

PUNJAB STATE ROAD SECTOR PROJECT

LOAN # 4843-IN

**Consultancy Services and Project Preparatory
Studies for Package II (Phase II)**

**Task B1: Review Suitability and Selection of the
OPRC Pilot Areas**



PUNJAB STATE ROAD SECTOR PROJECT LOAN # 4843-IN

**Consultancy Services and Project Preparatory Studies
for Package II (Phase II)
Task B1: Review Suitability and Selection of the OPRC
Pilot Areas**

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1 Executive Summary

When considering the actual portion of the project area to be included in the Pilot a number of factors were considered, including the need to consider discrete networks within the overall total project area.

The factors considered were:

- Outstanding Planned Upgradation, Rehabilitation and Renewal Works
- Connectivity
- Mix of Road Types
- Risk and Success Factors
- Contracting Industry Fit
- Representative Sample of Location
- Timing of Contacts

Based on our drive-over observations and our review of the available OPRC network data, and keeping the above network selection criteria in mind, two sub network areas (“Mansa” and “Sangrur”) from within the total provided OPRC network have been identified for inclusion within an overall OPRC Pilot network.

We conclude and recommend:

1. That the two identified networks “Mansa” and “Sangrur” are adopted as a Pilot network for the OPRC. Given the estimated annual cost of these networks it is our recommendation that these two are combined into a single Pilot network.
2. That the pilot project concept (subject to budgetary constraints) be expanded to other areas in Punjab state so that OPRC outcomes can be better assessed in a situation where there is a broader range of conditions. Options for locating an additional network would include the Amritsar network inspected on the 27 and 28 September and a network in Hoshiarpur that will be inspected upon approval by GOP of the final network configuration. Section 7.6 referencing the advantages of having networks from other areas of the Punjab also refers.
3. That Pilot Network tenders are timed so they are let at such time intervals as to ensure for prior tender outcomes to be determined before subsequent tenders are required to be submitted
4. That, along the lines of discussion at the industry workshop, for the purposes of comparison, consideration is given to allocating one of the OPRC Pilot networks to the Public Works Department (PWD) to administer under the same performance criteria.

2 Introduction

As part of the Opus International Group (Opus) submission for the *Punjab State Road Sector Project Loan # 4843-In Consultancy Services and Project Preparatory Studies For Package II (Phase II)* the RFP, in regard to the selection of Pilot areas stated the following:

Task B-1: **Checking suitability and selection of the proposed road sections to be included in OPRC**

32. At the beginning of the assignment, the Consultant shall review the list of road sections proposed as possible candidates for OPRC (see Attachment -1). The Consultant shall also be provided with a condition survey of some of sections along with video of these roads sections undertaken by the feasibility study consultant (Package 1 Phase 1). The consultant shall then carry out a desk and visual survey/inspection of those roads. Based on the result of this survey and issues outlined below, the Consultant shall recommend to the Government the roads to be included in the pilot. In preparing his recommendations the Consultant shall;
- take account of the sources available to finance OPRC.
 - ensure that sections where major up gradation and rehabilitation works are to be executed are included in the project as part of the initial improvement works.
33. The Consultant shall also give consideration to:
- create a contiguous and consistent road network with proposals to add/subtract from the defined road links
 - the capacity of the local industry and responsiveness of international contracting industry.

In addition to the RFP our submitted methodology, following discussions with the PRBDB, stated as follows

The road sections to be reviewed for OPRC implementation are listed in Table 3.1. Under this task, attention will be devoted to confirming or modifying this selection, based on both the findings under the foregoing tasks and the following:

- The need to have a contiguous and consistent network
- The capacity of the local contracting industry
- Availability of data to apply OPRC (and ability to collect supplementary data in a timely and cost-effective manner)
- Level of risk (e.g. it would be unwise to pilot OPRC on sections of roads where the levels of risk/uncertainty are unusually high)
- Logistics issues (e.g. accounting for the difficulties if road sections are widely separated)
- As these sections are meant to pilot the OPRC form for the Punjab network, there is a need for them to be representative of the conditions and resource demands of the entire network
- Physical works that may have occurred on the network between the time of the Feasibility Study fieldwork and the present
- Overlaying the financial resource restrictions that may be applicable

Outputs: Report recommending roads for piloting OPRC

There were no negotiated amendments to the Opus Technical Proposal methodology.

A list and layout of the project roads as included in the ToR is included in Appendix A.

3 Network

3.1 Network Data

A significant amount of network data was provided both in the RFP and subsequently following discussions with the PWD and PRBDB. Broadly speaking this data consisted of the following groups;

- Document titled “Road Database and Proposed Interventions For OPRC” – provided in the RFP
- A hand annotated copy of the document titled “(WB PSRSP Phase II) provided during the network inspection
- Approved and Progress details of PMGSY works for the periods 2005/06, 2006/07 and 2007/08 provided during the network inspection
- GIS layers of settlements and roads in the project area
- Satellite images of the project area
- The Interim Part A: Feasibility Study Report.

4 Network Inspection

An initial full inspection of the project area was carried out from the 10 September 2008 until the 13 September 2008 inclusive. Approximately 150km of the 650km network was inspected on each day and the information collected included;

- For the full network, notes on visual condition for the corridor and pavement with locations in terms of distance of changes in condition. A sample of this output is attached in Appendix B
- For the full network, an estimation of the nature and timing of the next area type maintenance treatment
- Photos of the start and end of each route as well as photos of any items of specific interest on the routes
- A GPS trace of the inspection route

For a significant number of the routes it was not readily apparent where the actual start and end points were. Assistance to determine these was provided by PRBDB staff.

4.1 Network Inspection Outputs

From the data gathered during the inspection a number of outputs in terms of derived information were able to be produced. These included;

- A GPS trace of the extent and location of the project network roads. The purpose of this GPS data was
 - To provide a definitive record of the network as we understand it from the information we have been provided
 - To provide a means of spatial and linear location referencing for the network
 - To enable follow up site visits (e.g. 20 September 2008) to be carried out efficiently at this initial project stage without the necessity of specific road location knowledge.
- From the GPS data an initial map of the network was highlighted to indicate, for the whole network, which sections of road were in any of three condition states i.e.
 - Intervention now
 - Intervention in years one to five
 - Intervention in years five to ten

An image of the generated map is attached as Appendix C

- A spreadsheet for the network which, aside from recorded condition, details for each route, a treatment strategy specified by location within the route and the treatment year. Treatments are identified as being either
 - Rehabilitation
 - Resurfacing
 - Heavy Maintenance

Routine maintenance is identified as the treatment in the absence of any of the above.

5 Current Network Maintenance Programme

From the information we have been provided with we have identified the items of significant maintenance work on the initial network which are scheduled to be carried out within the term of the OPRC. These items are as shown in Table 1 below

Table 1

		Treatment	Start Km	End Km	Length	Width Before	Width After
Route 2	Zero point at Northern (Barnala) end and distance runs increasing South	Upgradation	11	94	83	5.5	7.0
Route 4	Zero point at Eastern (Moonak) end and distance runs increasing West	Upgradation	0	38	38	5.5	7.0
Route 8	Dhuri to Bhalwan	PMGSY	1.2	11.8	10.6	3.05	5.5
Route 12	Zero point at Eastern (Lehragaga) end and distance runs increasing West	Upgradation	0	43	43	3.05	5.5
Route 15	Zero point at Western (NH-64) end and distance runs increasing East	Upgradation	0	20	20	3.05	5.5
	Total Length				195		

Of the above lengths Route 8 is out to tender and therefore the Identified up gradation on the project network which is outstanding comprises 184kms. It is possible that the Route 8 work will be completed prior to the commencement of the OPRC.

6 Network Issues

6.1 Consistency

From the inspection observations there is a high degree of consistency in the network environment. This consistency extends to the following;

- Surrounding environment – this is exclusively crop growing agricultural land throughout the project area and provides a consistent, evenly graded boundary for the project roads outside urban areas. With irrigation for crops the water tables are, at times, high and in some cases at the same level or marginally above the adjacent pavement surfacing. In such areas this results in wet pavement layers and flooding following rainfall. Flooding of mainly Link roads was observed in a number of locations in a second inspection shortly after significant rainfall. As a result of the low gradient in these areas, surface water runoff is minimal.
- Materials – the subgrade material appears consistent across all of the project area and consists of a light sandy silt. Suitable pavement aggregate is not available within the network area and has to be transported long distances to the project area.

6.2 Condition

- Shoulders – significant lengths of the network have encroaching vegetation and shoulder build up which results in water being trapped on the pavement following rain and this leads to accelerated pavement and surfacing deterioration.
- Pavement – During our inspection significant areas of pavement cracking and potholes were observed. Other areas inspected ranged from excellent condition to fair, Appendices B and C address the detail of the condition information gathered.

7 Network Selection

When considering the actual portion of the project area to be included in the Pilot a number of factors were considered. Included in these is the need to consider discrete networks within the overall total project area. The factors to be considered that are addressed below pertain primarily to the Mansa/Sangrur network. In the Amritsar network some roads have been added and others removed since they were inspected on 25 to 27 September 2008. These roads as well as all roads on the Hoshiarpur network and one new road on the Mansa/Sangrur network will need to be inspected after project roads have been approved by GOP.

7.1 Outstanding Planned Upgradation, Rehabilitation and Renewal Works

From a mix of the pavement information supplied and the drive-over records the amount of outstanding currently planned work on the Mansa/Sangrur network was determined as well as an estimate of the observed need for pavement or surfacing intervention. Table 1 above details the identified outstanding up gradation works and, in addition, there are outstanding rehabilitation and renewal needs as well. These have been identified and an estimated quantity of planned work for the total project length over 10 years is shown in Table 2 below;

Table 2

Year	Upgrade Km	Rehab Km	Renewal Km
1	92	18	18
2	92	18	18
3		30	60
4		30	60
5		30	60
6		30	60
7		30	60
8		30	60
9		30	60
10		30	60

7.2 Connectivity

The RFP calls for the need to “create a contiguous and consistent road network with proposals to add/subtract from the defined road links”. To meet this requirement the amount of “dead running” on the network needs to be minimised and consideration is to be given to those lengths which may need to be added in or removed in order to make travel around the network as efficient as possible

7.3 Mix of Road Types

For the purposes of comparison and, as far as it is practicable, any pilot network needs to include a representative mix of the different road types i.e.

- State Highway
- Major District Road
- Other District Road

Although Link (Village) Roads were included in the original pilot network, roads in this classification are not recommended for OPRC. For roads meeting other selection criteria existing planned upgradation is to be actively included within the OPRC networks though this should not be a determining factor on its own.

7.4 Risk and Success Factors

7.4.1 Risk

Upgradation is not likely to require significant land acquisition since earlier identified link roads are no longer included in the pilot network. In the Mansa/Sangrur network addition of 1.5 m paved shoulders is limited to state highways and the Right of Way on these roads is adequate to accommodate this intervention.

The selection of roads in Hoshiarpur has not yet been finalised and therefore these roads have not been inspected. Since some roads could be located in hilly areas the risk of landslides and erosion and possibly right of way acquisition could be a factor. It is possible that cross drainage on some of the project roads in all networks is inadequate and this will need to be explored during the conceptual design phase.

7.4.2 Success

Through routes with substantial traffic flow have been actively included e.g. Routes 1 and 2. Such routes provide an opportunity for a larger number of road users and local residents to observe and experience the benefits of effective asset management such as timely pavement rehabilitation on visibly cracked and failing sections of pavement. These higher trafficked roads also offer users an increased level of Vehicle Operating Cost savings as well as increased Travel Time savings.

On the basis of these Risk and Success criteria network selection has focussed on State Highways and Major District Roads. A relatively minor amount of Other District Roads have been considered for inclusion and Link Roads have been excluded.

7.5 Contracting Industry Fit

From available costing information, discussions with the local contracting industry, feedback from the industry workshop and work carried out under Task A4 we have concluded that;

- From the aspects of network ownership, effective community involvement and the benefits to be gained from local knowledge, it is realistic and preferable for local contractors to be able to undertake the OPRC contracts.

- The network size should be consistent with a level of required financing that can be managed by local contractors. The level of required financing is estimated from information obtained on local construction and maintenance activity rates.
- Based on workshop feedback, consideration (on an as yet to be decided equitable basis) be given to allowing the PWD an opportunity to benchmark their delivery capability alongside the contracting industry in an OPRC environment on a network

7.6 Representative Sample of Location

Given the high degree of consistency within the current project length and given the network size restriction addressed in section 7.4 it is our view that there should be between two and four networks selected for inclusion in the Pilot. Also, by extending the location of the Pilot networks beyond the currently identified project area to other areas of the Punjab, OPRC outcomes will be able to be better assessed in a situation where there is a broader range of;

- local contractors operating
- locally available materials
- environmental factors e.g. topography, climate

It will also be desirable to have benefits arising from the OPRC spread across more than one Pilot area.

7.7 Timing of (Multiple) Contract Tendering

It has been our experience that when embarking on a number of new Pilot contracts (i.e. more than a single contract) such as the OPRC, it is preferable to stage the introduction of the contracts. The benefit of this approach is that tenderers will know the outcome of previous tender rounds prior to retendering. For this to occur, the contracts could be let at say four monthly intervals or in such time intervals as to ensure prior tender outcomes are determined before subsequent tenders are submitted.

8 Identified Network Options

Bearing the above network selection criteria in mind, two sub network areas from within the total provided in the original pilot network have been identified for inclusion within an overall OPRC Pilot network. These are illustrated in Appendix D.

The two identified areas “Mansa” and “Sangrur” each contain a mixture of State Highways, Major District Roads and Other District Roads. The stated lengths of each have been derived from the provided information, vehicle odometer readings and GIS based map scaling and, as such, have an estimated accuracy to within ± 2.5 km. Each has been identified on the basis of the criteria detailed in Section 7. The “Mansa” network contains a higher level of planned outstanding upgradation works. Specific information on the mix of roads within each of these networks is contained in the tables below.

Table 3 - Sangrur Network 181 Km
Estimated Annual Cost = 32 Crore Rs

Sr. No.	Name Of Road	Category of Road	Total Length (km)	Pavement Width (m)			
				10	7	5.5	3.05
A. Sangrur (Malwa)							
A1	SH12A Bhawanigarh - Sunam <i>First intervention:</i>	SH	23	3.5 <i>Renew</i>	23.5	0	0
	SH12A Sunam - Bhikhi <i>First intervention:</i>		30	1.3	24.7		
			<i>Renew 1.3 Upgrade 9, Renew 15.7</i>				
A3	MDR21 Sangrur - Sunam - Jakhall <i>First intervention:</i>	MDR	48	2 <i>Renew</i>	12 <i>Renew</i>	35 <i>Renewal</i>	0
A4	MDR19 Budhlada - Jakhall <i>First intervention:</i>	MDR	28	0	0	28 <i>Rehab</i>	0
A5	MDR14 Bhikhi - Budhlada - State Border <i>First intervention:</i>	MDR	34	0	34	0	0
			<i>Renewal 24, Rehab 10</i>				
A9	ODR 05/03 Badbar - Laungowal - Sunam <i>First intervention:</i>	ODR	18	0	0	18 <i>Renewal</i>	0
Length (Sangrur) :			181	6.8	94.2	81	0
SH Length :			53				
MDR Length :			110				
ODR Length :			18				
Link Length :			0				

Table 4 - Mansa Network 200 Km

Estimated Annual Cost = 37 Crore Rs

Sr. No.	Name Of Road	Category of Road	Total Length (km)	Pavement Width (m)			
				10	7	5.5	3.05
B Mansa (Malwa)							
B1	SH12A Bhiki - SH13 <i>First intervention:</i>	SH	14	0	32.1	0	0
	SH12A SH13 - Kotshamir <i>First intervention:</i>		41	0	22.9	0	0
B2	SH13 Barnala - Mansa <i>First intervention:</i>	SH	46.1	7.2		38.9	0
	SH13 Mansa - State Boundary <i>First intervention:</i>		46.3	4.3		42	0
B5	MDR20 Dhanaula - Bhiki <i>First intervention:</i>	MDR	25	0	0	25	0
B10	ODR9 Mansa - Talwindi Sabo <i>First intervention:</i>	ODR	28	0	0	28	0
Length (Mansa) :			200.4	11.5	55	133.9	
SH Length :			147.4				
MDR Length :			25				
ODR Length :			28				
Link Length :			0				

9 Conclusions and Recommendations

Based on our drive-over observations together with our review of the available OPRC network data and the above sections our conclusions and recommendations are;

1. That the two identified networks “Mansa” and “Sangrur” are adopted as a OPRC network. Given the estimated annual cost of these networks it is our recommendation that these two are combined into a single network.
2. Based on reasons given in section 7.6 consideration be given to establishing additional networks in other areas within the Punjab. The inclusion of additional networks could include the options of Amritsar and Hoshiarpur.
3. That Pilot Network tenders are timed so they are let at such time intervals as to ensure for prior tender outcomes to be determined before subsequent tenders are required to be submitted
4. That along the lines of discussion at the industry workshop, for the purposes of comparison, consideration is given to allowing the PWD to compete for one of the OPRC networks.

Of the above, recommendation 2 has potentially the most immediate impact in that it requires additional effort to identify and confirm any additional network(s) such that the necessary data collection can proceed in a timely manner. Recommendation 4 will require additional work to develop the contract format which would fit with the inclusion of the PWD option.

10 Appendices

10.1 Appendix A – List of Roads for OPRC

Sr.No.	Name of Road	Length in Kms.
1	Bhawanigarh Sunam Bhikhi Kotshamir road	107.00
2	Barnala Handiaya Hari-Singhwala Mansa-Sardulgarh Sirsa road (Up to State Boundary)	93.67
3	Sangrur Sunam Lehra Jakhal road (Up to State Boundary)	49.11
4	Moonak Budhlada Jakhal road	37.76
5	Dhanaula Bhikhi Rattia (Up to State Boundary)	59.50
6	Dhuri- Barnala road Via Moolowal Sekha Rangian	30.44
7a &	Dhuri-Sherpur	19.80
7b	Sanghera-Sherpur including Bypass Barnala	21.61
8	Dhuri- Bhalwan – Sangrur road	22.71
9	Barbar longowal Sunam	18.23
10	Mansa to Talwandi sabo road	28.00
11	Sardulgarh ratia road to sangha up to Haryana boarder	15.88
12	Lehragagal- ladel-Kishengarh -Bareta- kulerian- sher khan wala- Boha	43.31
13	Harigarh to cheema	24.50
14	Longowal pakho	22.00
15	NH-64 to Ballo Bhikhi	30.50
16	Sangrur Harari Changal Kanjla.	9.00
17	Budhlada Ratia to Bareta- kulerian Road	19.00
	Total	652.02

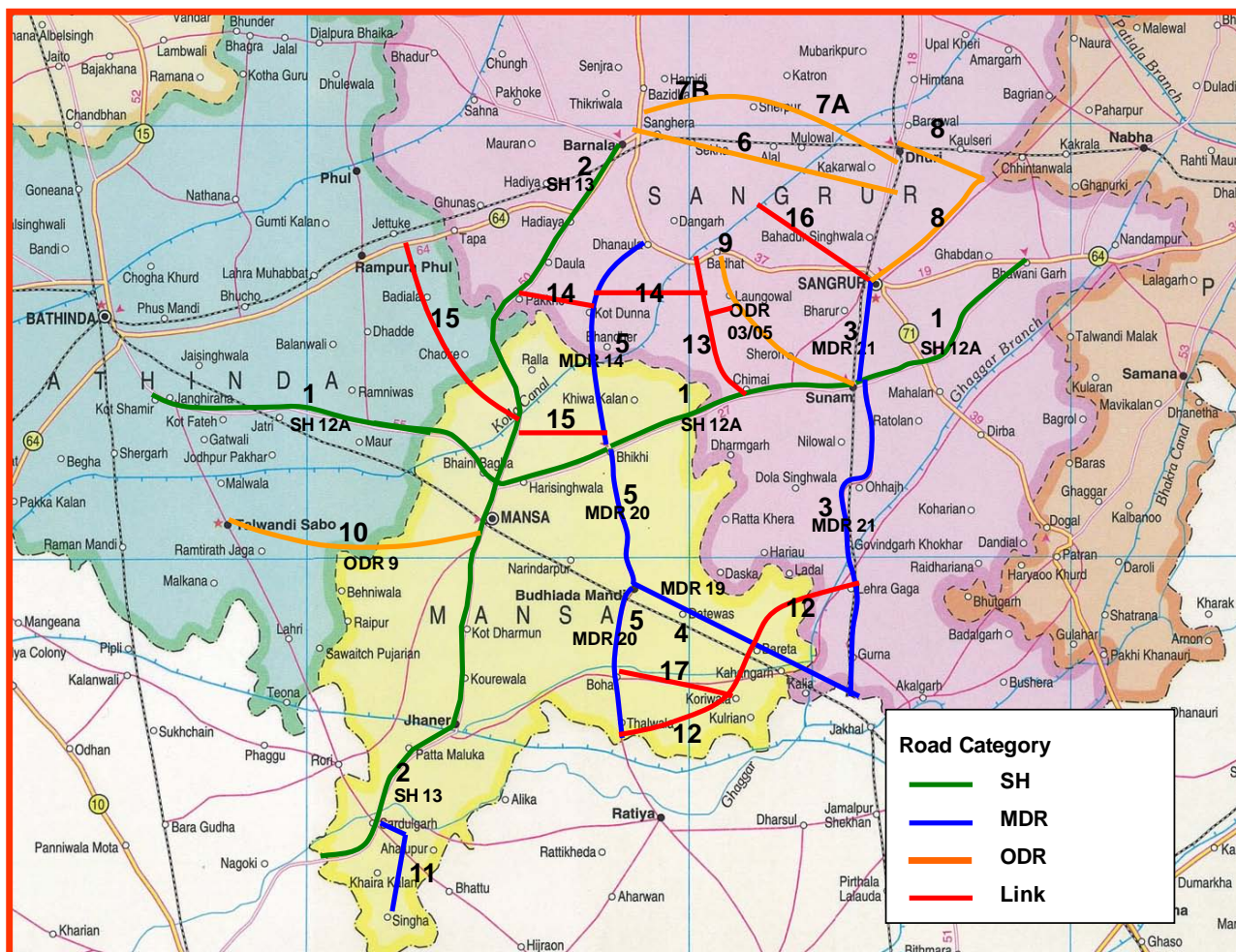
10.2 Appendix B – Sample Inspection Sheet Output

Road Num 1 (Sh12A)		From Kotshamir - NH64		Date		Page Number 2																					
From	To	Length	Mile Post km	Photo Ref	Width (m)	Impediments	Bridges (ch)	Culverts (ch)	Roughness Assessed	Visual	Low Spots	Last Work	FWP (L=ungradation, P=Pavement Rehab, S=Resurface)										Other				
1	2	3	Sealed	Shoulders	Trees	Shrines	Other						Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Comments			
missed first 200-300m																											
Kotshamir - Bhiki																											
0	1.5	1.5		210	210																						
1.5	10	8.5	6.8=182	215																							
10	12.5	2.5																									
12.5	19	6.5	13.5=95, 14.4=94km																								
19	22.9	3.9																									
22.9	29	6.1	24.7=83	230		7	vegetation on shoulders																				
29	31	2				7	vegetation on shoulders																				
31	37	6				7	vegetation on shoulders																				
37	39	2		255		7	vegetation on shoulders																				
39	40.4	1.4				7	vegetation on shoulders																				
40.4	52.8	12.4	42.1=66, 52.0=56			7	vegetation on shoulders																				
52.8	53.3	0.5				10																					
INTERSECTION WITH ROAD 5 (MDR 20/MDR14)																											
Bhiki - Bhawanigarh																											
0	0.5	0.5						0.5		4-5 poor																	
0.5	1	0.5						1		4-5 fair																	
1	1.6	0.6								4-5 very poor																	
1.6	2.6	1								4-5 fair/poor																	
2.6	4.1	1.5							2.6	4-5 poor																	
4.1	5	0.9							4.1	4-5 poor																	
5	7.8	2.8								4-5 very poor																	
7.8	9	1.2								4-5 fair																	
9	13.5	4.5	10.2=44km							2-3 good (apart from failing patches)																	
13.5	14.8	1.3	13.3=41km							2-3 good (apart from failing patches)																	
14.8	19.5	4.7	15.2=39km	1130					18.1	2-3 good (apart from failing patches)																	
19.5	23.9	4.4								2-3 good (apart from failing patches)																	
23.9	25.1	1.2	25.1=29km							2-3 good (apart from failing patches)																	
BREAK AS WE WENT UP RD 9 TO COLLECT TRACE																											
0	0.4	0.4	0=29							2-3 good (apart from failing patches)																	
0.4	1.3	0.9				4	lane divided			2-3 good (apart from failing patches)																	
1.3	1.5	0.2								2-3 good (apart from failing patches)																	
1.5	1.8	0.3								2-3 good																	
1.8	2.6	0.8								2-3 fair																	
2.6	4.4	1.8				4	lane divided			2-3 fair																	
4.4	10.4	6	8.9=20							2-3 fair																	
10.4	10.7	0.3								2-3 good																	
10.7	15	4.3								2-3 fair																	
15	15.5	0.5		1230	1230					2-3 very cracked																	
15.5	19	3.5	12.8=16							2-3 fair																	
19	20.4	1.4								2-3 poor																	
20.4	21.5	1.1								2-3 fair																	
21.5	22.5	1	21.7=7							2-3 v poor																	
22.5	25	2.5								2-3 poor																	
25	26.4	1.4								2-3 poor																	

Summary 104.8 km long
 Bridges
 Culverts

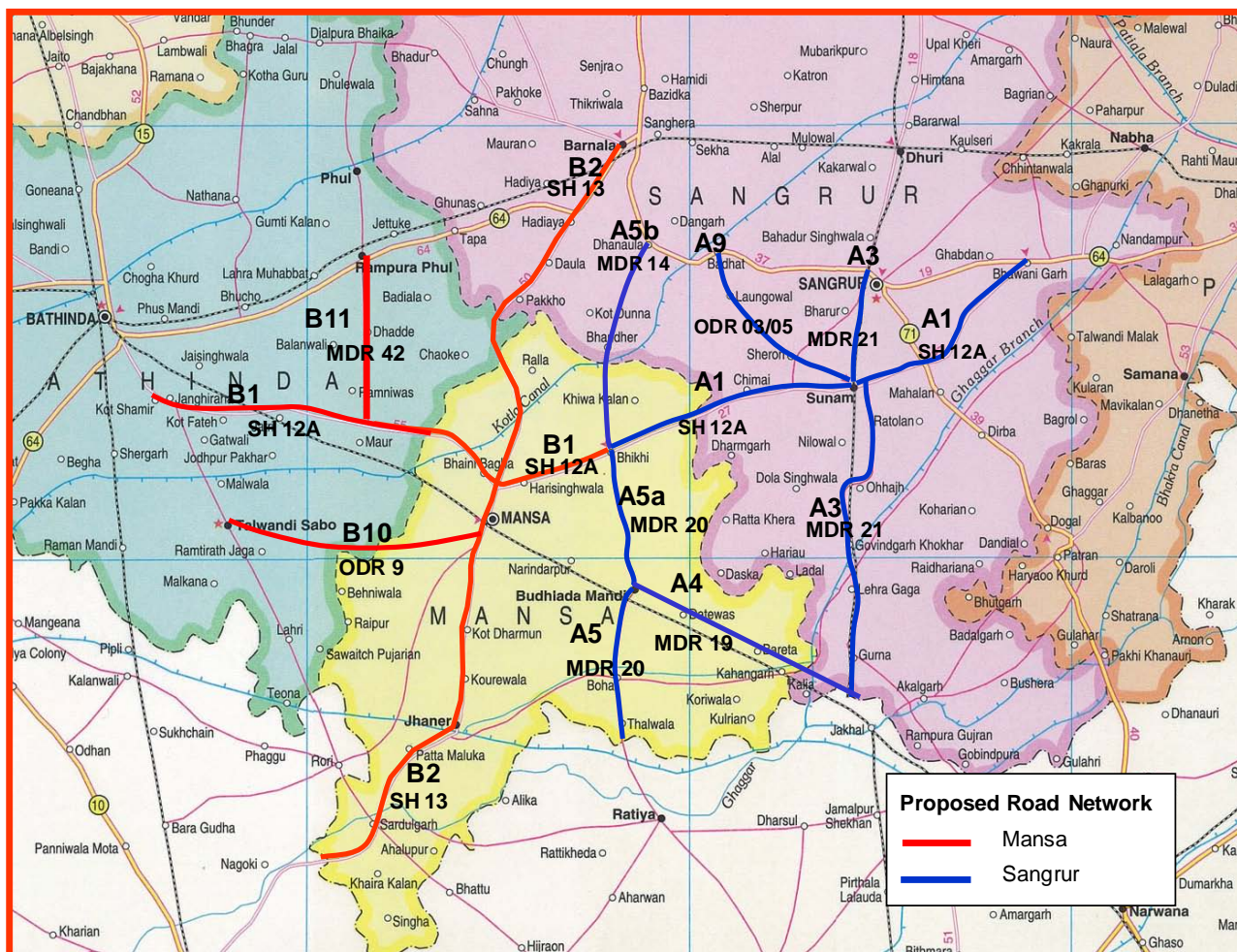
1st Section (0-19): Lots of wheelpath cracking. Need to resurface in the first couple of years before it falls apart
 1st Section (19-53.3): All needs to be done in 1st couple of years with some heavy mtce patches before the resurfacing work
 2nd Section: The widening in particular is not in good shape. Will need heavy mtce of 5-10% for much of it, then rehab in a few years time.
 3rd Section: The main concern is with the patches that have already been patched once and now those are failing.

10.3 Appendix C – Sangrur and Mansa Network (Original 652km)

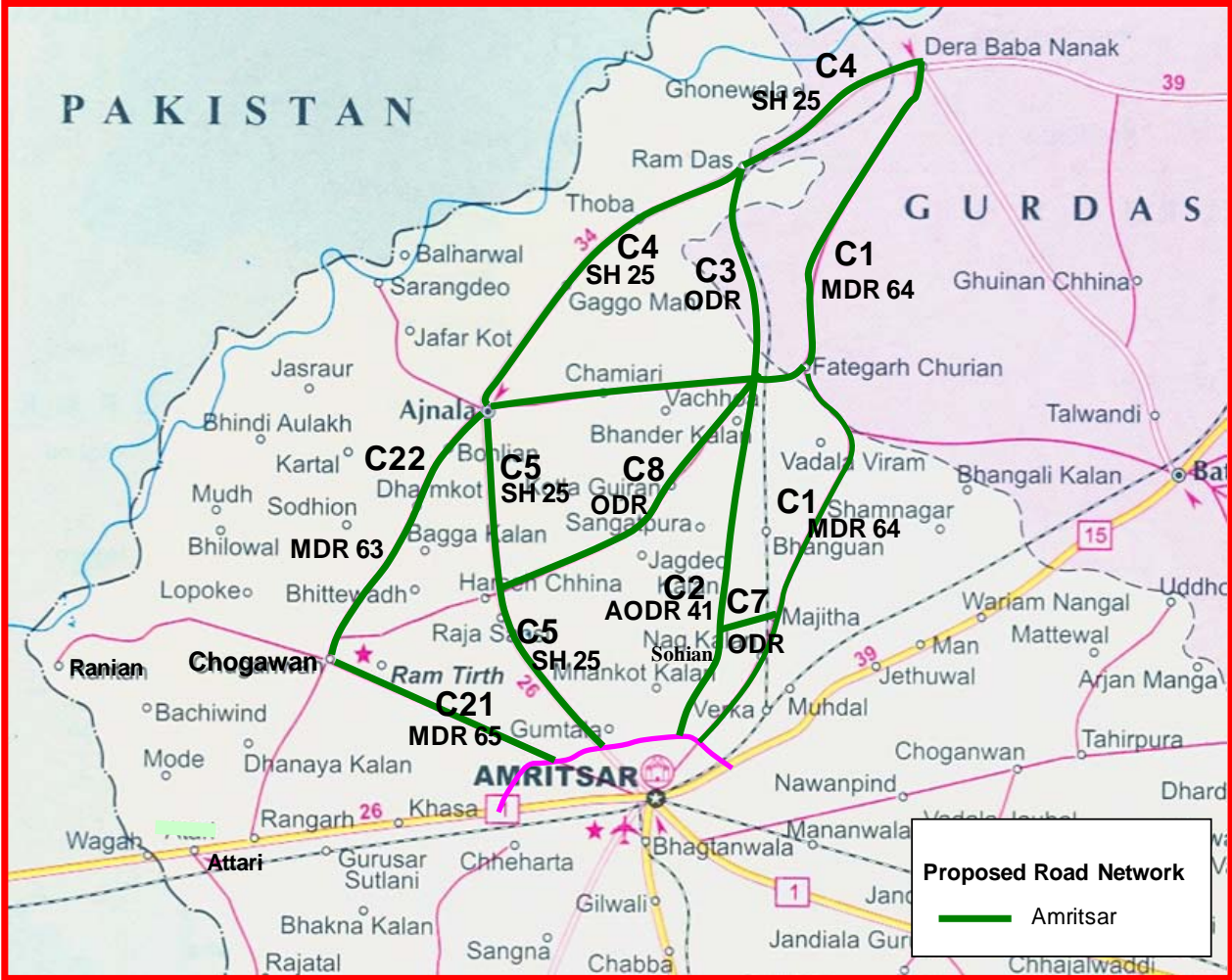


10.4 Appendix D – Currently Proposed Networks for OPRC

10.4.1 Mansa/Sangrur



10.4.2 Additional Amritsar Network



10.4.3 Additional Hoshiarpur Network

