

GOVERNMENT OF PAKISTAN
MINISTRY OF COMMUNICATIONS
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**TOLL REVENUES
VERSUS
MAINTENANCE COST, N-5**

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I. INTRODUCTION

Tolls are a reliable source of generating funds for financing the construction and maintenance of the roads. Presently, tolls are being collected on Karachi-Hyderabad Super Highway and major bridges on National Highway N-5 namely Sutlej, Ravi, Chenab, Jhelum, Tarraki, Haro and Attock. An exercise has been carried out to determine the proportion of maintenance cost recovered by the existing toll charges being paid by the road users on these facilities.

The volume of vehicle-wise traffic has been calculated in terms of Annual Average Daily Traffic (AADT) on the basis of the traffic count data and estimates of AADT for 1995-96. The toll rates for these bridges and super highway and the average cost per Km for routine maintenance were provided by the NHA. NHA, at present, is not using the method of virtual length of the road section accounting for the width of the road for estimating the requirement of routine maintenance. This is worked out on the basis of flat rates i.e. Rs 50,000 per Km for 2 lane and Rs 75,000 for Km for 4 lane facility.

The total length of N-5 is 1,756 Km as per summary below:

<u>S.No.</u>	<u>Section</u>	<u>Kms</u>
1)	Karachi - Ubaro	= 596
2)	Ubaro - Sahiwal	= 506
3)	Sahiwal - Attock	= 528
4)	Attock - Torkham	= 126

	Total:	= 1756

NHA has also worked out the funding needs of maintenance of entire net-work upto year 2001 which is reported at Annex-I. From this information, the requirements for periodic maintenance have been estimated on the proportionate length basis for each of the sections of N-5 mentioned above.

More over, NHA has proposed to undertake dualization of remaining stretches of N-5 which is expected to be completed by the year 2000-01. As a result the traffic volume and the requirement of maintenance would be increased. The projections of traffic, routine maintenance requirements and toll revenues have been worked out on the basis of following assumptions while that of periodic maintenance is based on information indicated at Annex-I :

- a) Escalation in the cost per Km for routine maintenance of dual carriageway and toll rates (as per Planning Commission's Formula for working out increase in cost of project). 13%
- b) Traffic growth as assumed by NHA for proposed fifth highway project

- Car	4.7%
- Wagon & Bus	5.2%
- Truck	7.0%
- Art. Truck	7.2%

The projections thus made for each of the above sections of N-5 have been incorporated in the ensuing analysis.

II. SECTION-WISE ANALYSIS OF TOLL REVENUES
VIZ-A-VIZ MAINTENANCE REQUIREMENTS

1. Karachi-Ubaro: The length of the road between Karachi-Ubaro is 596 Kms. Of this, Karachi-Hala Section, totalling 211 Kms has been dualized while dualization of Hala to Ubaro is under construction. Presently toll charges have been levied on super highway only, at the following rates :-

Car	Rs 12.00
Wagon	Rs 20.00
Bus	Rs 25.00
Truck	Rs 25.00
Articulated Truck	Rs 40.00

The total motorized traffic in terms of AADT on Karachi-Hyderabad super highway during 1995-96 was 10,886. The revenue collected through toll was estimated at Rs 94.27 million.

The funding requirement for the routine maintenance of Karachi-Hyderabad super highway is estimated at Rs 12.23 million and from Hyderabad to Ubaro, amounts to Rs 22.85 million. Thus the total funds, required for routine maintenance are estimated at Rs 35.08 million. Regarding the periodic maintenance of Karachi-Ubaro including Karachi-Hyderabad super highway, the requirement based on information indicated at Annex-I is worked out as Rs 32.83 million.

During 1996-97, the estimated expenditures on routine and periodic requirements were Rs 13.41 million and Rs 28.15 million respectively.

It is, evident that total funds needed for routine and periodic maintenance of the road section from Karachi-Ubaro amount to Rs 67.91 million while the expenditure was Rs 39.08 million. Both the requirement funds for maintenance and expenditure incurred on it during 1996-97 is 72% and 42% of the estimated toll revenue being collected on super highway and thus can adequately be met through existing toll charges collected on Karachi-Hyderabad super highway.

In view of the dualization of road from Hala to Ubaro (a distance of 385 Kms) as proposed under fifth highway project, the funding requirements are projected on the basis of escalation in cost per Km for routine maintenance to Rs 50.66 million and for periodic maintenance as per information given in Annex-I to Rs 75.42 million. Based on the traffic growth rates assumed above, the AADT between Karachi-Hyderabad is expected to increase to 13,758 vehicles. As a result, the projected toll revenues based on the escalated toll rates would increase to Rs 137.42 million which is 10% more than the total projected maintenance needs of the road from Karachi to Ubaro.

2. Ubaro - Sahiwal: The Ubaro-Sahiwal Section of N-5 is 506 Kms long. Out of this road between Mian Channu-Sahiwal, totalling 76 Kms is dual carriageway while dualization from Ubaro-Rahimyar Khan and Bahawalpur-Mian Channu is under construction. The toll charges have been levied only on the Sutlej bridge between Bahawalpur and Multan at the following rates :-

Car	Rs 3.0
Wagon	Rs 7.0
Bus	Rs 10.0
Truck	Rs 10.0
Articulated Truck	Rs 15.0

The total motorized traffic in terms of AADT on the Sutlej bridge during 1995-96 was 4977. The revenue collected through toll was estimated at Rs 13.02 million.

The routine maintenance of the entire length including the dual carriageway from Mian Channu to Sahiwal is estimated at Rs 27.20 million. On the basis of NHA data (Annex-I), Rs 23.67 million are required for periodic maintenance of this section. The total routine and periodic maintenance requirements amount to Rs 50.87 million.

During 1996-97, the expenditure incurred on routine and periodic/emergency maintenance of Ubaro-Sahiwal road were Rs 12.99 million and Rs 24.36 million respectively.

Both the expenditures and toll revenue collected on the Sutlej bridge fell short of funds required for routine & periodic maintenance. However, for the recovery of cost of routine maintenance only the toll rates on Sutlej bridge may be increased as under :-

Car	: 7
Wagon	: 17
Bus	: 25
Truck	: 25
Articulated Truck	: 37

Considering the dualization of 241 Kms from Ubaro to Rahimyar Khan and Bahawalpur to Mian Channu sections, the routine and periodic maintenance requirements are projected to increase to Rs 37.70 million and Rs 52.07 respectively by 2000-01. Based on the AADT projections of 6238 vehicles on the Sutlej bridge the toll revenue is projected to increase to Rs 18.81 million. Even the projected toll revenues are less than the projected requirements of routine & periodic maintenance and thus substantiated that toll rates on Sutlej bridge may be raised enough to recover the maintenance cost of road between Ubaro and Sahiwal.

3. **Sahiwal-Attock:** Sahiwal-Attock section of the road is about 528 kms in length. According to NHA, about 325 kms have been dualized while 203 Kms are of two lane road. Presently, the tolls are collected on five bridges only between Lahore & Attock namely, Ravi, Chenab, Jhelum, Taraki & Haro. The details relating

to AADT, toll charges, estimated toll revenues during 1995-96 and their projections for year 2000-01 are as under :-

	CAR	WAGON	BUS	TRUCK	A. TRUCK	TOTAL
Ravi Bridge						
<u>1995-96</u>						
AADT	18567	6692	3261	10895	1169	40584
Toll Rate (Rs)	3	7	10	10	15	
Toll Rev (Rs Mill)	20.33	17.10	11.90	39.77	6.40	95.50
<u>Projections 2000-01</u>						
AADT	22312	8196	3994	14281	1544	50327
Toll Rates (Rs)	3.40	7.90	11.30	11.30	16.95	
Toll Rev. Rs Mill. (Rs. Million)	27.61	23.66	16.47	58.90	9.55	136.20
Chenab Bridge						
<u>1995-96</u>						
AADT	4199	2020	1372	4587	303	12481
Toll Rate (Rs)	5	10	15	15	25	
Toll Rev (Rs Mil)	7.66	7.37	7.61	25.11	2.76	50.42
<u>Projections 2000-01</u>						
AADT	5046	2474	1680	6013	400	15613
Toll Rates (Rs)	5.65	11.30	16.95	16.95	28.25	
Toll Rev. (Rs. Mill)	10.41	10.20	10.39	37.20	4.12	72.33
Jhelum Bridge						
<u>1995-96</u>						
AADT	3423	1451	1022	4098	292	10286
Toll Rate (Rs)	3	7	10	10	15	
Toll Rev (Rs Mil)	3.75	3.71	3.73	14.96	1.60	27.74
<u>Projections 2000-01</u>						
AADT	4113	1777	1252	5372	386	12900
Toll Rates (Rs)	3.40	7.90	11.30	11.30	16.95	
Toll Rev. (Rs. Mill)	5.09	5.13	5.16	22.16	2.39	39.93
Tarraki Bridge						
<u>1995-96</u>						
AADT	3740	2051	981	3629	227	10628
Toll Rate (Rs)	5	10	15	15	25	
Toll Rev (Rs Mil)	6.83	7.48	5.37	19.87	2.07	41.63
<u>Projections 2000-01</u>						
AADT	4494	2512	1202	4757	300	13265
Toll Rates (Rs)	5.65	11.30	16.95	16.95	28.25	
Toll Rev (Rs Mil)	10.41	10.20	10.39	37.20	4.12	72.33

	CAR	WAGON	BUS	TRUCK	A. TRUCK	TOTAL
Haro Bridge						
<u>1995-96</u>						
AADT	5416	2132	981	3774	205	12508
Toll Rate (Rs)	5	10	15	15	25	
Toll Rev (Rs Mill)	9.88	7.78	6.37	20.66	1.87	45.56
<u>Projections 2000-01</u>						
AADT	6508	2611	1202	4947	270	15538
Toll Rates (Rs)	5.65	11.30	16.95	16.95	28.25	
Toll Rev (Rs Mil)	13.42	10.77	7.44	30.61	2.78	65.02

The total revenue collected on these bridges was estimated at Rs 260.85 million.

The finding requirement of routine maintenance of the entire road length including dual carriageway is estimated to amount Rs 34.53 million. As per the maintenance needs worked out by NHA (Annex-I), the periodic maintenance of Sahiwal-Attock section is estimated at Rs 34.70 million. The routine and periodic maintenance requirements on entire road length total to Rs 69.23 million.

During 1996-97 the expenditures incurred on the routine and periodic maintenance were Rs 12 million and Rs 22 million respectively.

Evidently, it highlights the fact that the total toll revenue collected on the five bridges is exceedingly higher than the funding needs of the routine and periodic/emergency maintenance and the expenditure incurred on this account for the existing road length between Sahiwal-Attock.

Allowing for the dualization of the remaining portion of the road section from Sahiwal to Attock, the funds required for routine and periodic maintenance are projected to Rs 44.88 million and Rs 66.82 million respectively. Even then the existing estimates of toll revenue of Rs 260.85 million would be sufficient enough to cater for the maintenance needs of the length of the road between Sahiwal and Attock. Nevertheless, the toll revenue would also be increased to Rs 363.16 million with the projected increase in traffic in terms of AADT, as tabulated above, by 2000-01.

4. **Attock-Torkham:** The length of road between Attock to Torkham is 126 Kms. Of this, Nowshera-Peshawar Section, totalling 43 Kms has been dualized while dualization of Attock to Nowshera is under construction. Presently the toll charges have been levied on the Attock bridge only at the following rates :

Car	Rs 5
Wagon	Rs 10
Bus	Rs 15
Truck	Rs 15
A. Truck	Rs 25

The total motorized traffic in terms of AADT on the Attock bridge during 1995-96 was 11927. The revenue collected through toll was estimated at Rs 43.70 million.

The routine maintenance of the entire length including the dual carriageway between Nowshera-Peshawar is estimated to amount Rs 7.38 million. As per the information at Annex-I, the requirement of funds for periodic maintenance of Attock-Torkham route is estimated at Rs 6.87 million. The total routine and periodic maintenance is estimated to cost Rs 14.25 million.

During 1996-97, the expenditures incurred on routine and periodic/emergency maintenance were estimated at Rs 4.21 million and Rs 7.82 million respectively. This indicates that the toll revenue is more than sufficient to cater for the maintenance requirements and expenditures for the road between Attock and Torkham.

In view of the dualization of the road between Attock to Nowshera (27 Kms), the projected cost of routine maintenance and periodic maintenance of road from Attock to Torkham including dual carriageway would be increased to Rs 9.14 million and 12.40 million respectively by 2000-01. Although the revenue collected from Attock bridge would also increase to Rs 62.36 million on the basis of increase in traffic volume to 14822 AADT, the projected requirement of routine and periodic maintenance after dualization of this Section can be met from the existing toll revenue of Rs 43.70 million.

III. TOLL REVENUES AND OVERALL MAINTENANCE REQUIREMENTS ON N-5

A summary of funding requirement of routine and periodic maintenance viz-a-viz the tolls revenues received on different locations of N-5 for the year 1995-96 is given below:

Toll Revenues & Maintenance Requirements for 1996-97
(Rs. Million)

N-5 Road Section	Toll Rev. 1995-96	Maintenance Reqt.			Percent of Toll Rev		
		Routine Maint.	Periodic Maint.	Total	R.M.	P.M.	Total
1	2	3	4	5	6	7	8
KHI-UBARO	94.27	35.08	32.83	67.91	37%	35%	72%
UBARO-SAHIWAL	13.02	27.20	23.67	50.87	209%	182%	391%
SAHIWAL-ATTOCK	260.85	34.53	34.70	69.23	13%	14%	27%
ATTOCK-TORKHAM	43.70	7.38	6.87	14.25	18%	16%	34%
Total:	411.84	104.19	98.07	202.26	25%	24%	49%

This indicates that funds required for maintenance of N-5 are half of the toll revenues collected in 1995-96.

It is clear from above that cost of routine maintenance and periodic maintenance on N-5 during 1996-97 can be recovered adequately by the toll revenue estimated on the basis of existing toll rates and traffic volume on major bridges of N-5 and Karachi-Hyderabad super highway. However, the toll revenue collected on Sulej bridge between Bahawalpur-Multan is less than the estimated maintenance cost required for the road between Ubaro-Sahiwal. Even the routine maintenance requirement alone exceeds the toll revenue on this section.

Considering the dualization of remaining sections of N-5 proposed to be completed by year 2000-01, the projected requirements of maintenance both routine and periodic and toll revenues have been worked out for the year 2000-01, incorporating the premium of 13% over the existing routine maintenance cost per km and the toll rates which are summarized below :-

**Projected Toll Revenue & Maintenance Requirements
for 2000-01**

(Rs. Million)

N-5 Road Section	Toll Rev.	Maintenance Reqt.			Percent of toll reve		
		Rout Maint.	Per. Maint.	Total	R.M.	P.M.	Total
1	2	3	4	5	6	7	8
KHI-UBARO	137.42	50.66	75.42	126.08	37%	55%	76%
UBARO-SAH	18.81	37.70	52.07	89.77	200%	277%	477%
SAH-ATTOCK	373.06	44.88	66.82	111.70	12%	18%	30%
ATTOCK-TORKHAM	62.36	9.14	12.40	21.54	15%	20%	35%
Total:	591.65	142.38	206.71	349.09	24%	35%	59%

It is evident from above that the projected maintenance requirements would remain less than the toll revenues expected to be collected on N-5 by the year 2000-01. However, the recovery of maintenance cost appears to be improved by 10% from 49% in 1995-96 to 59% in 2000-01. It may be brought out here that even the projected requirements of maintenance of Rs. 349.09 million can be met from the existing estimates of toll revenue (Rs 411.84 million) collected on N-5 during 1995-96.

It may be added that the estimated total revenue of Rs 411.84 million on N-5 is more than the allocation of Rs 403.25 million made available for the routine, periodic maintenance etc, of the entire National Highways Network in all the provinces during 1996-97.

Against the availability of funds for entire network, the expenditure estimated on the routine/periodic maintenance of N-5, on the prorata basis, amount to Rs 122.46 million. The details are as under:

Expenditure Incurred on Maintenance During 1996-97

(Rs Million)

N-5 Road Section	<u>Expenditure incurred on</u>			Routine + Periodic Maint. Req.
	Routine Maint.	Periodic Maint	Total	
KARACHI-UBARO	13.41	28.15	41.56	67.91
UBARO-SAHIWAL	12.99	24.36	37.35	50.87
SAHIWAL-ATTOCK	12.00	22.00	34.00	69.23
ATTOCK-TORKHAM	4.21	7.82	12.03	14.25
TOTAL:	42.61	82.33	124.94	202.26

As can be seen the expenditure on both routine and periodic maintenance was 62% of the requirements during 1996-97. It may be worthwhile to mention that there has been a shortfall between the funds availability or expenditure and the requirement

of routine and periodic maintenance for the past several years which resulted in the accumulation of a huge maintenance backlog. If the deferred maintenance remains unattended the deterioration in the network gets worse and as a consequence, the network would require major rehabilitation, reconstruction etc. Considering this the cost of rehabilitation and reconstruction of N-5 extracted on prorata basis from information indicated at Annex-I has also been incorporated in the overall requirements of funds for maintenance and compared it with the toll revenues as under :

**Overall Maintenance Requirements including
Rehabilitation/Reconstruction of N-5**

(Rs. Million)

Year	Routine Maint.	Periodic Maint.	Rehab./ Streng.	Recons- truction	Total	Toll Rev.N-5
1995-96	104	98	127	77	406	412
1999-2000	142	207	171	77	597	592

It is emerged from above that when the estimated cost of reconstruction and rehabilitation/strengthening is added in the funding needs of routine and periodic maintenance of N-5, the total maintenance cost would be just equivalent to estimated toll revenue and its projections during 1995-96 and 2000 01 respectively.

IV. SENSITIVITY ANALYSIS

The above analysis emanates that a break even seems to be almost achieved between the toll revenues and the total maintenance requirements including rehabilitation/reconstruction.

costs during 1995-96. Moreover, the projected funding requirements of maintenance and the toll revenues after allowing for escalation assumed at 13% on per Km cost of routine maintenance would remain at almost equilibrium for the year 20001-01.

A sensitivity analysis is carried to examine the change in break even situation. If cost per Km and toll rates on N-5 is not increased and the existing estimates are used, the projected maintenance requirement on completion of dualization of N-5 by 2000-01 would recover 90% of the total revenues. In case the routine maintenance cost per Km and toll rates is increased by 13% and 10% respectively, the toll revenue would be 97% of the maintenance needs by the year 2001-01. The estimated figures may be seen at Annex-II.

V. CONCLUSIONS

The present toll regime and the revenues estimated to be accrued from them on different locations of N-5 can adequately cater for the requirement of funds needed for routine maintenance and periodic maintenance as well as the rehabilitation/ reconstruction of the entire N-5.

The revenue can be raised further by (a) levying toll on the dualized sections and (b) enhancing the charges at the bridges. The later appears to be more practical option.

MAINTENANCE REQUIREMENT 1997-2001 (AT 1996 PRICES)

(Rs. Million)

Year	Routine Maintenance	Periodic Maintenance	Rehabilitation/Strengthening	Reconstruction	Total
1996-97	60	270	480	290	1100
1997-98	65	360	650	325	1400
1998-1999	65	380	655	305	1405
1999-2000	65	400	645	290	1400
2000-2001	70	420	530	180	1200
Total:	325	1830	2960	1390	6505

PROJECTIONS OF TOLL REVENUES VIZ-A-VIZ
THE TOTAL MAINTENANCE REQUIREMENTS INCLUDING
REHABILITATION / RECONSTRUCTION COSTS ON N-5
FOR THE YEAR 2000-01

(Rs. Million)

Projections with	Toll Rev. N-5	Rout. Maint. (R.M)	Periodic Maint.	Rehabilitation	Reconstruction	Total Maint. Req.of N-5	%age of Toll Rev.to Maint. Reqt.
No increase in the present per Km cost of R.M and Toll Rates	524	125	207	171	77	580	90%
Increase of 13% in the existing per Km cost of R.M and 10% in the present toll regime	576	142	207	171	77	597	97%