

GOVERNMENT OF PAKISTAN  
PLANNING AND DEVELOPMENT DIVISION  
NATIONAL TRANSPORT RESEARCH CENTRE

388-41322

MAJ

1979

08726

+++

RESEARCH NOTE

BUS PASSENGER LOADS AND MILEAGE —  
A SURVEY OF INTERCITY BUS OPERATIONS

NTRC-33

By:

Abdul Majeed  
Deputy Chief

31st May, 1979

CONTENTS

<u>S.NO.</u>		<u>PAGE NO.</u>
1.	<u>INTRODUCTION:</u>	1
	Scope and Methodology	1
	Coverage	3
	Limitations	4
2.	<u>PASSENGER LOAD SURVEY:</u>	5
	Frequency	5
	Hourly Variations	6
	Load Factors	6
	Variation by Hour of the Day	8
	Distribution of Buses by No. of Passengers.	9
3.	<u>ROUTE SURVEY:</u>	10
	Travel Times	12
	Conclusions and Recommendation	13
4.	<u>LIST OF TABLES</u>	
	(i) Average Intervals.	6
	(ii) Frequency of Buses by hour and direction	6
	(iii) Average Passenger load between Rawalpindi and other places.	7
	(iv) Average load by direction and hour of the day.	8
	(v) Distribution of Buses by load category (%)	9
	(vi) Passenger turn-over, average load and lead	10
5.	<u>LIST OF ANNEXURES</u>	
	Annex. -A. Frequency of Buses and loads by Routes.	16
	"    -B. No. of buses by routes and times	17
	"    -C. Average load (per bus) by routes and times	18
	"    -D. Distribution of Buses by No. of Passengers for hours of day and direction.	19

BUS PASSENGER LOADS AND MILEAGE -  
A SURVEY OF INTERCITY BUS OPERATIONS

INTRODUCTION:

Frequent complaints of public about the availability of transport services has given rise to the need for collection of data on various aspects of transport. Among other things, the agencies concerned with planning, control and regulation of road transport services need information on bus passenger loads and mileages performed for assessment of demand and supply conditions to ensure availability of transport services; for estimation of operating costs and revenues for regulation and control of fares; and for forecasting of demand for transport for long term planning, etc. However, there is no regular source of information to provide reliable data on these variables. The controlling agencies, therefore, often make assumptions which may be widely different from reality. Policies formulated on such hypothetical assumptions can lead to erroneous results.

Therefore, in order to make realistic estimates of passenger load and daily mileage performed by buses on intercity routes, a short survey of bus operations was carried out by the National Transport Research Centre. The results of this survey are described in this report.

SCOPE AND METHODOLOGY:

The investigations included: (i) a survey of bus loads at Rawat, 10 miles in the south of Rawalpindi

on G.T Road; and (ii) a survey of Lahore-Rawalpindi Route for finding loads, journey time and turn round times for a round trip.

The survey at Rawat was carried out on 29th March, 1979 from 9 A.M. to 5.00 P.M. Buses to and from Rawalpindi were checked and the following information was noted:

- (i) Registration number;
- (ii) Route - Main stations of origin or destination.
- (iii) Time of arrival with one hour interval; and
- (iv) Number of passengers on board, excluding Driver and Conductor.

Two enumerators were posted on each side of the road to record the above information. Time was noted at change of hour only. The registration number and route of bus were noted while the vehicles approached the bus stop. The counting of passengers was done either before or after boarding and alighting had taken place. Care was taken to avoid double counting involved in counting both boarding and alighting passengers.

For buses not stopping at the station, the number of passengers was estimated according to whether the bus was loaded sparsely, less than half, more than half, full(seated, few standing passengers, heavily over-loaded) as could be visually seen.

However, it was not possible to cover all the buses passing at the survey station. Each enumerator could check only one bus at a time. Buses that passed the survey station when the enumerators were busy in checking others were not noted. An estimate of coverage is given in the next section.

For the Route Survey, six observers travelled from Rawalpindi to Lahore and back by the same bus and recorded the following information:

- (i) Time of arrival and departure at terminals and at intermediate stations; and
- (ii) Number of passengers boarding and alighting at each stop all over the route.

The above information provided estimates of passenger load over the entire route, journey time including stopping at intermediate stops and terminals.

The observers left Rawalpindi with an interval of one hour from each other from 5.00 A.M. on 1st April, 1979. However, there was inordinate delay for two out of six buses due to technical or mechanical problems. Therefore, the observers of these buses had to return by a different bus.

Coverage:

The number of buses per hour on Rawat-Mandra Section observed in May 1978, while carrying out Travel speed Surveys, varied between 54 to 67 from 1200 to 1700 hours. As compared to this the average number of buses noted in the present survey varied from 60 to 80. Thus the number of buses missed is not significant!

The coverage can also be varified from scheduled frequencies. For example, private buses for Lahore leave after an interval of 10 minutes and Government buses after 30 minutes. The average interval is thus be 7.5 minutes. In addition, some buses go back without taking their turn at the terminal.<sup>(1)</sup> The actual interval is therefore likely

(1) In such a case they are not allowed to carry any passenger at the terminal. These buses pick up passengers on the way.

to be less than 7.5 minutes. The interval indicated by the survey data was actually 4.4 minutes. This also confirms that coverage of the survey is fairly high. It also indicates that more than 60% of buses do not take their turn at the terminal; i.e. they go back out of turn.

Limitations:

The survey at Rewat was of a very limited scope. The total high type <sup>(2)</sup> length of roads in the country is 20,000 miles and the survey point represents a 20 miles road section only. The sampling proportion is therefore 1/1000 which is extremely small.

Similarly, the route survey covered only six round trips or 12 one way trips. The average number of buses on Rewat-Rawalpindi Section is not less than 1200 per day <sup>(3)</sup>. The sample is thus 1/100 for the route. If, however, all the routes are taken together, the sampling proportion would be less than 1/1000. The coverage is therefore limited with respect to both time and place. The results are therefore specific to time and place to which they relate and may not be applicable elsewhere. There is likely to be a large variation in load and mileage performed at other places and on different routes. This should be kept in view while evaluating the results. However, the survey does provide factual data of great value.

---

(2) Metalled and surfaced roads are clasified as high type.

(3) The number of buses on this section given by Traffic Count Data are; 1976 = 1415; 1977 =1107, or average of two  $\times$  years=1261. . . . Of summary of Traffic Count Data for Pakistan Highway for 1976 and 1977, Planning and Design Directorate, Punjab Highways Department, Lahore.

THE RESULTS

PASSENGER LOAD SURVEY:

The number of buses checked, number of passengers carried by these buses, and average load for inward and outward directions for each route are given at Annexure-A. It would be seen there-from that during 8 hour survey, from 9 A.M. to 5 P.M. a total of 553 buses of intercity routes including sub-urban services were intercepted at the survey point. Of these, 266 buses were in inward direction and 287 in outward direction. These buses carried in all 26,290 passengers of which 11,264 were in inward direction, and 14,926 in outward direction. The resulting load factor is 43 passengers in inward direction, 52 in outward direction or an average for both directions of 48 passengers.

The number of buses to and from Lahore was largest for Lahore (219). This is followed by Gujranwala (101), local sub-urban (76), Faisalabad (49), Sialkot (39), Chakwal (37), Sargodha (33), Mirpur (11).

The number of buses in two directions should normally balance over the day as buses cannot move in one direction only all the time. However, there is significant difference in the number of buses in each direction. For example, the number of buses coming from Lahore was 130 as against 89 going to Lahore. This can be ascribed partly to adjustment of frequencies according to variations in demand at different time of the day and partly to short sampling period.

Frequency:

On the basis of number of buses covered in the survey, the interval of bus services to and from Rawalpindi comes to one bus every 1.7 minutes in each direction.

Interval for individual routes are as below:

(i) Average Intervals

Lahore-Rawalpindi	4 Minutes
Gujar Khan "	10 "
Faisalabad "	20 "
Sialkot "	25 "
Chakwal "	26 "
Sargodha "	29 "
Mirpur "	87 "

The above intervals are based on average of two directions. The actual intervals would be slightly lower if the buses not covered in the survey are also added.

Hourly Variations:

The distribution of buses by time and direction for each route is shown in Annexure-B. A summary of the same is reproduced below:

(ii) Frequency of Buses by Hour and Direction

<u>H o u r</u>	<u>No. of buses checked</u>		
	<u>Inward</u>	<u>Outward</u>	<u>Total</u>
0.900-1000	25	35	60
1000 - 1100	41	33	74
1100 - 1200	31	31	62
1200 -1300	27	40	67
1300 - 1400	40	34	74
1400 - 1500	27	37	64
1500 - 1600	43	37	80
1600 - 1700	32	40	72
<u>T o t a l :</u>	<u>266</u>	<u>287</u>	<u>553</u>
<u>Average :</u>	<u>33</u>	<u>36</u>	<u>69</u>



As is evident from the above, the range of variation in inward direction is between 25 and 43 with an average of 33. The variation in outward direction is between 31 and 40 with an average of 36. The variation for both directions combined is between 60 and 80 with an average of 69 buses per hour. The greater variation in inward direction is perhaps due to the fact that intervals are more evenly spaced nearer the place of origin than at a distant place. The buses in inward direction are farther away from their place of origin and hence less regularly spaced.

Load Factors:

As indicated in Annexure-A, the 553 buses checked carried in all 26,290 passengers resulting in average load of 48 passengers. This comprises of an average load of 43 passengers in inward direction and 52 in outward direction as below:-

(iii) Average Passengers Load between Rawalpindi and other places:

<u>Origin/ Destination</u>	<u>Inward</u>	<u>outward</u>	<u>Both Directions</u>
Lahore	43	50	46
Gujar Khan	41	57	49
Faisalabad	44	51	48
Sialkot	43	49	47
Chakwal	41	50	45
Sargodha	40	49	42
Mirpur	50	54	52
Local	40	52	49
<b>Total:</b>	<b>43</b>	<b>52</b>	<b>48</b>

The variation between routes is not much. The load in inward direction varied from 40 to 44 passengers for all routes except for Mirpur where the load was 50.

The frequency on this routes as smallest of all - 5 in one direction and in the other. The variation in outward direction is between 49 and 57 with an average of 52.

Variation by Hour of the Day:

Further details of average loads by direction and Hour of the day are shown in Annexure-C, attached.

A summary of the load is as follows:

(iv) Average Load by Direction and Hour of the day:

Hour Direction	0900	1000	1100	1200	1300	1400	1500	1600	All
Inward	54	47	47	38	41	39	39	39	43
outward	41	48	51	51	51	56	59	57	52
B o t h	47	47	49	46	46	49	49	48	48

The above figures display the pattern of daily and weekend variations. In the first instance, it may be noted that unlike routes, variations between hours are significant. At 0900 hours average load was highest in inward direction (54) and lowest in outward direction(41). This is due to more people coming to city in the morning for work. At other hours the average load in inward direction ranged between 38 and 47 and in outward direction between 48 and 59.

Secondly, it will be seen that heaviest load in outward direction was 59 persons at 15 hours. This balances the morning inflow. People from nearby places come to the city in morning and go back in the afternoon.

Thirdly, excepting 0900 hours, load in outward direction is consistently more than the inward direction. The same was the case for individual routes. This shows the weekend pattern. The survey date being a weekend, more people were going out.

Fourthly, the load factor in inward direction is larger in the morning and declines in the afternoon. In the outward direction, the reverse is true. Perhaps, the numbers of those going out increase in the afternoon after closing of working hours.

Distribution of Buses by No. of Passengers:

The distribution of buses according to number of passengers carried by hour of the day and direction is shown at Annexure-D, attached. A summary of the same is given below:

(v) Distribution of buses by load category(%)

Passenger Class	Proportion of Buses (%)		
	Inward	Outward	Both
15 - 25	10	1	5
26 - 35	14	4	9
36 - 45	35	12	23
46 - 55	35	49	42
56 - 65	6	30	18
Above 65	-	4	2
Total:	<u>100</u>	<u>100</u>	<u>100</u>

It would be seen that 42% of buses were carrying full or nearly full loads (46 - 55 passengers). Of the remaining, 38% were less than fully loaded and 20% overloaded. Of the latter 18% were carrying 56 -65 passengers and 2% were carrying more than 65 passengers. The last category can be regarded as excessively overloaded.

Looking at the two directions, it would be seen that proportion of buses in lower load categories is relatively more in inward direction. In the outward direction, the proportion of buses is relatively more. This is in-line with higher load factor in outward direction than in the inward direction as indicated before.

ROUTE SURVEY:

The above load factors relate to a specific place only. To have an idea of the variation over a longer length, information was obtained for loads on Lahore-Rawalpindi Route by enumerators actually travelling in the buses. They noted number of passengers boarding and alighting and time of arrival and departure at each stop and at terminals. The results are given below. As the number of observations of this survey is very small, it is not possible to give distributions. Hence the results are confined to averages only:

(iv) Passenger Turnover, Average load and lead:

<u>Direction</u>	<u>Rawalpindi/ Lahore</u>	<u>Lahore/ Rawalpindi</u>	<u>Both Directions</u>
1. Total no. of passengers boarding/alighting	205	117	322
2. Average distance travelled by each passengers(Miles)	38	62	47
3. Average load per bus	43	40	42

It will be seen from the above that passenger turn-over was more in Rawalpindi/Lahore direction where the average number of passengers boarding a bus on the whole route was 205. As against this only 177 boarding in the reverse direction. In other words, 322 passengers boarded a bus on a round trip between Lahore and Rawalpindi.

The average distance travelled by a passenger was 38 miles in Rawalpindi/Lahore direction as against 62 miles in Lahore/Rawalpindi direction or 47 miles for both directions combined. Thus, smaller number of passengers travelled longer distances in inward direction and larger number of passengers travelled shorter distance in outward direction with the result that difference in average load in two directions was not significant. It worked out to 43 in Rawalpindi/Lahore direction, 40 in Lahore/Rawalpindi Direction and 42 for both directions combined.

The difference in average length of trip in two directions seems entirely due to the timings of observations in Rawalpindi/Lahore direction, the observations were made in the forenoon, when there is more local traffic. In the reverse direction, major part of travel was made at night when short distance traffic is not there. Hence the difference in composition of traffic.

It would be recalled that survey at Rewat indicated average load of 48 passengers whereas the load for the entire Lahore/Rawalpindi Route is 42. The higher load at Rewat might be due to relatively more short distance traffic at that place during time of the survey or the difference could entirely be due to sampling. It would be recalled that survey at Rewat covered most prominent working hours of the day i.e. 0900 to 1600 hours during which there is more local traffic and hence higher load factors. On the other hand, the survey of Rawalpindi/Lahore route covered continuous the travelling for 24 hours, This figure therefore includes variations for all hours of the day and is therefore more realistic.

Travel Times:

The record of travel and turn round times for 12 journies made on Rawalpindi/Lahore Route provides the following results.

<u>T r i p</u>	<u>Travelled Time</u>	
	<u>Average</u>	<u>Minimum</u>
(a) Travel time-one direction	6 Hrs.40 Mnts.	6HRS.20 mnts.
(b) Time spent at terminals each side	5 Hrs.58 mnts.	2 Hrs.57 mnts.
(c) Round Trip	25 Hrs.16 mnts.	-

It is evident from the above that a bus takes 6 Hours 40 Minutes to travel between Lahore and Rawalpindi - a distance of 284 K.M. and spends about six hours at each terminal, making a round trip in 25 hours 16 minutes.

The variation in travel time is quite small, +22 Minutes. However, variation in time spent at terminals is quite large, from about 3 to 11 hours. The main reason is that buses usually spend more time at their base, where repair and maintenance is carried out in their home depots. Thus at each terminal some buses stay for short time and some very long times resulting in greater variation. Secondly, frequencies are adjusted according to availability of traffic at different times of the day. For example, the buses arriving at the terminal in the evening may go back nex morning. Both these factors account for larger variations in time spent at terminals.

It may be indicated that round trip time being 25 hours 16 minutes, buses on Rawalpindi/Lahore Route will make at the most six round trips in a week.

It may further be added that out of 6 buses selected for actual travelling, one was taken off for repairs and did not turn back. If this is taken as an average, a bus would make only  $5\frac{1}{2}$  round trips in a week or 280 trips in a year. However, taking account of time required for major repairs and overhauls, for fitness certificates, etc. a maximum of 250 trips in a year would be more realistic estimate.

It should be remembered that Lahore/Rawalpindi is an "A Class" Route, where less than 3 years old buses are allowed. On other routes, where older buses operate, the utilisation would be relatively less.

Conclusions and Recommendations:

The main purpose of this exercise was to provide information on passenger loads and mileage performed by buses on intercity routes.

The average load observed at Rewat near Rawalpindi was 48 passengers. This figure, however, relates to most prominent 8 working hours of the day when there is rush on account of more short distance traffic. The survey of Lahore/Rawalpindi Route indicated average load of 42 passengers. This figure seems to be on the lower side as it includes, with equal weight, night travel when the demand is at the lowest level and local short distance traffic is absent. Therefore, an average load of 45 seems to be a more reasonable approximation.

The maximum seating capacity of a bus of the type operating in Pakistan is 52 passengers. There are also buses built on shorter chassis which have a seating capacity of 42 passengers.

Such buses are predominant in hilly areas and on secondary routes. At the survey site, the proportion of such buses was not insignificant. The average capacity would, therefore, be approximately 50 passengers on this route.

In comparison to above capacity, the average load of 45 passengers provides a utilisation ratio of 90%. At this rate the level of service is extremely poor. There will be overloading and long waiting lines for most of the day time traffic. Hence, public complaints.

In air transport, a load factor of 60% is regarded as a "Turn-Away" point and a signal for capacity expansion. If this is taken as a guide, the position in road transport is of acute shortage. In order to provide a reasonable level of service a load factor of 70 to 75 percent should be aimed at.

The travel time records indicated that a bus can make at the most  $5\frac{1}{2}$  round trips a week or 286 round trip per year. Taking into account time required for major repairs and overhauls, a maximum of 250 trips a year would be more realistic estimate for Lahore-Rawalpindi Route. The length of this Route being 284 k.m., the annual running comes to 142,000 k.m. This level of utilisation is extremely high and can only be sustained by buses of at the most 3 years age. The utilisation of other buses would be less. This may be compared with an average utilisation of 64,000 k.m. per buses assumed in the Fifth Five Year Plans.

It is evident from the above that the present capacity is being stretched to its limits both in terms of load factor and utilisation of fleet, with the nature of poor level of service and loud public complaints.



These are the signs of shortage and need for capacity expansion.

Before concluding, it may be restated that sample size of both the surveys is extremely small. The results are, therefore, specific to time and place and may or may not be applicable elsewhere. Therefore, it is suggested that in order to obtain better results, a similar survey may be carried out on various important routes.

Frequency of Buses and Loads by Route

Origin/ Destination	No. of Buses Inward	Buses Outward	No. of Inward	Passengers Outward	Average Inward	Load onward	Both Dire- ction
1.	2	3	4	5	6	7	8
Lahore	130	89	5605	4434	43	50	46
Gujar Khan	48	53	1977	3009	41	57	49
Faisalabad	17	32	750	1617	44	51	48
Sialkot	12	25	514	1319	43	49	47
Chakwal	19	18	775	896	41	50	45
Sargodha	16	7	633	341	40	49	42
Mirpur	5	6	251	323	50	54	52
Local/Suburban	19	57	759	2987	40	52	49
<b>T O T A L:</b>	266	287	10554	14,926	43	52	48

No. of Buses by Route and Time Annexure-B

R O U T E	0900	1000	1100	1200	1300	1400	1500	1600	Total
Lahore/Rawalpindi	10	12	15	16	21	12	25	19	130
Rawalpindi/Lahore	14	10	9	11	7	13	10	15	89
Gujar Khan/R.pindi	9	11	5	5	4	4	6	4	48
R.pindi/Gujar Khan	5	6	7	9	6	6	7	7	53
Faisalabad/R.pindi	1	5	1	1	1	1	4	3	17
Rawalpindi/F.Abad.	6	3	3	5	4	4	5	2	32
Sialkot/Rawalpindi	1	2	-	-	4	2	1	2	12
R.pindi/Sialkot	1	4	3	4	4	3	3	3	25
Sargodha/R.pindi	1	2	4	1	2	3	2	1	16
R.pindi/Sargodha	1	1	1	1	1	-	-	2	7
Chakwal/R.pindi	1	6	-	3	4	1	2	2	19
R.pindi.Chakwal	3	1	2	1	5	2	3	1	18
Mirpur/R.pindi	2	2	1	-	-	-	-	-	5
R.pindi/Mirpur	-	1	2	1	1	1	-	-	6
Local Inward	-	1	5	1	4	4	3	1	19
Outward	5	7	4	8	6	8	9	10	57
Grand Total, Inward	25	41	31	27	40	27	43	32	266
Outward	35	33	31	40	34	37	37	40	287

Annexure-C

Average Load (Per Bus) by Route and Time

Route	0900	1000	1100	1200	1300	1400	1500	1600	Total
Lahore/R.pindi.	52	47	45	40	43	45	40	40	43
R.pindi/Lahore.	40	49	52	55	45	51	59	53	50
Gujar Khan/R.pindi.	49	45	52	37	40	24	35	28	41
R.pindi/GujarKhan	46	55	54	50	58	85	62	64	57
F.Abad/R.pindi	44	47	52	20	40	18	43	47	44
R.pindi/F.Abad	43	43	47	50	52	58	56	59	51
Sialkot/R.pindi	46	54	-	-	35	60	27	47	43
R.pindi/Sialkot	52	41	48	52	36	57	62	56	49
Sargodha/R.pindi	35	50	42	20	38	40	40	35	40
R.pindi/sargodha	42	48	42	48	60	-	-	51	49
Chakwal/R.pindi	56	45	-	44	36	32	36	35	41
R.pindi/Chakwal	43	48	49	52	52	47	56	48	50
Mirpur/R.pindi	52	47	52	-	-	-	-	-	50
R.pindi/Mirpur	-	52	47	52	65	60	-	-	54
Local Inward	-	58	51	30	42	29	39	18	40
Outward	33	48	52	52	45	59	60	58	52
Grand Total.Inward.	54	47	47	38	41	39	39	39	43
Outward	41	48	51	51	51	56	59	57	52
Both Directors	47	47	49	46	46	49	49	48	48

Distribution of Buses by No. of Passengers  
for Hours of day and Direction

Passenger Class	0900	1000	1100	1200	1300	1400	1500	1600	All	%
<u>INWARD</u>										
15 - 25	-	2	1	7	3	3	5	5	26	(10)
26 - 35	1	2	1	4	9	7	9	5	38	(14)
36 - 45	6	12	10	5	15	11	18	17	94	(35)
46 - 55	13	21	15	11	11	6	11	-	93	(35)
56 - 65	5	4	4	-	2	-	-	-	15	(30)
66 & over	-	-	-	-	-	-	-	-	-	-
<b>Total :</b>	<b>25</b>	<b>41</b>	<b>31</b>	<b>27</b>	<b>40</b>	<b>27</b>	<b>43</b>	<b>32</b>	<b>266</b>	<b>(100)</b>
<u>OUTWARD</u>										
15 - 25	3	-	-	-	-	-	-	-	3	(1)
26 - 35	7	2	-	2	1	-	-	-	12	(4)
36 - 45	8	9	6	6	-	3	1	1	34	(12)
46 - 55	15	16	19	26	18	16	9	21	140	(49)
56 - 65	1	6	6	6	15	12	24	15	85	(30)
66 & Over	-	-	-	-	-	6	4	3	13	(4)
<b>Total :</b>	<b>34</b>	<b>33</b>	<b>31</b>	<b>40</b>	<b>34</b>	<b>37</b>	<b>38</b>	<b>40</b>	<b>287</b>	<b>(100)</b>
<u>BOTH DIRECTIONS</u>										
15 - 25	3	2	1	7	3	3	5	5	29	(5)
26 - 35	8	4	1	6	10	7	9	5	50	(9)
36 - 45	14	21	16	11	15	14	19	18	128	(23)
46 - 55	28	37	34	37	29	22	20	26	233	(42)
56 - 65	6	10	10	6	17	12	24	15	100	(18)
66 & over	-	-	-	-	-	6	4	3	13	(2)
<b>Total :</b>	<b>59</b>	<b>74</b>	<b>62</b>	<b>67</b>	<b>74</b>	<b>64</b>	<b>81</b>	<b>72</b>	<b>553</b>	<b>(100)</b>