

RURAL TRANSPORTATION SCENE IN SOUTHERN INDIA

by

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1. INTRODUCTION

Nearly seventy-five per cent of Indian population live in rural areas. This rural population is spread over 5.8 lakh settlements of different sizes throughout India. Rural development is getting increased attention recently from planners as this is closely linked up with the overall economic development of the country. Road network in rural areas constitutes one of the essential infrastructures required for the development of agrarian Indian economy. A comprehensive study of rural travel patterns, changes in transport demand with time and other related issues on traffic and transport help planners and other decision makers in developing appropriate long term strategies.

As per the National Transport Policy Committee (NTPC 1980) report the role of rural roads as a catalyst for the development of the country has not been fully realised. This holds good even today. Unfortunately, traditional cost benefit models when used for rural road development may not provide investment justification on a large scale.

The latest road development plan for India, 1981-2001 has the following goals and policies concerning rural transportation.

- a) Road network should be so developed so as to preserve the rural oriented economy of the country facilitating the evolution of small towns. This will narrow down the differences in living standards between rural and urban populations. This in turn will encourage medical and agricultural scientists and qualified teachers and engineers to settle in villages, thereby contributing to the upliftment of living conditions and economy of villages.
 - b) By 2001, all villages with more than 500 population to be connected by an all weather road, and villages with less than 500 population will have an all weather road within 3 km in plain areas and 5 km in hilly areas.
 - c) Major district roads should connect all towns with more than 1500 population. Other district roads should connect settlements in population range 1000-1500. The other district roads (ODR) and village roads (VR) commonly known as 'rural roads' provide accessibility to the villages by connecting them to district roads, state highway or national highway and prominent market towns, administrative headquarters, etc. It is
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expected that improved accessibility will directly contribute to the different sectors of rural development such as agriculture, forestry, fishery, dairy farming, etc. This will result in the economic development of the region. In addition, the improvement in health and medical care, education, and postal services will also contribute to the social upliftment of villagers. The end result may be gainful employment to the under employed rural people.

2. Rural Transportation Study

In order to develop a long term data base for the policy analysis, the Ministry of Transport has initiated a new study on rural transportation. Two agencies viz.,

- (i) Indian Institute of Management, Bangalore and
- (ii) National Council for Applied Economic Research, New Delhi

who had carried out an earlier study on bullock cart usage (1978) were identified again to carry out rural transportation studies. The scope of the present study is much broader in concept than the earlier one and embraces all modes of rural transportation for freight and passenger movement. The study area entrusted to Indian Institute of Management, Bangalore encompasses the southern, central and western parts of the country.

3. Objectives:

The major objectives of the present study are:

- Changes in the role and ownership of transport modes, ownership pattern of different modes by income and land holding.
- The demand for freight as well as passenger movement at present
- The growth rates of demand for movement (both passenger and freight) during the time period that elapsed between the two studies viz. the present study (1989) and the earlier study (1978).
- The pattern of demand variation with respect to accessibility of settlements by all weather roads and fair weather roads between the two study periods i.e. 1978 and 1989.
- Study of transport demand analysis by mode at mandis, rural industries and establishments.

4. Study Region and Methodology:

The study region consists of states of Andhra Pradesh, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa and Tamilnadu and union territory of Pondicherry. The study region accounts for 42.3 per cent of country's rural population.

The methodology adopted for the present study is similar to that of the 1978 study, so that travel patterns could be meaningfully compared. A sub-sample of the villages selected in the 1978 study have been chosen. Primary surveys were conducted at selected households in these villages and details collected regarding the annual travel pattern of these households. Using suitable growth factors the survey results have been projected to give the total regional transportation characteristics. The current study updates the data base of the earlier study and analyses the overall rural traffic pattern existing in 1989.

Primary surveys were organised in 60 villages out of 200 villages that were selected in the earlier study. A three step process was followed to select these villages. The 200 villages used for data collection in the previous study were distributed according to accessibility type and population grouping. The sample sixty villages of the present study were selected in each accessibility group and population group in proportion to their number in the previous study. On the basis of a pilot study in the sixty villages, households in the study region were classified into 16 different strata based on household income and vehicle ownership. Primary data was collected from 648 households spread over these 16 different strata. Households in the selected villages were drawn in a systematic fashion so as to cover all the sixteen different strata in the region. The overall sample of 60 villages and 640 households were decided taking into account the time requirements and financial constraints. The data collected from the household sector covered socio-economic characteristics, passenger and freight movement patterns. A non-household travel survey at selected mandis, rural industries and rural establishments was also carried out at selected villages. Using statistical techniques, the primary data was expanded to produce study region characteristics.

5. FINDINGS OF THE STUDY

5.1 Cart and Bicycle Stock:

The total cart stock in the study region is about 9.33 million and bicycle stock is estimated to be 15.1 million. Compared to 1978, the cart stock has only marginally increased by about 10 per cent during the last one decade (refer table 1). The results suggest that old carts are

continuously replaced by new ones indicating large investments. Amongst households owning carts, 56 per cent had a land holding of less than 2 hectares. Comparison with 1978 data indicates that the cart owning households with less than 2 hectare of land had increased by almost 100 per cent over the last 11 years (refer table 2). It is observed that more families are utilising borrowed funds to purchase carts compared to the earlier study.

TABLE 1: COMPARISON OF CART STOCK 1978-89 (in '000s)

Year	Traditional	Improved	Total
1978*	8618	93	8711
R.%	98.9	1.1	100.0
1989	8433	896	9329
R.%	90.4	9.6	100.0
Ratio of 1989 to 1978	0.98	9.6	1.1

Note: R% - row percentage

*Source: Page 28 of Report "Animal Cart in the Rural System", Part 1, IIMB, 1978

TABLE 2: PERCENTAGE DISTRIBUTION OF CART OWNING HOUSEHOLDS BY LAND HOLDING 1978-1989

Land holding in hectares	1978*	1989
Upto 1.0	8.2	12.6
1.1 - 2.0	21.2	42.9
2.1 - 10.0	56.5	37.9
Over 10	11.6	2.9
No land	2.5	3.7

*Source: Page 41 of Report "Animal Cart in the Rural System", Part 1, IIMB, 1978

5.2 Total Quantum:

The total quantity of traffic had changed from 694 million tonnes in 1978 to 891 million tonnes in 1989, resulting in an increase of 1.3 times during last 11 years as per the details given in table 3. During the same period the tonne-kilometers of traffic had changed from 2694 tonne-kilometers to 9069 million tonne-kilometers showing an increase of 3.4 times. Thus the annual compounded growth rates are 2.23 per cent and 11.67 per cent respectively for tonnes and tonne-kilometers of movement.

TABLE 3: CHANGES IN RURAL TRAFFIC PATTERN DURING 1978-89

Mode of transport	Qty. transported (million tonnes)		Quantum of traffic movement (million tonne km.)	
	1978	1989	1978	1989
Carts	468	431	1802	1384
Bicycles	1	18	4	52
Headload	143	35	134	33
Tractors	29	259	157	2263
LCV/truck	30	137	484	5236
Others	23	11	113	101
Total	694	891	2694	9069
Increase in number of times over 1978 values	1.3 times		3.4 times	
Compound growth rates (between 1978-89)	2.23 per cent		11.67 per cent	

The data at the village level shows that the villages with higher population generate higher per capita traffic (refer table 4)

TABLE 4: SHARE OF POPULATION AND TOTAL TRAFFIC (TKM) BY SETTLEMENT SIZE

Settlement size	%age share of population	Percentage share of traffic		Annual traffic generated per person	
		tonnes	TKM	tonnes	TKM
Upto 500	11.9	5.0	2.0	1458	5287
501 - 1500	29.8	33.7	16.7	3925	18256
1501 - 5000	36.1	48.6	34.0	4672	30771
Above 5000	22.2	12.7	47.3	1985	69684

5.2.1 Change in Freight Traffic During 1978-89

Freight traffic flow pattern between 1978 and 1989 is provided in tables 5 and 6. The intra values have come down compared to tremendous increase in the outflows. Possibly, the improvement in agricultural yield in rural areas and the export of surplus from villages to urban areas is a contributory factor. The total quantum of commodities moved by carts towards intra, inflow and outflow is more or less stagnant during the last one decade. Overall, it has marginally come down. The movement by headload has also

come down considerably particularly for intra movement. Trucks and tractors are carrying a much higher tonnage and bulk of this movement is for outflows.

TABLE 5: CHANGE IN ANNUAL FREIGHT TRAFFIC BY MODE
1978-1989 (in millions tonnes)

Mode	1978*				1989			
	Intra	Inflow	Outflow	All	Intra	Inflow	Outflow	All
Cart	375	14	79	468	317	25	89	431
Headload	139	3	1	143	34	1	0	35
Truck**	1	1	28	30	1	2	134	137
Tractors	22	2	5	29	59	2	198	259
Cycles	-	1	-	1	11	3	4	18
Others	16	3	4	23	1	6	4	11
All	553	24	117	694	423	39	429	891

*Source: Page 59 of "Animal Cart in the Rural System", part 1, the analytical report, 1978

** Includes LCVs.

TABLE 6: CHANGE IN TRAFFIC FLOW BY MODE BETWEEN 1978 AND
1989 (in million tonne-kilometers)

Mode	1978*				1989			
	Intra	Inflow	Outflow	All	Intra	Inflow	Outflow	All
Cart	759	171	872	1802	377	198	809	1384
Headload	114	16	4	134	28	4	0	32
Truck**	2	68	414	484	1	33	5202	5236
Tractors	41	34	82	157	103	32	2128	2263
Cycles	0	4	0	4	16	20	16	52
Others	24	42	47	113	2	62	37	101
All	940	335	1419	2694	527	349	8192	9068

*Source: Page 59 of "Animal Cart in the Rural System", part 1, the analytical report, 1978

5.3 Effect of Household Income on Annual Traffic

The traffic generation by households is expected to be related to the household income as well as vehicle ownership. Table 7 provides information on the share of annual traffic by household income. Households with less than Rs.10,000 income, though constituting 80 per cent of the total households, generate only 19.1 per cent of the total tonnage. In terms of tonne-kilometers, their contribution is 6.4 per cent. At the other end of the spectrum, households with more than Rs.50,000 income representing only 0.6 per cent of total households generate

17.4 per cent of tonnage and account for 53 per cent of tonne-kilometers.

TABLE 7: SHARE OF ANNUAL TRAFFIC BY HOUSEHOLD INCOME

Income (Rs.)	Percentage of households	Tonnes	Tonne-km.
Upto 5000	43.9	3.0	1.0
5001-10000	36.3	16.1	5.4
10001-20000	13.9	32.0	13.5
20001-50000	5.3	31.5	27.1
Over 50000	0.6	17.4	53.0
All	100.0	100.0	100.0

5.4 Freight Movement on Different Types of Roads

An analysis has been carried out regarding the share of different modes of traffic in terms of tonnage for all weather road (AWR) and fair weather road (FWR). Details are provided in tables 8 and 9. The share of bullock carts in FWR is very high at 56.8 per cent and tractors closely follow at 27.2 per cent.

TABLE 8: PERCENTAGE DISTRIBUTION OF TRAFFIC IN TONNES BY MODE AND TYPE OF ROAD

Type of road	Carts	Tractors	LCV/Trucks	Others	All
AWR	23.7	42.0	28.0	6.3	100.0
FWR	56.8	27.2	7.5	8.5	100.0

TABLE 9: PERCENTAGE DISTRIBUTION OF ANNUAL TRAFFIC IN TONNES BY TRIP DISTANCE AND TYPE OF ROAD

Type of road	Distance in km				All
	Upto 1	1.1-5	5.1-10	Over 10	
AWR	8.0	23.6	48.0	20.4	100.0
FWR	40.4	34.8	24.0	0.8	100.0

However, carts and tractors are ideally suited for this type of track condition. The traffic pattern on AWR is quite different. The share of carts on these roads is 23.7 per cent only. Tractors carry a higher share of 42 per cent of the load and LCV/trucks carry 28 per cent of the load. This difference in the traffic pattern between AWR and FWR clearly shows a shift from cart mode to mechanical modes when good road conditions are available.

In terms of share of traffic in different distance ranges, it is seen that the overall distance covered is much less on FWR compared to AWR. Roughly about 40 per cent of the traffic (tonnage) moves to a distance of less than 1 km and 75 per cent travel to a distance of less than 5 km on FWR. This is exactly reverse in AWR compared to FWR. Only 8 per cent of traffic moves to a distance of less than 1 km and about 32 per cent of traffic moves to a distance of less than 5 km.

Information on movement in terms of TKM by road type is presented in tables 10 and 11. The share of carts on FWR is 33.7 per cent whereas its share on AWR is only 9.8 per cent. The LCVs/trucks dominate the movement on AWR. The data also reveals that on AWR more than 70 per cent of the trips are beyond 10 km while 96 per cent of the trips are of less than 10 km on FWR.

TABLE 10: PERCENTAGE DISTRIBUTION OF TRAFFIC IN TKM BY MODE AND TYPE OF ROAD

Road type	Carts	Tractors	LCV/Trucks	Others	All
AWR	9.8	18.1	70.3	1.8	100.0
FWR	33.7	48.3	14.8	3.2	100.0

TABLE 11: PERCENTAGE DISTRIBUTION OF TRAFFIC IN TKM BY TRIP DISTANCE AND TYPE OF ROAD

Road type	Distance in km				All
	Upto 1	1.1-5	5.1-10	Over 10	
AWR	0.5	4.6	23.0	71.9	100.0
FWR	10.8	27.4	58.3	3.5	100.0

5.5 Vehicle Trip Distribution by Modes

Particulars of vehicle trips by quantity carried per trip by all modes are given in table 12. Nearly 98 per cent of the trips carry a load of less than one tonne. The percentage of trips with more than five tonnes per trip is very small i.e. of the order of 0.3 per cent. The quantity carried by all trips with less than one tonne per trip accounts to 57 per cent of the total freight movement in the study region. A very small percentage (2.3%) of total tonnage is carried by trips with more than 10 tonnes per trip. This indicates that a substantial number of trips are made to transport agricultural produce from fields to households and perhaps that is the main reason that the majority of trips carry less than one tonne per trip.

TABLE 12: VEHICLE TRIPS BY QUANTITY CARRIED - ALL MODES
(in '000s)

Quantity carried (tonnes)	Trips		Tonnes	
	Number	Percentage	Number	Percentage
Upto 1	5464522	98.3	507802	57.0
1.1 - 2.0	40178	0.7	76569	8.6
2.1 - 5.0	38109	0.7	155567	17.4
5.1 - 10.0	13290	0.3	131107	14.7
Over 10	1377	0.0	20430	2.3
All	5557476	100.0	891475	100.0

5.6 Modal Shift:

There is a shift in the pattern of traffic movement from non-mechanised modes to mechanised modes in the period 1978 to 1989. Over the last one decade, as per table 13, the percentage share of bullock carts in tonnage carried came down from 67.4 per cent in 1978 to 48 per cent during 1989. Substantial reduction has also taken place in manual movement (headload) of goods. Against this, the share of mechanised vehicles (tractor, LCV and truck) has increased from 8.4 per cent in 1978 to 44.5 per cent in 1989.

TABLE 13: MODAL SHIFT BETWEEN 1978-89 IN TONNAGE CARRIED BY DIFFERENT MODES

Mode	Quantity (million tonnes)				Growth in	
	1978		1989		tonnage	trip load
	value	%	value	%		
Carts	467.8	67.4	430.4	48.3	0.92	0.39
Trucks	29.8	4.3	137.2	15.4	4.63	0.59
Tractors	28.4	4.1	259.3	29.1	9.07	1.39
Bicycles	1.0	0.1	17.8	2.0	17.60	1.11
Others	24.0	3.5	10.7	1.2	0.46	0.24
Total vehicular	551.0	79.4	855.4	96.0	1.55	0.58
Headloads	143.0	20.6	35.6	4.0	0.25	0.42
Total	694.0	100.0	891.0	100.0	1.28	1.20

Note: Growth in tonnage = 1989 tonnage divided by 1978 tonnage

Growth in trip load = 1989 average load per trip divided by 1978 average load per trip.

As per the details presented in table 14 the traffic flow in terms of Tonne kilometers was dominated by animal carts during 1978 (66.9%). In 1989, trucks carried the highest percentage (57.7%).

TABLE 14: MODAL SHIFT BETWEEN 1978-89 IN TKM BY DIFFERENT MODES

Mode	Quantum of movement (million tonne kilometers)				Growth in	
	1978		1989		TKM	lead
	Value	%	Value	%		
Carts	1802.3	66.9	1378.5	15.2	0.77	0.83
Trucks	484.9	18.3	5232.8	57.7	10.72	2.34
Tractors	156.2	5.8	2267.2	25.0	14.43	1.59
Bicycles	5.4	0.2	54.4	0.6	11.58	0.66
Others	110.5	4.1	99.8	1.1	0.89	1.91
Total vehicular	2559.3	95.0	9032.7	99.6	3.53	2.27
Headloads	134.7	5.0	36.3	0.4	0.24	0.99
Total	2694.0	100.0	9069.0	100.0	3.37	2.62

Note: Growth in TKM = 1989 tonne kilometers divided by 1978 tonne kilometers
 Growth in lead = 1989 lead divided by 1978 lead.

Even though there is a decline in the quantum of traffic moved (both in terms of tonnes and tonne-kilometers) from 1978 to 1989, by carts, headload and others, this reduction is not uniform across all types of movements (intra, inflow and outflow).

5.7 Shift in Modal Split Due to Changes in Accessibility

The change in accessibility from FWR to AWR is expected to have a direct impact not only in terms of traffic generation but also in terms of the modal shift. Table 15 provides details about the modal shift when the accessibility changed during the time period 1978 to 1989. In those villages where there was no change, cart was main mode of traffic catering to 82.6 per cent of tonnage and 47.2 per cent of tonne-kilometers. However in those settlements, which had FWR earlier and subsequently there is a change of accessibility into AWR, mechanical modes such as tractors and trucks played a dominant role in freight transportation compared to carts. The share of carts in terms of tonnage decreased to 32.4 per cent compared to 82.6 per cent. The share of mechanised modes shot up from 9.0

per cent to 66 per cent in tonnage. In terms of tonne-kilometers movement, the role of bullock cart had changed drastically from 47.2 per cent to 3.6 per cent, while the share of truck had changed from 37.2 per cent to 91 per cent.

TABLE 15: EFFECT OF CHANGE IN ACCESSIBILITY ON MODAL SPLIT
(in percentage)

Mode	Change in accessibility 1978-89			
	FWR-FWR		FWR-AWR	
	Tonnes	TKM	Tonnes	TKM
Carts	82.6	47.2	32.4	3.6
Tractors	3.2	10.1	34.3	5.0
Trucks	5.8	37.2	31.7	91.0
Bicycle	3.7	2.1	0.1	0.0
Headload	3.6	0.7	1.1	0.1
Others	1.1	2.7	0.4	0.3
All	100.0	100.0	100.0	100.0

5.8 Vehicular Trips:

The total number of freight trips has changed marginally from 5.2 billion to 5.6 billion during the time period 1978 to 1989. However, if manual trips (headload) are excluded, the increase in vehicular trips (all modes put together) shows substantial increase from 1.2 billion in 1978 to 3.2 billion in 1989. Thus the vehicular trips had an annual compound growth rate of 9.3 per cent (refer table 16).

TABLE 16: CHANGE IN VEHICULAR TRIPS DURING 1978-89

Mode of transport	No. of trips (in million)			
	1978		1989	
	Number	%	Number	%
Carts	957.6	18.4	2247.1	40.4
Trucks	6.2	0.1	42.8	0.8
Tractors	12.5	0.2	81.6	1.6
Bicycles	28.8	0.6	458.2	8.2
Others	194.6	3.7	374.7	6.7
Total vehicular trips	1199.7	23.0	3204.4	57.7
Headloads	4005.3	77.0	2353.1	42.3
Total	5205.0	100.0	5557.5	100.0

table 16 cont'd...

Compound growth rate
between 1978-89

For vehicular trips	9.34
Overall trips	0.60

6.0 PASSENGER TRAVEL

In the present study, in addition to freight transportation characteristics in rural areas, passenger travel aspects, which have some bearing on planning and operating transport infrastructure have been considered. The passenger characteristics exhibit a different pattern compared to freight movement. This study does not consider passenger trips within the village boundary but deals exclusively with trips whose destination is beyond village boundary.

6.1 Travel Modes:

As per the data presented in table 17, the three dominant modes used for passenger travel are bus, walk and bicycle together accounting to 96 per cent of total passenger trips. Buses have penetrated into rural settlements and 43 per cent of the total passenger travel is accounted by them. Walk trips still account for 33.8 per cent of total trips, with the remaining 66.2 per cent being made by vehicles. Bullock carts have virtually no role to play in exclusive passenger movement.

TABLE 17: PERCENTAGE DISTRIBUTION OF PASSENGER TRIPS BY SETTLEMENT SIZE AND MODE

Settlement size	Mode of transport				Total
	Walk	Cycle	Bus	Others	
Upto 500	63.5	18.1	17.7	0.7	100.0
501 - 1000	36.4	28.8	31.1	3.7	100.0
1001 - 2000	31.2	25.7	38.9	4.2	100.0
2001 - 5000	32.0	9.9	53.1	5.0	100.0
Over 5000	25.8	20.9	52.2	1.1	100.0
All	33.8	19.8	43.0	3.4	100.0

6.2 Trip Purpose:

The purposewise analysis of passenger travel indicates that education trips account for nearly one-third of the total trips. Trade, commerce and business trips together

constitute about 17 per cent of passenger trips.

6.3 Trip Length:

The mean travel time for all the three dominant modes viz. walk, bicycle and bus is more or less same at about 30 minutes. However, in terms of average trip distance figures vary for individual modes due to changes in the speed of operation of each mode. The average passenger trip length for all purposes is about 7 km.

6.4 Passenger-cum-freight Trips:

Exclusive trips are made in rural areas for passenger movement. Passenger trips for business, trade etc. is not necessarily clubbed with commodity movement. Only 3.5 per cent of passenger trips contained some freight component also.

6.5 Settlement Size and Trip Rates:

Per capita trip rates increase with the settlement size as per the data presented in table 18. Further, the share of bus trips to total trips also increases with the settlement size. The policy of connecting larger settlement sizes with buses may be a possible explanation.

6.6 Effect of size of Settlements:

The settlement size and the connectivity pattern will have a bearing on the socio-economic and travel characteristics of the settlements. The per capita trip analysis for the above types of settlements shows that there is an increase in per capita trips when settlements are connected by all weather roads. Similarly, as the size of the settlement increases the per capita trip rate increases. The mean household income is also related to the size of settlement and increases with the size of the settlement.

Travel characteristics of settlements with less than 5000 and more than 5000 population is shown in table 19. Smaller settlements have a higher proportion of trips under agriculture, whereas trade, commerce and business trips are more important in larger settlements. There is no significant difference in the health, social and other trip purposes. The composition of modes of transport shows smaller towns have higher bias towards walk trips than larger towns. This pattern gets reversed for bus trips. There is no significant difference in bicycle trips between different settlement sizes.

**TABLE 19: PASSENGER TRIP CHARACTERISTICS OF SETTLEMENTS
WITH LESS THAN 5000 AND MORE THAN 5000 POPULATION**

Item	Settlement Size	
	Less than 5000	More than 5000
A. TRIPS BY PURPOSE (%)		
Agriculture	17.4	4.4
Trade, Commerce & Business	15.1	24.6
Education	31.4	37.9
Health	6.2	5.0
Social	9.8	7.7
Others	20.1	20.4
B. TRIPS BY MODE (%)		
Walk	35.6	25.8
Bicycle	19.5	20.9
Bus	40.8	52.2
Others	4.1	1.1
C. MEAN TRIP LENGTH (km.)	8.9	9.8
D. MEAN PER CAPITA TRIP	1.09	1.56
E. MEAN HOUSEHOLD INCOME (Rs. per annum)	7021	12406

7.0 NON-HOUSEHOLD TRAVEL

The present study also covers on non-household travel analysis such as market centres (mandi), rural industries and commercial establishments in rural areas.

Overall in non-home based freight movement, bulk of the transportation needs are met by the mechanised modes. The share of the carts is not significant.

7.1 Mandi Travel:

Mandis are the retail/wholesale distribution centres for agricultural commodities in rural areas. Data shown in table 20 indicates that cereals and pulses account for 80 per cent of the total tonnage of movement to and from mandis. Carts' share of mandi traffic (tonnage) is only 16 per cent. Trucks and tractors cater to the remaining 84 per cent of traffic.

TABLE 20: PERCENTAGE DISTRIBUTION OF COMMODITY MOVEMENT IN TONNES BY TYPE OF COMMODITY AND MODE OF TRANSPORT - TO MANDI

Commodity	Mode of transport				Total
	Carts	Tractors	LCV/ trucks	Others	
Cereals/ pulses	51.8	47.3	89.3	0.0	76.9
Fruits, veg. & edible oil	37.8	52.7	4.5	100.0	17.1
Cash crops	10.4	0.0	4.0	0.0	4.5
Consumer goods	0.0	0.0	2.2	0.0	1.5
All	100.0	100.0	100.0	100.0	100.0

FROM MANDI

Commodity	Mode of transport				Total
	Carts	Tractors	LCV/ trucks	Others	
Cereals/ pulses	10.8	8.6	80.6	0.0	100.0
Fruits, veg. & edible oil	35.2	42.8	18.4	3.6	100.0
Cash crops	37.3	0.0	62.7	0.0	100.0
Consumer goods	0.0	0.0	100.0	0.0	100.0
All	16.0	13.9	69.5	0.6	100.0

7.2 Rural Industries:

The main commodities moved to and from industry are cash crops and consumer goods. About 87 per cent of the rural industrial traffic is handled by LCV/trucks (refer table 21).

**TABLE 21: PERCENTAGE DISTRIBUTION OF COMMODITY MOVEMENT
IN TONNES BY TYPE OF COMMODITY AND MODE OF
TRANSPORT - TO INDUSTRY**

Distance range (km)	Mode of transport				Total
	Carts	Tractor	LCV/Truck	Others	
Cereals & pulses	26.4	64.7	5.0	66.7	9.8
Fruits & veg.	7.5	7.8	7.4	6.2	7.4
Cash crops	39.2	0.0	36.9	26.3	36.4
Engg. goods	0.0	0.0	2.9	0.0	2.5
Bldg mtls.	19.8	21.6	6.4	0.8	7.4
Consumer goods	2.9	0.0	40.5	0.0	35.3
Others	4.2	5.9	0.9	0.0	1.2
All	100.0	100.0	100.0	100.0	100.0

FROM INDUSTRY

Distance range (km)	Mode of transport				Total
	Carts	Tractor	LCV/Truck	Others	
Cereals & pulses	23.9	5.5	44.2	26.4	100.0
Fruits & veg.	8.9	0.9	87.0	3.2	100.0
Cash crops	9.5	0.0	87.7	2.8	100.0
Engg. goods	0.0	0.0	100.0	0.0	100.0
Bldg mtls.	23.6	2.4	74.0	0.0	100.0
Consumer goods	0.7	0.0	99.2	0.1	100.0
Others	31.1	4.0	64.9	0.0	100.0
All	8.8	0.8	86.5	3.9	100.0

7.3 Commercial Establishments:

Traffic from this sector mainly comprises of cereals and pulses, building material and consumer goods as given in table 22. Together these account for 92 per cent of the total tonnage. About 60 per cent of this traffic is handled by LCV/truck. Buses cater to 25 per cent of the traffic. Bullock carts carry only 8 per cent of this traffic.

TABLE 22: PERCENTAGE DISTRIBUTION OF COMMODITY MOVEMENT IN TONNES BY TYPE OF COMMODITY AND MODE OF TRANSPORT - TO ESTABLISHMENT

Commodity	Mode of Transport					Total
	Cart	LCV/ Truck	Cycles	Bus	Others	
Cereals/ pulses	43.5	8.9	68.8	69.6	60.6	31.5
Fruits, veg. & edible oil	2.0	0.3	3.7	8.3	18.2	3.0
Fertilizers	1.0	6.0	0.0	0.0	0.0	3.6
Timber & Bldg.Mtls.	25.7	77.2	0.0	0.0	0.0	47.6
Consumer goods	23.8	5.6	25.0	21.2	21.2	12.4
Others	4.0	2.0	2.5	0.9	0.0	1.9
All	100.0	100.0	100.0	100.0	100.0	100.0

FROM ESTABLISHMENT

Commodity	Mode of Transport					Total
	Cart	LCV/ Truck	Cycles	Bus	Others	
Cereals/ pulses	10.4	16.7	13.0	55.2	4.7	100.0
Fruits, veg. & edible oil	4.9	4.9	7.3	68.3	14.6	100.0
Fertilizers	2.0	98.0	0.0	0.0	0.0	100.0
Timber & Bldg.Mtls.	4.0	96.0	0.0	0.0	0.0	100.0
Consumer goods	14.4	26.9	12.0	42.5	4.2	100.0
Others	16.0	64.0	8.0	12.0	0.0	100.0
All	7.5	59.2	5.9	24.9	2.5	100.0

8.0 SUMMARY AND CONCLUSIONS

8.1 Summary of Findings

8.1.1 The total cart stock in the study area is about 9.33 million. The total bicycle stock is estimated to be 15.1 million. Compared to 1978, there is a marginal increase in the cart stock by about 10 per cent. Overall, the cart stock is younger in 1989 compared to 1978.

- 8.1.2 The earlier 1978 study indicated that bullock cart played a prominent role in rural freight transportation. A large quantity of agricultural products were transported using carts. Carts had a dual role to play in its usage for both farm and non-farm purposes.
- 8.1.3 There is a shift from bio-energy modes (carts and headloads) to petroleum energy (motorised vehicles) modes. Carts carried 67.5 per cent of the total tonnage in 1978, which came down to 48.3 per cent during 1989. Headload which accounted for about 21 per cent in 1978 was 4 per cent only in 1989. Trucks, LCV and tractors accounted for only 8.4 per cent in 1978 and accounted for 44.5 per cent in 1989.
- 8.1.4 The traffic flow in terms of TKM was dominated by animal carts during 1978 (66.9%). In 1989, trucks carried the highest percentage (57.7%).
- The total quantity of traffic had changed from 694 million tonnes in 1978 to 891 million tonnes in 1989, resulting in an increase of 1.3 times during last 11 years. During the same period the TKM of traffic had changed from 2694 million TKM to 9069 million TKM; showing an increase of 3.4 times. The lead for the entire rural traffic had changed from 3.9 km to 10.2 km during the same period. It indicates that average lead had increased by 2.6 times.
- 8.1.5 In general, bullock carts are used on inferior roads (FWR), while LCV/truck dominates the movement in superior roads (AWR).
- 8.1.6 In the study area, 5.6 billion trips per annum are performed in 1989 as against 5.2 billion trips per annum in 1978. If trips by headloads are excluded, then the total number of trips performed by vehicles in 1989 is 3.2 billion as against 1.2 billion in 1978. This shows a substantial increase in vehicular trips by about 2.7 times during the last decade.
- 8.1.7 In the study region, rural passenger travel characteristics exhibit an entirely different pattern compared to rural freight movement. The average number of trips per week per household is 5.5. Trip is defined for purposes of passenger transport as movement beyond settlement. On an average 13 per cent of households did not make any trips in a week. Per capita trip rate per week in the study region is 1.0. Per capita passenger trip rate increases with household income and

settlement size. Settlements connected by all weather road (AWR) have a higher trip rate than settlements connected by fair weather road (FWR).

- 8.1.8 Non-household travel analysis includes market centres (Mandi), Rural industries and Commercial establishments. In Mandi traffic, cereals and pulses account for nearly 80 per cent of tonnage. Trucks and tractors carry 84 per cent of the total quantity of goods. Carts account for only 16 per cent of tonnage. Nearly two-thirds of the quantity is transported beyond 20 km.
- 8.1.9 The main commodity moved to and from industries are cash crops (36.4%), and consumer goods (31%). Nearly three-fourths of commodity tonnage is transported beyond 30 km. LCV/trucks account to 87 per cent of the total tonnage. 8.1.10 With reference to the traffic flow of commercial establishments, cereals and pulses, timber/building materials and consumer goods together account for about 92 per cent of total tonnage. LCV/truck account for 59 per cent, buses to 25 per cent and bullock carts carry only 8 per cent of the total tonnage.

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