APPENDIX J-5

THE DEDUCT POINT SYSTEM

Table 2: Example of Condition Categorisation: Crocodile Cracking

Cracks : Crocodile					
Degree	Isolated ← Extent → Extensive				
	1	2	3	4	5
1	VG	VG			
2	VG			F	F
3		F	F		
4		F			VP
5				VP	VP

ii. ***Step 2: Assign Deduct Points***

Based on the generic condition category ranges defined in Table 1 above, a Deduct Point range is also defined for each condition category in Table 3 below.

Table 3: Condition Category Ranges and Related Deduct Point Ranges

Condition Category	Condition Index Range		Deduct Point Range	
	Minimum	Maximum	Minimum	Maximum
VG	85	100	00	15
F	50	<70	>30	50
VP	00	<30	>70	100

The Second Step is to select an appropriate Deduct Point within the Condition Category range for each Degree and Extent combination in the matrix. Table 4 represents the Deduct Points selected for crocodile cracking by the expert panel.

Table 4: Example of assigned Deduct Points for Crocodile Cracks

Cracks : Crocodile					
Degree	Isolated ← Extent → Extensive				
	1	2	3	4	5
1	4	12			
2	12			31	35
3		31	40		
4		50			65
5				70	80

Graphical displays are also used to visualise the Deduct Point allocations and ensure smooth transitions between condition categories. Figure 1 provides an illustration of the Deduct Point allocation for the crocodile cracking example used in the subsection.

It is important to note that the allocation of these Deduct Points is specific to the condition index being calculated. For example the crocodile cracking Deduct Point for the Condition Index – Surfacing (CI_{SURF}) will be different to the crocodile cracking Deduct Point for the Condition Index – Pavement (CI_{PAVE}). A Deduct Point of zero could even be allocated if the defect does not contribute to the Condition Index being calculated.

particular defect (say for crocodile cracking – Table 4) is then adjusted and all the Defect combinations' deduct points re-ranked.

The process continues until the panel is confident that the ranking represents the correct contribution to the specific condition index.

iv. ***Step 4: Aggregation***

In the final step the contribution of different defects are aggregated to a "Total Deduct Point (TDP)" (Maximum 100). Experience in evaluating feedback from practitioners, indicates that:

- In giving reasons for placing a road in a certain condition category (e.g. poor), there is seldom the need to use more than 3 significant defects. (*For example, a road is in a poor condition due to crocodile cracking, pumping and potholes).* In the Deduct Point System used here, provision has been made to incorporate up to six (6) defects
- The contribution of the primary defect (highest Deduct Point) should be taken as the full value (100%).
- The contribution of the secondary defect should be in the order of 20% to 30% of the assigned Deduct Point.
- The contribution of the tertiary defect should be in the order of 10% of its Deduct Point.
- Contribution of additional defects should not be more than 5%.
- This gives a total of 170% of all deduct points for 6 defects.
- Limit the TDP to 100 in order not to obtain negative values.
- Specify that certain defects cannot act as Primary defects. Pumping of fines is one such an example

The Total Deduct Point (TDP) is therefore defined as:

$$TDP = DP1_{PRIM}+(a)*DP2_{SEC}+(b)*DP3_{TERT}+(c)*DP4_{OTHER}+(d)*DP5_{OTHER}+(e)*DP6_{OTHER}$$

DP1 = Deduct Point with highest value

DP2 = Deduct Point with next highest value, etc.

(a) = 0.20

(b) = 0.10

(c) = 0.05

(d) = 0.05

(e) = 0.05

4. DEDUCT POINT APPLCATION: CONDITION INDEX PAVEMENT (CI_{PAVE})

b) Deduct Point Equation

The Condition Index Surfacing (CI_{PAVE}) is defined as:

$$CI_{PAVE} = DP1_{Prim} + (a)*DP2_{Sec}+(b)* DP3_{Tert}+(c)*DP4_{other}+(c)*DP5_{other}+(c)*DP6_{other}$$

(a) = 0.20

(b) = 0.10

(c) = 0.05

(d) = 0.05

(e) = 0.05

The Deduct Points for each defect contributing to the CI_{SURF} can be read from the Tables 8-20 to 8-31.

Table 7: Example of Deduct Point Calculation (CI_{PAVE})

Defect	Degree	Extent	Deduct Point
Block/Stab. Cracks	0	0	**0**
Longitudinal Cracks	3	2	**25**
Transverse Cracks	3	2	**25**
Crocodile Cracks	3	3	**40**
Pumping	3	3	**31**
Rutting	3	1	**18**
Undulation/Settlement	2	1	**15**
Patching	3	3	**44**
Struct: ailure/Potholes	5	1	**38**
Surface Drainage	4	4	**30**
Unpaved Shoulders	0	4	**0**
Edge Breaking	5	1	**18**

Condition Index (CI_{PAVE})		
Sorted Deduct	**Corresponding Defect**	**Index contribution**
44	Patching	44 (100%)
40	Crocodile Cracks	8 (20%)
38	Struct: Failure/Potholes	4 (10%)
31	Pumping	2 (5%)
30	Surface Drainage	1 (5%)
25	Longitudinal Cracks	1 (5%)
	Total Deduct Points	**60**
	CI = 100 –Total Deduct	**40**
	Condition Category	

Table 8-1

Surfacing Failures/Patching

	Surfacing Failures/Patching				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	None	None	**C**	B	B
2	None	**C**	**C**	B	B
3	None	**C**	B	B	**A**
4	**C**	B	B	**A**	**A**
5	**C**	B	B	**A**	**A**

	Surfacing Failures/Patching				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	2	9	**24**	30	35
2	8	**17**	**29**	35	43
3	13	**24**	36	44	**53**
4	**18**	30	43	**52**	**63**
5	**20**	34	48	**58**	**68**

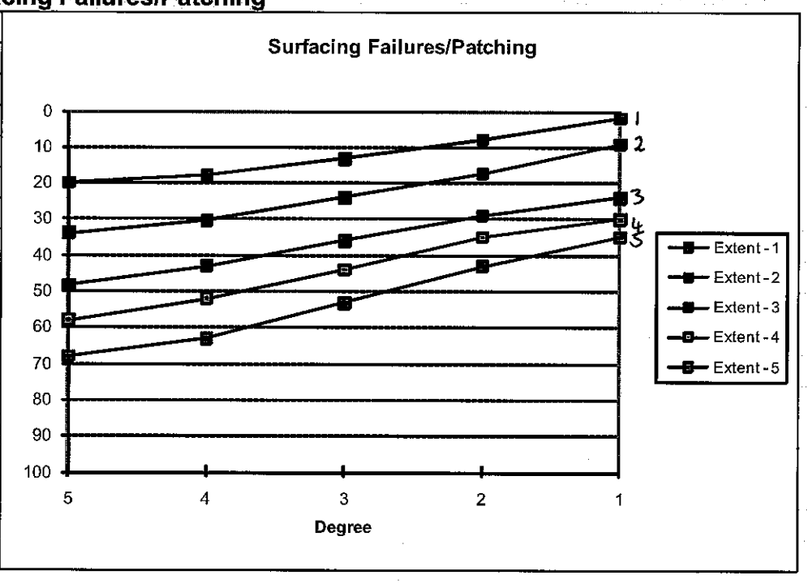

Table 8-3

Aggregate loss

	Aggregate loss				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	None	None	None	None	None
2	None	None	**C**	**C**	**C**
3	None	**C**	**C**	B	B
4	**C**	B	B	**A**	**A**
5	**C**	B	**A**	**A**	**A+**

	Aggregate loss				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	2	4	8	12	14
2	5	11	**18**	**21**	**25**
3	10	**20**	**29**	38	45
4	**15**	32	43	**52**	**60**
5	**22**	42	**55**	**63**	**70**

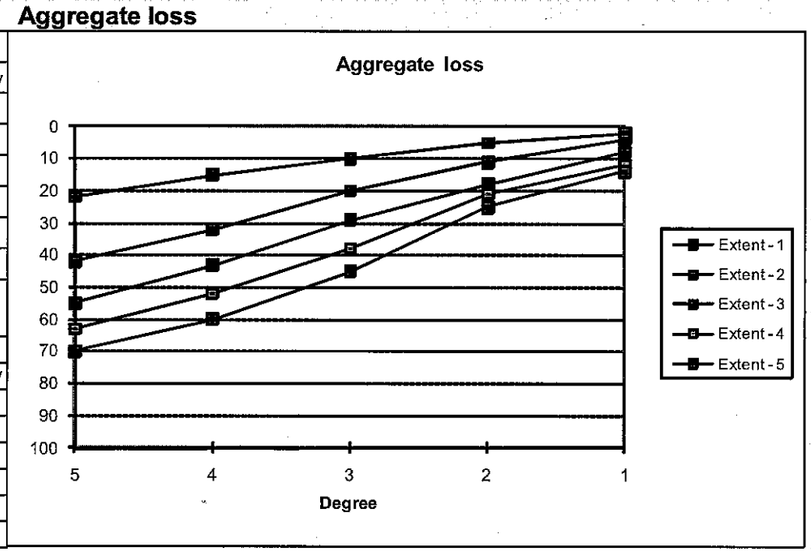

Table 8-5

Bleeding-Fattiness

	Bleeding-Fattiness				
	Few	<– Extent –>			Many
Degree	1	2	3	4	5
1	None	None	None	None	None
2	None	None	None	None	None
3	None	None	**C**	**C**	**C**
4	None	None	**C**	B	B
5	**C**	**C**	B	**A**	**A**

	Bleeding-Fattiness				
	Few	<– Extent –>			Many
Degree	1	2	3	4	5
1	0	1	2	3	4
2	2	4	8	10	12
3	4	10	**17**	**22**	**29**
4	8	14	**25**	35	42
5	**15**	**25**	37	**50**	**60**

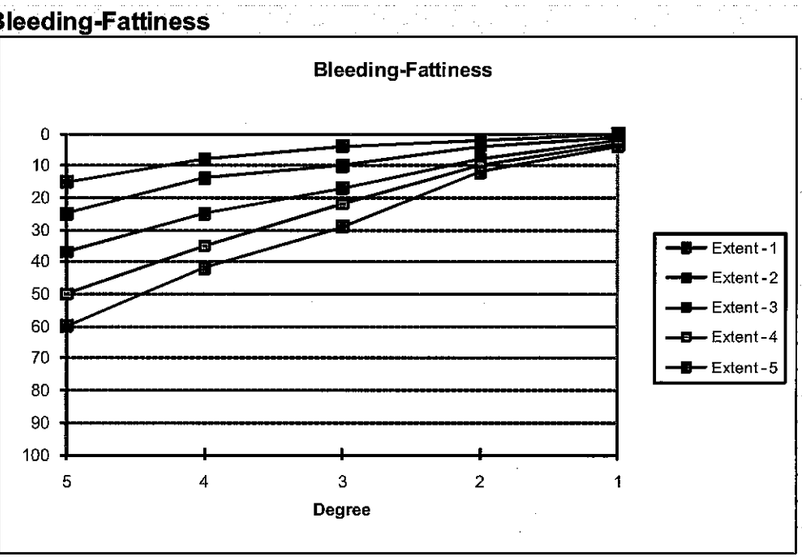

Table 8-7

Cracks-Longitudinal

	Cracks-Longitudinal				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	None	None	None	C	C
2	None	C	C	C	B
3	C	C	B	B	B
4	C	B	B	A	A
5	C	B	A	A	A+

	Cracks-Longitudinal				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	6	12	14	18	25
2	9	21	25	29	35
3	15	26	35	40	45
4	18	35	45	53	60
5	21	40	53	63	70

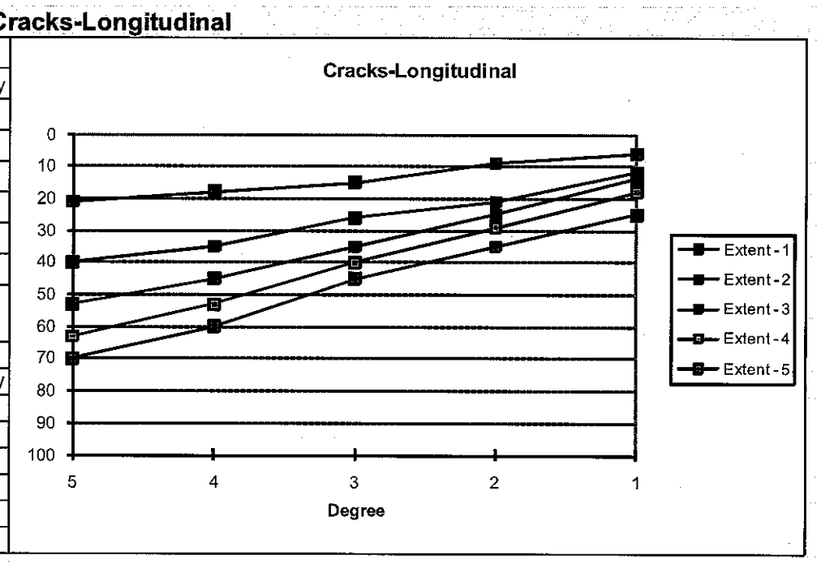

Table 8-9

Cracks-crocodile

	Cracks-crocodile				
	Few		<– Extent –>		Many
Degree	1	2	3	4	5
1	None	None	**C**	**C**	**C**
2	None	**C**	**C**	B	B
3	**C**	B	B	**A**	**A**
4	**C**	B	**A**	**A**	**A+**
5	B	B	**A+**	**A+**	**A+**

	Cracks-crocodile				
	Few		<– Extent –>		Many
Degree	**1**	2	3	4	5
1	4	12	**16**	**21**	**28**
2	11	**18**	**24**	30	35
3	**18**	30	40	**50**	**58**
4	**25**	43	**57**	**65**	**75**
5	33	55	**70**	**77**	**85**

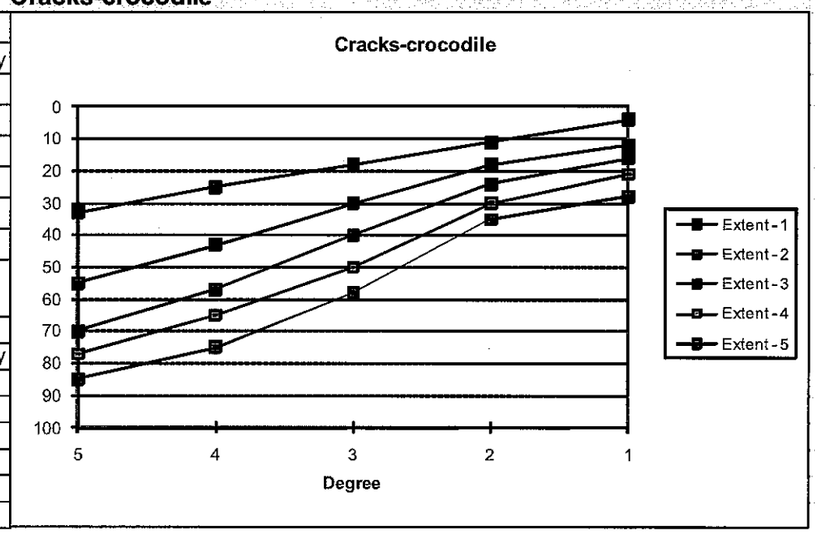

Table 8-11

Rutting

	Rutting				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	None	None	None	None	None
2	None	**C**	**C**	**C**	**C**
3	None	**C**	**C**	B	B
4	**C**	**C**	B	B	**A**
5	**C**	B	B	B	**A**

	Rutting				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	2	4	6	8	10
2	8	**15**	**17**	**19**	**21**
3	12	**20**	**28**	35	40
4	**15**	**25**	35	42	**50**
5	**19**	30	38	48	**59**

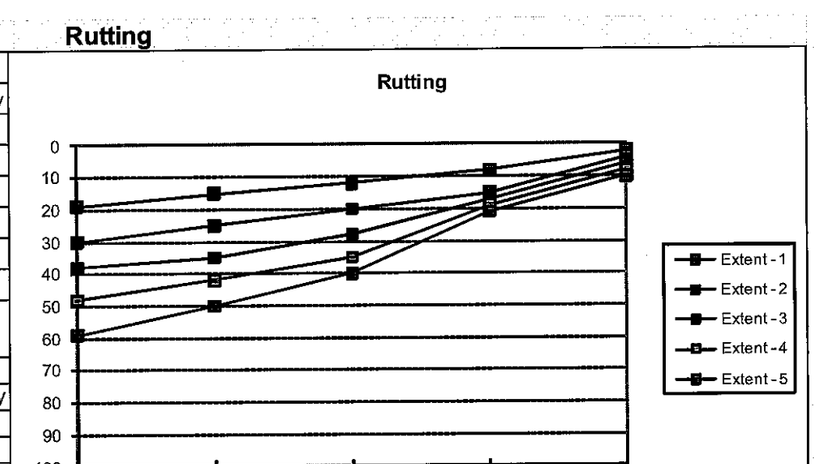

Table 8-14

Potholes

	Potholes				
	Few	<– Extent –>			Many
Degree	1	2	3	4	5
1	None	None	None	None	None
2	None	None	None	None	None
3	None	None	None	None	None
4	None	None	None	None	None
5	None	None	None	None	None

	Potholes				
	Few	<– Extent –>			Many
Degree	1	2	3	4	5
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0

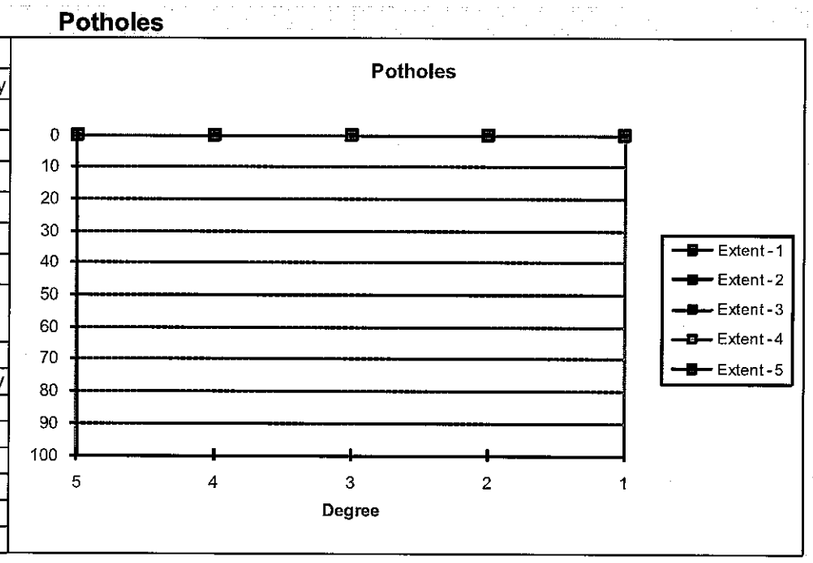

Table 8-15

RIDING QUALITY - SCI

	RIDING QUALITY - SCI				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1				None	
2				None	
3				**C**	
4				**C**	
5				B	

	RIDING QUALITY - SCI				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1				0	
2				8	
3				**18**	
4				**26**	
5				34	

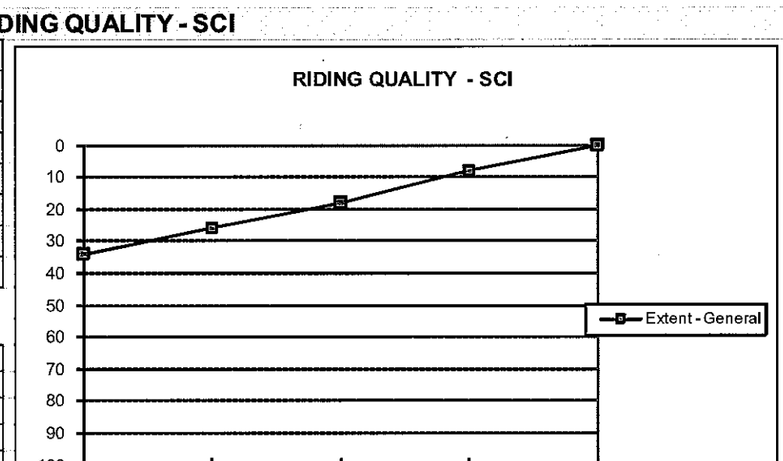

Table 8-18

Unpaved Shoulders

	Unpaved Shoulders				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1				None	
2				None	
3				None	
4				None	
5				None	

	Unpaved Shoulders				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1				0	
2				0	
3				0	
4				0	
5				0	

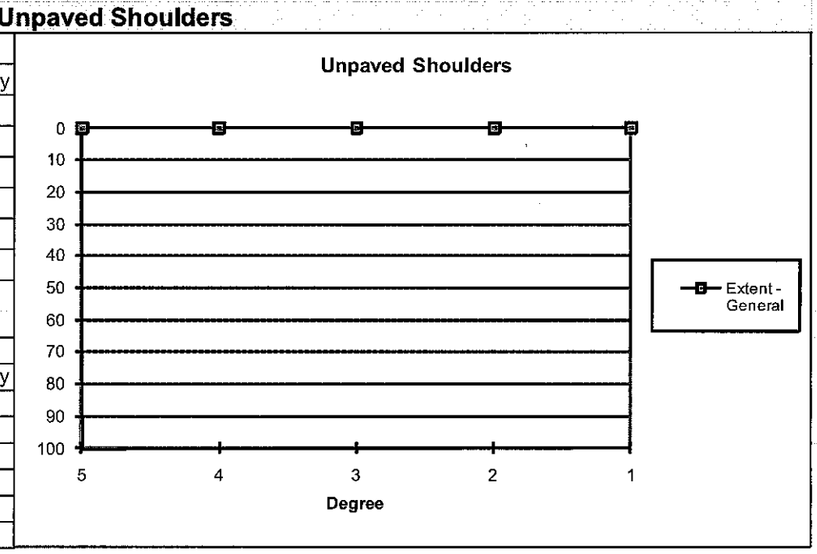

Table 8-19

	Edge Breaking				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	None	None	None	None	None
2	None	None	None	None	None
3	None	None	None	None	None
4	None	None	None	None	**C**
5	None	None	None	**C**	**C**

	Edge Breaking				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	1	1	2	3	4
2	1	2	**4**	**6**	**8**
3	2	**3**	**6**	9	12
4	**3**	4	8	**12**	**16**
5	**3**	5	**10**	**15**	**20**

Edge Breaking

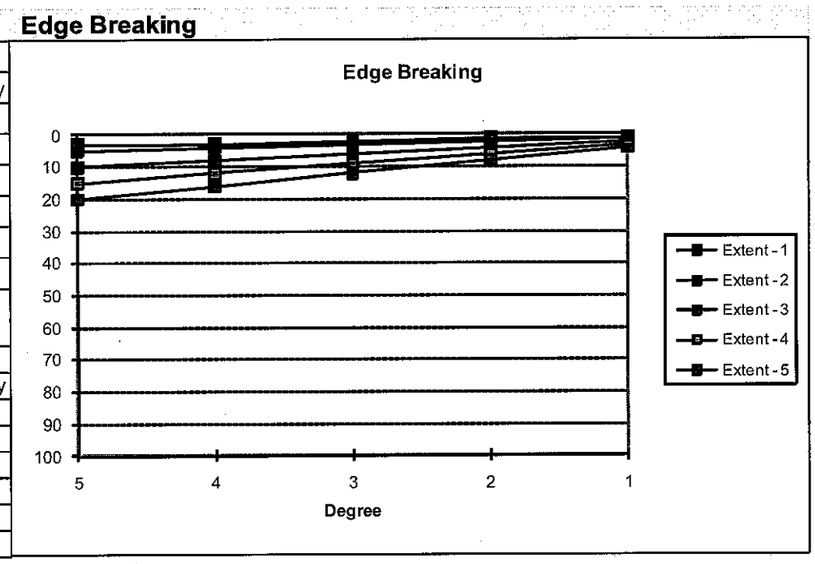

Table 8-20

Cracks-Blockmed

	Cracks-Blockmed				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	VG	VG	VG	**G**	**G**
2	VG	**G**	**G**	**G**	F
3	**G**	F	F	F	F
4	**G**	F	**P**	**P**	**P**
5	**G**	F	**P**	**P**	**P**

	Cracks-Blockmed				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	6	12	14	**18**	**25**
2	9	**21**	**25**	**29**	35
3	**15**	30	35	40	45
4	**18**	35	**50**	**55**	**60**
5	**21**	40	**55**	**60**	**65**

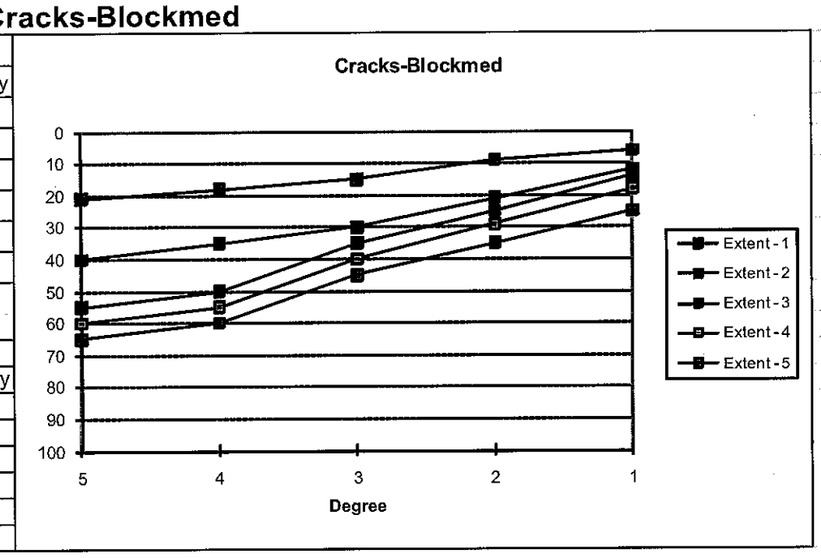

Table 8-22

Cracks-Transverse

	Cracks-Transverse				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	VG	VG	VG	VG	VG
2	VG	**G**	**G**	**G**	**G**
3	VG	**G**	F	F	F
4	**G**	F	F	**P**	**P**
5	**G**	F	**P**	**P**	**P**

	Cracks-Transverse				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	2	4	8	12	14
2	4	**15**	**18**	**21**	**25**
3	8	**25**	30	35	40
4	**15**	30	42	**50**	**55**
5	**21**	35	**50**	**55**	**60**

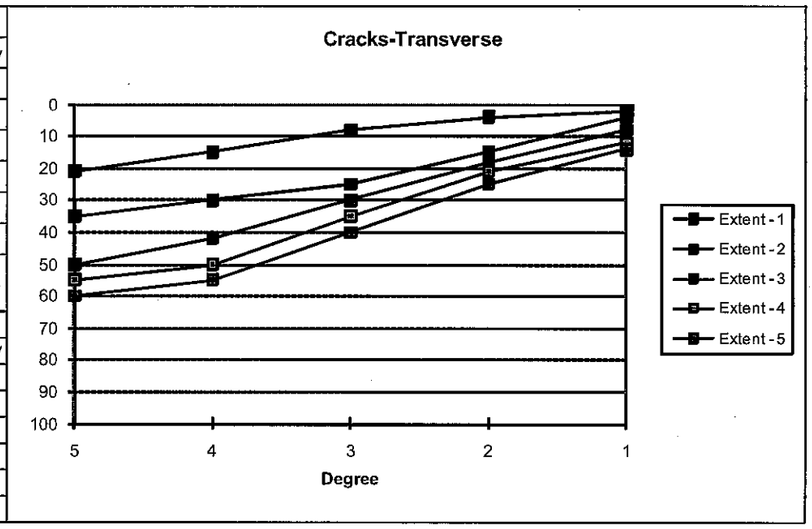

Table 8-24

Pumping

	Pumping				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	VG	VG	**G**	**G**	F
2	VG	**G**	**G**	**G**	F
3	VG	**G**	F	F	**P**
4	**G**	F	F	**P**	**P**
5	**G**	F	F	**P**	**P**

	Pumping				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1	2	12	**18**	**21**	30
2	4	**19**	**25**	**29**	35
3	8	**26**	31	42	**50**
4	**15**	30	36	**50**	**55**
5	**18**	34	40	**54**	**60**

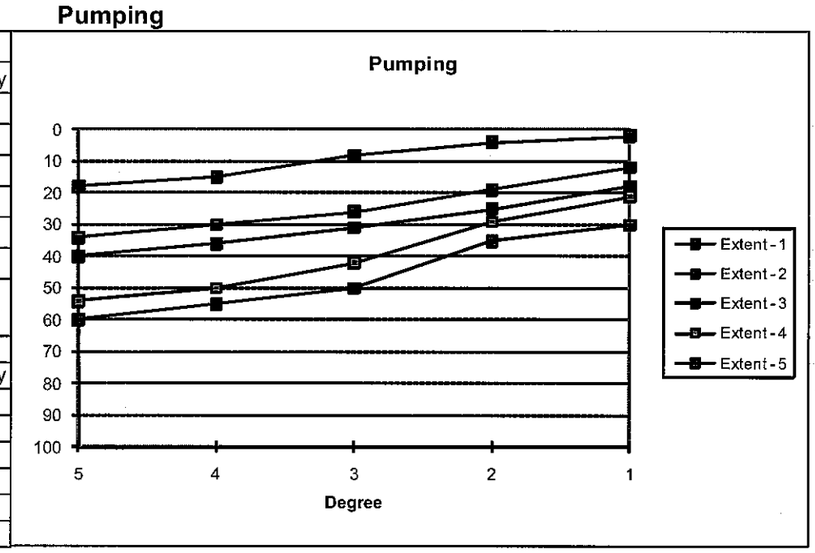

Table 8-26

Undulations

	Undulations				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	VG	VG	VG	VG	VG
2	G	G	G	F	F
3	F	F	P	P	VP
4	F	P	VP	VP	VP
5	F	P	VP	VP	VP

	Undulations				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1	2	4	6	8	10
2	15	20	25	30	33
3	30	40	50	56	60
4	35	50	70	75	79
5	38	53	73	78	84

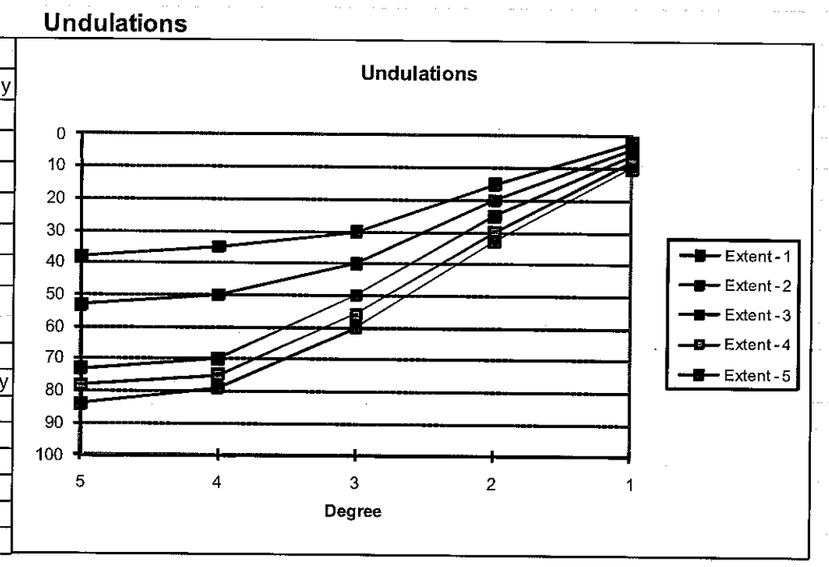

Table 8-28

	Potholes				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1					
2					
3	**G**	**F**	**P**	**P**	**P**
4	**F**	**P**	**VP**	**VP**	**VP**
5	**F**	**P**	**VP**	**VP**	**VP**

	Potholes				
	Few	<-- Extent -->			Many
Degree	1	2	3	4	5
1					
2					
3	**21**	**40**	**55**	**60**	**69**
4	**34**	**51**	**70**	**76**	**84**
5	**38**	**56**	**75**	**83**	**90**

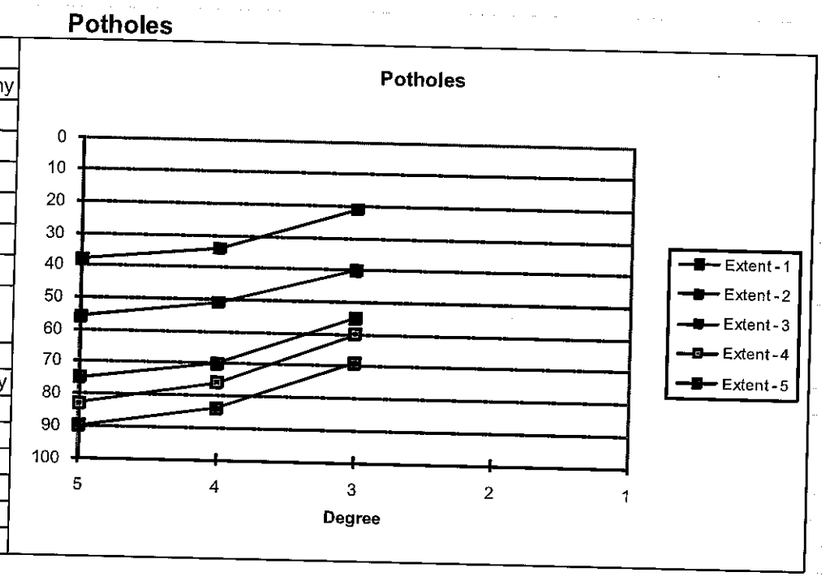

Table 8-30

Unpaved Shoulders

	Unpaved Shoulders				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
VG				VG	
G				VG	
F				**G**	
P				F	
VP				**P**	

	Unpaved Shoulders				
	Few		<-- Extent -->		Many
Degree	1	2	3	4	5
1				0	
2				13	
3				**25**	
4				38	
5				**50**