



1998-08-10

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Road Badger Inc.
1992 Glenmore Avenue
Sherwood Park, AB T8A 2G5

**Attention: Ray Gillard
General Manager**

Dear Sir:

RE: "ROAD BADGER" FIELD ASSESSMENT

As requested, UMA Engineering has undertaken a field evaluation of the "Road Badger" to objectively quantify its performance. The "Road Badger" is a piece of road maintenance equipment that is connected to the back of a grader and is used to rehabilitate and extend the serviceability of unpaved roads, thereby reducing overall road costs. Rather than regularly placing additional gravel to replenish the travelling surface, this equipment utilizes hydraulics to operate a patented scarifier and disc system to break up the road surface and work the existing gravel without disturbing the existing road grade.

These tests were conducted on an early prototype and the latest commercial product has encompassed refinements and improvements suggested during the evaluation process.

UMA Engineering's evaluation program consisted of a series of grain size analysis before and after the "Road Badger" operation, visual road inspection and photographic records. Six different trial road sections were set aside by local municipalities for testing of the "Road Badger".

A.	Range Road 231	North of Township Road 540	County of Strathcona
B.	Range Road 231	South of Township Road 540	County of Strathcona
C.	Range Road 234	North of Highway 37	M.D. of Sturgeon
D.	Range Road 232	North of 167 Avenue	County of Strathcona
E.	Range Road 223	North of Township Road 540	County of Strathcona
F.	Township Road 540	East of Range Road 224	County of Strathcona

Field Evaluation

The field evaluation consisted of a visual inspection of the road surface and obtaining documentary photographs. The photographs are included in Appendix A following this report. The initial sampling procedure consisted of sampling the top 0 to 70 mm of surfacing material and then sampling the material from 75 to 150 mm. Each sampling location was marked at the side of the road to ensure consistent locations before and after. Typically, two sample locations were chosen for each trial road section.

The visual inspection of the roadways indicated that they were generally in poor condition. Trial road locations E and F were considered to be in fair condition only. Some of the roads contained deteriorated cold mix at the surface or below a thin gravel surfacing. There was washboard evident at locations C and F and a rough or uneven surface at all locations.

After the initial sampling and documentation, the "Road Badger" road maintenance equipment was used on the road as it would for standard maintenance. The required depth of scarification was determined visually and set using the "Road Badger's" hydraulic depth control system. One pass of the equipment over each portion of the road is standard, however, some areas with a cold mix asphalt surface required an additional pass. The "Road Badger" was able to maintain the original grade line and did not appear to break or fracture the aggregate. Typical regrading operations tend to fracture some of the gravel as the blade shears off those rocks at the interface between the grader blade and the intact road.

After the "Road Badger" equipment had worked the surface, the grader would tight blade the gravel material to reshape the road cross-section. The "after" gravel samples were collected at the completion of the grading from adjacent to the previous samples. Observations and photographs were then taken of the refinished roadway surface.

The visual inspections of the completed roadways showed that the surface defects were no longer evident. The washboard and rough surface had been corrected and the cross drainage on the roads was noticeable. There appeared to be more gravel at the surface with a more even distribution than before the road treatment.

Analysis

In order to quantify the effect of the "Road Badger" equipment on the roadway, grain size analysis were performed on the granular samples obtained in the field evaluation. The percentage of gravel (by weight of gravel retained on the 5.0 mm screen) in each sample was compared between the "before" and "after" samples (see Table 2). The sieve plots are provided in Appendix B.

Generally, the results show a significant increase in the percentage gravel near the surface. The comparison with the deeper samples (A-2: 50 to 125 mm) indicates a reduced change or no change at all. There were two comparisons where there was a reduction in the percentage of gravel noted. The presence of cold mix asphalt in some locations made the grain size analysis impossible to perform. It should be noted that at location C-1: 0 to 35 mm, the Road Badger process broke up the cold mix asphalt such that a grain size analysis could be performed.

Road Section	Location	Depth (mm)	% Gravel		% Change (-ive)
			Before	After	
A	1	0 - 50	42.4	51.8	22.2
		50 - 125	22.9	-	-
	2	0 - 50	42.2	50.7	20.1
		50 - 125	37.1	37.7	1.6
B	1	0 - 50	33.8	29.7	(12)
		50 - 125	45.8	*	-
	2	0 - 75	25.4	28.7	13
C	1	0 - 35	*	53.9	-
		35 - 100	*	-	-
	2	0 - 50	27.2	42.8	57.3
		50 - 100	26.9	39.3	46.1
D	1	0 - 65	36.5	48.9	34
E	1	0 - 60	66.5	64.2	(3)
	2	0 - 60	44.3	63.5	30
F	1	0 - 60	42.1	48.5	15.2

- * Unable to perform analysis due to the presence of cold mix asphalt.
- Grain size analysis sample not obtained.

For comparison, Alberta Infrastructure's Standard Specifications for new construction are as follows:

- Surfacing Gravel (Designation 4-25) requires 45 to 85% gravel.
- Base Course Gravel (Designation 2-40) requires 38 to 68% gravel.

The results of this evaluation indicate that this piece of road maintenance equipment - the "Road Badger" has a noticeable and measurable effect on breaking up hard road surfaces such as gravel, oiled gravel and gravel with dust abatement additives. The operation of the Road Badger produces a surface with more gravel, allows for reclamation and re-mixing of oil and dust abatement products, allows for the grading-out of road surface defects such as washboard and ruts, and facilitates improved cross-section drainage. All of these items work toward a longer serviceable life for existing roads.

This equipment also reduces the two potential problems with grader operation - the shifting of gravel from side to side (and the resulting potential losses) and the potential of cutting too deep and bringing up the underlying soil.

We trust that this information is sufficient at this time. Please call the undersigned at (780) 486-7657 if you have any questions or comments.

Yours truly,

UMA Engineering Ltd.



Roland R. Merkosky, P.Eng.
Geotechnical Project Engineer

