



# **POLARIS**

**Notice of Proposed Rulemaking on Safety  
Standard for Debris Penetration Hazards  
Docket No. CPSC-2021-0014**



## Leveraged Broad Field Performance Data (2 million vehicles with 14+ million years in service)

Analyzed where on the vehicle debris penetration reports occurred

Correlated field performance of numerous vehicles and identified designs have different report rates

## Standard Development

Identified vehicle coverage locations based on field performance data

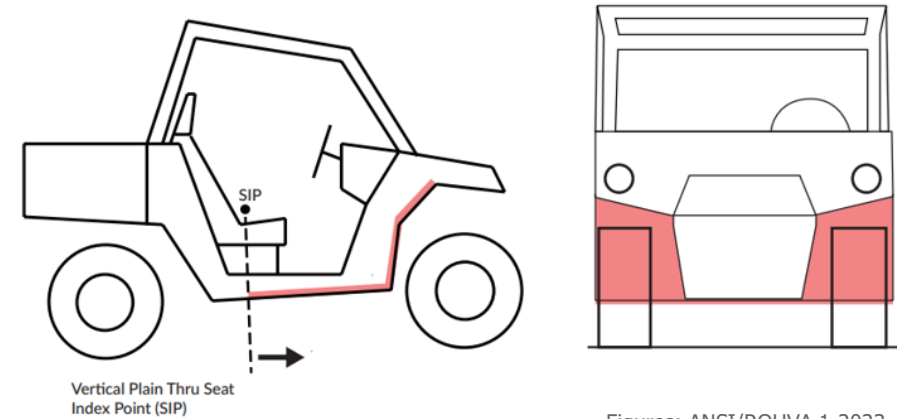
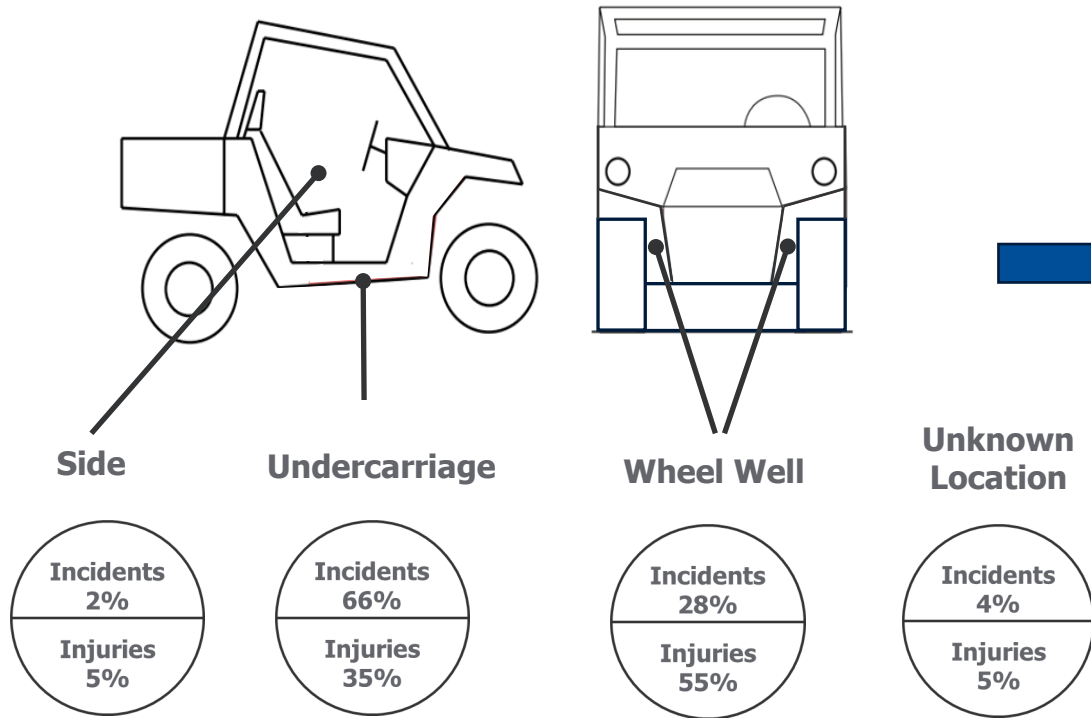
Delivers consistent, repeatable results

Correlated pass/fail criteria to field performance data



## CPSC October 2024 Released Data

## Industry Standard Test Method Coverage



Figures: ANSI/ROHVA 1-2023

In October, CPSC released 53 IDIs on which it based the NPR and five additional IDIs; industry's previously relied upon data set for industry standard, included the vast majority of these IDIs

CPSC released data is consistent with the larger set of industry data used to create the industry test procedure and shows need to address both undercarriage and wheel well areas

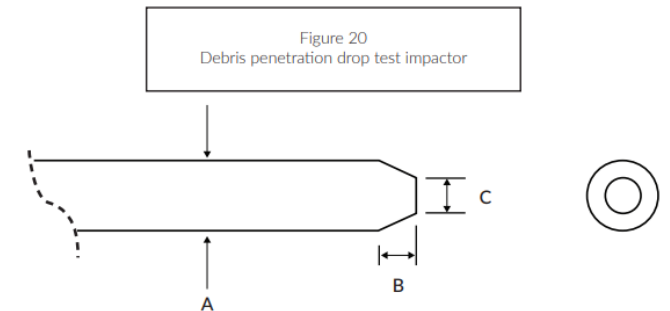
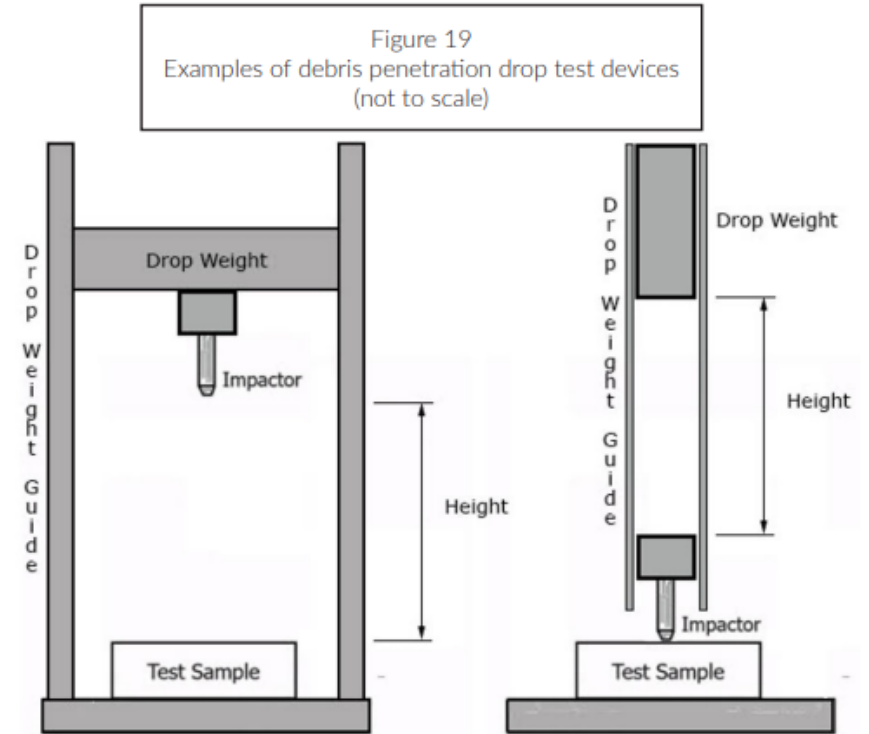


## Drop Test Selection

- Repeatable impacts created
- Energy of impacts adjusted to categorize designs (next slide)
- All areas identified in field performance review tested
- Impact speed set by drop height to correlate to field data
- Standard approach: lab test used to evaluate impact strength
- CPSC approved comparable test in connection with recall

## Industry Test Requirements

- Impact Speed = 10 mph
- Impact Energy = 355J



**Provides Full Incident Zone Coverage, Repeatable, Tied To Field Data**

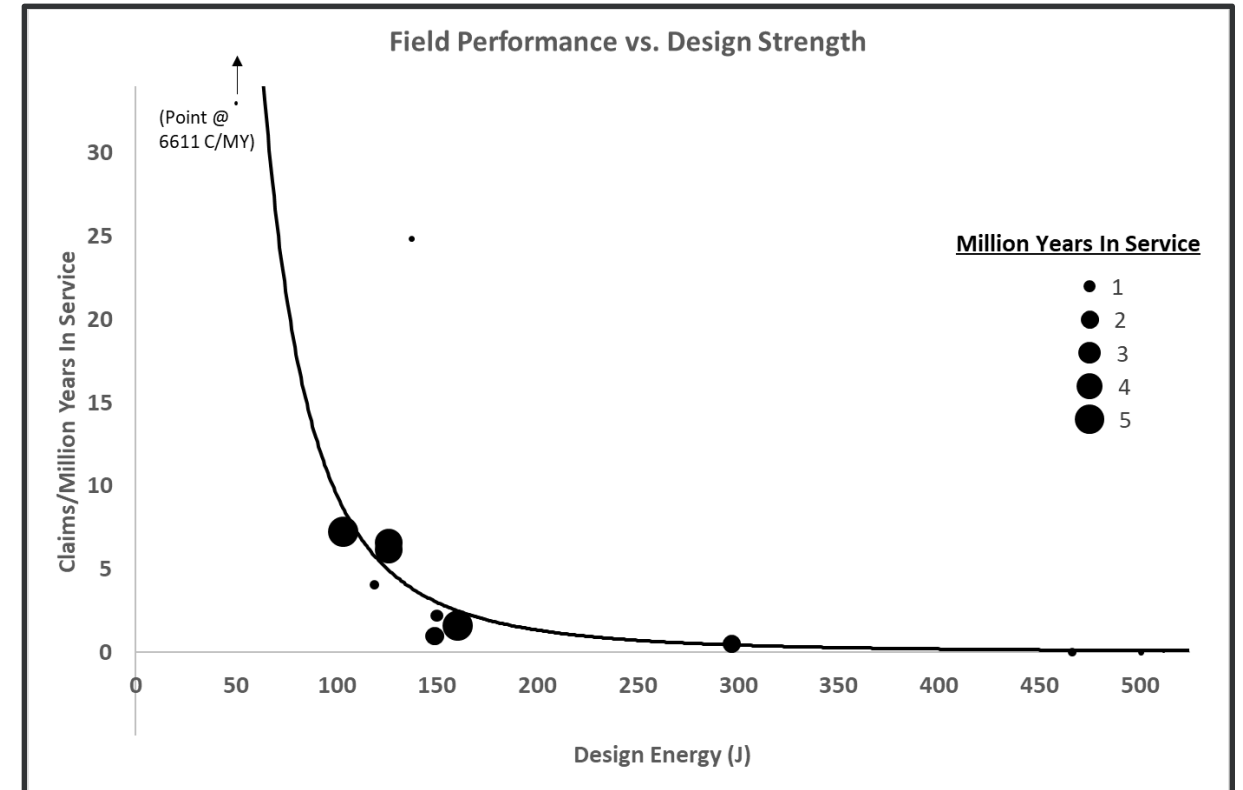


Extensive testing performed to understand strength of vehicle impact surfaces

Over 170 tests completed to determine design energy capability across multiple OEM vehicles

Incident rates compared to design energy capabilities to identify at what value (280J) the claim rate approaches zero claims

Energy requirement for industry standard: 355J





## Dowel Impactor

Large variation in strength results in poor repeatability  
Manufactured dowel strength inconsistent with natural stick strength

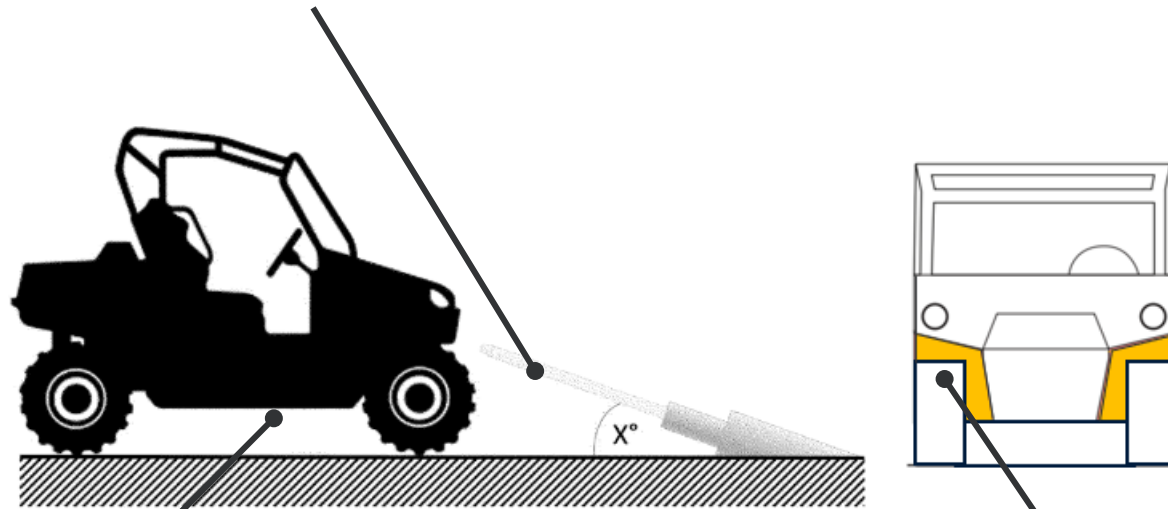


Figure 7— Illustration of Debris Penetrator Test Dowel Orientation

### No Undercarriage Coverage

66% of incidents  
35% of injuries

### Limited Wheel Well Area Testing

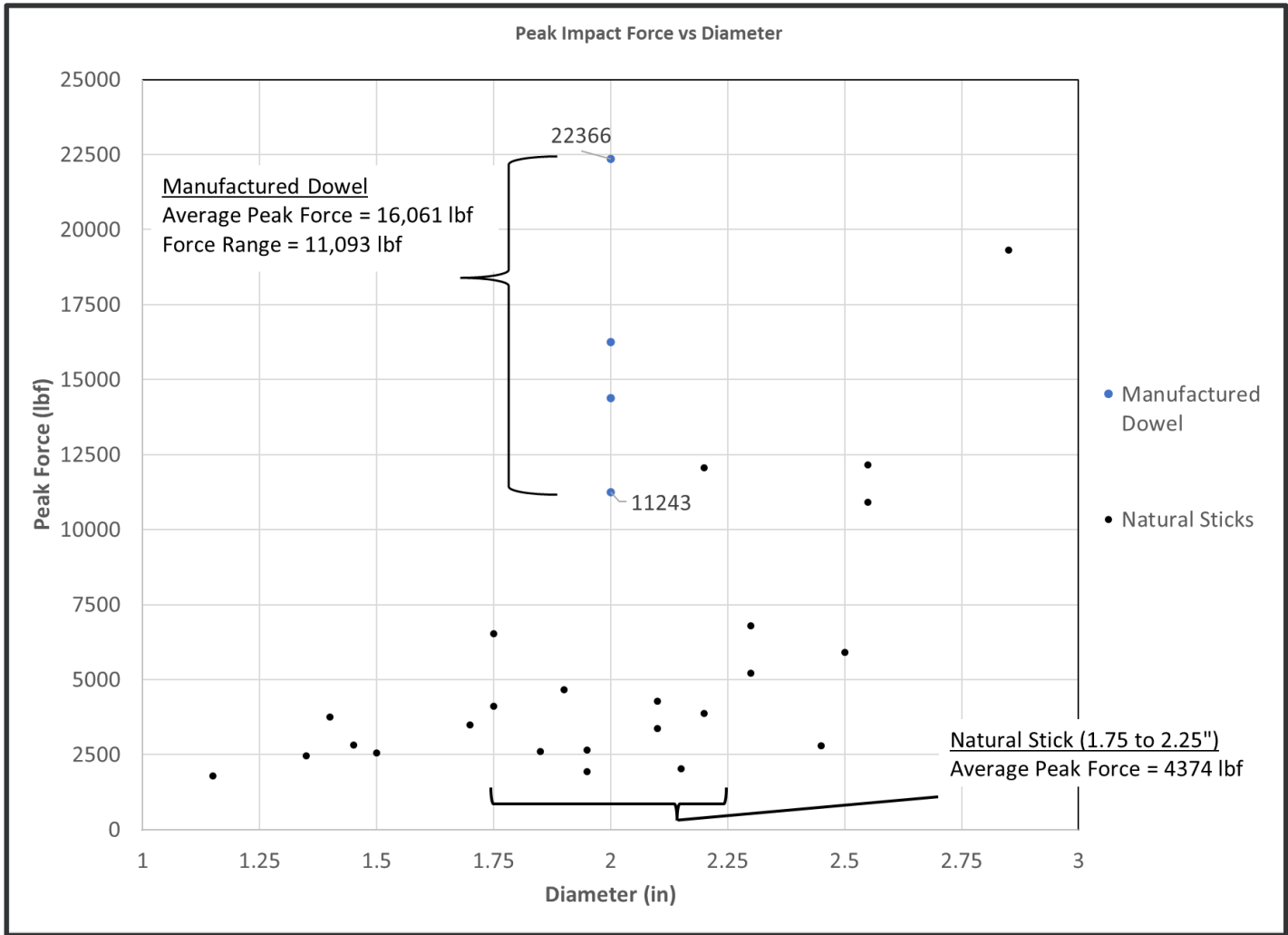
Testing of wheel wells limited by vehicle design  
Obstructions (e.g., tires, suspension, guards, etc.)  
Limited ability to test all areas in wheel well

## Lacking Repeatability, Coverage & Correlation To Field Performance



Manufactured dowel 2x as strong as natural sticks

Variation as much as 2x



## Not Tied To Natural Stick Strength





## 10 MPH Test - Pass

Table 20: Vehicle F – Sled Impact Run #3

**Configuration:** OEM Components (No Guard)

**Nominal Impact Speed:** 10 mph

**Actual Impact Speed:** 10.15 mph

**Primary Impact Location:** Stick aligned to impact where overlapping sections of the OEM components meet at a point. (Same Impact Point as Run #2). No C-Brace was used, and movement of the stick holder base was restrained.

11 3/4" Above Bottom of Floorboard  
18 1/2" Left of Vehicle Centerline

**Stick Length:** 62"

**Stick Penetration:** No

**Peak Force at Base of Stick:** 10,176 lb

**Run Outcome Narrative:**

The stick tip slid upward and outward, until the tip of the stick became constrained by a frame member under the plastic. The stick made a 1" diameter dent in the plastic as it pushed against the frame member. This dent can be seen in the photo to the right. There was significant stick force, with significant vehicle lifting and yawing. The front wheels of the of cart lifted off the floor during impact and the cart yawed 9° counterclockwise.



Pre-Impact Stick Alignment



Post-Impact – Side View



Post-Impact – Front View

## 6 MPH Test - Fail

Table 21: Vehicle F – Sled Impact Run #4

**Configuration:** OEM Components (No Guard)

**Nominal Impact Speed:** 10 mph

**Actual Impact Speed:** 5.96 mph

**Primary Impact Location:** Stick aligned to impact area outside of shock absorber where there would be no vehicle component constraints on stick motion. No C-Brace was used, and movement of the stick holder base was restrained.

15 3/4" Above Bottom of Floorboard  
23 3/4" Right of Vehicle Centerline

**Stick Length:** 72 1/2"

**Stick Penetration:** Yes

**Peak Force at Base of Stick:** 2,451 lb

**Run Outcome Narrative:**

The stick did not slide but penetrated at the impact point. The stick penetrated the fender flare and pushed aside the main floor penetrating between the main floor and the vehicle frame.



Pre-Impact Sick Alignment



Post-Impact – Side View



Post-Impact – Front View



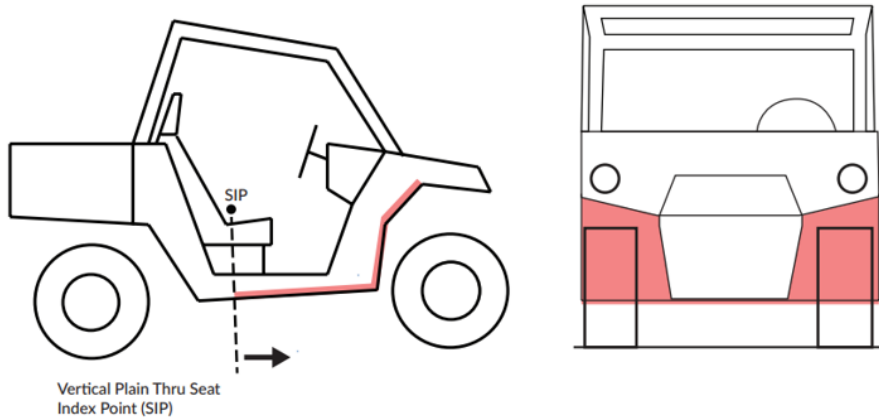
Post-Impact – Interior View

# SEA Testing Demonstrates Test Method Inconsistencies



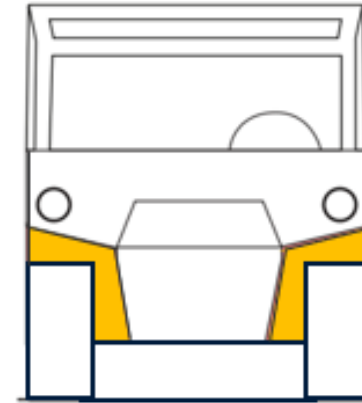


## Industry Standard



- ✓ Coverage
- ✓ Pass/Fail Criteria Tied To Field Performance
- ✓ Repeatable

## NPR Test Method



- ✗ Coverage
- ✗ Pass/Fail Criteria Tied To Field Performance
- ✗ Repeatable

**POLARIS**

Think Outside