Technology Brief

FIELD TESTING AND STANDARD EVALUATION OF WHEEL CHOCKS MANUFACTURED FROM RECYLCED HIGH-DENSITY POLYETHYLENE

Background

This project evaluated the use of wheel chocks manufactured from 100% recycled high-density polyethylene (HDPE), for large vehicles used in the fire and rescue industry.

Turtle Plastics (Lorain, Ohio) manufactures and markets useful products from recovered plastics. One of its new product lines is a wheel chock manufactured from 100% recycled HDPE. Currently, many of the wheel chock products in the market are manufactured from aluminum. Other companies manufacture chocks made from steel, wood, and virgin or recycled plastic. This project evaluated Turtle Plastics current wheel chock design to:

?? Compare field performance of Turtle's wheel chock to two different aluminum wheel chock designs, with respect to preventing movement of fire trucks on two different surfaces; and

?? Meet an industry standard for chock breakage, as published by the Society of Automotive Engineer's (SAE)

Key Words

Materials: Recycled HDPE.

Technologies: Injection molding.

Applications: Plastic chocks for use in the fire and rescue industry.

Market Goals: Market penetration; viable competition to aluminum chocks used extensively.

Abstract: Evaluation of wheel chocks manufactured from recycled HDPE, for large vehicles used in the fire and rescue industry.

Field Testing

Sample plastic wheel chocks from Turtle Plastics and two different designs of competing aluminum chocks were tested. The field test was conducted on asphalt with the following variables:

?? two slopes; 3 degrees and 30 degrees horizontal;

?? two starting positions; a static position with the clock up against the wheel, and a rolling start.

The fire truck used for these tests was a Pierce Lance 2000 model with 44.5 inch diameter tires. Ladder trucks use outriggers to lift the truck rear axles (and wheels) when the ladder is extended. Only one front tire is chocked in usual practice, therefore the test replicated this practice.

Static and dynamic tests were conducted. For static tests, a single chock at a time was placed in front of and touching the truck tires, and the brake was released. Wheel and chock movement was observed.

For the dynamic tests, a single chock was placed a set number of inches in front of the truck tire, and then the brake was released. The truck rolled toward the chock before contacting the chock. The chock was set four inches in front of the tire on the 3 degree slope and two inches in front of the tire on the steeper slope.

The findings of interest for both static and dynamic tests were the ability to stop truck movement, and the amount of chock movement after release of the truck brake and contact with the front tires.

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Conclusions of Field Test

The performance of three wheel chock designs (aluminum block, aluminum fold-up, and plastic) supporting one front tire (44.5 inch diameter) of a fire truck was compared on asphalt surfaces. The plastic and both aluminum wheel chock designs prevented fire truck movement on a 3-degree slope asphalt surface during static and dynamic roll tests.

In the 30-degree slope test, both aluminum chock designs slid, but did stop, fire truck movement during static and dynamic tests. The plastic wheel chock did not stop truck movement during the static test on a 30 degree slope; therefore dynamic tests were not completed. The plastic teeth did not grip the asphalt surface as well as aluminum teeth.

In the current design of the plastic chock that was field tested, the bottom plastic teeth did not offer adequate friction on asphalt at the steeper slope tested, and did not dig into the asphalt surface to prevent truck movement. Metal teeth may be one option to consider for future chock design.

As previously mentioned, the plastic chock curvature very closely matched the tire perimeter. It may be that the larger wheel contact curvature radius of the aluminum chocks is intentional, as it would force more of the truck weight onto the chock teeth and down into the pavement. A chock that "fits" the wheel curvature may have more horizontal force acting on the bottom surface, when more downward vertical force is needed to keep the chock stationary.

Subsequent to this testing, Turtle Plastics designed and produced a smaller plastic chock, that fit better into the standard carrying compartments on fire trucks. This chock was tested to the SAE Standard discussed below.

Chock Breakage Testing Per SAE Standard J348

Turtle Plastics discovered a chock breakage standard, by the Society of Automotive Engineers (SAE), titled "SAE J348 Wheel Chocks." The standard only tests for strength and breakage resistance, not for traction performance or other performance properties. Proving that Turtle's chock product meets this requirement may enhance the companies' product marketing development.

General Motors Institute at Kettering University conducted testing to SAE J348 on Turtle's older and newer version of the chock. Sample chocks submitted included one of the same design used in the Virginia testing, and one sample of a more compact chock. Per the test standard, an ultimate test of 35.5 tons was used on each of the two chocks, a 10% overload from the specified 32 tons as per SAE J348.

Conclusions of SAE J348 Standard Testing

Both chocks, large and small, withstood the applied load of 35.5 tons without any visual or permanent damage as prescribed in SAE Standard J348. The small chocks exhibited visual elastic deformation at the maximum load. At elevated temperatures and long time loading history, this elastic deformation could result in some permanent distortions since polymeric materials are prone to creep. Additional wall thickness in the small chock could alleviate this possibility.

The length to height ratio of both chocks is 1.50. SAE J348 suggests a ratio of 1.73. Based on the static load test results for the large and small chocks, this slight non-conformance does not appear to be a deterrent to the structural integrity of the chocks. Possible design alternatives were suggested to address the length to height ratio.

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For More Information

For a copy of the report, *Field Testing and Standard Evaluation of Wheel Chocks Manufactured From Recycled High-Density Polyethylene,* call CWC at (206) 443-7703, email info@cwc.org, or visit the CWC Internet Website at www.cwc.org.

CWC is a nonprofit organization providing recycling market development services to both businesses and governments, including tools and technologies to help manufacturers use recycled materials. This research was partially funded by CWC's Recycling Technology Assistance Partnership (ReTAP), through a grant from the U.S. Environmental Protection Agency.

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