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BOZENA 4 Mini Mineclearance System Assessment Phase 1

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Executive Summary

This report summarises the results of an assessment of the Mini Mine Clearance System (B4 MMCS). The trial was designed to be the first phase of a three-phase assessment process evaluating handling and mobility characteristics and general performance capabilities. Phase two will be conducted in Sweden and will assess specific performance and survivability criteria. Phase 3 will be conducted in a mine-affected country and will be in the form of a reliability and user acceptance test.

The three phases of this trial are to be carried out in response to a request from the manufacturer, who saw the value of impartially testing the B4 MMCS against internationally agreed criteria – CEN Workshop Agreement (CWA) on Test and Evaluation of Demining Machines.

The results from the tests recorded in this report demonstrated that the machine has the ability to process the ground consistently down to 200mm and clear medium to high levels of vegetation (as defined in the CWA listed above), albeit with limitations.

Overall the B4 MMCS showed that it could be operated safely and has the potential to carry out demining operations such as Vegetation Clearance and Ground Preparation. It is recommended that the B4 MMCS progress to the second phase of testing to further assess performance against mine targets and also assess its survivability against specified mine threats.

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1 Introduction

1.1 Background

As part of a Canadian co-ordinated test this trial is phase 1 of a three-phase trial to test the B4 MMCS against the criteria laid down in the CWA on Test & Evaluation of Demining Machines. This phase of the trial will concentrate on mobility and aspects of performance. Subject to the preliminary results of the trial the B4 MMCS will be shipped to Sweden for further performance testing and also survivability testing. Finally, provision has been made to subject the B4 MMCS to reliability and user acceptance testing in a mine-affected country at a later date.

1.2 Aim

The aim of the trial was to evaluate the performance and mobility of the B4 MMCS under generic threat and terrain conditions.

1.3 Trial Objectives

The objectives of the trial were:

- To assess the mobility of the B4 MMCS.
- To make a “rule of thumb” assessment of the performance of the equipment under prescribed conditions and to estimate clearance rates of both mined and vegetated areas.
- From available information, to make an estimate of the running costs and logistical support required for the equipment during operations.

1.4 Authority

As part of a Canadian lead multi-lateral ITEP test, QinetiQ was tasked to carry out the trials by the Department For International Development (DFID). The core trials team comprised of representatives from the Canadian Centre for Mine Action Technology, SWEDEC (Sweden), United States Department Of Defense and QinetiQ (UK).

1.5 Support Request

Way Industries was tasked to supply a B4 MMCS for test. The support required included operation, maintenance and spares throughout the trial.

2 Equipment under test

The BOZENA 4 Mini Mine Clearance System (hereinafter referred as B4 MMCS) is a tracked mechanical mine clearing machine remotely controlled using a man-portable transmitter. The manufacturer (Way Industries) states that it is designed for clearing AP mines - both pressure and tripwire fused - and for AT mines up to 9 kg of TNT charge. The system is potentially suitable for clearing between buildings, along paths, plantations, around permanent obstacles and where the ground cannot carry heavy weights. It will mainly be road transported on a trailer between working areas. The operator can control the B4 MMCS from an armoured, air-conditioned cabin with line-of-sight visibility.

B4 MMCS is protected from detonations by an armoured shield situated at the front of the vehicle, directly behind the flail. In addition, the whole machine is protected with an armoured metal covering, giving protection against damage from detonations.

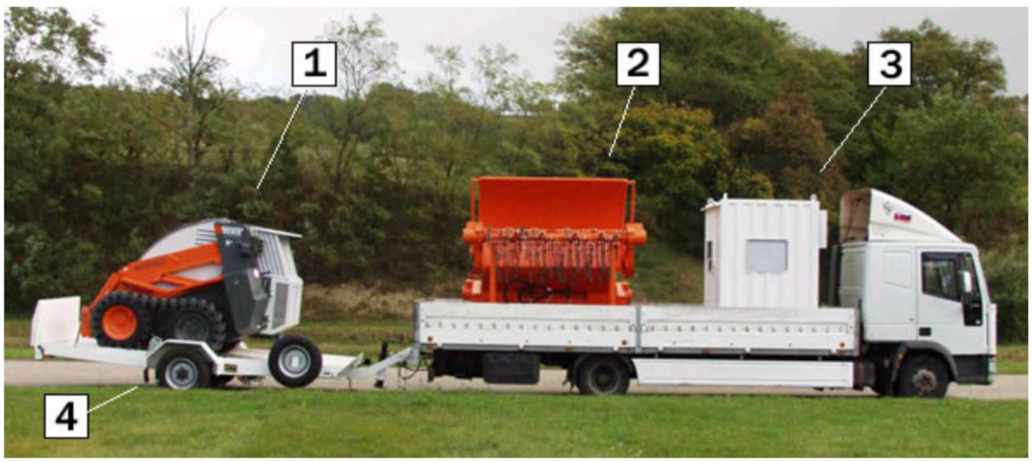


Figure 2-1: B4 MMCS and associated parts

The complete B4 MMCS package consists of *:

1. Prime mover B4-L1203 RC
2. Flail (2 pcs) - working tool
3. Operator's monitoring cabin (air-conditioned)
4. Trailer for transport between operational sites

*The customer to provide the truck

Only items one and two were assessed during the trial.

3 Trials methodology

3.1 Location

The trial took place between 10th & 11th June 2004 in the vicinity of the Way Industries factory in Krupina, Slovakia.

3.2 Trial rationale

The rationale behind the trial was to provide an assessment of the mobility, functionality and general performance capabilities of the machine. This was not intended to be an exhaustive test providing comprehensive mine clearance data, but rather an indication of the suitability of the machine for operating in a field environment and as much information as possible regarding its limitations and capabilities.

It is being considered as phase 1 of a 3-phase test regime, as follows:

Phase 1 – mobility, functionality and general performance

Phase 2 – thorough mine clearance testing, under controlled conditions against a statistically significant number of targets, plus vehicle and operator survivability tests

Phase 3 – field testing over a period of several months, to provide realistic productivity and running cost information.

These 3 phases of testing are aligned to the recommendations under development in CEN WS12, which aims to provide agreed international best practice for the testing of mine clearance machines. The intention is to conduct phase 2 of the tests at SWEDEC (Swedish EOD and Demining Centre) in Sweden. The details of phase 3 have yet to be finalised but should be conducted in conjunction with an End User (either a demining NGO or commercial demining company). This will ensure best possible use is made of the facilities available in each location, and that the machine is not put forward to the next phase of testing until it has been confirmed that it is ready and suitable.

3.3 Records

A trials plan and safety plan were prepared in advance of the trial. All trial activities were recorded on video and still photographs. Results of each test were recorded on trial performance sheets that have been retained by QinetiQ and are available on request.

4 Test procedure

Test procedure sheets were issued for each test; a summary of the tests is shown in Table 4-1 below. A description, summary of results and comments/observations of each test are detailed in Section 5.

Test	Description	Category
A1	Weights & Dimensions	Mobility
A1a	General Dimensions	Mobility
A1b	Axle Weights	Mobility
A2	Handling & Mobility	Mobility
A2a	Turning Circle	Mobility
A2b	Travelling and Working Speed	Mobility
A2c	Slopes & Gradients	Mobility
A2d	Obstacles	Mobility
A3	Field of Vision	Mobility
A4	Remote Control	Mobility
A4a	Failsafe	Mobility
A4b	Controlled Shutdown	Mobility
A4c	Range	Mobility
A4d	Operational Control	Mobility/performance
A5	Ground Flailing	Performance
A5a	Speed versus Depth	Performance
A5b	Terrain following	Performance
A5c	Slope & Ditch Clearance	Performance
A6	Vegetation Clearance	Performance
A7	Logistics	Logistics

Table 4-1: List of planned tests

5 Results

5.1 Weights and Dimensions

5.1.1 General Dimensions

The following measurements were taken using a tape measure, a clinometer and a straight edge:

Measurement	Length/Angle	Verified by Trials Team
Overall length	6052mm	✓
Overall length of prime mover B4-L1203 RC	3972 mm	
Overall length of flail	2180mm	
Wheelbase (Length between front & rear axles)	1100mm	✓
Width between the external faces of the wheels	1910mm	✓
Width of flail header	2716mm	
Width of cut made by flail	2220mm	✓
Number of hammers	40	
Maximum depth of bite	up to 250 mm	
Overall height of flail	1300 mm	
Overall height of flail with cover	1405 mm	✓
Maximum working height of the prime mover B4-L1203 RC	2 145 mm	✓
Activating diameter	1400 mm	
Swing of flail	up 15°	
	down 15°	
Ground clearance under belly of tractor	240mm	✓
Approach angle*	65°	✓
Departure angle	23°	✓
Track contact area (tarmac)	1420 x 300mm	✓

(* The approach angle is effectively 90° since with the flail raised to 3.85m, the front wheels would be the first part of the vehicle to hit an obstacle in all but the most challenging situations.)

Table 5-1: B4 MMCS general dimensions

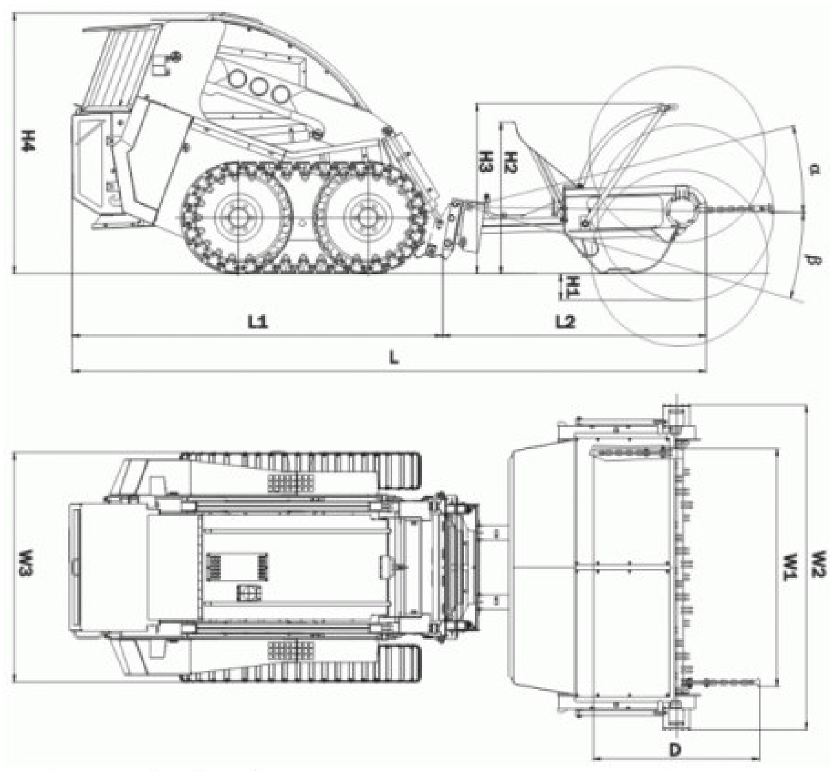


Figure 5-1: Dimensions of B4 MMCS

5.1.2 Weights

The individual wheelstation weights were measured by an independent 3rd party – Súdst of Žilina.

The B4 MMCS used had a full tank of fuel and the recommended levels of oils and coolant. Due to the likelihood of damage to the measuring equipment the tracks were removed and weighed separately.

The following results were obtained from the average of the readings taken. All measurements are in kilograms for convenience.

Note: Figure 5.2 shows the machine on the scales with no flail to show the method of measurement. The flail unit was attached for the actual measurement.

	Mass
Left front wheel weight (without tracks)	1594kg
Right front wheel weight (without tracks)	2130kg
Left rear wheel weight (without tracks)	974kg
Right rear wheel weight (without tracks)	1179kg
Front axle weight (without tracks)	3725kg
Rear axle weight (without tracks)	2153kg
Weight of tracks	242kg
Gross vehicle weight	5878kg
Weight of flail unit only	1068kg
Note from manufacturer: The fuel and hydraulic tanks are placed at right and left rear sides of the prime mover and as we can see the difference approx. 200 kg is quite normal. But whole weight of the attached flail head is kept on the front axle and the difference of more than 500 kg was because the flail head was supported by central pin and it leaned to the right side and put pressure on the right lock but the left lock had been lightened. This feature allows transverse ground following. The weight was oriented to the right side. If the locks had been locked and the flail head was fixed in horizontal position, the weight distribution would have been equal to the both sides.	

Table 5-2: B4 MMCS weights

Figure 5-2: B4 MMCS on the load cells (without flail unit)

5.2 Handling and mobility

5.2.1 Turning Circle

The B4 MMCS was parked on an area of level tarmac. A container of salt was attached to the front left corner of the flail header, positioned so that salt would pour onto the ground directly beneath the outermost corner of the vehicle as it turned to the right. The vehicle was then driven slowly through 360° to the right using its maximum turning lock whilst a second container of salt was held adjacent to the outer edge of the front left wheel so as to mark a line showing the minimum kerb-to-kerb turning circle.

It was noted that since the B4 MMCS was a skid-steer machine it could theoretically turn on its own axis – which was more or less the case.

The diameters of the two circles of salt thus produced were measured as follows:

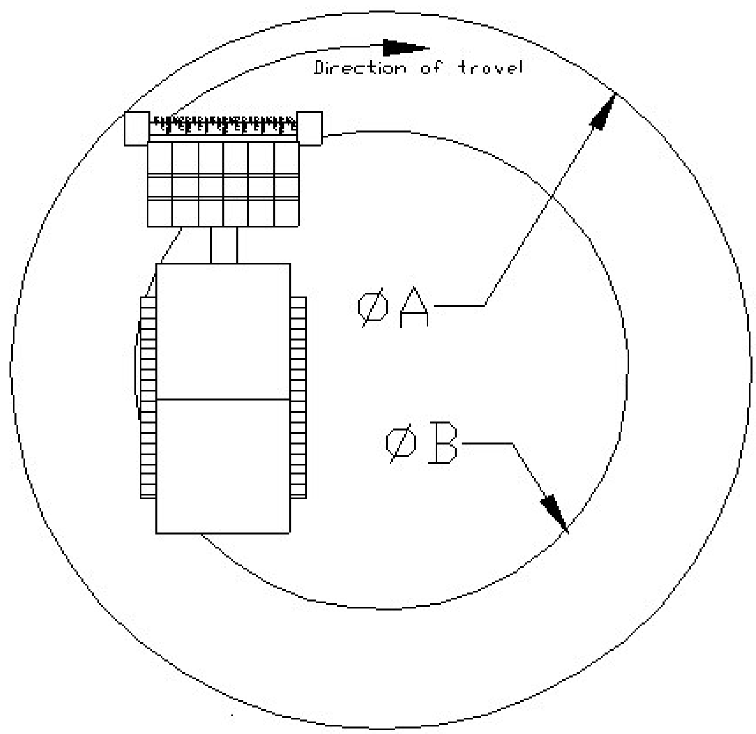


Figure 5-3: Turning circle of B4 MMCS

Direction	ØA	ØB (metres)
Forward right-hand lock	6150mm	2300mm

Table 5-3: Turning circle of B4 MMCS

5.2.2 Straight Line Speed and Braking

A dedicated Straight Line Speed and Braking test was not felt necessary since, as a remote controlled machine, it would be usually operated at a walking pace when manoeuvring outside of a mined area.

B4 MMCS has a hydrostatic braking system therefore when the system fails mechanically the brakes will engage due to lack of hydraulic pressure.

During the trial it was observed that the operator had good control whilst manoeuvring and braking.

5.2.3 Slopes and Gradients

An area was located on some agricultural land near the Way Industries factory, which had sufficiently challenging hills. The hill section was approximately 20m long consisting of wet loamy soil covered in lush grass (it had rained the previous night).

The B4 MMCS was required to drive up these slopes, come to a complete stop halfway up the slope and then continue to the top of slope. The procedure was then repeated for the machine reversing up the slope.

B4 MMCS was not required to operate the flail during this test.

The following results were obtained.

Gradient	Terrain	Result
27° - Driving forward	Loamy Soil, light vegetation (Off-road)	Lost traction at the stated gradient. * B4 MMCS tended to creep back down the slope when instructed to stop. This was remedied by engaging a separate function via the remote control unit.
13° - Driving in reverse†	Loamy Soil, light vegetation (Off-road)	Lost traction at the stated gradient. B4 MMCS tended to creep back down the slope when instructed to stop. This was remedied by engaging a separate function via the remote control unit.
* - However there was evidence that B4 MMCS had climbed to the top of the hill on the previous day in better conditions. † - Gradient less in reverse due to direction of tread on tracks and differing axle weights		

Table 5-4: Results of the slope test

Figure 5-4: B4 MMCS climbing up the grass slope

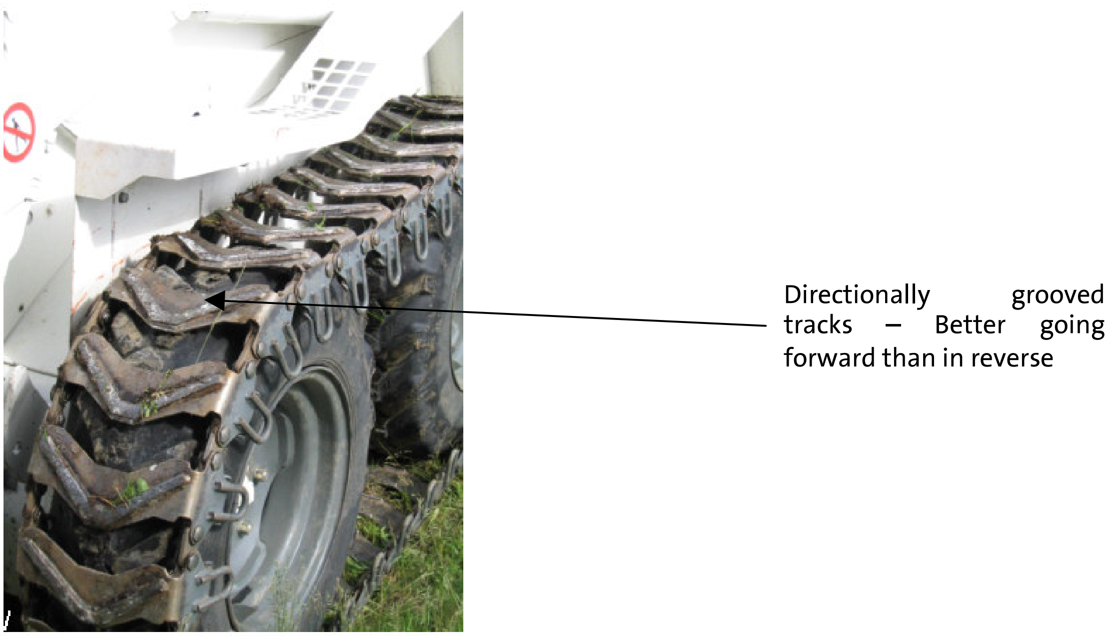


Figure 5-5: B4 MMCS climbing up the grass slope

5.2.4 Rough Terrain & Obstacles

No dedicated Rough Terrain & Obstacle tests were carried out due to time constraints.

5.3 Field of Vision

The aim of this test is to assess all round driver visibility. Although an on-board camera is available for B4 MMCS (see 5.5 Ground Clearance) it is primarily used in other EOD roles since the flail unit partially obscures the view. The camera unit was not assessed as part of this report. Other than the camera, operators are reliant on their eyesight and the view from the safe area they are operating the remote control unit from. Therefore a Field of Vision test was not required.

5.4 Remote Control

The remote control system works on a semi-duplex principle with one transceiver mounted to the rear of the Prime Mover B4 L1203RC and the other as part of a man portable control box.

5.4.1 Controlled Shutdown & Failsafe

Prior to evaluating the performance of the system under remote control, a basic check of its safety was carried out. This was done to ensure that the vehicle could be brought to a rapid and controlled shutdown. This was satisfactorily demonstrated, with no apparent delay between the operator's commands and the vehicle responding. Based on the limited trial it appears that the B4 MMCS fails safe to a state with the engine off and the brakes engaged.

5.4.2 Range

The operator moved to a point across the valley approximately 2km away by line of sight. At this distance the operator demonstrated full control of the B4 MMCS by turning through 180°, moving the flail unit up and down, operating the flail unit and finally shutting the system down using the emergency stop. It was observed that although the operator had good control of the B4 MMCS the picture from the camera was intermittent during manoeuvring. This was possibly due to the antenna at the rear being partially obscured by the rest of the machine when the B4 MMCS is facing the operator.

5.4.3 Operational control

The feedback available to the operator was limited to visual observation hence precise operation was not straightforward at any great distance. However this is common for any machine that operates visually and by remote control. To allow the operator to work closer to the machine, B4 MMCS also comes with an armoured operating cabin.

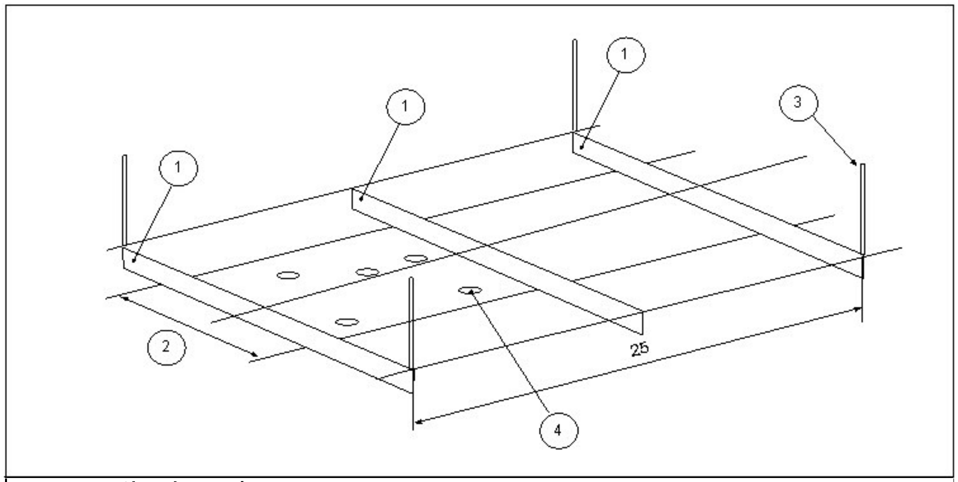
The flail was also operated under remote control during the Ground Clearance tests described in section 5.5.

5.5 Ground Clearance

5.5.1 Speed versus depth

A series of 6m long lanes of flat ground were marked out for flailing. Each area had three hardboard sheets buried in it, 2.4m long by 0.3m wide, buried on edge flush with the surface, orientated across the direction of travel of the machine (see Figure

5-7). The intention of these tests was to flail each area at a constant depth (around 20cm) and to alter the forward speed of the machine with each test until the hardboard sheets indicated that forward speed was too high and hence obtain maximum forward flailing speed for the machine at that flailing depth (in that terrain).



1 Fibreboard
2. Track width
3. Marker poles
4. Surrogate mines (No mines were be used in this test)

Figure 5-6: Layout of test lane

The boards provided a clear indication of how deep the flail chains were cutting and whether they were achieving consistent cutting across the width of the flail. Previous tests on other machines had indicated that if flailing depth is too large, or forward speed too high or flail rotational speed too low, uneven flailing will occur and sections of the hardboard strips remain intact *(*see Figure 5-8*)*, whereas correct flailing will cut away an even depth of the boards across the entire width. In the figures below the small squares on the background paper are 20mm X 20mm.

General Test Conditions:

The test lanes were laid in a field on a slight slope (~8°). The field consisted of loamy topsoil with lush meadow grass.

Unless stated the flail rotational speed was set at approximately 350rpm.

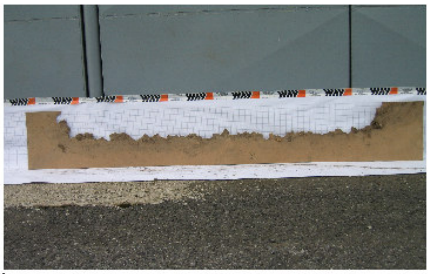


Figure 5-7: Example of a consistent cut across the width of the flail

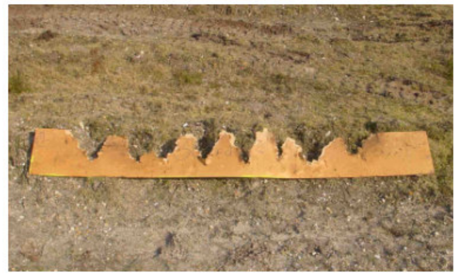


Figure 5-8: Example of an inconsistent cut across the width of the flail

Figure 5-9: B4 MMCS flailing

Run	Speed	
	m/s	Km/h
1	0.108	0.39
2	0.063	0.23
3	0.08	0.29
4	0.095	0.34
5a	0.08	0.29
5b	0.032	0.12

Table 5-5: Times and speeds for flailing runs

Run 1 - On the first test the operator was instructed to operate the B4 MMCS at a speed that he felt was appropriate to the conditions. The operator selected automatic speed setting 1 for which the average forward speed was recorded as 0.39km/h. The test was attempted by working down the slope of the field. As can be seen by the three fibreboards for this run (Figure 5-10 to Figure 5-12), the cut across the flail width was to some extent inconsistent and showed skip zones. These skip zones are particularly well illustrated by boards 2 & 3 – It can be seen that from a depth of

50mm to the maximum depth of approximately 200mm the ground was only partially processed.

Figure 5-10: Run 1, Board 1

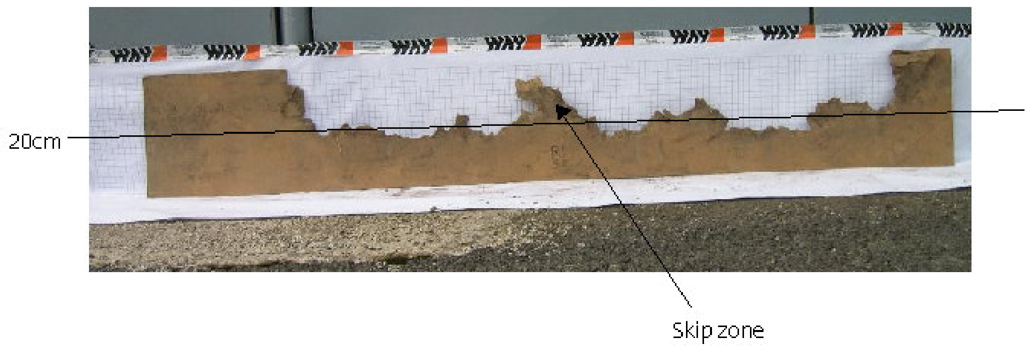


Figure 5-11: Run 1, Board 2

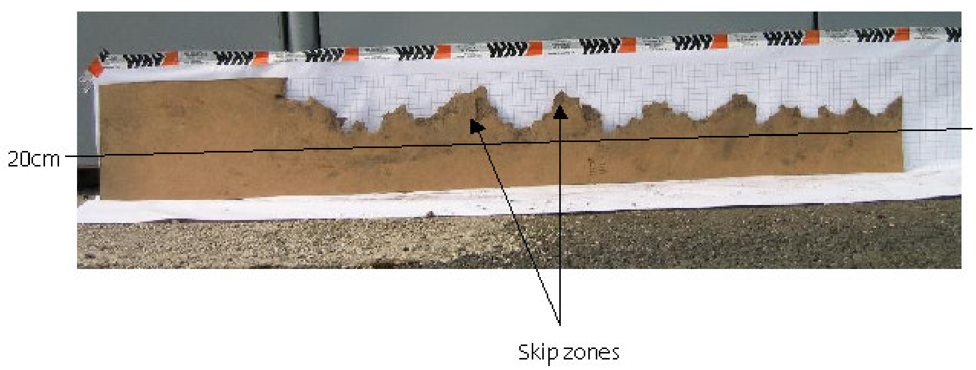


Figure 5-12: Run 1, Board 3

Run 2 - From the information gathered during the first run it was considered that the forward speed had been too fast for the ground conditions. The operator was instructed to operate the B4 MMCS at a slower speed. Currently, there is no automatic speed setting below the 0.39km/h used in Run 1 so the operator controlled the speed manually for the rest of the test. The average forward speed for Run 2 was recorded as 0.23km/h and the test was attempted by working down the slope of the field. As can be seen in Figure 5-13 to Figure 5-15 this combination of forward speed and flail speed was better suited for the depth of engagement of the flail.

It can be seen that B4 MMCS managed a consistent cut across the width of the flail at approximately 200mm (deviating only slightly above and below this depth).

Figure 5-13: Run 2, Board 1

Figure 5-14: Run 2, Board 2

Figure 5-15: Run 2, Board 3

Run 3 – Run 3 was a repeat of the previous run except that the B4 MMCS was required to work up the slope. The operator controlled the forward speed by hand although this time the speed was recorded as slightly quicker (0.29km/h). It was decided that the first fibreboard of the run would be disregarded since the B4 MMCS had not settled to a controlled forward speed or depth by the time it had hit it.

Again it can be seen in Figure 5-16 & Figure 5-17 that B4 MMCS managed a consistent cut across the width of the flail at approximately 200mm (deviating only slightly above and below this depth).

It appears that for this terrain type the maximum forward speed attainable without creating skip zones was approximately 0.29km/h. At speeds above this the cut profile became less consistent.

Figure 5-16: Run 3, Board 2

Figure 5-17: Run 3, Board 3

5.5.2 Terrain following (Run4)

On the B4 MMCS, the flail head runs on skids and has passive float in two axes which potentially helps it to maintain a constant depth of cut.

The tests described above demonstrated no difficulty in maintaining a constant depth of flailing on flat ground. A further test on undulating ground was set up to determine how accurately uneven terrain could be followed.

Two hardboard sheets were laid longitudinally on a flat area. Two of the unused test lanes were used, however the direction of work was at right angles to that in the previous set of tests. This was intended to give an indication of how consistently the depth of flailing could be maintained in this flat area, as the wheels of the vehicle passed through the bumps and dips of a previous run.

It should be noted that this test is not perfect since the aspect of the fibreboard shown towards the flail is relatively narrow. There is always a possibility that the board will pass between two flail chains undamaged. This test result should be seen as indicative and not an accurate representation of the flail's performance. If the boards are examined closely in Figure 5-19 & Figure 5-20 it can be seen that in addition to the sections of board that have broken away there are also scuffmarks along the board.

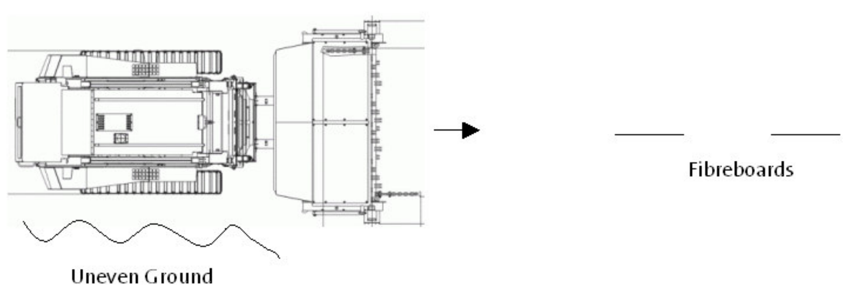


Figure 5-18: Terrain following test layout

Figure 5-19: Run 4 Board 1

Figure 5-20: Run 4 Board 2

5.5.3 Stability during overlap (Runs 5a & 5b)

The final test in this section was designed to assess the effect on the flail cut when the B4 MMCS was working with one side in a previously flailed lane. It was aimed to show that the flail could still maintain a consistent cut parallel to the ground profile without sinking excessively in the broken ground.

To achieve this a sheet of fibreboard was dug in across a marked out lane and an overlapping lane (Figure 5-21). Both lanes were then flailed and the fibreboard examined.

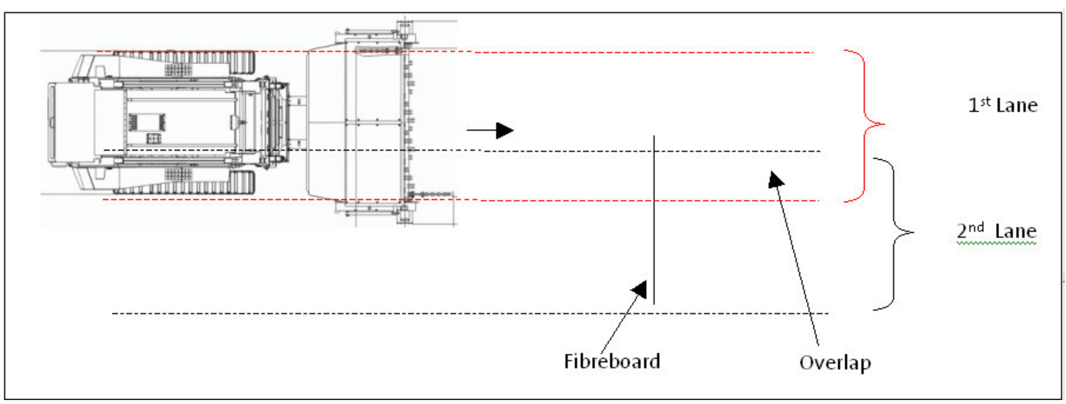


Figure 5-21: Diagram of the Overlap test

As can be seen in Figure 5-22 there was good consistency of cut at the overlap.

Figure 5-22: Overlap

5.6 Vegetation clearance

In many situations flails are used just to clear vegetation without engaging the ground and hence the ability of the B4 MMCS to do this was assessed.

The test involved clearing a ~20m long strip of shrub, bush and small trees. The test run started with ~1m tall shrub and bush with an average diameter branch at 0.5m high of 15mm. This progressed into larger bushes and small trees (~2.5m tall) with an average diameter at 0.5m high of 20mm. Finally, the test run concluded with a 7m tall pine tree with a trunk diameter at 0.5m of 170mm.

It was not possible for the operator to set the flail head to skim the ground (such as in a vegetation clearance/ground preparation role) due to the design of the skids. A different height of skid could easily be fabricated if B4 MMCS was required to operate in this role.

The B4 MMCS was able to clear the shrub, bushes and small trees with the flail head skids resting on the ground. However (unsurprisingly) it had to raise the flail head to tackle the larger trees. It conducted the task at a speed comparable to that of the other clearance runs described above.

Investigation of the cleared run it indicated that B4 MMCS has enough power to clear vegetation and maintain a good level cut through the ground.

Figure 5-23: B4 MMCS attacking a pine tree during the vegetation test

Figure 5-24: Remnants of the pine tree after flailing

5.7 Logistics

It was not possible to gather any meaningful data on cost efficiency and reliability during the three days of the testing. All that can be said is that during the trial period the B4 MMCS required no repair or maintenance other than daily checks and cleaning.

5.8 Multi-tool versatility and others

Although it does not fall into any of the pre-planned test categories, one important feature of the machine is worth highlighting – its ability to switch between various tools using standard attachments manufactured by Way Industries for their range of earth moving and construction equipment. These include:

- Standard Shovel
- Toothed Shovel
- Combined Shovel
- Pallet Fork
- Pliers for wood
- Angled blade
- Backhoe
- Auger

As well as an Armoured Rake Shovel for sifting during demining tasks.

Also not tested was the auto recovery winch.

5.9 Other Factors

The B4 MMCS operates a pressurised automatic fire control/suppression system using a halogen substitute and sacrificial hoses. The fire suppression system was not tested during the trial period.

6 Conclusions

6.1 Safe Operation

- The B4 MMCS fails-safe to a state with the engine off and the brakes engaged in the event of a malfunction or from instruction from the operator. This is considered safe for demining operations.
- The B4 MMCS operates a pressurised automatic fire control/suppression system using a halogen substitute and sacrificial hoses. This could be considered as adequate for demining operations.

6.2 Mobility and Transportability

- B4 MMCS is a compact system that can be transported on its own trailer by a small truck.
- Under its own power, B4 MMCS appears to have the ability to tackle fairly challenging terrain assisted by its tracked wheels giving it a relatively low ground pressure. However, due to the flail head, the B4 MMCS is front heavy – the front axle supports 63% of the vehicle mass. This combined with the short wheelbase could cause B4 MMCS problems backing up from ditches/ trenches or even driving up slopes (as seen in section 5.2.3). It was also noted that the directionally grooved tracks gave good traction in the forward direction but were less effective in reverse.

  Comment from Manufacturer: This statement is absolutely correct with a lifted flail head, but with the flail touching the ground a significant portion of the flail head's weight is released from the front axle. The FU2 *(Flail Unit)* construction is made that way so that actually some weight (400-500 kg) is being returned from FU2 back to the front axle with the torsion rod. This is favourable for stability of flailing and keeps sufficient weight on the front axle.
- Being a skid-steer vehicle B4 MMCS is theoretically able to turn on its own axis giving it a small turning circle. This was demonstrated by the corner to corner turning circle that was measured at 6150mm compared to the overall length of 6052mm.
- B4 MMCS demonstrated good remote control response and range (~2km line of sight). The B4 MMCS also fails safe to a state with the engine off and the brakes engaged in the event of a malfunction or from instruction from the operator.
- The camera is not useful for flailing ops due to the view being partially obscured by the flail head. However, it may be quite useful in an EOD (Explosive Ordnance Disposal) role, especially for shovel-rake use in removing dangerous objects.
- It was noted that cable routing to the antenna on the vehicle caused cable damage due to pinching around the door seal.

6.3 Performance

- On this particular B4 MMCS the lowest automatic speed setting on the forward speed controller was too fast. This meant that it had to operate under manual speed control to get the low speed required for a consistent cut at any significant depth. The soil in the test lane was relatively benign so a lower set of speed settings would be advisable to achieve best uniformity of cut, especially in more challenging soils.

Comment from Manufacturer: The problem that appeared during the test in Krupina was that B4 MMCS was sinking thus increasing soil resistance. This, together with uneven terrain forced the operator to make corrections with lifting the flail head to keep the machine in a straight direction. If a further speed reduction were required then a change of the skid shape would be needed.

- B4 MMCS showed a good ability to maintain an acceptable flail cut down to 200mm at the lowest speed (approx. 0.29 km/hr). At this speed it was on the edge of creating skip zones showing that this was the maximum speed for the ground at a flail depth of 200mm. At higher speeds skip zones got bigger.
- Although the flail hammers are comparatively lightweight they are attached to the flail axle with heavy-duty chain and a bar that acted as a whip. This combination of hammer, chain and whip seemed to work very well.
- The stability skids allowed the flail head to follow ground well. No step or unevenness was observed between overlapping lanes – one skid on hard ground, one on soft. It was noted however that the skids tended to sink when in soft ground.
- The vegetation cutting ability was good but was hampered slightly by the inability to keep the flail out of the ground. If it is imperative to leave the ground intact, skid boosters or different skids could be fitted.

7 Recommendations

The most important recommendation is that the minimum forward automatic speed setting of the machine needs to be reduced for effective flailing.

Other recommended modifications which do not necessarily preclude further testing but which would still be beneficial are as follows:

- It could be better to have the skids inside the flail path – to avoid mine strikes.
- Provide the B4 MMCS system with skid boosters or different sized skids for other tasks, such as Vegetation Clearance.

Finally, it is recommended that the B4 MMCS progresses to the second phase of testing to further assess performance against mine targets and also assess its survivability against specified mine threats.

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Abstract

This report summarises the results of an assessment of the B4 MMCS Mini Mine Clearance System. The trial was designed to be the first phase of a three-phase assessment process evaluating handling and mobility characteristics and general performance capabilities.

The trial was carried out in response to a request from the manufacturer, who saw the value of impartially testing the B4 MMCS against internationally agreed criteria – CEN Workshop Agreement (CWA) on Test and Evaluation of Demining Machines.

Overall the B4 MMCS showed that it could be operated safely and has the potential to carry out demining operations such as Vegetation Clearance and Ground Preparation.

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