

## Table of Contents

Foreword .....	9
Major denotations .....	11
Major definitions .....	14
<b>1. Introduction .....</b>	<b>17</b>
<b>2. Characteristics of the rock bolt testing methodology per standard ASTM D7401-08, and a mathematical model for bolt bar elongation and internal friction .....</b>	<b>39</b>
<b>3. Characteristics of the bolt testing methodology developed at the Główny Instytut Górnictwa .....</b>	<b>51</b>
<b>4. Impact resistance testing of dynamic yielding SECURA bolts of the MANGANESE CORBETT BOLT type .....</b>	<b>54</b>
4.1. Subject and scope of testing .....	55
4.2. Test results .....	57
4.3. Result analysis for bolt tests in continuous tubes .....	60
4.4. Result analysis for bolt tests in split tubes .....	72
4.5. Testing summary for the dynamic yielding SECURA bolts of the MANGANESE CORBETT BOLT type .....	79
<b>5. Impact resistance testing of D-Bolt® dynamic bolts .....</b>	<b>87</b>
5.1. Subject and scope of testing .....	88
5.2. Test results .....	91
5.3. Summary of the D-Bolt dynamic bolt testing .....	102
<b>6. Impact resistance testing of Nevada and Nordic self-drilling dynamic bolts .....</b>	<b>104</b>
6.1. Subject and scope of testing .....	105
6.2. Test results .....	108
6.3. Summary of the Nevada and Nordic self-drilling dynamic bolt tests .....	119
<b>7. Impact resistance testing of shock-resistant injection cable bolts .....</b>	<b>123</b>
7.1. Subject and scope of testing .....	124
7.2. Test results .....	127
7.3. Summary of the shock-resistant injection cable bolt tests .....	135
<b>8. Impact resistance testing of expansion shell bolts .....</b>	<b>137</b>
8.1. Subject and scope of expansion shell bolt testing per the expanded methodology developed based on standard ASTM D7401-08 .....	138
8.2. Results of expansion shell bolt testing per the expanded methodology developed based on standard ASTM D7401-08 .....	140
8.3. Summary of expansion shell bolt testing per the expanded methodology developed based on standard ASTM D7401-08 .....	149

8.4. Results of expansion shell bolt impact resistance testing per the GIG methodology.....	151
8.5. Summary of expansion shell bolt testing per the GIG methodology.....	158
<b>9. Impact resistance testing of resin bolts – bolts constructed from deformed bars.....</b>	<b>160</b>
9.1. Subject and scope of testing of Ø20 bolts formed from 34GS steel.....	160
9.1.1. Test results for resin bolts constructed from Ø20 deformed bars made from 34GS steel.....	161
9.1.2. Test summary for resin bolts constructed from Ø20 deformed bars made from 34GS steel.....	165
9.2. Subject and scope of testing of Ø22 bolts .....	165
9.2.1. Test results for resin bolts constructed from Ø22 deformed bars made from ATLAS III steel.....	166
9.2.2. Test summary for resin bolts constructed from Ø22 deformed bars made from ATLAS III steel.....	171
<b>10. Impact resistance testing of resin bolts – bolts constructed from deformed bars with a spiral rib pattern forming a thread along the entire length .....</b>	<b>172</b>
10.1. Subject and scope of testing .....	173
10.2. Test results .....	175
10.3. Test summary for resin bolts – bolts formed from deformed bars with a spiral rib pattern forming a thread along the entire length.....	185
<b>11. Impact resistance testing of rope bolts .....</b>	<b>189</b>
11.1. Subject and scope of testing .....	189
11.2. Test results.....	190
11.3. Summary of rope bolt testing.....	193
<b>12. Summary.....</b>	<b>195</b>
References.....	202
Figure index.....	225
Picture index.....	231
Table index.....	232