Investigating Speed Patterns and Estimating Speed on Traffic-Calmed Streets

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Introduction

Safer Residential Streets
- Speeding on local streets is a major concern.
- Create safer streets to protect road users and improve community livability.
- Employ speed reduction techniques – traffic calming.

Traffic-calmed streets = Lower speeds?
- Previous research agree.
- Are lower speeds maintained throughout the entire length of a street?
- Are the speeds simply lower across and in proximity with a traffic calming device?

Research Objectives
- To determine the speed-reducing effect and the extent of influence zones of vertical and horizontal deflections.
- To examine the effect of traffic calming devices on speed variation.
- To develop methods for the prediction of speed on traffic-calmed streets.

Research Area
17 residential streets in Christchurch, calmed by speed humps, speed tables, angled slow points and mid-block narrowings.
Analysis of Speed Profiles

Speed profiles were plotted to compare speed-reducing effect and to determine influence zone of the different devices.

Testing for Variation In Speed

The F-test for equality of variances of speeds at the device and at distances from the device were conducted.

Speed Estimation Methods

- Speed-distance curves were produced to estimate speed at varying distances from the devices.
- Models for estimating speed midway between speed humps and speed tables were developed using linear regression.

General Speed Patterns

- Speed hump
- Speed table
- Angled slow point

Speed-Reducing Effect

Comparison of speeds on streets with isolated calming devices:
- Operating speed (km/h)
- Street speed (km/h)
- Speed difference (km/h)
### Influence Zones Results

Influence zones (in metres) of isolated calming devices

### Variation of Speed at Devices

Large deviations from the mean speed when traversing calming devices imply that there is significant behavioural differences among drivers.

Variances in speed were:
- **smaller** across the speed hump and the raised angled slow point than other sections on the respective streets.
- **larger** across the speed table than other sections of the street.
- **similar** throughout streets with the flush angled slow point and mid-block narrowings.

### Speed Difference Curves Results

- Speed-distance relationships were approximately quadratic in form.
- Speed difference curves can be used to estimate speed at varying distances from the device if the design speed is known.

### Speed-Spacing Models Results

For speed humps

- $V_{85} = 0.127S_h + 28.74$
  - $R^2 = 0.946$
- $V_{\text{mean}} = 0.125S_h + 22.99$
  - $R^2 = 0.944$

where $V_{85}$ is the 85th percentile speed, $V_{\text{mean}}$ is the mean speed, and $S_h$ is the spacing of speed humps.
**Results**

### Speed-Spacing Models

**For speed tables**

\[ V_{85} = 0.068S_T + 40.0 \]

\[ R^2 = 0.825 \]

\[ V_{mean} = 0.082S_T + 31.33 \]

\[ R^2 = 0.811 \]

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**Speed tables**

- **85th Percentile Speed**
  - 35
  - 40
  - 45
  - 50
- **Mean Speed**
  - 35
  - 40
  - 45
  - 50

<table>
<thead>
<tr>
<th>Speed spacing (m)</th>
<th>Speed humps</th>
<th>Speed tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 50</td>
<td>≤ 85</td>
<td>≤ 125</td>
</tr>
<tr>
<td></td>
<td>≤ 165</td>
<td>≤ 165</td>
</tr>
<tr>
<td></td>
<td>≤ 175</td>
<td>≤ 215</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>≤ 70</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>≤ 145</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>≤ 45</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>≤ 105</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>≤ 165</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>≤ 225</td>
</tr>
</tbody>
</table>

* Desired maximum street speed not attainable

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### Conclusions

**Are vertical deflections effective?**

- The speed hump produced the lowest operating speed (21.9 km/h) and largest speed change (-21.1 km/h). Variation of speeds across the speed hump was lower compared to other sections on the street.

- The speed table does reduce speed (-11.1 km/h), but operating speed is 15 km/h above the target speed of 20 km/h.

**Are horizontal deflections effective?**

- Mid-block narrowings do not reduce speed significantly.

- Angled slow points have a greater speed-reducing effect than mid-block narrowings and the speed table, but street and operating speeds are high.

**Appropriate spacing for desired speed**

- 85th percentile speed exceeds 50 km/h if spacing of:
  - speed humps is > 170 m
  - speed tables is > 145 m

- The spacing of speed humps is recommended to be ≤ 85 m to achieve a desired maximum 85th percentile of 40 km/h.

- A desired maximum 85th percentile speed of 40 km/h may not be attainable with speed tables, but 45 km/h is possible if spacing of speed tables is ≤ 70 m.
Closing

Achieving Low Speed Environments

- For traffic calming measures to be effective,
  - select devices that produce optimal speed-reducing effect.
  - use multiple devices that are appropriately spaced.
- There is a better chance of achieving low speed environments if a 30 km/h or 40 km/h speed limits is imposed and supported by traffic calming measures.

Thank You.

Appendix

Speed Hump vs Speed Table

- Street speed - LOWER
- Operating speed - LOWER
- Speed difference - BIGGER

Angled Slow Points: Raised vs Flush

- Street speed - LOWER
- Operating speed - LOWER
- Speed difference - BIGGER
Mid-block narrowings: Raised vs Flush

- Street speed: LOWER
- Operating speed: LOWER
- Speed difference: SLIGHTLY BIGGER

Mid-block narrowings: One-Lane vs Two-Lane

- Slightly lower speeds