



Road Pavement Forum

Condition Assessment of the Gauteng Provincial Road Network and Results of the 2008 Life Cycle Cost Analysis

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11 November 2008



Presentation Overview

- **Network characteristics and traffic**
- **Current and historic network condition**
- **Life cycle cost and needs analysis**
- **Funding scenarios**
- **Summary**
- **Challenge to RPF members**



Characteristics and traffic on the paved road network



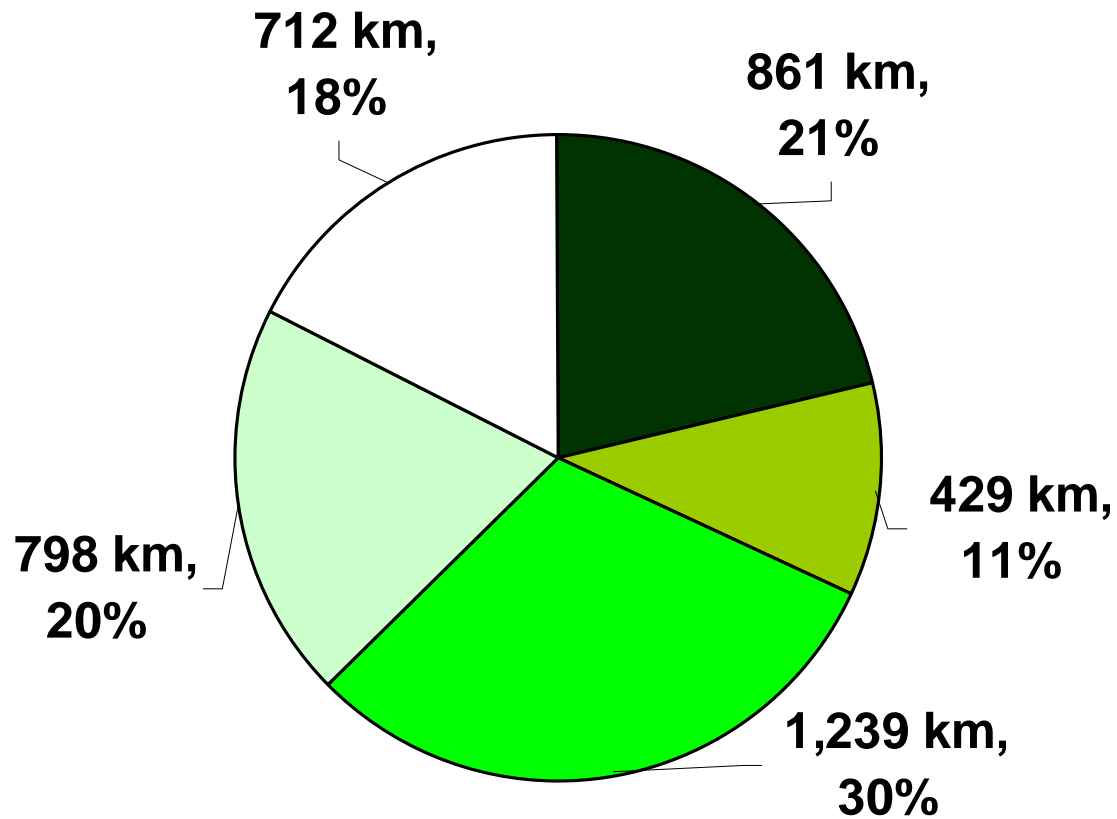
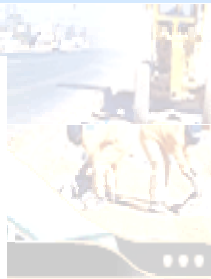
Paved Network

- **Total paved network = 4,038 km**

District	Class A	Class B	Class C	Class D	Class E	Total
Benoni	117	289	310	137	7	861
Bronkhorstspuit	25	203	102	97	2	429
Krugersdorp	192	422	340	282	3	1,239
Pretoria	143	200	241	208	6	798
Vereeniging	93	207	247	147	19	712
Total	569	1,322	1,239	871	37	4,038



Road length per District

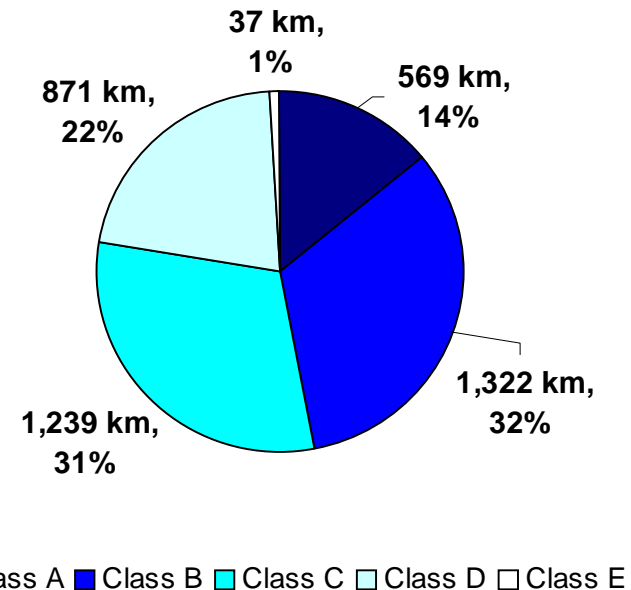


- Benoni
- Bronkhorstspuit
- Krugersdorp
- Pretoria
- Vereeniging



Road Class distribution

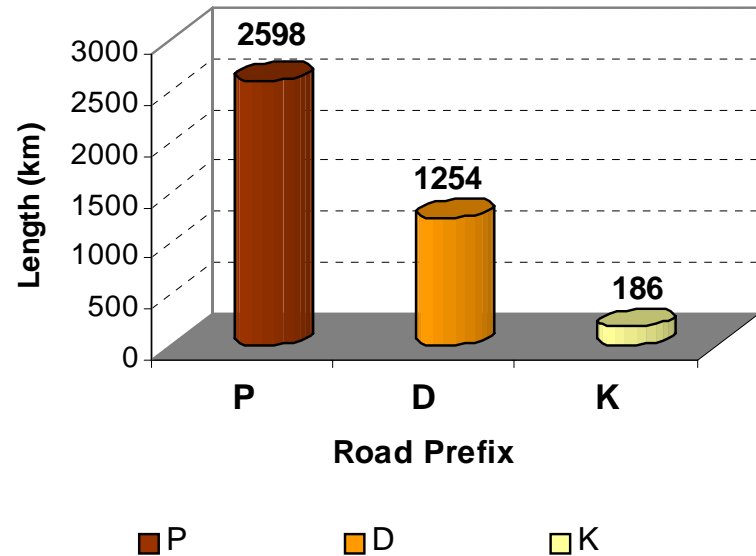
- **Class A: National primary roads (national mobility)**
- **Class B: Provincial primary roads (inter-city mobility)**
- **Class C: Provincial secondary roads (inter-district mobility)**
- **Class D: Provincial tertiary roads (also inter-district)**
- **Class E: Local access roads**





Length of P, D, K roads

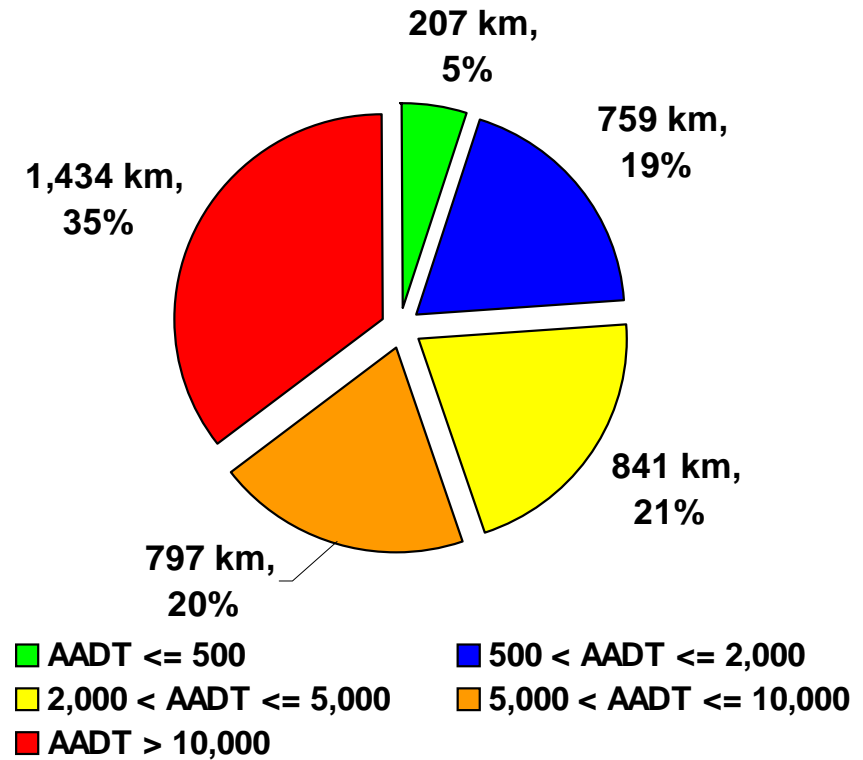
- **P = Provincial road**
- **D = District road**
- **K = Urban through road**





Traffic distribution

- Majority (55%) of roads carry traffic in excess of 5,000 vehicles per day
- 35% carry in excess of 10,000 vpd





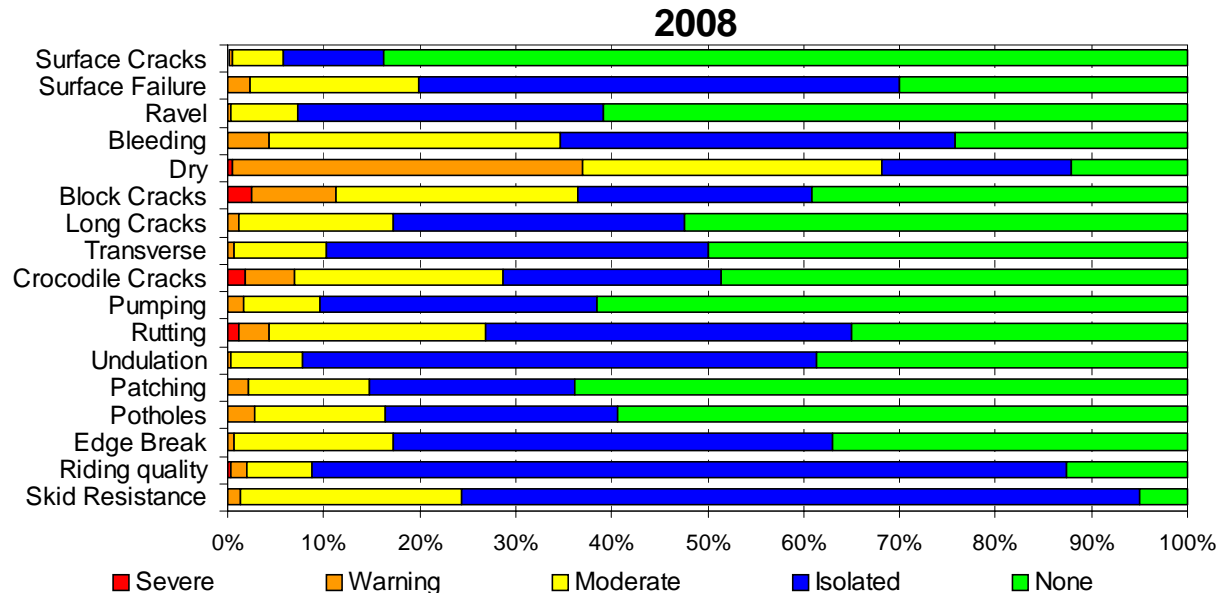
The current (2008) and historic network condition





TMH9 Distress Ratings (2008)

- Most of the distresses have between 10 and 30% in the moderate, warning and severe categories, with less than 10% in the warning and severe categories.
- Surfaces are dry, with some failures, skid resistance, ravelling and bleeding problems. Block, longitudinal and transverse cracking prevalent on half the network. Thus high need for resurfacing.
- Moderate and isolated crocodile cracking, pumping, rutting and riding quality problems point to need for rehabilitation of parts of the network.





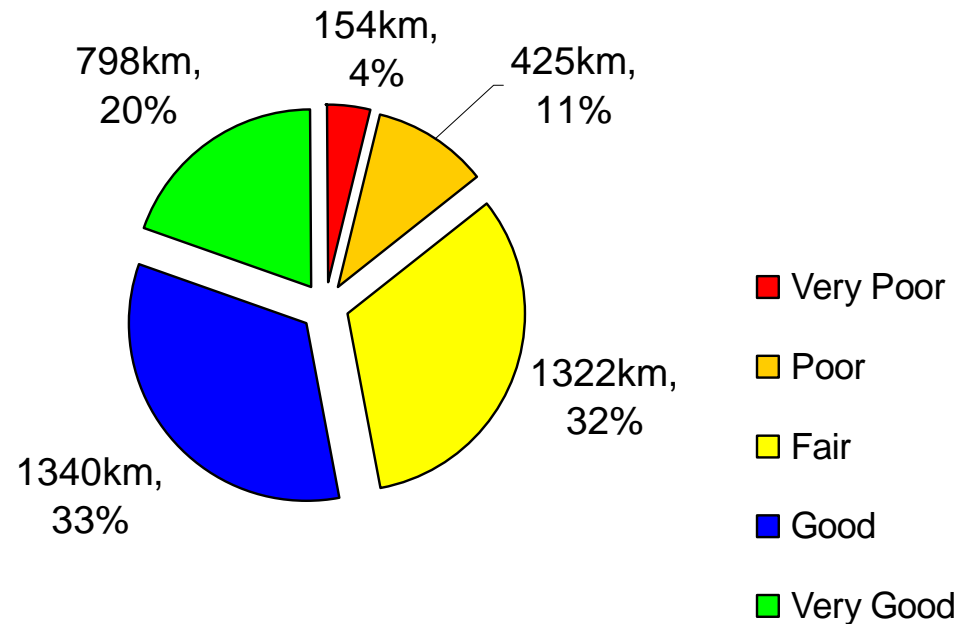
Visual Condition Index (VCI)

- Used for reporting the condition of a road segment or a full road network.
- VCI is calculated using the TMH9 visual assessment ratings:
 - **Very good: 85% to 100%**
 - **Good: 70% to 85%**
 - **Fair: 50% to 70%**
 - **Poor: 35% to 50%**
 - **Very poor: 0% to 35%**



Average network VCI

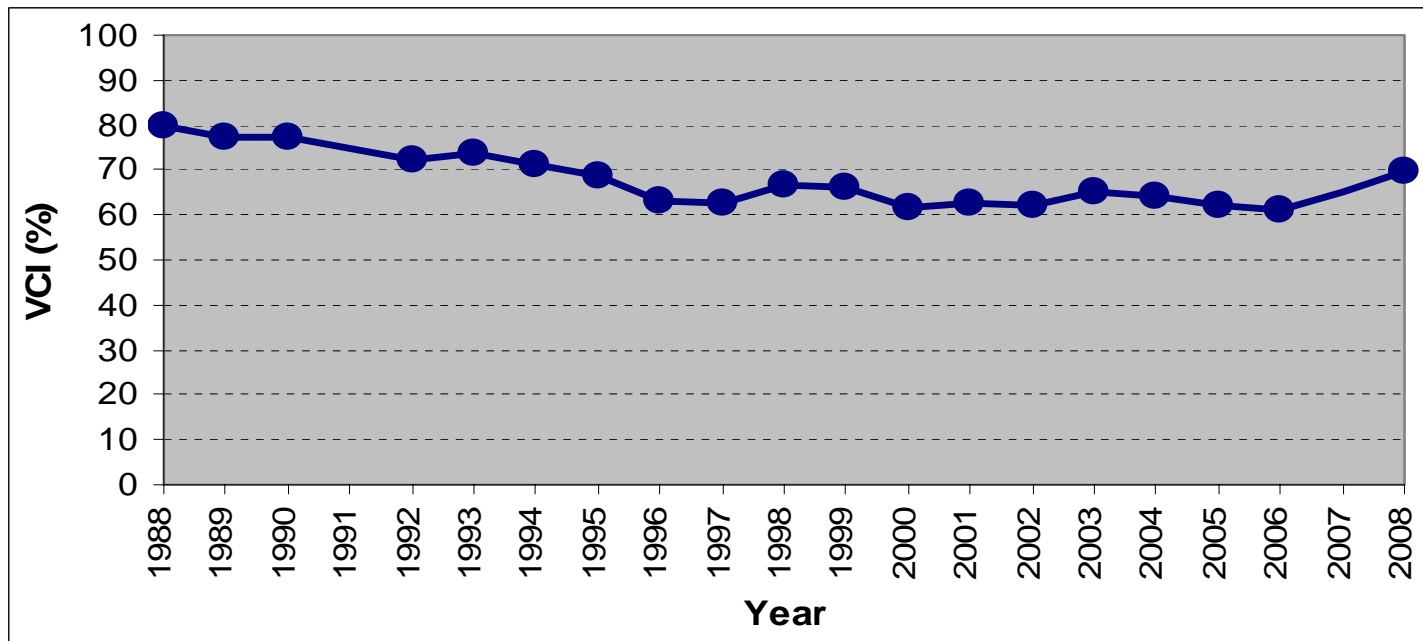
- **Average VCI for 2008 = 69%**
(ie at the border between fair and good).
- **15% is poor to very poor**
..thus requiring expensive rehabilitation.
- **A “healthy” network has a maximum of 10% poor to very poor roads.**
- **32% is fair...thus requiring preventive maintenance to prevent these roads from deteriorating into the poor category. This % is too high.**





Historic network VCI

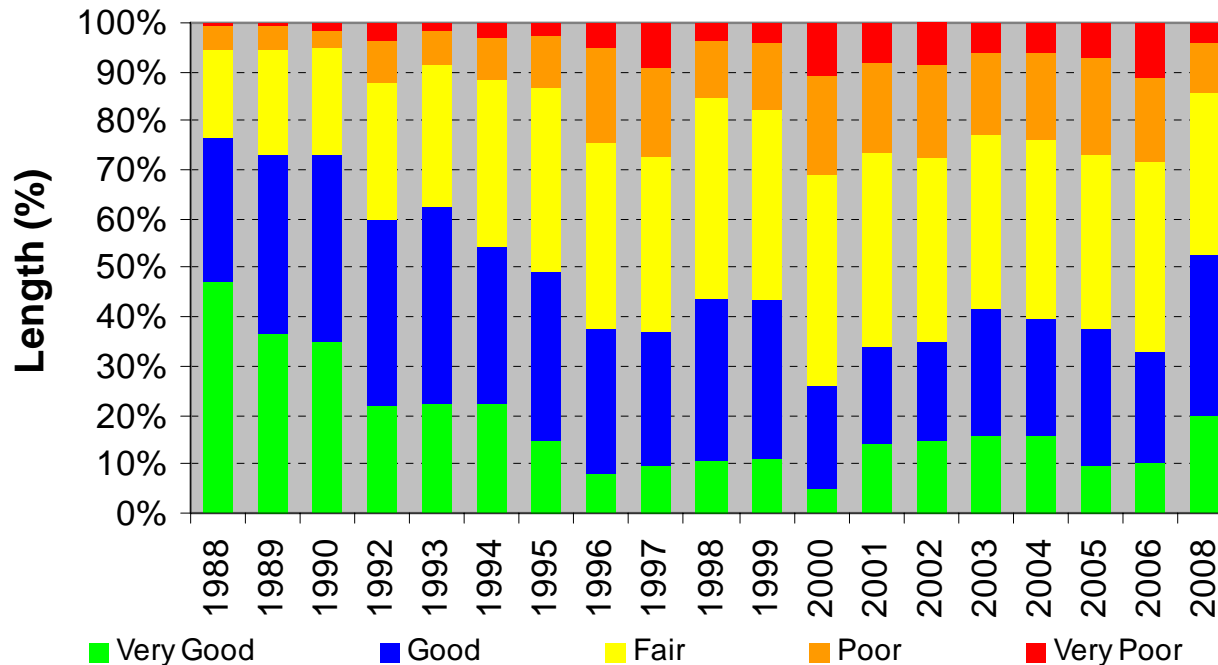
- **Deterioration: 84% in 1985 to 69% in 2008.**
- **For 2006 to 2008 a slight improvement in the average network condition was noted.**
- **Reason: Slight differences in the TMH9 assessment approach between the assessment teams appointed before and after 2007, as well as a number of roads in transitional VCI area.**



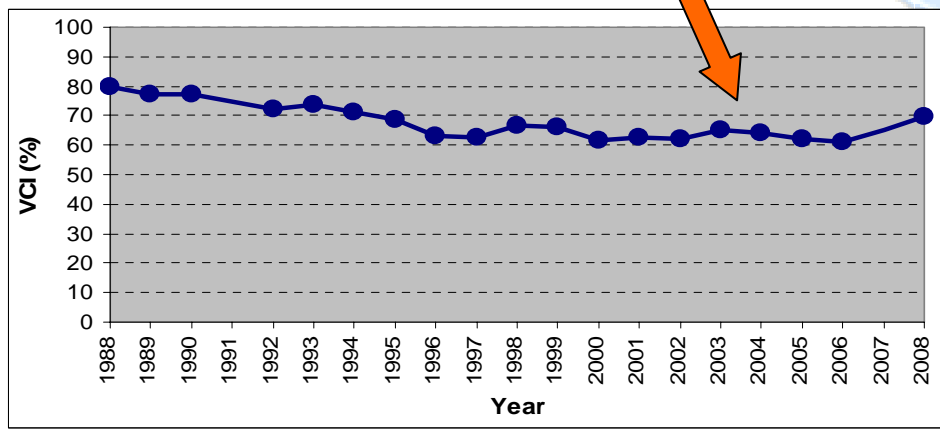


Historic VCI distribution

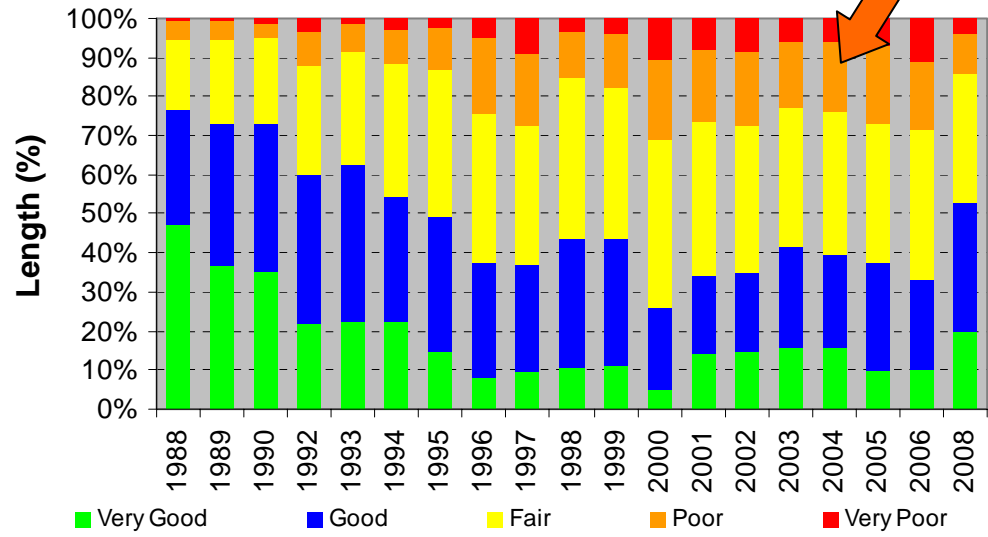
- According to the 2008 visual assessments, 15% of the total paved network is in a poor or very poor condition. This proportion is lower than for the period 2000 to 2006. Of some concern is still the large percentage of the network in fair condition that needs maintenance (reseals)



Importance of preventive measures (reseals)



- The 3 years 2001 to 2003:
 - 670 km (17%) of the network was resurfaced (substantial).
 - Note positive influence on network VCI.
- The 2 years 2004 to 2005
 - 206 km (5%) of the network was resurfaced (small length).
 - Note little influence on network VCI.





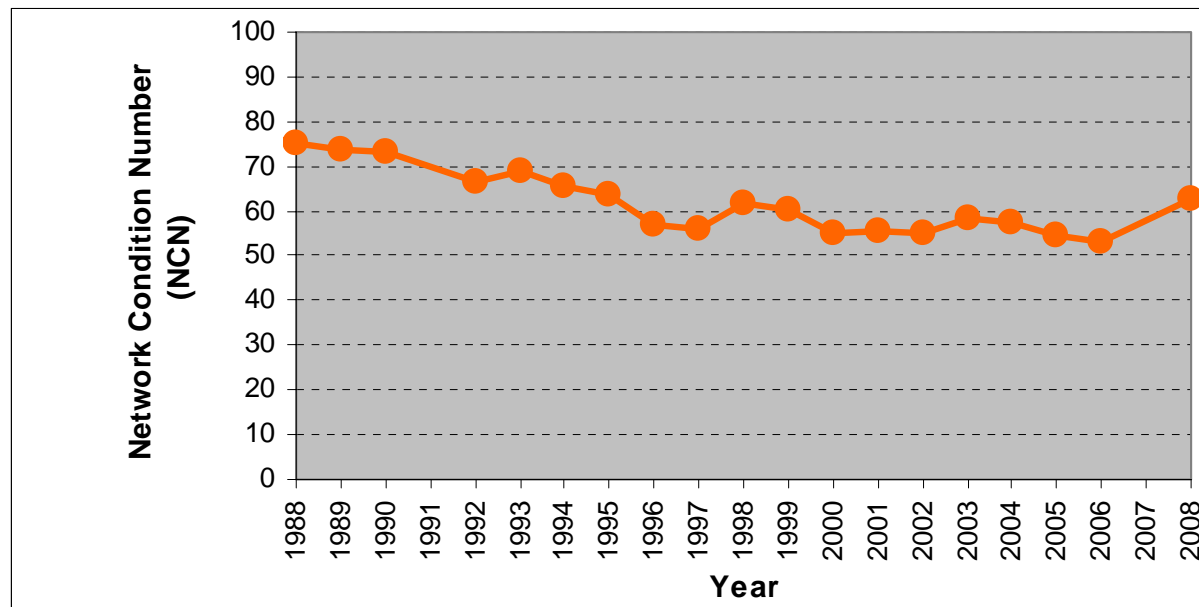
Network Condition Number (NCN)

- **Similar to the VCI, but weighted for condition, thus ensuring a high sensitivity for changes in the poor and very poor categories.**
- **Weights:**
 - 1.0 Very good
 - 1.2 Good
 - 1.8 Fair
 - 2.7 Poor
 - 4.0 Very poor



Historic NCN

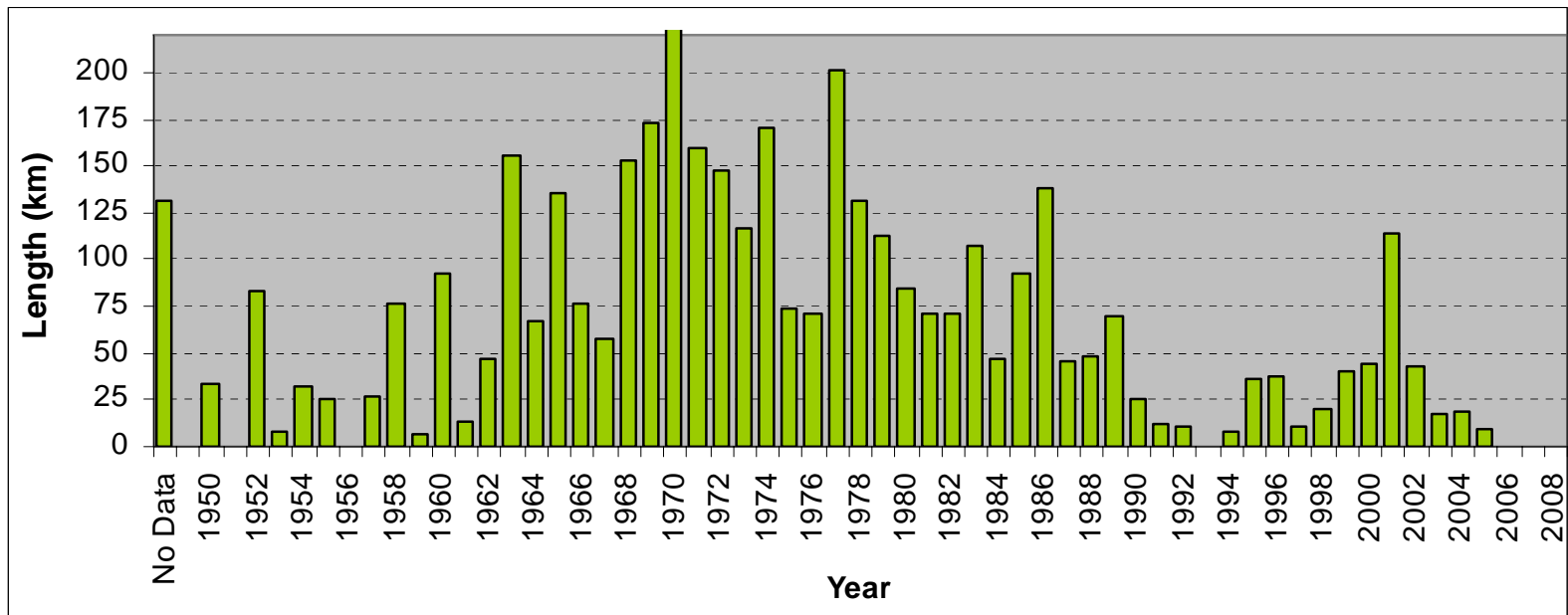
- Rate is more rapid than the VCI due to increase in fair, poor and very poor road categories.





Pavement Structure Ages

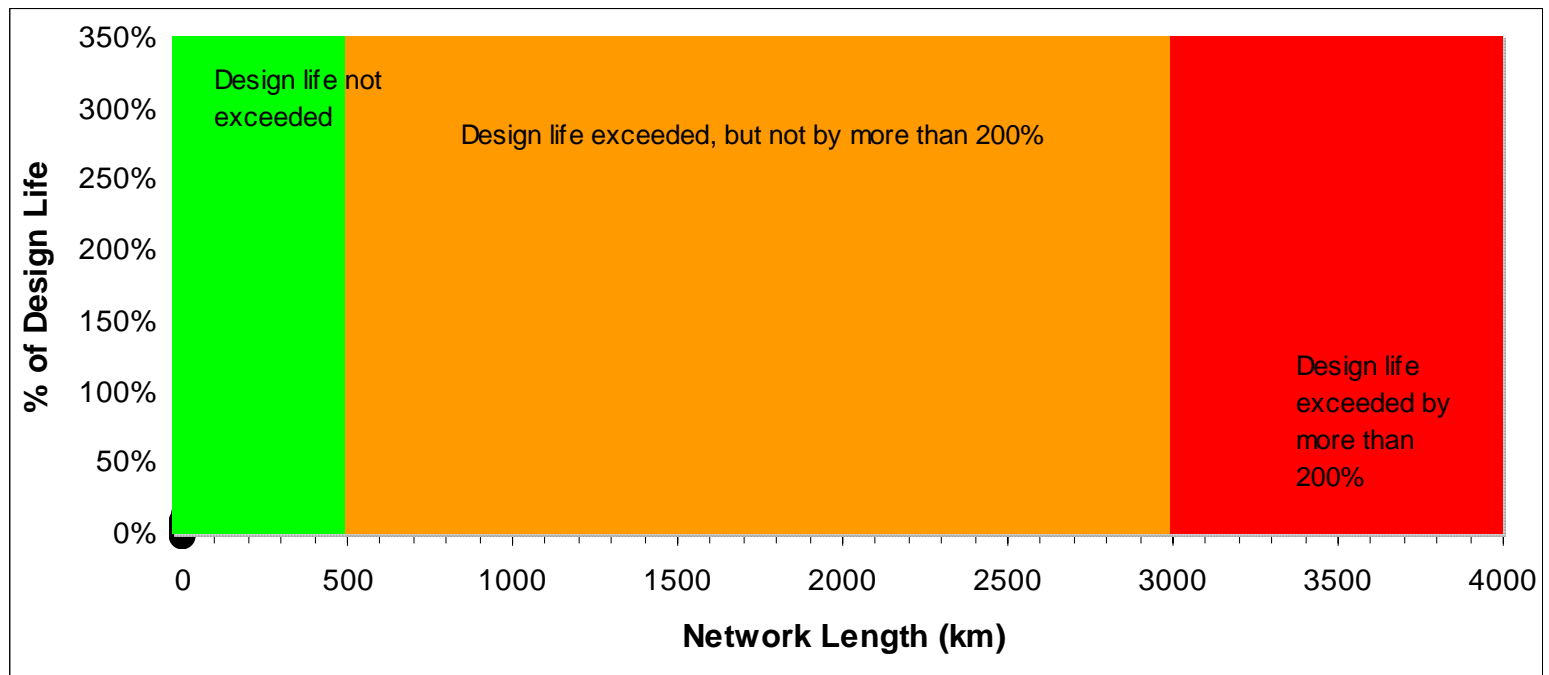
- Provides indication of future pavement replacement demand.
- Rehabilitation rate has decreased tremendously since 2000.
 - Historic: 18 km pa resulting in expected life span of over 200 years.
 - Required: 100 km pa to ensure a 40 year life span.
 - Or 200 km pa to ensure a 20 year life span.





Remaining Life

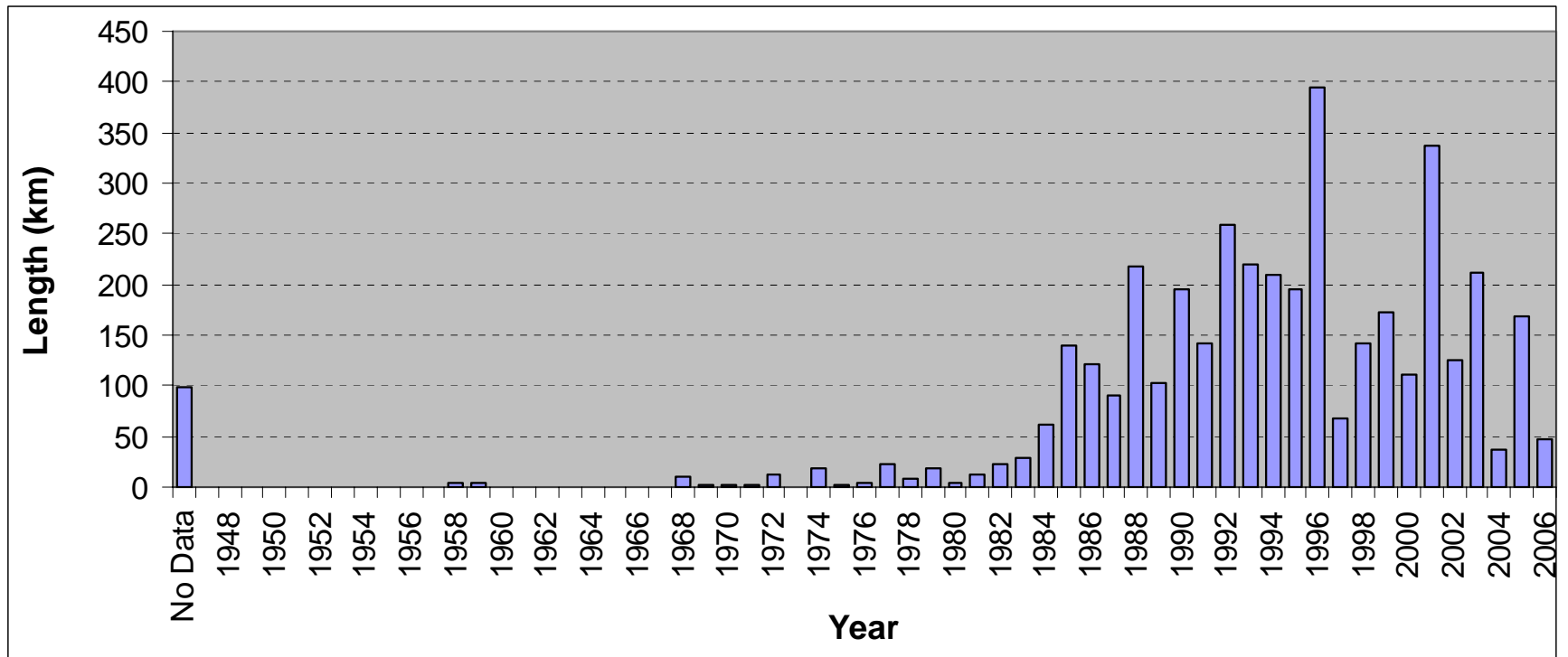
- 564 km have not reached the end of their design life.
- 2,404 km have already exceeded their design life (by not more than 200%).
- 938 km have exceeded their design life by more than 200%.





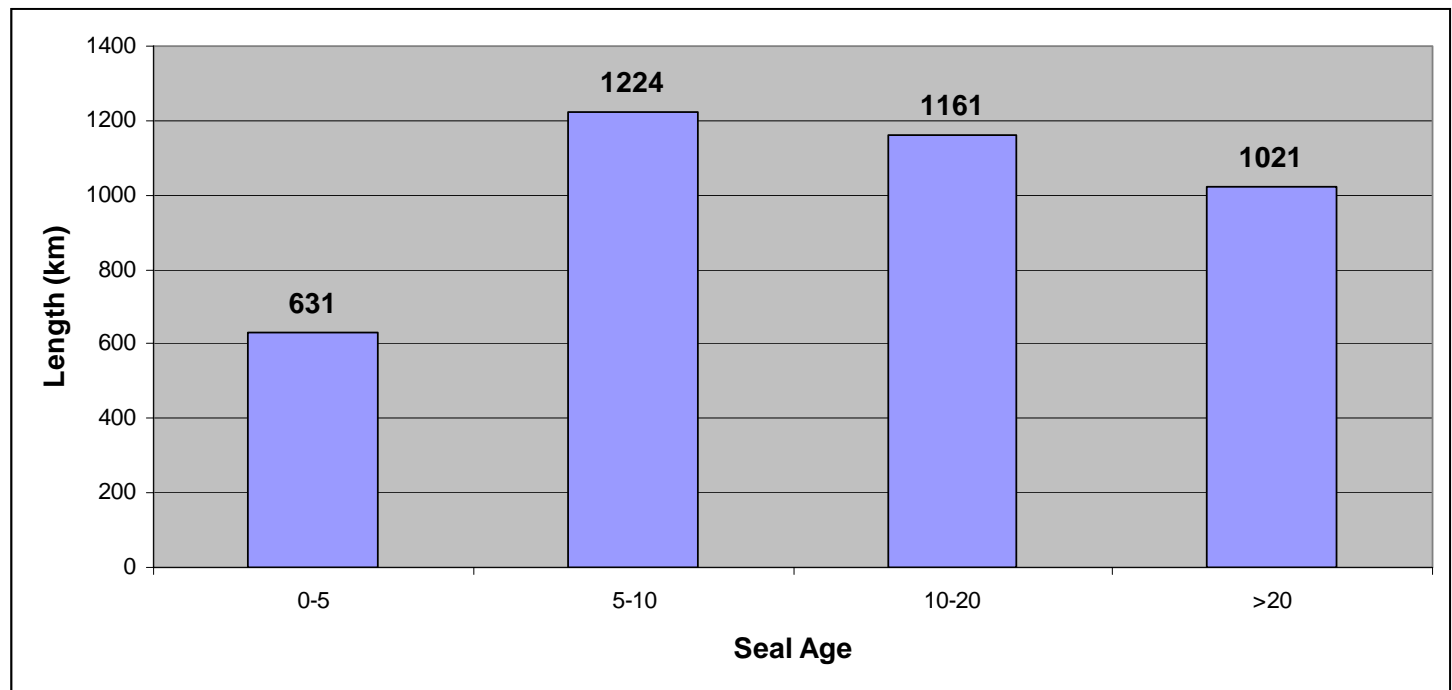
Pavement Surfacing Ages

- Increased resealing rate is now a priority



Pavement Surfacing Ages

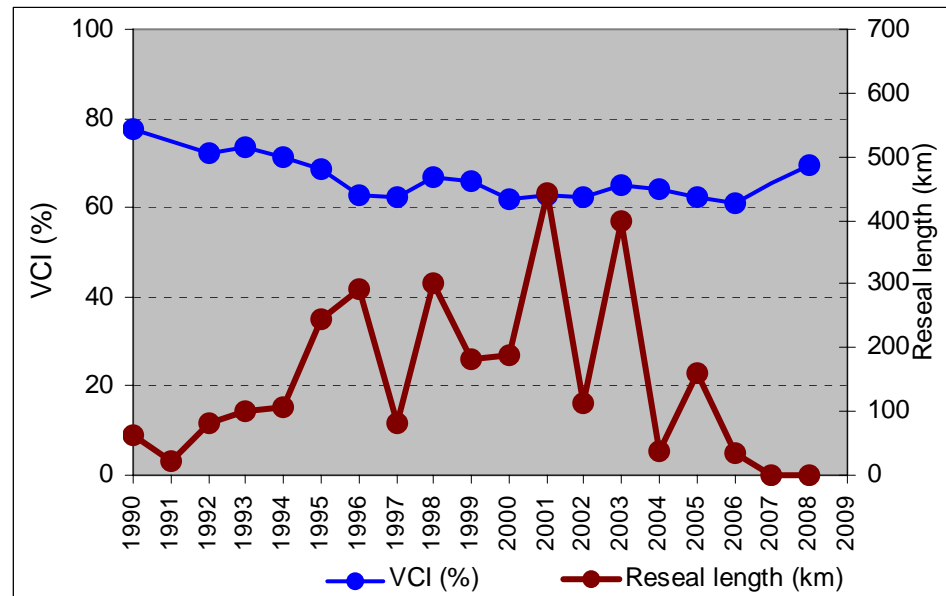
- Provides an indication of current reseal need.
- 54% of surfacings are more than 10 years old! This can be considered the resurfacing backlog, and is seriously problematic for the health of the network.
- 25% (1,021km) is older than 20 years, should have been resealed long time ago.
- 29% (1,161km) is between 10 and 20 years old, requires resealing now.





Reseal history versus Condition (VCI)

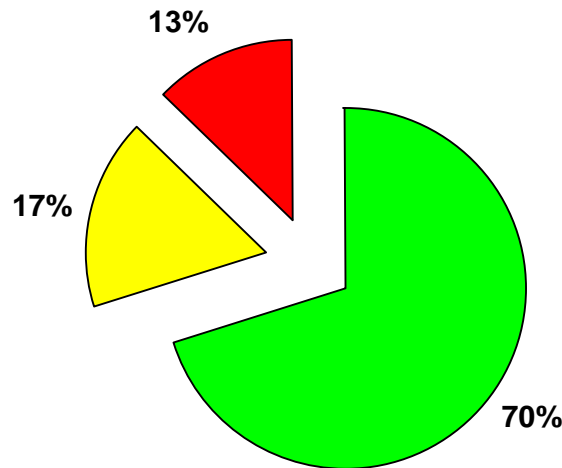
- Reseal, as a preventive maintenance action, can delay the deterioration of the network's condition.
- Influence of high reseal lengths in 1996 and 2001 is evident.





Roughness & Rut Depth - 2008

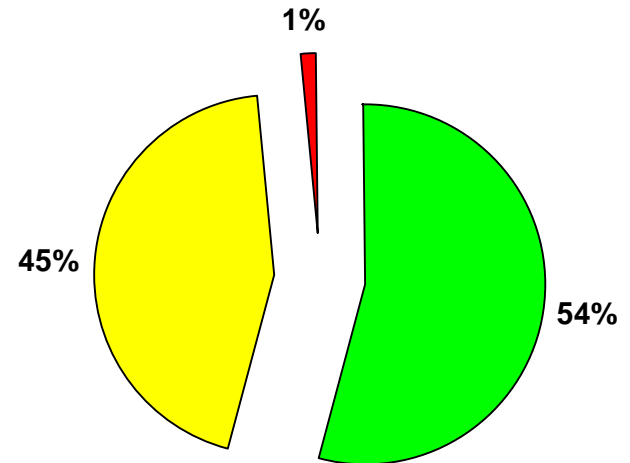
Roughness - 2008



■ Sound ■ Warning ■ Severe

Note 'severe' roughness on 13% of network, and 'severe' + 'warning' on 30%. It confirms need for rehabilitation.

Rut depth - 2008



■ Sound ■ Warning ■ Severe

Note 'warning' rut depth on 45% of network. It also confirms need for rehabilitation.



The life cycle cost (LCC) needs analysis



Treatments and costs

UNIT PRICES 2008 PAVED ROAD ANALYSIS, R/m²

Date of condition data	2004	2005		2006	2008*
		1 st run	2 nd run		
Diluted emulsion	R3.50	R3.50	R3.50	R11.20	R13.26
Pothole patching	R285.00	R230.00	R230.00	R300.00	R390.00
Reseal	R50.00	R108.00	R25.00	R77.00	R101.00
Heavy Rehab	R280.00	R260.00	R260.00	R405.00	R525.00
Light Rehab	R180.00	R120.00	R120.00	R195.00	R250.00

A 30% increase in unit prices was assumed from 2006 to 2008



Funding scenarios investigated

- Investigate the current funding scenario that was allocated for the maintenance and rehabilitation of paved roads in Gautrans.
- Determine the consequences if the grants provided by National Treasury are allocated for other purposes.
- Determine the consequences if the grants provided by National Treasury are allocated solely towards the maintenance and rehabilitation of the paved roads of Gautrans.
- Compare then the expected current funding scenario with increased funding scenarios,
 - to high-light the consequences of the current funding constraints,
 - to determine the funding for maintaining the paved road network at its current condition,
 - to determine the funding to improve the current condition of the network and
 - to determine the current backlog with regards to rehabilitation.



The current funding scenarios



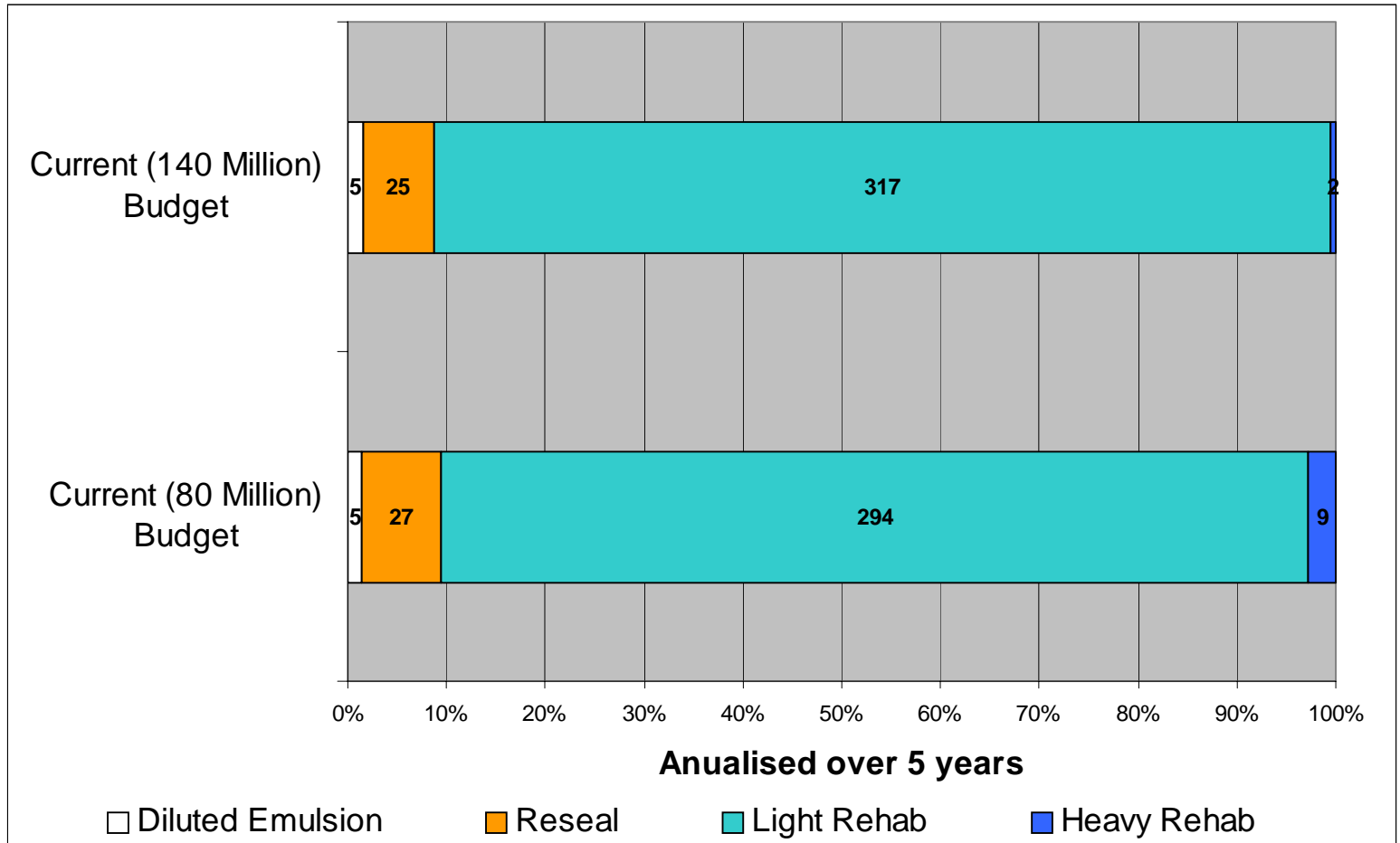
Current funding scenarios

Year	2008	2009	2010	2011	2012+
Current budget, with R80 million in the first year	R80 m	R354 m	R418 m	R421 m	R415 m
Current budget, with R140 million in the first year	R140 m	R354 m	R418 m	R421 m	R415 m



Fund distribution

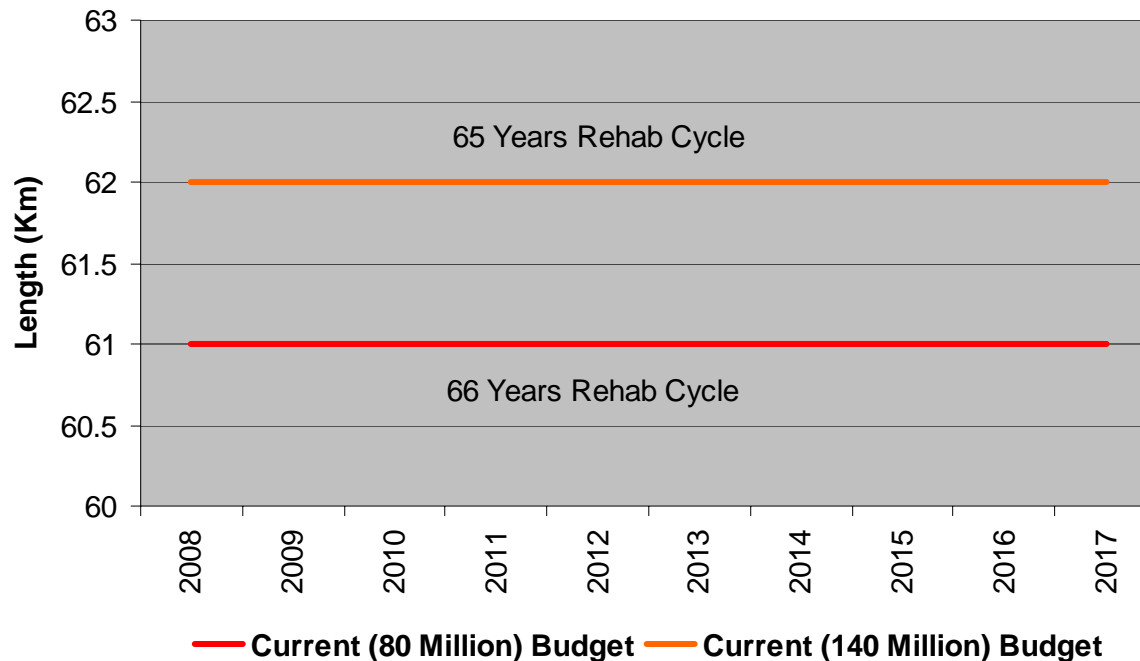
- 10% of the available funding allocated to reseals.
- Majority of remainder for light rehabilitations because funding is heavily constrained.





Rehabilitation frequency

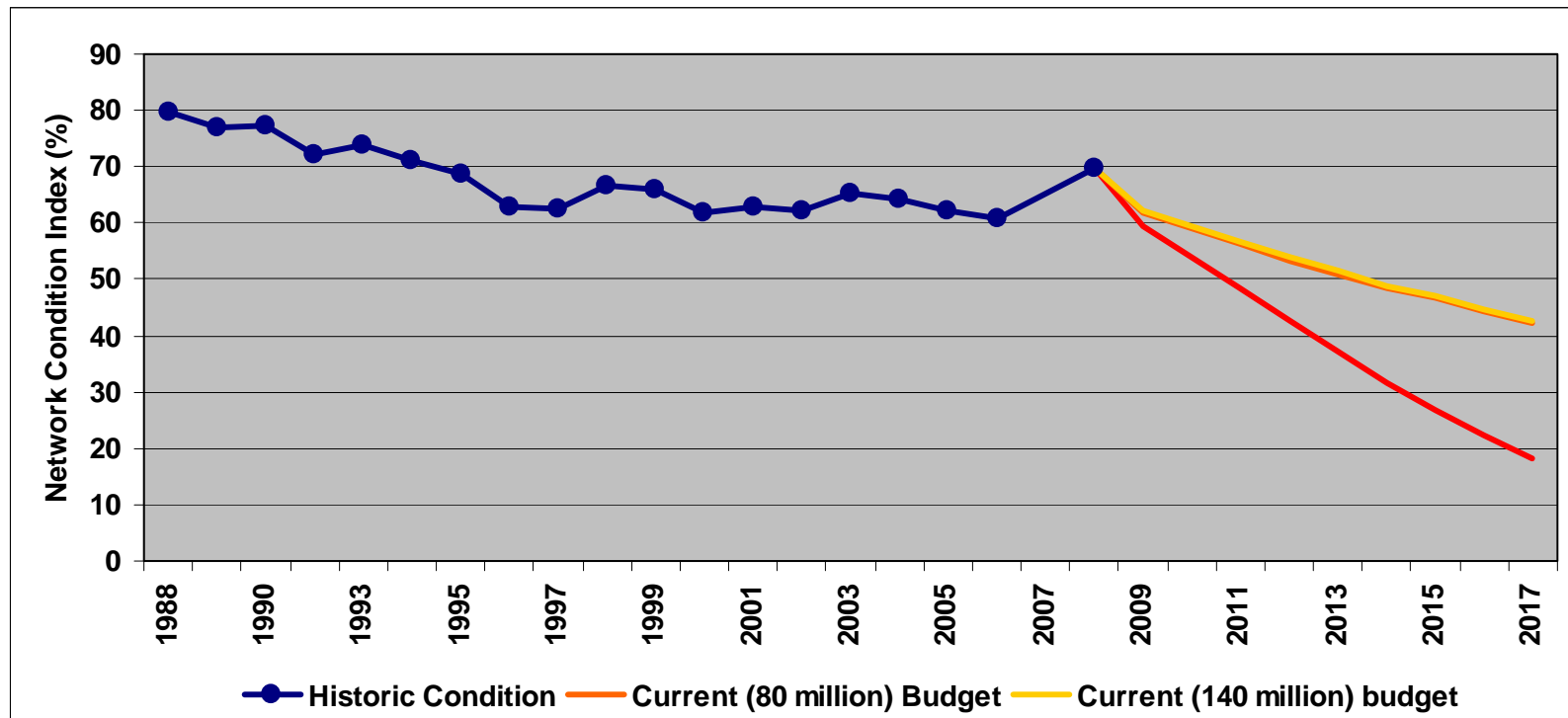
- The expected funding results in a rehabilitation frequency of once every 65 / 66 years.
- This is alarming as:
 - Roads are designed to last 20 years, inclusive of a preventive maintenance plan during this life.
 - Majority of current rehabilitation projects are designed for a 15 year life.





Predicted Condition

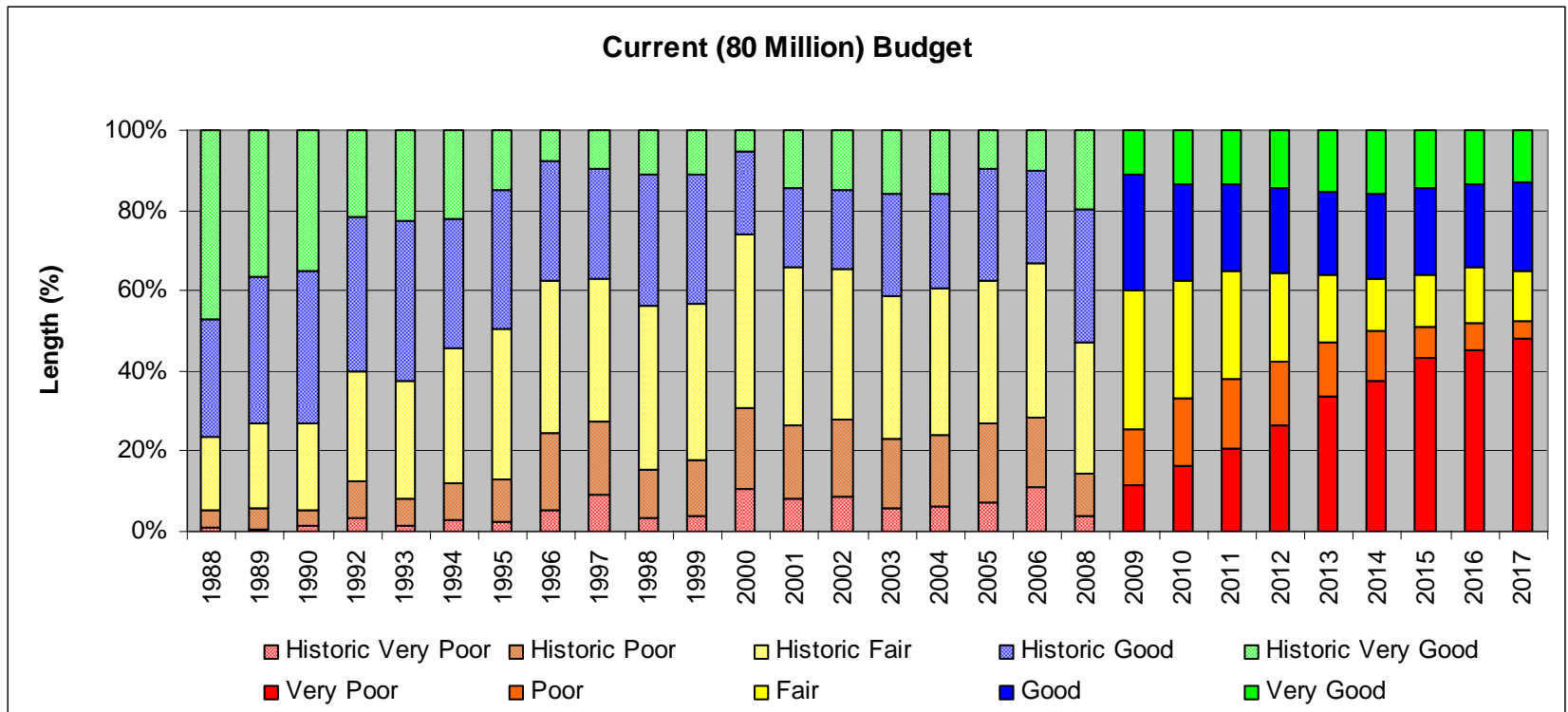
- Current funding (with or without grants) are not enough to improve the condition of the paved road network.
- Decrease in condition percentage after 10 years:
 - 42.3% if Current (R80 million) Budget is allocated
 - 42.6% if Current (R140 million) Budget is allocated





Predicted Condition Distribution

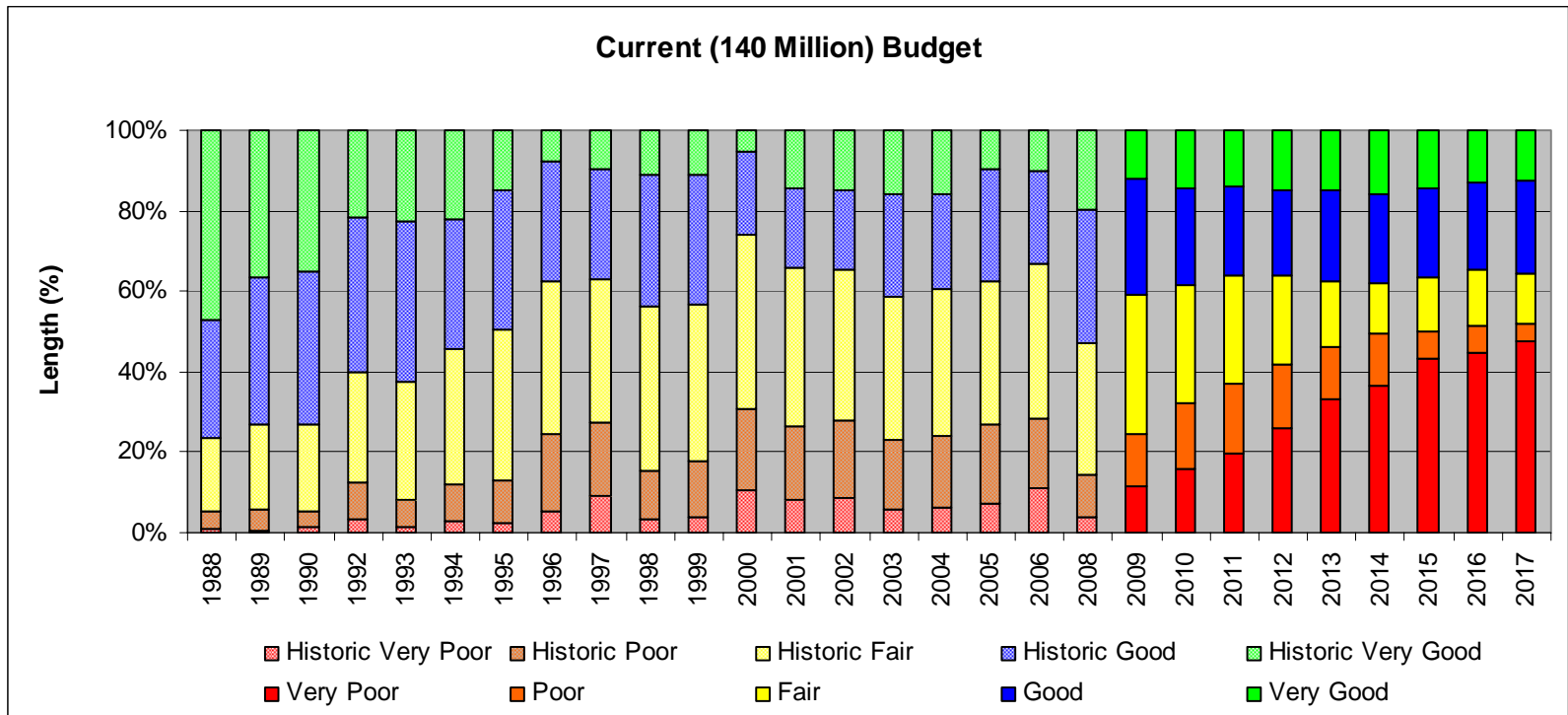
- Current budget, with R80 Million in first year:
 - Very poor roads reach 1,909 km (48%) after 10 years





Predicted Condition Distribution

- Current budget, with 140 Million in first year :
 - Very poor roads reach 1,899 km (47%) after 10 years





Increased funding scenarios versus the current expected funding scenario

Increased funding scenarios

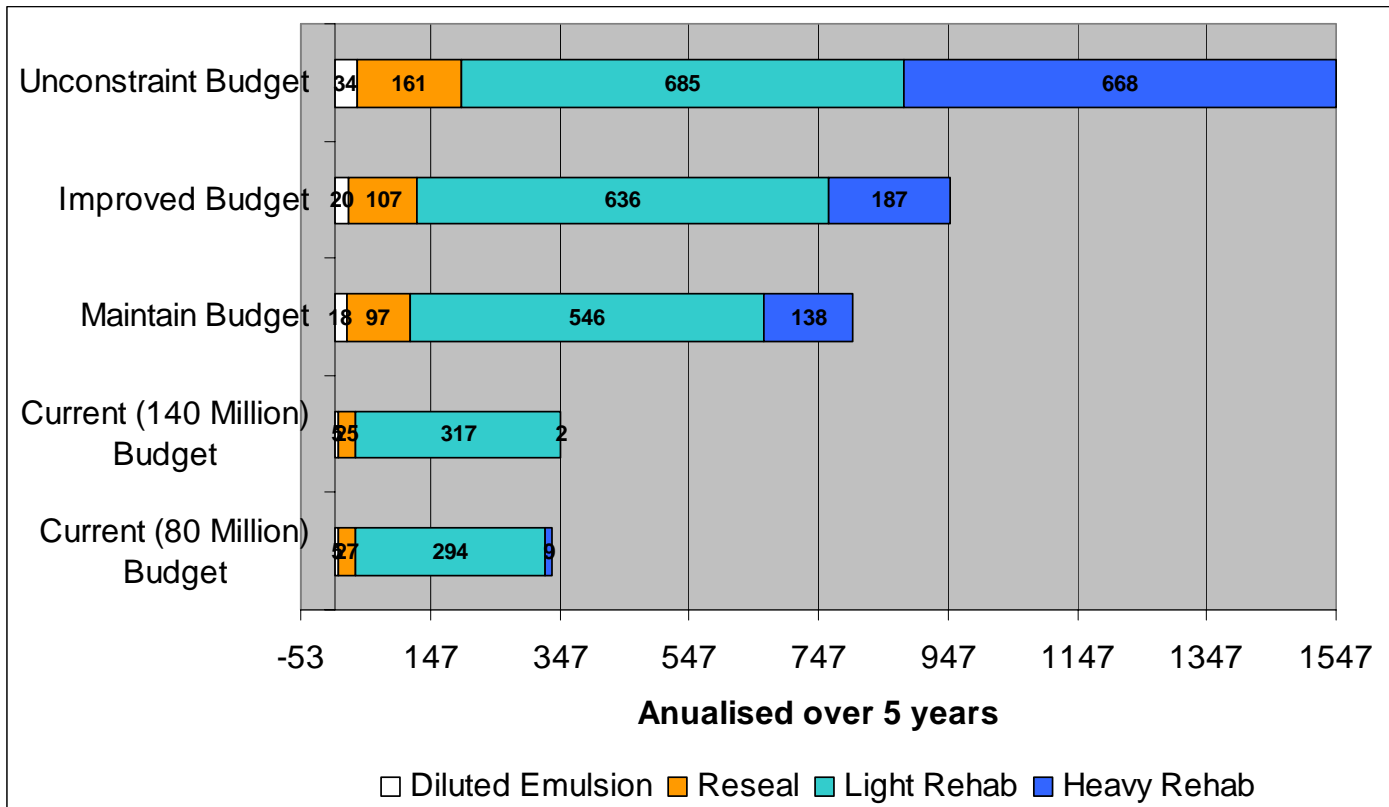
Year	2007	2008	2009	2010	2011+
Current budget, with R80 million in the first year***	R80 m	R354 m	R418 m	R421 m	R415 m
Current budget, with R140 million in the first year	R140 m	R354 m	R418 m	R421 m	R415 m
Maintain budget (prevent further deterioration)	R800 m	R800 m	R800 m	R800 m	R800 m
Improve budget	R950 m	R950 m	R950 m	R950 m	R950 m
Unconstrained budget (Remove backlog immediately)	R5,168 m	R1,103 m	R949 m	R833 m	R856 m
<p><i>The values of all the budget scenarios are given in terms of the monetary value of 2008. The expected budget levels of the Current Budget was therefore deflated to 2008, for 2009 and onwards.</i></p>					

*** Expected current funding scenario



Fund distribution

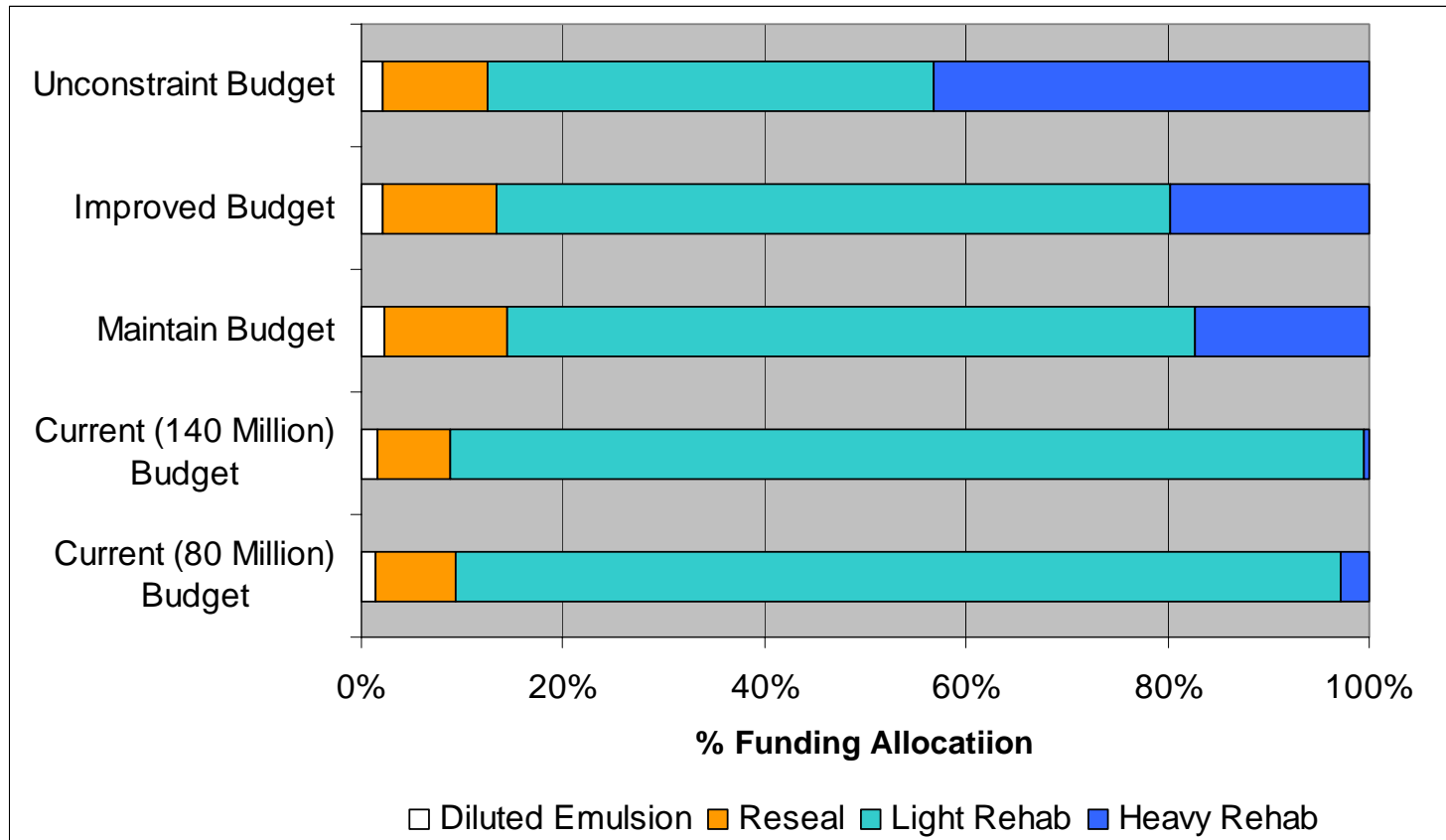
- Annualized fund distribution averaged over 5 years
- Allocation for reseals as preventive maintenance action does not decrease proportionally with a decreased budget.
- Reseals prolong the life-span of a road structure by protecting the structure against the ingress of water.





Fund distribution

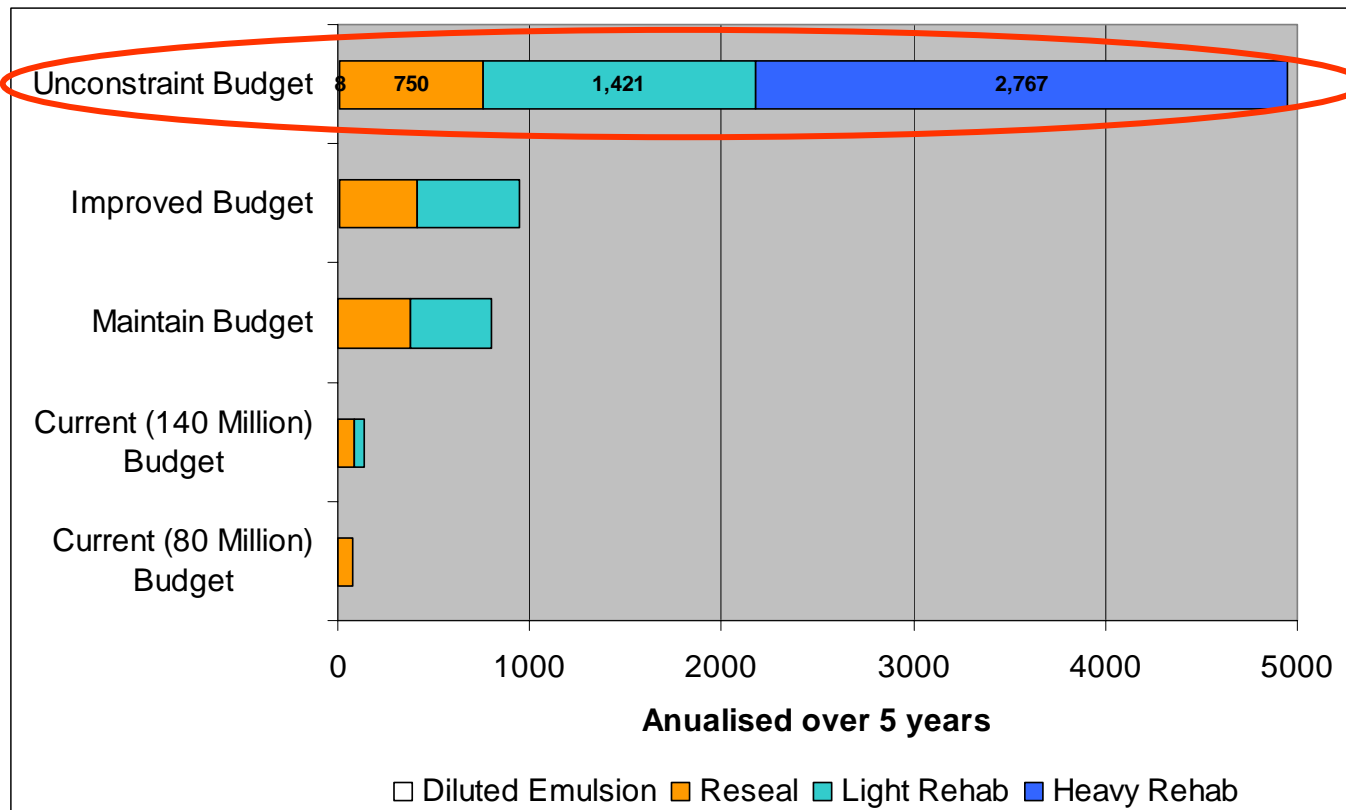
- Note how the allocations of the available funding towards reseals and light rehabs increase, as the funding decreases.
- Heavy rehabs increase with increased budget.





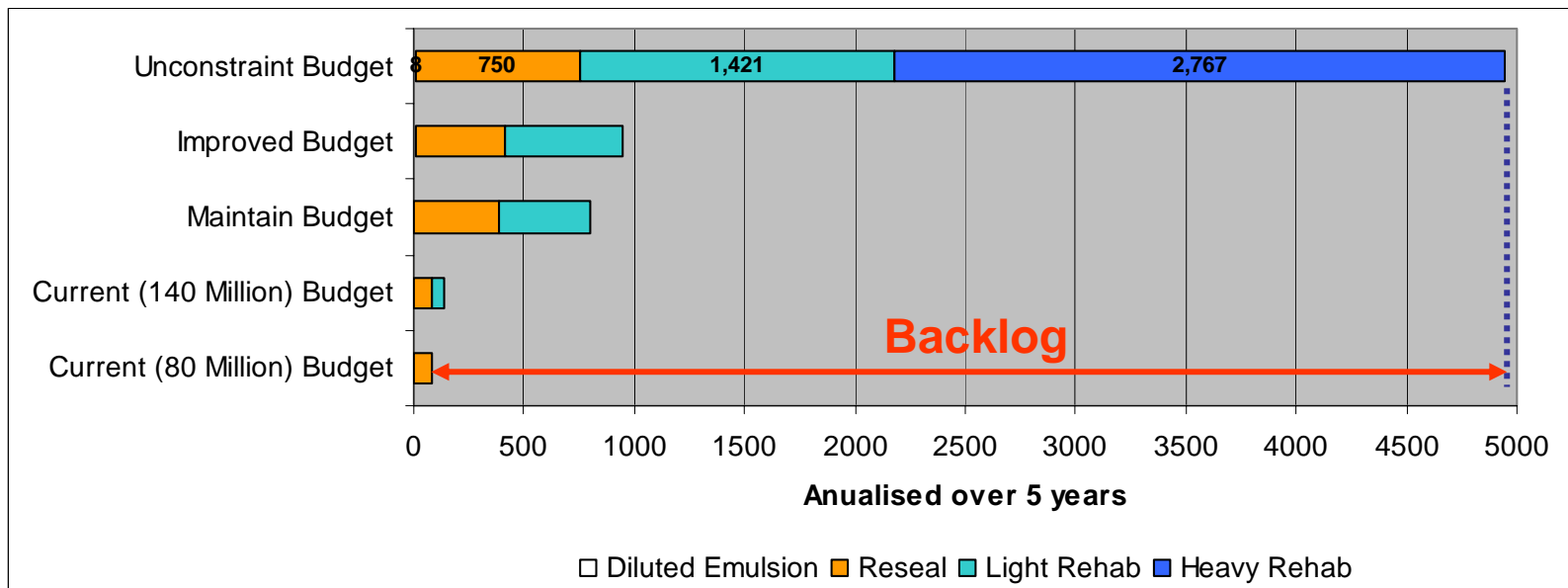
Immediate Need

- **Immediate need:** Is defined as the funding requirement of 2008 (immediately) according to the Unconstrained Budget, i.e.:
 - R750 million for Reseals
 - R1,421 million for Light Rehabilitation
 - R 2,767 million for Heavy Rehabilitation
- *I.e. the funding that is required to re-instate the entire network to a “Good” condition.*



Backlog

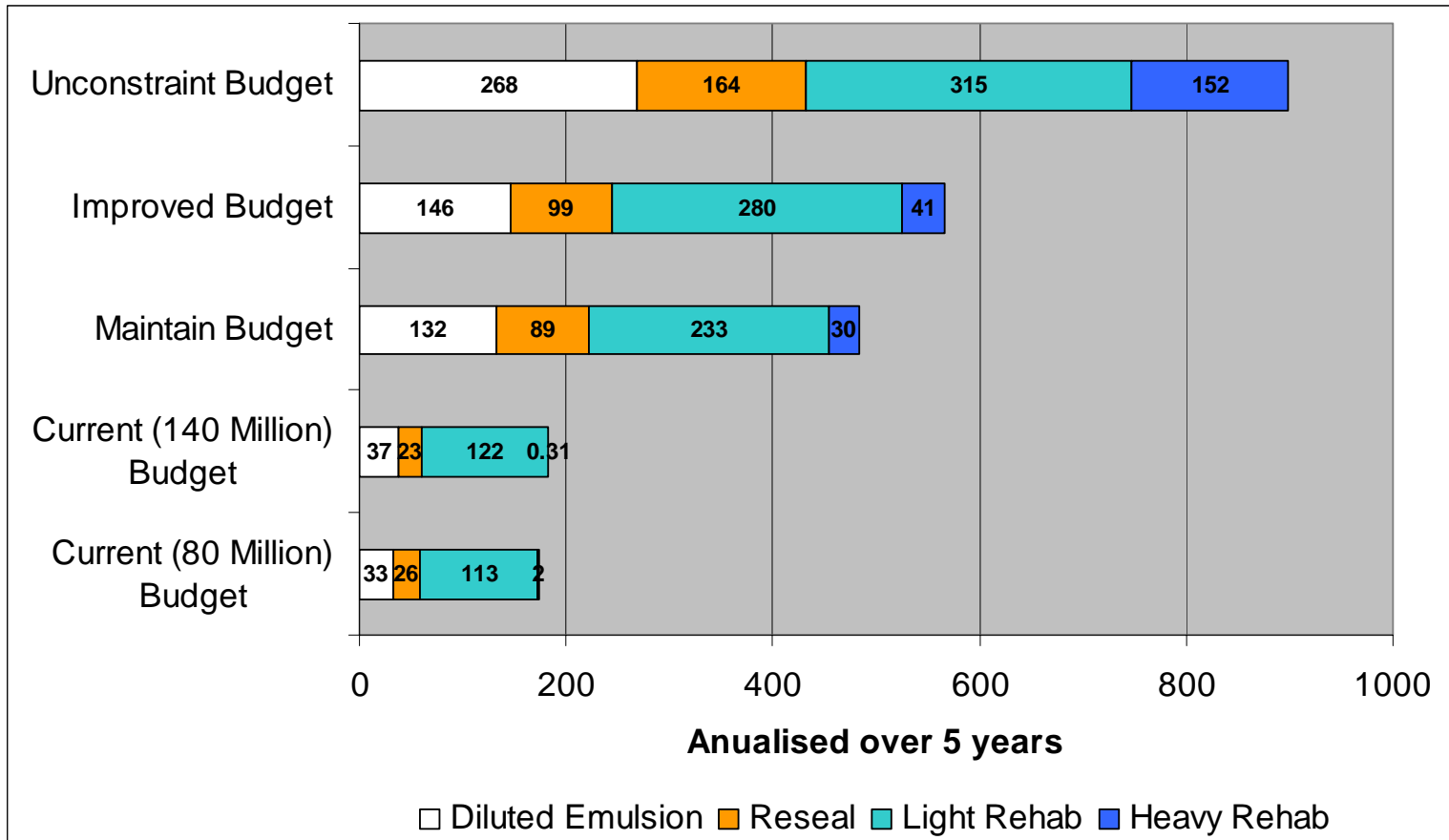
- Backlog is thus the difference between the “Immediate need” according to the Unconstrained Budget and the funding level of the Current Budget.
- Total BACKLOG is thus:
 - R672 million for Reseals
 - R1,421 million for Light Rehabilitation
 - R 2,767 million for Heavy Rehabilitation
- BACKLOG spread (annualised) over 5 years is:
 - R134 million pa for Reseal
 - R391million pa for Light Rehab
 - R658 million pa for Heavy Rehab





Treatment lengths

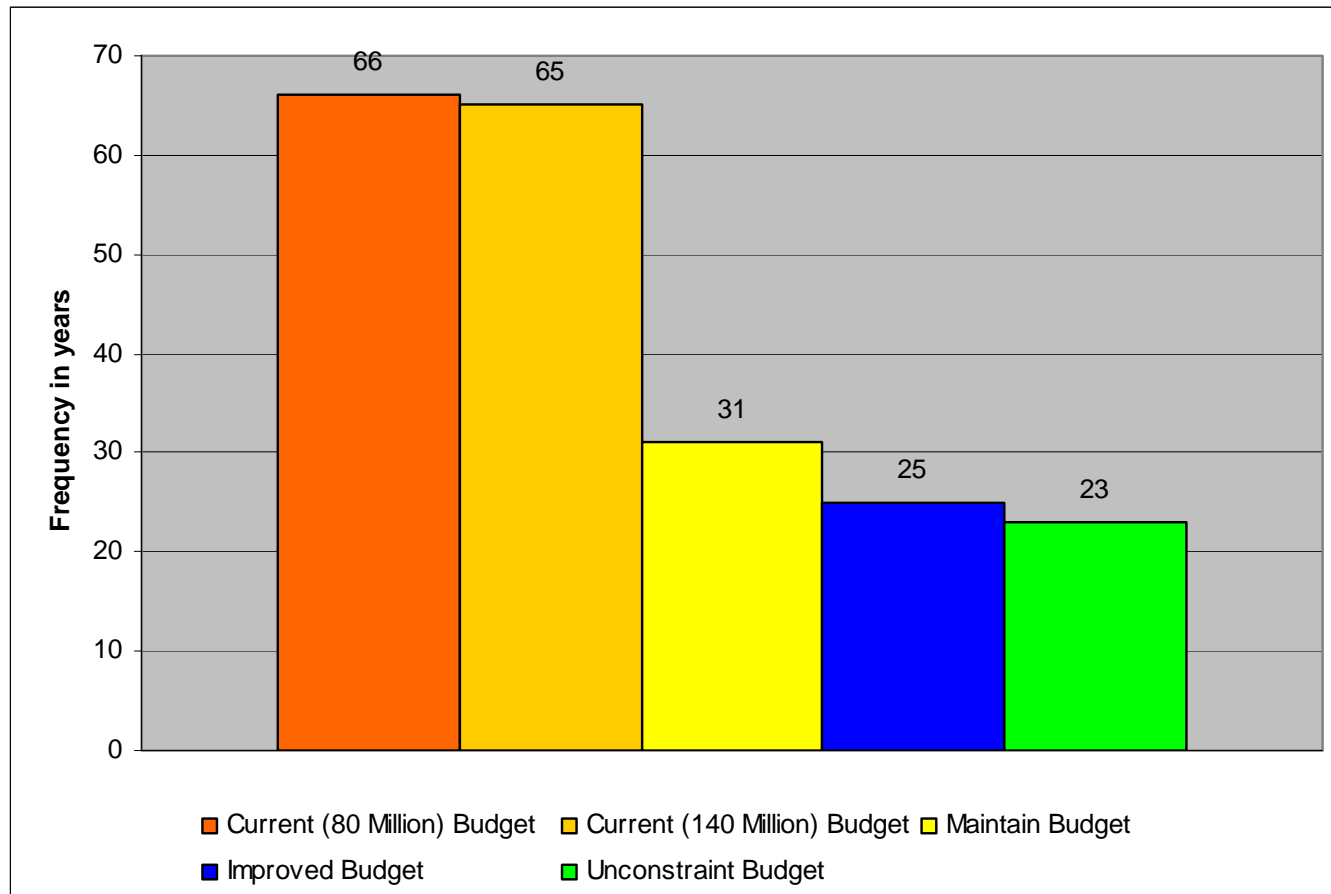
- Averaged annual lengths that can be treated with the four funding scenarios.





Rehabilitation frequency

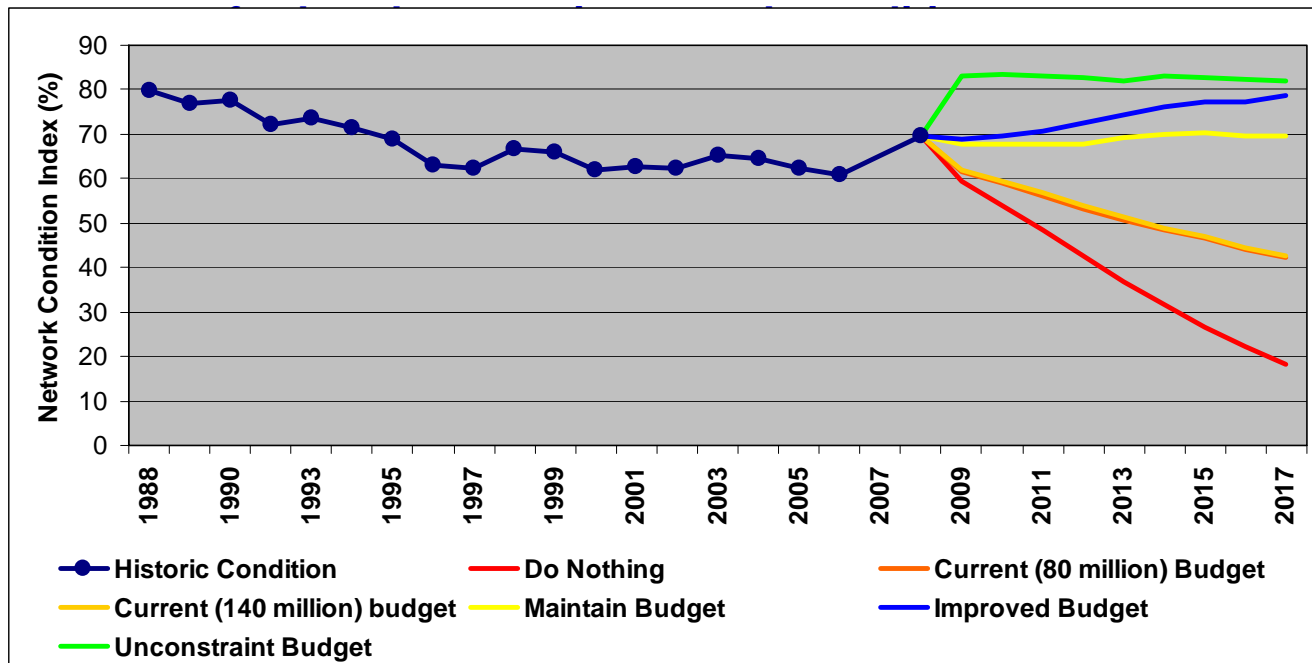
- The graph shows the rehabilitation frequencies that can be achieved with respective funding levels:
 - The Current Budget cannot maintain the network at levels that correspond with the current design life of Gautrans (which is 12 to 15 years)
 - The funding scenario of R950 million per annum (Improved Budget) is in line with the current design life of rehabilitations in Gautrans.





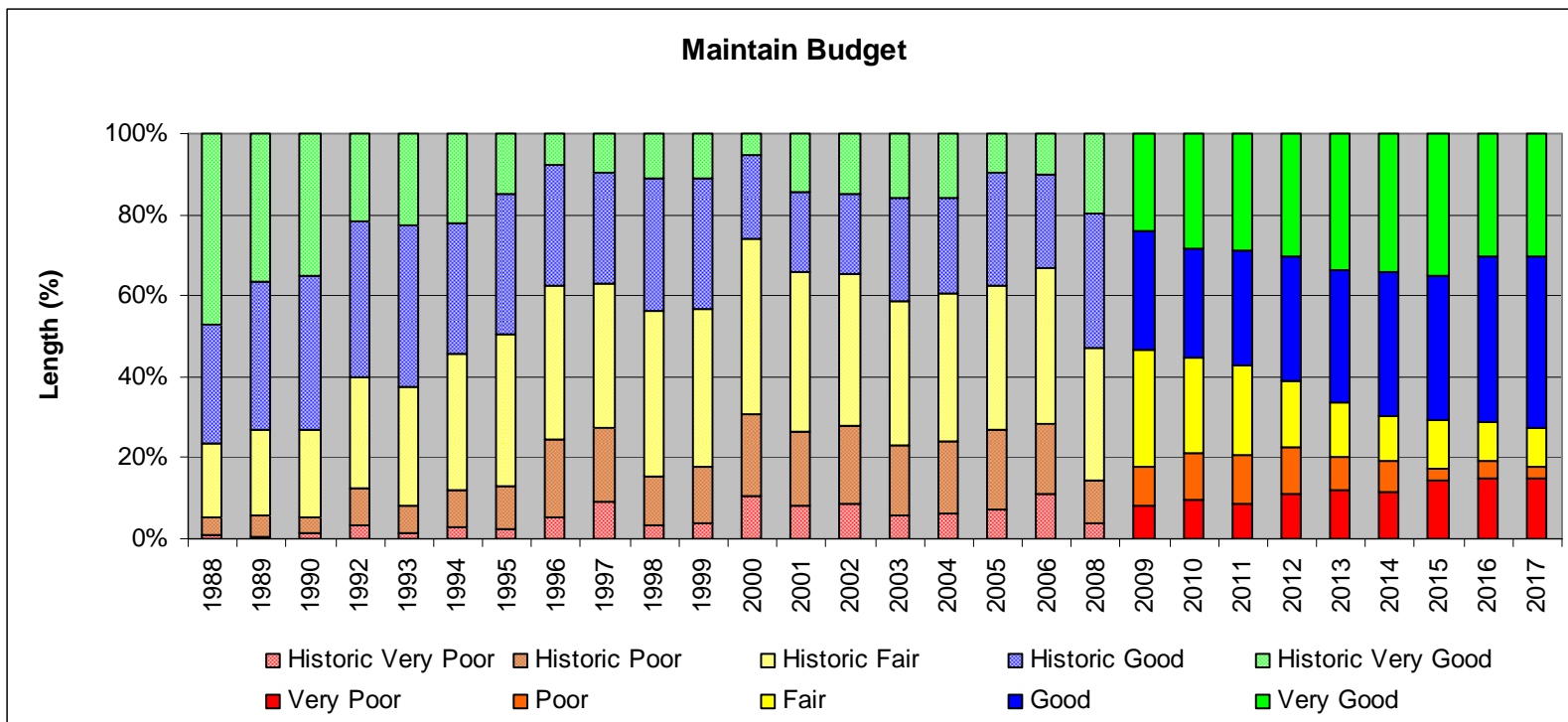
Predicted Condition

- Predicted future condition according to the LCC analysis :
 - The Current Budget is inadequate to prevent a further deterioration in network condition. Condition will be almost 40% by 2017, i.e. on the verge of an overall “poor” category.
 - The Maintain Budget will maintain the network at approx 69%, i.e. a “fair” condition, but still cannot improve the current situation.
 - The Improved Budget will steadily increase the condition of the network to 79%.
 - The Unconstrained Budget maintains the network at a maximum level. Current funding should be increased by R800 million pa to



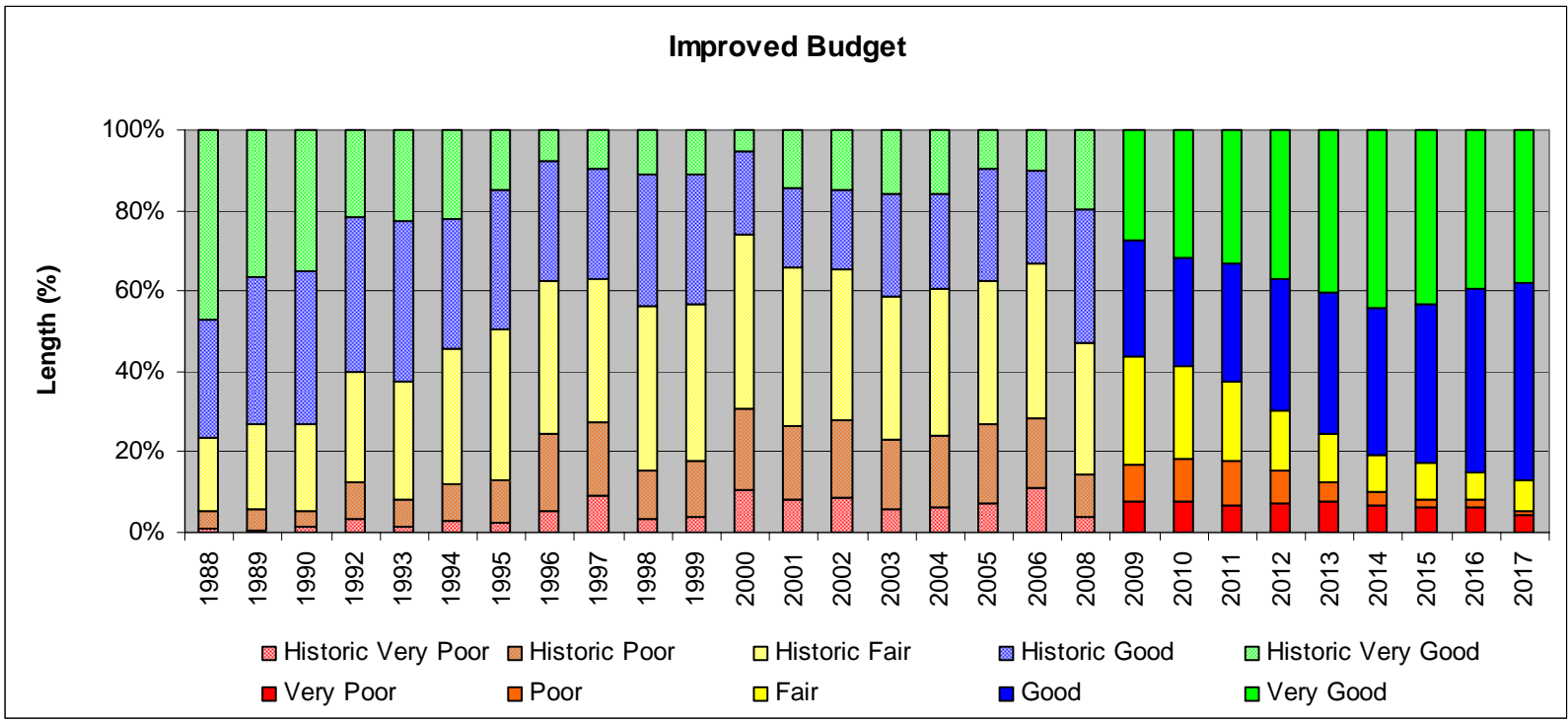


Predicted Condition Distribution: Maintain Budget



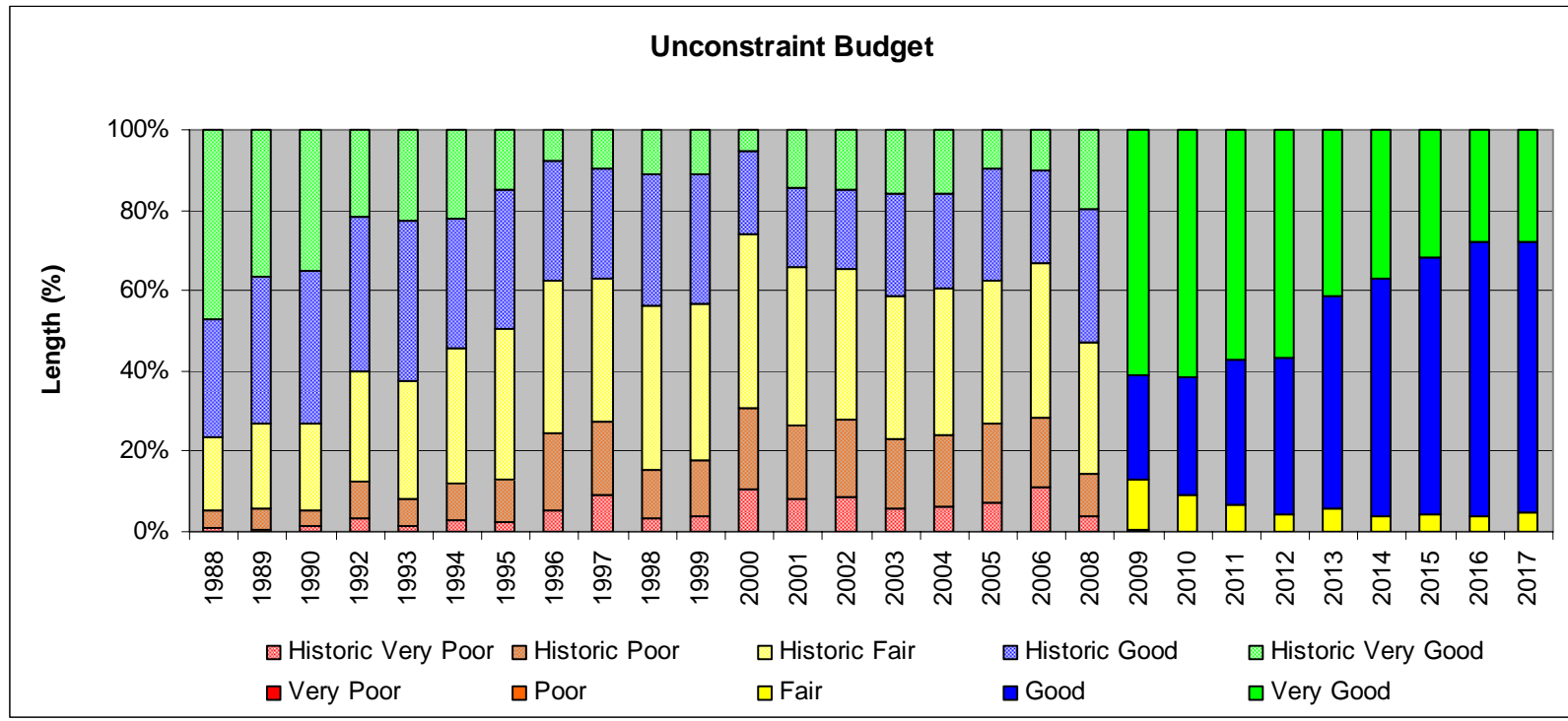


Predicted Condition Distribution: Improve Budget



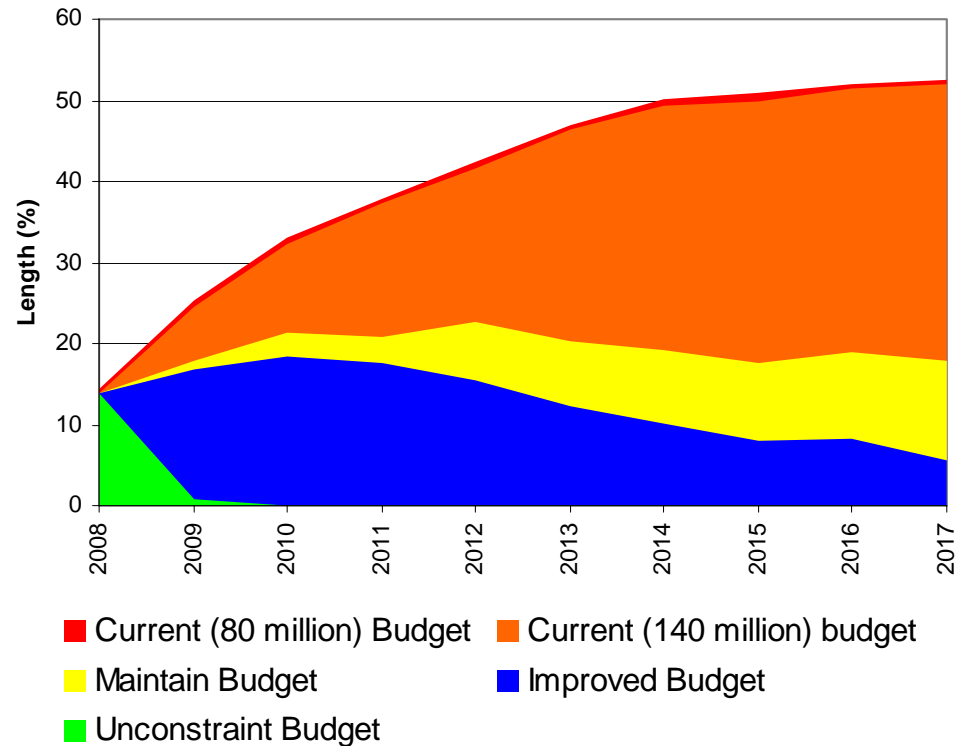


Predicted Condition Distribution: Unconstrained Budget



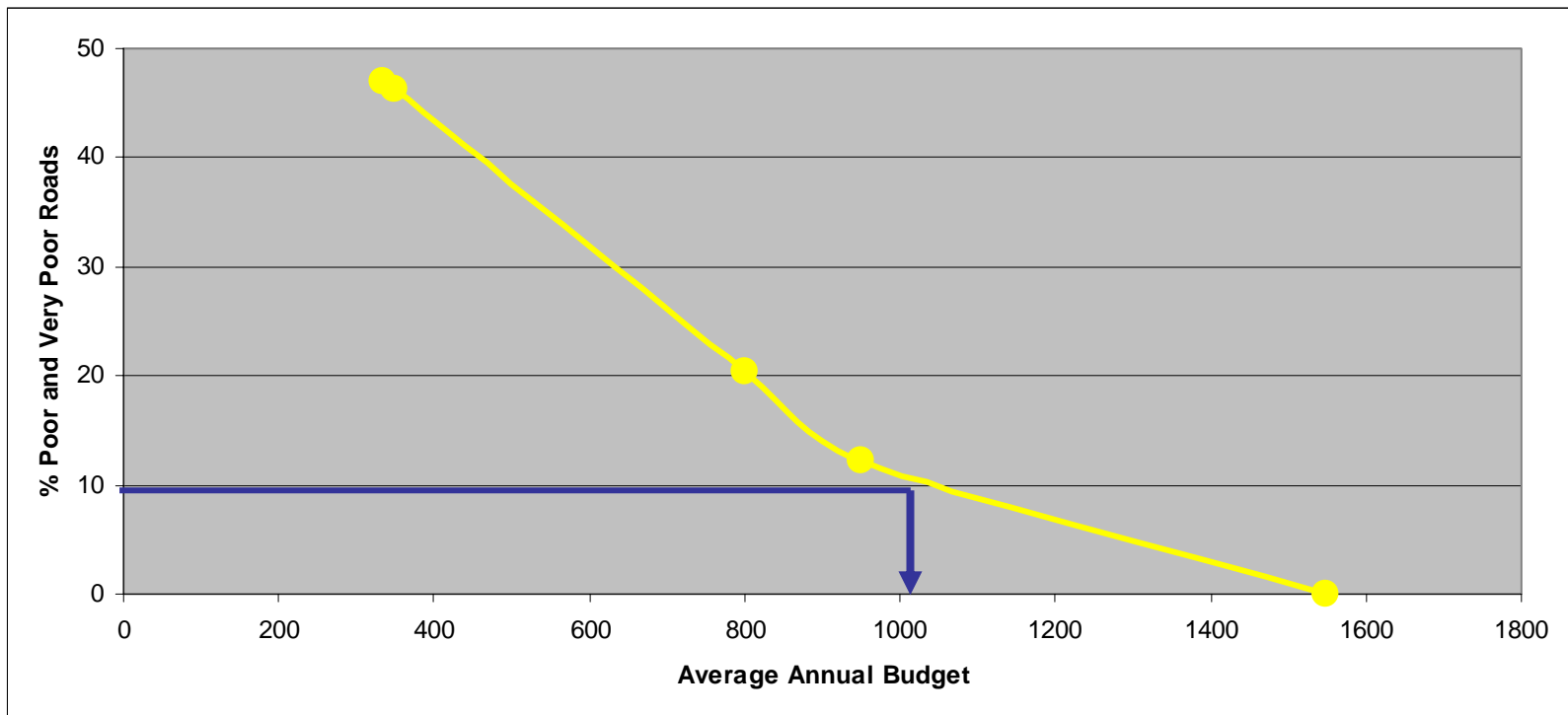
Backlog (Roads in a Poor to Very Poor Condition)

- If the Current Budgets (R80 & R140 million) are implemented, the proportions of “poor and very poor” will continue to soar.
- The Improve Budget decreases the roads in poor and very poor condition to below 10% by 2015. .
 - The unit prices are very high. A budget increase of R150m pa (difference between Maintain and Improve), can increase the annual maintenance of the network by a mere 50-100km (1%-2%).
 - The relative “small” difference between the Improve and Maintain Budgets is therefore understandable.



Required budget to maintain the network with a maximum of 10% “poor and very poor” roads

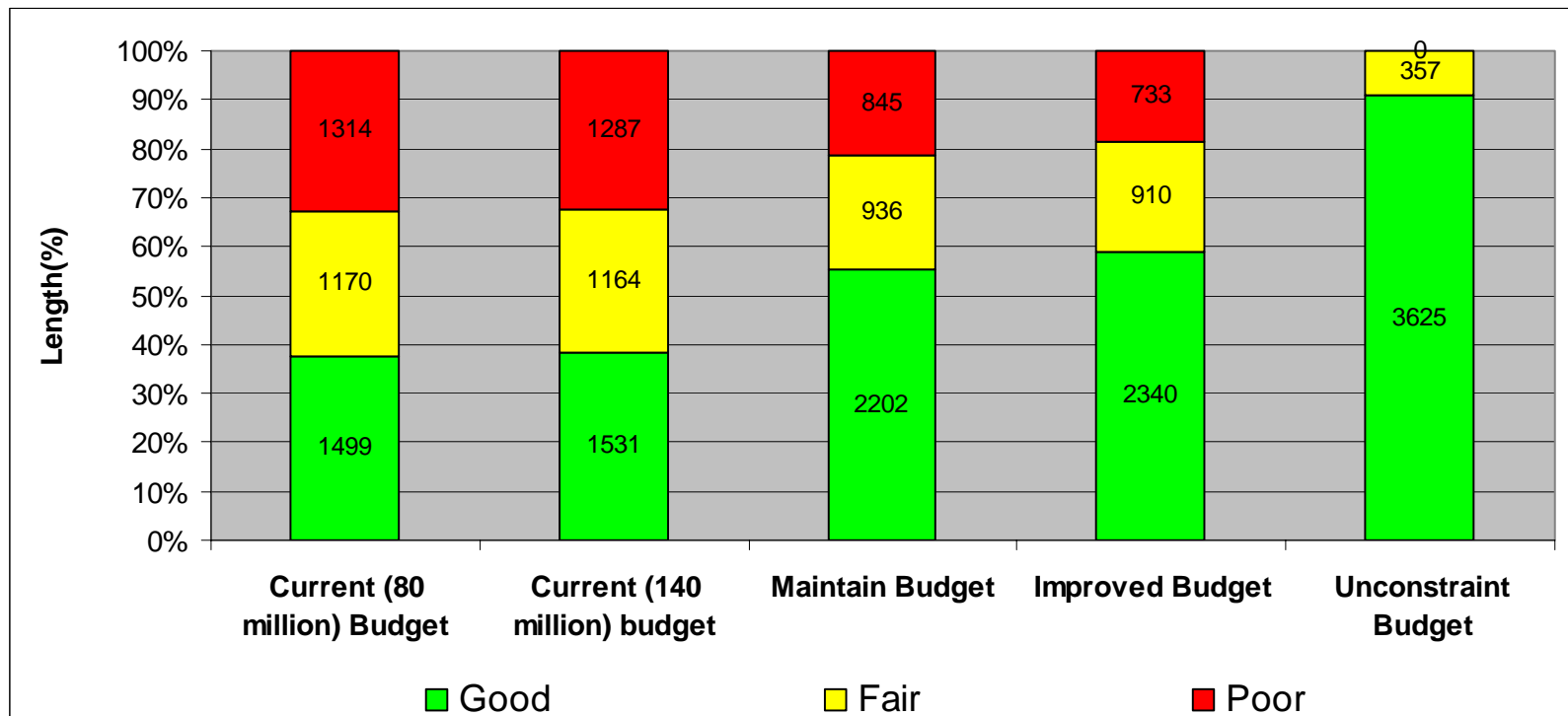
- It is estimated that an annual budget just over R1,000 million is required over the next 5 years to maintain the network with acceptable (< 10%) Poor/Very Poor levels.





Predicted condition in 2010 (FIFA World Cup Soccer year)

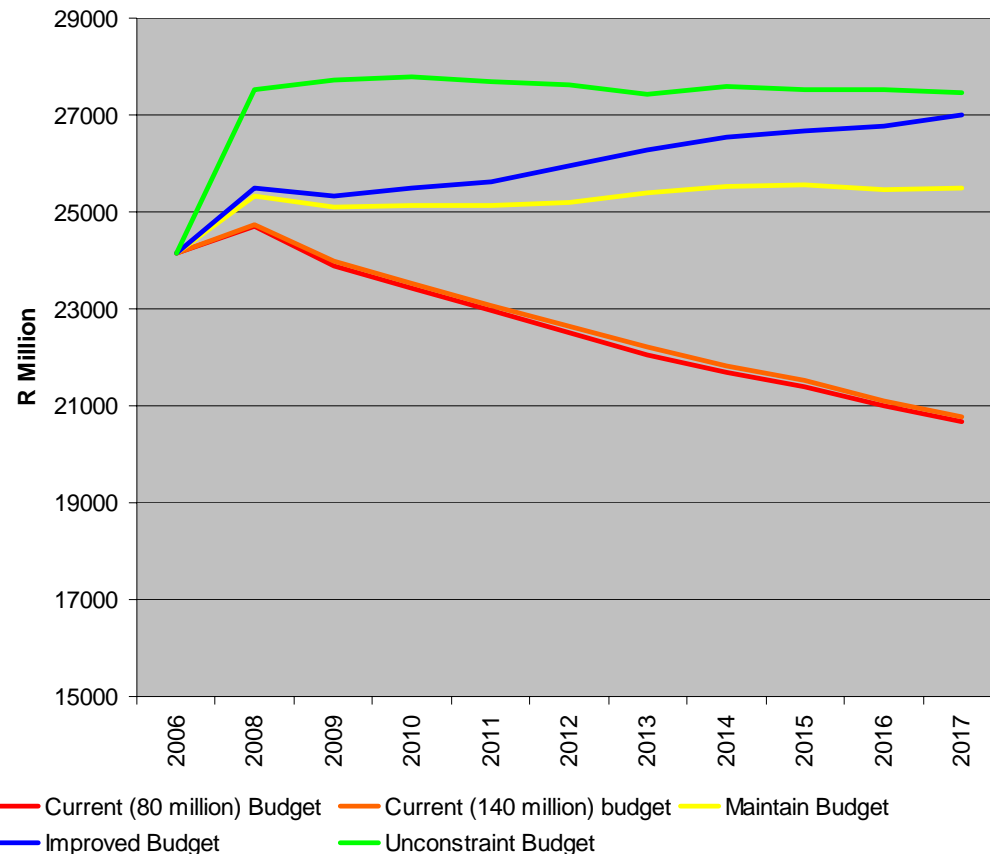
- The values shown in the bars are kilometre length.





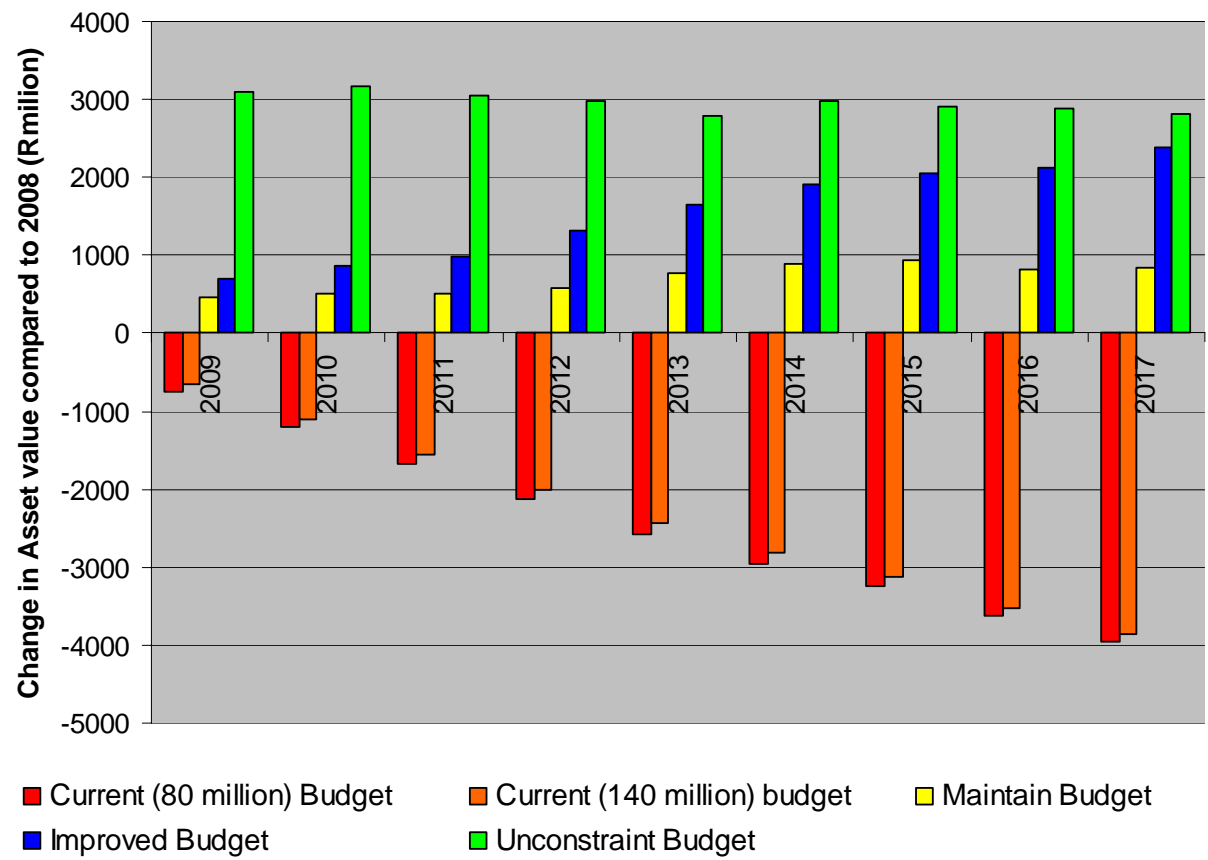
Predicted Asset Value

- **Maximum potential asset value is R35.6 billion.**
- **Current asset value is approximately R24.6 billion, which is 78% of the potential value – does not include value of bridges!**
- **An improvement in asset value is achievable for a budget of R800million pa or higher.**



Predicted change in Asset Value

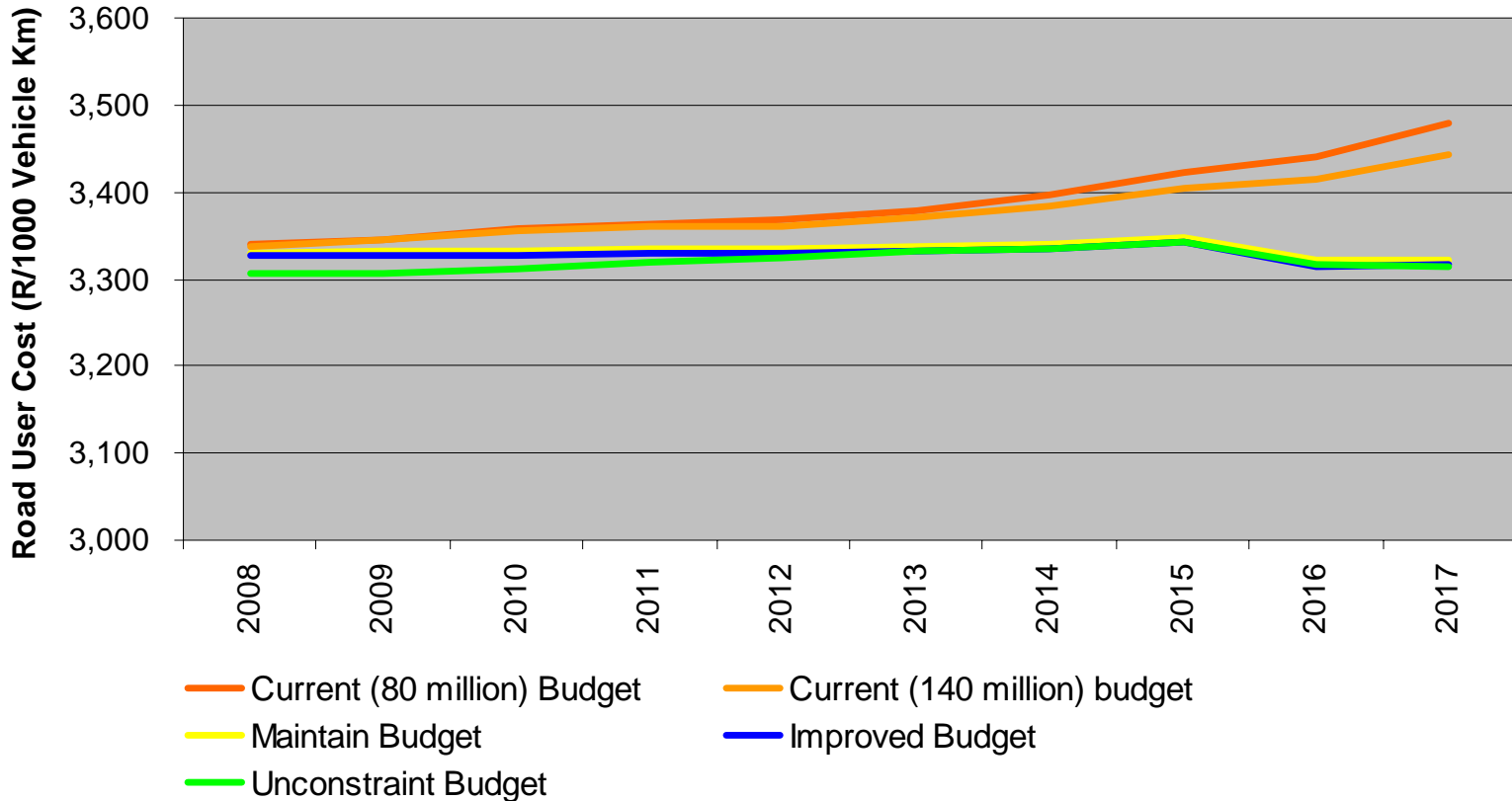
- The Current Budgets (R80 and R140 million) cannot prevent a further decrease in asset value. The decrease in asset value is a direct result of the deterioration of the pavement layers of the network.





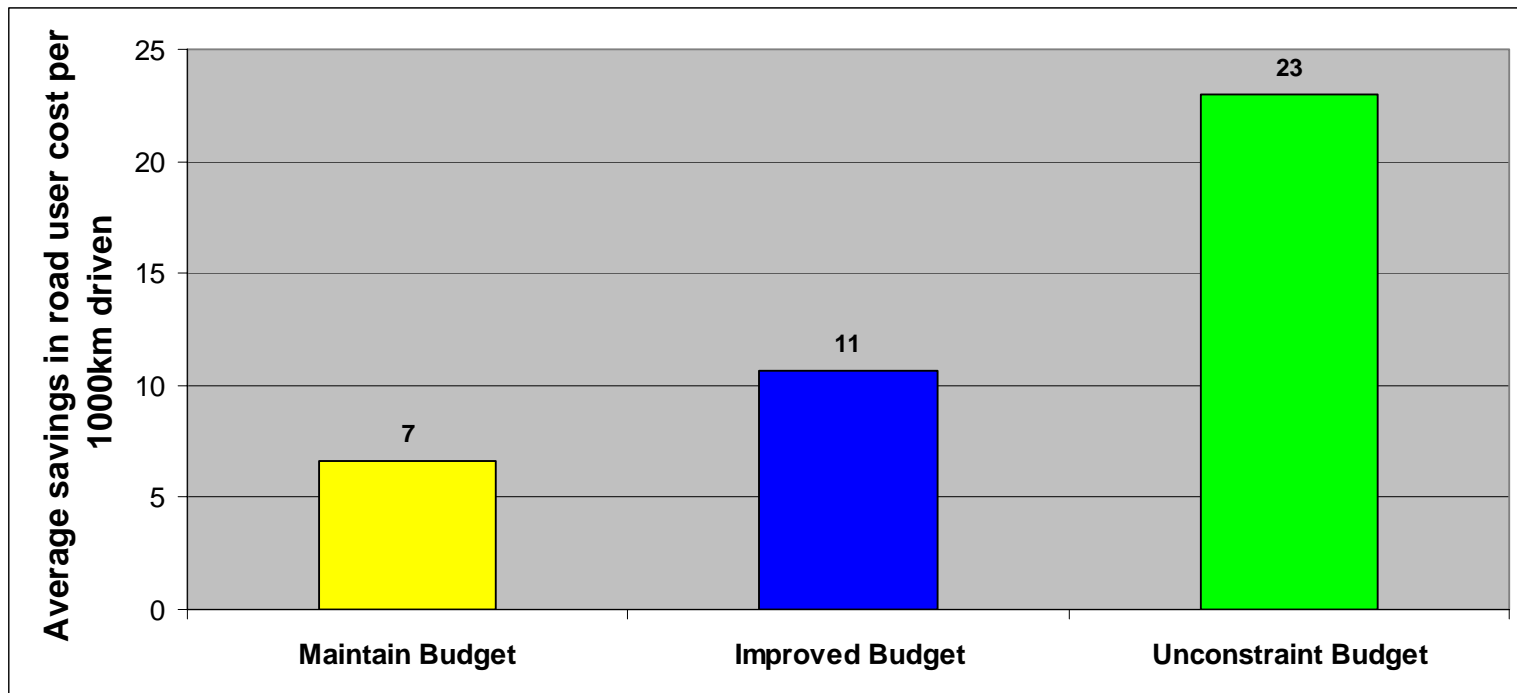
Predicted Road User Cost

- **Current Budgets cannot decrease the cost to road users of the Province.**



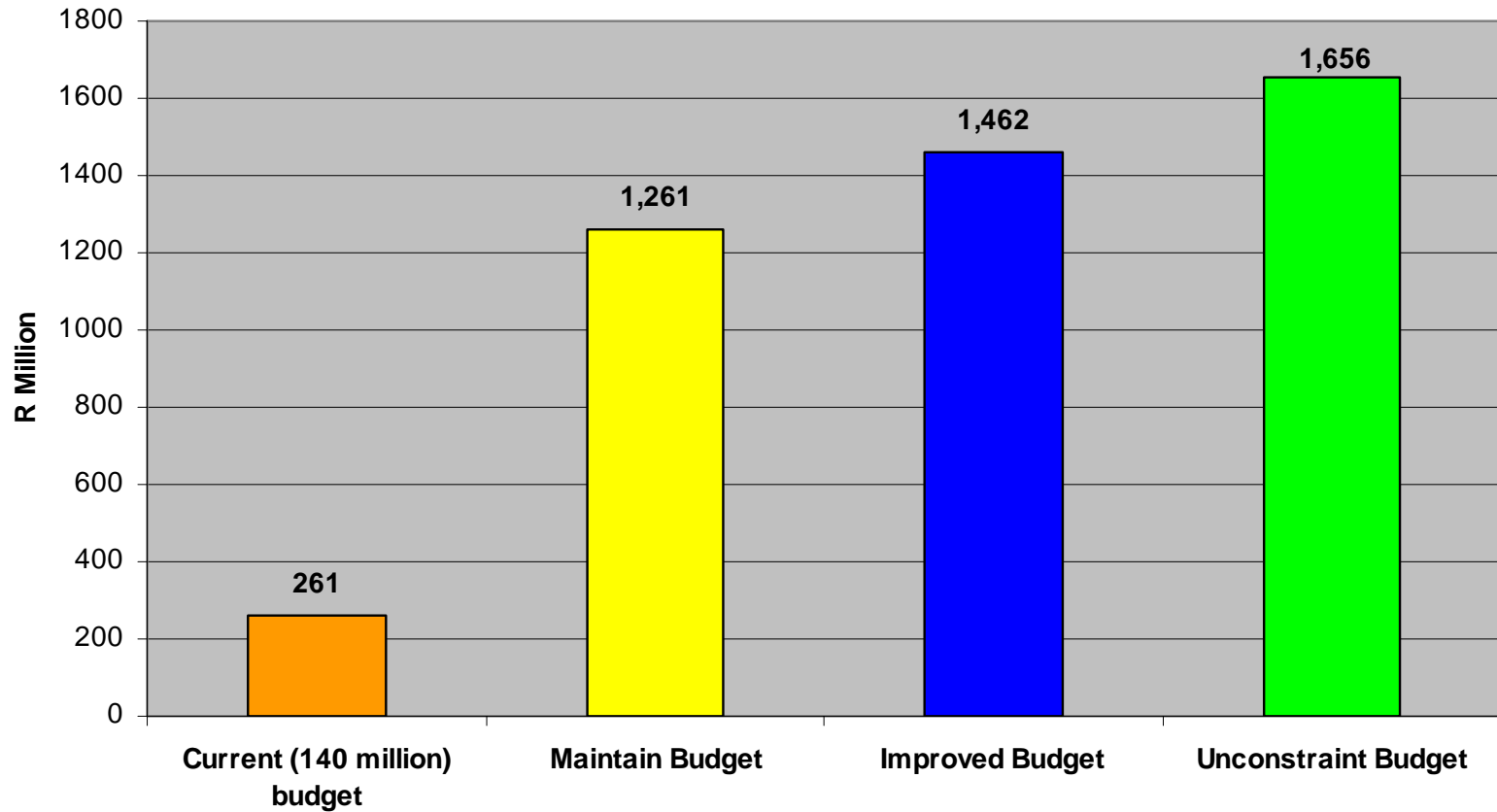
Annual savings in road user costs if Current Budget is increased

- Road user costs were compared to the road user costs of the Current Budget.
- Average annualised savings of increased funding levels are :
 - R7 per 1,000 veh-km for Maintain Budget
 - R11 per 1,000 veh-km for Improve Budget
 - R23 per 1,000 veh-km for Unconstrained Budget





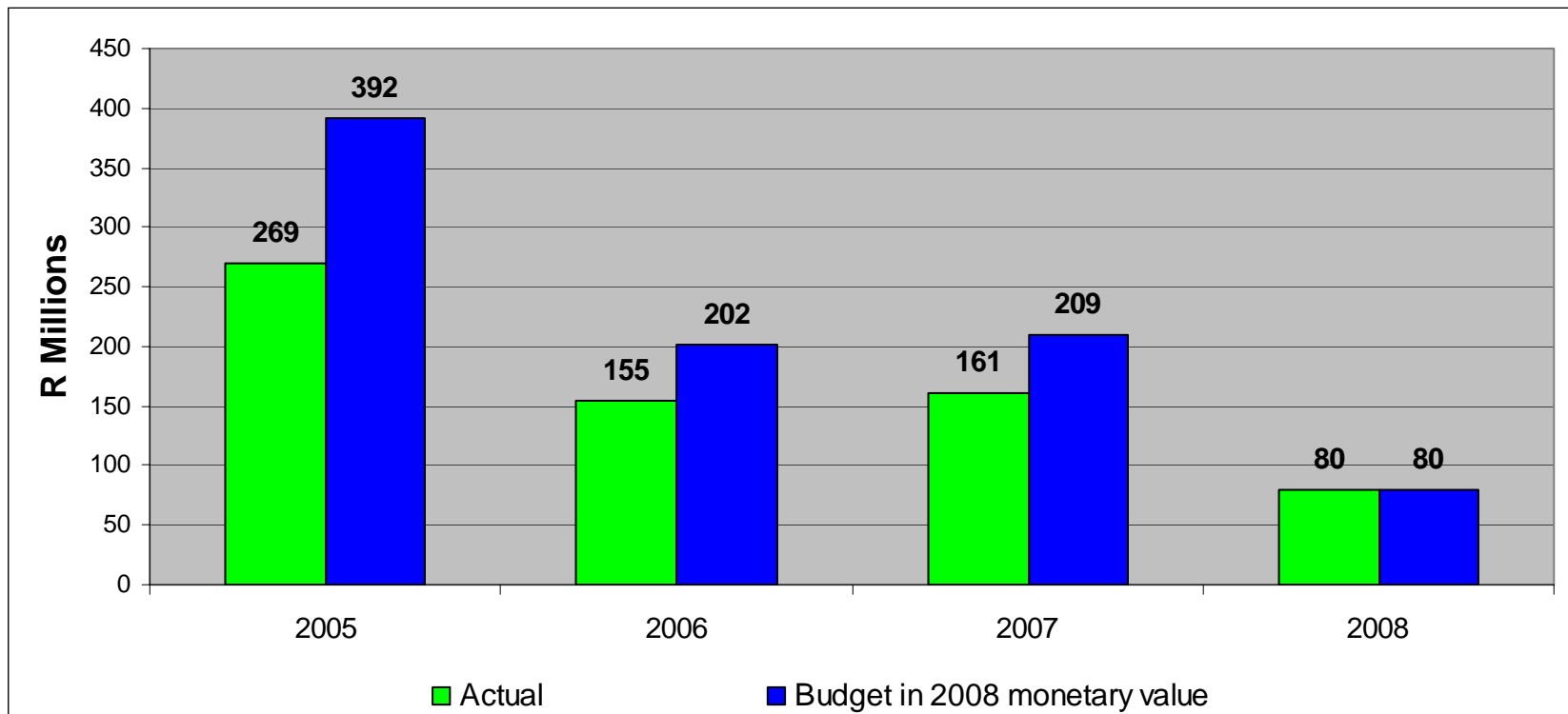
Road User Cost saving in 2013





Allocated budget for 2005 to 2008

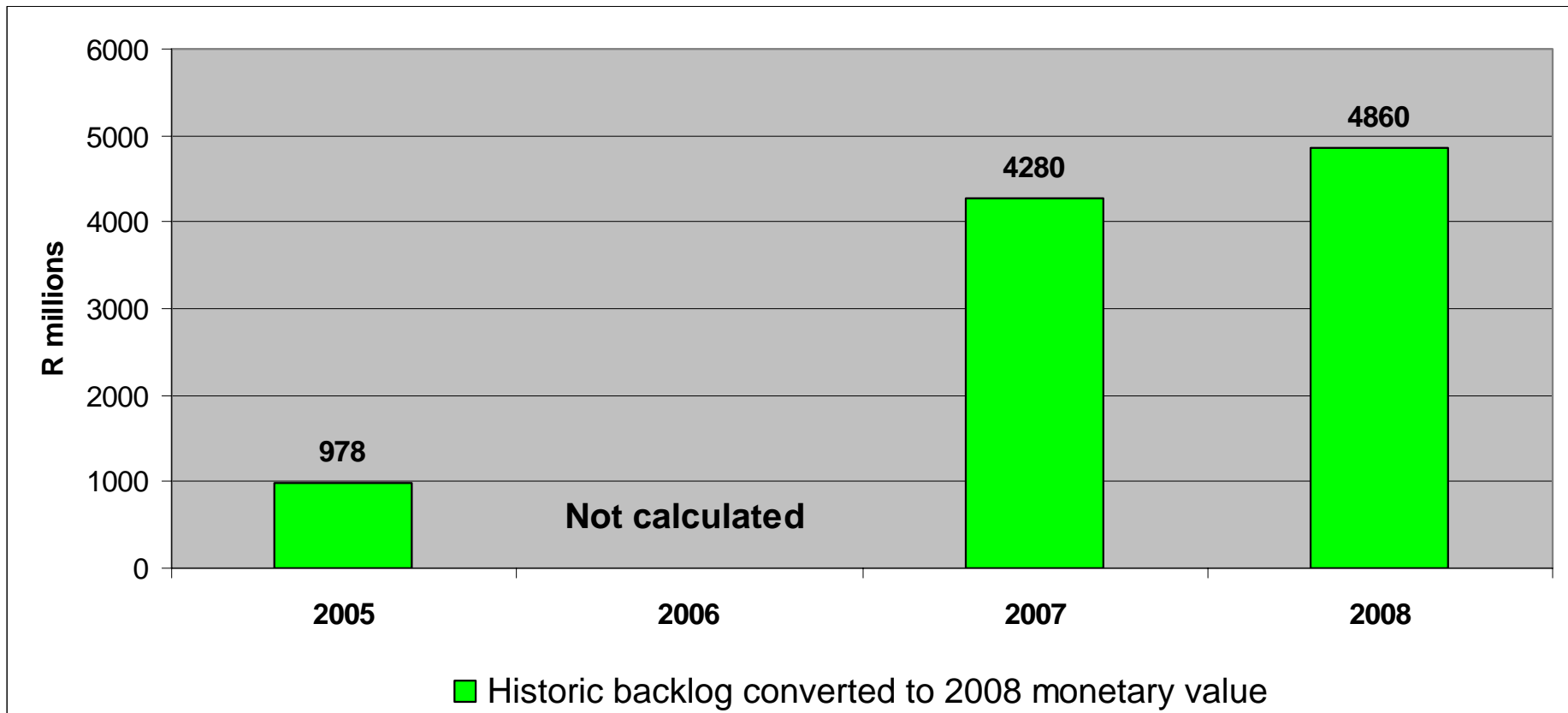
- The budget for 2008 is even less than the very low budgets of 2006 and 2007.
- The network requires increased funding levels to improve the overall condition.





Historic Backlog

- The backlog continues to grow and the high increase in backlog in 2007 is a direct result of the low budgets of 2006 and 2007.





In summary

- **The Gautrans paved network:**
 - Very old network that carries high traffic volumes
 - Average condition is on the border between fair and good
 - Has too high % in poor and very poor condition
 - Has too high % in fair condition
 - Has a substantial (54%) backlog for resurfacing
 - Has a substantial portion (85%) exceeding structural design life
 - Is currently in a fairly stable condition, but will be adversely affected through further inadequate funding allocations



In summary

- **Past and current maintenance policies and funding of Gautrans:**
 - In the past maintained the network successfully through preventive maintenance (reseals)
 - Current funding levels for preventive maintenance are now seriously too low
 - Current funding levels do not at all address ever increasing backlog for rehabilitation
 - Current funding levels not appropriate given the current condition of the network
 - Technical analysis of priorities indicates available funds for programmable maintenance should be used on freeways
 - Due to extent of and condition of freeways no funding will be available for reseal of other roads if freeways resealed
 - Freeways to be included in GFIS , but timeframes not agreed, which results in catch 22 situation!



The Challenge

- **Roads authorities caught between**
 - Aging road infrastructure that is rapidly deteriorating
 - Increased axle and traffic loading on road network
- **Problem exacerbated by**
 - Limited funding that is unlikely to increase in short to medium term
 - Impact of available funding eroded by escalation in road rehabilitation cost
 - Not only road rehabilitation required but also need to increase capacity (K15, K29, K71 etc.)
- **Cannot resolve dilemma with current funding allocation and traditional ways of doing things!**



The Challenge /2

- **Innovative measures required if backlog is to be eliminated within reasonable timeframes and funding constraints:**
 - Contracting models (NEC options)
 - Alternative materials (Power station/Sasol ash)
 - New technologies (UTRCP)
- **Use of new bitumen products and technologies**
 - Resistance to change
 - Limited knowledge base
 - New entrants into consulting market
- ***Innovation in use of concrete products and technologies, e.g. rollout of UTRCP in road rehabilitation projects!***

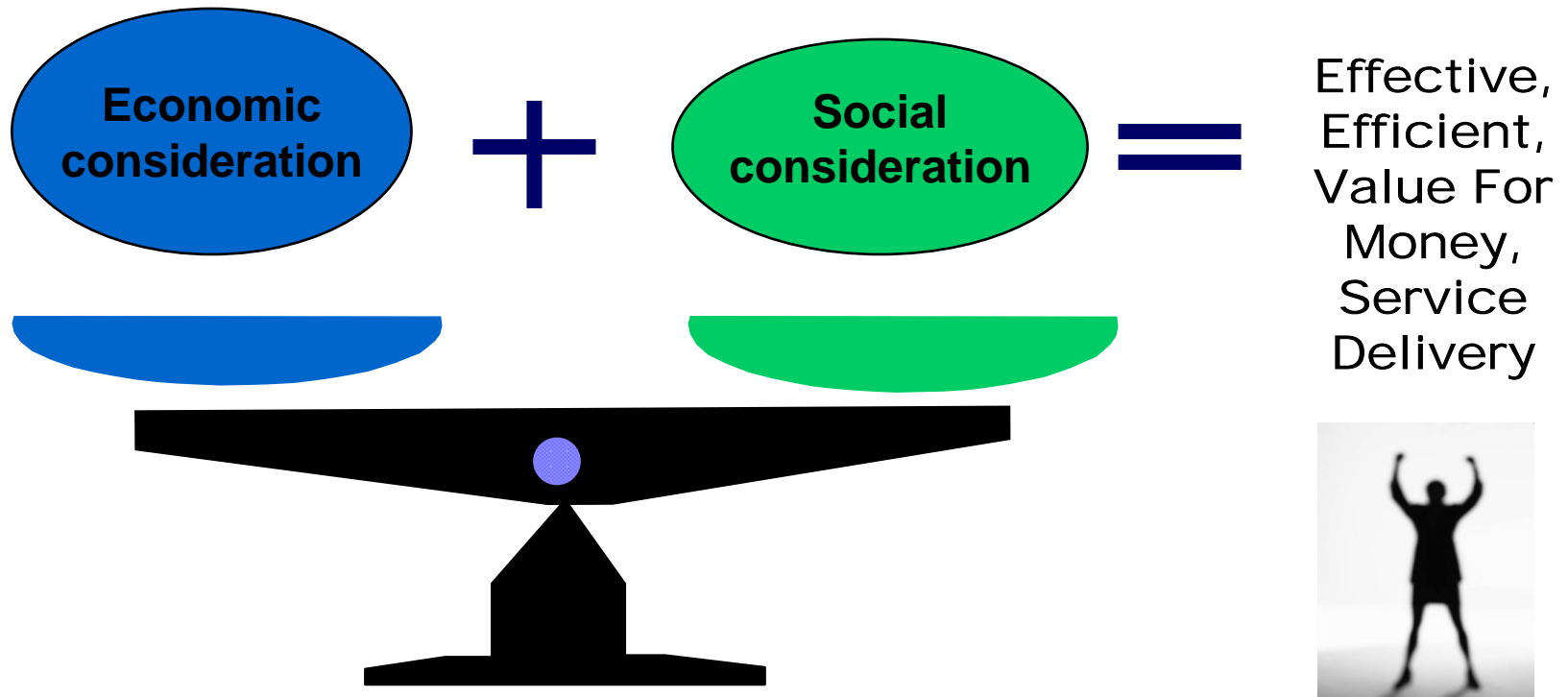


Why Ultra Thin Reinforced Pavements?

- Increase of labour content by an estimated 350%
- Training and skills acquired, e.g. concreting can be applied in other sectors
- Up scaling of technology to provincial and national roads possible
- Reduced layer works required, which reduces amount of work to be carried out by plant
- Reduces depth of “box cut”, which limits damage to and need for relocation existing underground services
- Less maintenance required, and more durable
- Investment in equipment fairly low (no barrier to entry)
- Environmental benefits – fly ash, waste product is used
- Reduced the reliance on imported material (bitumen)
- Reduced construction costs and contract period
- Less energy required for illumination (street lights)



Remember the Imperatives!!



Service Delivery Model Objective