

Noida Toll Bridge Company Limited
DND Flyway Traffic Forecast Validation and
Revenue Forecasts
February 2006



Halcrow Consulting India Limited

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Noida Toll Bridge Company Limited

DND Flyway Traffic Forecast Validation and Revenue Forecasts

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Vice President
Noida Toll Bridge Company Limited
Toll Plaza
DND Flyway
NOIDA-201301
For the attention of Ajai Mathur

Our ref THMVLR/1486

20 February 2006

Your ref

Dear Mr Mathur

**Traffic Revalidation and Cash Flow Analysis
Consent Letter**

We hereby certify that Halcrow Consulting India Limited has prepared this report based on reports and data provided by you and collected from various secondary sources as mentioned in the report.

This report has been prepared based on terms of reference for this project by the experts of HCIL in this field. We have no objection to this report being included in the AIM admission document.

Please contact us if you have any question regarding the information prepared in the report.

Yours sincerely

A handwritten signature in blue ink that reads 'Pawan Maini' with a horizontal line underneath.

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Noida Toll Bridge Company Limited

Toll Plaza
DND FlyWay
NOIDA-201301

To whom it may Concern

Executive Summary

At the request of NTBCL, Halcrow Consulting India Limited has prepared a traffic revalidation and cash flow analysis of DND flyway along its proposed development of Mayur Vihar link road as on dated 17 Feb 2006.

The scope of work includes review of the traffic forecasts and development of revenue forecasts and cash flow analysis.

Previously, there are four forecasts that have been prepared for DND Flyway since 2002. The first was prepared by WSA Engineers India Pvt Ltd in 2002. Further forecasts, primarily based on the 2002 study were presented in the 2004 study by Wilbur Smith Associates Private Limited. Additionally, Fairwood Consultants performed a study that evaluated the impact of the residential developments on Noida-Greater Noida Expressway on the DND Flyway. Finally, NTBCL developed traffic forecasts based on the earlier studies, other developments occurring primarily on the eastern side of Yamuna, and the traffic counted on DND Flyway. The comparative analysis of DND flyway traffic forecast has been shown in Table 1

Year	2002 Traffic Study	NTBCL Forecast, 2005	Current Study Forecast
2011	90,780	136,453	126,841
2021	122,233	199,611	200,504

Table 1 DND Flyway Average Daily Traffic Forecast Comparison (vehicles)

The traffic forecast for the DND Flyway and the proposed Mayur Vihar Link Road has been reviewed in light of the pervious studies and substantial population growth in the region. The Mayur Vihar Link Road is proposed to be developed by

NTBCL to shorten the travel distance for people living in Mayur Vihar and others accessing areas in its vicinity. A recent study had estimated the impact of developments in a narrow stretch along the Noida-Greater Noida Expressway. This was extended to other undeveloped areas of Noida and Greater Noida, and it is estimated that these developments will result in an additional population of 1.6 million. Other developments in recently and earlier developed areas will result in another 0.4 million for a total population growth of 2.0 million.

This population increase is significantly greater than a previous estimate of 0.64 million by 2002 traffic study. Therefore, the traffic is also expected to grow significantly more than that estimated in the 2002 traffic study. It is expected that in the financial year ending 2021, there will be 200,504 daily vehicle trips on DND Flyway. This is more than the 2002 traffic study estimate of 122,233 and the 2005 estimate of 199,613. The roadway capacity of 222,000 vehicles is adequate for the expected traffic. The toll plaza capacity is about 25% higher than this, and thus none of these components are expected to constrain the traffic flow or its growth.

There are other developments occurring in the influence area which can impact the traffic on DND Flyway. These include changes to the public transport system and provision of a metro connection to parts of Noida, the Commonwealth Games in the year 2010 which will result in significant developments on the eastern side of Yamuna, and the

The condition of the existing facility and in particular the pavement and embankment has also been reviewed. The pavement was designed for a load of 50 MSA, but the expected load is less than 4 MSA. The physical review also established that the pavement condition is good, and therefore the first overlay is expected only in the financial year ending 2009. The overlay is expected to cost Rs 58.75 million (at year 2006 prices).

As the traffic increases, it is expected that technology changes will be needed to the toll plaza on an incremental basis. This will help improve the throughput of the toll plaza and is expected to cost Rs 10 million per year. The electronic toll collection facility is being used by a growing number of facility users and varies between 20 and 33 percent for the three primary classes. It is expected that after 2010 no discount will need to be provided for users of the ETC system.

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The toll fee is expected to increase by 6% annually over the future years. This is a conservative estimate, given that the CPI has increased by 7.7% annually in the past ten years. A discounted cash flow analyses has been performed and the present value of the project has been determined as Rs 17.9 billion.

1

Introduction

DND Flyway, the direct connection between Delhi and Noida was opened to traffic in February 2001. The traffic on this facility has steadily increased and has now exceeded 65,000 vehicles on a daily basis. The facility is owned and operated by the Noida Toll Bridge Company Limited (NTBCL). NTBCL has evaluated options for increasing the traffic flows on this facility and is pursuing the development of a link to Mayur Vihar, which is to the north east of the existing facility.

Previously, NTBCL had a traffic validation study performed to get a better estimate of the traffic forecast after opening of the DND Flyway. This study, performed by WSA Engineers India Private Limited resulted in *Delhi Noida Direct Flyway - Traffic Revalidation Study – Final Report*, October 2002. Subsequently, NTBCL had a further study performed to study the impact of the rapid residential developments in Noida and Greater Noida, along the Greater Noida Expressway. This study resulted in the *Residential Development on Noida-Greater Noida Expressway – Traffic Impact Study*, Fairwood Consultants, and December 2004. NTBCL then developed future forecasts of traffic based on these studies and considering the impact of other commercial and industrial developments.

NTBCL is now placing a Global Depository Receipt (GDR) in the London Stock Exchange for the Mayur Vihar Link Road project, and has asked Halcrow Consulting India Limited (HCIL) to perform a review of the traffic forecasts prepared by NTBCL and also develop the revenue forecasts. This work has been performed by HCIL in an independent manner.

1.1

Scope of Work

The scope of work includes review of the traffic forecasts and development of revenue forecasts. The following reports are to be reviewed as part of this study:

1. Traffic revalidation study final report, WSA Engineers India Pvt Ltd, October 2002
2. Augmentation of Traffic on DND Flyway, Wilbur Smith Associates Private Limited, November 2004

3. Residential development on Noida-Greater Noida Expressway – Traffic impact study, Fairwood Consultants, December 2004
4. Traffic forecasts for DND Flyway prepared by Noida Toll Bridge Company Limited, 2005
5. Pavement performance data for DND Flyway - 2002 to 2005

Specifically, the scope of work of this study will include

1. Review of the traffic forecasts for the next 15 years presented in the earlier reports and comments on the same. We will review both the production and attraction side of trips (employment and residential data). Additionally, changes in fuel prices, land and other developments and road network changes will also be considered. Based on these, if needed, revised forecasts will be presented.
2. Review of operations and maintenance (O&M) costs for the facility for the next 15 years. This will be based on the costs expended to date, a review of the condition of the facility (primarily the pavement condition), the contract with the toll facility operator, and the forecasted increases in the toll. In relation to this review, we will obtain the pavement condition data and also a copy of the relevant portions of the O&M agreement with the toll facility operator.
3. To prepare the discounted cash flow analyses based on the traffic and O&M expense projections.

1.2

Report Structure

The report is presented in 5 chapters. The second chapter provides a summary of the assumptions of the previous studies and the traffic forecasts presented. An update on the commercial and residential developments is provided in the third chapter. Additionally, the resulting impact on traffic expected on DND Flyway and a review of the previous forecasts is provided in this chapter. The forecasted O&M expenses are presented in Chapter 4, and the discounted cash flows for the project are subsequently presented. This chapter also includes a review of the pavement condition. The summary of the study is presented in Chapter 5.

2 Transportation Network and Earlier Traffic Forecasts

2.1 *Existing Transportation System*

The present transport system is characterized by road traffic congestion with declining ambient air quality accompanied by a rising trend in road accidents. There have been recent efforts to combat this, including conversion of all commercial vehicles to Compressed Natural Gas (CNG) and the metro rail started in 2003. However, the situation is likely to worsen due to increasing population and economic growth.

Efforts are being made to improve the transportation system. A number of flyovers, bridges and pedestrian subways are under construction and many more are being contemplated. In addition, existing roads are being widened and new roads constructed. The peripheral expressway and NH2 bypass are being taken up to siphon off inter-city traffic passing through Delhi. Within Delhi, in addition to the metro, bus rapid transit corridors are also being planned. Several low cost and quickly implementable transport system management (TSM) measures are being given a lot of importance in order to improve traffic flow. TSM plans are being prepared for various corridors and will be taken up for implementation.

The river Yamuna that runs North-South forms a natural barrier that restrains expansion of Delhi to the East. Noida located east of Yamuna is a township that is under development since 1976. Today it has become one of the satellite towns of Delhi. The traffic that is generated by this satellite town is substantial and the interaction with Delhi is also substantial. The traffic between the East of river Yamuna including Noida and Delhi was of the order of 3,70,000 PCUs daily in 2002 (Traffic revalidation study final report, WSA Engineers India Pvt Ltd, October 2002) and is serviced by four bridges including the Delhi Noida Direct (DND) Flyway, which are shown in Figure 1



Figure 1 Four Major Bridges Connecting Trans Yamuna Area

It is seen that on the eastern side of Yamuna, the residential areas are fast developing. The Mayur Vihar and Noida areas are developing very fast and so is the traffic volume. Similarly, there are many destinations in South Delhi that attract significant amount of traffic, and these will be more accessible with the development of the Kalindi Kunj Bypass. Hence it is expected that there will be great demand for bridges to cross the river to reach the business districts of Delhi and thus both the north and south links are critical to providing for this traffic.

2.2

Earlier Traffic Forecasts

As detailed previously, there are four forecasts that have been prepared for DND Flyway since 2002. The first was prepared by WSA Engineers India Pvt Ltd in 2002. Further forecasts, primarily based on the 2002 study were presented in the 2004 study by Wilbur Smith Associates Private Limited. Additionally, Fairwood Consultants performed a study that evaluated the impact of the residential developments on Noida-Greater Noida Expressway on the DND Flyway. Finally, NTBCL developed traffic forecasts based on the earlier studies, other developments occurring primarily on the eastern side of Yamuna, and the traffic counted on DND Flyway.

2.2.1

Traffic revalidation study final report, WSA Engineers India Pvt Ltd, October 2002

A conventional gravity model was developed in order to model traffic on the DND Flyway in the earlier study has been used. This model includes a traffic assignment process with a combined partial distribution and mode choice function. The transport model was developed in SATURN (Simulation and Assignment of Traffic in Urban Road Networks) for an average morning peak hour (to capture the journey to work period).

The study area was divided into 179 zones. Primary traffic surveys were performed on the four major bridges, capturing the traffic on both sides of Yamuna River. Detailed intersection turning movement counts were performed at nine locations, two of which were on the east side of Yamuna. A detailed origin-destination analysis was performed for the users of each of the four major bridges. Additionally, speed and delay surveys were performed on the major roads in the vicinity of the bridge. The model was calibrated based on the available data for each of the bridges. The base network considered for the model is presented in Figure 2.

Changes to the transportation network were considered for the future years, and forecasts were accordingly developed for the years 2011 and 2021. Population and employment forecasts were also made for the areas under consideration. A summary of the population growth rates considered are presented in Table 2.

Area	2001-2011	2011-2021
Noida	5%	3%
Greater Noida	6%	4%

Area	2001-2011	2011-2021
Ghaziabad	4%	3%
East and North-East Delhi	3%	1.8%

Table 2 Annual Population Growth Rates (%) in 2002 Traffic Study

These growth rates result in the population forecast of 8.08 million in the above areas in 2021, as compared to 4.55 million in 2001. Employment is expected to grow at a slightly faster rate, from 1.08 million in 2001 to 2.2 million in 2021 in the same areas.

As links to the north and south of the DND Flyway were being considered, the impacts of these links were also evaluated and traffic forecasts were developed for a range of combinations. The results for relevant ones are presented in Table 3 for reference. The original report referenced the link to the north as the link to Sector 14A. As this link is now named Mayur Vihar link, the changed name is presented in the table.

<i>Option</i>	<i>Year</i>		
	2004	2011	2021
Base Case	48,507	78,125	107,551
Mayur Vihar	58,200	90,780	122,233
Mayur Vihar and South Link	75,929	106,765	137,143

Table 3 Forecasted Traffic on DND Flyway - 2002 Traffic Study

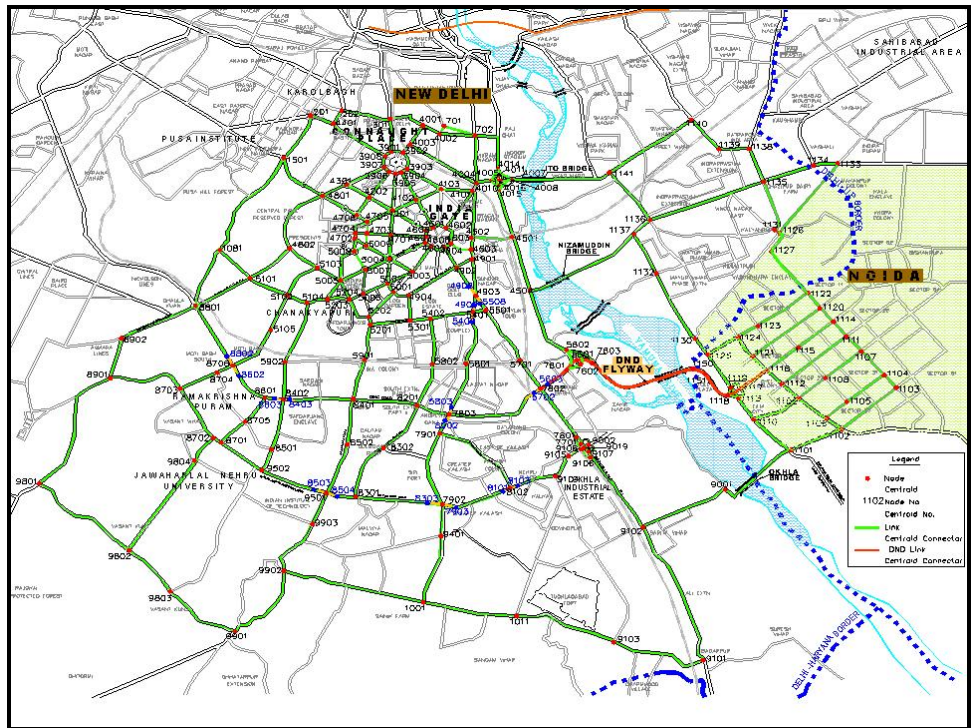


Figure 2 Base Network for 2002 Traffic Revalidation Study

2.2.2

Residential development on Noida-Greater Noida Expressway – Traffic impact study, Fairwood Consultants, December 2004

A study was performed in 2004 to evaluate the impact of residential developments within 1 km of the Noida-Greater Noida Expressway on the traffic on DND Flyway. Ten sectors in Noida (889 hectares [Ha]) and eight areas of Greater Noida (321 Ha) were considered for this study. The existing developments within each of these developments were reviewed and additionally the planned density of development was also reviewed. Based on this, an estimate of new units expected to be developed by 2007 and 2009 was developed, and subsequently based on occupancy assumptions, the number of occupied households were estimated for those forecast years.

Simultaneously, a random household survey was performed for 50 households to primarily determine the trip making propensity and travel patterns of those trips. Based on this survey, the following average characteristics were determined:

- Working trips per household per week = 16.8 one-way trips
 - Proportion of working trips to Delhi = 20%
 - Proportion of working trips to Delhi via DND Flyway = 21%
- Non-walking non-working trips per household per week = 4.2 one-way trips
 - Proportion of these trips to Delhi = 44%
 - Proportion of the trips to Delhi via toll bridge = 22%

Thus, the resulting weekly impact on DND Flyway is 0.706 one-way working trips and 0.407 one-way non-working trips per household.

The area expected to be developed by 2007 and 2009, the estimated household, population and the resulting trips on DND Flyway are presented in Table 4.

Year	2007	2009
Area which will be developed in Noida and Greater Noida (Ha)	281	844
Population capacity (persons)	128,266	428,539
Actual residents expected (persons)	59,841	306,181
New households	13,916	71,205
Daily trips on DND Flyway	2,212	11,314

Table 4 Impact of Estimated Developments in Noida and Greater Noida (Fairwood, 2004)

As summarized in the table, the expected residential developments are estimated to result in 2,212 one-way trips on DND Flyway in year 2007 and 11,314 one-way trips in year 2009.

2.2.3

NTBCL Traffic Forecast, 2005

NTBCL has developed traffic forecasts based on the traffic growth observed on DND Flyway, and also based on the commercial and residential developments that are happening on the eastern side of Yamuna. The traffic on DND Flyway was just a little over 20,000 vehicles when it opened in 2001. However, the traffic has

steadily grown since then. A summary of the traffic data for each of the years and the growth experienced is presented in Table 5

Year ending 31 March	Buses/Trucks	2-wheelers	Cars	Total	Annual Growth (%)
2001*	278	4,833	12,050	17,161	
2002	652	6548	15309	22,509	31.2%
2003	861	10973	26632	38,467	70.9%
2004	1129	12934	33489	47,552	23.6%
2005	1211	14587	37040	52,838	11.1%
2006**	1299	16828	42056	60,184	13.9%

* Part year, from start of facility operation – 7 February 2001

** For the period April 2005 to December 2005

Table 5 Traffic Growth on DND Flyway - 2001 to 2006

As can be seen in Table 5 there was significant growth in the initial period, and although the growth in 2005 was lower at 11.2%, it has expected to increase to 17.3% for the financial year ending 31 March 2006. The month wise increase in traffic is depicted in Figure 3.

As expected, the revenue realization has grown at a faster rate. This is partly because of toll rate increases, due to which the average revenue realized per vehicle has increased. The average revenue realized per vehicle for each financial year and also the total increase in revenue is presented in Table 6.

Year ending 31 March	Average Revenue per vehicle (Indian Rupees)	Average Daily Revenue (Indian Rupees)	Annual Growth of Revenue (%)
2001*	12.85	220,461	
2002	11.66	262,495	19%
2003	11.68	449,340	71%
2004	12.92	614,279	37%
2005	13.94	736,722	20%
2006**	14.62	879,942	19.1%

* Part year, from start of facility operation – 7 February 2001

** For the period April-December 2005

Table 6 Revenue Growth for Traffic on DND Flyway - 2001 to 2006

The traffic forecast prepared by NTBCL can be segregated into two parts, as is presented in Table 7. The first is related to the growth expected on the facility without any additional links. This growth is forecasted to be 17.5% annually for the next three years, then decreasing to 12% in the fourth year and further reducing by 2% every year, till it stabilizes at 4% in the 2014 financial year ending 31 March of that year for three years. From 2017, the growth rate is expected to reduce to about 3%.

The only additional link considered by NTBCL is the Mayur Vihar link. The forecast due to the Mayur Vihar link is 11,285 vehicles in the first year (year ending 31 March 2008), then growing by 3.9% annually for the first three years, 1.5% for the following years.

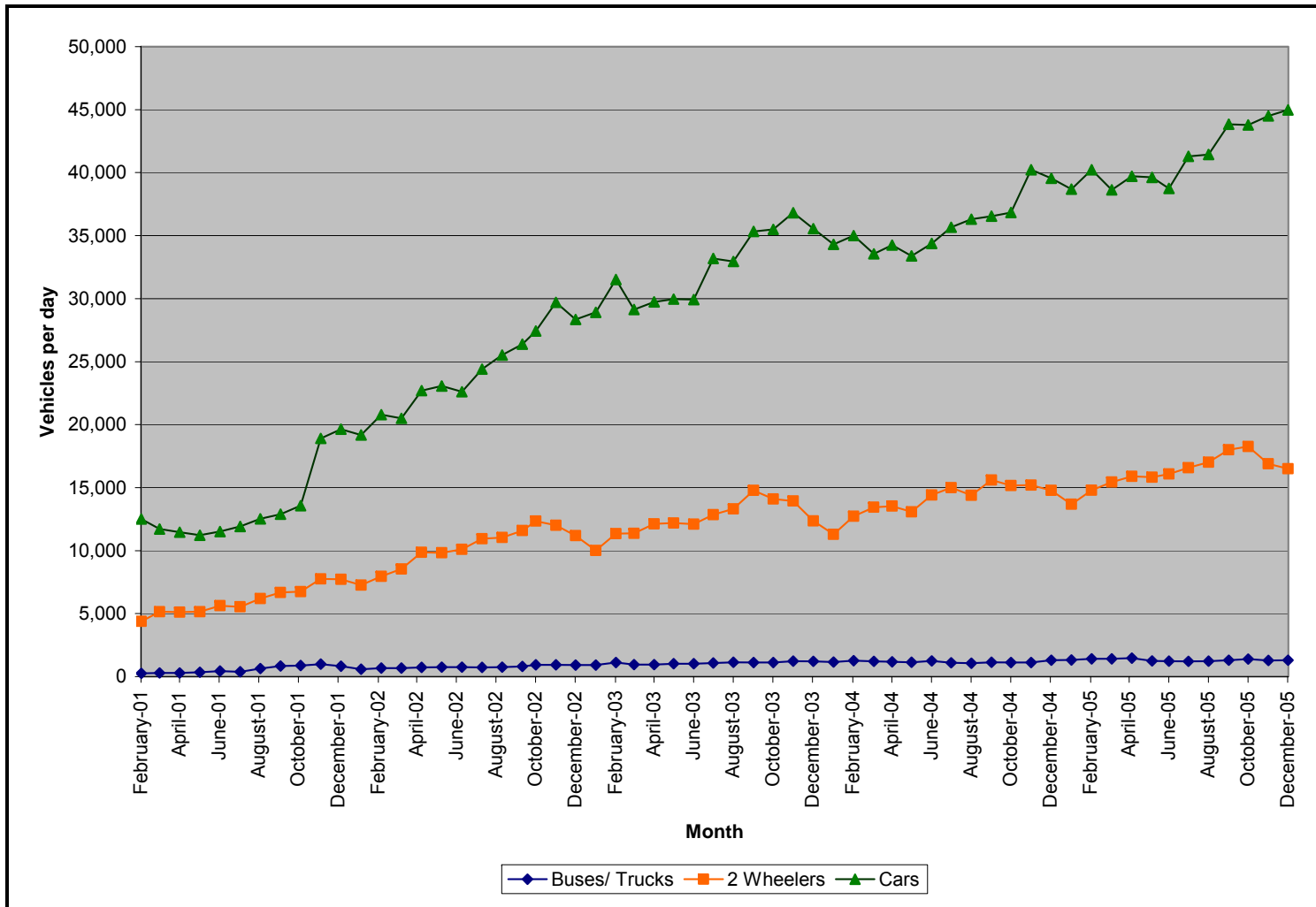


Figure 3 Average Daily Traffic on DND Flyway (vehicles)

Financial Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Existing Delhi Noida Toll Bridge												<i>(Vehicles/day)</i>			
Trucks/ Buses	1,645	1,932	2,270	2,542	2,796	3,020	3,201	3,329	3,462	3,601	3,717	3,833	3,949	4,065	4,181
Cars	51,111	60,042	70,533	78,997	86,897	93,849	99,480	103,459	107,597	111,901	115,510	119,119	122,728	126,337	129,946
2-Wheelers	20,060	23,565	27,682	31,004	34,104	36,833	39,043	40,605	42,229	43,918	45,334	46,751	48,167	49,583	51,000
Total	72,816	85,539	100,485	112,543	123,798	133,701	141,723	147,392	153,288	159,420	164,561	169,703	174,844	179,985	185,127
Growth Rate	17.5%	17.5%	17.5%	12.0%	10.0%	8.0%	6.0%	4.0%	4.0%	4.0%	3.2%	3.1%	3.0%	2.9%	3%
Additional Traffic due to Mayur Vihar Link															
Trucks/ Buses	382	397	412	428	445	452	459	466	473	480	487	494	502	510	510
Cars	6,853	7,118	7,394	7,681	7,982	8,103	8,225	8,350	8,476	8,604	8,734	8,866	9,000	9,136	9,136
2-Wheelers	3,629	3,770	3,916	4,068	4,227	4,291	4,356	4,422	4,489	4,557	4,626	4,695	4,766	4,838	4,838
Total	10,864	11,285	11,723	12,177	12,655	12,846	13,040	13,237	13,437	13,640	13,847	14,056	14,268	14,484	14,484
Growth Rate	4%	4%	4%	4%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	0%
Total Traffic															
Trucks/ Buses	2,027	2,329	2,682	2,970	3,241	3,472	3,660	3,795	3,935	4,081	4,204	4,327	4,451	4,575	4,691
Cars	57,964	67,161	77,928	86,678	94,879	101,952	107,705	111,808	116,073	120,505	124,244	127,985	131,728	135,473	139,082
2-Wheelers	23,689	27,335	31,598	35,072	38,332	41,124	43,399	45,027	46,718	48,475	49,960	51,446	52,933	54,422	55,838
Total	83,680	96,824	112,208	124,720	136,453	146,548	154,764	160,630	166,725	173,060	178,408	183,758	189,112	194,469	199,611
Growth Rate		16%	16%	11%	9%	7%	6%	4%	4%	4%	3%	3%	3%	3%	3%

Table 7 Traffic Forecast by NTBCL, 2007-2021 (vehicles)

3

Population and Employment Growth and Impact on Traffic

3.1

Population Forecasts

The population of Delhi is expected to grow from 13.8 million in 2001 to 23 million by year 2021 (Traffic revalidation study final report, WSA Engineers India Pvt Ltd, October 2002). This estimate appears to be based on the broad assumption that the population of Delhi will grow at a similar rate as that of urban population in the rest of India. Population forecasts for all of India and the urban population have been prepared by the *Registrar General and Census Commissioner* and are presented in Table 30, Projected Population of India 1996-2016, (<http://www.censusindia.net/cendat/datatable30.html>) and these forecasts and the resulting annual growth rates are presented in Table 8.

Year	Total Population		Urban Population	
	(in '000s)	Annual Growth Rate (%)	(in '000s)	Annual Growth Rate (%)
1996	934,218		27.73	
2001	1,012,386	1.62%	28.77	2.37%
2006	1,094,126	1.57%	30.35	2.66%
2011	1,178,889	1.50%	31.99	2.58%
2016	1,263,543	1.40%	33.67	2.44%

Table 8 Population Forecast for India (1996-2016)

Considering that the population of Delhi will continue to grow at a rate of 2.44% annually, the population in 2021 will be 22.7 million.

3.2

Residential Development in Noida and Greater Noida

As mentioned in Chapter 2, a study was performed in 2004 to evaluate the impact of residential developments within 1 km of the Noida-Greater Noida Expressway on the traffic on DND Flyway by Fairwood Consultants in December 2004. However, as both Noida and Greater Noida have other developments which will impact the traffic on DND Flyway, a larger study area was considered. The methodology considered in the earlier study was extended to cover the other Sectors of Noida which are undergoing development or are likely to be developed in the coming years.

The key assumptions made while extending the study area were:

- The previous study's results which had been derived from the household survey of 50 houses in the vicinity of Noida-Greater Noida Expressway also apply to the other parts of Noida and Greater Noida.

- The average population density per hectare for Noida has been taken as 500. This has been done after referencing the Noida Master Plan 2021.

For Noida, the areas have been grouped in four different zones relative to their distance from the Noida-Greater Noida Expressway. Zone I includes sectors that are adjacent to the expressway (< 1 km). Zone II and III comprise of sectors that are in the ranges of 1 – 3 km and 3 – 5 km respectively. The sectors further east (> 6 km) have been grouped under Zone IV. All these residential sectors are the ones where major development is planned for the coming decade. The sectors/zones and the planned land use is shown in Figure 4 and those considered in this study are presented in Table 9.

Each of the sectors were categorized based on the density of development expected. As detailed sector wise data were not available from the Noida Authority, a check was made with the earlier study to ensure that this assumption would lead to realistic results. Additionally, a site visit along with review of recent satellite imagery (see Figure 5) was used to check the level of developments in these additional sectors.

Zone	Sectors	Area (Ha)	Population Capacity
I	92, 96 - 99, 106, 128, 133 -136	650	325,000
II	42, 43, 45 - 48, 82, 104, 107, 109, 110	626	313,000
III	49, 50, 101,	254	127,000
IV	72 - 79, 114 -120, 122	1,013	506,500
Total			1,271,500
No. of Households (Household size of 4.3 persons/household)			295,697

Table 9 Additional Residential Developments in Noida till 2021

It is expected that all this development will take place in the next 15 years (by 2021). Typically, the occupancy rate of developments ranges from 85% to 95%, as there are always certain units unoccupied either because of a pending sale or because of a change in the tenant renting the place. An occupancy rate of 90% is considered for the Noida and Greater Noida developments at full buildout. It is expected that in Noida the growth will be rapid first and will gradually slow down, and 75% of the households are expected to be

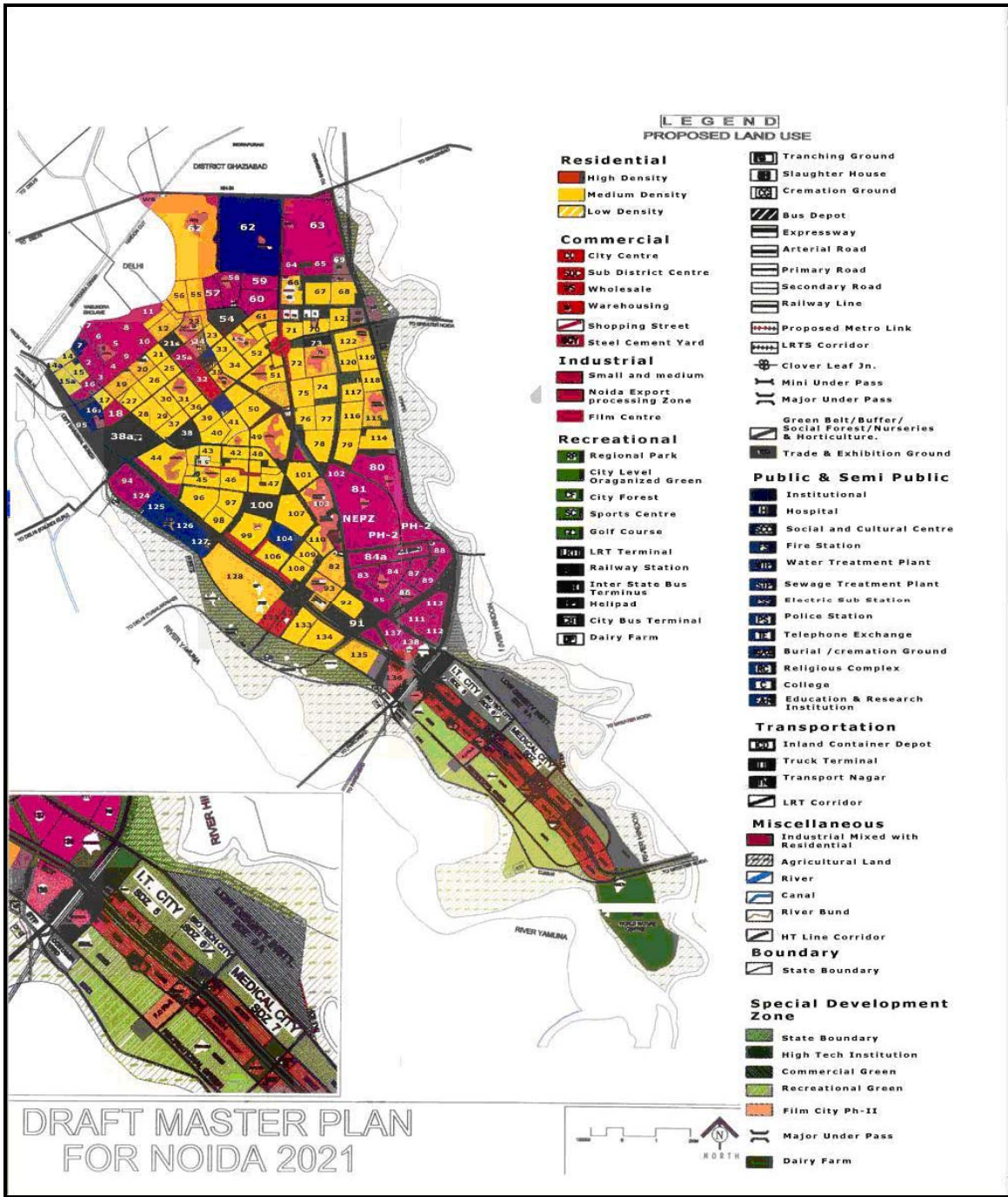


Figure 4 Noida Masterplan



Figure 5 Recent Satellite Image of Noida

developed and 90% of those occupied in the next 10 years (199,595 occupied households by year 2016). In the Fairwood study, it was determined that the weekly impact on DND Flyway of residential developments in Noida and Greater Noida was 1.113 trips per household. A similar rate is appropriate for these additional residential developments and the net impact is expected to be 31,736 daily trips by the year 2016 and 42,314 daily trips by the year 2021.

In Greater Noida, layout plans have been approved for 29 sectors. Of these, 24 sectors are residential, and there are three industrial and one each of institutional and institutional green sectors. In addition, there are 8 recreational green and 13 commercial sectors. Almost 30% of the total area of about 6,000 Ha has been allocated for residential areas. As noted in the Fairwood report, only 321 Ha which is within 1 km of the Greater Noida Expressway has been considered in that study. The balance of 1,398.58 Ha is also expected to have a significant impact on the traffic on DND Flyway. The density of population for Greater Noida has been considered as 350 per Ha, as in the Fairwood report. All the land is expected to be developed and 90% of the households occupied by the end of the plan period, year 2021. As the growth in Greater Noida is not as rapid as in Noida, it is estimated that 67% of the balance land will be developed by the year 2016 (that is in ten of the next fifteen years). Considering the same trip generation rate, these developments will result in 10,914 daily trips by the year 2016 and 16,290 daily trips by the year 2021 on the DND Flyway. Thus, the net impact of the residential developments in Noida/Greater Noida is estimated to be 42,650 daily trips by the year 2016 and 58,604 daily trips by the year 2021 as is summarized in Table 10.

Development	Noida		Greater Noida	
	2016	2021	2016	2021
Additional Population	858,261	1,144,347	295,170	440,553
Additional Occupied Households	199,595	266,127	68,644	102,454
Additional Daily Traffic on DND Flyway	31,736	42,314	10,914	16,290

Table 10 Additional Traffic on DND Flyway due to Additional Residential Developments in Noida and Greater Noida

3.3

Other Developments East of Yamuna

Other than residential development in Noida and Greater Noida, there are many other developments that will have a significant impact on the travel across the river, and in particular on DND Flyway.

There are significant commercial and institutional developments that have taken place in the past few years in Noida, and more recently along the Greater Noida Expressway. Additionally, there have been significant commercial developments in east Delhi, in the areas of Kausambhi, Vaishali and further to the east in Ghaziabad. There is a planned mega amusement park in Noida, which alone has the ability to attract significant traffic.

Also, due to shortage of commercial space in Delhi, many businesses are relocating or taking their growth to the suburbs. For example, many new offices are being developed in Noida, and the sector 18 market has developed as a prime destination place attracting many people from Delhi. Although the development of office space in Noida could result in a decrease in some trips towards Delhi (from Noida), it is estimated that these trips will be replaced by reverse trips by Delhi residents, with the net impact of this being close to nil.

3.4

Impact of Development on Traffic Forecasts

The impact of the developments is considered in two principal ways. Firstly, the growth considered in the 2002 traffic study by WSA Engineers India Pvt Ltd was 5% and 6% respectively for the Noida and Greater Noida areas till the year 2011. It was estimated that these growth rates would decrease to 3% and 4% respectively in the period 2011-2021. Considering the 2001 population data for Noida (0.29 million) and Greater Noida (0.24 million) as reported in that study, the population forecast for 2021 for each of these areas is 0.635 million, for a total population of 1.27 million. Based on the same data, the estimated population in 2005 is 0.66 million.

However, it appears that the growth rates have been underestimated in the 2002 traffic study. As has been presented earlier, considering only the new areas that are expected to develop in Noida and Greater Noida, an increase in population of 1.6 million is expected. Additionally, it is estimated that the sectors considered in the Fairwood study would also fully develop by 2021, and this will result in an additional population of 215,000, thus taking the total population growth in these new areas to 1.815 million. It is also expected that the density in the existing developed areas will increase marginally by 10%, such that the total population

increase will be about 2 million. Therefore, the expected growth in population in the period 2005 to 2021 will be almost three times of that considered in the 2002 traffic study.

Based on a review of the interaction between the developments on the western and eastern side of Yamuna, it is estimated that the developments on the eastern side contribute to about half of the traffic. As presented in the 2002 traffic study, considering that both the links are developed (to the north – Mayur Vihar link, and to the south), the traffic is expected to increase by about 110% to 122,233 vehicles. As the population growth is underestimated, if the expected population develops by 2021, the actual growth realized will be 220% and thus the expected traffic in 2021 will be 186,000 vehicles.

Secondly, as noted in the previous section, the additional areas that are expected to develop will likely result in 58,604 daily trips on DND Flyway. The areas considered in the Fairwood study are expected to result in 11,300 daily trips by year 2009, and 16,950 daily trips when they are fully developed. Thus, it is expected that these residential developments alone will result in a total of over 75,554 daily trips. Further developments in existing residential sectors are expected to result in 20% more trips, and therefore based on these changes alone, the traffic is expected to increase by about 90,660 vehicles. Considering that the 2002 traffic study considered only one-third of this growth, it would appear that the 2021 traffic estimate was underestimated by 55,400 vehicles, and that the 2021 traffic estimate with the Mayur Vihar link should be 177,633 vehicles.

As two alternate methodologies have been considered, and both of them are conservative in that the impact of other commercial and residential developments are not considered, it is proper to consider the average of the two estimates, and therefore the 2021 daily estimate for traffic on DND Flyway is 181,950 vehicles. However, this estimate does not account for the additional trips expected to be generated by the commercial developments, and considering a conservative estimate of 10% additional trips due to these developments, the revised 2021 daily estimate is 200,000 vehicles.

3.5

Mayur Vihar Link Traffic Forecast Review

The NITBCL traffic forecast for Mayur Vihar Link is as presented in the earlier traffic study. As per this forecast, when the facility starts operation in January 2007, it will result in additional traffic of about 11,000 vehicles per day on DND Flyway. Further, a growth of 3.9% of additional traffic is forecast till 2011, followed by a

growth of 1.5% for the following years. This will result in a total growth of about 35% from the expected start of the facility (1 January 2007) till the year 2021. This forecast appears to be appropriate, given that the link will primarily service areas of Mayur Vihar that are significantly developed. The one major development in the immediate vicinity that is currently underway is the Mayur Vihar District Centre, which is located just north of the Chilla Regulator and directly opposite from where the Mayur Vihar link will join the Delhi Noida link road. The impact of the traffic expected to be generated by this development is within the forecast traffic.

3.6

DND Flyway Capacity

The capacity of the DND Flyway is dependent on two primary constituents – the first being the road and the second being the toll plaza. The basic capacity of an uninterrupted facility for Indian conditions is 525 passenger car units/hr/m (PCU/hr/m) of road width (*Guidelines for Capacity of Urban Roads in Plain Areas*, Indian Roads Congress, 1990 [IRC: 106-1990]). DND Flyway is 4 lanes wide in each direction, with a pavement width of 14 m. Thus, the theoretical capacity is 7,350 PCUs per direction per hour or 1,837.5 PCU/lane. It should be noted that the theoretical capacity of roadways in other countries is considered to be higher. For example in the US, the maximum service flow rate for freeway segments varies from 2,250 to 2,400 passenger cars/hr/lane (*Highway Capacity Manual 2000*, Transportation Research Board, 2000). It is expected that the capacity of DND Flyway would be atleast 2,000 PCU/hr/lane or 8,000 PCU/hr/direction.

Currently, during the peak period there is a significant directional split. However, as this is an urban facility and as the developments increase east of Yamuna and become more varied, the directional split is expected to converge to 50:50. The average peak hour traffic on Indian urban roads varies from 6% to 9% of the daily traffic, and it is expected that on this facility it will be about 8%. Thus, the capacity of each side of the roadway will be 100,000 PCUs for a total capacity of 200,000 PCUs. It should be noted that with the current and expected traffic composition, the weighted PCU equivalent is 0.9, and therefore for this composition the capacity is about 222,000 vehicles per day.

The toll plaza has 34 total lanes, which includes the following

- Two-wheelers = 12
- Cars = 17

- Extra wide = 1
- Future – Two-wheeler lanes = 4 or Cars = 2

Considering the peak direction, there can be 9 car/truck lanes and 6 two-wheeler lanes available at a minimum. The least capacity of the lane is when it is operated manually, and that is 300 vehicles per hour. The capacity is 1,000 vehicles per hour for the automatic/electronic toll collection lanes. Currently, over 30% of the transactions are handled electronically. Although the processing rate is slower than 1,000 vehicles per hour (silver lane – contactless card), in the future it is expected that a majority of the traffic will use the transponders (gold lane) and therefore the higher processing rate will be achieved. Considering that in the future at least two-thirds of the traffic will use automatic toll lanes, the capacity in the peak direction will be 11,500 vehicles per hour (10,000 in ten automatic lanes, and 1,500 in five manual lanes). This capacity, together with the additional capacity to be created through the Mayur Vihar Link Toll Plaza is greater than the road capacity of 8,900 vehicles per hour, and thus the toll plaza will not be a constraint.

3.7

Traffic Forecast for DND Flyway and Comparison with Earlier Forecasts

As presented in Section 3.4, it is estimated that with the Mayur Vihar link in place, the daily traffic on DND Flyway will be 200,000 vehicles for the year ending 31 March 2021.

As has been presented earlier in Section 2.2.3, NTBCL has estimated the traffic for year ending 31 March 2006 as 61,985 vehicles, which includes 43,509 cars/auto-rickshaws, 17,076 two-wheelers and 1,400 trucks and buses. Detailed data obtained from NTBCL shows that the average daily traffic for the first nine months (starting April 2005) is 60,183 vehicles, which includes 41,991 cars/auto-rickshaws, 16,783 two-wheelers and 1,295 trucks and buses. It has also been noted that the average traffic during the months of January to March is greater than that in the preceding nine months. An analysis of this was performed for the past three years, and the results are presented in Table 11. On an average, the traffic in the January to March period is 7.5% more than that in the preceding nine months. On this basis, the traffic for January to March 2006 is estimated, and the average traffic for the year 2006 is estimated as 61,193 vehicles, as compared to the 61,985 vehicles in the NTBCL forecast.

Year	Financial year ending 31 March, Average Daily Traffic (vehicles)		Growth
	April-Dec	Jan-March	
2003	37,374	41,773	11.8%
2004	47,402	47,980	1.2%
2005	52,081	55,198	6.0%

Table 11 Average Daily Traffic on DND Flyway in last 3 months vs first 9 months of each Year

Given that the average traffic in the financial year ending 31 March 2005 was 52,860 vehicles, a growth of 15.8% is expected for the financial year ending 31 March 2006. This is significantly higher than the 11.2% growth achieved in the previous year. It should be noted that as presented in Section 2.2.1, if no link was developed, the traffic on DND Flyway was expected to increase from 48,507 vehicles in 2004 to 78,125 vehicles in 2011, at an annual rate of almost 7%. However, the growth achieved has been 50 to 130% higher than the forecasted growth. This is primarily because of two reasons. Firstly, there have been significant commercial developments in the Noida area in the past two years, which have resulted in attracting more traffic. Secondly, the fuel prices have increased rapidly in the past two years. As shown in Table 12, the price of petrol has increased by almost 14% annually for the past two years, and that of diesel by almost 20% annually for the past two years.

Financial Year ending 31 Mar	Petrol		Diesel	
	WPI	Annual Growth (%)	WPI	Annual Growth (%)
2002	158.1		252.3	
2003	163.4	3.35	273.5	8.40
2004	178.7	9.36	300.4	9.84
2005	203.5	13.88	360.4	19.97
2006	231	13.51	430.2	19.37

Table 12 Historical Increase in Fuel Price Indices (2002 to 2006)

Two years ago, the operating cost for a typical car was Rs 3/km. A person who saved 5 km by using the DND Flyway would think twice before using it, given the toll of Rs 15 at that time. However, as the operating cost has increased to Rs 5/km, there is a net savings of Rs 8 per trip, as the toll has only increased to Rs 17.

This has resulted in additional motorists shifting to DND Flyway. The same logic also applies for two-wheelers and other vehicle types, where the operating costs have increased rapidly because of the increase in the fuel cost.

Based on the current review performed, the traffic in year 2021 is forecasted to be 200,000 vehicles. Given the rapid growth of development in the recent past and the various planned developments, it is expected that the growth will be significantly higher in the initial years. Although it will be difficult to achieve a sustained growth of 15.8% as is expected in the year 2006, it is estimated that the growth rate will be 15% in the next three years. As noted in the Fairwood report, over 11,000 daily vehicle trips are expected to be added due to the new developments within 1 km of the Noida-Greater Noida Expressway, and coupled with the current growth being experienced, this 15% estimate is conservative.

In the fourth year, a growth of 12% is estimated, and in following years the growth will be lesser as the developments get built out and fully occupied. A 2% reduction in the growth rate is expected to 10% for 2011 and 2012, followed by an annual reduction of 2% till it reduces to 6% in the year 2014. It is expected to further reduce to 5% in 2015, 4% in 2016, finally stabilizing at 3% in 2019. The forecasted traffic in year 2021 is 200,504 vehicles on this basis. A summary of the forecasted growth rates is presented in Table 13 and the resulting traffic in Table 15.

Year	Forecast growth rate (%)
2007 to 2009	15
2010	12
2011-12	10
2013	8
2014	6
2015	5
2016-2018	4
2019-2021	2

Table 13 Forecasted Growth Rate for Traffic on DND Flyway

The traffic forecast as part of this study is compared with the earlier forecasts prepared as part of the 2002 traffic study and the forecasts prepared by NTBCL in 2005. This comparison is presented in Table 14. As detailed previously, there are two primary reasons why the forecasts have increased significantly over the 2002 traffic study. Firstly, there is significant additional growth taking place on the

eastern side of Yamuna as compared to the earlier forecast. For example, the population growth expected is three times that forecasted in the previous study. The reason why the traffic is expected to grow more initially is because of the recent developments that have either already taken place or are in the planning/execution stage. Additionally, the increase in fuel prices and the subsequent increase in operating costs have accelerated the shift from alternate facilities to DND Flyway.

Year	2002 Traffic Study	NTBCL Forecast, 2005	Current Study Forecast
2011	90,780	136,453	126,841
2021	122,233	199,611	200,504

Table 14 DND Flyway Average Daily Traffic Forecast Comparison (vehicles)

Traffic Projections for Existing Delhi Noida Toll Bridge													(Vehicles/day)				
Year Ending 31st March	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Two wheelers	17,097	19,662	22,611	26,002	29,123	32,035	35,238	38,058	40,341	42,358	44,052	45,814	47,647	49,076	50,549	52,065	
Car/Autos	42,776	49,192	56,571	65,057	72,864	80,150	88,165	95,218	100,931	105,978	110,217	114,626	119,211	122,787	126,471	130,265	
LCVs	277	318	366	421	471	519	570	616	653	686	713	742	771	794	818	843	
Truck/Buses	836	961	1105	1271	1423	1566	1722	1860	1972	2070	2153	2239	2329	2399	2471	2545	
Heavy Vehicles with 3 axles	98	112	129	149	167	183	202	218	231	242	252	262	273	281	289	298	
All Heavy Vehicles > 4 Axles	110	126	145	167	187	206	226	244	259	272	283	294	306	315	325	334	
Total Commercial and Buses	1,320	1,518	1,746	2,008	2,248	2,473	2,721	2,938	3,115	3,270	3,401	3,537	3,679	3,789	3,903	4,020	
Total	61193	70372	80928	93067	104235	114658	126124	136214	144387	151606	157671	163977	170537	175653	180922	186350	
Growth Rate	15.8%	15.0%	15.0%	15.0%	12.0%	10.0%	10.0%	8.0%	6.0%	5.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	
Additional Traffic due to Mayur Vihar Link																	
Two wheelers		3,494	3,629	3,770	3,916	4,070	4,131	4,194	4,257	4,321	4,387	4,453	4,520	4,588	4,658	4,728	
Car/Autos		6,597	6,853	7,118	7,394	7,684	7,801	7,918	8,038	8,160	8,283	8,408	8,535	8,664	8,795	8,928	
LCVs		77	80	83	86	90	91	93	94	95	97	98	100	101	103	104	
Truck/Buses		233	242	251	261	271	275	280	284	288	292	297	301	306	311	315	
Heavy Vehicles with 3 axles		27	28	29	31	32	32	33	33	34	34	35	35	36	36	37	
All Heavy Vehicles > 4 Axles		31	32	33	34	36	36	37	37	38	38	39	40	40	41	41	
		368	382	397	412	429	435	442	448	455	462	469	476	483	491	498	
Total		10,459	10,864	11,285	11,723	12,183	12,367	12,554	12,743	12,936	13,132	13,330	13,531	13,736	13,943	14,154	
Growth Rate		4%	4%	4%	4%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	
TOTAL TRAFFIC																	
Two wheelers	17,097	20,523	26,240	29,772	33,039	36,105	39,370	42,251	44,598	46,679	48,439	50,267	52,167	53,665	55,207	56,793	
Car/Autos	42,776	50,819	63,424	72,175	80,258	87,835	95,966	103,137	108,970	114,138	118,500	123,034	127,746	131,451	135,266	139,193	
LCVs	277	337	446	504	558	608	662	709	747	781	810	840	871	896	921	947	
Truck/Buses	836	1,018	1,347	1,522	1,685	1,837	1,998	2,140	2,256	2,358	2,446	2,536	2,630	2,705	2,781	2,860	
Heavy Vehicles with 3 axles	98	119	158	178	197	215	234	250	264	276	286	297	308	317	326	335	
All Heavy Vehicles > 4 Axles	110	134	177	200	221	241	262	281	296	310	321	333	346	355	365	376	
Total	61,193	72,951	91,792	104,352	115,958	126,841	138,491	148,768	157,131	164,542	170,802	177,307	184,068	189,388	194,866	200,504	

Table 15 Revised Forecast of Average Daily Traffic for DND Flyway (vehicles)

Other Factors with potential impacts on Traffic Forecasts

There are some factors which can have a significant impact on travel patterns and proportion of travel on different modes. Some of them are listed below:

- Noida and Greater Noida currently lack good public transport facilities. In the future, this scenario is possibly going to change with the advent of Metro rail and other improvements. Although the proposed alignment of Metro rail is for Noida via Mayur Vihar to Central Delhi whereas the potential commuters of DND Flyway travel from Noida / Mayur Vihar to South Delhi, there is likely to be a change in pattern in commuting and consequently it may effect traffic on the DND Flyway.
- Many offices in Delhi are in the process of relocating to Noida and Greater Noida. It will nullify the need of residents of Noida and Greater Noida to travel to Delhi for work purposes but at the same time people who reside in Delhi will be traveling to Noida and Greater Noida for work.
- The Commonwealth Games are planned to be held in India in 2010. The Games village and other important facilities are currently being planned on the eastern side of Yamuna. It is likely that in these facilities will in turn result in additional developments in the vicinity, thus increasing the attractiveness of the area and the possibility of more trips across the river Yamuna. The existing major stadiums located west of Yamuna will continue to be used for the Games, and this will also result in significant traffic across Yamuna.
- All other bridges across Yamuna are maintained and operated by the government (Public Works Department in most cases). Typically there is a paucity of resources to perform the maintenance activities which results in disrepair of these facilities. Also, funds are not easily available for capacity enhancement, and all these bridges are currently operating at capacity during the peak periods. As the DND Flyway has residual capacity available, it is possible that traffic from the other bridges will shift to DND Flyway, thus resulting in a more rapid growth in the next few years.

The impact of these and other changes can be evaluated with a comprehensive transportation model, after making due consideration for the planning variables.

4 Operation & Maintenance and Discounted Cash Flows

DND Flyway is a 6 km long eight-lane facility that has been operational since February 2001. Interchanges are provided at the two ends where it meets with the Ring Road on the west and with the Delhi-Noida link road on the east. There are three ramps on the west side (Ramps A, C, and E) and four ramps on the east side (Ramps A to D). Currently there is one toll plaza which has 27 operational lanes and eight future planned lanes for two-wheelers.

4.1

Design Characteristics

The facility is a flexible pavement road, constructed on embankment with soil dredged from the adjacent Yamuna river. As per the *Delhi-Noida Bridge Project, Draft Detailed Project Report, Volume 2 – Design Report*, Kampsax International A/S, March 1995, the main facility pavement has an asphalt thickness of 190 mm consisting of 40 mm asphaltic concrete, 65 mm bituminous macadam, and 85 mm dense bituminous macadam. This is built on base thickness of 225 mm and sub-base of 200 mm. According to Indian Road Congress standards for a 20-year design life, the pavement can adequately handle upto 50 million standard axles (MSA) traffic.

The facility includes one major bridge (552.5 m long, which has 13 spans of 42.5 m) over Yamuna river which is a precast segmental twin box girder bridge. The box girder is 2.75 m deep and each 4 m segment weighs 90 T. The superstructure is supported on hollow box piers cast-in-place. There is one minor bridge (2 spans of 15 m) over the Hindon cut which is a simply supported bridge.

4.2

Toll System and Facilities

The vehicles are classified in six different classes for toll collection, and these classes are detailed in Table 16.

Class	Description
Class I	Two Wheelers (Scooters and Motor Cycles)
Class II	Light Vehicles : All light motor vehicles with 2/3 axles including 3 wheelers

Class	Description
Class III	Light Commercial Vehicles – All LCVs with 2 or more axles
Class IV	Medium Vehicles-All heavy vehicles with 2 axles (including buses/trucks)
Class V	Large Vehicles – All heavy vehicles with 3 axles
Class VI	Extra Large Vehicles – All Heavy Vehicles with 4 or more axles

Table 16 Toll Classes and Vehicle Types

There are three different methods of toll collection – manual, semi-automatic and fully automatic. These systems are detailed next.

4.2.1

Manual Toll Collection

In this system the toll is collected manually in cash at the toll plaza on per trip basis. The toll is collected for all the categories, and the current rates for respective categories are detailed in **Table 17**.

Vehicle Class	Vehicle Description	Cash Tariff Rs. Per Passage
1	Two Wheelers	9
2	Cars/Jeeps	18
3	LCV's	35
4	Buses/ Trucks	45
5	Large Vehicles	60
6	Extra Large Vehicles	80

Table 17 Existing Toll Rates (Valid up to 31 January, 2007)

4.2.2

Electronic Toll Collection – Silver Lane

The Company offer discounted tariff to regular users through pre-paid contactless smart cards. The dedicated lanes for smart card users known as Silver Lanes ensure that the transactions have processed faster with reduced waiting time for regular users. The applicable tariff is deducted from the pre-paid account on every usage and the users can recharge/top-up the account when the account balance gets used up.

4.2.3 Electronic Toll Collection – Gold Lane

This is also a pre-paid facility class II vehicles (for cars and jeeps) where an electronic tag /On-Board-Unit (OBU) is installed on the windscreen of the vehicle and the OBU interacts with the toll management system through radio frequency for debit of the applicable amount of toll into the pre-paid account for every passage. The user is not required to stop and the vehicle can cross the toll plaza through the Gold Lane at a speed of around 30 kmph. Under the Gold Lane also, per trip rate is currently discounted for the commuters. An initial fee of Rs. 2,000 is charged towards the cost of OBU.

4.2.4 Increase in Toll Rates

The toll rates on DND Flyway are revised annually based on the increase in the Consumer Price Index (CPI) for urban non-manual employees. The toll rate is first calculated based on the increase in CPI and is then rounded off to the nearest rupee for Class I and II vehicles and to the nearest 5 rupees for the remaining classes of vehicles.

Class	2001	2002	2003	2004	2005	2006
I	7	7	8	8	8	9
II	15	15	15	16	17	18
III	30	30	30	30	35	35
IV	35	35	40	40	40	45
V	50	50	55	55	60	60
VI	60	65	70	70	75	80

Table 18 History of Toll Rate Revisions on DND Flyway (Rs/Trip)

When the facility first started operating, significant discounts were given for the vehicles using the electronic toll collection, to encourage its usage. However, these

discounts have been steadily decreased and now vary from only 5 to 22% for different classes. Even with this low level of discount the use of ETC is significant for three classes as shown in Table 19.

I	II	III	IV	V	VI
19.2%	32.8%	19.5%	7.1%	0.0%	0.0%

Table 19 ETC Usage in Year 2005 by Vehicle Classes

4.3

Pavement Condition and Performance

It is noted that the number of heavy vehicles is significantly small. The commercial vehicles are in Classes III to VI mainly comprising of light commercial vehicles and trucks. However, buses / mini buses are also classified as Class IV/III. Although there is no separate data available on number of trucks, as there are a significant number of bus movements observed, it is estimated that 25% of Class IV vehicles, and all of Class V and VI vehicles are trucks. The current average daily volume of trucks is 400.

It has also been observed that the number of buses and trucks are growing at a significantly lower rate than cars and two-wheelers. This can be seen from the fact that in the past two years, the growth for buses/trucks is 7% and 8%, whereas for cars it is 11% and 15%. For performing a worst case analysis, a 10% growth rate is considered for trucks for the next five years, and 5% for the following ten years. As per *Guidelines for the Design of Flexible Pavements (Second Revision)*, Indian Roads Congress, 2001 (IRC:37-2001), a vehicle damage factor of 3.5 is considered. Additionally, as this is a four-lane facility in one direction, 45% trucks in one direction are considered to ply in the critical lane. The resulting equivalent standard axles for the 20 year design period are 3.6 million. This is significantly less than the 50 MSA design provided.

Pavement roughness is regarded as an important measure of pavement performance as it directly evident to the facility users. A detailed study of pavement roughness was performed in 2003 (*Roughness Survey for DND, Technical Report*, STUP Consultants Pvt Ltd, November 2003) after the facility had been operating for almost three years. A summary of the results is presented in Table 20.

From (km)	To (km)	Roughness (m/km)
0.2	1	1.724
1	2	1.904

From (km)	To (km)	Roughness (m/km)
2	3	1.876
3	4	1.980
4	5	2.109
5	5.3	1.925

Table 20 Pavement Performance Data, November 2003

The recommended threshold value for national highways in India is 3.47 mm/km. The observed values on DND Flyway are less than 60% of the threshold value, which demonstrates that the pavement is performing well. A recent site visit has confirmed this and the current pavement condition is as depicted in Figure 6.



Figure 6 Existing Pavement Condition of DND Flyway

4.4

Facility Operation and Maintenance

NTBCL has contracted with Intertoll Consultants to operate and maintain the facility. Intertoll has significant staff and equipment based at the site for this purpose. These staffs patrol the facility, perform routine maintenance, and are also responsible for the operation which includes collection of toll.

The facility appears to be in good working order. The primary elements studied on a recent site visit included a visual inspection of the main bridge and embankment, the two other major features of this facility. The embankment height varies from 3 to 5 m. detailed soil penetration tests had been performed on the embankment in 2000. Subsequently liquefaction analysis has been done, which has shown that the embankment is in very good condition. A view of the existing embankment condition is depicted in Figure 7.



Figure 7 Existing Embankment Condition

4.5

O&M Expenses

As per the latest agreement signed on dated 8 Feb. 2006, with NTBCL, Intertoll will receive Rs 2.12 million as O&M expenses per month basis. Besides that, NTBCL will also reimburse as power expenses and as other expenses for main Flyway to Intertoll for each of the month currently aggregating to 0.7 million per month. These expenses shall be escalated based on Consumer Price Index for urban non-manual employees. The O & M cost for Mayur Vihar link road has been estimated Rs 5.1 million from 2008 onwards and escalated on the basis of Consumer Price Index for urban non-manual employees.

As noted previously, the pavement condition is also good, and therefore no overlay is anticipated to be needed for the next two years. It is expected that in the year 9, a periodic overlay would have to be carried out and thereafter repeated every five years. A summary of the pavement area is provided in Table 21.

Component	Length (m)	Width (m)	Area (sq m)
Main Road	11,282	14.5	163,589
Delhi Side			
Ramp-A	600	11	6,600
Ramp-B	520	11	5,720
Ramp-C	600	7.5	4,500
Ramp-D	940	11	10,340
Ramp-E	519	7.5	3,893
Noida Side			
Ramp-A	517	7.5	3,878
Ramp-B	433	7.5	3,248
Ramp-C	460	7.5	3,450
Ramp-D	430	7.5	3,225
Mayur Vihar Link Road	2,800	7.5	21,000
Mayur Vihar Toll Plaza area			1,500
Main Toll Plaza area			42,000
Total			272,942

Table 21 DND Flyway Pavement Area (sq m)

As per the design, a 30 mm overlay is required to be provided. The cost for the overlay will include the cost of cleaning the pavement surface, applying the tack coat and the cost of the bitumen concrete. At year 2006 prices, the cost of the overlay will be Rs 58.75 million, which includes the cost of supervision for this activity.

There will be additional expenses related to the toll plaza. As noted previously, the ETC is currently used by 20 to 33 percent of the three main classes of vehicles. However, it is expected that its use will grow to over 65 percent in the future. This will increase the throughput of the toll plaza and will ensure that it does not become a bottleneck for traffic flows. However, technology upgrades will be needed, typically on a lane by lane basis, to ensure that this facility is affordable and attractive to consumers. This technology upgradation and regular system upgradation is expected to cost Rs 10 million per year.

4.6

Discounted Cash Flows

The cash flow analysis is prepared with the objective of estimating the revenue forecast, additional capital cost due to development of new links and review of operation and maintenance expenses.

Accordingly, the scope of services of the study is to review the financial model of the project including estimation of the cash flow analysis including the additional capital expenditure due to new development of Mayur Vihar link.

4.6.1

Basic Assumptions and Inputs of the Cash Flow Analysis (CFA)

This CFA has been specially developed for this project. The basic assumptions of the models are as follows

- As per the Concession Agreement the toll rates are revised annually on the basis of change in consumer price index (CPI) for urban non manual employees published by RBI. The CPI has increased from 156 in 1991 to 477 in November, 2005 indicating a compounded annual growth rate of 7.7%. However, for the purpose of cash flow analysis a conservative escalation rate of 6% per annum has been assumed.
- The escalation rate for operation and maintenance expenses has been considered 2% higher than the CPI inflation rate i.e. @ 8% per year for the operation period.
- The construction schedule for the Mayur Vihar is being considered for 9 months, such that this facility is operational from 1 January 2007.
- The traffic growth rate has been taken as presented earlier in the report. The growth rate for specific modes has been estimated separately for different periods as mentioned in the revenue section of this report.
- The traffic has been separately estimated for electronic and regular users.

The following tax rates have been assumed for the project analysis:

- Income tax as 30 % of base rate, surcharge of 10 %, education cess of 2 %, effective rate of 33.66 %, minimum alternate tax of 7.65%. The project being in the infrastructure sector covered under section 80 IA of the Income Tax

Act is eligible for a tax holiday for a continuous block of 10 years to be opted by the company within the first 20 years. Since the company is carrying forward significant amount of business loss and unabsorbed depreciation, there will be no tax payable till FY 2010. The Company is assumed to avail of the tax holiday during the period FY 2011 to 2020 (years 11th to 20th from start of operations) and only MAT will be payable during this period. Tax at normal tax rate has been provided in FY 2021.

- The rate of depreciation for tax computations has been assumed @ 10% per annum on written down value basis with a salvage value of 5%.

4.6.2

Additional Capital Expenditure and Phasing

The additional cost for Mayur Vihar link road shall be Rs. 300 million which will be fully spent in 2007. The construction and commencement of operations schedule is presented in Table 22.

Start of Construction	1 April 2006
Construction Period	9 Months
Start of Operations	1 January 2007

Table 22 Schedule of Mayur Vihar Link Construction

4.6.3

Revenue from the Project

The total revenue of the project comes from toll collection, advertisement and interest earned from investments. This report only includes the revenues earned from toll collection. The toll rates has been escalated based on CPI of urban non-manual workers for Delhi. The revenue during 2008 after completion of Mayur Vihar link is expected to be Rs. 555.86 million.

- 1) For the purpose of estimating the future cash flows, the revenue has been computed on the basis of traffic forecast presented in chapter III and the applicable toll rates effective February 1, 2006 with an annual escalation of 6% per annum. Interest on cash surpluses and advertisement income / expenses

relating thereto have not been considered since the same is not part of the terms of reference.

- 2) Out of the gross income estimated above O & M expenses comprising the fees payable to the O & M operator has been provided Rs 34 million for FY 2007 for main project and Rs. 5.1 mn. For Mayur Vihar Link Road for FY 2008. The periodic overlay expenses has been escalated at the assumed rate of CPI inflation i.e. 6% and establishment and other O & M expenses of the Company have been projected using the estimated costs for 2006 provided by the Company as the base with an annual escalation of 2% above the inflation rate i.e. 8% per annum.
- 3) The capital expenses anticipated for the Mayur Vihar Link has been netted out for estimating annual net cash flow. No adjustment has been made with respect to increase and decrease in current assets since the Company does not have any debtors relating to the toll income and the level of inventories in respect of the smart cards / ETC tags are expected to remain constant.
- 4) Discount rate used for the DCF analyses is the cost of capital of the company : The cost of equity for the company has been determined using the capital asset pricing model. The prevailing yield on the 10 year G-Sec has been taken as Risk-free rate which works out to 7.2% (Source : The Economic Times, New Delhi January 24, 2006). The Market return is determined by averaging the annualised growth rate in NSE Nifty and BSE Sensex over last 10 years which works out to 10.75%. The beta (β) for the Company is 0.91. Thus cost of equity works out to approximately 10.5%.
- 5) Assuming a debt equity ratio of 1:1 and cost of debt @ 8.5% pa. for similar projects, the weighted average Cost of Capital is calculated as 9.5%.
- 6) Terminal Multiplier: The net cash flow (post tax) for the year 2021 has been assumed for estimating terminal value of the project. Assuming a conservative growth rate of 4% in toll rates and a 1% rate of growth in traffic, the terminal multiplier works out to 22.4 times.
- 7) Thus the present value of the future cash flows of the Company has been estimated as presented next.

	<u>Rs. Million</u>
Discount Factor	9.5%
NPV of net cashflows till 2021	7,450
Rate of growth in toll rates	4.0%
Rate of Growth in traffic	1.0%
Multiplier	22.4
Terminal Value	37,146
PV of Terminal Value	10,426
Value of Project	17,875

The detailed computations have been placed at Appendix A.

5

Conclusions

The traffic forecast for the DND Flyway and the proposed Mayur Vihar Link Road has been reviewed in light of the previous studies and substantial population growth in the region. The Mayur Vihar Link Road is proposed to be developed by NTBCL to shorten the travel distance for people living in Mayur Vihar and others accessing areas in its vicinity. A recent study had estimated the impact of developments in a narrow stretch along the Noida-Greater Noida Expressway. This was extended to other undeveloped areas of Noida and Greater Noida, and it is estimated that these developments will result in an additional population of 1.6 million. Other developments in recently and older developed areas will result in another 0.4 million for a total population growth of 2.0 million.

This population increase is significantly greater than a previous estimate of 0.64 million. Therefore, the traffic is also expected to grow significantly more than that estimated in the 2002 traffic study. It is expected that in the financial year ending 2021, there will be 200,504 daily vehicle trips on DND Flyway. This is more than the 2002 traffic study estimate of 122,233 but less than the 2005 estimate of 199,613. The roadway capacity of 222,000 vehicles is adequate for the expected traffic. The toll plaza capacity is about 25% higher than this, and thus none of these components are expected to constrain the traffic flow or its growth.

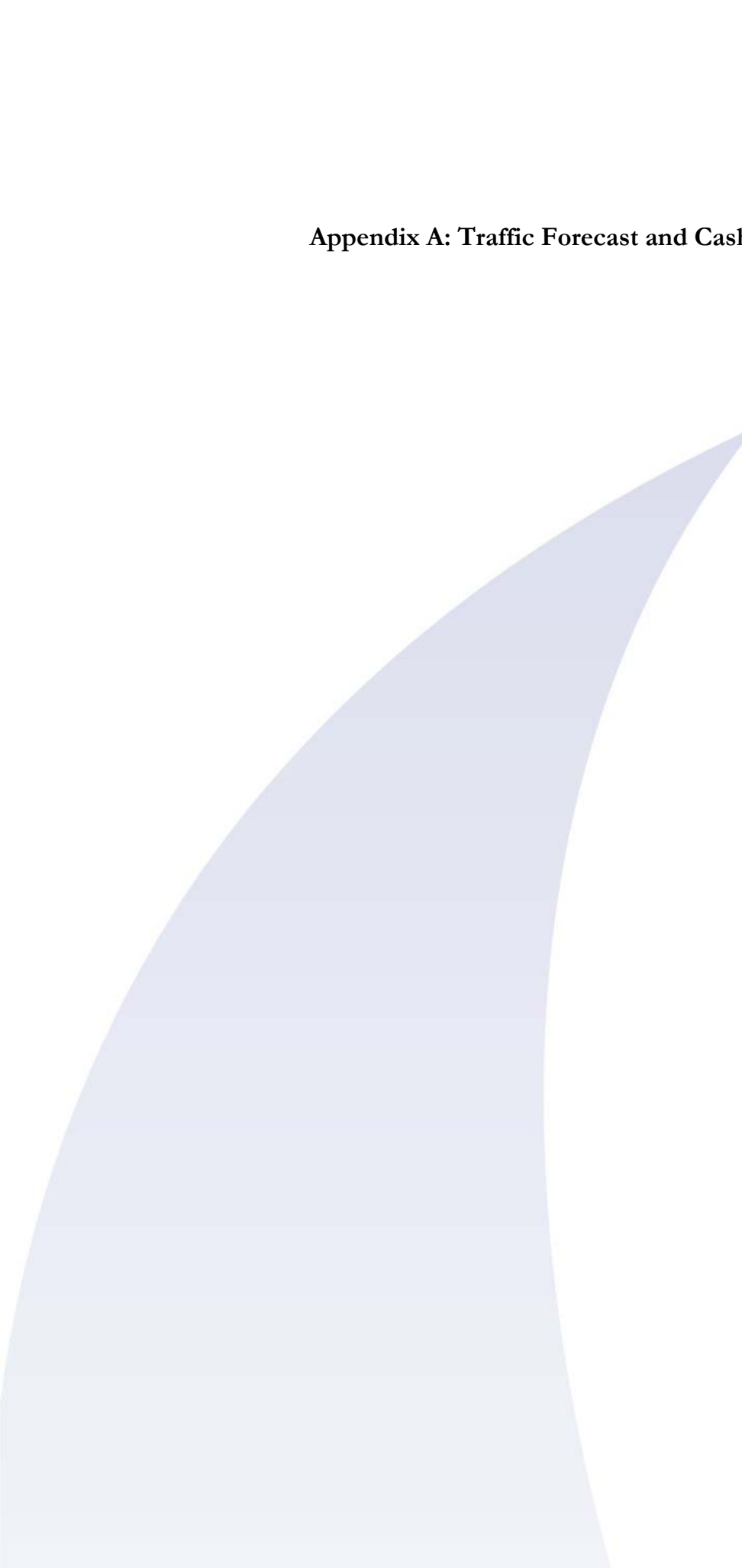
There are other developments occurring in the influence area which can impact the traffic on DND Flyway. These include changes to the public transport system and provision of a metro connection to parts of Noida, the Commonwealth Games in the year 2010 which will result in significant developments on the eastern side of Yamuna, and the

The condition of the existing facility and in particular the pavement and embankment has also been reviewed. The pavement was designed for a load of 50 MSA, but the expected load is less than 4 MSA. The physical review also established that the pavement condition is good, and therefore the first overlay is expected only in the financial year ending 2009. The overlay is expected to cost Rs 46 million (at year 2006 prices).

As the traffic increases, it is expected that technology changes will be needed to the toll plaza on an incremental basis. This will help improve the throughput of the toll

plaza and is expected to cost Rs 10 million per year. The electronic toll collection facility is being used by a growing number of facility users and varies between 20 and 33 percent for the three primary classes. It is expected that after 2010 no discount will need to be provided for users of the ETC system.

The toll fee is expected to increase by 6% annually over the future years. This is a conservative estimate, given that the CPI has increased by 7.7% annually in the past ten years. A discounted cash flow analyses has been performed and the present value of the project has been determined as Rs 17.9 billion.



Appendix A: Traffic Forecast and Cash Flow Analysis

Year Ending 31st March	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Annual Increase of User Charges	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Maximum Permissible Toll																
Two wheelers	8.8	8.8	9.4	9.9	10.5	11.1	11.8	12.5	13.3	14.1	14.9	15.8	16.8	17.8	18.8	20.0
Car/Autos	17.7	17.7	18.7	19.8	21.0	22.3	23.6	25.1	26.6	28.1	29.8	31.6	33.5	35.5	37.7	39.9
LCVs	35.3	35.3	37.4	39.7	42.1	44.6	47.3	50.1	53.1	56.3	59.7	63.3	67.1	71.1	75.3	79.9
Truck/Buses	44.2	44.2	46.8	49.6	52.6	55.7	59.1	62.6	66.4	70.4	74.6	79.1	83.8	88.8	94.2	99.8
Heavy Vehicles with 3 axles	61.8	61.8	65.5	69.5	73.6	78.1	82.7	87.7	93.0	98.5	104.5	110.7	117.4	124.4	131.9	139.8
All Heavy Vehicles > 4 Axles	79.5	79.5	84.3	89.3	94.7	100.4	106.4	112.8	119.5	126.7	134.3	142.4	150.9	159.9	169.5	179.7
Toll Rounded Off																
Two wheelers	9	9	9	10	11	11	12	13	13	14	15	16	17	18	19	20
Car/Autos	18	18	19	20	21	22	24	25	27	28	30	32	34	36	38	40
LCVs	35	35	35	40	40	45	45	50	55	55	60	65	65	70	75	80
Truck/Buses	45	45	45	50	55	55	60	65	65	70	75	80	85	90	95	100
Heavy Vehicles with 3 axles	60	60	65	70	75	80	85	90	95	100	105	110	115	125	130	140
All Heavy Vehicles > 4 Axles	80	80	85	90	95	100	105	115	120	125	135	140	150	160	170	180
ETC- Silver/Gold																
Two wheelers	7	8	8	9	10	11	12	13	13	14	15	16	17	18	19	20
Car/Autos	17	17	18	19	20	22	24	25	27	28	30	32	34	36	38	40
LCVs	30	30	30	35	35	45	45	50	55	55	60	65	65	70	75	80
Truck/Buses	45	45	45	45	50	55	60	65	65	70	75	80	85	90	95	100
Heavy Vehicles with 3 axles	55	55	60	65	70	80	85	90	95	100	105	110	115	125	130	140
All Heavy Vehicles > 4 Axles	65	65	70	75	80	100	105	115	120	125	135	140	150	160	170	180

Cash Users	TRAFFIC PROJECTIONS															
Year Ending 31st March	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Traffic Projections for Existing Delhi Noida Toll Bridge												<i>(Vehicles/day)</i>				
Two wheelers	13,822	15,895	18,280	21,022	23,544	25,899	28,489	30,768	32,614	34,244	35,614	37,039	38,520	39,676	40,866	42,092
Car/Autos	28,744	33,056	38,014	43,716	48,962	53,858	59,244	63,983	67,822	71,214	74,062	77,025	80,106	82,509	84,984	87,534
LCVs	223	256	295	339	380	418	459	496	526	552	574	597	621	640	659	679
Truck/Buses	777	893	1,027	1,181	1,323	1,455	1,601	1,729	1,833	1,924	2,001	2,081	2,164	2,229	2,296	2,365
Heavy Vehicles with 3 axles	98	112	129	149	167	183	202	218	231	242	252	262	273	281	289	298
All Heavy Vehicles > 4 Axles	110	126	145	167	187	206	226	244	259	272	283	294	306	315	325	334
Total	43,773	50,339	57,890	66,574	74,562	82,019	90,221	97,438	103,284	108,449	112,787	117,298	121,990	125,650	129,419	133,302
Growth Rate	15.8%	15%	15.0%	15.0%	12.0%	10.0%	10.0%	8.0%	6.0%	5.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Additional Traffic due to Mayur Vihar Link																
Two wheelers		2,825	2,934	3,048	3,166	3,290	3,340	3,390	3,442	3,494	3,546	3,600	3,654	3,710	3,766	3,823
Car/Autos		4,433	4,605	4,783	4,969	5,164	5,242	5,321	5,401	5,483	5,566	5,650	5,735	5,822	5,910	5,999
LCVs		62	65	67	70	72	73	75	76	77	78	79	80	82	83	84
Truck/Buses		216	225	234	243	252	256	260	264	268	272	276	280	284	289	293
Heavy Vehicles with 3 axles		27	28	29	31	32	32	33	33	34	34	35	35	36	36	37
All Heavy Vehicles > 4 Axles		31	32	33	34	36	36	37	37	38	38	39	40	40	41	41
Total	-	7,594	7,889	8,194	8,512	8,846	8,980	9,115	9,253	9,393	9,535	9,679	9,825	9,973	10,124	10,277
Traffic Growth Rate		3.9%	3.9%	3.9%	3.9%	3.9%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%

Appendix 2 Average Daily Traffic (vehicles) Traffic Forecast for 2006 to 2021 – Cash Users

ETC	TRAFFIC PROJECTIONS FOR ETC															
Year Ending 31st March	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Traffic Projections for Existing Delhi Noida Toll Bridge													<i>(Vehicles/day)</i>			
Two wheelers	3,275	3,766	4,331	4,981	5,578	6,136	6,750	7,290	7,727	8,114	8,438	8,776	9,127	9,400	9,683	9,973
Car/Autos	14,032	16,137	18,557	21,341	23,902	26,292	28,921	31,235	33,109	34,764	36,155	37,601	39,105	40,278	41,487	42,731
LCVs	54	62	71	82	92	101	111	120	127	134	139	145	150	155	159	164
Truck/Buses	59	68	78	90	100	110	121	131	139	146	152	158	164	169	174	180
Heavy Vehicles with 3 axles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
All Heavy Vehicles > 4 Axles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	17,420	20,033	23,038	26,493	29,673	32,640	35,904	38,776	41,103	43,158	44,884	46,679	48,547	50,003	51,503	53,048
Growth Rate	15.7%	15.0%	15.0%	15.0%	12.0%	10.0%	10.0%	8.0%	6.0%	5.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Additional Traffic due to Mayur Vihar Link																
Two wheelers		669	695	722	750	780	791	803	815	828	840	853	866	879	892	906
Car/Autos		2,164	2,248	2,335	2,426	2,521	2,559	2,598	2,637	2,677	2,717	2,758	2,800	2,842	2,885	2,929
LCVs		15	16	16	17	18	18	18	18	19	19	19	19	20	20	20
Truck/Buses		16	17	18	18	19	19	20	20	20	21	21	21	22	22	22
Heavy Vehicles with 3 axles		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
All Heavy Vehicles > 4 Axles		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		2,865	2,976	3,091	3,211	3,337	3,387	3,439	3,491	3,543	3,597	3,651	3,706	3,762	3,819	3,877
Growth Rate			3.9%	3.9%	3.9%	3.9%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%

Appendix 3 Average Daily Traffic (vehicles) Traffic Forecast for 2006 to 2021 – ETC Users

Traffic Projections for Existing Delhi Noida Toll Bridge												(Vehicles/day)				
Year Ending 31st March	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Two wheelers	17,097	19,662	22,611	26,002	29,123	32,035	35,238	38,058	40,341	42,358	44,052	45,814	47,647	49,076	50,549	52,065
Car/Autos	42,776	49,192	56,571	65,057	72,864	80,150	88,165	95,218	100,931	105,978	110,217	114,626	119,211	122,787	126,471	130,265
LCVs	277	318	366	421	471	519	570	616	653	686	713	742	771	794	818	843
Truck/Buses	836	961	1105	1271	1423	1566	1722	1860	1972	2070	2153	2239	2329	2399	2471	2545
Heavy Vehicles with 3 axles	98	112	129	149	167	183	202	218	231	242	252	262	273	281	289	298
All Heavy Vehicles > 4 Axles	110	126	145	167	187	206	226	244	259	272	283	294	306	315	325	334
Total Commercial and Buses	1,320	1,518	1,746	2,008	2,248	2,473	2,721	2,938	3,115	3,270	3,401	3,537	3,679	3,789	3,903	4,020
Total	61193	70372	80928	93067	104235	114658	126124	136214	144387	151606	157671	163977	170537	175653	180922	186350
Growth Rate	15.8%	15.0%	15.0%	15.0%	12.0%	10.0%	10.0%	8.0%	6.0%	5.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Additional Traffic due to Mayur Vihar Link																
Two wheelers		3,494	3,629	3,770	3,916	4,070	4,131	4,194	4,257	4,321	4,387	4,453	4,520	4,588	4,658	4,728
Car/Autos		6,597	6,853	7,118	7,394	7,684	7,801	7,918	8,038	8,160	8,283	8,408	8,535	8,664	8,795	8,928
LCVs		77	80	83	86	90	91	93	94	95	97	98	100	101	103	104
Truck/Buses		233	242	251	261	271	275	280	284	288	292	297	301	306	311	315
Heavy Vehicles with 3 axles		27	28	29	31	32	32	33	33	34	34	35	35	36	36	37
All Heavy Vehicles > 4 Axles		31	32	33	34	36	36	37	37	38	38	39	40	40	41	41
		368	382	397	412	429	435	442	448	455	462	469	476	483	491	498
Total		10,459	10,864	11,285	11,723	12,183	12,367	12,554	12,743	12,936	13,132	13,330	13,531	13,736	13,943	14,154
Growth Rate		4%	4%	4%	4%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
TOTAL TRAFFIC																
Two wheelers	17,097	20,523	26,240	29,772	33,039	36,105	39,370	42,251	44,598	46,679	48,439	50,267	52,167	53,665	55,207	56,793
Car/Autos	42,776	50,819	63,424	72,175	80,258	87,835	95,966	103,137	108,970	114,138	118,500	123,034	127,746	131,451	135,266	139,193
LCVs	277	337	446	504	558	608	662	709	747	781	810	840	871	896	921	947
Truck/Buses	836	1,018	1,347	1,522	1,685	1,837	1,998	2,140	2,256	2,358	2,446	2,536	2,630	2,705	2,781	2,860
Heavy Vehicles with 3 axles	98	119	158	178	197	215	234	250	264	276	286	297	308	317	326	335
All Heavy Vehicles > 4 Axles	110	134	177	200	221	241	262	281	296	310	321	333	346	355	365	376
Total	61,193	72,951	91,792	104,352	115,958	126,841	138,491	148,768	157,131	164,542	170,802	177,307	184,068	189,388	194,866	200,504

Appendix 4 Total Traffic Forecast (Year 2006 to 2021) in vehicles

Ending 31st March	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cash Users																
Revenue Projections for Existing Delhi Noida Toll Bridge													<i>Rs. Million</i>			
Two wheelers	45	52	60	77	95	104	125	146	155	175	195	216	239	261	283	307
Car/Autos	189	217	264	319	375	432	519	584	668	728	811	900	994	1084	1179	1278
LCVs	3	3	4	5	6	7	8	9	11	11	13	14	15	16	18	20
Truck/Buses	13	15	17	22	27	29	35	41	43	49	55	61	67	73	80	86
Heavy Vehicles with 3 axles	2	2	3	4	5	5	6	7	8	9	10	11	11	13	14	15
All Heavy Vehicles > 4 Axles	3	4	5	5	6	8	9	10	11	12	14	15	17	18	20	22
Total	255	293	352	432	513	585	701	797	897	984	1097	1216	1343	1466	1594	1729
Additional Revenue due to Mayur Vihar Link																
Two wheelers	0	2	10	11	13	13	15	16	16	18	19	21	23	24	26	28
Car/Autos	0	7	32	35	38	41	46	49	53	56	61	66	71	76	82	88
LCVs	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2
Truck/Buses	0	1	4	4	5	5	6	6	6	7	7	8	9	9	10	11
Heavy Vehicles with 3 axles	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2
All Heavy Vehicles > 4 Axles	0	0	1	1	1	1	1	2	2	2	2	2	2	2	3	3
Total	0	11	48	53	59	63	70	75	80	85	93	100	108	116	125	133

Appendix 5 Detailed Annual Revenue Forecasts for Cash Users (Rs in millions)

Year Ending 31st March	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
ETC	Revenue Projections for ETC															
Existing Delhi Noida Toll Bridge																
Two wheelers	10	11	13	16	20	25	30	35	37	41	46	51	57	62	67	73
Car/Autos	87	100	122	148	174	211	253	285	326	355	396	439	485	529	575	624
LCVs	1	1	1	1	1	2	2	2	3	3	3	3	4	4	4	5
Truck/Buses	1	1	1	2	2	2	3	3	3	4	4	5	5	6	6	7
Heavy Vehicles with 3 axles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Heavy Vehicles > 4 Axles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	98	113	137	167	198	240	287	325	369	403	449	498	551	601	653	708
Additional Revenue due to Mayur Vihar Link																
Two wheelers	0	0	2	2	3	3	3	4	4	4	5	5	5	6	6	7
Car/Autos	0	3	15	16	18	20	22	24	26	27	30	32	35	37	40	43
LCVs	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Truck/Buses	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Heavy Vehicles with 3 axles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Heavy Vehicles > 4 Axles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	4	17	19	21	24	27	28	31	32	35	38	41	44	48	51
TOTAL REVENUE																
Two wheelers	55	66	84	107	130	145	172	200	212	239	265	294	324	353	383	415
Car/Autos	276	328	432	518	606	705	841	941	1074	1166	1298	1437	1585	1727	1876	2032
LCVs	3	4	6	7	8	10	11	13	15	16	18	20	21	23	25	28
Truck/Buses	14	17	22	28	34	37	44	51	54	60	67	74	82	89	96	104
Heavy Vehicles with 3 axles	2	3	4	5	5	6	7	8	9	10	11	12	13	14	15	17
All Heavy Vehicles > 4 Axles	3	4	5	7	8	9	10	12	13	14	16	17	19	21	23	25
Total	353	421	554	671	791	912	1085	1225	1376	1505	1674	1854	2043	2227	2419	2621

Appendix 6 Detailed Annual Revenue Forecasts for ETC Users and Total Revenue (Rs in millions)

Year ending March 31,	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Toll Revenue	353	421	553	671	791	912	1085	1225	1376	1505	1674	1854	2043	2227	2419	2621
Operating Expenses																
Establishment Costs	67	72	78	84	91	98	106	114	123	133	144	155	168	181	195	211
O&M Fee-DND Flyway	38	36	38	40	43	45	48	51	54	57	61	64	68	72	77	81
Other expenses			10	11	11	12	13	13	14	15	16	17	18	19	20	21
Mayur Vihar Link Exp		1	5	5	6	6	6	7	7	8	8	9	9	10	10	11
Total O&M Cost	104	109	131	140	150	161	173	185	199	213	228	245	263	282	302	324
Income Tax/MAT			4	18	26	37	50	60	70	71	84	98	122	136	150	719
OPERATING SURPLUS	249	312	419	512	614	714	863	981	1108	1222	1362	1511	1658	1809	1966	1577
CAPITAL AND PERIODIC EXPENDITURE																
Overlay Expenses (w/off)				51					69					92		
New Links		300														
Total Capital and Periodic Expenditure		300		51					69					92		
NET CASH FLOW		12	419	461	614	714	863	981	1039	1222	1362	1511	1658	1718	1966	1577
Discount Factor	9.5%	1.00	0.91	0.83	0.76	0.70	0.64	0.58	0.53	0.48	0.44	0.40	0.37	0.34	0.31	0.28
NPV till 2021	7450															

Terminal Value Multiplier				
Rate of growth in toll rates	4.0%		Terminal Value	37146
Rate of Growth in traffic	1.0%		PV of Terminal Value	10426
Rate of Growth in income	5.0%		Value of Project	17875
Multiplier	22.4			

Appendix 7 Discounted Cash Flow Analysis (Rs in Million)

We appreciate the opportunity to perform this evaluation and are available should you need further assistance in this matter.

A handwritten signature in blue ink that reads "Pawan Maini". The signature is written in a cursive style and is underlined with a single horizontal line.

.....
Dr Pawan Maini

Director

A handwritten signature in blue ink that reads "Prakash Gaur". The signature is written in a cursive style and is underlined with a single horizontal line.

.....
Prakash Gaur

Senior Infrastructure Planner

A large, light blue, abstract shape that resembles a stylized 'S' or a curved arrow, starting from the bottom left and curving towards the top right. It has a soft, gradient-like appearance.

Appendix B: Certificate of Qualification

Halcrow Consulting India Limited

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CERTIFICATE OF QUALIFICATION

I, Pawan Maini, Director, Halcrow Consulting India Limited, 38, Ring Road, Lajpat Nagar III, New Delhi – 110 024, INDIA, hereby certify:

1. I am an employee of Halcrow Consulting India Limited, which prepared Traffic Re-validation and Cash Flow Analysis Report of Delhi – Noida - Direct Flyway for Noida Toll Bridge Company Limited (NTBCL). The effective date of this evaluation is 20th February, 2006.
2. I do not have, nor do I expect to receive, any direct or indirect interest in the securities of NTBCL.
3. I am a Post Graduate and Doctorate in Transportation Engineering from University of Colorado, USA; I am Member of Indian Road Congress, India, Life Time Member Institute of Urban Transport, India, having more than 15 years of professional experience in the field of transportation engineering.
4. The report is based on specific assumptions including socio-economic forecast of region and land use data derived from secondary sources. These assumptions are specified in the report

A handwritten signature in blue ink that reads "Pawan Maini". A horizontal line is drawn underneath the signature.

Dr. Pawan Maini
New Delhi, India
20th February, 2006

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CERTIFICATE OF QUALIFICATION

I, Prakash Gaur, Senior Infrastructure Engineer, Halcrow Consulting India Limited, 38, Ring Road, Lajpat Nagar III, New Delhi – 110 024, INDIA, hereby certify:

1. I am an employee of Halcrow Consulting India Limited, which prepared Traffic Re-validation and Cash Flow Analysis Report of Delhi – Noida - Direct Flyway for Noida Toll Bridge Company Limited (NTBCL). The effective date of this evaluation is 20th February, 2006.
2. I do not have, nor do I expect to receive, any direct or indirect interest in the securities of NTBCL.
3. I have done Masters in Economics, Transportation Planning, Transport and Maritime Economics (Institute of Transport and Maritime Management Antwerp, University of Antwerp, Belgium) and Currently Pursuing Doctor of Philosophy (Ph. D.) in Capacity Planning of Port (ITMMA); I am Member of Indian Road Congress, India, Member of Institute of Rail Transport and Member of Chartered Institute of Transportation Economics, having more than 11 years of professional experience in the field of Transportation Economics.
4. The report is based on specific assumptions including socio-economic forecast of region and land use data derived from secondary sources. These assumptions are specified in the report.

A handwritten signature in blue ink, appearing to read 'Prakash Gaur', with a long horizontal stroke extending to the right.

Prakash Gaur
New Delhi, India
20th February, 2006