferred maintenance needs).

In Option 2 ML 5, 4, and 3 roads are reduced to ML 2 roads. Additionally, 1,000 miles of ML 2 roads are reduced to ML 1 roads. In this example, the Forest's budget can only support 50 percent of the road system. In Option 1, 38 percent of the routes are ML 1. In example two, 62 percent of the routes are ML 1, meaning all motorized traffic is prohibited for periods of time that exceed one year. Neither example accounts for deferred maintenance needs, only annual maintenance needs are considered.

Both examples presented in table 3 hold steady the 4,262 miles of roads found on the Tonto NF. Reducing MLs would result in changes to road bed surface maintenance and modification of drainage structures, thereby reducing the composition of traffic and user comfort. These measures would likely fall short of meeting program needs.

Transferring Jurisdiction to other Maintenance Entities

Maintenance costs can be reduced while maintaining resource benefits, if roads are transferred from the FS system to the jurisdiction (ownership) of another entity. Often, counties are an ideal candidate. Roads under county jurisdiction become public roads, while allowing the Forest to maintain road use. The Tonto NF determined in the 2003 Tonto NF Roads Analysis that road maintenance would be reduced by \$194,000 per year, if 37.5 miles were removed from Forest jurisdiction.

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Decommissioning roads

Decreasing the total number of Tonto NF road system miles will reduce annual maintenance costs. Abandonment and obliteration are two methods for decommissioning roads. Abandonment is the most cost effective, as no funds are required to perform the action; however, this action is dependent upon the ability of the road and terrain to naturally reclaim itself sufficiently enough to discourage future use by the public.

The costs associated with obliteration vary greatly. Scarifying and seeding, signing, and blocking entrances are methods often used. In some areas, felling trees and/or blocking roads with boulders is relatively cost efficient and effective. These more cost-effective methods may not be suitable for the entire Tonto NF (where trees or boulders are unavailable). Where the re-establishment of natural drainage patterns and stream channels (re-contouring) is needed (steep slopes or highly erosive soils) a larger investment is required.

Increase intervals for scheduled maintenance

Reducing the frequency of maintenance is another alternative for decreasing annual maintenance needs. The option presented in table 4 brings the average road maintenance budget to \$1,806,128. The road maintenance budget in 2006 was \$1,601,000.

Table 4. Existing and reduced annual maintenance on roads.

Maintenance Level	Current # of Miles Tonto NF	Tonto NF Annual Maintenance Needs per Mile	Annual Cost	Proposed Reduction	Tonto NF Annual Maintenance Needs (Given Reductions Occur)
	(Objective Maintenance Level Infra August 2009)	(July 2006)		Reduce annual maintenance needs to once every:	
5	67	\$12,303	\$ 824,301	2 years	\$ 412,150.50
4	94	\$ 9,029	\$ 848,726	3 years	\$ 282,908.67
3	316	\$ 3,357	\$1,060,812	4 years	\$ 265,203.00
2	2,170	\$ 1,949	\$4,229,330	5 years	\$ 845,866.00
1	1,615	-			
			\$6,963,169		\$1,806,128.17

Conclusion

It seems likely that the road maintenance budget may be sufficient with the right combination of cost reduction strategies. No cost reduction scenario alone is likely to meet the Tonto NF's program needs, while operating entirely within the Forest road maintenance budget. Only through creative combinations of these scenarios and management actions may a balanced solution evolve. It is unrealistic to simply close enough roads to match the current budget, as this strategy is unlikely to result in a functional sustainable route network. Therefore, a minimum system of roads needs to be established with the funding available and sensible planning that maximizes the needs of the Forest users and fulfils the objectives of the Tonto National Forest.