

Vehicle Tracking with Corrugated Paper

Rod A Hunter

This preliminary material has been prepared as part of on-going research by Hunarch Consulting into the spatial correlates of wheelchair and scooter use in buildings and facilities..

There are a number of ways of recording actual travel paths, including laser range-findersⁱ, infraredⁱⁱ, sonar and electromagnetic tracking devicesⁱⁱⁱ, video photography, trailing pens as used by Bails^{iv}, brushes as used by Ringaert et al^v, piezo cable mats^{vi} as developed by Paradiso et al^{vii}, dusted travel surfaces or wheels. They all have inherent problems however.

An alternative technique adopted by Hunarch Consulting in its Australian research is corrugated paper.

The basis of the technique is that clear impressions of vehicle wheel tracks are left on the paper. These can then be simply measured for entry into a database for statistical analysis, or recorded and processed photogrammetrically for entry into a graphical program such as Autocad.

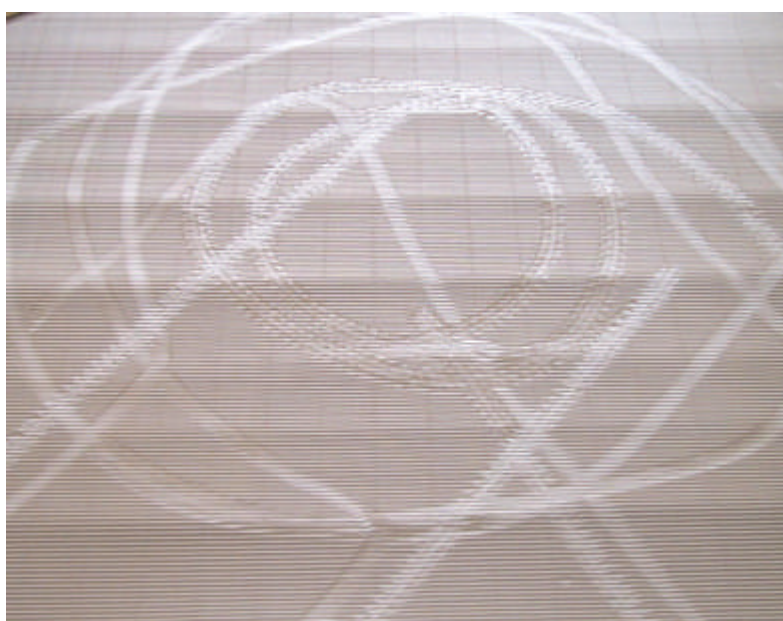


Figure 1: Wheel tracks before coloured i.d. marking

The corrugated paper is available in rolls, and is inexpensive. However because sheets have to be replaced after each trial, several rolls of paper would be required for recording several

ⁱ E.g. Sick LMS laser scanner:

http://www.sickoptic.com/kommerce_server/kommerce_productdata.asp?Web_class=164&type=2
Surphaser http://www.ageo.co.uk/laser_scanning/index.htm

ⁱⁱ E.g. Codamotion. <http://www.codamotion.com/>

ⁱⁱⁱ E.g. Polhemus Isotrack II. <http://www.polhemus.com/isotrks.htm>

^{iv} Bails J H. Project Report of the Field testing of Australian Standard AS1428-1977: Part 2, Vol 5 of 5.)ct, 1983. (Unpublished report to Australian Government)

The trailing pens were used on a scale model of wheelchairs, not on actual wheelchairs

^v Ringaert L, Rapson D, Qiu J, Cooper J Shwedyk E. Determination of New Dimensions for Universal Design Codes and Standards with Consideration of Powered Wheelchairs and Scooter Use. March 2001. universal design institute Uni of Manitoba.

^{vi} http://www.msiusa.com/piezo/piezo_coax_cable.htm

^{vii} Paradiso J A, Hsiao K, Strickon J, Lifton J, Adler A. Sensor systems for interactive surfaces. <http://researchweb.watson.ibm.com/journal/sj/393/part3/paradiso.html>

drivers performing several different travel and manoeuvres. However, using the same sheet for more than once can reduce this problem. This can be done by tracing wheel marks with different coloured pens immediately after each run. This not only reduce paper consumption, but also simplifies cross-referencing between different trials for the same driver.

Providing that the key points of the occupied vehicle, including the wheel contact points with the travel surface are also recorded, either before or after the movement trials, it is only necessary to record the wheel tracks of one drive wheel. This increases the efficiency of the tracking trials, and further reduces paper consumption.

The corrugations are capable of reflecting the different tyre treads of wheels, hence for wheelchairs that have different tyres on their drive and castor wheels, it is relatively easy to distinguish between their tracks.

The corrugated paper technique is preferable to the floor marking techniques of Bailsⁱ and Ringaert et alⁱⁱ because the recording of the actual wheel tracks reduces a calibration stage. It also does not entail any interference with the occupied vehicle.

An inherent problem of the corrugated paper is that it can be “scrunched” (i.e. multiply creased) during certain rotational manoeuvres. However this can be avoided by taping the edges to the floor surface. Various tapes have been tried for this purpose, and they have been found to be successful for carpet and smooth vinyl floors, including dusty or greasy floors. Different tapes are required for different conditions.

Additional testing with different grades of backing paper and pitch of corrugations are being carried out by Hunarch Consulting. Stiffer backing paper will minimise the “scrunching” of the corrugated paper during some manoeuvres. Finer corrugations might increase the rollability of the travel surface, and facilitate identification of the wheel tracks.

Linear travel

The corrugated paper technique appears to works very well for recording wheel tracks left by rotational manoeuvres. However, where measurement of steering accuracy for linear travel is required, over a distance of say, 10 metres, the corrugated paper poses additional logistical problems, such as the possible need for additional taping (although this will not be required to avoid scrunching), and

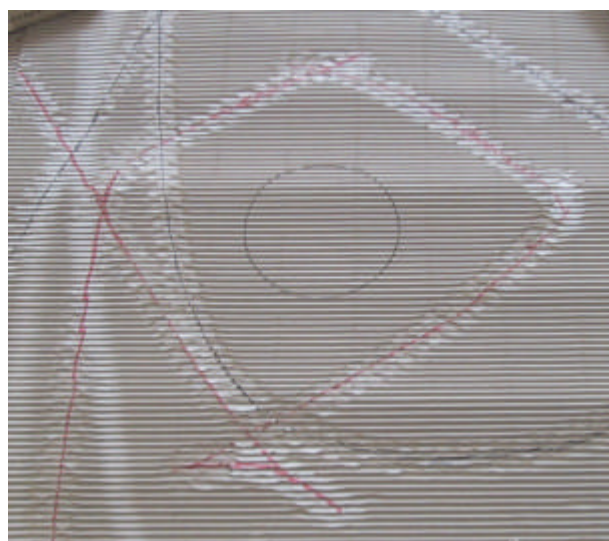


Figure 2: Wheel tracks marked with coloured i.d. lines. Note different tyre treads.

ⁱop cit
ⁱⁱop cit

increased paper consumption. Tests are being carried out by Hunarch Consulting to determine the extent of these problems



Figure 3: Wheel tracks around a slalom course bollard

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