Designation: E2804 – 11

Standard Test Method for Evaluating Emergency Response Robot Capabilities: Mobility: Confined Area Obstacles: Stairs/Landings[1]

This standard is issued under the fixed designation E2804; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 *Purpose:*

1.1.1 The purpose of this test method is to quantitatively evaluate a teleoperated ground robot's (see Terminology E2521) capability of traversing stairs with landings in confined areas.

1.1.2 Robots shall possess a certain set of mobility capabilities, including negotiating obstacles, to suit critical operations such as emergency responses. Stairs with landings are a type of obstacle that exists in emergency response and other environments. These environments often pose constraints to robotic mobility to various degrees. This test method specifies apparatuses, procedures, and metrics to standardize this testing.

1.1.3 The test apparatuses are scalable to provide a range of lateral dimensions to constrain the robotic mobility during task performance. Fig. 1 shows three apparatus sizes to test robots intended for different emergency response scenarios.

1.1.4 Emergency response ground robots shall be able to handle many types of obstacles and terrain complexities. The required mobility capabilities include traversing gaps, hurdles, stairs, slopes, various types of floor surfaces or terrains, and confined passageways. Yet additional mobility requirements include sustained speeds and towing capabilities. Standard test methods are required to evaluate whether candidate robots meet these requirements.

1.1.5 ASTM Task Group E54.08.01 on Robotics specifies a mobility test suite, which consists of a set of test methods for evaluating these mobility capability requirements. This confined area stairs/landings test method is a part of the mobility test suite. The apparatuses associated with the test methods challenge specific robot capabilities in repeatable ways to facilitate comparison of different robot models as well as particular configurations of similar robot models.

1.1.6 The mobility test suite quantifies elemental mobility capabilities necessary for ground robot intended for emergency response applications. As such, users of this standard can use either the entire suite or a subset based on their particular performance requirements. Users are also allowed to weight particular test methods or particular metrics within a test method differently based on their specific performance requirements. The testing results should collectively represent an emergency response ground robot's overall mobility performance. These performance data can be used to guide procurement specifications and acceptance testing for robots intended for emergency response applications.

NOTE 1—Additional test methods within the suite are anticipated to be developed to address additional or advanced robotic mobility capability requirements, including newly identified requirements and even for new application domains.

1.2 *Performing Location*—This test method shall be performed in a testing laboratory or the field where the specified apparatus and environmental conditions are implemented.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are not precise mathematical conversions to inch-pound units. They are close approximate equivalents for the purpose of specifying material dimensions or quantities that are readily available to avoid excessive fabrication costs of test apparatuses while maintaining repeatability and reproducibility of the test method results. These values given in parentheses are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E2521 Terminology for Urban Search and Rescue Robotic Operations

E2592 Practice for Evaluating Cache Packaged Weight and Volume of Robots for Urban Search and Rescue

[1] This test method is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.08 on Operational Equipment.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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