

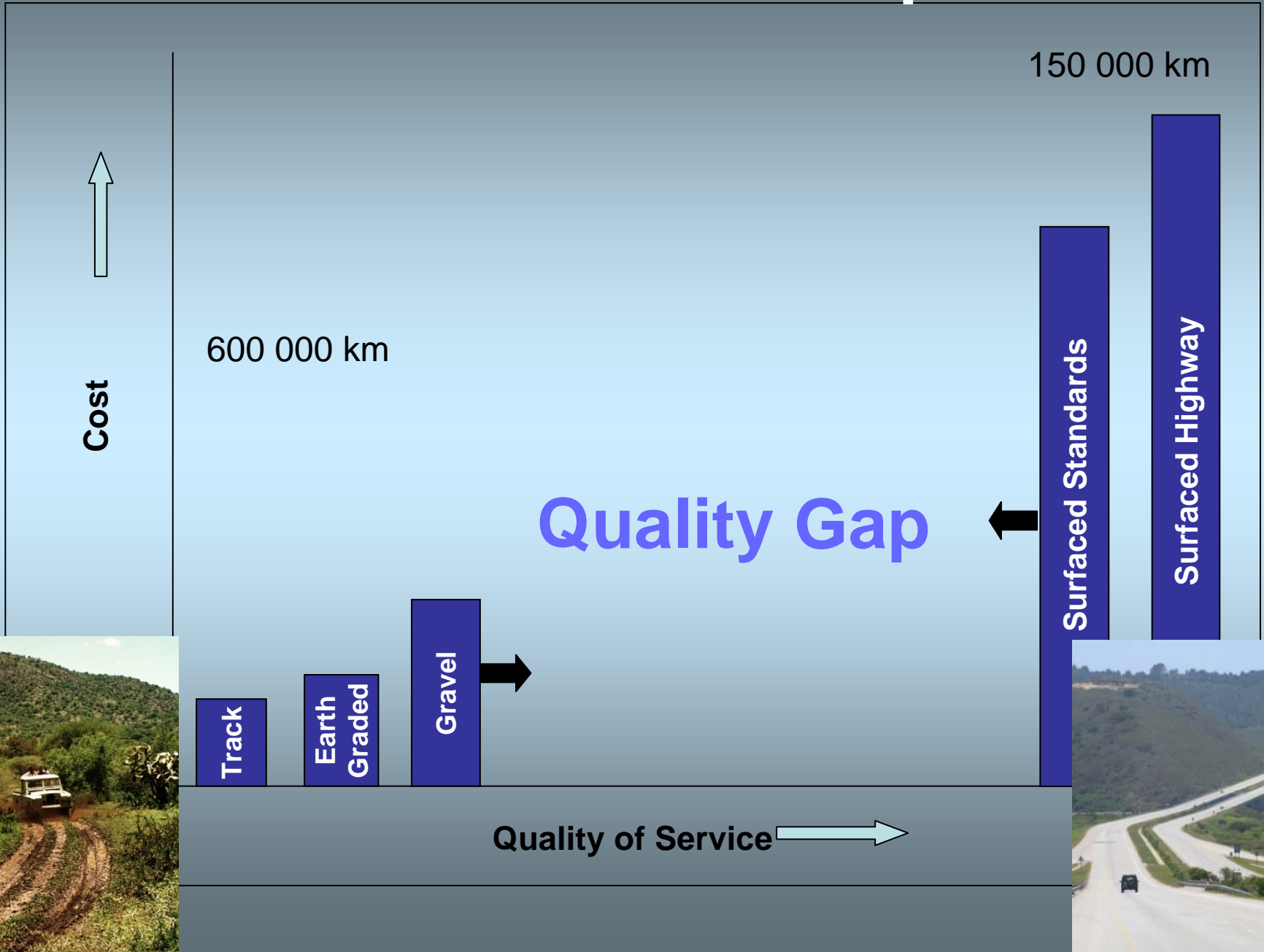
Road Pavement Forum 13 – 14 May 2009

Optimisation of gravel road maintenance

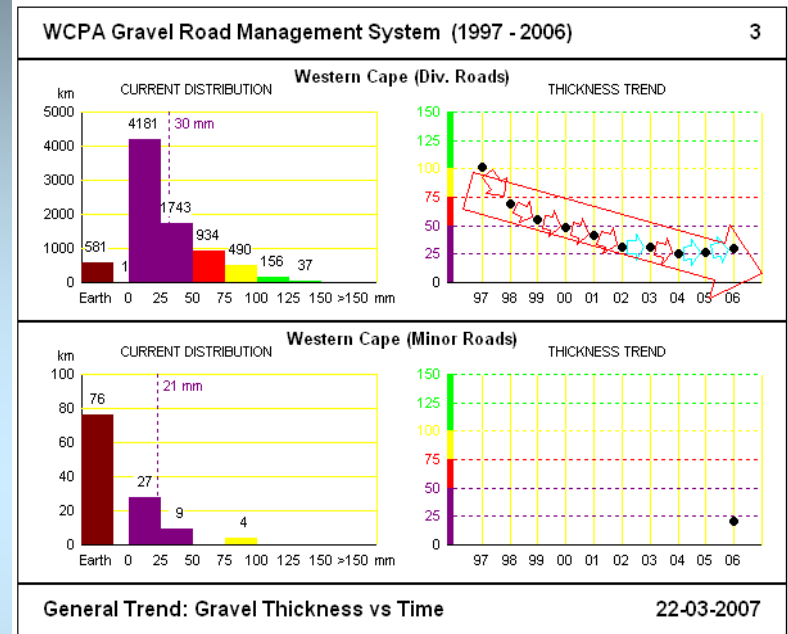
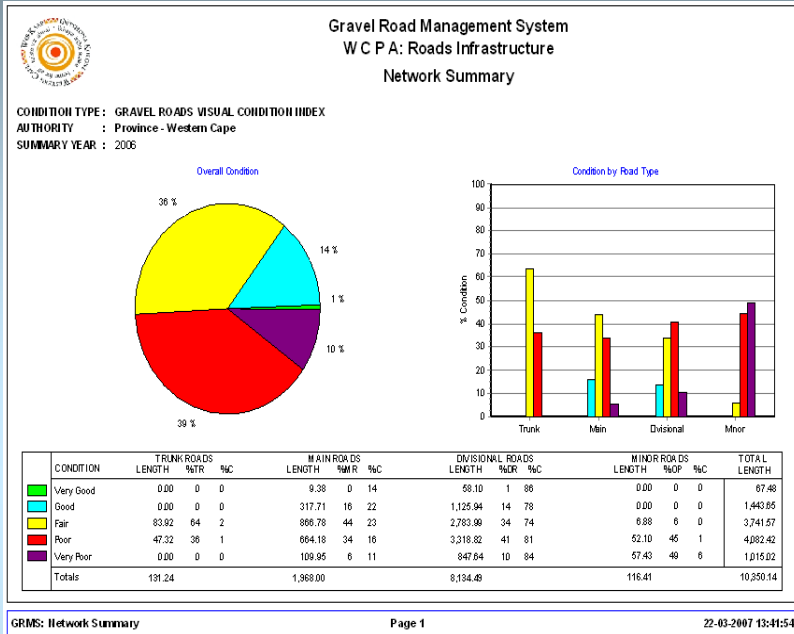


**Gerrie van Zyl &
Hans Ottervanger**

SA Road User Perception



ROAD MANAGEMENT SYSTEM RESULTS



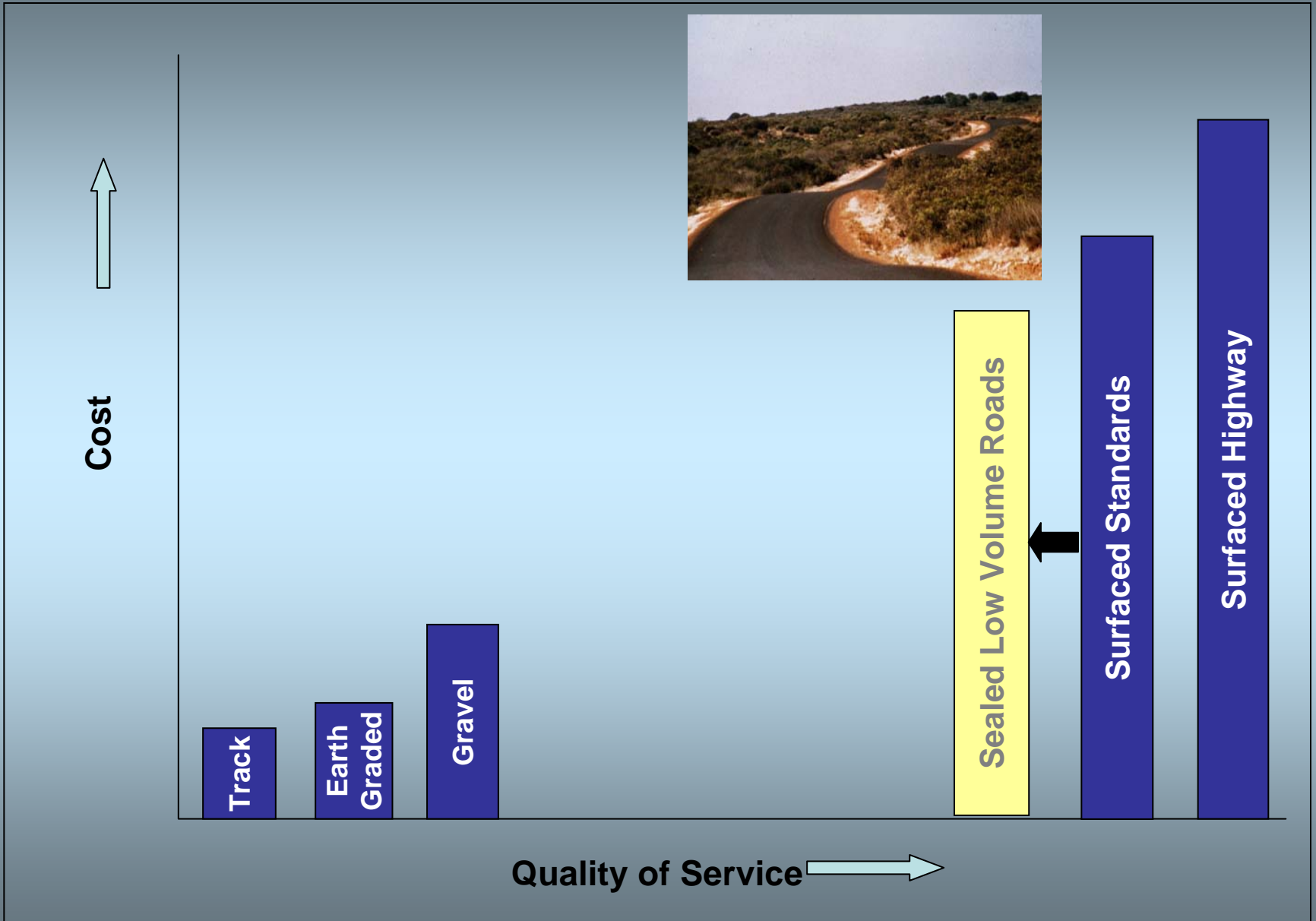
Road User Response



AFRICA SPEED TRAP



Current drive in southern Africa



Quick survey on LVSR in SA

AREA	Kilometres
Formal Transvaal Province (Now incorporating Gauteng, Mpumalanga, Limpopo, North West)	+800
Western Cape	+ 500
Kwazulu Natal	+1000
Free State	+ 300

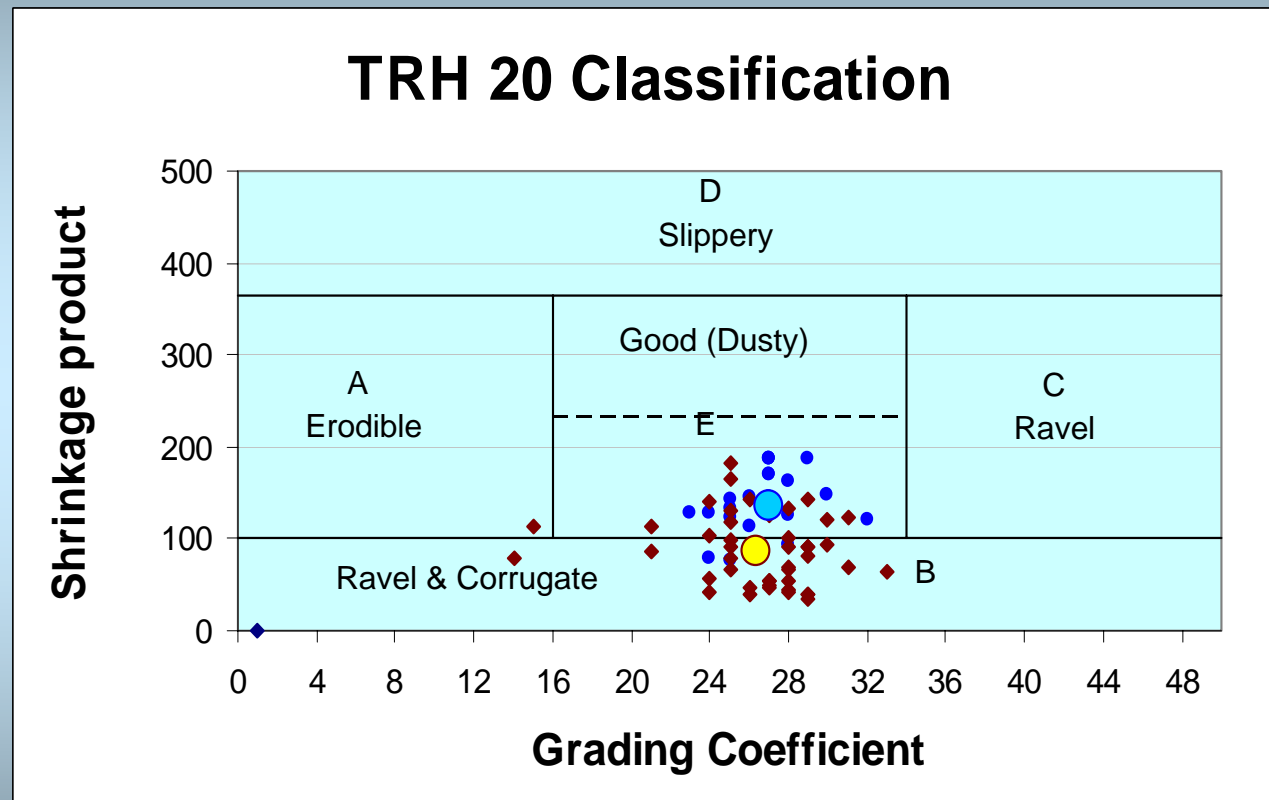
2001

Western Cape improvement strategy

17 Actions initiated including

- **Assistance (Appointment of 5 Consultants)**
- **Management**
 - Upgrading of the Gravel Road Management System
 - Development of Gravel Management System
 - Keeping track of productivity and cost
- **Road and material design**
 - Borrow pit investigation
 - Formal design and approval
- **Construction**
 - Training
 - Quality control
 - Trial sections
 - Processes & Equipment

Material selection & mechanical modification

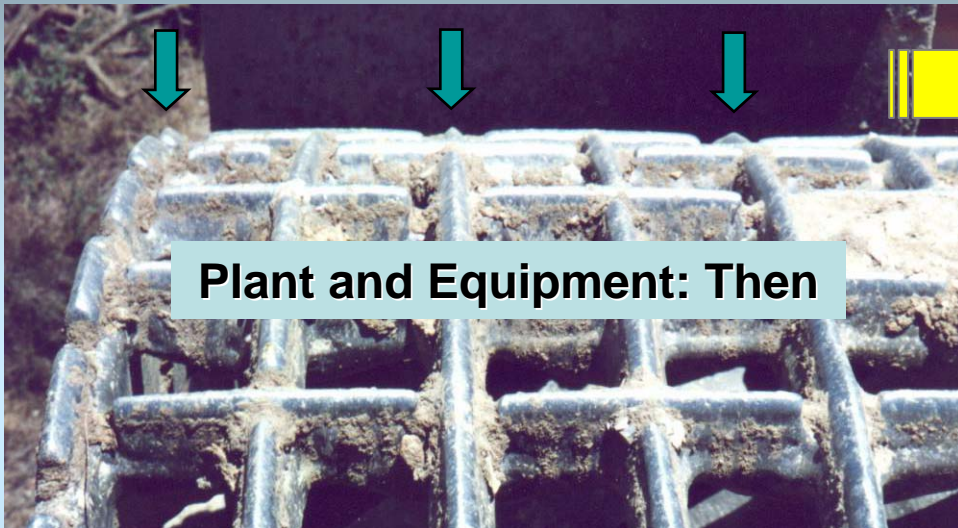


Shrinkage product (Sp) = % linear shrinkage x % passing 0,425 mm sieve

Grading coefficient (Gc)

= $([\% \text{ passing } 26,5 \text{ mm} - \% \text{ passing } 2,0 \text{ mm}] \times \% \text{ passing } 4,75 \text{ mm}) / 100$

Construction Plant & Quality Control



Plant and Equipment: Then



Plant and Equipment: Now



Construction: Place & Go!



Construction: Quality & Control

Controlled Construction Processes

Effective Grid rolling



Remove Oversize Manually



Pneumatic Roller Final Compaction



Wet Rolling (Slushing)

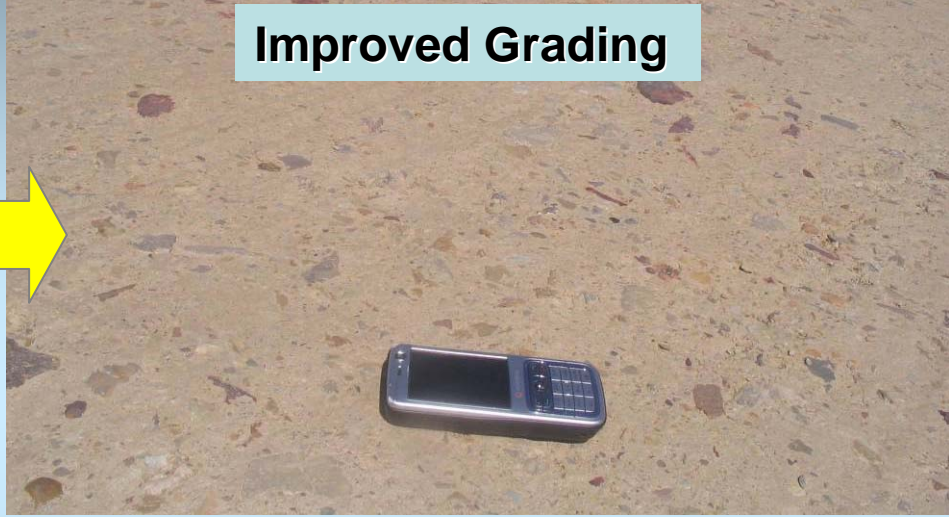


Wearing Course Finish

Poor Grading



Improved Grading



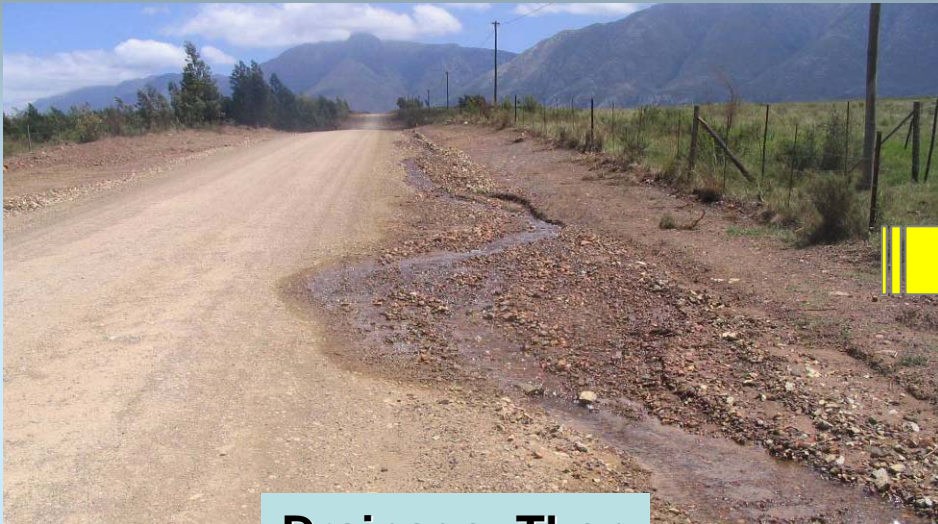
Compaction at OMC



Excellent Riding Quality



Drainage



Drainage: Then



Drainage: Now

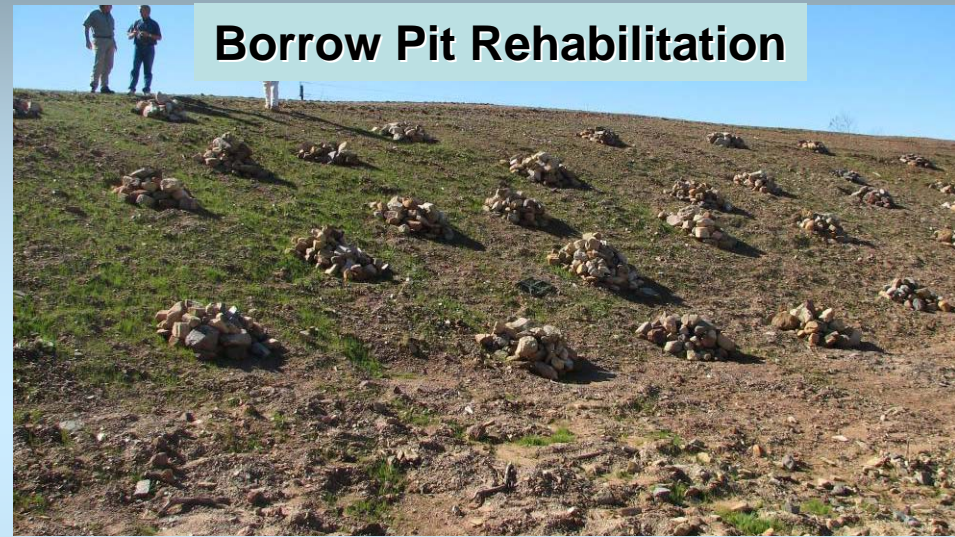


Borrow Pit Development, Mining & Rehabilitation

Public Participation



Borrow Pit Rehabilitation



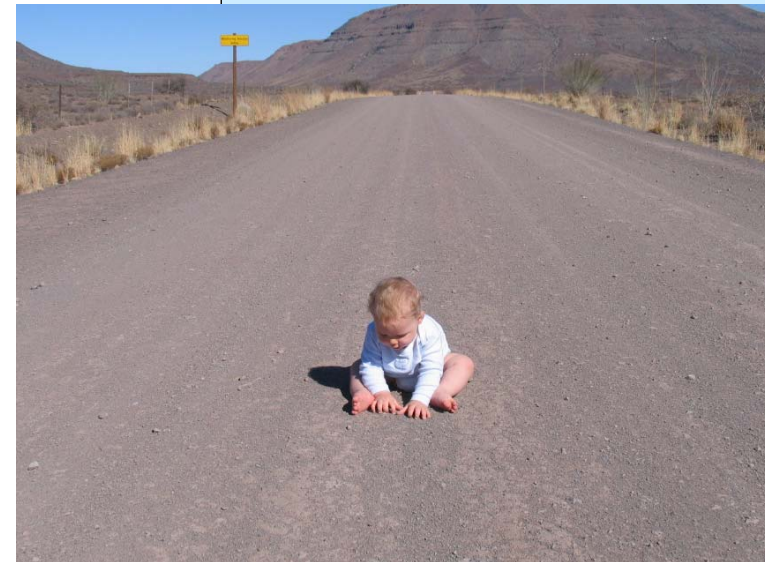
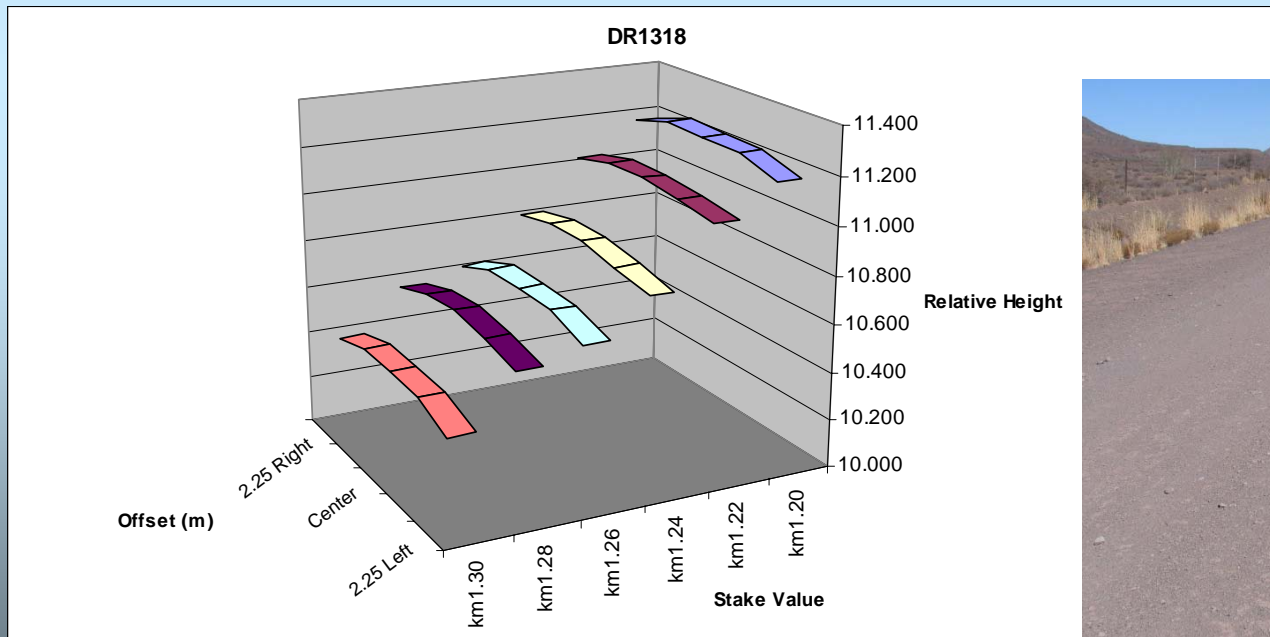
Improved Mining Techniques



Environmentally friendly toilets

PERFORMANCE MONITORING

- Visual assessment of distress development and progression
- Roughness measurement
- Gravel loss and shape change measurement
- Structural capacity
- Change in material properties



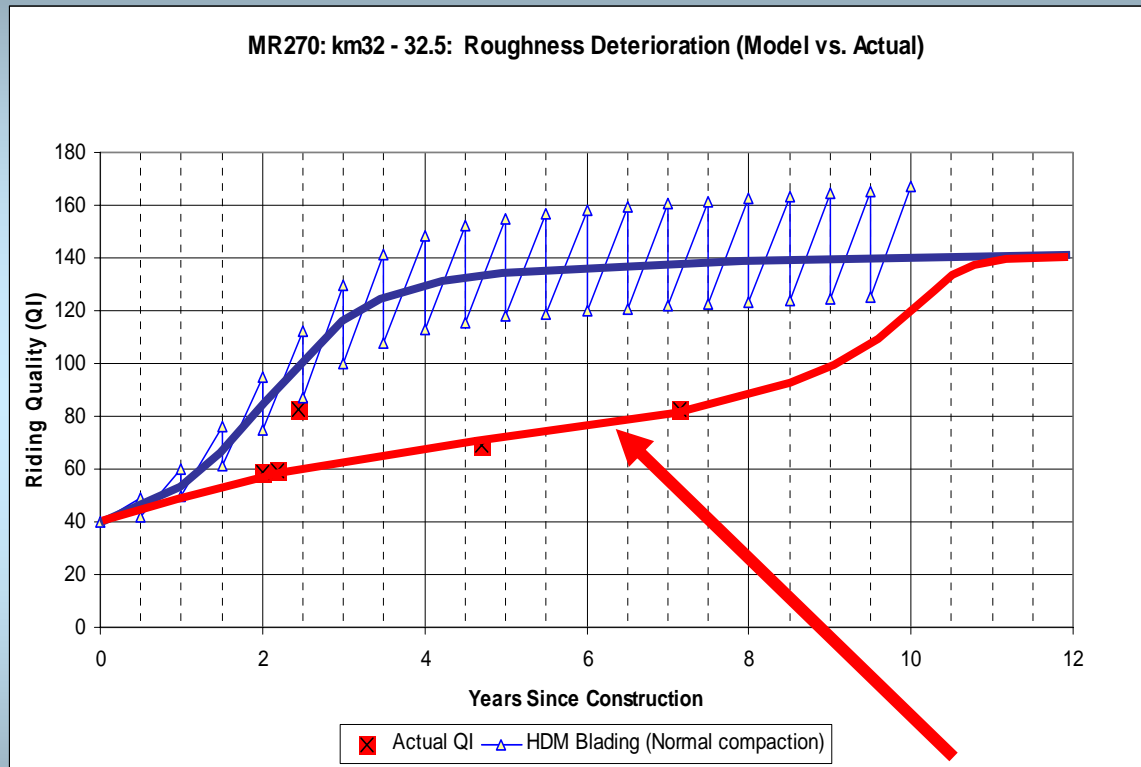
Impact on gravel loss



Gravel Loss less than 50% of predicted

OBSERVATIONS AND IMPLICATIONS

- Much slower roughness deterioration than predicted

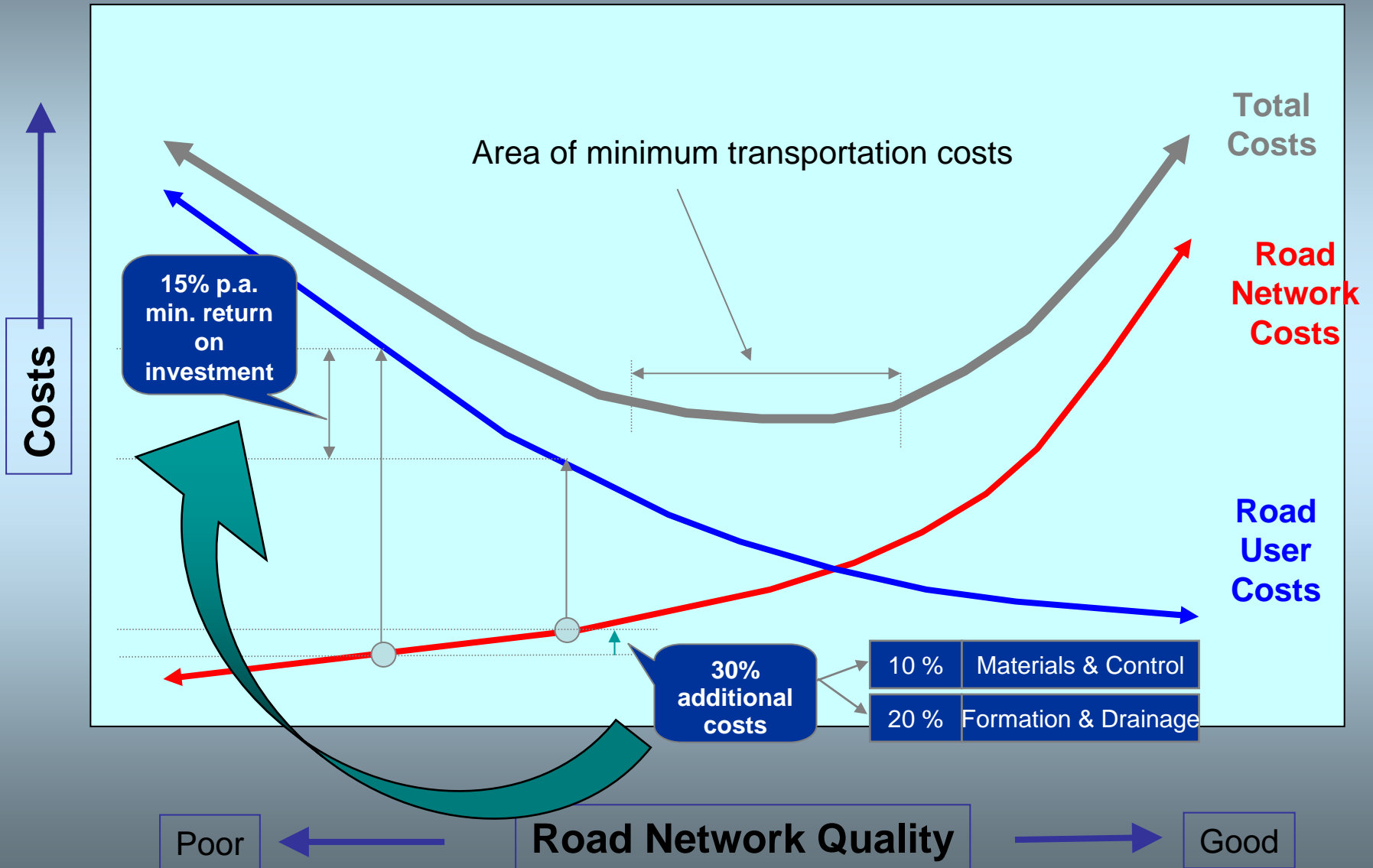


AADT = 66, 17% heavy

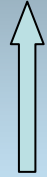


Improved performance directly related to savings in VOC

EFFECT OF IMPROVEMENTS IMPLEMENTED



Cost ↑



Quality of Service ↑



Track

Earth Graded

Gravel



Well designed Engineered Gravel



Sealed Low Volume Roads

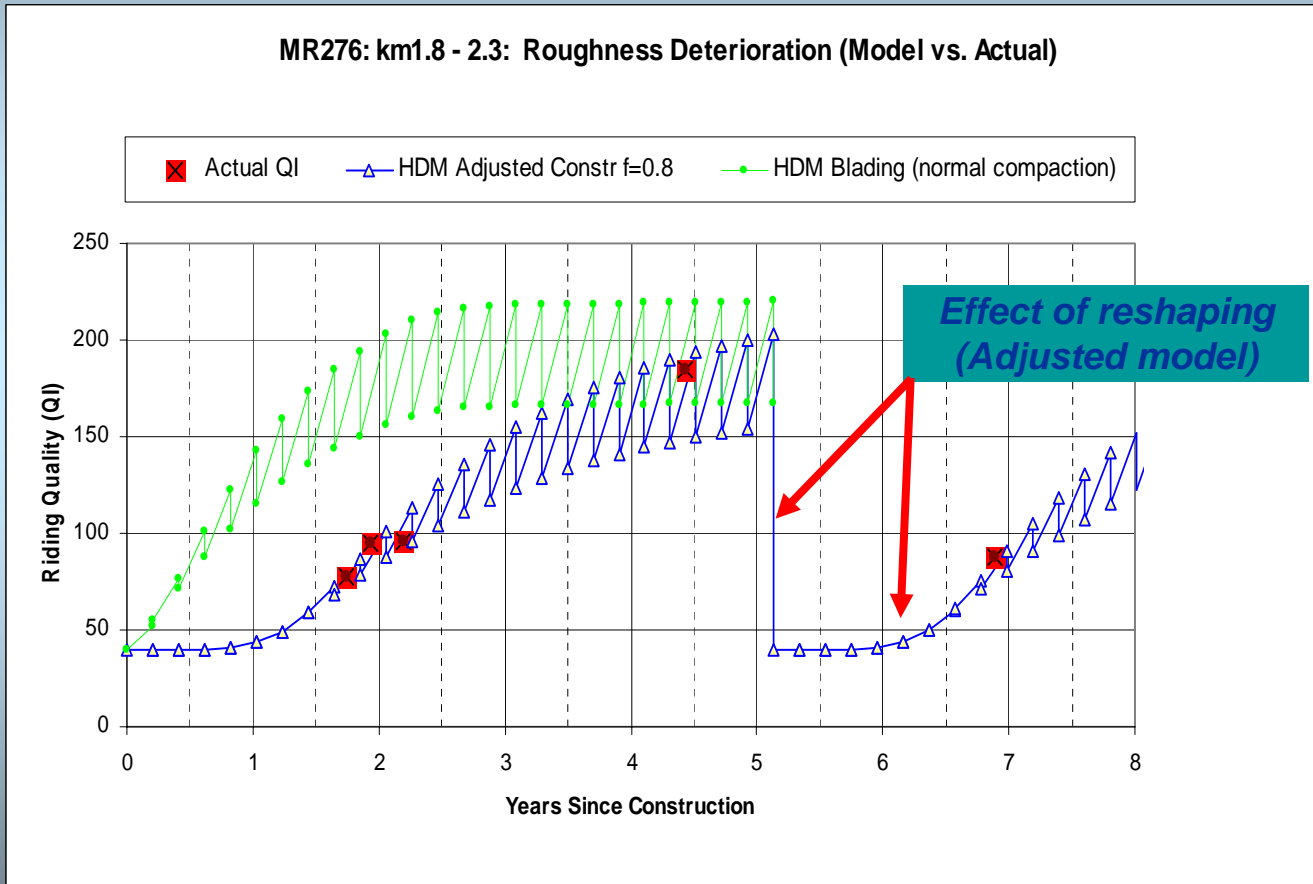


Surfaced Standards

Surfaced Highway

Maintenance strategy changed

- Reshaping more economic than continuous blading at high roughness levels



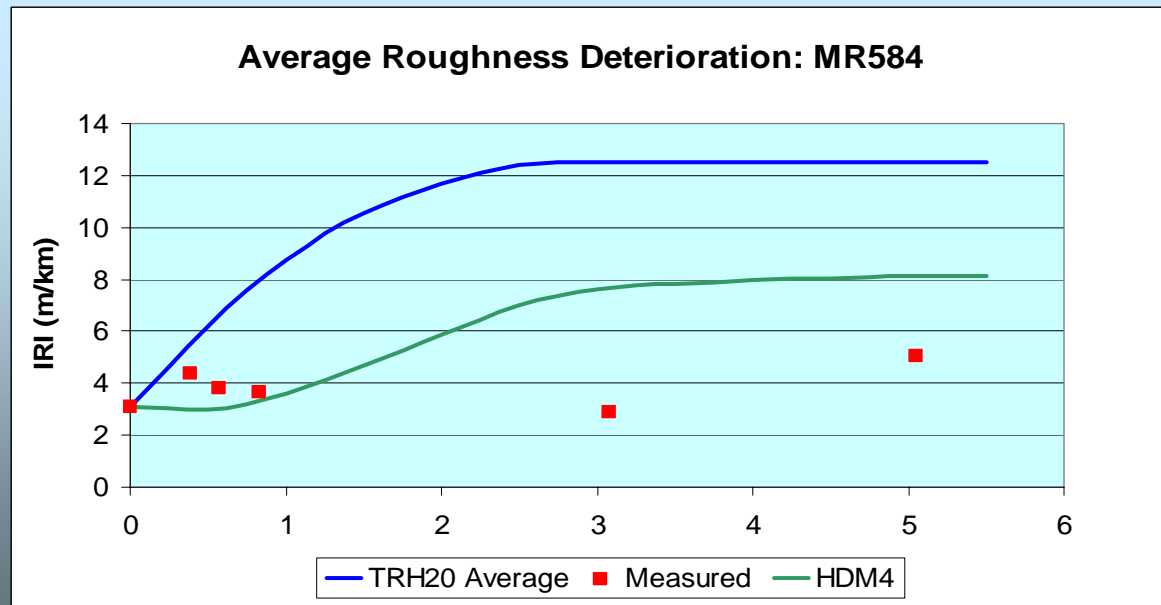
AADT = 323, 19% heavy
(2001)



AADT > 500
(2007)

CONCLUSIONS ON LIGHT BLADING

- Correct regular light blading prevents rapid deterioration
- Confirm “NO” deterioration as a result of blading
- The effect of light blading not simulated by current models
- More than double the frequency of hard blading, but blading at higher speed (up to 70 blade km per day)
- Applicability of light blading strategy dependent on quality of construction and suitability of available maintenance material



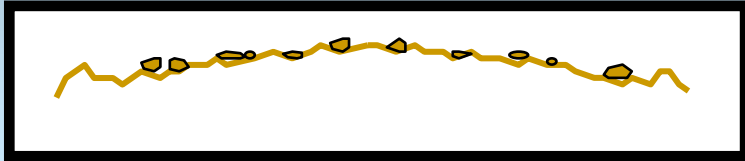
AADT = 86, 14% heavy

Eden drive towards optimising blading strategy

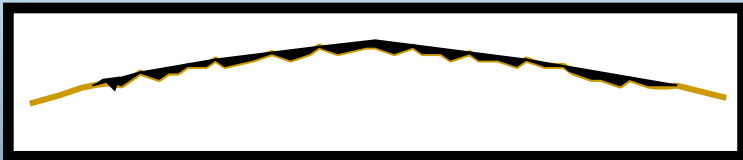
- **Task team under J Strydom & H Ottervanger**
- **Workshop on blading best practice**
- **Field visits**
- **Obtain all available information from WCPA**
- **Categorise road network**
- **Workshop to formulate best strategy**
- **Documentation**
- **Implementation**
- **Training**

Light blading

- Remove cohesionless material



- Spread fine material (moist & slightly plastic)



Grading/ Hard Double Blading

- **Grading/ Heavy Blading**

- Typically < 50 mm distress/ deformation
- Moisten
- Loosen
- Restore shape
- Roll



Reshape/ Rework

- Reshape/ Rework i.e. reconstruct wearing course layer using the existing material

Drainage

Rip

Moisten



oversize

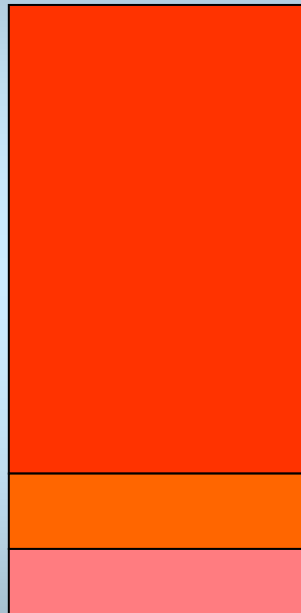


EFFECT OF BLADING FREQUENCY



Cost components

ROAD USER COSTS

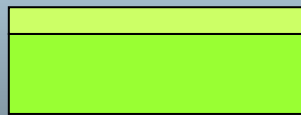


VEHICLE OPERATING COSTS

TIME COSTS

ACCIDENT COSTS

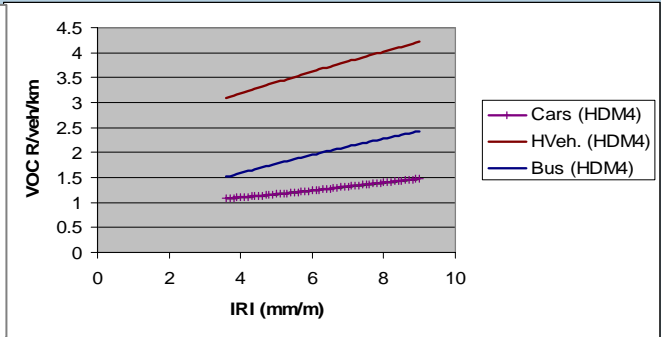
AGENCY COSTS

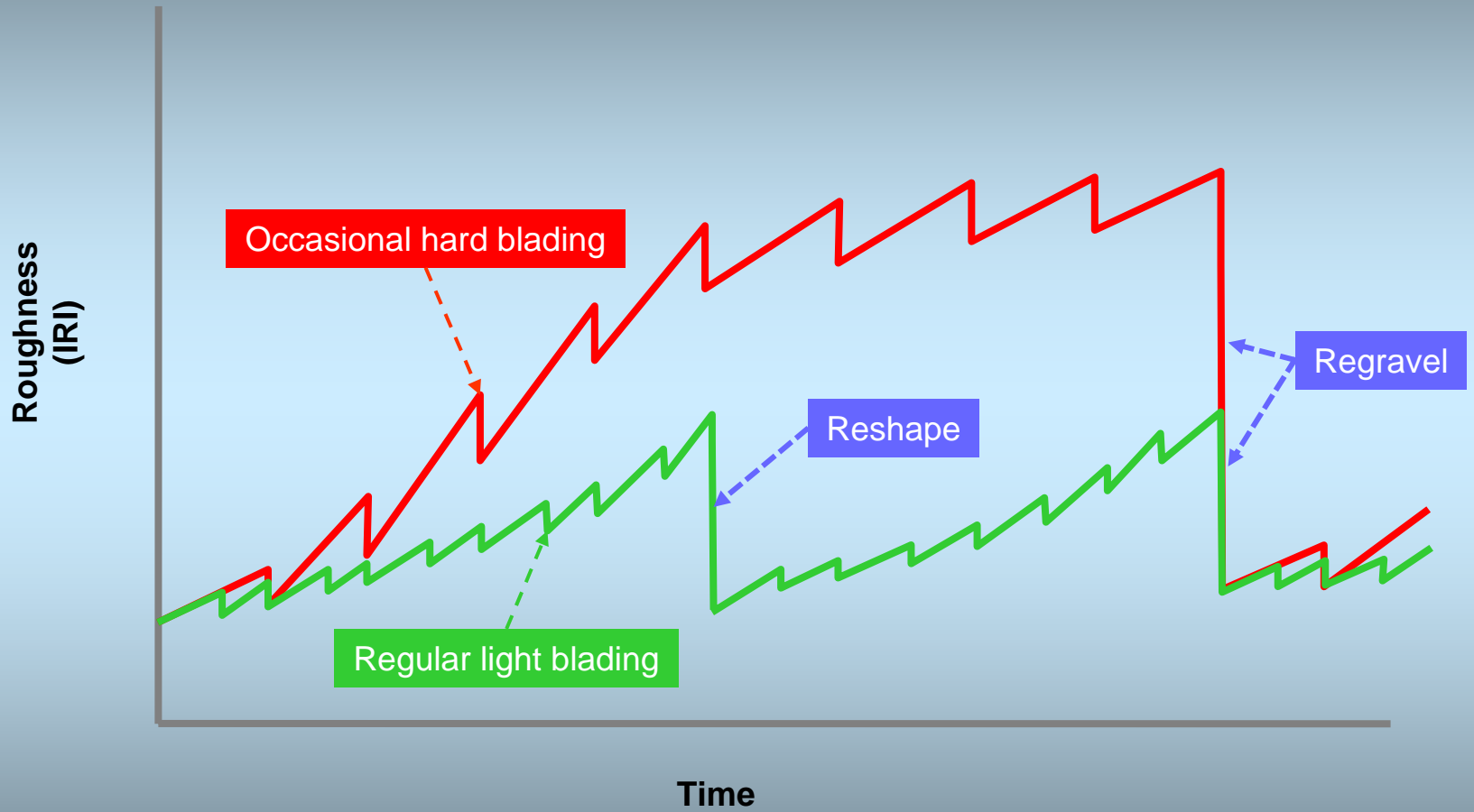


MAINTENANCE COSTS

CONSTRUCTION COSTS

Direct relationship between VOC and Riding Quality





Eden drive towards optimising blading strategy

- Task team under J Strydom & H Ottervanger
- Workshop on blading best practice
- Field visits
- Obtain all available information from WCPA
- Categorise road network
- Workshop to formulate best strategy
- Documentation
- Implementation
- Training

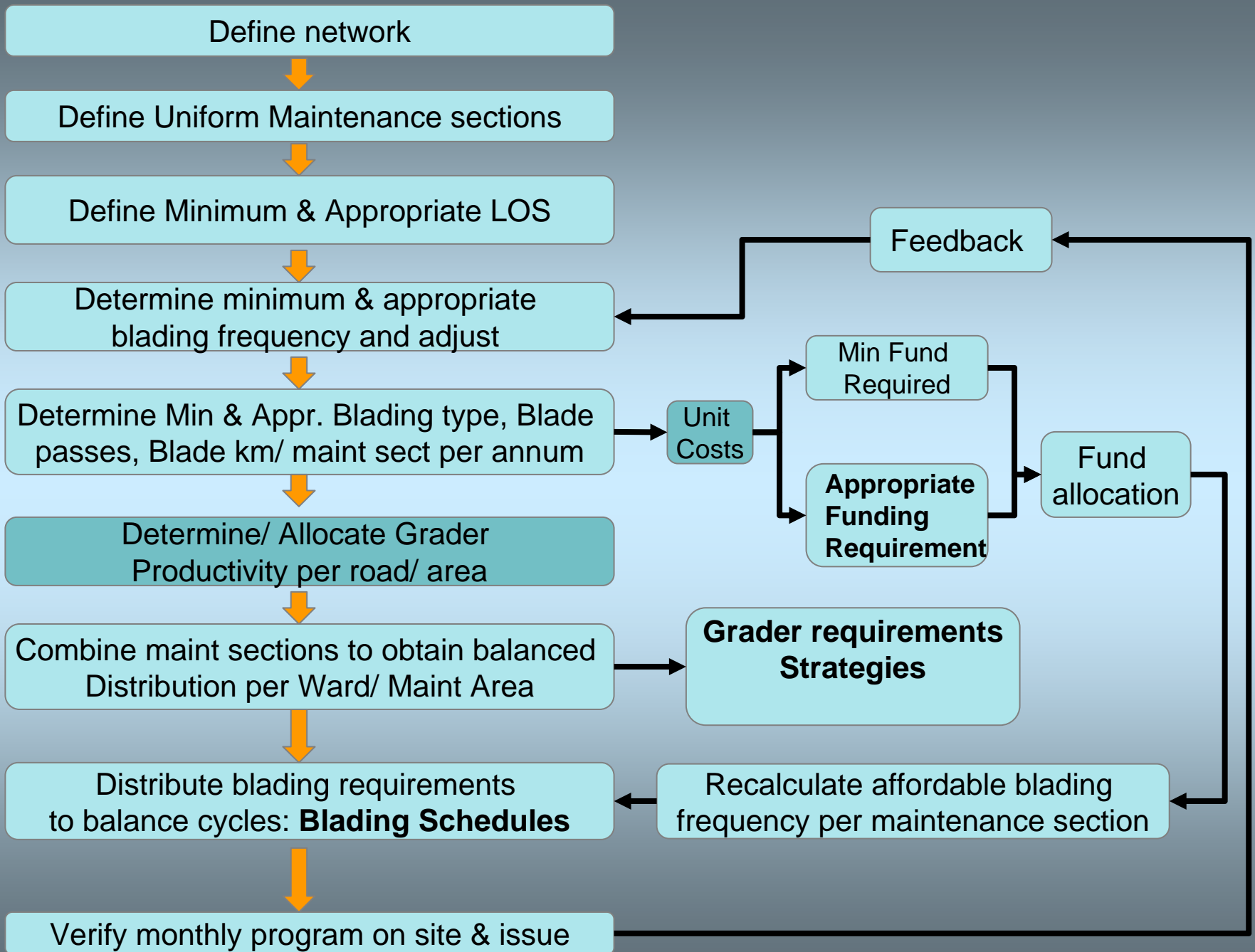


Table 6 Productivity (Blade km per day)

Maintenance measure	Easy Conditions	Moderate	Difficult conditions
Light blading	65	45	25
Hard rain blading	30	25	20
Hard blading with water bowser	20	15	10

Note:

Difficult conditions could include

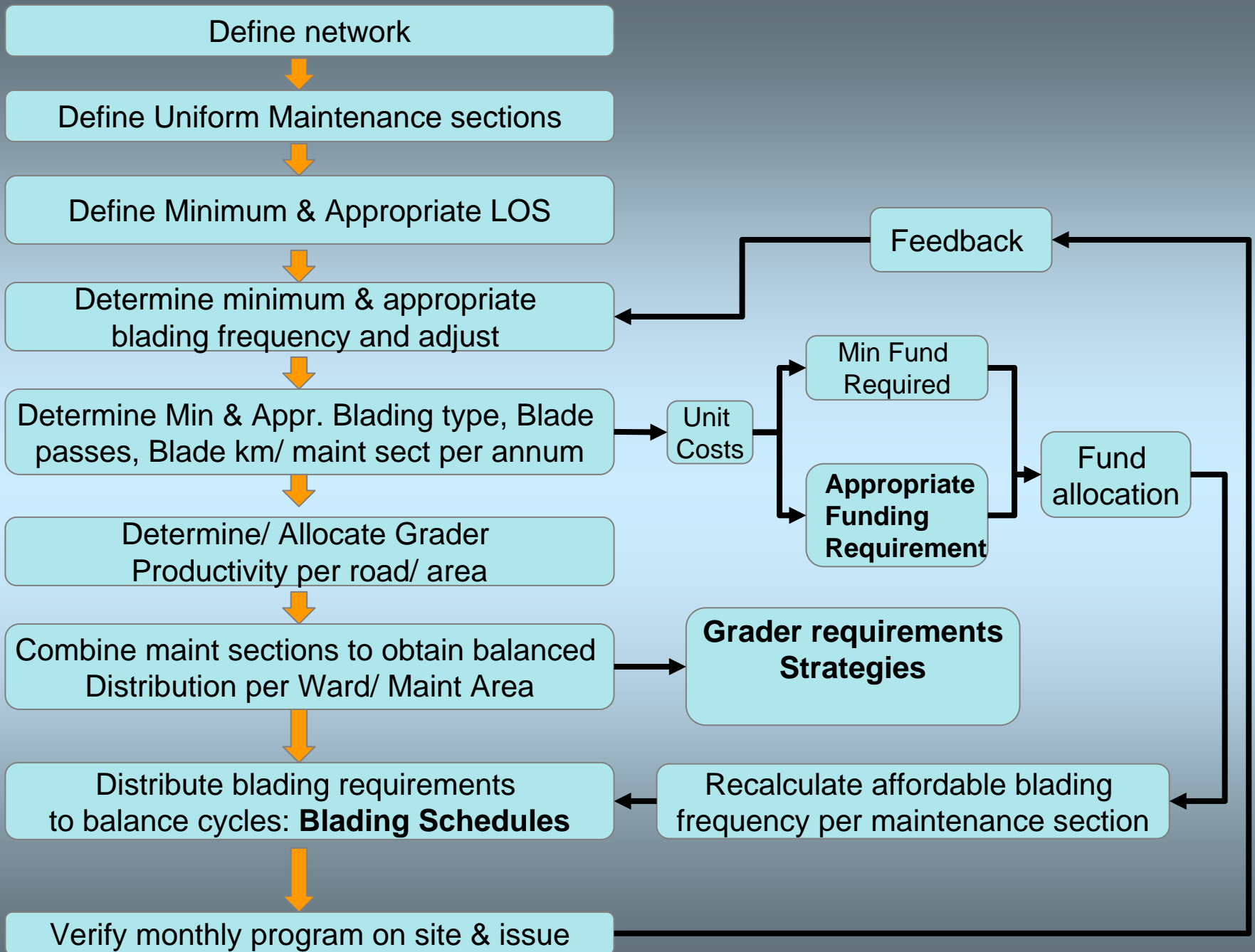
- Only 4 working hours due to travel policy/ distance to depot
- Steep grades
- High traffic volumes resulting in shorter blading sections and additional time to accommodate traffic
- Hard material
- Poor condition
- Long haulage for water bowser

Easy conditions include

- Moist fine material
- Flat areas
- Close to base (long potential working hours)
- Low traffic volumes

Table 11 Equipment costs

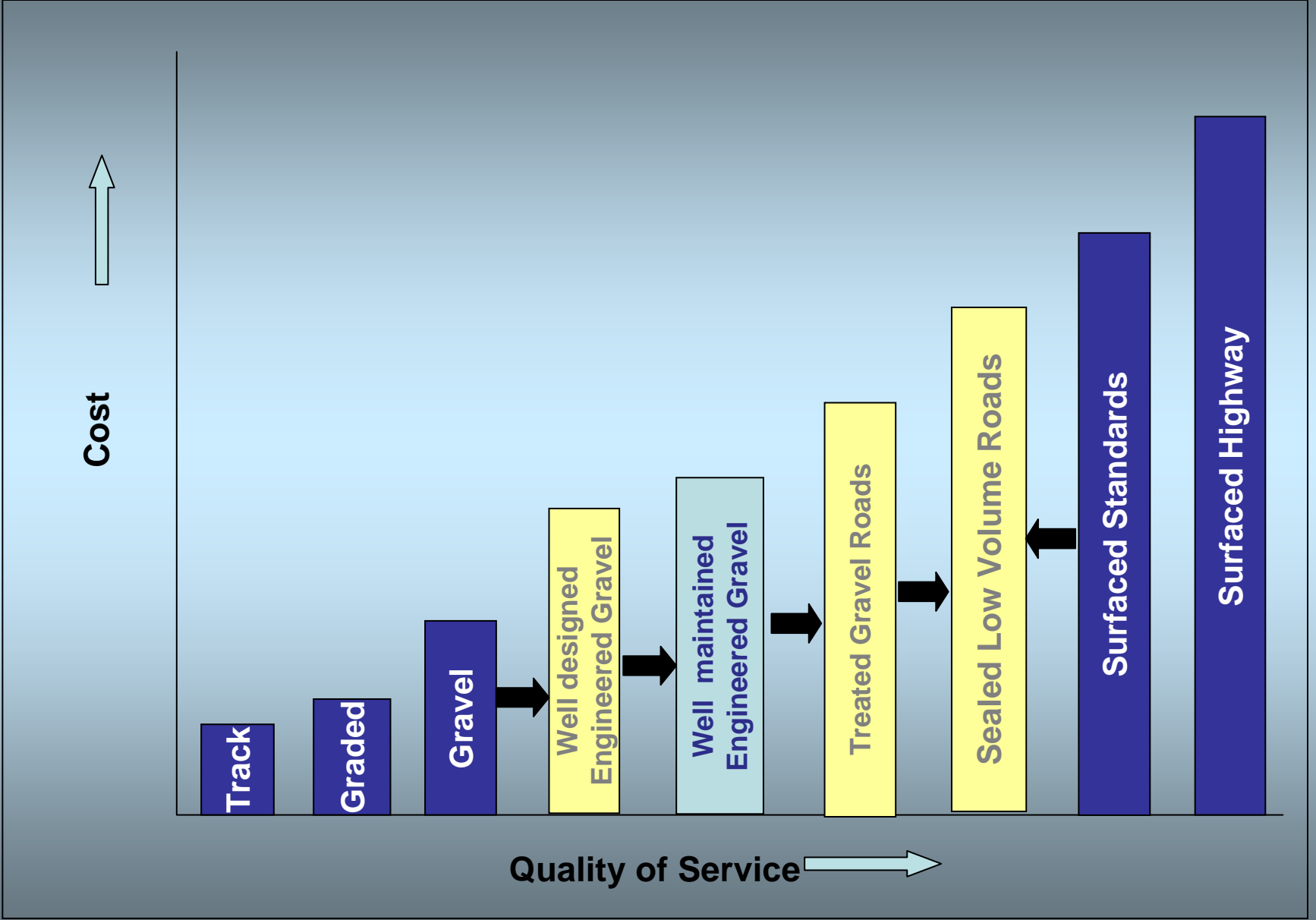
Equipment	Cost per hour (including operator)	Cost per day	Cost per blade km (15 blade km per day)	Cost per blade km (20 blade km per day)	Cost per blade km (25 blade km per day)	Cost per blade km (50 blade km per day)
Production (km/day)			15	20	25	50
Maintenance grader	R 353.80	R 2,830.40	R 188.69	R 141.52	R 113.22	R 56.61
Water bowser	R 326.68	R 2,613.44	R 174.23	R 130.67	R 104.54	
			R 362.92	R 272.19	R 217.75	
Vibratory roller (12 ton)	R 871.00	R 6,968.00	R 464.53	R 348.40	R 278.72	



Funding model (Reallocation)

Traffic (AADT)	Gravel thickness	Environmental	Climate (Weinert)
50%	20%	20%	10%

Agricultural Sensitive Produce	Agricultural Non-Sensitive Produce	Tourism	Connection Route
40%	20%	20%	20%



Results after implementation

- **Well defined monthly programs**
- **Major reduction in complaints**
- **Positive feedback from communities/ RU**
- **Ability to adjust blading programs with reduced/ increased funding**

Monthly program issued to operator

EDEN DISTRIKSMUNISIPALITEIT: DEPARTEMENT TEGNIESE DIENSTE
MAANDBEPLANNING: JULIE 2008

WYK: Odn Wes

Bertus Hartzenberg

Hoeveelheid werksdae vir operateur in maand:

16

Beplande lem km vir maand:

320

SIKLUS	PAD NOMMER	PAD NAAM	KILOMETER AFSTAND		LEM KM	TAAKBESKRYWING	OPMERKING	AFGEHANDEL
			VAN	TOT				
1	DR01649	Paardebont	0.00	3.42	14	Ligte droë skraap		
1	DR01649	Paardebont	3.42	20.00	66	Ligte droë skraap		
1	DR01649	Paardebont	20.00	42.60	90	Ligte droë skraap		
1	DR01656	Saffraanrivier	0.00	12.36	49	Ligte droë skraap		
1	DR01677	Zeekoegat/Wynands	0.00	11.18	45	Ligte droë skraap		
1	DR01693	Steenondepad	0.60	12.37	47	Ligte droë skraap		
	DR01655	Mount Hope	0.00	4.00	16	Ligte droë skraap		
	DR01655	Mount Hope	4.00	11.50	30	Ligte droë skraap		

Totale Beplande Lem km vir die maand: 357

Nota: Operateur moet in opmerking kolom die skraaptoestande beskryf Bv Nat, Baie droog, Stofgate ens.

Operateur moet datum waarop seksie afgehandel is in afgehandel kolom skryf.

Die Vorm moet aan die einde van elke maand ingehandig word by die supt.

Operateurs inligting:

Datum		TAAKBESKRYWING	Addisionele inligting rondom staantyd, soos reen, werktuig breek, operateur siek ens.
Van	Tot		
1-Jul-08		Padskraaper operateurs vergadering	
23-Jul-08		Spanbesoeke met Gert, Alvin, Maevia, Reginald	
28-Jul-08	31-Jul-08	Nqf 4 kursus	

Results after implementation

- Well defined monthly programs
- Major reduction in complaints
- Positive feedback from communities/ RU
- Ability to adjust blading programs with reduced/ increased funding
- Ability to manage emergency work

Note: Process verified with other authorities – TRH20

- Emphasis now on training (DVD)

END

