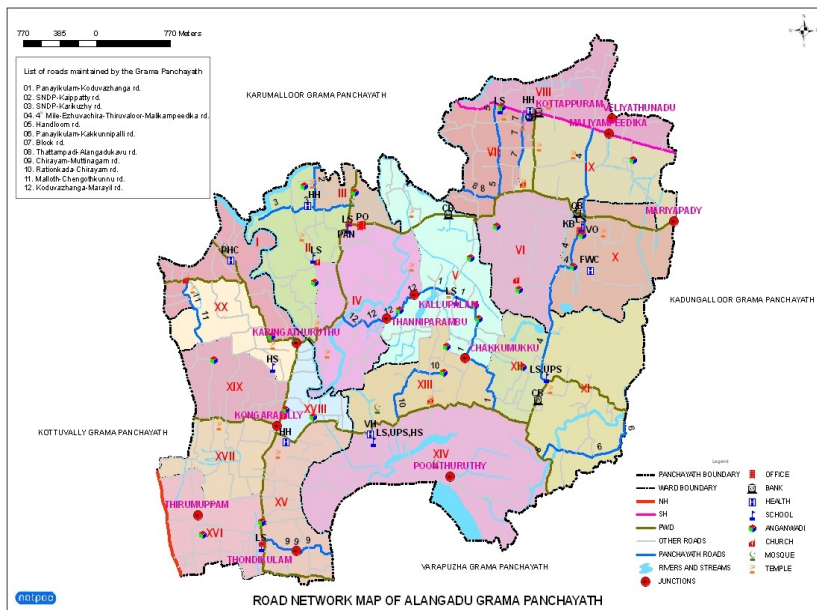
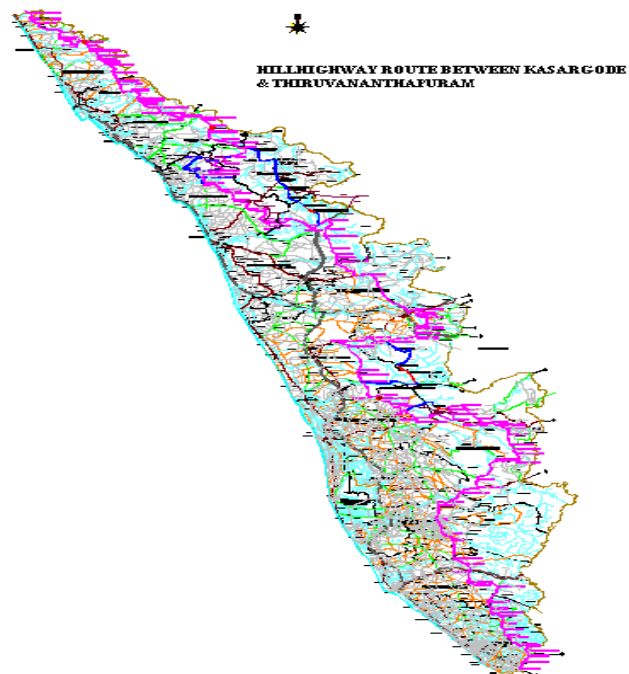


The division concentrates on projects relating to a wider spectrum of rural road planning viz., connectivity of settlements, transport priority index (TPI), link priority index (LPI), village affinity index (VAI), circuitry index (CI), preparation of road network maps for grama panchayaths in GIS formats, estimation of road length requirement for cent percent connectivity, etc.



The division was in charge of the finalization of Hill Highway stretch between Kasaragode and Thiruvananthapuram in Kerala State.





Another major project completed by the division is “prioritization of roads under Swaminathan Package in Idukki district”.



METHODOLOGY FOR RURAL ROAD PLANNING

1. Data Sources

Preparation of master plan for rural roads require a large amount of data pertaining to existing road conditions, location of micro settlements, availability of infrastructure facilities in micro settlements, demographic characteristics of population, rural road condition etc. Such type of detailed data pertaining to the above factors was not readily available at Panchayat or Block levels. Therefore, road length and settlement level data was collected with the active association of block officials. For this purpose, NATPAC has prepared general questionnaires and imparted training to block level personnel in association with the Department of Rural Development (Government of Kerala) in data collection and maintaining the necessary database for routine purposes.

Road maps posed a great problem, as these were not readily available in a uniform scale and in most case no scale at all. Administrative maps were collected from various sources including Centre for Earth Science Studies (CESS), District Rural Development Agency (DRDA) and Block Development Offices, etc.. NATPAC also has a vast collection of block level maps prepared under various projects like NABARD assisted Rural Infrastructure Development Fund (RIDF) and Janakeey Asootranam projects. All these maps were suitably collated to prepare the final panchayat level as well as block level maps.

2. Field studies

The information relevant to the study were gathered by preparing two sets of questionnaires, one pertaining to the road level data and the other regarding the micro-settlement level details. The forms of the questionnaire are shown in **Appendices 1 & 2**. The stepwise procedure adopted in data collection is shown in **Figure 1**.

NATPAC had given training to Block Development officers, Assistant Engineers and Junior Engineers for collecting the information from the field and filling up of questionnaires. The Block Officials were given detailed instructions

regarding each item in the questionnaires. The officials of NATPAC again reviewed the data obtained and necessary corrections were carried out.

3. *Identification of growth, market and service centres*

A network approach has been adopted for the preparation and master plan for the rural roads in the state of Kerala. Under this approach, a hierarchical pattern of rural roads has to be evolved. At the first level; the micro-settlements, which do not have all-weather roads, have to be identified. At the second level of rural roads network development, important settlements have to be linked with growth, market and service centres in the region. At the third level, all the settlements have to be linked directly with each other.

Central place theory is usually used in the identification of growth, market and service centres. Growth centres are of the highest order followed by market, service and village centres. In the present study all the corporations, municipal towns and district headquarters, have been considered as Growth Centres (GC). All the special grade panchayats with population above 35,000 have been considered as Market centres (MC), while those panchayats, which are classified as special grade with a population of above 25,000, or grade I panchayats with a population of 30,000 are taken as Service centres (SC). The rest of the panchayats come under the category of Village centres (VC).

4. *Computation of Transport Priority Index (TPI)*

The first step in the arena of rural road development is to provide all - weather road accessibility to all the settlements. Since huge financial resources are required for providing accessibility; it would be appropriate to connect all the settlements in a phased manner. In order to achieve this, a Transport Priority Index (TPI) has been developed and computed for all the so far unconnected micro-settlements in the district. The rating of indicators for Transport Priority Index (TPI) is shown in **Table 1**.

Transport priority Index has been developed based on seven sets of indicators namely Educational, Transport & Communication, Administration, Health,

Commercial facilities, Public Utilities and Policies. A five point scoring method has been adopted for arriving the weightages. Weightages of 16, 8, 4, 2 and 0 were given according to the influence area of the facility and the developmental potential. For example College having higher influence area gets higher rating (16) compared to high school, which has lower influence area and consequently lower rating (8). Certain policy variables have also been included in the rating. For example, SC/ST population has been given a higher priority than BC population in a settlement. Hilly and coastal area have also given higher rating as per the national standards.

In this way TPI values reflect the development potential, planning priority and availability of infrastructure facilities in the settlement. Rural roads network developed based on the TPI values is expected to foster the rural development by increasing the utilisation of existing infrastructure- facilities and consequently resulting in lesser cost of operation. Since connectivity to all the settlements can't be given simultaneously; a three-phase approach has been adopted. In the 1st phase settlements, which are having TPI values greater than 100 have to be connected while in the 2nd phase settlements whose TPI values between 80 and 100 should be given connectivity. In the 3rd phase connectivity should be given to all the settlements whose TPI values are lesser than 80.

5. Computation of Village Affinity Index (VAI)

At the second stage, for rural road network development, important settlements have to be linked directly to the growth centre or market centre or service centre. For this purpose a Village Affinity Index (VAI) has been developed. VAI values have been computed between village centres and settlements of higher order which include growth centres or market centres or service centres.

The mathematical form of the VAI is described below:

$$VAI_{(i,j)} = \frac{K * P_i * Q_j * TPI_i}{D_{(i,j)}^n}$$

Where $VAI_{(i,j)}$ = Village Affinity Index between ith village and jth growth/market/service centre.

$P_{(i)}$	=	Population of i^{th} village
$Q_{(j)}$	=	Population of j^{th} growth/market/service centre
$TPI_{(i)}$	=	Transport Priority Index value of i^{th} village
$D_{(i,j)}$	=	Distance (Kms) between i^{th} village and j^{th} growth/market/service centre
K	=	A scale factor
n	=	A constant

The above form of the model is a modified version of the gravity model. The calibrated values of k and n are 0.000001 and 2.0 respectively. VAI values have been computed for all the villages in each block separately. Suppose there are L villages and M growth/market/service centres in a block, then a $L \times M$ matrix of VAI values has been computed. This matrix was scanned row-wise and the maximum VAI value and corresponding pair of settlements were noted. The link connecting the village and the identified growth/market/service centre was proposed as the new link.

For deciding the new direct linkages to growth/market/service centres, the Circuity Index (CI) has been developed. The mathematical form of Circuity Index is given below:

$$\text{Circuity Index (CI)} = \frac{\text{(Actual distance of villages to the Centre)}}{\text{(Air distance between village and the centre)}}$$

If the Circuity Index was found less than 1.5, no link has been proposed and if it exceeded 1.5, the corresponding link was proposed.

6. Network optimisation

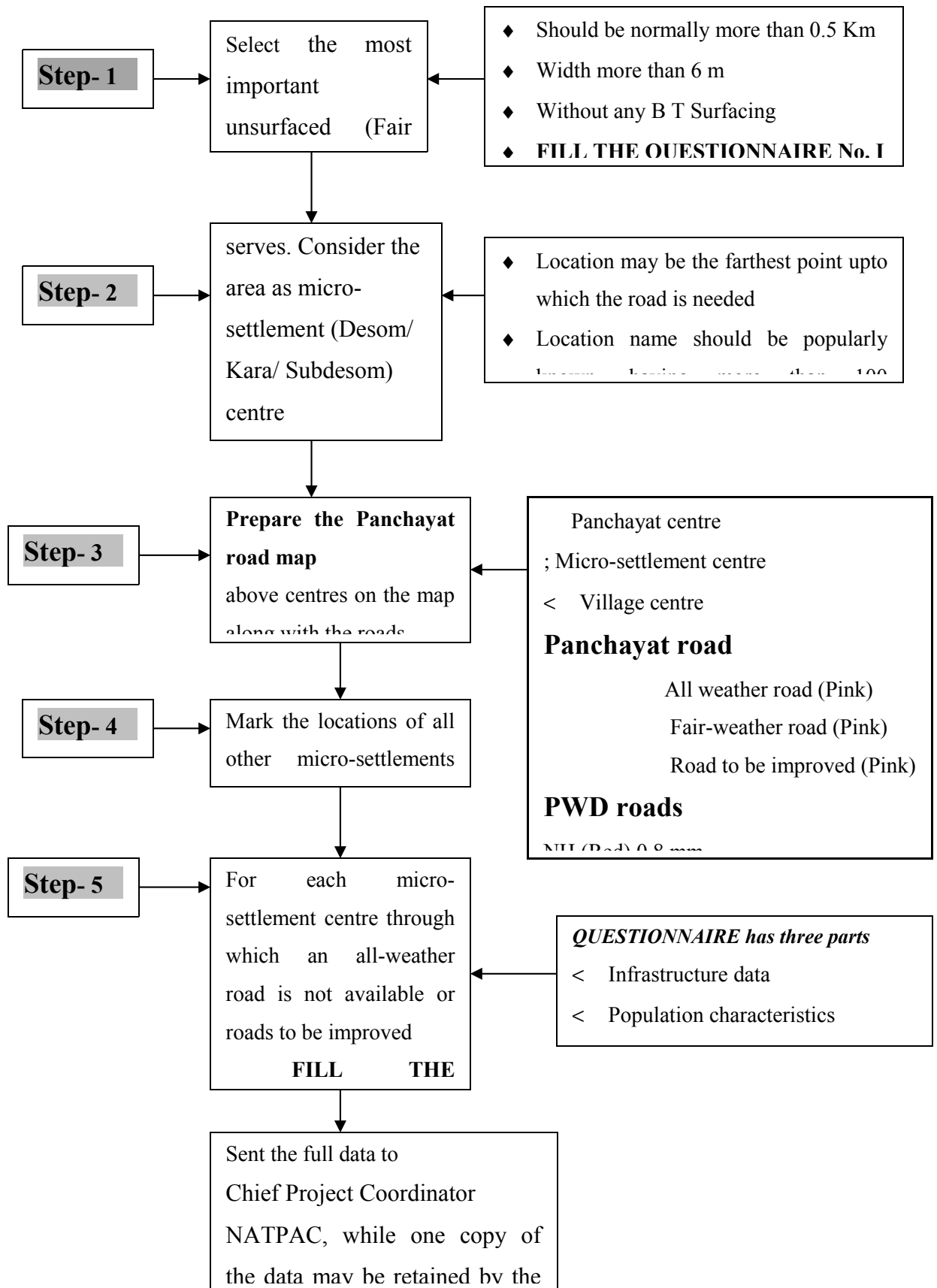
The road length required for the state of Kerala has been estimated at State, District and block levels. Two levels of rural road network namely connectivity level and linkages to growth and market centres have taken care of only part of the required road length. The remaining roads have to be developed by providing multiple linkages to all the settlements. This has been attained by analysing the whole rural roads network and thus calculating the desired road length in each block and district.

TABLE 1

Rating of indicators for Transport Priority Index (TPI)

Sl. No	Indicator/ facility		Weightage				
			16	8	4	2	0
1	<i>Educational</i>	(i) L.P./U.P.school	-	-	Yes	upto 2 Km	2 Km+
		(ii) High school	-	Yes	upto 2 Km	2-5 Km	5 Km+
		(iii) College	Yes	upto 2 Km	2-5 Km	5-10 Km	10 Km+
		(iv) Tutorial or private College	-	-	Yes	upto 2 Km	2 Km+
2	<i>Transport & Communications</i>	(i) Post office	-	Yes	upto 2 Km	2-5 Km	5 Km+
		(ii) STD or Fax or internet	-	-	Yes	upto 2 Km	2 Km+
		(iii) Bus service	Yes	upto 2 Km	2-5 Km	5-10 Km	10 Km+
		(iv) Jeep service	-	Yes	upto 2 Km	2-5 Km	5 Km+
		(v) Boat jetty	-	-	Yes	upto 2 Km	2 Km+
		(vi) Vehicle ownership (%)	10+	5-10	2-5	1-2	<1
3	<i>Administration</i>	(i) Panchayat office	-	Yes	upto 2 Km	2-5 Km	5 Km+
		(ii) Village office	-	-	Yes	upto 2 Km	2 Km+
		(iii) Krishi Bhavan	-	-	Yes	upto 2 Km	2 Km+
		(iv) Electricity Board office	-	Yes	upto 2 Km	2-5 Km	5 Km+
		(v) Village extension office	-	-	Yes	upto 2 Km	2 Km+
4	<i>Health</i>	(i) Hospital/dispensary	Yes	upto 2 Km	2-5 Km	5-10 Km	10 Km+
5	<i>Commercial</i>	(i) Weekly market	-	-	Yes	upto 2 Km	2 Km+
		(ii) Commercial establishment (or shops)	-	Yes	upto 2 Km	2-5 Km	5 Km+
		(iii) House hold industry	-	Yes	upto 2 Km	2-5 Km	5 Km+
6	<i>Public Utilities</i>	(i) Public water supply	-	Yes	-	-	No
		(ii) Police station or police out post	-	Yes	up to 2 Km	2-5 Km	5 Km+

		(iii)	Ration shop (PDS)	-	Yes	up to 2 Km	2-5 Km	5 Km+
7	<i>Policy</i>	(i)	Hilly area	-	-	Yes	-	No
		(ii)	Coastal area	-	-	Yes	-	No
		(iii)	SC/ST Pop (%)	30+	20-30	10-20	1-10	<1
		(iv)	BC/OBC Pop (%)	40+	30-40	20-30	10-20	<10
		(v)	Total Population	2000+	1000-2000	500-1000	200-500	<200



STEP-WISE PROCEDURE FOLLOWED FOR SUPPLYING INFORMATION
FIGURE 1

Notes:

1. Show all the roads listed above along with settlement centres in the map
2. For each settlement listed in item No.8 above, fill up the Questionnaire No.II

NATIONAL TRANSPORTATION PLANNING AND RESEARCH CENTRE
THIRUVANANTHAPURAM

NATIONAL RURAL ROADS PROJECT (NRRP)

QUESTIONNAIRE NO.II - HABITATION LEVEL DATA

I INFRASTRUCTURE DATA - MICRO SETTLEMENT (Desom/Kara/Sub-desom wise)

1 a) Name of Micro - settlement (Desom/Kara/Sub-desom /Ward).....

b) Name of Panchayathc) Sl.No. on map.....

2 Provide the details of infrastructure facilities available in the micro - settlement (Desom/Kara or Sub - desom) mentioned above in the following **Table**

Sl.No	Name of facility	If available indicate the number of units in the settlement	If not available – indicate the distance to the nearest centre where available
i)	L.P./U.P.school		
ii)	High school		
iii)	College		
iv)	Tutorial or private College		
v)	Post office		
vi)	STD or Fax or internet		
vii)	All weather road connectivity (Yes/No)		
viii)	Bus service (Yes/No)		
ix)	Jeep service(Yes/No)		
x)	Boat jetty(Yes/No)		
xi)	Panchayath office		
xii)	Village office		
xiii)	Krishi Bhavan		
xiv)	Electricity Board office		
xv)	Village extension office		
xvi)	Hospital/dispensary		
xvii)	Weekly market		
xviii)	Commercial establishment (or shops)		

xix)	House hold industry		
xx)	Public water supply		
xxi)	Hilly area(Yes/No)		
xxii)	Coastal area(Yes/No)		
xxii i)	Police station or police out post		
xxi v)	Ration shop (PDS)		

Contd.

II CHARACTERISTICS OF LOCAL POPULATION

i No. of households : Total..... SC/ST..... BC/OBC...

)

ii No. of households owning a motor vehicle

)

III CERTIFICATION

Certified that the above information is correct to the best of my knowledge

Reporting officer : Signature :

Name :

Designation :

Appendix 1 (Contd.)

3. List of all other settlements having Bitumen Tar Road:

Sl.No	Name of Settlement	Area	Population

4. Length of all types of roads in the Panchayath

Type of road	Length in Km
A PWD Road	
National Highway (NH)	
State Highway(SH)	
Major District Road(MDR)	
Other District Road(ODR)	
Village Road(VR)	
B Panchayath Road	
BT surfaced road	
WBM	
Earthern	