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REBUILDING AGRICULTURAL MARKETS PROGRAM RAMP ROAD REHABILITATION REPORT

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REBUILDING AGRICULTURAL MARKETS PROGRAM (RAMP)

RAMP Impact Assessment # 2
Road Rehabilitation

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Road Rehabilitation Impact Assessment

Table of Contents

SUMMARY

Rural road development in Afghanistan has suffered due to war and lack of maintenance. About 80% of the rural population is not able to access markets with motorized transport, either because the roads are of poor quality and hence seasonal and/or there are not roads at all. Even the major market centers (or major growth centers) are poorly linked with each other and with local markets. The estimated road density of 0.027km of road per square kilometer of land and the ratio of roads to cultivated land of 0.35km of road per square kilometer of land places Afghanistan at the bottom end of developing countries. This has several effects. Only an estimated one-third to one-half of the agricultural output enters the market. Markets are also poorly integrated. Fares and rates are high because of high vehicle operating costs. Up to 20 percent of the fruit and vegetables sold are damaged while transported. Innovation is thwarted as farmers pursue a subsistence first strategy which is dominated by cereal crops.

The rebuilding agricultural markets program (RAMP) has since 2003 rehabilitate 49 road segments in 7 provinces: 1 in Wardak; 2 in Ghazni; 3 each in Baghlan and Parwan; 7 in Kunduz; 9 in Balkh; and 24 in Nangarhar. These road segments have a total length of 522km. The rehabilitation work involved surfacing, track/earth gravel, compacting and upgrading to all season road, and all minor and major cross drainage works, washes, culverts and on existing gravel. The roads were selected because they link farms with district market centers. Some of the roads also connect villages with primary roads and highways and through them with “major” markets in the country and in the region.

An internal evaluation was launched to measure the impact of the rehabilitated roads. Data were collected by means of classical road impact assessment tools, such as traffic and passenger surveys and changes in vehicle operating costs to compare with and without rehabilitation costs and benefits. In addition, agriculture and marketing related data were collected from household surveys using semi-structured questionnaires. Villages within a 2km radius of a road (defined as the impact zone) constituted the universe of the assessment. Control villages lying outside the impact zone were surveyed for counterfactual purpose. Some of the roads were completed lately to have a meaningful impact, especially on agriculture. However, based on data from roads completed over a cropping season ago, it was possible to estimate the impact of the investments for all roads.

The major finding of the assessment is that, improved roads have generated substantial positive impacts. Farmers have saved travel time, ranging from 0.51 minutes/km by taxi/car to 1.14 minutes/km by truck, depending on the condition of the roads before the rehabilitation. Substantial gain of up to 5 minutes/km was also made by non-motorized transport. The supply of transport has increased substantially, especially share-ride taxis and mini-buses offering frequent service, whereas in the past the only service was a rural bus offering one or two runs a day. Improved roads have also influenced the number of trips farmers make to markets and district centers. On average, farmers are able to make 5 percent more trips per year with rehabilitation as the roads are open throughout the year and the transport service is quite competitive. Vehicle operation costs have gone down by at least 16 percent, thus benefiting both transport operators and farmers – the latter by way of reduced fares and rates. Survey data indicate that freight costs for transporting inputs and outputs between markets and villages has gone down by 10 percent after rehabilitation of the roads.

The production and marketing of agricultural produce are largely similar between the treated and control villages. In all cases, subsistence crops dominate farming. Commercial crops account for a smaller share of the area and aggregate impact value. That said, the roads that were completed two years ago have started to impact agriculture production and marketing activities in many ways. High-value vegetables are grown in large quantity in the impact zone, presumably because high spoilage loss associated with poor roads has fallen by 50 percent for perishables. Most crops in the treated villages also exhibit higher yields than in control villages, arising from increased intensification of input use and higher cropping intensities. The volume of net surplus exported from the treated villages (having deducted various outlays, like seed and domestic food consumption) is also higher for treated villages. Farmers in treated villages are able to get better prices for their products as they are able to transport their products to main markets and sell at competitive prices. This suggests that opportunities for commercialization of agriculture in the 2km zone of influence are far better with rehabilitation of the roads.

The roads have a minimum of 7 years service, with turn round maintenance in year 4. However, in order to guard against over estimating benefits, impacts are claimed for the first three years only. By pulling together all the streams of benefits, the imputed net benefit from the rehabilitation of the roads amounts to US$28.6M over a three year period, with a return on investment ratio of 3:1. About 40 percent of the total benefit was due to increased agriculture production and marketing, 26 percent was due to improved fares and rates accrued to farmers, and the remaining 33 percent was saving made by transport operators by way of reduced vehicle operation costs.

Though not quantified due to lack of time, observations during the survey and PRA interactions with local informants indicate that the roads have also improved access to people traveling to district agriculture departments and medical centers. Survey data also revealed that farmers are able to procure farm inputs with great ease from nearby cities. Local shops are fully stocked with merchandise items and prices are reasonable. A number of new economic initiatives have also sprung in some locations, like mills and workshops. Although it is difficult to attribute these developments entirely to the rehabilitation of roads, it is quite clear that the roads have provided the impetus for increased agricultural output and incomes.

I. INTRODUCTION

Afghanistan is typified by low levels of productivity of land, labor and capital in almost all sectors of the economy, in particular, in agriculture and allied sectors in rural areas. It was noted, long ago, that "The economic organization of Afghanistan resembles a wide sea dotted with islands of economic activity, each one more or less limited to its own local market, primarily because of inadequate transportation"(World Bank, 1978).[1] This is probably true today as well. As a landlocked country, roads are the principal mode of transportation for both internal and international traffic. The total length of roads in the country prior to outbreak of the war was estimated at 17,000 km. The all-weather road network extended 9,200 km of which 2,560 km was asphalt and concrete highways. The principal agricultural areas and commercial centers were linked by a highway system which linked Kabul in the East with Baghlan and Mazar-i-Sharif in the North, Kandahar in the South and Herat in the West. The remaining roads were gravel roads, tracks and improved earth roads.[2] The secondary roads - engineered earth roads- link farms, rural villages, and small towns with major highways. However, these roads were generally substandard to handle traffic at a reasonable cost. In many cases, they were either destroyed or damaged from the war and constitute real bottleneck to economic development.

Beyond the primary and secondary roads, the country's rural road network is also made up of tracks, trails and footpaths that link rural villages and local market. Given the rugged topography of the country, these non-motorized rural roads are important for the livelihood of rural communities. They allow the movement of people and animals over steep terrain and are typically characterized by low quality standards and limited transit.

Rural Afghanistan is clearly underserved with respect to road infrastructure. The estimated road density of 0.027 km of road per square kilometer of land places Afghanistan at the bottom end of developing countries. Although a scattered population and the presence of large uncultivable expanses bias the road density downward, the ratio of roads to cultivated land of 0.35 km of road per square kilometre of land is also very low. Barely 20% of the rural population has access to motorized transport. Year-round and relatively easy access to motorized transport is confined to villages located in close proximity to markets and cities. Many villages are extremely isolated either because the roads are of poor quality and hence seasonal and/or there are no roads at all for motorized transport. [3] This has several effects. Only an estimated one-third to one-half of the agricultural output enters the market due to poor or inaccessible roads. Markets are also poorly integrated. As recently as 2004, the regional difference in the price of wheat between Mazar-i-Sharif in the North and Kandahar in the South was as high as 67 percent.[4]

Access to motorable farm-to-market roads is essential for the development of the rural economy. Roads permit diversification of activities, induce higher productivity and improve incomes. Improved village-to-market roads provide incentives to farmers to use more fertilizer and more land can also be planted with improved varieties and high-valued crops; markets for commodities will also develop further driving up agricultural productivity.

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[1] Quoted in The World Bank (1973) "Afghanistan – The Journey to Economic Development", Volume 1, P. 139.
[2] U.S. Trade & Development Agency (2003) "National Roads Rehabilitation Projects", Afghanistan: Rebuilding a Nation, Transportation Sector – Profile No. 5.
[3] The Asian Development Bank (2003) "Emergency Infrastructure Rehabilitation and Reconstruction Project", ARP:AFG 36673.
[4] FAO (2004) "FAO/WFP Crop Assessment Mission to Afghanistan, Special Report" 8 September, 2004.

Evidences from other developing countries support this contention. Based on some econometric literature reviewed, roads have strong direct and indirect effects on economic development, and these are even more significant when roads are combined with complementary investments, such as education, irrigation, and credit. This suggests that poverty reduction in Afghanistan could be hastened if rural roads are developed/rehabilitated in locations that are pivotal in terms of multiplier effects favoring agriculturally more productive communities.

Rural roads will also generate substantial direct benefits, such savings from traffic movements, vehicle operation costs, and freight and passenger transport costs. Roads can also be social and economic arteries for communities in a broader sense, with a myriad of localized impacts. This includes the ability to make periodic social visits and access public services, etc. Beyond this, the effect of rural roads in Afghanistan may include political stability, ethnic reconciliation and state building. There may also be several changes in "non-economic" attributes of farm households, such as demographic characteristics, division of work, etc.

The rebuilding agricultural markets program (RAMP) has since 2003 been rehabilitating roads to provide farmers reliable year-round access to markets, improve market integration and provide incentives to increase agriculture production. A total of 13 job orders were issued to rehabilitate 49 road segments distributed in 7 provinces: 1 in Wardak; 2 in Ghazni; 3 each in Baghlan and Parwan; 7 in Kunduz; 9 in Balkh; and 24 in Nangarhar. These road segments have a total length of 522km. The rehabilitation work involved surfacing, track/earth gravel, compacting and upgrading to all season road, and all minor and major cross drainage works, washes, culverts and on existing gravel. No new roads were built. The roads are considered critical instruments for agriculture growth, because they link villages with district market centers. Some of the roads also connect villages with primary roads and highways and through them with "major" markets in the country and in the region. The total cost of rehabilitating these roads is US$9.1 Million, giving an average cost of US$17,000 per km road.

This impact assessment measures the economic benefits of the village-to-market roads rehabilitated by RAMP. All the road structures rehabilitated over the three year period, 2003 – 2006, constitute the universe of the study. The focus of the assessment is dictated by the strategic objective of RAMP – that is to provide people with improved access to markets for the physical movement of inputs and outputs so as to increase agriculture production and incomes.[5] Thus the methodology measures the changes in agriculture output (indirect impacts) as well as the more direct economic benefits by drawing on classical road impact assessment tools, such as traffic and passenger surveys and changes in vehicle operating costs. Predictably, the indirect impact of the roads completed lately is minimal, because the investment will begin to generate value added benefits after at least one full crop year of the rehabilitation. In other words, improvements in agriculture yields do not occur in the first year. Thus, assuming a lag of one year, it was possible to determine the indirect impacts of the roads completed lately. Savings made from reduction in spoilage loss and vehicle operating costs are realized immediately after rehabilitation and were measured for each road directly from the survey.

[5] Numerous other benefits that roads induce, like health, education and gender are not measured by this study. The focus of the study is guided by the strategic objective of RAMP.

The report gives a full description of the methodology used, including survey instruments, criteria for selection of treated and control villages. It also deals with assumptions, coefficients and models, assessment tools and the approach pursued to validate and attribute impacts. Both direct and indirect impacts are quantified for the sample locations/roads and aggregated for the impact zone. The expected economic life of the roads is estimated to be 7 years, with turn round (maintenance) in year 4. However, benefits are claimed for the first three years only.

II. METHODOLOGY

1. Data

There are two components to the road impact assessment. One measures the direct impacts (vehicle operating costs, savings in travel time, fares and freight charges) by monitoring the flow of traffic on market and non-market days. The second component involves measuring the indirect impacts – on agriculture production and marketing activities. Data were collected by means of a survey. However, due to security concern, four road structures were not surveyed. These structures are, Akram Khail Murga Road in Nangarhar, Agakhel Bridge in Wardak and Merai and Jaghuri-Malistan roads in Ghazni. The impact of Akram Khail road was determined by extrapolating appropriate coefficients from nearby road segments in Khogyani district, corroborated with secondary information compiled from key informants. The other three structures in Wardak and Ghazni were not evaluated, because it was not feasible to field survey teams to collect data. In addition, three other roads, Sayed Ahmad Shah, Kod Barq and Qasemali Lala Maydan in Kunduz were not evaluated. Ahmad Shah road was surveyed but the quality of the data was very poor and had to be abandoned. Kod Barq and Qasemali roads were completed lately.

For the traffic survey, 30 sites were selected out of a possible 46 (Table 1). This was achieved by aggregating those roads overlapping. That is, where two or three roads run parallel to each other and are two to three kilometer apart and the 2 kilometer buffer zone (the zone of influence) is overlapping, they are treated as a single unit of analysis. This is the case particularly in Nangarhar province. There 18 segments, all of which are overlapping. Some of these segments are also located on the same major road. For example, on the Kama-Gushta road, there are 6 segments, each separated by less than 2km from other. To treat each of these overlapping segments as single units was unnecessary and too expensive, both in time and resource.

Strategic locations, between the local market and the roads, were selected and a surveyor was assigned to each of the sites to monitor and record the hourly flow of traffic, its mix and volume. Transport counts were generally undertaken on two “normal” and two “market” days. This distinction between normal and market days is in some cases blurred, because in villages close to major cities virtually every day is a market day and transactions can be made on any day of the week. The distinction however holds for outlying villages, the large majority of cases in the survey.

Questionnaires designed to capture the direct impacts of the roads were also administered to transport operators. Drivers were interviewed to record traffic movement, place of origin and destination of the traffic, passenger movement, volume and type of freight, distance traveled, use of the roads and cost of transportation. These data were required to compare the with and without-project situation and quantify impacts. Due to security concerns, the traffic surveys were carried out from 6AM to 5PM, with some variation between locations.

For the farmer survey, potentially, all the villages lying along the 2km influence zone and beyond this zone constitute the universe of the study. However, the selection of the villages was done purposively in which one village from the 2km influence zone another from villages lying between 2 to 4km (i.e. outside the influence zone) were selected for each road unit to assess the distance effect of the rehabilitated roads. In many cases, villages lying alongside the roads did not show marked differences in resources and agricultural practices, and sampling two villages for every road, irrespective of the distance between them, would not have added much value to the survey. This reduced the total number of sample villages to 39, as shown in Table 1. Annex 1A-1F (maps) also shows the locations for the traffic survey and the sample villages in relation to the roads. The X and Y coordinates for the maps were obtained from GPS readings taken during the survey.

Table 1. Distribution of Sample Villages and Traffic Survey Sites by Road Segment

Province	Road segments as per job order	Traffic Sites for survey	Villages for survey
Kunduz	7	6	8
Baghlan	3	6	4
Parwan	3	4	6
Nangarhar	24	7	11
Balkh	9	7	10
Total	46	30	39

Multi-level provincial agriculture and extension department personnel, IPs and key informants from local leaders helped in the selection of the treated and control villages. Prior to the survey, villages proposed were visited by the team to ascertain their suitability for the study. From each of the sampled villages (treated and controlled) an equal number of households (17) were randomly selected to capture differences in impact. The sample size was determined by applying the following formula:

$$Y = a+0.01X$$

Where, Y = size of the sample in a village
X = the total number of farmers in the control/treated village
a = sample farmers (constant)

Since the sample size was small, and there appears to be no feasible method of ensuring which households interviewers should select to administer the questionnaire, a system of stratified sampling was used whereby households were classified into three strata: those cultivating < 1 ha; those cultivating 1-2ha; and those cultivating > 2ha (note that this range differs from place to place). Allowing for variations between households in the agrarian structure, a proportionate number of households were randomly selected from each stratum for the interview.

The household survey was complemented by a community-level survey. In each of the sampled village, a PRA was conducted in which key informants, local shura and knowledgeable persons, both in the field and in Kabul provided general information about developmental issues in the villages by reference to the rehabilitated roads. The use of different tools ensured effective cross-checking and validation of the findings for study robustness.

2. Questionnaires and Checklists

Questionnaires and checklists were developed and translated to Dari. A questionnaire was administered to each household head in the sample frame. The questionnaire focused on general production and marketing practices, resources and transport access. Other variables likely to be influenced by transport, such as sources of income and employment were also addressed by the household survey.

Semi-structured interviews with key informants at national, provincial, and local levels also provided background information and perceptions about the impact of the roads.

The survey was used in common across all the roads to enable cross-project comparison and identification of emerging trends and impacts. Transporters were reluctant to take part in the survey, especially those working on major roads on market days unless cajoled by the police. In this case district governments were informed and where necessary the support of the local police department was sought to conduct the traffic survey. Extension workers from the MOAF in Kabul and from the provincial and district offices as well as experienced individuals from local NGOs implemented both the farmer and traffic surveys. A team of two persons per village implemented the farmer survey over a three day period. The traffic survey was conducted in each site by a surveyor, assisted by a local police, over a four day period.

3. Aggregation and Extrapolation

To extrapolate the benefits from the sample to the population served by the roads, baseline data had to be constructed for the 2km influence zone. Unfortunately, data on population and agricultural production pertaining to the zone of influence were hard to come by. Field interviews of key informants (farmers, maliks and other knowledgeable persons, including local extension workers) were conducted to collect such data, but the exercise provided only approximate information. Since the area of a 2km influence zone is proportional to the length of the road, key informants could not have a complete knowledge of all the villages lying along each road from the start to end. This was a practical problem and to an extent possible it was overcome by manipulating secondary data. This was done in several stages. First, to estimate the area in the 2km influence zone, coefficients were derived for1993 using AIMS data set, which were then extrapolated to 2004 based on data obtained from Cranfield University (courtesy of British Embassy in Kabul). The estimate breaks down area under a simple binary classification of land use: irrigation and rainfed. The total population living within the 2km influence zone was then estimated by dividing the irrigated agriculture acreage derived from the GIS maps by the average farm size/household which is derived from the road impact survey. Annex 2 provides the estimated area under each road. Methodologically the estimate is sound and conservative values are derived that are used to extrapolate the area cropped for each road zone of influence. Most of the population in the zone of influence is primarily farmers. Population growth is estimated at 2.3% per year over the next 7 years.

III. ASSESSMENT TECHNIQUES

1. Analytical Tools

A number of analytical tools are available to evaluate the benefits of roads. The most common of this is the **"consumer-surplus"** approach.[6] This values the direct benefits of roads, like vehicle operating costs, transport cost and travel time savings to road users. However, the consumer-surplus approach is inadequate to assess all of the benefits of rural roads. For low volume traffic roads, the biggest benefits arise not from savings in vehicle operating costs as such, but instead relate to the creation of basic vehicle access. These benefits, though complex to quantify, can be substantially greater than those associated with rehabilitating existing feeder roads. Moreover, the benefits from non-motorized traffic are not captured by the conventional consumer surplus approach.[7] In the districts where the RAMP roads are located, non-motorised traffic accounts for an important share of the aggregate traffic volume. Field study suggests that, at least, 10 to 15% of the total ton-kilometer is still carried by horse and donkey carts.

These special features of rural communities call for the conventional consumer-surplus approach to be augmented with other suitable approaches. One such approach is the **"producer-surplus"** approach.[8] This approach measures the impact of roads on local agricultural productivity and output. The method also captures post-harvest loss (spoilage due to bad roads and delayed marketing) and induced traffic due to economic activity. This approach is particularly suitable for roads where rehabilitation has provided improved accessibility than before for radical socio-economic transformation.

This impact assessment uses both the consumer and producer-surplus approaches to measure, respectively, the "direct" and "indirect" benefits. The direct benefits are "first round" traffic related effects, and they are realized through, for example, a reduction in vehicle operating costs (VOCs) for transport service providers, largely through a reduction in maintenance costs, and savings in fuel and other operating expenses. Transport operators spend less money and lose fewer working days for vehicle maintenance and repair. This is illustrated in Figure 1a, where the surplus under the demand curve is generated by a reduction in transport operating costs. At the same time, improved road induces economic development in the area (e.g. more shops, businesses, etc open up) which in turn attract more service providers to the route, resulting in changes in the modal mix, freight composition and competition. These benefits are also first round and are calculated using the consumer surplus.

Figure 1b depicts the benefits of "induced" traffic. Under competitive transport system, a reduction in transport operating cost due to improved road condition is shared between farmers (passengers in general) and transport operators. Part of the benefits of improved roads accrued to transport operators is transferred to local farmers, traders and consumers through reduced fares and freight rates, depending on the structure of the transport market.

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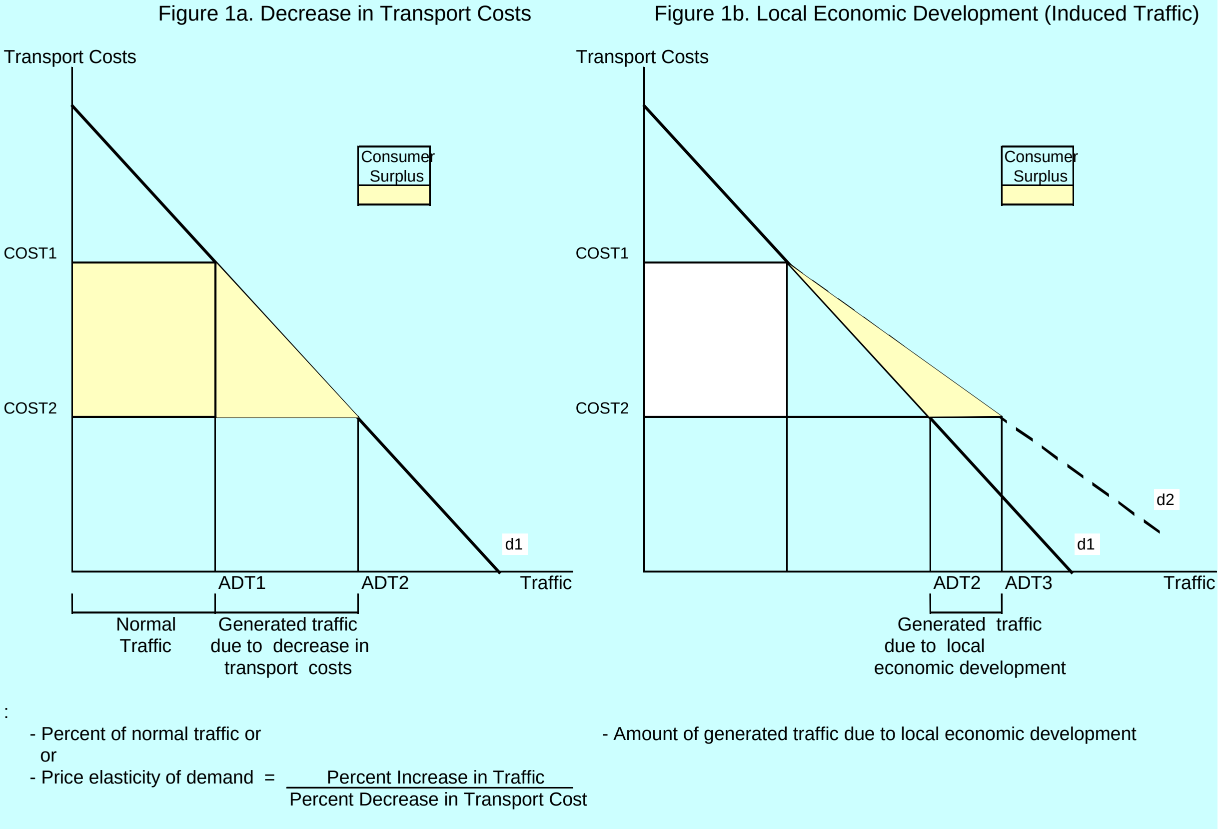
[6] World Bank (2005) "Low Volume Rural Roads" ,Transport Note No. TRN -21.

[7] The consumer surplus approach in most cases calculates benefits for conventional motorized means of transport. However, in Afghanistan, as in many poor countries, non-motorized traffic constitutes a significant component of the traffic on village to farm roads and given the poor state of roads and low traffic volume this traffic represents in some cases the bulk of total ton kilometers. Benefits to non-motorized traffic represent significant savings that are not captured by the conventional consumer surplus method.

[8] World Bank, Op cit.

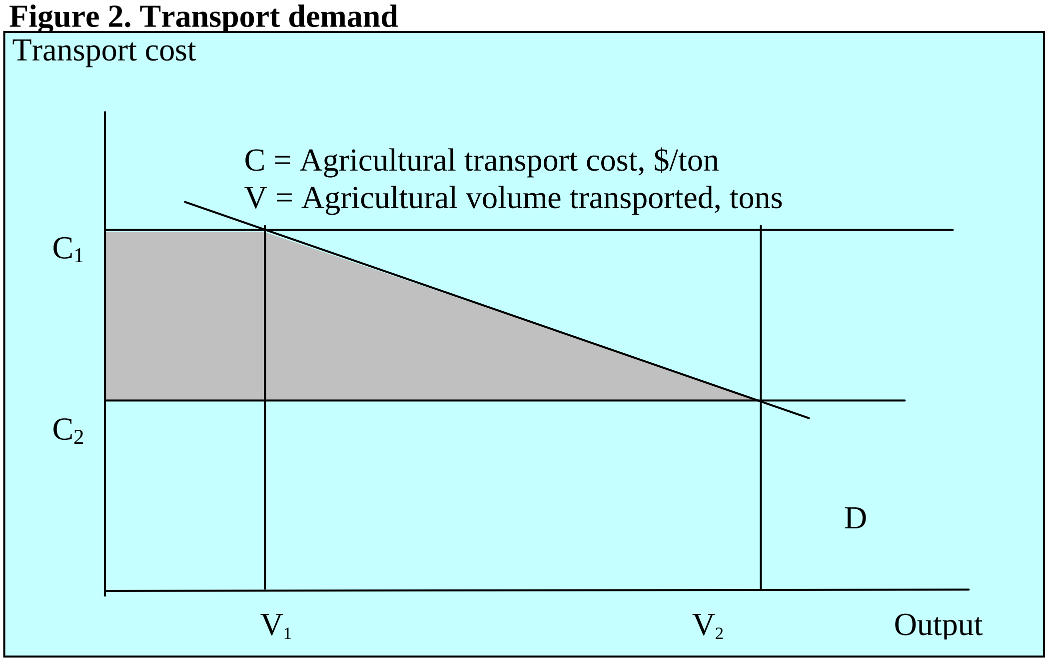
Figure 1: Direct benefits from rehabilitating roads



The indirect benefits capture the welfare enhancing effects with a focus on increased agricultural production, increased marketing activities, reduction in spoilage loss (storage loss, marketing and transporting losses). Indirect effects derive from the ability of farmers to operate profitable farm enterprises due to better access to markets, inputs, mobility, etc.

In Figure 2, improved roads stimulate the development of agriculture by allowing farmers to produce more and release a large proportion of their output to markets. With a reduction in

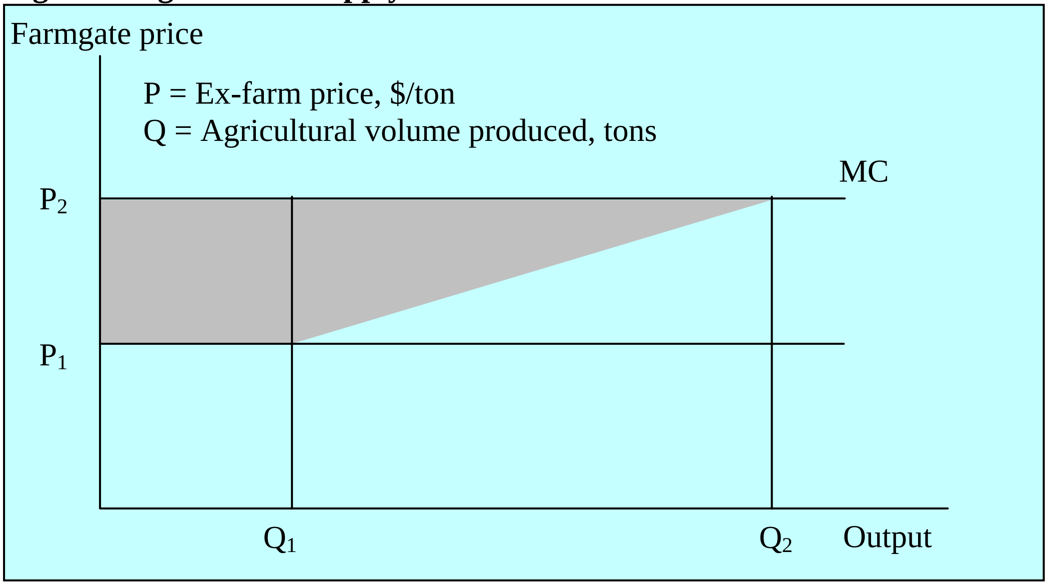
Figure 2. Transport demand



transport cost from C1 to C2, output increases and with it the volume of output reaching the market also increase from V1 to V2. Under competitive market conditions, increased integration into markets permits farmers to earn competitive prices for their products which in turn stimulate intensification of farming activities and increasing agriculture production.

This, in turn, facilitates the transition from subsistence to commercial agriculture, e.g. with regard to the use of fertilizer, pesticides and switching over to mechanized technology in processing activity. In Figure 3, Q1 is the without project output and P1 the farmgate price. The farmer saves from the reduction in transport costs and the real farmgate price rises to P2. This leads to an increase in production from Q1 to Q2. In this case, while the shaded rectangle represents cost savings to the farmer on normal output, the shaded triangle captures the gains on newly generated output.

Figure 3. Agricultural supply



To the extent that rural road investments are increasingly focused on agriculture rather than social objectives, the application and relevance of the producer surplus method is quite intuitive. It captures the value added in agriculture production arising from rehabilitation of farm-to-market roads**.** However, while the direct benefits can be measured independently of the indirect benefits, the latter are only meaningful in conjunction with the direct; it is in fact unrealistic to try and measure the indirect impacts without any knowledge of the direct effects. Hence, the approach adopted is to measure both the direct and indirect benefits. Evidently, while the direct benefits are straightforward to measure and attribute, the value added in agriculture productivity are more difficult to capture and attribute to roads. This is because the development of agriculture takes place as a result of an integrated and simultaneous development of irrigation, rural roads, markets, research and extension, etc. In this situation, the impact is synergistic in nature, where the contribution is made by each factor in combination with other factors. A methodology is required to isolate the impact of roads from other complementary activities.

2. Attribution

The most common technique used to isolate the benefits of roads from other activities is the double difference technique (DDT). The DDT uses the “before” and “after” situation combined with “with-without” project.[9] The changes in project villages before and after road improvement are netted out by changes in control villages during the same period to arrive at the net impact due to road improvement in project villages. The method estimates impact in two stages. First, it calculates the mean values for all relevant outcome indicators, Y, for the villages in the treatment group and in the control group, both in the baseline year and the follow-up year. This comparison generates the first of the two differences needed for applying the double difference method. The second difference is between the before project and after project situations. These values are captured in the following matrix. The difference in values in the fist column of the matrix indicates the mean change in the treatment group. The equivalence difference in the second column gives the mean change in the control group. The difference between the two differences is an estimate of the project impact in a particular zone of influence.

	On-Road	Off- Road
Baseline	$\overline{Y}$ road, 1	$\overline{Y}$ no road, 1
Follow-up	$\overline{Y}$ road, 2	$\overline{Y}$ no road, 2

Project Impact = ($\overline{Y}$ road, 2 - $\overline{Y}$ road, 1) – ($\overline{Y}$ no road, 2 - $\overline{Y}$ no road, 1)
[mean change in treatment group] [mean change in control group]

At the planning stage of the assessment, it was felt that the DDT could be applied to attribute road-related effects. However, it later became evident that the DDT could not be used in its entirety because of lack of baseline data. There is hardly any baseline data on any of the roads evaluated. The job order appraisal system in RAMP didn’t see the value of collecting baseline data that would have provided a benchmark to compare changes after rehabilitation. At the time of the survey, a recall technique was used to gather information but it did not generate dependable data to establish the before situation. In some cases, the roads appeared not to be the most important determinants in farmers’ livelihoods and, therefore, road-related information could not be easily recalled. Moreover, while some of the roads have been impacting economic development for a year or more, others were completed a few months ago. In the case of the latter group of roads, it was not possible to establish the before situation. This is particularly true for the indirect benefits. Benefits from agriculture related activities take time before they are realized. The absence of useful baseline and longitudinal information ruled out the possibility of using a more precise estimator of the before-after situations for a rigorous attribution of the indirect impacts.

The methodology employed to overcome this constraint is a partial application of the DDT, in which the effects of the rehabilitated roads on treated villages was captured by comparing the mean effects from the control villages. Data from control villages were treated as “benchmark” to compare agriculture related changes after the rehabilitation of the roads. This allowed the comparison of “with” and “without” project situations.

[9] The conceptual and methodological framework of this study is based on classic rural road studies of Vietnam as reported in World Bank and UNESCAP studies: Grootaert, C. (2002) *“Socio-Economic Impact Assessment of Rural Roads”*, World Bank; Van de Walle, D. and Cratty, D. (2002) *“Impact Evaluation of Rural Road Rehabilitation Project”*, World Bank; United Nations Economic and Social Commission for Asia and the Pacific (2000) *“Evaluation of Infrastructural Interventions for Rural Poverty Alleviation”*, UNESCAP, Bangkok, Thailand. Further information is also sought from the Asian Development Bank (2003) “Afghanistan, Emergency Infrastructure Rehabilitation and Reconstruction Project”, May 2003.

The validity of the technique obviously depends critically on comparability of the treated and control villages. The treated villages will have to be selected from the zone of influence, which is defined as the “impact zone” with a 2km radius on either side of the road. Given the rugged topography and settlement pattern in the countryside, a 2km buffer was deemed a realistic zone of influence beyond which the impact of the roads is expected to diminish. The control villages were selected randomly from a list of villages outside the 2km buffer but located in close proximity (not exceeding 4km from the 2km buffer). This randomness assured that the treated and control villages are statistically equivalent and comparable to one another; they differ only in the receipt of roads. Control villages have the same socio-economic attributes as the treated villages, except that they did not have access to roads, and if they did, they were not comparable type. Common to both villages, agriculture is the mainstay of the communities. A range of agriculture products are produced, depending on resource and agronomic factors, both for home consumption and for the market.

To augment the double difference technique, other RAMP sectoral activities that may have a bearing on agriculture production and marketing were superimposed on each of the roads to see if there was any overlapping on activities. The maps generated by GIS indicated that though some activities are localized, they are not within a reasonable distance from the roads to prejudice the outcome of the evaluation.

3. Quantification of Benefits

The roads are analyzed on a one-by-one basis, except those overlapping and lumped together as segments in Nangarhar. For analytical purpose the roads were classified into three categories, by completion dates: roads that were completed one year ago (i.e. one full crop cycle ago); roads that were completed a year ago but did not run the full crop cycle; and roads that were completed more recently. By far the majority of the roads, 25, were completed more than a year ago, and they are mostly located in the North in Kunduz, Balkh, Baghlan and Parwan provinces. Fewer than 10 roads fall into the second category, while a sizeable number of roads, 17, were completed this year. With little time lapsed, it was impossible to say what the indirect impact of the roads would be, especially of the latter two categories. Impacts that may occur through changes in agriculture activities, increased accessibility, enhanced communication, etc., take time to develop subsequent to rehabilitation roads. The roads that fall under the third category are not at this moment generating any discernable direct economic benefits as such. Even those roads completed a year ago but did not complete a full crop year have yet to impact agriculture and economic development of the areas in a meaningful way. For those roads completed lately, we can only observe some improvements vis-à-vis increased traffic density or improved access to markets. But assuming that these roads (the latter two categories) will also generate the same kind of productivity gains as with the first category of roads, a stream of benefits are projected to accrue. Valuation of benefits for the latter two categories of roads was in this case done after a one year lag, because some time will have to lapse before changes in cropping pattern, output and incomes are realized.

The stream of benefits measured are a) net gain in agriculture production (value added); b) reduction in spoilage loss; c) producer transport cost savings (freight cost); d) passenger road user savings (fares); and e) travel time cost savings (opportunity cost). Other impacts, like the difference in cropping pattern and the marketed surplus are also analyzed to shed light on the marketing behavior of farmers and also to measure transport costs. In each case the analysis was performed for seven years. The roads may last for a number of years, provided that they are periodically maintained. It is estimated that by year four some maintenance would be required to maintain the roads at the current level of operation. Irrespective of this, the benefits over the seven year period can rightly be attributed to RAMP. However, in order to guard against over estimation of benefits, a more conservative approach has been adopted in which benefits are claimed for the first three years only. The benefits were aggregated for each road by the five stream of benefits stipulated above.

Benefits are estimated in two ways: one is to value the increased physical production and other road related benefits at constant prices. This analysis was done on an incremental basis, without considering interest and the opportunity cost of capital, because they are assumed to be part of the total economic benefit accrued to farmers.

The other is a net incremental benefit (net of annual costs and capital costs) discounted to the present. This was done to establish efficiency ratios in resource allocation. For the roads completed lately (i.e. roads that did not cover a full one year), a one year delay was assumed before discounted benefits are realized. The discounted values are then summed together (as represented by ∑) for the life cycle analysis period (“N”) to yield an overall present value:

$$PV = \sum_{t=1}^{N} [\ 1/(1 + r)^t]A_t$$

Where

PV = present vale at time zero (base year)
r = discount rate
t = time (year); and
A = amount of benefit or cost in year t

The benefit cost ratio (B/C) is also used to judge the efficiency of resource allocation. The ratio is expressed as a quotient. For example, US$2.2M/US$1.1 = 2.0.

The technique employed to measure the direct impacts was based on a detailed analysis of traffic survey data. The indirect benefits are estimated from an analysis of the cropping pattern of the cross-sectional data generated by farmer/household survey. Outliers were omitted from the analyses in order to standardize the data. The analysis was based on several assumptions, and these are developed first, followed by a simplified model to disaggregate the benefits accrued between transport operators and farmers.

4. Assumptions and Coefficients

- Cereals (wheat, maize, rice); pulses; cash/oil crops (sesame, flax, cotton); fruit (grapes, apples, melon. etc); and vegetables (onions, potatoes, tomatoes, okra, eggplant, etc) dominate farm output, both in the treated and control villages. By taking the productivity differences of comparable crops cultivated in the treated and control villages, the net incremental agricultural output (i.e. value added) and the monetary value of the aggregate increased agricultural production marketed are calculated. This difference in productivity is then multiplied by the proportion of the area under each crop in the 2km influence zone to derive the net incremental output gain from each crop. This gain is further multiplied by the farmgate price (constant) of the treated village and aggregated to derive the value added gain from the roads. Production costs (labor, equipment, fertilizer, water, etc) are assumed to be internalized by the farmer.

• The theory of agrarian change states that improved access to roads induces farmers to take land used for lower value, less perishable crops (e.g. cereals) out of production, and to plant instead higher value crops (e.g. fruits and vegetables) which could be shipped to markets more quickly and fetch higher prices. However, for the villages covered by this assessment, crop selection based on market demand and geographic proximity will begin to take shape after a number of conditions are met first, most notably after food security concerns are adequately addressed from own production, agriculture is commercialized and producers are vertically integrated with processors and exporters. Moreover, if the experience of India is of any guide on intensification we would expect the roads to begin to influence area shift after at least three years, not earlier.[10] It is thus assumed that for the with-rehabilitation case, the proportion of land under each crop and the aggregate area cropped will remain unchanged for the entire duration under investigation. If intensification occurs this may be in cropping intensity rather than in crop selection and area expansion. The survey in fact suggests that in the influence zone there is very little land that is not cultivated.

• Crops are produced largely for home consumption but a significant amount is also sold locally in village and district markets, some of which is exported to regional markets like Mazar in the North and Kabul in the Central by "big" traders. The size of landholding is a crucial factor in generating the marketable surplus. The average landholding is 2-3ha/household, with great variation between locations. It ranges between 3-5ha in the North, 2-3ha in Nangarhar and 1-2ha in Parwan (see Annex 2 for the estimated area irrigated/household for each road). The net marketed surplus and the vehicle requirements for transporting the surplus to markets is derived by simply deducting the various outlays from the annual output. The two most important outlays are food and seed. Per capita consumption and seed requirements were taken from FAO documents[11], supplemented with information from knowledgeable persons working for the RAMP project. Seed requirements are estimated directly from the area cropped (Table 2).

Table 2: Coefficients for Consumption and Seed

Per capita consumption	(Source: RAMP, cost of production manual, 2004)					
(kg/person)	Wheat	160	Tomato	10	eggplant	7
	Rice	17	Onion	5	Melon	8
	Maize	2	Potato	9	w/melon	10
	Barley	1	Beans	1.2	Garlic	0.5
	Fruit	5	Chili	0.7	Sesame	0.1
			Okra	5	Cotton	0

Seed (kg/ha)	(Source: RAMP, cost of production manual, 2004)					
	wheat	140	Tomato	1	potato	1,225
	rice	140	Onion	2	Okra	10
	maize	70	sesame	50	eggplant	1
	barley	140	Beans	70	melon	5
	cotton	280	Garlic	500	Chili	1

[10] An analysis of time series data for 29 years for 235 villages in South Indian districts covering 22 crops along with various inputs (fertilizer, HYV, irrigation and market densities) showed that the determinants of market access have significant effect on total agricultural productivity. An increase of 10% in road length contributes to a 1.3% increase in aggregate agriculture productivity; and increase of 10% in the number of markets in a given area improved aggregate productivity by 1.1%. This study also indicated that productivity responds to market access after a three year lag. Khachatryan, A. and Von Oppen, M. (not dated) "Market Access and Plant Productivity in Indian Agriculture".

[11] FAO/WFP (2004) "Crop and Food Supply Assessment Mission to Afghanistan', Special Report, Rome.

• The per-ton farmgate prices of locally marketed (village) and "major" (provincial or district centre) market from the zone of influence are unique for each road. Farmgate prices before rehabilitation of the roads were obtained by adjusting the local market prices collected during the survey by transport cost before the roads were improved. For the without-rehabilitation case, the difference in transport cost was added to the before-rehabilitation rate. The resulting increase in farmgate price is very small, at most ten percent, and would by itself provide little disincentive to farmers to increase production. But this is normal for rehabilitation projects, in contrast to construction of penetration feeder roads to inaccessible locations where transport cost reductions of significant amount (in some cases up to 90 percent or more) can be expected. More important would be the reductions in spoilage and cost of inputs, such as fertilizer, used by farmers.

• Yields before and after rehabilitation are derived from the survey and adjusted with more realistic figures from RAMP resource persons and from previous surveys in order to guard against overoptimistic productivity gains. In most cases, crop yields are substantially below what farmers claimed to have obtained from their fields. It is assumed that yields will not increase because of the rehabilitation of roads alone. In fact roads do not have direct yield enhancing effect, in the absence of complementary activities – improved seeds, irrigation, extension, etc. Thus, a constant crop yield was assumed for year two to seven.

• Roads reduce losses arising from transporting output to local markets. It is generally believed that post-harvest crop losses, especially of perishables, reaches 20 to 30% in developing countries, part of which is attributed to marketing. From interviews with farmers in the treated and control villages and from discussions with knowledgeable specialists in RAMP, coefficients were estimated for each crop for the without and with-rehabilitation situation to capture marketing related spoilage losses. These coefficients are summarized in Table 3. Evidently, the coefficients are much lower than the average losses commonly used by specialists in Afghanistan. They vary from 10 percent for vegetables and fresh fruit to 2 to 5 percent for cereals and pulses. These coefficients may change after year three as roads deteriorate in the absence of rehabilitation. But it is assumed that the roads will be maintained in year four and this will permit the standard of the roads to be restored to their current level and the spoilage loss will remain unchanged. On the basis of this assumption spoilage coefficients were applied to each crop and the net benefit attributable to rehabilitated roads is derived for the base year and year one. The percentage difference between the two years is applied to estimate the benefit for the remaining five years.

Table 3: Coefficients for Crop Spoilage

	cotton	cereals/beans	tomato	melon	potato	garlic/onion	chili	other vegs
before	5%	2.0%	10.0%	12.0%	2.0%	2.0%	2.5%	4.0%
after	3%	1.0%	5.0%	8.0%	0.5%	0.5%	1.0%	1.0%

• Accurate calculation of a road's effect on VOC requires knowledge of the relationship between vehicle performance and road conditions, and a clear assumption about future vehicle-fuel efficiency and performance. The conventional approach to estimate vehicle operating costs (World Bank, Technical Paper 234) uses the "highway design and maintenance standards model" (HDM–VOC) for traffic density above 200 average daily traffic (ADT) as a function of the vehicle characteristics, utilization and unit costs, and road geometry and roughness. The data requirement of this model are, however, extremely expansive and beyond the scope of this study.

The alternative and simplified model, tested for low volume rural roads in Uganda ((Ojukwu, not dated)[12] measures the economic benefits of individual feeder roads by combining VOC, producer travel time cost saving (PTTC) and producer-surplus transportation cost savings (PSTC). This method measures the direct benefits, but not the indirect, value added, benefits from agriculture change; it takes the incremental production as given and only focuses on benefits that accrue outside the direct production line.

Following the Ugandan example, vehicle operation costs are predicted to improve with rehabilitation of roads. To derive the benefits from a reduction in VOC the following assumptions are made:

i. The annual operating days will be 244. This was derived by taking into account the effects of seasonality. Thus, between May to September, traffic flows 6 days/week; and October to April, traffic flow slows down to 4 days/week.
ii. Traffic with-rehabilitation is projected to grow at 2 percent per annum.
iii. Various cost components (operating, spare parts, and maintenance) are derived from the survey and calculated per km for each vehicle type.

The traffic growth rate is imputed for the foreseen increase in traffic due to increased economic activity in the influence zone (induced) thus affecting equally motorized traffic. It is also assumed that the significance of non-motorized transport will decline over time. Fuel, oil and other cost components are derived directly from the survey. Table 4 summarizes these cost components before and after rehabilitation of the roads. The example applies to Kama-Gushta road in Nangarhar province.

• Roads reduce transport cost by improving the competitiveness of markets for freights. Average costs for transporting agriculture products over a one km road for both without and with-rehabilitation is calculated for each transport type adjusted with information obtained from key informants. [13]The actual calculation is however done for each location for the most common transport type used to transport agricultural inputs and outputs. To derive the net gain from reduced transport cost, the difference in per ton-km cost between the treated and controlled villages is calculated for year one. For year two to seven, agriculture is assumed to grow at the rate of 1.5% per annum and the reduction in transport cost is the residual benefit arising from transporting the additional increase of marketed surplus. The net reduction in transport cost, derived by taking the percentage difference between year one and two, is applied for year three through seven. Underlying this is the assumption that per ton-km cost of transportation will remain constant for the whole period.

[12] Chiji Ojukwa *"Economic Analysis and Prioritization of Feeder Road Rehabilitation – the Case of Southwestern Uganda"*, African Development Bank, not dated.
[13] This was done partly because the data generated by the survey was patchy and could not be relied on. The exception is Nangarhar. The rate for the various segments in Nangarhar is derived directly from the traffic survey.

Table 4: Coefficients for Vehicle Operating Expenses

VOC Based on Market Survey						
			After Rehabilitation		**Before Rehabilitation**	
Truck (1)	Fuel	Truck 2-6Mt	15litre/100km	Litre/km	Litre/km	Speed
	Speed	20km/hour	3.00	0.15	0.31	2.40
			$/lire-km	0.092	0.16	
Pickup	Fuel	700kg capacity	12litre/100km			
	Speed	50km/hour	1.71	0.12	0.28	1.457
				0.073	0.14	
Truck (2)	Fuel	8Mt capacity	80litre/210km	0.38	0.57	
	Speed	30km/hour	4.00	0.233	0.291	3.2
Taxi/Car	Fuel		10litre/100km	0.1	0.18	
	Speed	55km/hour	1.33	0.061	0.091	1.20
Minibus	Fuel		15litre/100km	0.15	0.33	
	Speed	35km/hour	2.0	0.092	0.168	1.70
Tractor	Fuel		1litre/3km	0.33	0.52	
	Speed	20km/hour	4	0.204	0.267	3.2
Motorbicycle	Fuel		litre/18km	0.13	0.22	
	Speed	65km/hour	1.33	0.076	0.109	1.20
		After Rehabilitation			**Before Rehabilitation**	
Prices	Fuel	30	Afs/litre		25	Afs/litre
		0.61	$/litre		0.51	$/litre
	Oil					
		Oil and filter changed after every 1500km. The cost of this is Afs 500				
	Taxi/Car	$0.0068				
	Trucks, Tractor	1500 Afs per 1000km			$0.0306	
	Minibus, Light Truck $ Pickup	800 Afs per 1200km			$0.0136	
	Motorbicycle	80Afs per 700km			$0.0023	
Note:	Fuel price excludes normal price increase and tax, estimated to be 10Afs/litre					

- Traffic volumes determine both the number of travelers who will benefit from the rehabilitated roads, the frequency of travels and the extent of savings made by farmers. Unfortunately we have no historical record of traffic flow to project traffic growth. Assuming a 2.5% population growth and a 1.5% growth in agriculture, the traffic response generated for with-rehabilitation is approximated at 2% per annum. Traffic on rehabilitated roads is expected to increase at this modest rate as drivers seek to take advantage of the better driving conditions and as competitive fares and rates attract more movement of goods and people. Drivers who formerly avoided the roads because they were too bad may now start to use them. As the roads remain operational year round, drivers will also access the roads even in the peak of the winter season, adding to the ADT volume. Other drivers may also make longer trips to more remote locations than they did before the rehabilitation.[14]

[14] In more developed economies, local roads are treated as segments of a regional road network and traffic forecasting is appropriately done at a regional level. Data on expected regional traffic growth, based on economic, demographic, and land use trends and projected relationships between these variables are then entered into the region's travel demand model to simulate the regional traffic flow. The data requirement for this kind of analytical sophistication is tremendous, however.

• An important benefit of road rehabilitation is travel time saving to commuters. Travel time is a major component of cost to farmers, which includes time as well loss of output value. Time saving is a function of the predicted increase in traffic volume and its mix. For with-rehabilitation, the time-saving benefit per trip will increase in response to the change in traffic volume. This saving is calculated directly from the reduction in delay based on changes in the volume/capacity ratios caused by the rehabilitation, after allowing for traffic adjustments. Assuming a return trip (road length x 2), time savings are converted to person-days and valued at their opportunity costs favored by the shadow rural wage rate for rural Afghanistan. Eight hours are assumed to constitute a worked day.

• Annual road maintenance costs, which are negligible in the without-project situation, are estimated by RAMP engineer to be US$500 per km, starting with year 2. Turn-round, requiring rehabilitation in year four, is also estimated to be 30% of the capital cost, depending on the condition of the road.

5. Distribution of Benefits

With the assumptions given above, we can calculate the benefits (B) from the rehabilitated roads. These benefits comprise of those accruing to transporters and producers. An equation used by the World Bank[15] specifies this as:

$$B = B_1 + B_2$$

Where

B_1 = benefits accruing to transporters

B_2 = benefits accruing to farmers

The portion of the transport savings accruing to transport operators in the form of higher profits is measured as a function of the ADT by the equation:

$$B_1 = F_2 Q_2 – F_1 Q_1 – (K_2 Q_2 – K_1 Q_1)$$

Where

K_1, K_2 = economic cost (fuel, tyre, oil, etc) of transporting one ton of surplus output without and with rehabilitation, respectively (US$/MT).

Q1 and Q2 = quantity of surplus output transported without and with rehabilitation, respectively (MT)

F_1, F_2 = freight rate of transporting one ton of surplus output without and with rehabilitation, respectively (US$/MT).

Total cost with-rehabilitation is deducted from without-rehabilitation cost to derive the VOC savings/km. This saving is multiplied by the ADT and the total road length to derive the daily VOC savings, which was further multiplied by the annual operating days to derive the annual savings made by transport operators.

Ignoring for the time being the share of consumption and seed, the net incremental gain in output (B_2) to be had in a specific year from rehabilitation of a road in the zone of influence is calculated as:

[15] World Bank (1979) “Identification and Appraisal of Rural Roads Projects”, Staff Working Paper # 362.

$B_2 = (P_1 – P_2) (Y_1 – Y_2)$ Ha

Where

B_2 = Net incremental agriculture output

P_1 and P_2 = Mean price without and with rehabilitation, respectively (US$/Mt)

Y_1 and Y_2 = Mean yield without and with rehabilitation, respectively (Mt/Ha)

Ha = Acreage in the 2km zone of influence

Applying this equation yields the value added from agriculture production for the 2nd year. Research from India suggests that improving access to markets induces a 3% growth in agriculture productivity, and this is realized with a lag of at least two to three years after the completion of the road. It was assumed, rather conservatively, that the RAMP roads will induce an annual increase in agriculture productivity of 1.5% per annum for year two and three and a further 2% for year 4 to 7 (year one impact is determined by the survey data). These growth rates were applied to all roads, except to Alef Berdi road located in Imamsahib district, Kunduz province. This road connects a large number of isolated villages and given a timely and appropriate maintenance, the road will induce more intensification of production in the zone of influence. The annual growth rate for Alef Berdi road is thus assumed to be 2% for year two and three and 3% for year four to seven.

Assuming a competitive transport sector, part of the savings transporters make is passed on to farmers transporting inputs and outputs from markets and farms by way of reduced transport cost. To determine savings farmers make we need first to deduct the quantity of output allocated for consumption and seed. The difference is net surplus transported to markets. On-farm consumption is determined by the equation:

$C_t = P_1 (H_1 – H_2) – ½ (H_1 – H_2) (P_2 – P_1)$

Where

C_t = on-farm consumption (US$)

H_1, H_2 = food and seed consumed without and with rehabilitation, respectively (Mt)

P_1, P_2 = farmgate price of a specific agricultural product consumed without and with rehabilitation, respectively (US$/Mt)

The second term is not computed, since its value is negligible. The rest of the calculation involves determination of (a) population in the zone of influence during year Y of the with-project situation; and (b) elasticity of local per capita consumption of product C starting in year 1 (kg/capita/annum). Per capita consumption estimates were taken from FAO documents for staples and from RAMP cost of production manual. Elasticities for other crops are estimates given by RAMP agriculture specialists (see table 2). Assuming the area cropped with a particular crop remains constant over time, the seed required (kg/ha) is simply a function of the proportion of area cropped with that crop.

Farmers' transport cost saving (cost savings on existing and generated traffic), less on-farm consumption, was determined from the following equation:

$U_t = (P_1 – P_2) Q_1 + ½ (P_1 – P_2) (Q_2 – Q_2)$

Where

U_t = Producers' annual transport cost savings (freight)

P_1, P_2 = Weighted average transport cost without and with rehabilitation, respectively (US$/Mt-KM)

Q_1, Q_2 = Volume of surplus crop marketed without and with rehabilitation, respectively (Mt-KM)

Given that the rehabilitation of the roads is predicted to increase the volume and mix of traffic, the increase in traffic can be expected to impact competition and reduce transport cost. The benefit of this to road users is reflected in reduced fares. This benefit in reduced fares is estimated from the equation:

$$U_t = ½ (Q_e + Q_d) (C_e – C_d)$$

Where:

U_t = Producers' transport cost savings (fares)

Q_1, Q_2 = Annual trips without and with road rehabilitation, respectively (total trips/year)

C_1, C_2 = Passenger transport fare without and with road rehabilitation, respectively (passenger fare/passenger-km)

Applying the above equation for normal and generated traffic where the latter is assigned one-half of normal traffic benefits gives the annual passenger user cost savings. For year one the benefit is derived directly from the farmer survey in which the difference in fares between the treated and controlled villages is attributed to the impact of the roads. It is assumed however that from year two on wards, passenger fares will not go up by more than the cost of fuel and incidental expenses to operate vehicles. Thus, by holding fares constant and assuming an annual growth in trips of 5%, the road user benefits are derived for year two to seven.[16]

Benefits from reduction in spoilage loss are simply a function of the volume of net surplus available for marketing and a measure of the efficiency with which the transport system functions. The net marketed surplus is the value added gain in output less local outlays (consumption and seed). In equation form, the benefits from reductions in spoilage are estimated:

$$U_t = ½ (C_1 \text{ x } S_1 \text{ x } P_1) – (C_2 \text{ x } S_2 \text{ x } P_2)$$

Where

U_t = Net producer savings marketed with rehabilitation (US$/Mt/Crop)

C, S, P refer to, respectively, crop spoilage loss, crop surplus sold, and mean farmgate price with subscripts 1 and 2 denoting without and with-road rehabilitation situations.

A critical aspect of the evaluation also involves computing the impact of the roads on productive time saved, including time associated with non-motorized travel and the transit time freight. Recent studies from Bangladesh, Ghana, and Tanzania indicate that where transport is not efficient, journey to markets is extremely cumbersome and takes any thing up to two or three times longer time than otherwise, and therefore the time "wasted" should be given a monetary value. The average base travel time saving values for rural travelers in these countries were: Taka 3.50 per hour (US$ 0.06) for Bangladesh, Cedi 1,627 per hour (US$ 0.18) for Ghana and TZS 195 per hour (US$ 0.18) for Tanzania. These base values were

[16] To illustrate, consider Darqad road in Baghlan province. The number of trips per adult/household with and without rehabilitation is, respectively, 50 and 41 per annum. Both these values are derived from the survey. Assuming a 5% annual growth in trips, the average number of trips per adult in year two would be 52, further increasing to 55 in year 3. By year 7, it will have reached 67 trips. By applying the equation, the first year generated passenger user cost saving would be US$2,751.5 which will grow to US$3,269.3 in year 3, and so on.

51%, 64% and 49% respectively of the rural wage rate in study areas of Bangladesh, Ghana and Tanzania.[17]

To measure the benefits from a reduction in travel time we first derive the net gain in terms of the number of trips made by farmers outside the villages. This is derived from the survey of farmers in the treated and control villages. Having adjusted for seasonality and assuming one adult/household travels to markets, the total number of trips is calculated for each road without and with rehabilitation. The estimate is that a household makes 30 to 45 trips per annum without rehabilitation, depending on the road. This trip frequency is low and is, of course, due to the high cost of transportation. With rehabilitation of the roads, the number of trips is expected to increase by at lest 5% per annum because of more vehicles on the roads and a reduction in passenger fares. To derive farmers' travel time savings, we estimate the opportunity cost of productive time from the following equation:

$$U_t = Q_2\,[(T_1 - T_2)/\,Y_a\,]W_g$$

Where

U_t = Producer time savings
T_1= Weighted average time by vehicle type without rehabilitation (minute/km)
T_2 = Weighted average time by vehicle type with rehabilitation (minute/km)
Y_a = Weighted annual vehicle operating time (days)
W_g = Daily rural wage rate in Afghanistan (opportunity cost, excluding the poppy locations) (US$/day)
Q_2 = Volume of passenger movement with rehabilitation (passenger-km)

T in minute is converted to hours and then to days and multiplied by US$ 4/day – the average daily wage rate in rural Afghanistan – to derive the opportunity cost of time foregone.

IV. RESULTS

The key effects of the rehabilitated roads are found in three main areas: in transport, agriculture and marketing. In transport, improved roads mean less time to reach markets and services, reduced transport costs (fares and freight charges), increased quality and frequency of services, and reduced vehicle operation costs. In agriculture, they mean increased overall levels of agricultural activities, and, overtime, a possible land-use shift by farmers from low-value cereals toward higher-value vegetables and fruits. In marketing, improved roads mean increased marketable surplus, reduction in post-harvest loss and better farmgate prices to farmers. These benefits are measured for each road. The layout of the analysis is presented in a series of spreadsheets for each road annexed to the report (Annex 3).

The more striking impacts achieved, derived from the first category of roads (i.e. roads completed over a year ago) are summarized and described first. This will be followed by valuation of the benefits, aggregated by six key impact categories: savings in VOC, travel time, fares, freight rates, reduction in spoilage loss, and value added from agriculture production.

[17] DFID (2005) "Valuation of Travel Time Savings: Empirical Studies in Bangladesh, Ghana and Tanzania and a Practical Model for Developing Countries" A Brief from I.T. Transport Ltd.

1. Direct Benefits

1.1 Traffic Analysis: Transport Modes, Volume, and Competition

All the roads are improved from their originally deteriorated condition. In some cases this improvement was quite significant involving major structure works. Annex 3-A through to Annex 3-E depicts the average daily traffic and its mix and the changes overtime in the traffic volume and the economic benefits that accrue to farmers. Relevant explanatory notes are given in Darqad road. The majority of the traffic consists of motorized transport, comprising of taxis and minibuses for people, and pickups and small trucks for commercial purposes. It is worth stating that transport in some locations comprises of poorly maintained old and inefficient vehicles that drive up vehicle operators' costs.

Analysis of the traffic data suggests that the difference in the mix and volume of traffic between normal and market days is quite significant for all roads. Traffic on a market day is at least twice more than in a normal day.

Patterns of transport demand and supply are linked to population density and agricultural activities of the area. High transport density is associated with medium to high population density, irrigated agriculture, cash crops and access to markets. In such areas transport services have achieved a critical mass, making it easy to operate various modes of transport and the rates are quite competitive. This is the case with segments 1 to 6 in Nangarhar, Alef Berdi in Kunduz, and Darqad and Jue Naw roads in Baghlan where the average area/household is more than 3ha and agricultural activities are more intensive and, consequently, taxis and trucks shuttle between villages and markets quite frequently. This compares with low traffic intensity for all the three roads in Parwa which also has a low area/household ratio. Locations that have low agricultural surplus also experience low transport density. The ADT for these areas is relatively low and the mix of vehicles favours more public transport rather than freight. Examples are Sinjid Dara in Parwan, Mangala in Baghlan, and most of the roads in Balkh. The latter has a high average area per household, but the aggregate output is significantly less compared to say Darqad. Here, taxis and minibuses account for a bigger share of the total motorized vehicle compared to trucks and pickups in high productive locations. A vicious circle develops in which inefficient transport, fewer users, and services impede development. The high traffic density on certain transit roads like Kama-Gushta in Nangarhar gives a wrong impression. This is an alternative to Tourkum road for traffic shuttling between Afghanistan and Pakistan, and because of this the volume of traffic on this road tends to be significantly high. Otherwise, the Kam-Gushta road serves a low agriculture environment and the net ADT on this road is substantially lower than most other roads rehabilitated in the province.

1.2 Changes in Vehicle Operation Cost

Perhaps one of the more significant gains of the rehabilitated roads is that the cost of operating vehicles has dropped, leading to lower prices for freight and passenger services than before the improvement. On high traffic density roads like highways, operating costs are affected by speed, traffic volume and the condition of roads. In the case of the RAMP roads, vehicle operating costs are due largely to the quality of the roads that affect fuel consumption, wear and tear, and the demand for services. Survey data indicated that the rehabilitated roads have significantly reduced VOCs, largely through a reduction in maintenance costs. Across all the roads, operators now spend less money on maintenance of their vehicles, and are losing fewer days a month when their vehicles are being repaired. For example, for a truckload (6mt capacity) of merchandise between two population centers, the cost went down from US$0.225/km before the project to US$0.0.189/km after the road was rehabilitated. This reduction was possible because of the improved condition of the roads, which resulted in lower vehicle operating costs.

1.3 Changes in transport cost (fares and rates)

Part of the gain transport operators make from reduced operating costs is passed on to farmers. Transport cost for transporting inputs and outputs between markets and villages has fallen, on average, by about 10% after rehabilitation of the roads. It now ranges from US$0.66/ton/km in Darqad to US$0.36/ton/km Segment 1 in Nangarhar province. This fall in freight rate is due to the intensity of competition that is developing along the roads. It is also fueled by larger surplus being marketed from the locations. By contrast, little competition is developing on Mangalah road in Baghlan and Koli Ambo road in Balkh, and a few other roads due to lack of demand caused by low marketable surplus.

It would also seem that competition is affected by distance to markets. In the case of roads close to markets, the benefits are much clearer. The improved road surface has attracted more service providers to the routes (i.e. no entry barrier) and more competition and a variety of available transport services has resulted. Transport operators no longer charge exuberant rates and fares, and also do not demand that vehicles must be full (that is, all seats are taken or paid for) before they drive to the villages. Transport operators shuttle between villages and market centres, sometimes with minimum number of passengers. They make more trips a day because of the better surface and charge the “normal” rate per person and load. This is particularly the case with roads located in close proximity to provincial market centers.

Conversely, the longer the distance to markets, competition is weak and fares and rates are somewhat higher. Transport operators demand that vehicle users either team up with other passengers and rent a vehicle on a contract basis or pay individually the full rate, which includes a margin to cover their cost when they returnin case they don’t get enough number of passengers and loads. Alef Berdi in Kunduz, and Mangalah in Baghlan are examples. Although the frequency of transport services has increased on these roads, transport rates and fares have not fallen much. It is unlikely that the Manglaha road will be attractive to most transport operators in the short term. There does not appear to be the critical mass of demand for services driven by agriculture potential of the area. Transport operators almost universally gravitate toward areas with better roads and larger market.

1.4 Changes in transport efficiency (travel time)

Travel time associated with a market trip is valued at the average traveler’s wage plus overhead - representing the cost to the traveler. Analysis of travel time by different modes of transport reveals that the value of reduced time accounts for a larger share of the benefits of the rehabilitated roads. Depending on the condition of the roads before the rehabilitation, passengers have gained 0.51minute/km by taxi/car to 1.14 minute/km by truck. Substantial gains of up to 5minutes/km are also made by animal cart. The average gain for motorised transported is 0.75 minutes/km, which is in the range of 20% of that incurred before the rehabilitation. This saving in time is made due to faster travel and easier access of vehicles.

2. Indirect Benefits

2.1 Changes in output (value added)

The roads have a high potential to induce agriculture change through supply side effects. Data from the roads completed over a year ago indicate that the overall level of agriculture activity has increased in volume of production, productivity of the land, and monetary values of the output. The spatial position appears to have a bearing on agriculture activities. Holding some critical variables constant (such as population density, resource endowments, etc.), we note that access to markets (i.e. all season roads) explains the difference in crop productivity between the treated and control villages. Where communities are far from district and provincial marketing centers, the dynamism of this change is lessened considerably. Impact appears to be of a higher order in locations closer to cities and market centers, or where the density of population and settlements is higher, than in areas that area farthest.

Farmers crop selection strategy reflects more of a pre-occupation with subsistence first strategy and in some cases an adaptation to remoteness from markets (distance factor), exemplified by the emphasis on low-value crops and away from transport intensive perishable crops, like vegetables and fruits. Access to roads implies advantages in accessing information, markets for inputs as well as factors of production and technology. In some locations, relatively more land is planted with vegetables. In some Segments in Nangarhar, new saplings are being developed.[18] Although the data are patchy to draw a firm conclusion about area allocation, the indication is that the transformation of the agricultural economy may, in time, follow the Von Thunen model in which improved accessibility will induce a shift from subsistence to cash crops or from low value grains to vegetables and fruits yielding higher profits but whose perishability requires reliable and speedy transport. This shift to higher-value products, combined with the adoption of improved technology (assuming it is feasible and available) will ultimately raise the value added from agriculture production in Afghanistan.

2.2 Changes in marketing loss

Agriculture output, especially fruit and vegetables, are transported to village markets using non-motorised transport, while to district and provincial market centers the common mode is motorised transport. In some cases traders venture to villages and purchase products (mainly fruit) and transport them to markets. This is particularly the case with interlinked transaction, involving the marketing of fresh fruit in which traders advance money to farmers before it was harvested.

Losses associated with transporting to markets are substantial, especially for fruit and vegetables. The damage and losses incurred are caused primarily by exposure to sun, dust and rain, poor packaging and inappropriate loading and unloading practices. With rehabilitation, the haulage of produce is quick and efficient such that the loss has been cut somewhat (see Table 3).

[18] In segment 1, 3 and 5, 37ha land has been planted with plum, apricot, apple, grape and pomegranate.

3. Aggregating Benefits

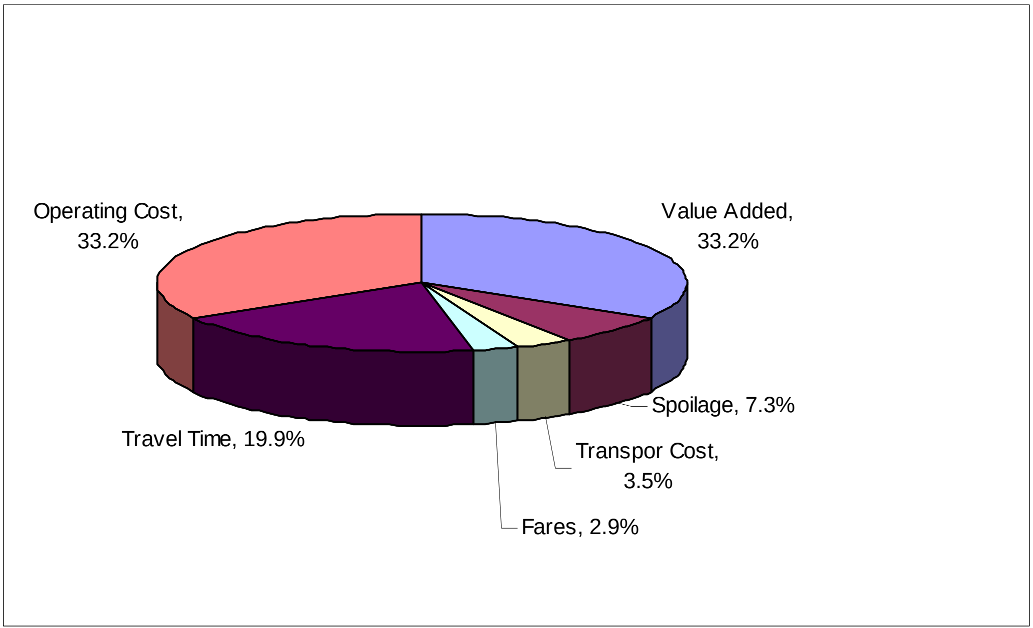
By aggregating the direct and indirect benefits, the net incremental benefits were estimated for each road. These benefits are summarized in Table 5. Figure 4 depicts the breakdown of impact by category.

The passenger benefits from normal and generated traffic is 2.9% of the total impact. The comparable figures for freight and travel time savings are, respectively, 3.5% and 19.9% of the total benefit. A major saving was also made from reduction in vehicle operation cost to transport operators. It accounts for 33% of the total impact value. This value was in fact much higher had it not been shared with farmers by way of reduced fares and rates. The benefit in terms of increased agriculture production is 33% while saving from reduction in spoilage loss is estimated just over 7% of the total impact. When aggregated, these six streams of benefits generated a net incremental benefit of US$28.6M with a return on investment ratio of 3:1. This benefit is produced in the first three years, with one year lag after rehabilitation.

Table 5: Contribution to Benefits

	ROAD	VALUE ADDED AGRICULTURE PRODUCTION	REDUCED SPOILAGE SAVINGS	PRODUCER SURPLUS TRANSPORT COST SAVINGS	PASSENGER USER COST SAVINGS (fares)	TRAVEL TIME COST SAVINGS (opportunity cost)	NET VEHICLE OPERATING COST SAVINGS	TOTAL US$	LENGTH (Km)	BENEFIT/KM (US$)
	Aaq Masjid Road	132,256.3	19,608.5	5,145.3	28,332.4	106,479.7	221,319.2	513,141.4	10.80	47,513.09
	Alef Berdi	65,354.6	27,457.0	26,743.0	29,749.3	617,624.4	1,526,126.0	2,293,054.2	23.40	97,993.77
	Canal	86,430.7	59,331.0	3,067.4	9,605.7	16,708.8	46,232.7	221,376.2	11.80	18,760.69
	Chimtal	819,272.9	61,696.2	47,761.8	5,483.3	140,143.5	313,467.7	1,387,825.3	16.00	86,739.08
	Darqad	475,328.2	101,825.1	23,103.8	9,134.4	24,886.7	19,937.5	654,215.7	7.80	83,873.80
	Deragai	119,432.6	23,219.2	10,849.6	1,336.7	63,294.5	127,424.8	345,557.4	12.00	28,796.45
	Dih Qazi	75,761.9	41,554.3	10,272.4	1,048.2	119,209.0	248,731.8	496,577.6	7.00	70,939.66
	Ismail Qishlaq	51,914.4	9,982.1	730.3	2,486.8	85,987.1	173,815.7	324,916.4	4.00	81,229.09
	Jangal Bashi	606,467.8	70,742.5	28,896.2	36,933.0	62,418.3	70,564.7	876,022.5	12.60	69,525.59
	Jue Naw	422,095.0	91,698.5	24,126.9	14,651.8	197,552.7	302,278.6	1,052,403.5	12.20	86,262.58
	Kama-Gushta	526,881.2	84,187.9	39,976.5	44,743.3	116,942.9	173,711.4	986,443.2	20.00	49,322.16
	Khone Balkh	156,173.1	32,177.4	6,679.2	785.2	38,098.3	83,184.6	317,097.8	8.30	37,749.73
	Kol-i-Ambo	18,653.5	3,404.9	2,779.8	10,572.5	158,703.5	1,956.0	196,070.2	26.00	7,541.16
	Langar Khana	5,691.4	1,888.4	905.6	2,861.1	199,256.0	460,384.2	670,986.7	18.00	37,277.04
	Mainshah	81,876.7	57,744.3	11,795.4	4,280.0	47,303.2	125,442.6	328,442.4	9.60	34,212.75
	Mangalah	13,776.6	45,411.6	10,185.4	17,382.6	76,327.0	164,068.8	327,152.0	14.90	21,956.51
	Sinjid Dara	8,895.2	7,698.4	252.9	378.0	15,010.0	39,522.6	71,757.2	4.20	17,085.05
	Tarnab Boin	162,078.8	28,930.5	9,500.4	4,920.7	84,878.5	153,310.6	443,619.4	11.50	38,575.60
	Yangi Arigh	32,483.1	9,511.8	1,897.6	846.3	129,283.2	286,159.3	460,181.3	9.50	48,440.13
	Segment 1, Nangarhar	158,641.3	31,026.3	9,182.4	1,682.5	141,565.6	242,812.9	584,911.0	7.80	74,988.59
	Segment 2, Nangarhar	65,052.0	15,405.3	5,760.2	2,034.0	126,717.7	227,314.7	442,283.9	24.10	18,352.03
	Segment 3, Nangarhar	708,199.8	206,667.0	80,426.8	40,912.7	828,040.5	1,372,996.8	3,237,243.6	43.00	75,284.74
	Segment 4, Nangarhar	433,156.2	44,717.3	52,213.2	42,717.7	576,999.0	893,432.4	2,043,235.7	37.70	54,197.23
	Segment 5, Nangarhar	88,798.8	159,902.2	6,409.1	9,815.6	327,998.2	473,075.7	1,065,999.6	9.30	114,623.61
	Segment 6, Nangarhar	436,685.1	104,302.6	42,134.7	5,012.2	193,241.1	242,123.9	1,023,499.7	12.40	82,540.30
A.	**Sub-total**	**5,751,357.0**	**1,340,090.4**	**460,796.0**	**327,705.8**	**4,494,669.3**	**7,989,395.1**	**20,364,013.6**	**373.90**	**54,449.23**
B.	**Estimated Impact**									
	Sayed Ahmad Shah Road, Kunduz	218,533.9	112,813.0	89,487.2	93,915.6	304,439.0	144,562.7	963,751.4	17.7	54,449.2
	Jaghuri Malistan Road, Ghazni	1,398,110.6	296,065.8	186,005.6	197,872.1	377,606.4	539,047.4	2,994,707.9	55.0	54,449.2
	Qasemi Lala Road, Kunduz	211,067.3	28,860.4	14,627.9	17,361.4	26,029.2	94,088.3	392,034.5	7.2	54,449.2
	Kod Barq Road, Balkh	1,229,433.4	173,395.3	153,971.2	95,036.4	282,748.4	341,393.3	2,275,978.0	41.8	54,449.2
	Merai Access Road, Ghazni	618,454.7	130,964.8	82,279.6	87,528.8	167,034.3	362,087.4	1,448,349.6	26.6	54,449.2
	20meter Agkheil Bridge, Wardak	60,874.0	12,890.8	8,098.7	8,615.4	16,441.1	13,080.0	120,000.0		
	Sub-total	**3,736,473.9**	**754,990.0**	**534,470.3**	**500,329.7**	**1,174,298.5**	**1,494,259.1**	**8,194,821.4**	**148.3**	**55,258.4**
A+B	**Grand Total US$**	**9,487,830.9**	**2,095,080.4**	**995,266.3**	**828,035.5**	**5,668,967.7**	**9,483,654.3**	**28,558,835.0**	**522.2**	**109,707.6**
	Share of Benefits	**33.2%**	**7.3%**	**3.5%**	**2.9%**	**19.9%**	**33.2%**			

Figure 4: Breakdown of Impact by Category



Efficiency tests show (Table 5) that all the roads have a high and positive internal rate of return and NPVs. The B/C ratios are also high enough to justify the investments. Some roads generate exceptionally high benefits; other relatively less. In four cases, however, the NPV and IRR values are negative, mainly because of the high turn round cost for rehabilitation and maintenance in year 4.

Table 6 Efficiency Test for Roads

Province	Road Segment	District	Implementing Partner	Length (km.)	Claimed Benefit for the 1st 3 Years, US$	Total Benefit Over 7 Years, US$	Efficiency Test for 3 Years		
							NPV (US$M)	IRR (%)	B/C (US$)
Baghlan	Jue Naw	Pul-e-Kumri	DAI	12.2	1,052,403.5	2,586,915.4	592,037.7	2.0	5.2
	Darqad	Pul-e-Kumri	DAI	7.8	654,215.7	1,622,682.8	365,184.0	1.9	5.1
	Mangalha	Pul-e-Kumri	DAI	14.9	327,152.0	809,793.8	39,325.5	0.2	1.3
Kunduz	Tarnab - Boin road	Khan Abad	KRA	11.5	443,619.4	1,110,503.7	190,192.4	1.0	2.7
	Jangal Bashi	Khan Abad	KRA	12.6	876,022.5	2,183,240.0	474,187.5	1.7	4.5
	Ismail Qishlaq	Imam Sahib	PRB	4.0	324,916.4	780,142.7	(48,846.3)	0.0	0.7
	Aaq Masjid	Imam Sahib	PRB	10.8	513,141.4	1,243,947.5	225,343.3	1.2	2.7
	Alif Berdi	Imam Sahib	PRB	23.4	2,293,054.2	5,541,747.9	1,315,177.0	2.6	5.5
Parwan	Sinjid Dara	Charikar	ACTED	4.2	71,757.2	171,863.8	(11,243.0)	0.0	0.7
	Canal	Charikar	ACTED	11.8	221,376.2	542,542.4	13,609.4	0.2	1.0
	Main Shakh	Charikar	ACTED	9.6	328,442.4	800,645.2	90,855.6	0.6	1.6
Balkh	Sarake Kohne Balkh	Dehdadi	AREA	8.3	317,097.8	757,402.1	112,343.5	0.8	2.0
	Kol-i-Ambo (Daggo)	Balkh	AREA	26.0	196,070.2	487,533.7	(212,546.3)	-0.3	0.4
	Dehbabi/Deragai	Balkh	AREA	12.0	345,557.4	824,458.3	76,006.5	0.5	1.4
	Chimtal	Chimtal	AREA	16.0	1,387,825.3	3,322,380.7	735,925.1	1.9	4.1
	Deh Qazi	Balkh	AREA	7.0	496,577.6	1,204,280.4	254,714.1	1.7	3.7
	Langarkhana	Nahari-Shahee	AREA	18.0	670,986.7	1,600,496.8	195,967.0	0.6	1.7
	Yangi - Arigh	Charbulak	AREA	9.5	460,181.3	1,102,186.1	186,540.3	1.0	2.3
Nangarhar	Kama - Ghosta	Kama	Relief International/HADF	20.0	986,443.2	2,388,776.1	478,476.8	1.5	3.2
	Segment 1	Sherzad	AACC	7.8	584,911.0	1,449,877.5	266,285.8	1.2	2.9
	Segment 2	Chaparhar	ABR	24.1	442,283.9	1,056,601.9	(204,178.0)	-0.3	0.5
	Segment 3	Shinwar	RSSA/Others	43.0	3,237,243.6	7,785,716.5	1,504,477.8	1.3	3.0
	Segment 4	Kama	HADF	37.7	2,043,235.7	4,897,187.3	840,327.9	1.0	2.4
	Segment 5	Rodat	DCG	9.3	1,066,000.2	2,241,890.9	585,625.1	2.1	4.6
	Segment 6	Khogyani	AACC	12.4	1,023,499.7	2,643,153.0	456,499.7	1.2	2.8
Ghazni	Merai Access Road	Qarabagh	GRSP	26.6	1,448,349.6	N/A	N/A	N/A	N/A
	Jaghuri Malistan	Jaghuri/Malistan	GRSP	55.0	2,994,707.9	N/A	N/A	N/A	N/A
Kunduz	Sayed Ahamad Shah Road	Imam Sahib	PRB	17.7	963,751.4	N/A	N/A	N/A	N/A
	Qasemi Lala Road, Kunduz	Aliabad	KRA	7.2	392,034.5	N/A	N/A	N/A	N/A
Balkh	Kod Barq Road, Balkh	Sholgara	PRB/KRA	41.8	2,275,978.0	N/A	N/A	N/A	N/A
Wardak	20 meters Agakhel Bridge, Jaghato Rashidan road	Hazarajat	AREA	0.0	120,000.0	N/A	N/A	N/A	N/A
	Total			**522.2**	**28,558,835.59**				
	N/A = basline data not available. Impact is estimated								

V. CONCLUSION AND SOME REFLECTION

1. Summary of Impacts

The rehabilitation of earth roads to all-weather feeder roads of maintainable standard has generally established effective communication between agriculturally productive areas and markets. In some cases the roads have improved access to people that are otherwise isolated and poorly serviced. The roads have reduced transport cost and increased the number of trips farmers make to markets. More vehicles shuttle between villages and markets. The return on investment is high, in most cases. There are no studies on the impact of road investments in Afghanistan to compare the benefits measured by this assessment. However, the estimated benefits are extremely conservative when compared to benefits derived from similar village-to-market roads in other developing countries. The average net benefit is US$55,258/km against a rehabilitation cost of US$17,433/km (see Table 5). The study thus attests to the fact that the projects were fully justified.

The study has also compared the general socio-economic wellbeing and development of the respective communities. These include a) purpose of travel outside the villages, frequency of travel and average travel time; b) frequency of buyers entering villages; c) access to services (e.g. crop processing, shops and chemists); d) livelihood opportunities outside the villages which may be attributed to roads; e) indirect impacts of roads on the general level of economic development (e.g. development of small businesses); f) commercialization of rural land, etc. These changes are not quantified due to lack of time.

Observations during the survey and PRA interactions with local informants indicate that the roads have improved access to people traveling to district agriculture departments and medical centers. Farmers are able to procure farm inputs with great ease from nearby cities. Local shops are fully stocked with merchandise items and prices are reasonable. A number of new economic initiatives have also sprung in some locations, like mills and workshops. Although it is difficult to attribute these developments entirely to the rehabilitation of roads, it is quite clear that the roads have provided the impetus for increased agricultural output and incomes.

Some observation about the roads is in order. First, the predicted impact in agricultural change is, in few cases, less than expectation. There are many reasons for this. One is that some roads are located in areas where the cropping pattern is dominated by subsistence crops. This is particularly the case for the roads in Balkh. There are nine road segments rehabilitated in Balkh province. These roads have a combined length of 150km and service farmers growing mostly traditional food crops of wheat, rice and beans. The only cash crop grown is melon but again this crop is planted almost everywhere. This is also the case in Kunduz and Nangarhar provinces.

Another reason is that there are no obvious linkage between the rehabilitation of village to market roads and the kind of crops that should be promoted by RAMP. Opportunities however exist to identify and promote certain high valued crops that were not initially included in the RAMP commodities list. The two most important crops in this regard are sesame and flax. These crops are planted in large area in Kunduz and in some locations in Balkh. A preliminary assessment of the cost of production indicates that even using traditional techniques of oil extraction these crops can generate higher return per unit land than any of the summer crops planted by farmers. Given appropriate technology and marketing infrastructure these oil seeds can drastically transform the agrarian scene in these provinces.

In other cases, roads are located in areas that have low agriculture potential. An example is a 15km Mangala road in Baghlan province. This road links sparsely populated villages that are mostly inhabited by new arrivals i.e. ex-refugees and IDPs with the Pulikumri – Mazar highway. Inevitably, the people along the 2km catchment area are poor; they occupy marginal lands that have no irrigation water and have therefore little in terms of surplus to sell even in the village market. Therefore, linking these people with Pulikhumri-Mazar highway has no obvious economic benefit as far as RAMP's strategic objective is concerned. The nearest high potential villages are at least 3km off the road and farmers in these locations use segments of Jue-Naw and Darqad roads to get to Pulikhumri market.

A related case is the Kolo-i-Ambo road in Balkh district. The total length of this road is 26km, and in much of the area is sparsely populated. Moreover, the road is not used by the population throughout the year. It is frequented in the winter when the alternative road corridor is closed. But in the winter, there is hardly any agricultural marketing activity, and traveling frequency is low and if people travel it is for social related matters. As a result the impact of this road was not high enough.

It is also worth mentioning that some of the roads are just segments which do not link the communities with markets. Certain discrete operations are carried out on most critical locations, like construction of washes and culverts. But this is not a substitute to rehabilitating the entire road length to connect all the communities with other roads that are in good condition, especially with primary roads that link villages with big markets and cities. This case was observed in some locations in Nangarhar. Road connectivity is essential to bring materials and agricultural inputs at affordable prices, and to enable farmers to sell their products in big markets at competitive prices. It is recommended that in future roads should be examined, and if necessary, financed as a whole, without being portioned into segments. Alternatively, the appraisal process of job orders should seek for justification of part rehabilitation of roads before sub-contracting projects.

A cursory look at the various activities supported by RAMP indicates that sector activities are not well integrated. Roads should in future be accompanied by parallel measures like irrigation in order to contribute effectively to development. Roads contribute only indirectly to agricultural change. In themselves, roads have only a marginal multiplier effect, as they do not contribute significantly either towards increasing farm output, the transfer of technology or job creation. Roads act as catalysts in promoting development, and their impact can be significant if accompanied with other sectoral initiatives designed to boost production and marketing activities. The selection of roads for rehabilitation should in future be taken up within a framework of an integrated sector strategy for intervention. A necessary condition for this would be to formalize coordination in Kabul between sector interventions (vis-à-vis identification, design) and implementation in the field.

Sustainability of the roads is critical for the stream of benefits to continue flowing as predicted. The practice so far is that local elders and government officials attending dedication ceremonies pledge their commitment to maintain the roads, but this pledge has not been formalized and institutionalized. Hence, the roads lack formal ownership, and in the absence of institutions to manage them they may fall apart much earlier than their expected lifespan. Examples abound from elsewhere in the Third World in which communities manage small-scale rural infrastructure projects sustainably by developing appropriate institutions, and there is no reason why these approaches shouldn't be adapted to the Afghanistan situation.

2. Practical Difficulties Encountered

A major difficulty of the assessment has been lack of baseline data. Monitoring components built into project design were limited to just assessing the physical completion of projects rather than tracking changes on beneficiary communities. Key indicators imputed in the job orders were, in most cases, overestimated.

Another problem was finding good control villages against which to compare project impacts. In some project locations in Balkh for example, there were very few villages that could be described as lacking completely any form of road access. In other cases the control villages did not have a sufficient population and their agriculture resources were somewhat dissimilar from the treated villages. Again in the case of Balkh and in some cases in Nangarhar and Baghlan too, it was difficult to locate control villages within a reasonable distance beyond the 2km impact zone. A lot of effort had gone into finding appropriate villages that did not compromise the results of the assessment.

Operationalising the survey proved very demanding. Extension workers recruited to implement the survey required substantial training and intensive supervision in the field to ensure data quality. Data anomaly was noted for the traffic survey in Kunduz, supposedly to be the easiest in terms of data collection, and the survey there had to be done again.

Despite the fact that major challenges had risen in undertaking this evaluation work, it is hoped that the approach pursued has produced adequately robust and useful results. As such, the impacts are defensible.

Annexes

Annex 1 = Maps indicating survey locations

Annex 2 = Agriculture land within 2km impact zone

Annex 3A – 3E contains the following information for each road

- Annex 3A = Valued added agriculture production
- Annex 3B = Fares
- Annex 3C = Vehicle operating cost
- Annex 3D = Travel time savings
- Annex 3E = Efficiency test