

# Contents

<b>Foreword</b>	1
<b>Executive summary</b>	3
<b>Introduction</b>	7
<b>Chapter 1. Mechanical clearance</b>	9
Introduction	9
Flail systems	10
Tiller systems	23
Mechanical excavation	30
Mine rolling	35
Conclusions, findings and recommendations	38
Annex 1. Examples of machines achieving clearance in demining operations	43
<b>Chapter 2. Risk assessment and mechanical application</b>	47
Introduction	47
Theory of risk	48
SWEDEC test results	61
CROMAC empirical data	64
Conclusions, findings and recommendations	67
Annex 1. Southern Lebanon (Operation Emirates Solidarity)	71
Annex 2. Mines Advisory Group in Viet Nam	72
Annex 3. The rock crusher	75
Annex 4. Kosovo: establishing tolerable risk	76
<b>Chapter 3. Mechanical application to area reduction</b>	77
Introduction	77
Case study 1: Area reduction of patterned minefields in Abkhazia	78
Case study 2: Area reduction of non-patterned minefields in Thailand	83
Conclusions, findings and recommendations	99
<b>Chapter 4. The application of machines to ground preparation</b>	103
Introduction	103
Surface ground preparation	105

---

Sub-surface ground preparation	111
Sub-surface ground preparation with metal removal	113
Conclusions, findings and recommendations	117
<b>Chapter 5. The protection of vehicles and plant equipment against mines and UXO</b>	121
Introduction	121
Assessing the mine and UXO threat	122
Effect of mines and UXO on unprotected vehicles, plant equipment and occupants	126
Mine/UXO protection levels	138
Principles for the protection of vehicles and plant equipment against the threat of mines and UXO	140
Annex 1. Trigonometry regarding the cone of destruction	147
Annex 2. Guidelines to estimate the survivability of vehicles, plant equipment and their occupants in the field	148
<b>Chapter 6. Mechanical cost-effectiveness</b>	151
Introduction	151
The Cost-Effectiveness Model (CEMOD)	152
Factors affecting cost-effectiveness	161
<b>Main study conclusions and recommendations</b>	165
<b>Bibliography</b>	169
<b>List of acronyms</b>	173
<b>Appendixes</b>	
Appendix 1. Membership of the User Focus Group	175
Appendix 2. Glossary of terms and abbreviations	176

---