

PAY-BACK PERIOD OF SHINKIARI-KUND FOREST ROAD

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ABSTRACT

Forest roads are important means of timber transportation, forest management, recreation, etc. This paper describes a study to determine the pay-back time period of Shinkiari-Kund forest road. It is concluded that Rs.3.437 million invested in the 19 km road building will be fully paid back in 4 years. Total timber to be harvested to break-even with the investment is estimated at 6,839 m³ (242,000 cft).

INTRODUCTION

Forest roads are important means of timber transportation, forest management, and recreation and for the provision of access-to-market to the villages located in the vicinity of such roads. The investment in road construction first pays to break-even with the costs and then starts generating surplus revenue. Investment is paid back directly and indirectly; better transportation facilities, lesser wear and tear of vehicles, lesser

transportation costs and above all, supply of better quality timber to the consumers. Therefore, the existing Shinkiari-Kund forest road, originally a low quality jeep road, was partly improved and partly realigned and converted to a truckable forest road.

Due to the absence of a truck road, timber extracted from Panjul and Massar Reserved Forests and Okhrilla Guzara, used to be in the form of scants and transported to a transfer yard (transit depot!) by jeeps or mules. During the process of conversion of logs to scants, almost 50% of the timber volume used to be lost (Stoehr, 1987). Besides logging problems, need for a good forest road upto Kund was also felt to provide a quick access to School Forests; for research and training purposes. A study was conducted to determine the pay-back period of Shinkiari-Kund Forest road. This paper gives the results of this study.

MATERIALS AND METHODS

To make the scope of this study limited and to examine the cost of a forest road against the (possible) direct benefits, only timber transportation on the fore-mentioned road has been considered. Basic data required for this purpose included road construction and reconstruction costs (Table 1), amount of timber harvested and transported during the same period (Table 2) and the average prices of logs and scants at the Gauharabad Timber Market (Table 3).

In order to determine the present net worth of the investments and returns, a real interest rate of 6% has been adopted (Alig et al, 1981; Fernando

et al, 1983) To estimate how much additional financial gains have been made due to permanent road network, a hypothetical situation was considered. For this purpose, a computer model was written in **BASIC** that was based on the information given in Tables 1, 2 and 3. The whole scenario was based on the assumption that had there been no forest road, the trees harvested would have been converted to scants and transported by mules (or jeeps) to a transfer yard. This would have caused a loss of up to 50% of log volume (Stoeher, 1987). For a better understanding of the problem, a schematic presentation is given as Figure 1:

Table 1. Shinkiyari-Kund Forest Road: Construction and Reconstruction Costs

Year	Expenditure (Rs.)	
	Nominal	Compounded @ 6%
1982	46,000	71,200
1984	315,000	434,000
1985	335,000	435,000
1986	224,000	274,700
1987	440,000	509,000
1988	527,000	575,200
1989	635,000	652,700
1990	318,000	318,000
Total	2,839,000	3,270,200
Maintenance @ 5%:	163,510	
Total incl. maint:	3,433,710	

Source: Office records of the Forest Products Research Division, PFI, Peshawar.

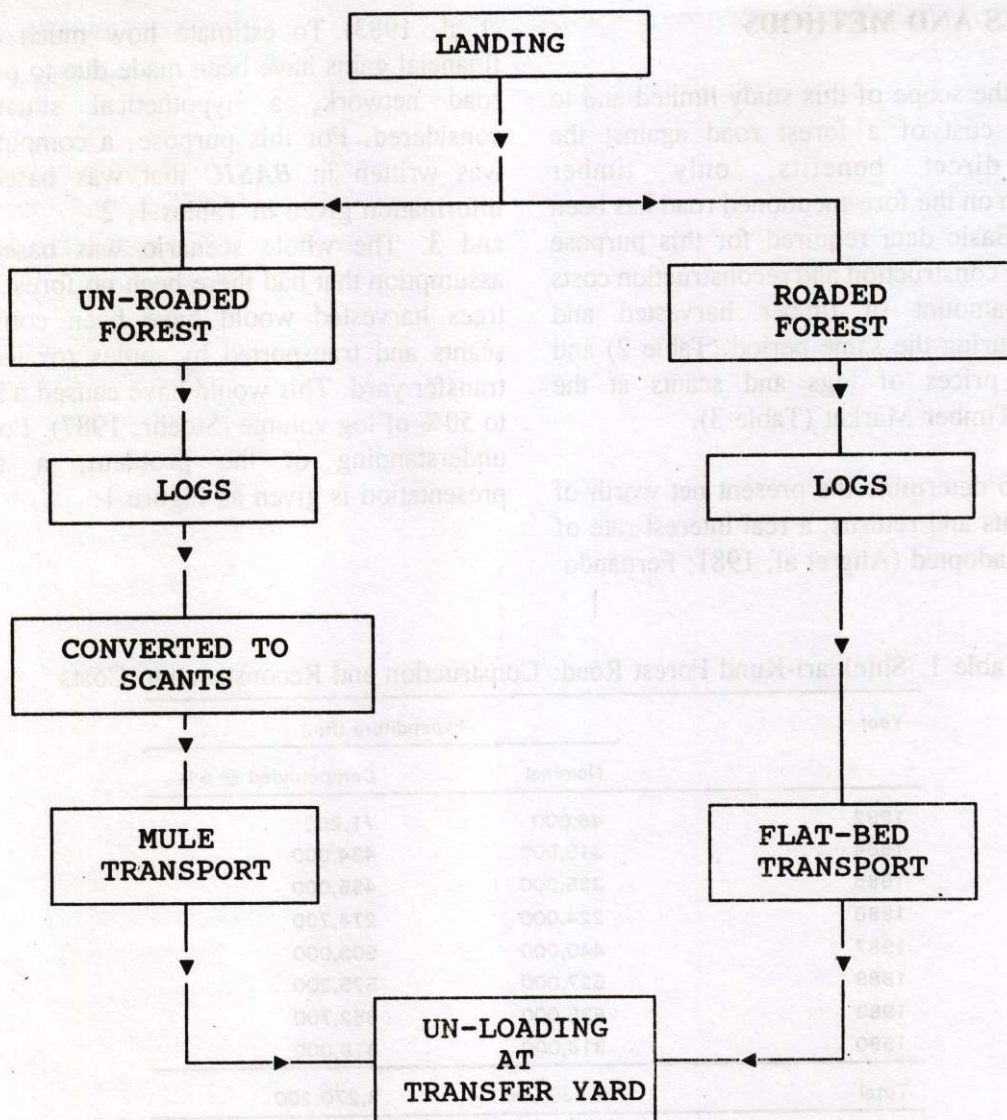


Figure 1. A Schematic Presentation of Landing-to-Transfer Yard Transportation Systems for Roaded and Un-roaded Forest Areas

Table 2. Log Volume Transported on Shinkiari-Kund Forest Road

Year	Log Volume (m ³)
1988	1,369
1989	4,186
1990	196
Total	5,751
Avg.	1,917

Source: Office records of the Asstt. Project Director,
Mansehra Intensive Forest Management Project.

Table 3. Log-and Scant Making Costs and Auction Prices

Year	Costs (Rs./cubic meter)		Prices (Rs./cubic meter)	
	Log-making	Scant-making	Logs	Scants
1988	376	2,031	659	2,454
1989	536	1,813	819	2,620
1990	468	1,988	750	2,832

Source: Office Records of the DFM, Gauharabad Timber Market

Since we have the scanting costs and market prices, all that is needed is to convert logs (transported on forest road) into (hypothetical) scants and determine the difference in the form of net additional revenue in the following manner:

Net Additional Revenue (NAR)
due to permanent forest road = Net (compounded) Revenue from Logs -
Net (compounded) Revenue from Scants -
compounded) Road Construction &
Maintenance Costs

NAR = Log volume * [Log price - Logging cost] -
Scant volume * [Scant price - Scanting
cost]

How much amount was spent on the forest road in real terms? This was determined by compounding the road construction costs by 6% and increasing it by 5% to account for the

maintenance costs. If the *sum of net revenue from scants and road construction costs* is subtracted from the *net revenue from logs*, a *positive* or a *negative* figure is expected to occur. If the former happens, this would mean that the road had already paid for itself; and generated some surplus revenue. In case of latter, more revenue needs to be generated to break-even with the costs.

By running the programme, a negative figure of Rs.584,252 occurred thereby implying that some additional revenue is to be generated to break-even with the costs (Appendix -I). The next thing to do was to find out:

"how much additional timber is needed to be harvested to off-set the deficit still existing?"

To generate Rs.584,252/-, a certain quantity of timber is needed to be harvested in future. Since road building costs have already been considered, all that is needed is to **subtract** the per cft **net revenue from scants** from the per cft **net revenue from logs**. This will give the NAR per cft. If the amount of Rs.584,252 is divided by the per cft NAR, the timber still to be harvested will be arrived at:

$$\begin{aligned} \text{Rs.584,252} &= \text{Log volume} * [\text{Log price} - \text{Logging cost}] - \\ &\quad \text{Scant volume} * [\text{Scant price} - \text{Scanting cost}] \\ &= V * [\text{Log price} - \text{Logging cost}] - V/2 * [\text{Scant price} - \\ &\quad \text{scanting cost}] \end{aligned}$$

Log and scant prices and log and scanting costs for a future year are based on the average prices for the period 1987-91. Scanting part of the equation has been divided by '2' as it is assumed that conversion from logs to scants causes a loss of 50% in volume. By substituting values in the right hand side of the equation, the additional log volume is determined:

$$\begin{aligned} 584,252 &= V * [1944 - 460] - V/2 * [2636 - 743] \\ &= 1484 * V - 947 * V \\ &= 537 * V \\ \text{or } V &= 1,088 \text{ m}^3 \end{aligned}$$

is the volume of timber that would generate Rs.584,252/- to break-even with the investment made in permanent road network.

Since additional timber volume to be harvested is 1,088 m³ and the average annual volume of timber removed during the road's operational period is 1,917 m³ (Table 2), the additional time needed to break-even with the costs (incurred on road construction) may therefore, be less than a year. ***The total payback period will thus be less than 4 years.***

CONCLUSIONS

Total compounded expenditure on road construction is about Rs.3.434 million (Appendix-

I). Total timber harvested so far (5751 m³) and to be harvested (1088 m³) to break-even with costs would be 6,839 m³. Road construction costs will therefore be Rs.502 per cubic meter (Rs.14.21/cft). These costs will keep on decreasing when more timber is harvested from forests accessible through Shinkari-Kund forest road. ***However, this will be true only if the road is kept in proper shape by regular maintenance and upkeep.***

REFERENCES

- Alig, R.J.; W.B. Kurtz; T.J. Mills. 1981. Financial Return Estimates of Alternative Management Strategies for 9-15 year old Southern Pine Plantations in Mississippi. Southern Journal of Applied Forestry. 5: 1, 2-7.
- Anon. 1977. Planning Forest Roads and Harvesting Systems. FAO Forestry Paper.No.2.
- Dykstra, Dennis P. 1975. Economic and Environmental Evaluation of Forest Harvest Alternatives - An Operations Research Methodology.
- Fernando, U.S.; F.W. Cubbage. 1983. Analysis of Fuelwood in Plantations in Sri Lanka. Sri Lanka Forester. 16: 1-2, 11-17
- Klemperer, W.D. 1983. Some implications of Inflation-caused Changes in Timing of Asset Yields. Forest science; 29:1, 149-159.
- Lussier, L. J. Planning and Control of Logging Operations.
- Pardes, Gonzalo and John Sessions. 1988. A Solution Method for the Transfer Yard Location Problem. Forest Products Journal. Vol. 38, No. 3.

Row, Clark, H. Fred Kaiser and John Sessions. 1981. Discount Rate for Long-term Forest Investment. *Journal of Forestry*. 79: 367-369, 376.

Steenbrink, P.A. Optimization of Transportation Networks.

Stoehr, Gerhard W.D. 1987. Cable Logging in the Outer Himalayan Mountain Forests: Needs and Limitations. In *Proceedings of IUFRO Symposium on "Role of Forestry Research in Solving Socio-Economic Problems in the Himalayan Region"*. pp 194-205.

Toledo, PE-de-N ; Yamazoe, G and Morase, JL-de. 1986. Cost/Return Analysis of Eucalyptus Production on Farm Property. Instituto de Economia Agricola. S. Paulo, Brazil.

Yeap, Yun H. 1988. Determination of Optimum Setting Dimensions and Road Standards for Uniform Terrain.

Appendix - I

100 REM PAYBACK PERIOD OF SHINKIARI - KUND FOREST ROAD

110 REM -----

120 REM

130 LOG88 = 1538 'Logs harvested in 1988 (cubic meters)

140 LOG89 = 3669!

150 LOG90 = 159

160 LC88 = 376 'Logging cost for 1988 (Rs./cubic meter)

170 LC89 = 536

180 LC90 = 468

190 LOGPR88 = 2031 'Log (auction) price in 1988 (Rs./cubic meter)

200 LOGPR89 = 1813

210 LOGPR90 = 1988

220 PI = 1.06 'Principal + (6%) Interest

230 TCRLOG = LOG88 * LOGPR88 * PI^2 + LOG89 * LOGPR89 * PI + LOG90 * LOGPR90
Total compounded revenue from logs till 1990

240 TCLCOST = LOG88 * LC88 * PI^2 + LOG89 * LC89 * PI + LOG90 * LC90
'Total compounded logging cost

250 NCRLOG = TCRLOG - TCLCOST 'Net compounded revenue from logs

260 CF = .5 'Conversion factor; from logs to scants

270 SCANT88 = LOG88 * CF 'Hypothetical scant volume in 1988 in the absence
of a standard forest road

280 SCANT89 = LOG89 * CF

290 SCANT90 = LOG90 * CF

300 SC88 = 659 'Scanting cost in 1988 (Rs./cubic meter)

310 SC89 = 819

320 SC90 = 750

330 SCPR88 = 2454 'Scant auction price in 1988 (Rs./cubic meter)

340 SCPR89 = 2620

350 SCPR90 = 2832

360 TCRSCANT = SCANT88 * SCPR88 * PI^2 + SCANT89 * SCPR89 * PI + SCANT90 * SCPR90 'Total
compounded revenue from (hypothetical) scants (Rupees)

370 TCSCOST = SCANT88 * SC88 * PI^2 + SCANT89 * SC89 * PI + SCANT90 * SC90
'Total compounded scanting cost (Rupees)

380 NCRSCANT = TCRSCANT - TCSCOST 'Net compounded revenue from scants (Rupees)

390 EXP82 = 46000! 'Expenditure incurred on roads in 1982 (Rupees)

391 EXP84 = 315000!

400 EXP85 = 335000!

410 EXP86 = 224000!

420 EXP87 = 440000!

430 EXP88 = 527000!

440 EXP89 = 634000!

450 EXP90 = 318000! 'Expenditure incurred on roads up to
 June, 1990 (Rupees)
 460 CEXP82 = EXP82*PI^7.5 'Compounded expenditure on roads in 1982 (Rupees)
 470 CEXP84 = EXP84*PI^5.5
 480 CEXP85 = EXP85*PI^4.5
 490 CEXP86 = EXP86*PI^3.5
 500 CEXP87 = EXP87*PI^2.5
 510 CEXP88 = EXP88*PI^1.5
 520 CEXP89 = EXP89*PI^1.5
 530 TCEXPR = CEXP82+CEXP84+CEXP85+CEXP86+CEXP87+CEXP88+CEXP89+EXP90
 'Compounded expenditure on roads till June, 1990
 540 CMC = TCEXPR*.05 'Compounded maintenance cost of roads; @ 5% of TCEXPR
 550 TCCROAD = TCEXPR + CMC Total compounded expenditure on roads
 560 NRROAD = NCRLOG - NCRSCANT - TCCROAD 'Net additional revenue due to roads
 570 PRINT USING " NET COMPOUNDED REVENUE FROM LOGS..... = RS. ###,###,###";
 NCRLOG
 580 PRINT USING " NET COMPOUNDED REVENUE FROM SCANTS ...= RS.
 #,###,###";NCRSCANT
 590 PRINT USING " TOTAL COMPOUNDED EXPENDITURE ON ROAD = RS. ###,###,###";
 TCCROAD
 600 PRINT USING " NET ADDITIONAL REVENUE DUE TO ROAD..... = RS. ###,###,###";
 NRROAD 610 END

By running this model, a deficit of Rs.584,252/- occurred:

RUN

NET COMPOUNDED REVENUE FROM LOGS..... = RS. 8,068,112
 NET COMPOUNDED REVENUE FROM SCANTS... = RS. 5,218,656
 TOTAL COMPOUNDED EXPENDITURE ON ROAD = RS. 3,433,708
 NET ADDITIONAL REVENUE DUE TO ROAD..... = Rs. - 584,252
 Log Revenue - { Scant Revenue + Road Building costs}