N2 WILD COAST PROJECT – ECONOMIC IMPACT OF THE IMPROVEMENTS TO THE SECTION BETWEEN THE PROSPECTON AND ADAMS ROAD INTERCHANGES

W J Pienaar and C J Bester

December 2002
EXECUTIVE SUMMARY

The purpose of this report is to determine:

- The economic justification of the improvements (by means of a cost/benefit analysis) to the N2 between the Prospecton and Adams Road Interchanges, which form part of the proposed Wild Coast Toll Road;
- The economic impact of tolling on the communities from Amanzimtoti to Scottburgh;
- The economic impact of the “do-nothing” scenario i.e. the economic cost of congestion to the area;
- The impact of tolling on the community, particularly the users of cars, minibus-taxis and buses, and the pensioners; and
- The socio-economic benefits of the resultant job creation for the communities of Umgababa, Umlazi and KwaMakuta.

The road sections that make up the existing alignments are four-lane freeways with full control of access. It is proposed that these sections be widened to six-lane freeways and that the pavement condition be improved. For the purpose of this report the characteristics that have an influence on the user costs are important. These are the following:

- Length;
- Horizontal alignment;
- Vertical alignment; and
- Pavement condition.

Of the original 31 road sections of the entire Wild Coast Toll Road, the sections relevant to this investigation are numbers 30 and 31. For the purpose of this report (and for more accurate traffic data) they were subdivided into four separate sections. They are the following:

- Section 51 – Prospecton Road to Joyner Road
- Section 52 – Joyner Road to Dickins Road
- Section 53 – Dickens Road to Moss Kolnick Drive
- Section 54 – Moss Kolnick Drive to Adams Road.
The analysis was done for a 30-year analysis period, an 8% discount rate, a two-year construction period, no residual value, and a 4% traffic growth rate.

From the analysis contained in the report the following conclusions are drawn:

- The project, given the various assumptions, is economically viable at a three per cent traffic growth rate.
- The total annual cost of tolling to users from the communities between Amanzimtoti and Scottburgh is estimated at R31,8 million, whereas the total benefits arising from the improvements will be R57,2 million per year.
- All road users will gain by making use of the proposed toll facility. Private car users (including pensioners) will gain a monetary saving of R1-40 per person per trip. The operators of minibus-taxis and buses will both experience net savings. In addition they will also have the opportunity to conduct additional revenue generating trips per day.

The proposed improvements to the road will decrease the annual cost of congestion from R187,48 million to R83,12 million.

In addition to road-user savings, substantial non-user benefits will be realised as a result of the road. The following groups of non-users stand to gain from the road:

- The general public
- Land owners and users
- Retailers
- Goods consignors and consignees.

The present (2002) value of the net regional developmental economic benefits that improvement of the freeway will yield is the total of the net regional income-multiplier effect of R252,2 million, and the present value of accelerated business income of R88,0 million. These add up to R340,2 million. (Approximately R226,9 m of the R252,2 m one-off net regional multiplier income will represent income accruing to the communities within Umgababa, Umlazi and KwaMakuta.)

The one-off net increase in regional income can be divided as follows:
Wages and salaries of the local population  

R100,9 m

Local industry  
R 75,7

Retailers  
R 50,4

Service providers (among others, financial service providers and estate agencies)  
R 25,2

- The present value of the accelerated recurring benefits of R88,0 million is equivalent to an additional annual income amount of R7,96 million. This additional annual amount earned by the local community can be divided as follows:

  Wages and salaries of the local population  
  R3,2m
  Local industry  
  R2,4m
  Retailers  
  R1,6m
  Service providers  
  R0,76m

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1. INTRODUCTION

The N2 Wild Coast Toll Road Project (1) is intended to improve the existing road link between East London (Gonubie Interchange) and Durban (Isipingo Interchange) – a current distance of approximately 631 km. It will connect major centres in the Eastern Cape and KwaZulu-Natal such as East London, Umtata, Port St Johns, Lusikisiki, Port Edward, Port Shepstone and Durban. A new route through the Wild Coast (between Port St Johns and Port Edward) will shorten the total length of the road by approximately 81 km and will attract traffic from the existing N2 through Mount Frere, Kokstad and Harding.

The purpose of this report is to determine:

- The economic justification of the improvements (by means of a cost/benefit analysis) to the N2 between the Prospecton and Adams Road Interchanges;
- The economic impact of tolling on the communities from Amanzimtoti to Scottburgh;
- The economic impact of the “do-nothing” scenario i.e. the economic cost of congestion to the area;
- The impact of tolling on the community, particularly the users of cars, minibus-taxis and buses, and the pensioners; and
- The socio-economic benefits of the resultant job creation for the communities of Umgababa, Umlazi and KwaMakuta.

The economic evaluation will be done without the effect of tolling – it is to determine whether the project itself is economically viable. The vehicle operating costs (VOC), time costs and accident costs of the users are considered. For the economic analysis the resource costs, or shadow prices, are used.

This report describes the calculation of the economic costs and benefits that are used in the analyses. Where no information was available, assumptions were made. These are fully motivated in the report.

2. DESCRIPTION OF ROAD SECTIONS

The road sections that make up the existing alignments are four-lane freeways with full control of access. It is proposed that these sections be widened to six-lane freeways and that
the pavement condition be improved. For the purpose of this report the characteristics that have an influence on the user costs are important. These are the following:

- Length;
- Horizontal alignment;
- Vertical alignment; and
- Pavement condition.

Of the original 31 road sections of the entire Wild Coast Toll Road, the sections relevant to this investigation are numbers 30 and 31. For the purpose of this report (and for more accurate traffic data) they were subdivided into four separate sections. They are the following:

- Section 51 – Prospecton Road to Joyner Road
- Section 52 – Joyner Road to Dickins Road
- Section 53 – Dickens Road to Moss Kolnick Drive
- Section 54 – Moss Kolnick Drive to Adams Road.

The road section lengths are according to the section definitions as supplied by the scheme developers and the National Roads Agency Ltd (SANRAL).

SANRAL and the scheme developers provided the existing and proposed alignments in terms of the gradients and the vertical and horizontal curves. These were reduced to indices of hilliness (m/km) and bendiness (°/km) that could be used to determine vehicle operating costs, speeds and accident rates.

The pavement condition of the existing sections was provided in terms of the HRI measurements over every 200 m section of road. The averages of these were calculated for each defined section and were recalculated as PSI values by means of the following equation:

$$\text{PSI} = \frac{(3.112-(3.112^2-4*0.324*(8.47-HRI)^{0.5}))/2*0.324}{2*0.324}$$

The characteristics of the different section are shown in Table 1.
### Table 1: Characteristics of sections

<table>
<thead>
<tr>
<th>Section</th>
<th>Length</th>
<th>Hilliness</th>
<th>Bendiness</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>2.6</td>
<td>34.0</td>
<td>20.0</td>
<td>3.45</td>
</tr>
<tr>
<td>52</td>
<td>2.3</td>
<td>34.4</td>
<td>23.2</td>
<td>3.45</td>
</tr>
<tr>
<td>53</td>
<td>3.0</td>
<td>32.4</td>
<td>22.5</td>
<td>3.7</td>
</tr>
<tr>
<td>54</td>
<td>2.6</td>
<td>32.8</td>
<td>23.7</td>
<td>3.7</td>
</tr>
</tbody>
</table>

#### 3. PROJECT ALTERNATIVES

Two alternative projects are considered in the analysis. It is the “Do-nothing” or null alternative, which comprises the existing situation and the proposed widening of the freeway to a six-lane facility.

#### 4. TRAFFIC ANALYSES AND FORECAST

##### 4.1. Daily Traffic

The average daily traffic (ADT) volumes are given in Table 2.

### Table 2: Average daily traffic

<table>
<thead>
<tr>
<th>Section</th>
<th>ADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>46 982</td>
</tr>
<tr>
<td>52</td>
<td>41 725</td>
</tr>
<tr>
<td>53</td>
<td>36 469</td>
</tr>
<tr>
<td>54</td>
<td>31 212</td>
</tr>
</tbody>
</table>

For the economic evaluation it was assumed that these volumes will be applicable to the existing as well as the improved scenarios.

##### 4.2. Traffic growth

In a study by the CSIR (3) it was estimated that the light traffic on the proposed route will grow at an annual rate of between four and five per cent and that the heavy vehicle traffic will grow at a rate of between 2,5 and 3,5 per cent. An overall growth rate of 4,0 per cent will be used in the analysis. In a sensitivity analysis, growth rates of two and three per cent will also be tested.
5. CHARACTERISTICS OF VEHICLES AND THEIR OCCUPANTS

5.1. Vehicle distribution by type

Three sources of information were used in determining the vehicle composition:

- The Comprehensive Traffic Observations (CTO) Yearbook (4);
- Roadside surveys and interviews (5) by the scheme developers; and
- Surveys during a visit to the proposed project.

The first two sources give the vehicle composition in terms of light and three classes of heavy vehicles only. During the latter surveys distinction was made between cars, light delivery vehicles, combi-taxis, buses and the three classes of heavy vehicles. The former classification agrees with the different toll classes whereas the latter classification gives a more accurate representation of vehicle occupancy and therefore the value of time. Two different vehicle compositions were therefore adopted, the first for vehicle operating costs and the time cost of the tolled scenario and the second for the time costs of the untolled scenario. The two are compatible in that cars, LDV’s and taxis are light vehicles and buses are considered as short (2 or 3-axle) trucks.

The secondary stations in the CTO network usually have a minimum of 14 days of observation. Weekend traffic is therefore included in their traffic composition. More weight was thus given to the results of this source.

In the main report it was determined that the vehicle composition for this section of road is 95:3:1:1 for the four toll classes and 93,0:2,0:0,3:4,7 for Cars:Taxis:Buses:Trucks.

5.2. Vehicle occupancy

During the roadside interviews by the scheme developers vehicle occupancies were determined for light and heavy vehicles. They were between 2,5 and 4,1 for light and between 1,9 and 3,0 for heavy vehicles. For the economic evaluation it was decided to use the values recommended by CBRoads (6) for this specific area. The main advantage is that more vehicle classes are given and at the same time the differences are not significant. The values are given in Table 3.
Table 3: Vehicle occupancies (people/vehicle)

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars &amp; LDV's</td>
<td>2.2</td>
</tr>
<tr>
<td>Taxis</td>
<td>7.2</td>
</tr>
<tr>
<td>Buses</td>
<td>46.9</td>
</tr>
<tr>
<td>Trucks</td>
<td>3.1</td>
</tr>
</tbody>
</table>

5.3. Trip purpose

The trip purpose distribution as recommended by CBRoads (6) was used. This is given in Table 4.

Table 4: Trip purpose by vehicle type (%)

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Work</th>
<th>Non-work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars &amp; LDV's</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>Taxis</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Buses</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Trucks</td>
<td>80</td>
<td>20</td>
</tr>
</tbody>
</table>

5.4. Income distribution

For the purposes of this study, no differentiation was made in respect of income distribution and the average time cost values were used in the analysis.

6. FACILITY CONSTRUCTION COSTS

The construction cost in 2002 Rand as provided by the scheme developer is R140 million. This value excludes the construction of the Adams Road Interchange because no user benefits related to that improvement were considered. The value includes contingencies, design and planning, but not VAT. In the economic analysis, the toll facilities and VAT was excluded and the R140 million was multiplied by a factor of 0.89 to bring the financial costs to economic costs. This is in line with the recommendation of the “Guidelines for the economic evaluation of urban transportation projects” (7).

The construction cost schedule assumed a two-year construction period in which the expenditure is divided equally between the two years.

A total concession and analysis period of 30 years was used. This long period led to the decision not to include a residual value in the economic analysis.
7. FACILITY MAINTENANCE AND OPERATING COSTS

The maintenance costs to be used in the economic evaluation was taken from recent contracts (8) and are as follows:

- Routine maintenance  R30 000 per km per year
- Reseal              R280 000 per km once every seven years

The latter figure was spread over seven years using a discount rate of 8%. From these values the following maintenance costs were used for the different types of road:

Four-lane R102 000/km pa
Six-lane  R140 000/km pa

It was assumed that the maintenance costs are constant in real terms and not a function of the traffic. It was, however, increased when the minimum PSI value was reached.

8. PAVEMENT CONDITION

The pavement deterioration model (6) used in the analysis is based on the model given in the CBRoads Manual:

$$\text{PSI}(t) = \text{PSI}(e) - [\text{PSI}(e) - \text{PSI}(s)] \times \left[ \frac{(1 + r)^t - 1}{(1 + r)^p - 1} \right]^n$$

Where:

- \(\text{PSI}(t)\) = PSI after \(t\) years from the present
- \(\text{PSI}(e)\) = existing PSI
- \(\text{PSI}(s)\) = PSI severe (2.5 for multi-lane and 2.0 for two-lane roads)
- \(t\) = time in years after the present year
- \(r\) = traffic growth rate
- \(p\) = remaining pavement life until severe condition is reached (years)
- \(n\) = pavement load equivalency exponent (4 for multi-lane and 2 for two-lane roads).

The value of \(p\) was read off the appropriate graphs in the CBRoads Manual. This model allows the pavement condition to reach the severe level after which it is kept at that value by increasing the maintenance costs by a factor of 3.0. The original model in the Manual allows
the pavement condition to deteriorate to the warning level only. The difference between the two models is less than two years and not significant over a 30 years analysis period.

9. **VEHICLE OPERATING COSTS**

9.1. **Base values**

From the HDM4 vehicle operating costs (2002 Rand) provided by SANRAL equations were developed to express the VOC as a function of the hilliness (rise plus fall, (m/km)) of the road. The equations are as follows:

- **Light vehicles**
  \[ VOC = 0.0168H^2 - 1.5856H + 1653.2 \]

- **Short trucks**
  \[ VOC = 0.2977H^2 + 4.6367H + 4574.4 \]

- **Medium trucks**
  \[ VOC = 0.2678H^2 + 24.592H + 5821.8 \]

- **Long trucks**
  \[ VOC = 1.0798H^2 + 16.597H + 11206.0 \]

Where:
- VOC = vehicle operating costs (R/1000km)
- H = Hilliness (m/km)

In an alternative evaluation where the hourly traffic volumes in stead of the ADT were used, the vehicle operating costs as provided by COSTDATA (9) as a function of the average running speed were used in the analysis. In this case the cost for the average vehicle was used as a function of the speed, that in turn was a function of the traffic volume. The relevant formula is as follows:

\[ VOC = 0.249V^2 - 3.97V + 2975.4 \]

Where:
- V = Vehicle speed (km/h)
9.2. Adjustment for traffic congestion

The VOC for urban roads is adjusted for traffic congestion by means of a factor, $f_c$, which is a function of the volume/capacity ratio, $v/c$. The factor is calculated as follows:

\[ \begin{align*}
    v/c = &< 0.4 \quad \text{then } f_c = 1.00 \\
    0.4 < v/c \leq 1.00 \quad \text{then } f_c = (v/c + 0.6)^{1.15} \\
    v/c > 1.00 \quad \text{then } f_c = 1.72
\end{align*} \]

The following values for the capacity of roads were used in the analyses:

- Dual four-lane: 41,367 veh/day
- Dual six-lane: 62,050 veh/day

9.3. Adjustment for the riding quality of the pavement

The vehicle operating costs are adjusted for pavement condition by means of the $f_r$ factor, which is determined as follows:

\[ \begin{align*}
    f_{rl} &= 0.0081 \times (QI) + 0.676 \text{ for light vehicles} \\
    f_{rh} &= 0.0036 \times (QI) + 0.856 \text{ for heavy vehicles} \\
    QI &= 92.63 - 56.39 \times \ln(PSI) \\
    f_r &= (1 - \%HV/100) \times f_{rl} + (\%HV/100) \times f_{rh} \text{ for two-lane roads} \\
    f_r &= 0.8 + 0.3 \times (1 - \%HV/100) \times f_{rl} + 0.9 \times (\%HV/100) \times f_{rh} \text{ for multi-lane roads} \\
    f_r &= \geq 0.95
\end{align*} \]

9.4. Adjustment for shadow pricing

All the above values are financial costs and to convert these values to economic costs a shadow price factor of 0.80 was used for all vehicle classes.
10. VEHICLE SPEEDS

10.1. Free-flow speeds

Light vehicle speeds were determined by means of travel time surveys. It was found that the speeds were a function of the bendiness of the specific road section. The formulation is as follows:

\[ V_L = 110.0 - 0.252 \times B \]

Where:

- \( V_L \) = speed of light vehicles (km/h)
- \( B \) = Bendiness of the road section (°/km)

The model fit is shown in Figure 1.

![Figure 1: Light vehicle speed vs bendiness](image)

Heavy vehicle speeds were taken as a function of the hilliness of a road section as used in the ECANET-program (10):
\[ V_S = 83,15 - 0,25*H - 0,0019*H^2 \]

\[ V_M = 82,9 - 0,618*H \]

\[ V_L = 84,0 - 0,5*H \]

Where:

The subscripts S, M and L refer to short, medium and long trucks

\[ V = \text{vehicle speed (km/h)} \]

\[ H = \text{Hilliness (m/km)} \]

**10.2. Vehicle speed during congestion**

In an alternative calculation of VOC during congestion, the normal weekday is divided into two periods, namely four hours of peak traffic and 14 hours of off-peak traffic. It is assumed that during the peak period 36% (four times 9%) of the ADT is found and during the off-peak period the remaining 64%. The speed of the average vehicle is determined by the traffic volume in a link performance function that is defined as follows:

\[ \text{Speed} = \frac{103,2}{1 + 0,5(V/n.m.c)^3} \]

Where:

\[ V = \text{traffic during the period} \]

\[ n = \text{number of lanes} \]

\[ m = \text{number of hours} \]

\[ c = \text{capacity of vehicles/lane/h = 1250 (in rolling terrain).} \]

**11. TIME COSTS**

The GDP per capita was used to determine the time costs for the economic evaluation.

From the per capita income of South African citizens (R27 491,60) the average cost per hour of all people and all hours is R3,14. The cost of a working hour can be determined by using the percentage of people employed and the number of working hours per year. This comes to a value of R38,09/h.
By using the vehicle occupancies, the work/non-work split and the vehicle composition the following economic values of time were determined:

Sections 51 - 54 \[ \text{R35,30/h} \]

These time costs are also multiplied by the congestion factor, \( fc \), to make provision for the lower speeds during congestion.

In the alternative calculation the lower speeds are first calculated and then the time costs are applied to the actual travel times related to these lower speeds.

12. ACCIDENT COSTS

Accident costs on a road section is dependent on the accident rate, the unit costs of different types of accident and the distribution of types of accident. As in the main report a rate of 0,60 accidents per million vehicle-km was used.

The unit costs of accidents as provided by SANRAL were updated from 1998 to 2002 by multiplying by 1,32 representing the inflation rate. The distribution of accidents from a study in KwaZulu Natal (12) was used to determine the average costs of accidents. This is shown in Table 5.

<table>
<thead>
<tr>
<th>Accident type</th>
<th>%</th>
<th>Cost (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>6,4</td>
<td>576 547</td>
</tr>
<tr>
<td>Serious</td>
<td>10,2</td>
<td>132 552</td>
</tr>
<tr>
<td>Slight</td>
<td>15,3</td>
<td>34 574</td>
</tr>
<tr>
<td>Damage only</td>
<td>68,1</td>
<td>22 694</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>71 164</td>
</tr>
</tbody>
</table>

13. TOTAL ROAD USER COSTS

The total road user costs consisting of the VOC, the time costs and the accident costs were calculated separately for each section for the “do-nothing” situation and the “do-something” situation – also referred to as the “before” and “after” conditions. In the economic analysis the road user costs were calculated for each of the thirty years of the analysis period. For the alternative calculation of the road user costs the values for the first and last year only of the analysis period were determined. The intermediate values were determined by means of interpolation using an exponential growth in costs. All the calculations were done in
spreadsheets and the detailed results are shown in Appendices A and B for the basic and alternative analyses respectively.

The following steps were used in the calculations for the basic analysis:

- From the characteristics of the road sections the speeds and VOC of the different vehicle types were determined;
- These were used together with the vehicle composition to calculate the average VOC and travel time.
- The different factors were determined from the road condition and the traffic volume.
- The accident rates were determined from the road characteristics.
- The section length, traffic volume and the above were then combined to determine the total VOC, time costs and accident costs.
- The road maintenance costs as a function of the road condition was added to the road user costs.

These calculations were done for each section for the before and after situation and for each year in the analysis period.

In the alternative analysis the speed of the average vehicle was determined from the traffic volume for the two periods of the day. These speeds were then used to calculate the VOC and time costs for these periods. The daily costs were then multiplied by 300 to reflect the number of working days per year as well as possible delays on Saturdays.

14. ECONOMIC ANALYSIS

The economic analysis was done for a 30-year analysis period, an 8% discount rate, a two-year construction period, no residual value, and a 4% traffic growth rate. The flow of costs and benefits and the results of the economic analysis are shown in Table 6.

The results from the alternative procedure are shown in Table 7.
Table 6: Economic analysis – SANRAL procedures (R million)

<table>
<thead>
<tr>
<th>Year</th>
<th>COSTS</th>
<th>SECTION 51</th>
<th>SECTION 52</th>
<th>SECTION 53</th>
<th>SECTION 54</th>
<th>TOTAL</th>
<th>B + C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-62.3</td>
<td>17.501</td>
<td>24.413</td>
<td>36.367</td>
<td>27.547</td>
<td>105.827</td>
<td>-62.300</td>
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<tr>
<td>4</td>
<td></td>
<td>17.596</td>
<td>25.447</td>
<td>34.575</td>
<td>30.022</td>
<td>107.639</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>12.776</td>
<td>22.642</td>
<td>32.595</td>
<td>32.841</td>
<td>100.854</td>
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<td>6</td>
<td></td>
<td>12.333</td>
<td>19.396</td>
<td>30.516</td>
<td>33.070</td>
<td>95.315</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>19.740</td>
<td>25.338</td>
<td>37.927</td>
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NPV 642.7
IRR 65.4%
B/C 7.91

The Net Present Values of the two procedures are of a similar order. However, the IRR and the B/C Ratio are much higher for the SANRAL procedure.

It is clear from the results that the project is economically viable at a minimum traffic growth rate of 3% pa.
Table 7: Economic analysis – Alternative procedures (Rmillion)

<table>
<thead>
<tr>
<th>Year</th>
<th>COSTS</th>
<th>MAINT</th>
<th>BENEFITS</th>
<th>TOTAL</th>
<th>2% GROWTH</th>
<th>3% GROWTH</th>
<th>4% GROWTH</th>
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<td>5.153</td>
<td>11.823</td>
<td>11.455</td>
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<td>33.563</td>
<td>121.520</td>
<td>121.153</td>
<td>347.630</td>
<td>347.263</td>
</tr>
</tbody>
</table>

| NPV  | -34.300| 153.519| 541.584 |
| IRR  | 5.8%   | 13.9%  | 21.4%   |
| B/C  | 0.81   | 2.78   | 6.85    |

15. THE ECONOMIC IMPACT OF TOLLING

15.1. All road users

By considering the daily traffic volumes between Amanzimtoti and Scottburgh, it can be calculated these communities will contribute 20 237 vehicles per day to the freeway. The following toll tariffs are currently proposed:
• Class 1: R4-00
• Class 2: R8-00
• Class 3: R12-00
• Class 4: R15-00

When taking into account the vehicle classification, an average value of R4-31 can be determined. Therefore, the total annual cost of tolling to users from these communities will be R4-31 x 20 237 x 365 = R31,8 million.

According to the first year benefit as calculated by means of the SANRAL procedures each vehicle will save R7-50 (= R7-60 VOC–R0-10 additional road maintenance cost) as a result of the improvements. This means that the total benefit to these communities is R57,2 million per year.

15.2. Private vehicle users and pensioners

Of the R7-60 saving per vehicle the VOC saving portion amounts to R6-10 in economic terms. As a financial amount the latter value is equivalent to R7-63 for all vehicle classes, and for cars it is R7-08. Assuming that pensioners (1) mostly travel by car, and (2) that they perceive their benefit when using the upgraded freeway to be equal to their financial vehicle operating cost savings (R7-08) minus the toll free (R4-00), their actual monetary (i.e. out of pocket) cost saving per car trip will be equal to R3-08. This is based on an average car occupancy rate of 2,2 persons, which translates to a monetary saving of R1-40 per person (pensioner).

15.5. Minibus-taxis

From the procedures provided by SANRAL the cost and time benefits for minibus-taxis can be determined. On this section of 10,5 km the savings in user costs as a result of the widening of the freeway are as follows:

• The vehicle operating cost saving for an average light (Toll class 1) vehicle is R1,75. This value includes all passenger cars, taxis and light delivery vehicles. It can safely be assumed that the savings for taxis will be higher than this average value
The average travel speed of light vehicles will increase from 73,3 to 92,9 km/h. This means that over a three-hour peak period (1,5 AM and 1,5 PM) the number of trips on this section of road can be increased from 21 to 26.

When the value of travel time savings of 15 commuters and the driver is calculated from the higher speeds and the values of individual travel time costs, a total of R5,05 per trip is found.

The total user cost savings, excluding any safety benefits, will amount to R6,80 per trip.

Not only is the road user savings less than the proposed toll tariff (R4,00), but the possibility of extra trips during the peak hours when the majority of passengers are carried, provide extra benefits to the taxi operators.

**15.6. Buses**

From the procedures provided by SANRAL the cost and time benefits for buses can be determined. On this section of 10,5 km the savings in user costs as a result of the widening of the freeway are as follows:

- The vehicle operating cost saving for a bus (Toll class 2) is R5,49. This value includes all vehicles with two or three axles.
- The average travel speed of buses and short trucks will increase from 62,2 to 78,8 km/h. This means that over a three-hour peak period (1,5 AM and 1,5 PM) the number of trips on this section of road can be increased from 18 to 22.
- When the value of travel time savings of 46 commuters and the driver is calculated from the higher speeds and the values of individual travel time costs, a total of R15,60 per trip is found.
- The total user cost savings, excluding any safety benefits, will amount to R21,09 per trip.

Not only is the road user savings less than the proposed toll tariff (R8,00), but the possibility of extra trips during the peak hours when the majority of passengers are carried, provide extra benefits to the operators.

**16. THE COST OF CONGESTION**

According to the procedures proposed by SANRAL, a road will operate congestion free when the volume/capacity ratio is less than 0,40. Once the average daily traffic (ADT) volume
exceeds 40% of the capacity of the road, the road user costs (vehicle operating, time and accident costs) will increase by a factor $f_c$ over the free-flow cost according to the following formula:

$$0.4 < \frac{v}{c} \leq 1.00 \text{ then } f_c = (\frac{v}{c}+0.6)^{1.15}$$
$$\frac{v}{c} > 1.00 \text{ then } f_c = 1.72$$

By considering the costs calculated for the four sections of road for the current year of operation the cost of congestion can be determined from the following formula:

$$\text{Congestion costs} = \text{total costs} \times \frac{(f_c - 1)}{f_c}$$

The calculation of these costs for the “do nothing” alternative and the proposed improvements are shown in Tables 1 and 2.

**Table 1:** Cost of Congestion – “do nothing” (Rmillion)

<table>
<thead>
<tr>
<th>Section</th>
<th>$f_c$</th>
<th>TOTAL RUC</th>
<th>CONGESTION COST</th>
</tr>
</thead>
<tbody>
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<td>1.72</td>
<td>155.76</td>
<td>65.20</td>
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<tr>
<td>2</td>
<td>1.72</td>
<td>122.56</td>
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<td>84.71</td>
<td>25.05</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>187.48</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2:** Cost of Congestion – “do something” (Rmillion)

<table>
<thead>
<tr>
<th>Section</th>
<th>$f_c$</th>
<th>TOTAL RUC</th>
<th>CONGESTION COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.42</td>
<td>122.78</td>
<td>36.31</td>
</tr>
<tr>
<td>2</td>
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</tr>
<tr>
<td>3</td>
<td>1.22</td>
<td>96.60</td>
<td>17.42</td>
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<tr>
<td>4</td>
<td>1.12</td>
<td>66.34</td>
<td>7.11</td>
</tr>
<tr>
<td>TOTAL</td>
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<td></td>
<td>83.12</td>
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</table>

From these tables it can be seen that the proposed improvements to the road will decrease the annual cost of congestion from R187.48 million to R83.12 million.

17. **SOCIO-ECONOMIC IMPACT ON LOCAL COMMUNITIES**

17.1. **General economic benefits**

The communities that will benefit most from the proposed investment in the analysed road section are those living in the magisterial districts of Umlazi and Umzinto. The socio-economic benefits stemming from the improvements can be divided into (1) a one-off
regional income multiplier effect triggered by the investment amount which flows into the region, and (2) recurring benefits resulting from the greater accessibility and mobility that the improvements/extensions will offer.

In addition to road-user savings, substantial non-user benefits will be realised as a result of the road. The following groups of non-users stand to gain from the road:

- The general public
- Land owners and users
- Retailers
- Goods consignors and consignees.

17.2. Economic benefits during the construction phase

The one-off regional income-multiplier for the entire Wild Coast Toll Road has previously (13) been estimated to be 3,19. However, the income-multiplier achievable within a magisterial district is always smaller than that of the greater province or country within which it lies. Regions within South Africa are highly interdependent. Therefore, the smaller the region, the higher the leakages out of the circular flow of local income. Due to the fact that approximately 90% of all labour will be recruited within the Umgababa, Umlazi and KwaMakuta areas, and that the required bitumen will be sourced locally, the local income multiplier (in comparison with that of the entire project) reduces by a value of 0,17 only. The one-off regional multiplier for the proposed road investment between Prospecton and Adams Road Interchange is estimated to equal 3,02.

During the two-year investment period the expenditure will take place as follows:

Year 1 – R70 million
Year 2 – R70 million

By using a real discount rate of 8% p.a. the present (2002) value of this investment amount equals R124,829 million.

The present value of the investment amount of R124,829 million will consequently increase to an eventual one-off regional gross income of R376,982 million. After deduction of the original investment amount, the present value of the net increase in one-off regional income is expected
to equal R252,2 million. Approximately R226,9 million of the latter amount will represent income accruing to the communities within Umgababa, Umlazi and KwaMakuta. (This represents the net income over and above the project wages earned by them during construction.)

The population within the service area of the road has a low savings propensity. Their income will be subject to a low tax rate. Their disposable income will, therefore, be spent relatively quickly within an expanding retail sector. The suppliers of timber, sand, stone and basic resources will similarly gain during the construction phase.

Based on the multiplier analysis contained in the main report (13) the one-off net increase in regional income can be divided as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages and salaries of the local population</td>
<td>R100,9m</td>
</tr>
<tr>
<td>Local industry</td>
<td>R 75,7</td>
</tr>
<tr>
<td>Retailers</td>
<td>R 50,4</td>
</tr>
<tr>
<td>Service providers (among others, financial service providers and estate agencies)</td>
<td>R 25,2</td>
</tr>
</tbody>
</table>

17.3. Recurring economic benefits during road operation

From this report it is evident that the upgraded freeway will increase accessibility and mobility between the magisterial districts of Durban, Umlazi and Umzinto, mainly through the alleviation of congestion and better riding quality. In view of the fact that the economy of these three magisterial districts are closely linked, it is assumed that the projected ratio of 34,9 percent between recurring benefits and one-off benefits for the entire N2 Wild Coast Road Project, will also apply to this section of the road. Increased accessibility and better mobility are therefore expected to result to an additional recurring income of R88,0 million (= R252,2 x 0,349) during the service period of the road.

The present value of the accelerated recurring benefits of R88,0 million is equivalent to an additional annual income amount of R7,96 million. Based on the findings of the main report (13), this additional annual amount earned by the local community can be divided as follows:
Wages and salaries of the local population R3,2m
Local industry R2,4m
Retailers R1,6m
Service providers R0,76m

17.4. **Total general regional economic benefits**

The present (2002) value of the net regional developmental economic benefits that improvement of the freeway will yield is the total of the net regional income-multiplier effect of R252,2 million, and the present value of accelerated business income of R88,0 million. These add up to R340,2 million. It should be noted that this amount of R340,2 is additional to the net benefits enjoyed by the users of the improved road section.

18. **CONCLUSIONS**

- The project, given the various assumptions, is economically viable at a three per cent traffic growth rate.
- The total annual cost of tolling to users from the communities between Amanzimtoti and Scottburgh is estimated at R31,8 million, whereas the total benefits arising from the improvements will be R57,2 million per year.
- All road users will gain by making use of the proposed toll facility. Private car users (including pensioners) will gain a monetary saving of R1-40 per person per trip. The operators of minibus-taxis and buses will both experience net savings. In addition they will also have the opportunity to conduct additional revenue generating trips per day.
- The proposed improvements to the road will decrease the annual cost of congestion from R187,48 million to R83,12 million.

In addition to road-user savings, substantial non-user benefits will be realised as a result of the road. The following groups of non-users stand to gain from the road:

- The general public
- Land owners and users
- Retailers
- Goods consignors and consignees.
The present (2002) value of the net regional developmental economic benefits that improvement of the freeway will yield is the total of the net regional income-multiplier effect of R252,2 million, and the present value of accelerated business income of R88,0 million. These add up to R340,2 million. (Approximately R226,9 million of the R252,2 million one-off net regional multiplier income will represent income accruing to the communities within Umgababa, Umlazi and KwaMakuta.)

The one-off net increase in regional income can be divided as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages and salaries of the local population</td>
<td>R100,9m</td>
</tr>
<tr>
<td>Local industry</td>
<td>R  75,7</td>
</tr>
<tr>
<td>Retailers</td>
<td>R  50,4</td>
</tr>
<tr>
<td>Service providers (among others, financial service providers and estate agencies)</td>
<td>R 25,2</td>
</tr>
</tbody>
</table>

The present value of the accelerated recurring benefits of R88,0 million is equivalent to an additional annual income amount of R7,96 million. This additional annual amount earned by the local community can be divided as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages and salaries of the local population</td>
<td>R3,2m</td>
</tr>
<tr>
<td>Local industry</td>
<td>R2,4m</td>
</tr>
<tr>
<td>Retailers</td>
<td>R1,6m</td>
</tr>
<tr>
<td>Service providers</td>
<td>R0,76m</td>
</tr>
</tbody>
</table>

19. RECOMMENDATIONS

It is recommended that the project be implemented.

20. REFERENCES