



BEAT THE BRAKES

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FINAL INVESTIGATION QUESTION

How does road surface affect the mean stopping distance of a toy car when ramp height and release point are kept fixed?

VARIABLES

Independent: road surface - smooth cardboard, felt, sandpaper.

Dependent (intended): natural stopping distance on the flat road, in metres.

CONTROLLED CONDITIONS

Fixed ramp height: 25 cm. Same car, release point and no-push release. Keep the ramp surface, road layout and measuring method constant.

Measure from the ramp exit to the front wheels.

OUR COMPLETED PHYSICAL MODEL



Actual group-built ramp, road and prediction marker.

PREDICTION & PHYSICS

Our prediction: the car would stop at 90 cm (0.90 m).

Surface, wheel and axle resistance oppose rolling and transfer mechanical energy into thermal energy and deformation. The car slows until it stops if the road is long enough.

Road-end contact is not natural stopping.

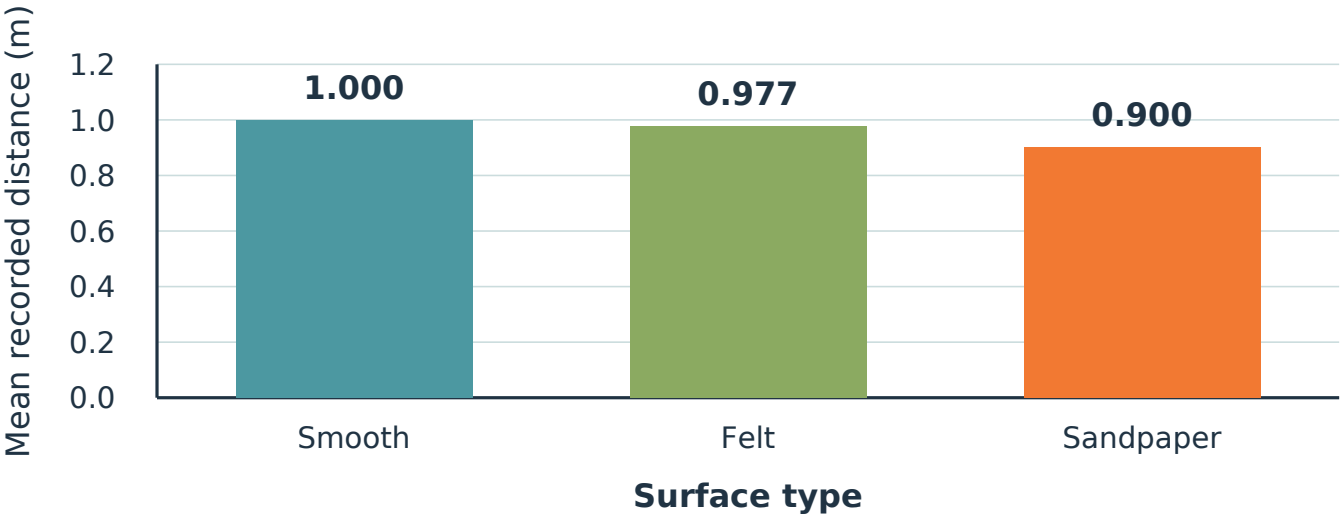
METHOD

Fix the ramp at 25 cm. Fit one surface flat. Place "Our Prediction" at 90 cm. Release the same car from the same point without a push. Record the distance to the front wheels from the ramp exit. Repeat three times per surface and calculate the mean. Note whether each run stops naturally.

RECORDED DISTANCES - ROAD-LIMITED TRIALS

Surface	Trial 1 (m)	Trial 2 (m)	Trial 3 (m)	Mean (m)
Smooth cardboard	1.000	1.000	1.000	1.000
Felt	1.000	0.950	0.980	0.977
Sandpaper	0.850	0.900	0.950	0.900
Mean recorded distance = (Trial 1 + Trial 2 + Trial 3) / 3				

MEAN RECORDED DISTANCE BY SURFACE



n = 3 per surface | Bars are not natural stopping means.

CONCLUSION & IMPROVEMENT

The recorded means were 1.000 m on smooth cardboard, 0.977 m on felt and 0.900 m on sandpaper. These numbers describe the reported road-limited runs. Because every car run reached the road end, we cannot determine the true mean stopping distance or reliably rank the surfaces by it. The 0.90 m prediction cannot be confirmed. Extend the flat road and repeat three natural-stop trials per surface at one fixed height.

LIMITATION: All nine trials reached the road end before stopping naturally. Values are recorded travel distances, not valid natural stopping distances.