

Measurement of cigarette butt litter accumulation within city bus shelters

Background—Transportation settings such as bus stops are increasingly the target for new smokefree area policies, including in New Zealand (e.g. plans by Auckland City Council).¹ Relevant issues for considering smokefree settings include secondhand smoke (SHS) exposure, nuisance, litter, fire risks and the normalisation of smoking.

National survey data in New Zealand indicates that SHS exposure at a bus stop or train station is regularly reported.² Other data indicates that public transport users report nuisance and health concerns around being exposed to SHS in these settings.³

Previous work has found markedly elevated levels of fine particulates from tobacco smoke in New Zealand bus shelters that were enclosed and partially enclosed.⁴ In two studies we found that a majority of smokers litter their cigarette butts,⁵ including at bus stops.⁶ In the survey presented here we attempted to new approach to studying the smoking at bus stops problem—by measuring cigarette butt litter and its accumulation rate.

Methods—The study area was a convenience sample of three major bus routes in Wellington City (largely around the researchers routine travel to work). “Bus shelters” were defined as discrete structures at bus stops with at least three walls and a roof (i.e. excluding partially sheltered bus stops that have some protection from surrounding buildings or overhanging shop roofing).

The three distinct areas of interest in terms of butt litter were the:

- (i) Shelter floor (as defined by the shelter walls);
- (ii) Rectangular area of footpath extending directly from the shelter to the street curb; and
- (iii) Street gutter directly in front of the shelter (as defined by the concrete surfacing vs asphalt surfacing of the road).

At bus stops without a shelter, the bus stop area was defined as that extending 6 metres from the bus stop signpost (in the direction of the bus arrival). In these cases there were two distinct areas surveyed: (i) the rectangular area of footpath extending 6 metres from the sign post to the street curb; (ii) the street gutter extending 6 metres behind the signpost. This area ran parallel to the footpath section surveyed.

On day 1 of the sampling we counted all the cigarette butts in the above areas for all the bus stops on the selected routes (on either side of the road). Then all these identified butts were removed. Day 2 of the sampling followed exactly the same route as on day 1, with sampling of the bus stops being as close to 24-hours later as possible.

The sampling days were all on weekdays and we selected periods where the weather forecast was for no rain and with wind velocities all being <35 km per hour

(according to the MetService forecast for the city). Sampling took place at non-peak commuting times when shelters were largely unoccupied.

Results—There was no evidence of cleaning or any other kind of bus stop maintenance between observer visits to the bus stops. During the second data gathering period, certain litter items were very frequently recalled and recognised from the first observation period. On average, 0.5 new items of litter (excluding butts) appeared per stop (range: -2 to 3 items), with only 12.9% of the stops (4/31) showing a reduction in litter counts.

A total of 314 cigarette butts were identified and removed in the baseline survey, and 123 new butts were identified in the repeat survey at 24-hours (Table 1). More new butts accumulated in the gutters compared to bus shelter floors ($p=0.005$), or on the adjacent pavement ($p<0.0001$, Student's two-tailed t-test). Somewhat unexpectedly, bus shelters with gaps between the walls and the floor had a significantly *greater* accumulation of new butts, compared to shelters where the walls and floor were connected (2.2 vs 0.7 new butts $p=0.014$).

On average, 2.5 new butts accumulated at bus stops with a rubbish bin less than 5 metres from the bus shelter or sign post (tabulated data available on request). In contrast, bus stops with no bin in sight accumulated an average of 1.3 new butts, though this difference was not statistically significant ($p=0.062$).

Table 1. Cigarette butts at bus stops at the baseline survey and accumulating after 24-hours

Area at the bus stops	Baseline (with all the butts subsequently removed)			New butts at the point of 24-hours after the baseline survey		
	No. of areas* with any butts (%)	No. of butts	Mean butts per area	No. of areas with any new butts (%)	No. of new butts	Mean of new butts per area
Bus shelter floor (n=34 shelters)	13 (38)	61	1.8	12 (35)	18	0.5
The pavement directly in front of the shelter, or for open bus stops, six metres from the bus stop signpost (in the direction of the bus arrival) (n=67)	21 (31)	57	0.9	13 (19)	19	0.3
The gutter directly in front of the shelter, or for open bus stops, six metres from the bus stop signpost (n=67)	52 (78)	196	2.9	37 (55)	86	1.3
Total – all of the above areas (n=168)	86 (51)	314	1.9	62 (37)	123	0.7

Discussion—This study suggests that it is feasible to assess cigarette butt accumulation at bus shelters in a systematic way. Therefore this type of method (in terms of before and after studies) could be used to study the impact of interventions such as the introduction of no-smoking signage at bus stops and policies requiring smokefree bus stops.

This study also provides additional evidence that smoking regularly occurs at bus stops and that smokers frequently litter their butts (including within bus shelters).

These findings are consistent with two previous New Zealand studies of smokers discarding their butts.^{5,6} This level of littering appears to be unrelated to the

availability of, and proximity to, rubbish bins. Nevertheless, the results we obtained will probably underestimate smoking at these bus stops, since we will have missed butts from smokers: (i) who did dispose of butts appropriately (in rubbish bins); or (ii) who disposed of butts in places outside of our study areas (e.g., to the sides or behind the shelter, onto the road and not in the gutter, or down drains).

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