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**CONSTRUCTION OF LOW COST ROADS  
(FINAL EVALUATION REPORT)**

**NTRC-213**

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**February, 2000**

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## **EXECUTIVE SUMMARY**

The National Transport Research Centre (NTRC) undertook the construction of Low Cost Roads as a Demonstration Project during 1987 - 1990 to introduce the concept of earth/gravel roads as an economical (low cost) solution for the low traffic volume roads in rural environment.

Six roads were constructed near Islamabad and in different parts of the Punjab province. Performance monitoring of these roads was carried out regularly. Surface condition parameters such as rutting, gravel loss, potholes and depression were monitored. Surface roughness was also measured using vehicle mounted Bump Integrator (B.I.) . First report containing construction specifications, cost per kilometer and surface condition was published in June, 1991. An other detailed evaluation was carried out in June - July, 1996 and the report was published in August, 1996. Now over ten years have passed since construction of these roads, final evaluation has been made. The salient feature of the final evaluation are as under:-

- i) The first low cost road namely Sharifabad-Tarlai was sealed out in 1991 under the Social Action Program of the Government. Similarly, the Dhuni Village (Distt. Hafizabad) was surface treated in 1993 under a similar program and both roads providing satisfactory service to the users.
- ii) The Kamra link of Dheri Malhu is sealed out whereas the Godo link is still unsealed. The visual condition of the road revealed

that there are too many cuts and crossing of drains, big humps and big potholes leaving the road surface in a very distressed condition and almost impassable.

- iii) The Dorro Road is partially sealed under the Tameer-a-Watan program by the local MNA. The sealed surface portion is quite satisfactory but the unsealed portion is in very shabby condition. There is complete gravel loss, big depressions with standing rain water have made the road not fit for village traffic.
- iv) The complete length of Humak-Jawa Road is still unsealed. A part of the road being used by industrial traffic is in very poor condition, however, a small portion adjacent to village Jawa has some gravel and relatively passable.
- v) The Sheikh Qureshian Road (Distt. Jhelum) is still unsealed but its condition is also very poor. A part of road near Sheikh Qureshian about 120 ft. has been ploughed by the local farmers due to land dispute and there existed no road. The gravel on this road was completely lost.
- vi) The Bump Integrator survey for roughness measurements could not be carried out as it was not possible at any unsealed section of the roads to maintain the constant speed of 32 kph (20 mph) by the BI vehicle.

## **1 : Introduction**

The construction of Low Cost Roads was taken up as a Demonstration Project by the National Transport Research Centre (NTRC) during 1987 to 1990, to introduce the concept of Low Cost Roads as an economical solution for the construction of low volume roads and to serve as an all weather access link to rural population.

## **2 : Construction Specification of Low Cost Roads**

A total of six low cost roads were constructed during the years 1987 to 1990 well spread in different parts of the Punjab province with the following specifications:

i) Tarlai - Sharifabad (Distt Islamabad in January, 1987)

Total Length = 1.13 km  
Width = 10 ft  
Design = 1" & down, 5" thick Nallah Bed Material

ii) Jumak - Jawa Road (Distt. Islamabad in April, 1987)

Total Length = 0.694 km  
Width = 10 ft  
Design = 3/4" sized crushed stone 5" thick.  
Khaka spread to fill the voids

iii) Dheri Mallhu Road (Distt. Attock in June, 1988 - Goddo Link)

Total Length = 0.674 km  
Width = 10 ft

- Design = 3/16" to 3/4" sized crushed stone  
6" thick laid over sand cushion.  
Khaka on the surface to fill the  
voids
- iv) Dorro Road (Distt. Islamabad in September, 1990)
- Total Length = 1.702 km  
Width = 10 ft  
Design = 3/16" to 1" sized crushed stone 6"  
thick laid over existing sub-grade.
- v) Sheikh Qureshian Road (Distt. Jhelum in 1991)
- Total Length = 1.722 km  
Width = 10 ft  
Design = 3/4" sized crushed stone 6" thick  
laid over 3" sand cushion with  
khaka on the surface to fill the  
voids
- vi) Dhuni Village Road (Distt. Hafizabad in 1991)
- Total Length = 1.312 km  
Width = 10 ft  
Design = 1-3/4" sized crushed stone 6"  
thick laid over the compacted sub-  
grade embankment

### **3 : Performance Monitoring of the Roads**

Since construction of these roads, performance monitoring was done on regular basis. Besides monitoring surface condition, such as gravel loss, potholes ruts and depressions etc., roughness measurements were also made using vehicle mounted Bump Integrator (B.I.). Roughness measurements (mm/km) were plotted against the age

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of the road (months) and it was observed that the roughness was increasing with the passage of time. Since there was no maintenance carried out on these roads, it was observed that gravel loss was increasing with the time and ruts and potholes were developed.

A comprehensive report No. NTRC-149 was published in June, 1991 containing the construction specifications, cost per kilometer, roughness Vs age, and was circulated in various Government and Semi-Government Departments and other concerned agencies to disseminate the results of the practical research carried out by the Centre.

#### **4 : First Detailed Evaluation**

Detailed evaluation of all the six low cost roads constructed during 1987 - 1990 was made in June - July, 1996 i.e. 8 years after construction. All the parameter such as roughness, traffic volume, surface condition and testing of material were made as part of the evaluation. The salient feature of the evaluation were:

- D) Even after 8 years of construction and used by the village level traffic of about 200 vpd, the roads were still in good condition;
- ii) Being very simple in construction technique, requiring no specialized equipment, these served as very good all weather connections to village population.

- iii) Without carrying out any maintenance, the roads were passable for village level traffic and proved their viability.
- iv) A comprehensive first evaluation report was published as research Publication No. NTRC-190 in August, 1996 and circulated among all the concerned agencies.

## **5 : Final Evaluation**

Since more than 10 years have been passed after construction of the roads, a visit was made between 17th to 19th February, 2000 for final evaluation. Following observations were made for the low cost roads:

### **I : Tarlai-Sharifabad Road**

This road was sealed under the Social Action Programme of the Government in 1991. Therefore, the low cost road has been used as a base-course for the metalled road. Thus the concept of construction of low cost and their subsequent use as part of stage construction has been fulfilled.

### **II : Dhuni Village Road (Distt. Hafizabad)**

The road was surface treated in 1993 under the Social Action Programme of the Government. The low cost road was used as a foundation for the surface treated road and therefore, it served as stage construction for the treated road.

### **III : Dheri-Mallhu Road**

The road was visited on 17-02-2000. The road has two portions namely: Kamra Link and Godo Link connecting the village Dheri Malhu. The Kamra link has been double surface treated whereas



the Godo link is still un-mattled. Photo graphs of the road were taken and also straight edge was used to check the depression and potholes. Following observations are made as part of the final evaluation:

- a) There are too many cuts and crossings of drains from the adjoining the residential areas. The drains are in the shape of open channel as well as cement pipes. The drain are built in a very crude manner creating big humps and leaving the road almost impassable.
- b) The gravel loss was more than 90% and the gravel splashed on the sides.
- c) Straight edge showed depressions and ruts of more than 7”.
- d) The Bump Integrator Unit could not be operated as it was not possible for the vehicle to ply at constant speed of 32 km/hr to measure the roughness.
- e) Photographs 1 to 5 show the drains, humps, depressions, and potholes of the road placed at Annex-A.

#### IV : Dorro Road

The road was visited on 18-02-2000 and following observations are made:

- a) Out of the total 1.702 km length of the road, the last 0.96 km from the village “Parrian” to the end point at village Dorro has been double surface dressed under the “Tameer-a-Watan” programme under the grant of local MNA (Syed Zafar Ali Shah).
- b) The newly surface treated portion of the road is giving good riding quality.

- c) The portion without treatment was observed in very distressed condition having gravel loss upto 95 %, deep rain cuts and erosion, potholes and ruts.
- d) The surface condition was almost deteriorated and to the extent hat carrying out BI survey was not possible. The track was almost impassable.
- e) While traveling on the road, there was hardly any difference in the condition as if there was a road or no road.
- f) Photographs 6 to 10 show the condition of the surface dressed road vis-à-vis gravel road showing gravel loss, potholes, depression filled with water and impassable condition of the road.

V : Humak-Jawa Road

The road was visited on 18-02-2000 and following observations were made:

- a) The adjoining areas is built up as an Industrial Estate and part of this road is subjected to trucks and commercial traffic. Under the use of this heavy traffic, the gravel loss was almost 100% and the condition has become like an old beaten track.
- b) The adjoining water passes through the road and there are heavy rain cuts
- c) A portion of the road where there is no traffic, some gravel is left and is under the use of local villagers (Jawa).
- d) Photographs 11 - 15 show the true picture of the road placed at Annex-A.

**VI : Sheikh Qureshian (Distt. Jhelum)**

The road was visited on 19-02-2000 and following observation are made:

- a) The road is in very distressed condition and have frequent deep ponds and depressions where rain water and irrigation water from the adjoining land was accumulated.
- b) A part of the road near village Sheikh Qurshian about 120 ft. was ploughed by the farmers due to some land dispute and there existed no road. However, the village traffic was plying on the cultivated land. The gravel on this portion of the road was completely lost.
- c) Roughness survey using BI Unit was not possible due to deep depression and impassable road condition.
- d) Photographs 16 - 20 show the deteriorated condition of the road.

**6 : Conclusion and Recommendations**

Based on the field observations such as rut depth, gravel loss, depression and potholes, following conclusions and recommendations are made:

- i) The NTRC's experiment of demonstration of low cost roads to serve as all weather connection to rural population as an economical solution has proved successful.
- ii) The low cost roads have served their purpose of providing a passable link without maintenance for more than 10 years.
- iii) The low cost roads constructed with well-graded crushed aggregate with adequate Khaka to fill the voids has proved better than the pitrun gravel. The crushed aggregate provided in the batter interlock and lesser gravel loss over the period than the pitrun gravel.

- iv) Since no maintenance was carried out to these roads, they could survive upto 10 years. In case, recurrent maintenance was provided, their life could have enhanced.
- v) As NTRC experiment has successfully proved and three publications on this experiment have been published, it is recommended that their further monitoring be stopped and the conclusions/recommendations of these reports be widely circulated for dissemination of knowledge.

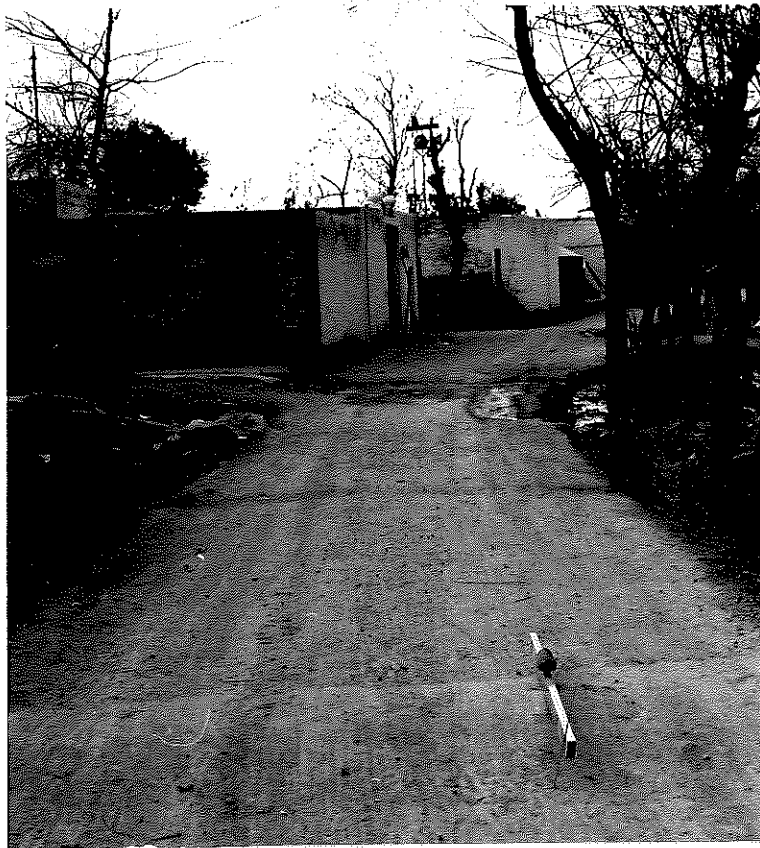
# **Annexure - A**



Photograph - 1: Dheri-Mallhu Road (Godo Link) showing open drain crossing road.



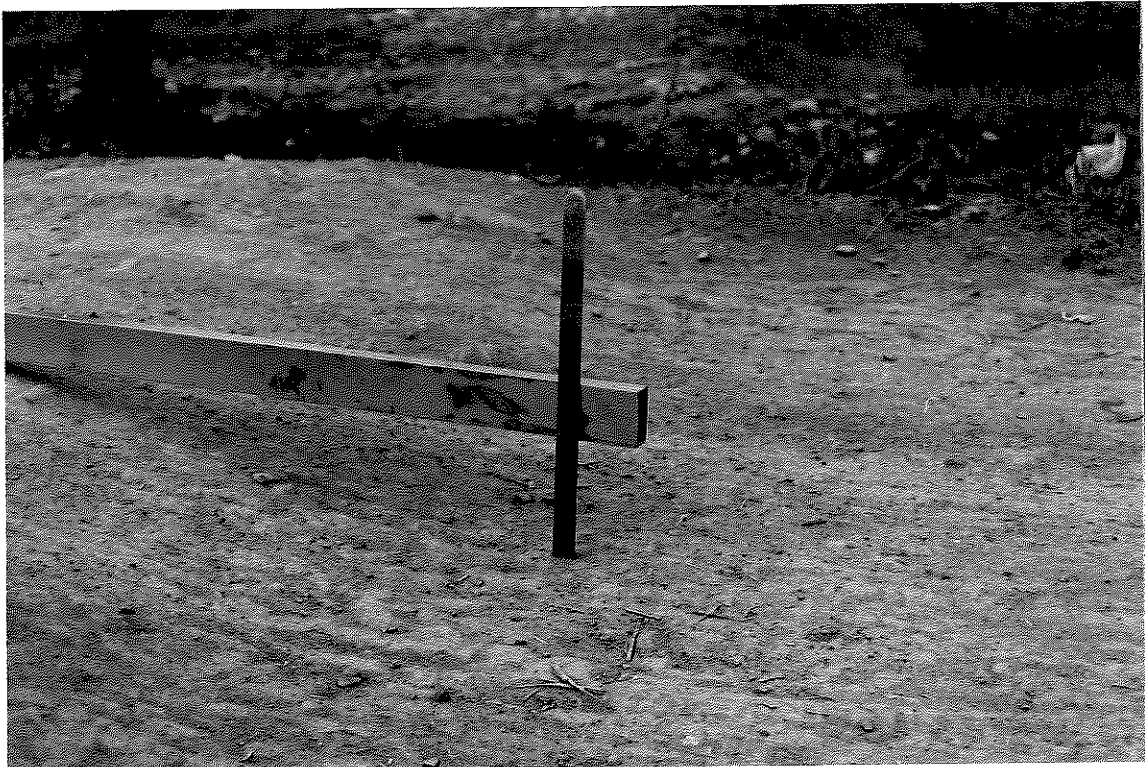
Photograph - 2: Dheri-Mallhu Road (Godo Link) showing damaged drain crossing the road



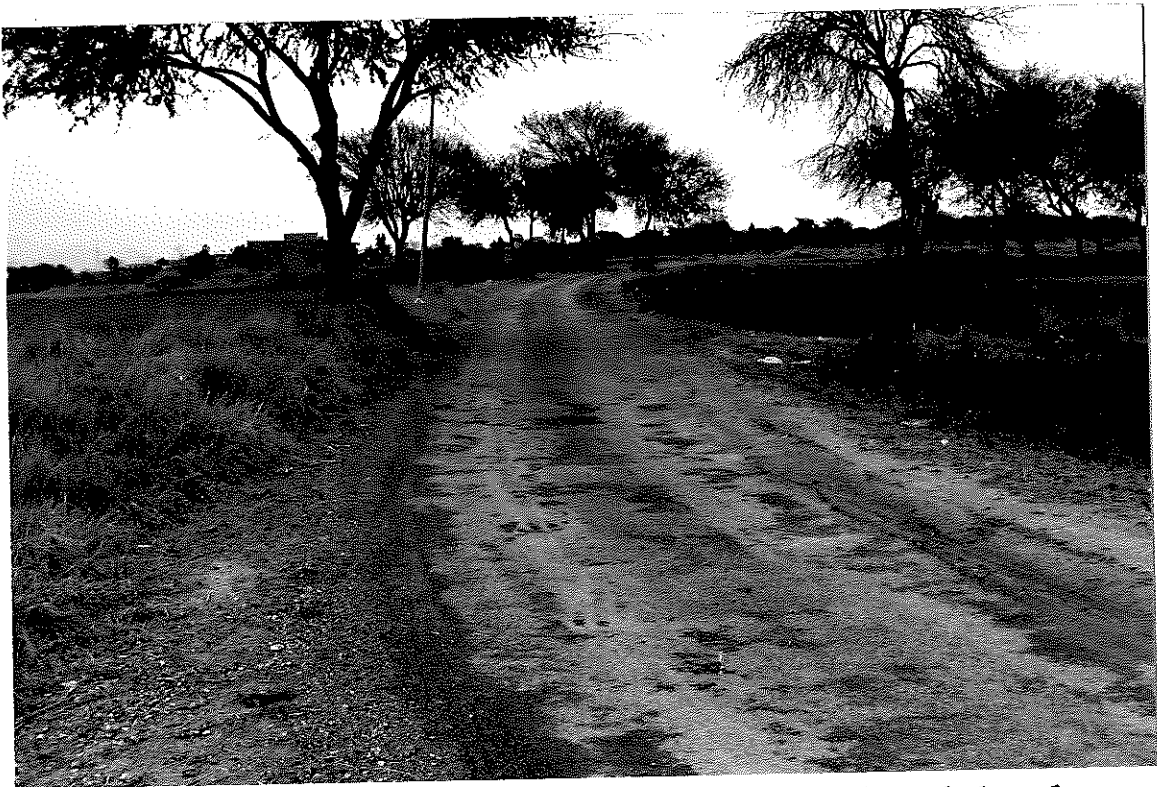
Photograph - 3: Dheri-Mallhu Road (Godo Link) showing drain crossing forming big hump.



Photograph - 4: Dheri-Mallhu Road (Godo Link) showing big depression with gravel loss



Photograph - 5: Dheri-Mallhu Road (Godo Link) showing 5" high hump



Photograph - 6: Dorro Village Road showing recently sealed surface

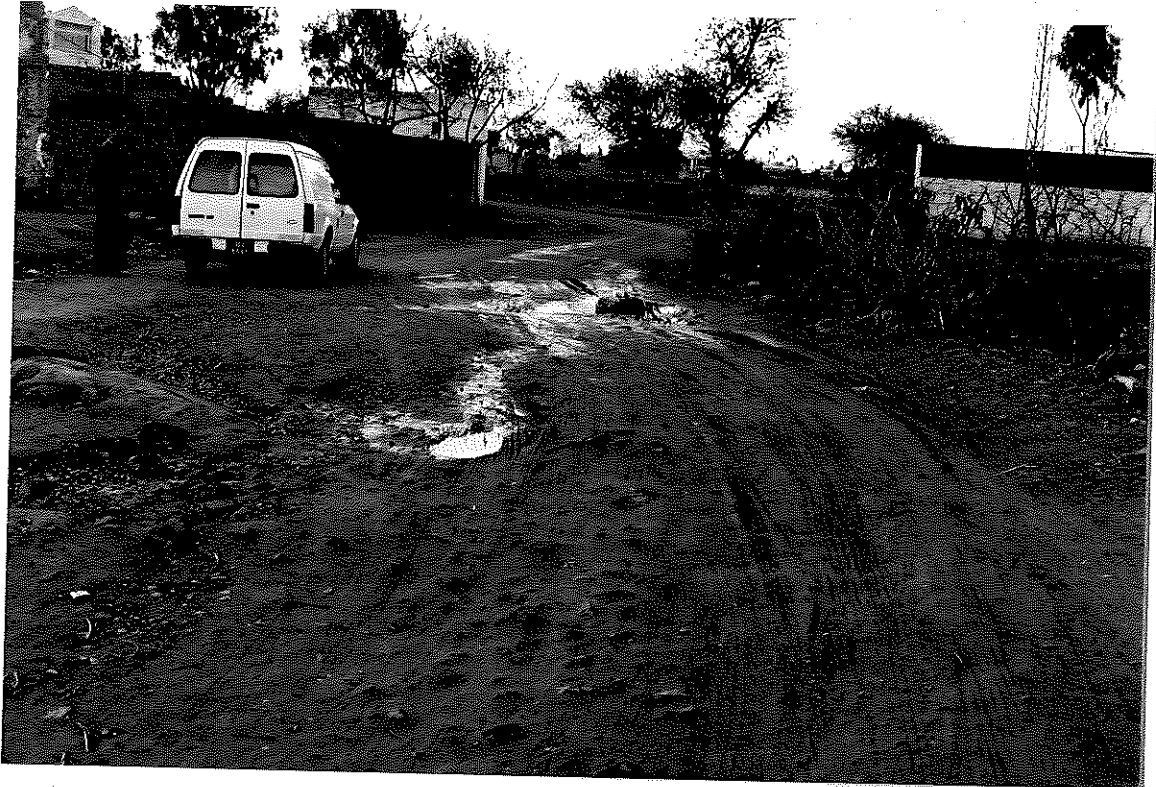




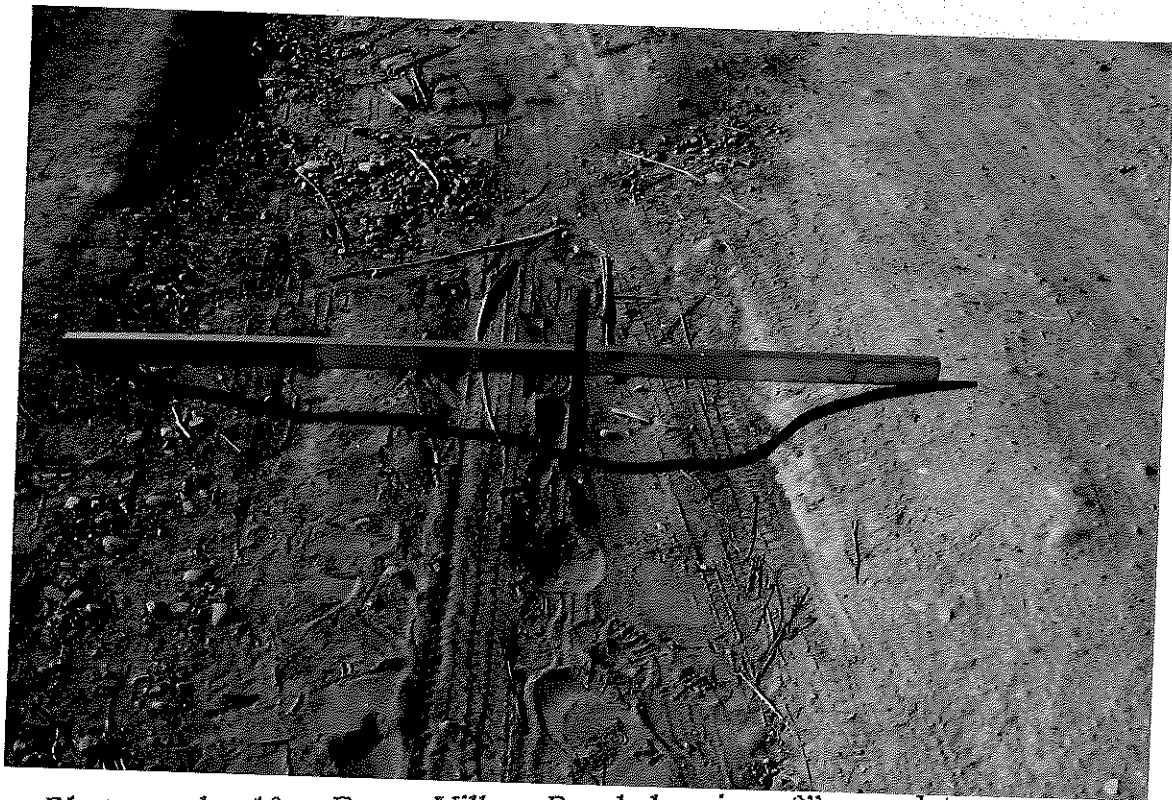
Photograph - 7: Dorro village Road showing damaged low cost road near village "Parrian"



Photograph - 8: Dorro Village Road showing 9" deep depression corrugation/rutting



Photograph - 9: Dorro village Road showing water stagnation over the road surface



Photograph - 10: Dorro Village Road showing 9" complete erosion of surface



Photograph - 11: Humak-Jawa Road showing surface condition with gravel loss



Photograph - 12: Humak-Jawa Road showing close view



Photograph - 13: Humak-Jawa Road close view showing gravel loss



Photograph - 14: Humak-Jawa Road showing view near Jawa with some residual gravel



Photograph - 15: Humak-Jawa Road showing 4" depression in the surface



Photograph - 16: Sheikh Qureshian Road showing ploughed land leaving no road



Photograph - 17: Humak-Jawa Road closer view of ploughed land



Photograph - 18: Sheikh Qureshian Road showing water ponding



Photograph - 19: Sheikh Qureshian Road another view of water ponding



Photograph - 20: Sheikh Qureshian Road showing gravel loss and rutting of surface