

Gravel Road Asset Management – Prioritising Maintenance Work

By David Bremert and Darren Shepherd (Shepherd Services Pty Ltd)

Introduction

Historically Rockhampton Regional Council (RRC) Coordinator drive its gravel roads to determine when the road needed to have work undertaken, based on their experience of when a road is rough enough. This method has been used for the past 50 years and has been undertaken without much disagreement by the ratepayers.

When the Coordinator vehicle is replaced annually, the number of complaints would increase for the next month or so.

However, is this method the right method to use on gravel roads? How do we know we are getting consistent results and servicing correctly and not over servicing roads?

Methodology

RRC decided to look at what *electronic performance criteria* it could use to determine when a gravel road would require grading and what type of systems were out there that could be easily fitted to the vehicles to measure this performance criteria.

Council had been using RACAS (HD camera and roughness device) to capture pre and post event damage on its road for Natural Disaster events since 2011. Council started to expand the use of RACAS device for assistance with answering road complaints and assistance with programming of works that occurred on the gravel and bitumen road network. This has been rather successful since 2011.

Council has then thought further about the intervention levels for the gravel road network, and has recently adopted the following:

- Smooth Running Surface in terms of Road Roughness
- Wet weather access – in term of Gravel Coverage by length
- Repair of high priority defects by identification and clarification of repair timeframes

These three intervention levels were then developed further, and modification were made to the RACAS system to enable these criteria's to be assessed, recorded and reported.

Smooth Running Surface

The criteria assessment was investigated, and the International Road Roughness measure was chosen to be the best criteria to use for the running surface as it was the industry benchmark.

As described in the graph below, a road increasingly becomes rough as the road ages after grading. For example, a newly graded road we would expect International Roughness levels of 3-4 (under the maintained unpaved roads and we have observed in practice) and as it becomes older and deteriorates then the International Roughness levels will go to a 7-8 where council then plan for the road to be placed on the program for grading.

This has a flow on effect on the speed of the road (what the vehicles are driven at). For example, a newly graded road would have an average speed of 80-100km/hr depending on geometric

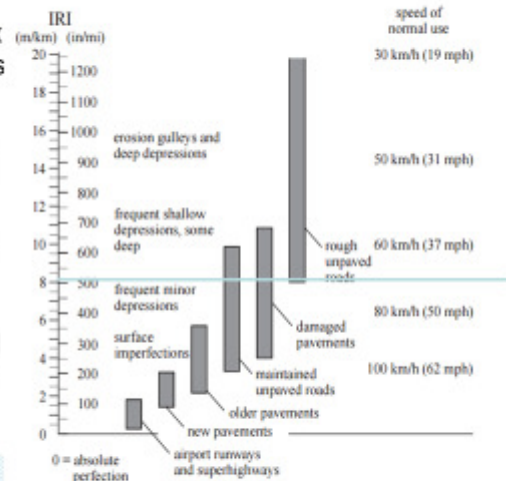
restraint, compared to a road that is at intervention at an IRI of 7 and 8, which would be a speed 60 to 70km/hr.

International Roughness Index Measure

International Roughness Index (IRI) is the common roughness measure used today.

A new sealed road is normally an IRI of 2 and in my experience *most unsealed roads are graded when an IRI of 6 to 8 is achieved.*

The related safe driving speed at IRI 8 is 70km/hr at IRI 6 it is close to 90km/hr



There is a relationship between IRI and safe driving speed

Also, another feature in the RACAS tools was its ability to predict the roughness level in 3 months' time based on deterioration modelling, using recent ARRB research in Australia. This ensures that we don't just leave a road if it is under the intervention today yet in 3 months it meets the intervention.

This feature has played an important scheduling tool for us as some of roads are over 1.5 hours away and Council would grade the roads that are in the area that exceeded the IRI 7 within 3 months.

RACAS ID	Road Name	Latest Run	Graded	Asset Number	Hierarchy	Length (m)	Avg. Speed (km/h)	Avg. IRI	3M Date	3M IRI	IRI Intervention	Grading Required	POI Count	Subgrade (m)	% Gravel Coverage	Gravel % Intervention	Gravel Required
1960	BOYS ROAD	10/11/2017	No	6256 SA	1554	1554	47.8	7	01/09/2018	9	7	Yes	1	0	100.00%	60%	No
1925	BULL FROG LANE	27/09/2017	No	11300 SC	6865	45.59	9	26/12/2017	9	7	Yes	1	0	100.00%	50%	No	
1933	CALLIUNGAL ROAD	10/09/2017	No	10040 SA	811	19.2	6	01/07/2018	8	7	Yes	0	0	100.00%	60%	No	
1958	Clem Clark Road	10/11/2017	No	55080 SA	379	20.83	5	01/09/2018	7	7	Yes	0	0	100.00%	60%	No	
1942	COLES AVENUE	10/09/2017	No	10060 9B	544	20.31	6	01/07/2018	6	7	No	0	0	100.00%	20%	No	
1939	CROSSLEY STREET	10/09/2017	No	10077 9A	121	14.39	5	01/07/2018	5	7	No	0	0	100.00%	50%	No	
1967	DUMP ROAD	13/10/2017	No	11451 SC	1474	39.59	7	01/11/2018	7	7	Yes	2	1474	0.00%	50%	Yes	
1937	ELECTUS AVENUE	10/09/2017	No	10101 SB	181	13.44	5	01/07/2018	6	7	No	0	0	100.00%	55%	No	
1954	ENRIGHT STREET	10/09/2017	No	10106 SA	217	18.85	6	01/07/2018	8	7	Yes	1	0	100.00%	60%	No	
1947	FLETCHERS CREEK ROAD	10/09/2017	No	10118 SA	1000	27.81	8	01/07/2018	11	7	Yes	1	0	100.00%	60%	No	
1928	GORDON LANE	10/04/2017	No	10133 SA	74	10.07	4	01/02/2018	6	7	No	1	0	100.00%	60%	No	
1969	GRANTLEIGH ROAD	13/10/2017	No	11453 SB	4185	47.52	7	01/11/2018	9	7	Yes	0	1585	62.13%	55%	No	
1975	JAMES ROAD	13/10/2017	No	11378 SB	364	37.18	7	01/11/2018	8	7	Yes	0	0	100.00%	55%	No	
1943	KANGAROO CRESCENT	10/09/2017	No	10176 SA	252	18.88	3	01/07/2018	5	7	No	0	0	100.00%	60%	No	
1941	KYONET STREET	10/09/2017	No	10184 9A	97	16.93	6	01/07/2018	6	7	No	0	0	100.00%	50%	No	
1930	Lee Street	10/04/2017	No	10189 SA	478	22.28	7	01/02/2018	9	7	Yes	1	0	100.00%	60%	No	
1955	MCHUGH ROAD	10/09/2017	No	10165 9B	74	10	5	01/07/2018	5	7	No	1	0	100.00%	20%	No	
1927	MOUNT HOPEFUL ROAD	27/09/2017	No	106450 SA	8885	44.84	9	26/12/2017	11	7	Yes	6	0	100.00%	60%	No	
1965	MUNNS ROAD	13/10/2017	No	11450 SB	6264	44.76	7	01/11/2018	8	7	Yes	3	0	100.00%	55%	No	
1948	Nine Mile Road	10/09/2017	No	10233 SA	7433	33.84	10	01/07/2018	12	7	Yes	1	0	100.00%	60%	No	
1968	OHL ROAD	13/10/2017	No	11452 SC	1115	43.76	8	01/11/2018	8	7	Yes	0	1115	0.00%	50%	Yes	
1973	POCOKC ROAD	13/10/2017	No	11293 SA	2129	42.49	8	01/11/2018	10	7	Yes	0	70	96.71%	60%	No	
1936	PORTERS LANE	10/09/2017	No	10263 SA	121	14.37	6	01/07/2018	8	7	Yes	1	0	100.00%	60%	No	
1935	PORTERS ROAD	10/09/2017	No	10264 SB	188	21.58	5	01/07/2018	6	7	No	0	0	100.00%	55%	No	
1938	Rockery Lane	10/09/2017	No	52360 SB	226	16.03	6	01/07/2018	7	7	Yes	0	0	100.00%	55%	No	
1971	SANDY CREEK ROAD	13/10/2017	No	6203 SA	14271	41.94	9	01/11/2018	11	7	Yes	0	7291	48.91%	60%	Yes	
1924	SIX MILE ROAD	27/09/2017	No	506451 SA	5881	47.22	9	26/12/2017	11	7	Yes	2	0	100.00%	60%	No	
1953	TAYLOR STREET	10/09/2017	No	10328 SA	643	22.09	8	01/07/2018	11	7	Yes	1	0	100.00%	60%	No	
1966	YOUNG STREET	13/10/2017	No	11523 SB	229	35.34	7	01/11/2018	9	7	Yes	0	0	100.00%	55%	No	

Wet weather access in terms of Gravel Coverage by length

This criteria was used as it is a measure of the ability of vehicle to be able to use the road when it is wet. As our council has a wet season that runs typically from December through to April each year the ability of our residents to use these roads is a high priority for Council.

Council undertook an investigation in to how to measure this criteria in a fast and efficient manner and decided that the measurement of subgrade by length can give us an indication of remaining gravel coverage over the road and also the location of future potential gravel replacement programs



So using the same RACAS system this measurement is made every two years (depending on significant rain events, then it is done annually) to determine councils future re-sheeting and gravel patching programs for roads that are under the set service level by roads hierarchy.

The RACAS system looks at the length of the road in question minus the length of the subgrade or breakout. This is then divided by the length of the road to determine a percentage of coverage.

RACAS does this by a visual assessment by the operator. This can be done whilst the vehicle is in motion or back at the depot. This measure is a good identifier where the re-sheeting funds are needed.

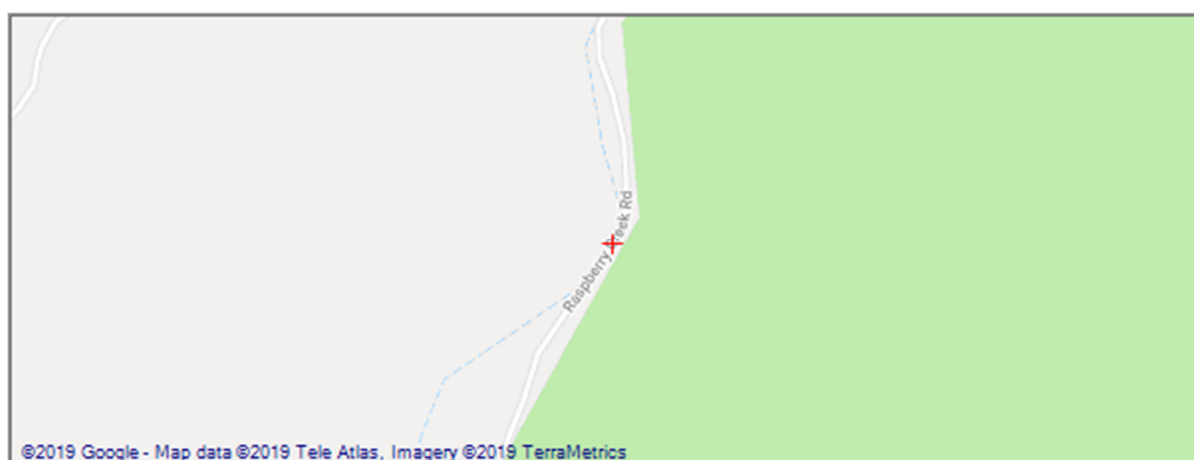
To enable a more efficient model for the deterioration of the depth of gravel, Council also undertakes a gravel depth sample every 1000m of roadway every 3 years. This allows for collaboration of the deterioration model.

High Priority Defects

Finally high priority defects on gravel roads that can possible cause an incident are considered as a priority to council for repair. A methodology for identification of defects and severity has been developed and the RACAS system is used to mark these defects while driving the car or afterwards back in the office by using a button called POI (point of interest)

RACAS has a reporting tool that will output all these defects into a report with photos and locations for programming temporary works below is an example report.

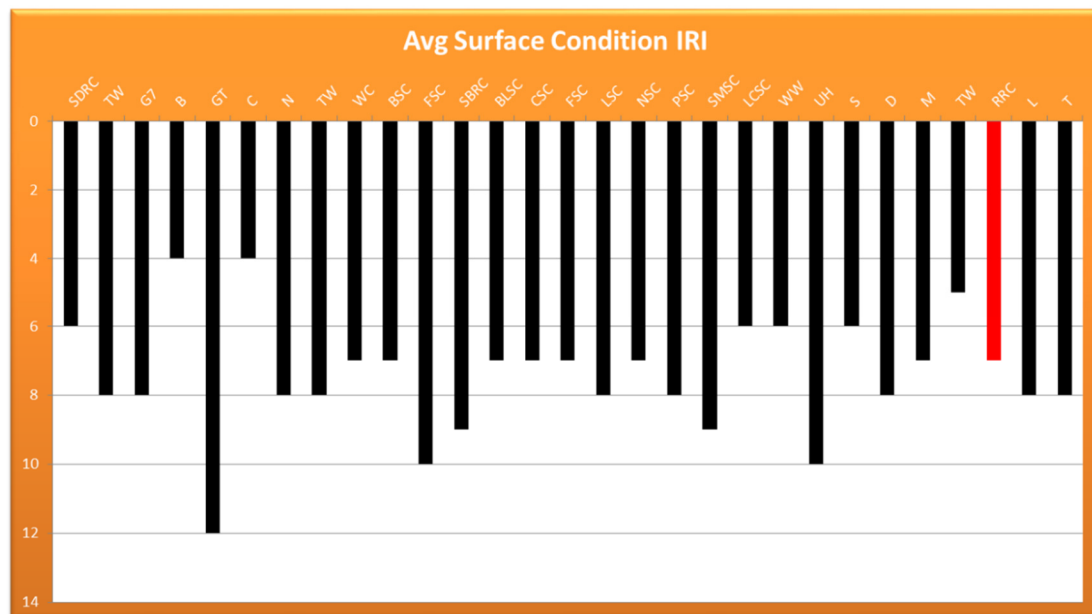
Road Name	Raspberry Creek Rd~~
Photo Name	Photo_2017_Oct_09_13_25_27_229.jpg
Longitude	150.474078
Latitude	-23.732827
Chainage	5407m
POI	High IRI
Gradient	2.4
Road Width	6.0



Findings

Rockhampton Regional Council then undertook benchmarking on the two main criteria of surface condition and gravel coverage. Shepherd Services Consulting undertook this benchmarking using the data they have gathered doing their unsealed roads training course in Australia.

Council has chosen an average surface roughness limit of 7 and it compares well with other Councils.

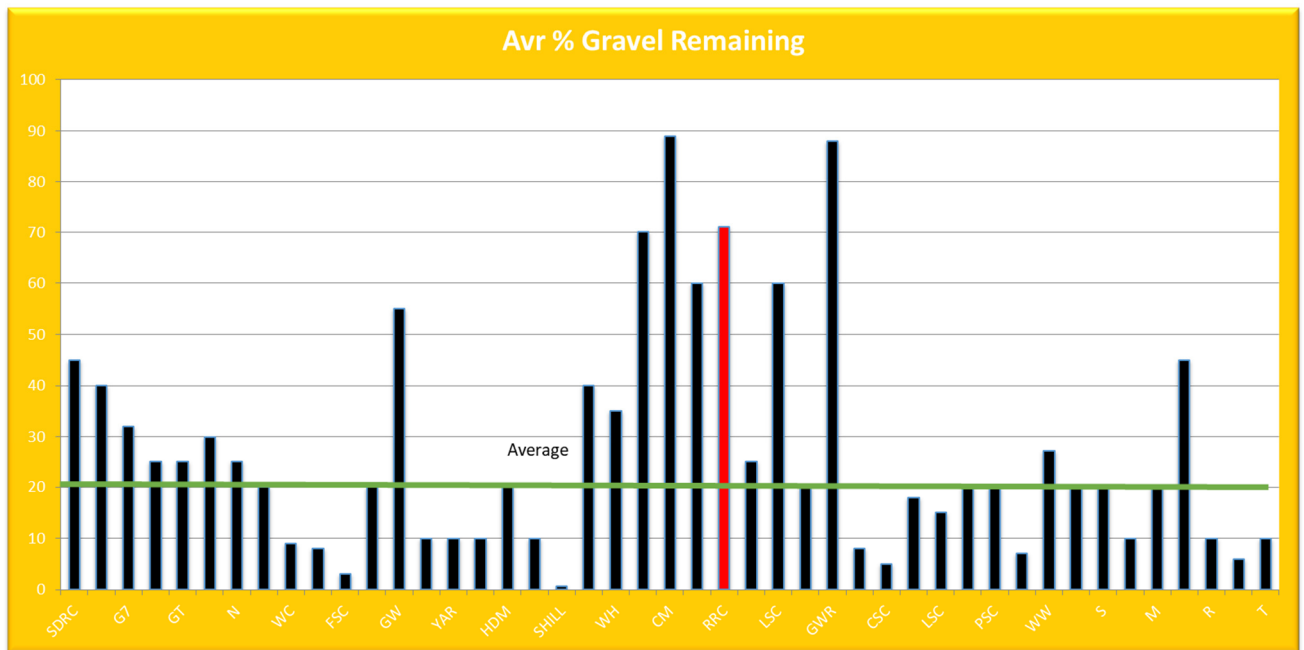


To get the Councillors on board, Councillors where saw the different levels of roughness and it was agreed that a roughness level of 7 would be set due and its fits councils budget restraints as well.

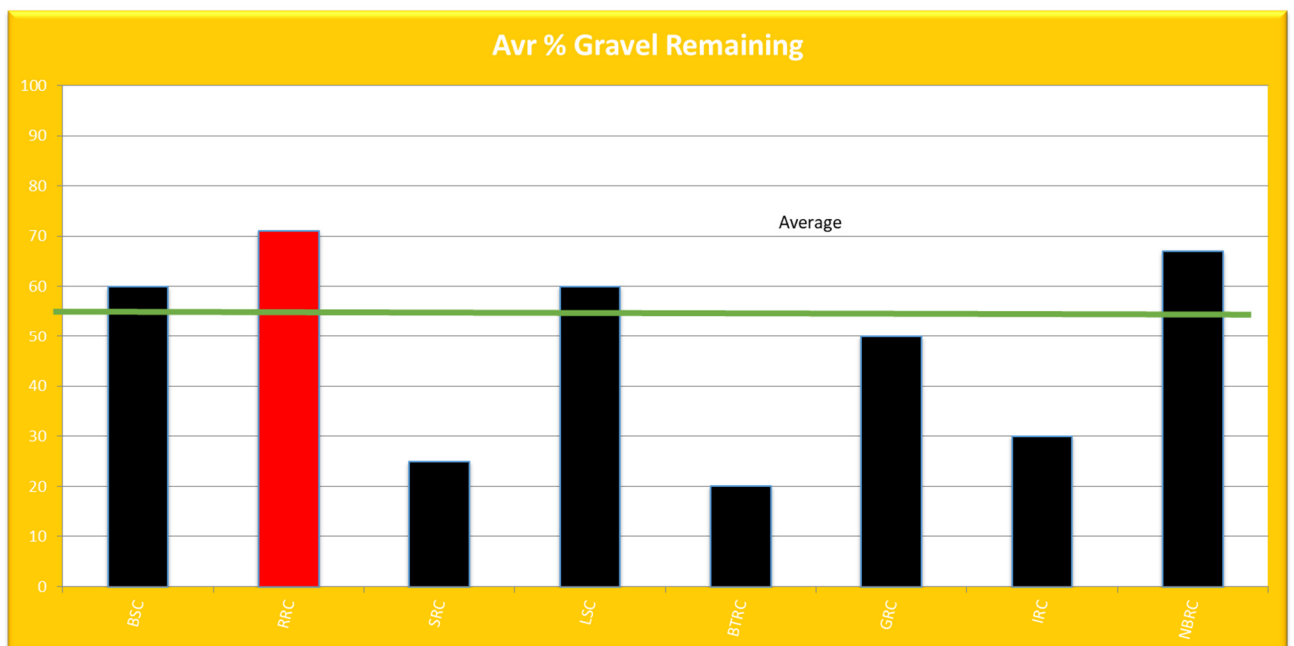
In regards, to the gravel coverage, as the collection of the data is done by the operator or technician the assessment of the data is subjective. Yet the data provides Council with a list of roads that require gravel re-sheeting and further investigation. These roads are then assessed by the Coordinator to determine the rectification measure.

A further enhancement to this process, is the on-site gravel depth measure. This was initially being undertaken to determine the asset value for our finance section and subsequently the depreciation value. For us in the Engineering world, this also allows a more optimised rectification selection e.g. heavy grade or a heavy grade with 50mm additional or a full re-sheet.

Council also requested Shepherds Services Consulting to undertake a benchmarking exercise in this area. The results are shown in the graph below.



National Benchmarking



Regional Benchmarking.

The results show that, the criteria of 70% for gravel coverage is a excellent level of service nationally and regionally it is above the average.

1. Conclusions

That Rockhampton Regional Council has developed the following service levels for its gravel road network –

- Smooth Running Surface – smooth Road Roughness – 7 IRI
- Wet weather access - Gravel Coverage – 70%

That by using RACAS, Rockhampton Regional Council can measure the above two criteria using its existing technologies and deliver services at a more optimised level.

These two service levels have been adopted by Council and are measure according to the road hierarchy. E.g. Category 3 Arterial roads are run every 3 months and our 5c Minor Access roads are run every 6 months.

2. References

Shepherds Services RACAS operational guidelines

Darren Shepherd - Director of Technical Services Shepherd Services Pty Ltd