# Appendix 1 Evidence Tables

***Question 9: Are settings-based travel planning (such as in workplaces, new residential developments or schools) interventions effective at reducing the health impact of, or people's exposure to, traffic-related air pollution?***

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / Comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Full citation<br>Watts, E., Stephenson, R., Evaluating an employer transport plan: effects on travel behaviour of parking charges and associated measures introduced at the University of Sheffield., LOCAL ENVIRONMENT, 5, 435-450, 2000<br><br>Quality score<br>-<br><br>Study type<br>Before and After<br><br>Aim of the study<br>To assess the impact of an employer transport plan (ETP) on changes in mode of travel to work by employees.<br><br>Location and setting<br>University of Sheffield, UK<br><br>Length of study<br>N/A<br><br>Source of funding<br>Not reported</td>
<td>Number of participants<br>n=182<br><br>Participant characteristics<br>The questionnaire targeted 500/5800 members of staff. The random sample was stratified by type of staff (academic, administrative and support).<br><br>Inclusion criteria<br>University staff members<br><br>Exclusion criteria<br>None stated</td>
<td>Intervention / Comparison<br>Introduction of a car park management system where staff were only able to park at the university if allocated a chargeable permit. Allocation was given on the basis of need using a points-based criteria system. In total there were 1245 parking spaces available, a number sufficient to enable approximately 20% of staff to park at any one time.<br><br>Travel incentives were also used to encourage the use of non-car modes, including: the introduction of a park and ride facility between an outlying hall of residence and the university campus; additions to two existing bus services; bus passes for sale on campus; extra cycle racks; signposting to ease pedestrian movement within the campus; and information on public transport.<br><br>Questionnaires were distributed to staff 6 months after the intervention was implemented. Participants completed the questionnaire about journeys to work over a 1 week period.</td>
<td>Outcomes<br>Previous and current modal split of transport use
<table>
<tr><th>Mode of transport</th><th>Previous mode</th><th>Current mode</th><th>Difference</th></tr>
<tr><td>Car driver</td><td>39.2</td><td>31.9</td><td>-7.3</td></tr>
<tr><td>Car passenger</td><td>7.7</td><td>7.7</td><td>0.0</td></tr>
<tr><td>Walk</td><td>18.2</td><td>18.7</td><td>0.7</td></tr>
<tr><td>Bus</td><td>14.9</td><td>16.5</td><td>1.8</td></tr>
<tr><td>Supertram</td><td>4.4</td><td>4.9</td><td>0.6</td></tr>
<tr><td>Train + other</td><td>4.4</td><td>3.3</td><td>-1.1</td></tr>
<tr><td>Cycle</td><td>2.8</td><td>2.7</td><td>0.0</td></tr>
<tr><td>Park and ride</td><td>0.0</td><td>2.2</td><td>2.2</td></tr>
<tr><td>More than one mode</td><td>8.3</td><td>11.5</td><td>3.4</td></tr>
<tr><td>Other</td><td>0.0</td><td>0.5</td><td>0.5</td></tr>
<tr><td>Total</td><td>100.0</td><td>100.0</td><td>-</td></tr>
</table>
Analysis<br>Overall, the sample that completed the questionnaire was just under 3.5% of the university workforce.<br>The results for the modal split before and after the intervention was implemented show that the car remained the dominant means of transport for staff but that there was an overall reduction of 7.3% in car-based journeys amongst respondents.</td>
<td>Limitations identified by the author<br>The availability of on street parking inhibited reductions in car use. Those ineligible for a permit or who objected to the principle of paying to park at work could continue to drive to work. Of the regular car drivers, 32% parked outside the university car parks and 21.5% parked on the street.<br>Incentives had a limited influence. New bus services did not serve the areas where the focus group participants lived and no-ne using the park and ride service had switched from car use or had actually parked and rode. Data from the bus operator also showed low usage for the service.<br><br>Limitations identified by the review team<br>Not clear how participants were randomly chosen for initial questionnaire.<br>Lack of power due to small sample size</td>
</tr>
</table>

## Study details

**Full citation**
Sargeant,J, Carter,T, Mcsweeney,S, Hughes,W, Cambridgeshire Travel Choice Project. Final Report, -, 2004

**Quality score**
-

**Study type**
Randomised Controlled trial

**Aim of the study**
To demonstrate whether targeting new starters (and existing car park users) with personalised travel information was an effective means of securing changes to travel behaviour and increased the proportion of employees travelling to work by more sustainable modes of transport.

**Location and setting**
Cambridge, UK

**Length of study**
3 months

**Source of funding**
The travel planning pilot project involved Cambridgeshire County Council and Addenbrooke's NHS Trust with co-funding from the Department for Transport.

## Population

**Number of participants**
**Total number of individuals within the Travel Choice Project**

| | Experiment group | Control group | Total |
|---|---|---|---|
| Addenbrooke's NHS Trust New Recruit project | 158 | 172 | 330 |
| Cambridgeshire County Council New Recruit project | 55 | 47 | 102 |
| Cambridgeshire County Council Car park access project | 145 | 136 | 281 |
| Total | 358 | 355 | 713 |

**Participant characteristics**
New recruits joining Addenbrooke's NHS Trust and Cambridgeshire County Council (Shire Hall site) and existing employees at Cambridgeshire County Council with access to the on-site car park.

**Inclusion criteria**
New recruits or existing staff with access to on-site car parking at the Shire Hall site.

**Exclusion criteria**
Existing employees whose main work base was not Shire Hall.

## Intervention / Comparator

**Intervention / Comparison**
Introduction of the Travel Choice project with individualised travel advice and guidance in order to encourage a shift in travel to work mode. All new recruits were randomly divided into an Experiment Group (targeted with the intervention) and a Control Group (no intervention).
In addition, all existing employees with access to the free car-parking site were included in a parallel project. From an alphabetical list of all those existing employees who had access to the main onsite car park, names were picked alternately (at random) to be placed in the Experiment or Control groups.
The existing staff project followed the same format with same points of contact as that for new recruits.
The Control and Experiment groups were compared after three months relative to week one for method of travel and number of car alone trips.

**Travel Choice Project Contact Stages**

**Control group:**
**Before employee start date – No contact**
**One week into post - No contact**
**3 months into post -**
Telephone survey
- Employment status (still in post?)

## Results

**Outcomes**

**Travel Choice modal split breakdown between car alone and other modes of transport at Week 1 and Month 3 of the project**

| | | % of car alone trips (actual numbers in brackets) | | % of trips by all other modes (actual numbers in brackets) | |
|---|---|---|---|---|---|
| | | Week 1 | Month 3 | Week 1 | Month 3 |
| Addenbrooke's NHS Trust New Recruit Project | Experiment | 26.5% (208) | 28.9% (228) | 73.5% (577) | 71.1% (562) |
| | Control | 33.0% (284) | 35.2% (303) | 67.0%* (576)* | 64.8% (557) |
| Cambridgeshire County Council New Recruit Project | Experiment | 45.5% (125) | 45.1% (124) | 54.5% (150) | 54.9% (151) |
| | Control | 51.9% (122) | 56.2% (132) | 48.1%* (113)* | 43.8% (103) |
| Cambridgeshire County Council Car Park Access Group | Experiment | 70.0% (503) | 60.9% (441) | 30.0% (216) | 39.1% (283) |
| | Control | 69.1% (461) | 74.7% (508) | 30.9% (206) | 25.3% (172) |
| Cambridgeshire County Council sub-projects combined | Experiment | 63.2% (628) | 56.6% (565) | 36.8% (366) | 43.4% (434) |
| | Control | 64.6% (583) | 69.9% (640) | 35.4%* (319)* | 30.1% (275) |

*Control group figures for 'all other modes' in Week 1 inferred from other data collected

**Percentage of individuals driving alone for five days a week at Week 1 and Month 3 stages**

| | | % of individuals driving alone for 5 days a week (actual numbers in brackets) | |
|---|---|---|---|
| | | Week 1 | Month 3 |
| Addenbrooke's NHS Trust New Recruit Project | Experiment | 19.6% (31) | 24.7% (39) |
| | Control | 29.1% (50) | 30.2% (52) |
| Cambridgeshire County Council New Recruit Project | Experiment | 38.2% (21) | 32.7% (18) |
| | Control | 46.8% (22) | 48.9% (23) |

## Notes

**Limitations identified by the author**
The car parks utilised in the study had different site access policies. Shift work for employees at the hospital site and the need to travel as part of work, mainly at the County Council. Sites were at opposite ends of city, which have different and contrasting public transport provision.
At Cambridgeshire County Council, a single designated officer within the Recruitment Team dealt with the whole recruitment process for specific posts. In contrast, at Addenbrooke's NHS Trust, recruitment was split across a number of teams.
The scale of recruitment differed across the two organisations with Addenbrooke's NHS Trust experiencing higher rates of general recruitment together with blocks of new intakes at specific times of the year

**Limitations identified by the review team**
The numbers in each group differed between the experiment and control groups and also between week 1 and Month 3 when results were assessed.

**Other comments**
At both sites there was a 95% response rate as part of the project for new recruits and, at Shire Hall within the car park access group, a 70% response rate was achieved (car park users comprised a parallel project at

| Study details | Population | Intervention / Comparator | Results | Notes |
|---|---|---|---|---|
| | | • Survey of Week 1 and current travel modes<br>• Reasons for choice of mode<br>• Perception of travel modes<br>• Usefulness of employer's standard travel to work advice<br>• Desirability of personalised Information pack<br><br>**Experiment group:**<br>**Before employee start date – Inform recruit about the Project and invite them to contact Advisor if desired**<br>**One week into post - Face-to face interview**<br>• Survey of current travel modes<br>• Discussion of travel needs and options<br>• Hand deliver personalised letter and travel information pack<br>After 3 months: Follow-up telephone survey<br>• Employment status (still in post?)<br>• Survey of current travel modes<br>• Reasons for choice of mode<br>• Perception of travel modes<br>• Usefulness of travel project (discussion and information pack) | <table><tr><td rowspan="2">Cambridgeshire County Council Car Park Access Group</td><td>Experiment</td><td>56.6% (82)</td><td>41.4% (60)</td></tr><tr><td>Control</td><td>44.1% (60)</td><td>64.0% (87)</td></tr><tr><td rowspan="2">Cambridgeshire County Council sub-projects combined</td><td>Experiment</td><td>51.5% (103)</td><td>39.0% (78)</td></tr><tr><td>Control</td><td>44.8% (82)</td><td>60.1% (110)</td></tr></table><br>**Analysis**<br><br>**Addenbrooke's NHS Trust**<br>There was a 2.2% increase in the number of car alone trips between Week 1 and Month 3 of the project in the Experiment group relative to the Control group. The number of individuals making 5 trips by car alone in the week was 5.5% higher (30.2 % against 24.7%) in the Control group compared to the Experiment group at the 3-month stage of the project. The changes between Week 1 and Month 3 are not statistically significant (chi-squared =0.37, p = 0.54). There was no evidence of modal shift at the hospital in terms of reducing car alone trips. Furthermore, there was no significant difference between the Experiment and Control groups at the three-month stage in terms of the number travelling to work five days a week by car alone.<br><br>**Cambridgeshire County Council (combined sub-group data)**<br>There was an 18% decrease in the number of car alone trips between Week 1 and Month 3 of the project in the Experiment group relative to the Control group. The number of individuals making 5 trips by car alone in the week was 21.1% higher (60.1% against 39.0%) in the Control group compared to the Experiment group at the three-month stage of the project. Looking at the two County Council data sets together, there was an 18% reduction in car trips in the Experiment Group compared with the control group and a significant reduction in people travelling alone by car on five days ($p<0.01$ using Mantel-Haenszel Inference for common odds ratio). | Cambridgeshire County council.<br>Other than direct personal contact and the provision of detailed personalised information, no further incentives were offered to individuals. The project did, however, utilise and promote existing initiatives and schemes available through each organisation's travel plan. The only intervention, therefore, was personal contact and individualised travel advice. |

***Question 9: The context in which settings-based travel planning (such as in workplaces, new residential developments or schools) interventions are effective at reducing the health impact of, or people's exposure to, traffic-related air pollution.***

| Study details | Research parameters | Inclusion / Exclusion criteria | Population | Results | Notes |
|---|---|---|---|---|---|
| **Full citation**<br>Watts, E., Stephenson, R., Evaluating an employer transport plan: effects on travel behaviour of parking charges and associated measures introduced at the University of Sheffield., LOCAL ENVIRONMENT, 5, 435-450, 2000<br><br>**Quality score**<br>-<br><br>**Study type**<br>Qualitative<br><br>**Aim of the study**<br>To assess the barriers to a change in travel behaviour resulting from the introduction of an Employer Transport Plan.<br><br>**Location and setting**<br>University of Sheffield, UK<br><br>**Source of funding**<br>Not reported | **Intervention / Comparison**<br>Introduction of a car park management system where staff were only able to park at the university if allocated a chargeable permit. Allocation was given on the basis of need using a points-based criteria system. In total there were 1245 parking spaces available, a number sufficient to enable approximately 20% of staff to park at any one time. Travel incentives were also used to encourage the use of non-car modes, including: the introduction of a park and ride facility between an outlying hall of residence and the university campus; additions to two existing bus services; bus passes for sale on campus; extra cycle racks; signposting to ease pedestrian movement within the campus; and information on public transport.<br><br>**Data collection**<br>Five focus groups were undertaken with participants split into types: 2 focus groups contained car users and 3 groups contained those who chiefly relied upon non-car modes of transport.<br><br>**Method of analysis**<br>Not described | **Inclusion criteria**<br>University staff members<br><br>**Exclusion criteria**<br>Not reported | **Number of participants**<br>Not clearly reported<br><br>8 people were invited to each group, however, non-attendance meant that only the car-user groups had 4 more more participants. | **Key themes**<br>**Reductions in Car Travel**<br>The policy causes a re-evaluation of the journey to work, with employees assessing the merits of car use against the costs and other disadvantages such as traffic congestion.<br><br>**Perception of the Transport Policy**<br>Participants were generally sceptical about the reasons for setting up the transportation policy. The policy was viewed as a means of income generation rather than an environmental policy designed to reduce car use. As such, employees did not think about the environmental implications of their journey to work but were concerned about paying for parking.<br><br>**Parking charges**<br>Staff tended to disregard the running costs of owning a car when comparing the cost of car travel against that of other modes. It was also indicated that the charges would need to increase considerably before providing sufficient incentive for them to re-evaluate their travel-to-work behaviour.<br><br>**Problems associated with Public Transport**<br>Participants said that public transport lengthened the working day due to time spent both travelling and waiting for transport to arrive. Other problems were inadequate services or the lack of a direct public transport route.<br><br>**Attitudes to Cars and Public Transport**<br>Some drivers had a more positive attitude towards public transport and had explored the possibilities of using travel alternatives, with some diversifying their travel away from the car on occasions. Other participants | **Limitations identified by author**<br>Not reported.<br><br>**Limitations identified by review team**<br>Eight people were invited to each focus group but due to non-attendance of some participants only the car-user groups had four or more participants. |

| Study details | Research parameters | Inclusion / Exclusion criteria | Population | Results | Notes |
|---|---|---|---|---|---|
| | | | | preferred to us the car and liked its convenience and flexibility. | |

***Question 10: Are personalised travel planning interventions to support low emission travel choices effective at reducing the health impact of, or people's exposure to, traffic-related air pollution?***

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / Comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Full citation<br>Nakayama,S, Takayama,J, Ecotravel Coordivator Program. Effects on travel behavior and environmental attitude, Transportation Research Record: Journal of the Transportation Research Board, 1924, 224-230, 2005<br><br>Quality score<br>-<br><br>Study type<br>Controlled before and after study<br><br>Aim of the study<br>To examine the impact of an ecotravel coordinator intervention on car travel mileage.<br><br>Location and setting<br>Kanazawa University and Ishikawa National College of Technology, Japan<br><br>Length of study<br>3 months (October - December 2002)<br><br>Source of funding<br>Not reported</td>
<td>Number of participants<br>Ecotravel coordinators = 15<br>Participants = 44<br>Non-participants (those who reported their travel behaviour but did not take part in the ecotravel coordinator intervention) = 92<br><br>Participant characteristics<br>Participants were students at the university and college Ecotravel coordinators were volunteers<br><br>Inclusion criteria<br>Not reported<br><br>Exclusion criteria<br>Students without a car were excluded from analysis</td>
<td>Intervention / Comparison<br>An ecotravel coordinator programme was established with the aim of reducing car use.<br>The role of the ecotravel coordinator was to:<br>• analyse travel behaviour of participants and themselves<br>• organise ecotravel meetings for reducing car use<br>• take the initiative in the meeting and inspire participants to understand their travel behaviour and improve their environmental attitudes<br>• give participants advice and suggestions for reducing car use<br><br>Coordinators formed their own groups. Each coordinator had approximately 3 participants.<br>All subjects reported the travel mileage measured on their car's odometers before and after the intervention.<br>A group of non-</td>
<td>Outcomes<br>Change in Car Travel Mileage
<table>
<tr><th></th><th colspan="2">Coordinator</th><th colspan="2">Participant</th><th colspan="2">Non-participant</th></tr>
<tr><th></th><th>1st Survey</th><th>2nd Survey</th><th>1st Survey</th><th>2nd Survey</th><th>1st Survey</th><th>2nd Survey</th></tr>
<tr><td>Mean (km/week)</td><td>129.00</td><td>59.00</td><td>176.54</td><td>92.12</td><td>176.29</td><td>173.99</td></tr>
<tr><td>% change</td><td colspan="2">-54.3</td><td colspan="2">-47.8</td><td colspan="2">-1.3</td></tr>
<tr><td>Mean difference</td><td colspan="2">-70.00</td><td colspan="2">-84.42</td><td colspan="2">-2.30</td></tr>
<tr><td>Standard deviation (SD)</td><td>101.04</td><td>54.69</td><td>124.91</td><td>86.26</td><td>149.50</td><td>157.52</td></tr>
<tr><td>Difference of SD</td><td colspan="2">-46.35</td><td colspan="2">-38.65</td><td colspan="2">8.02</td></tr>
<tr><td>Sample size</td><td>13</td><td>13</td><td>43</td><td>43</td><td>57</td><td>57</td></tr>
<tr><td>z-value</td><td colspan="2">-2.20**</td><td colspan="2">-3.48***</td><td colspan="2">-0.28</td></tr>
</table>
Wilcoxon's signed rank sum tests were used to determine the change in travel mileages between the first and second survey<br><br>Differences between types of study participant in Travel Mileage Reduction
<table>
<tr><th></th><th colspan="2">Coordinator</th><th colspan="2">Participant</th></tr>
<tr><th></th><th>Coordinator</th><th>Non-participant</th><th>Participant</th><th>Non-participant</th></tr>
<tr><td>Mean</td><td>-70.00</td><td>-2.30</td><td>-84.43</td><td>-2.30</td></tr>
<tr><td>Mean difference</td><td colspan="2">67.70</td><td colspan="2">82.13</td></tr>
<tr><td>Standard deviation (SD)</td><td>107.00</td><td>154.81</td><td>154.56</td><td>154.81</td></tr>
<tr><td>Difference of SD</td><td colspan="2">47.81</td><td colspan="2">0.25</td></tr>
<tr><td>Sample size</td><td>13</td><td>57</td><td>43</td><td>57</td></tr>
<tr><td>z-value</td><td colspan="2">-1.99**</td><td colspan="2">-2.90***</td></tr>
</table>
Mann-Whitney tests were conducted to examine whether the coordinators and participants reduced their travel mileage more than non-participant, and to eliminate seasonal and weather effects as well as other factors that may influence subjects<br>** p<0.05<br>*** p<0.01<br><br>Analysis<br>The ecotravel coordinators and participants of the programme reduced their travel mileage by 54% and 48% respectively, where as the non-participants only reduced their mileage by 1.4%. Reductions of the coordinators and participants of the ecotravel coordinator programme were statistically significant.</td>
<td>Limitations identified by the author<br>None reported<br><br>Limitations identified by the review team<br>The groups differed in size.<br><br>Groups were formed by the coordinators rather than being randomly selected and allocated to the intervention or control groups.</td>
</tr>
</table>

| Study details | Population | Intervention / Comparator | Results | Notes |
|---|---|---|---|---|
| | | participants who were not the subject of the intervention acted as a control group, reporting their travel behaviour for comparison with participants in the programme.<br><br>**Comparator**<br>The first survey of travel behaviour was undertaken between 10 - 16 October 2002 and the second survey between 12 - 18 December 2002. Ecotravel meetings were held between the 2 surveys. | The results also showed that the coordinators and participants reduced their travel mileage significantly more than non-participants. | |

***Review question 11: Are driver information, education and training interventions effective at reducing the health impact of, or people's exposure to, traffic-related air pollution?***

## Study details

**Full citation**
Caulfield, Brian, Brazil, William, Ni Fitzgerald, Kristian, Morton, Craig, Measuring the Success of Reducing Emissions Using an On-Board Eco-Driving Feedback Tool, Transportation Research: Part D: Transport and Environment, 32, 253-62, 2014

**Quality score**
-

**Study type**
Controlled trial

**Aim of the study**
To measure the effect of an on-board eco-driving tool on altering driving style and reducing emissions.

**Location and setting**
Netherlands

**Length of study**
10 months

**Source of funding**
European Commissions PEACOX Project under the Seventh Framework Program

## Population

**Number of participants**
n=167

**Participant characteristics**

| | Group | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| Age | | | | | |
| 18-30 | 21.8% | 8.0% | 7.8% | 27.2% | 48.6% |
| 31-50 | 43.8% | 54.2% | 35.8% | 55.3% | 32.2% |
| 51-65 | 24.6% | 22.1% | 49.1% | 17.5% | 19.2% |
| 65+ | 9.8% | 15.7% | 7.3% | 0.0% | 0.0% |
| Gender | | | | | |
| Male | 60.8% | 67.7% | 69.0% | 72.0% | 68.5% |
| Female | 39.2% | 32.3% | 31.0% | 28.0% | 31.5% |

Reviewing the personal characteristics of the groups, it is evident that Group D and Group E tend to contain younger participants whilst Group C is populated by older individuals. The gender split between the groups is reasonable similar, though Group D has a higher prevalence of males.

**Inclusion criteria**
Not reported

**Exclusion criteria**
Not reported

## Intervention / Comparator

**Intervention / Comparison**
An on-board eco-driving feedback tool.
Five different groups were analyzed during the trial period (Jan-Oct 2012). Participants were provided real time feedback on speeding and idling with alerts along with information on excessive manoeuvres and fuel consumption. The WEBFLEET website provided feedback in relation to their emissions and suggestions to reduce them.

| | | |
|---|---|---|
| Group A | Provided with on-board active driver feedback for the duration of the trial and access to WEBFLEET online. | n=82 |
| Group B | Provided with on-board active driver feedback for the duration of the trial and for the last 4 months were given access to WEBFLEET online. | n=27 |
| Group C | No intervention for 2 months. Then given both on-board active driver feedback and WEBFLEET online. | n=27 |
| Group D | No on-board active driver feedback for the duration of the trial. Then given WEBFLEET online after 2 months. | n=16 |
| Group E | Received no information at all on driving style. | n=15 |

## Results

**Outcomes**

**Average trip characteristics of the driving undertaken by each group in the trial**

| | Group A | Group B | Group C | Group D | Group E |
|---|---|---|---|---|---|
| | Mean (S.D) | Mean (S.D) | Mean (S.D) | Mean (S.D) | Mean (S.D) |
| Distance (km) | 56.8 (64.6) | 61.2 (72.8) | 57.3 (66.5) | 69.0 (79.7) | 49.0 (63.1) |
| Fuel usage (litres) | 3 (3.4) | 3.5 (4.2) | 3.2 (3.7) | 3.7 (4.5) | 2.8 (3.4) |
| Idle time (minutes) | 9 (8) | 12 (11) | 13 (16) | 13 (15) | 22 (18) |

**Average $CO_2$ Emissions per group**

| | Group A | Group B | Group C | Group D | Group E |
|---|---|---|---|---|---|
| | Mean (S.D) | Mean (S.D) | Mean (S.D) | Mean (S.D) | Mean (S.D) |
| $CO_2$ per km | 0.1387 (0.0889) | 0.1360 (0.0379) | 0.1354 (0.0305) | 0.1308 (0.0260) | 0.1409 (0.0395) |

**Comparison of the average weekly CO2 emissions per km – intervention groups vs. control**

| | Group A (%) | Group B (%) | Group C (%) | Group D (%) |
|---|---|---|---|---|
| Average reduction in $CO_2$ emissions | 4 | 4 | 3 | 6 |

**Analysis**

**Average trip characteristics**
The average travel distance between groups was similar. Group E (no intervention) covered the least average distance and used the least fuel during the trial. Group D (no on board driver feedback) covered the most distance and used the most fuel. The greatest average amount of idling time was shown in group E and the least in group A. There was a general trend in increasing idling time from groups A to E.

**Average $CO_2$ Emissions per group**
It can be observed that the highest average emissions are produced by the control group (Group E) and the lowest emissions were associated with Group D.

## Notes

**Limitations identified by the author**
Allocation of participants to groups was outside of the control of the authors.
Unable to follow a strictly random sampling procedure therefore user group comparisons should be interpreted with caution.
Due to instrument problems analysis within groups C and D were carried out on 9 and 7 participants only.

**Limitations identified by the review team**
Groups not equally split regarding numbers and characteristics such as age and driving profiles.
The authors did not report how participants were allocated.

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / Comparator</th><th>Results</th><th>Notes</th></tr>
<tr><td>me (FP7)</td><td></td><td></td><td>Comparison of the average weekly CO2 emissions per km – intervention groups vs. control<br>The results show how each of the test groups perform relative to the control group (Group E). Group D performed the best with an average reduction in emissions of 6% compared to the control group. Groups A and B also had on average a 4% reduction in $CO_2$ emissions compared to the control group with those in Group C having a 3% decrease in emissions.<br><br>Within group comparisons<br>Groups C and D received an intervention after a period of no intervention and so the effect can be looked at within these groups. Group C showed a reduction of 8.85% following access to both on-board feedback and online information, and group D showed a reduction of 10.3% following access to online information only.</td><td></td></tr>
<tr><td>Full citation<br>Eghbalnia, Cynthia, Sharkey, Ken, Garland-Porter, Denisha, Alam, Mohammad, Crumpton, Marilyn, Jones, Camille, Ryan, Patrick H., A Community-Based Participatory Research Partnership to Reduce Vehicle Idling Near Public Schools, Journal of Environmental Health, 75, 14-19, 2013<br><br>Quality score<br>-<br><br>Study type<br>Before and after study<br><br>Aim of the study<br>To promote an effective anti-idling</td><td>Number of participants<br><br>School Bus Drivers n=324<br>Parents of children attending the intervention schools n=1564<br>Staff, parents and students attending community events n=53<br>Staff and administrators of Cincinnati Public Schools (CPS) n=214<br><br>Participant characteristics<br>4 schools were selected to participate in the intervention. The schools were chosen because of the prevalence of reported asthma among the student population and potential exposure to TRAP from nearby major roads and idling school buses.<br><br>Inclusion criteria<br>Not Reported<br><br>Exclusion criteria<br>Not Reported</td><td>Intervention / Comparison<br><u>Bus drivers</u><br>Training (video and presentation) given to school bus drivers highlighting increased particulate exposure due to idling that may negatively impact on both children and adults health. Knowledge gained from training was assessed using a pre- and post educational test.<br><br><u>Staff and Parents</u><br>Attended an open houses, community or school assemblies on the importance of reducing vehicle idling time. Pre and post educational tests were given at the open house events.<br><br><u>Parents</u><br>Received idling reduction packets that included a letter describing the program, a fact sheet and pledge forms. Materials sent home at the same time as air quality assemblies were offered at the schools.<br><br><u>CPS Staff</u><br>Staff completed an online survey</td><td>Outcomes<br><br><u>Idling time</u><br>Average Idling time was measured pre intervention and post intervention at drop off and pick up from one participating school.<br><br><u>Buses</u><br><table><tr><td></td><td>Drop off</td><td>Pick up</td><td>Number of buses</td></tr><tr><td>Pre intervention</td><td>289 seconds</td><td>397 seconds</td><td>10</td></tr><tr><td>Post intervention</td><td>116 seconds</td><td>78 seconds</td><td>9</td></tr></table><br><u>Parent vehicles</u><br><table><tr><td></td><td>Drop off</td><td>Pick up</td><td>Mean number of vehicles at drop off</td><td>Mean number of vehicles at pick up</td></tr><tr><td>Pre intervention</td><td>29 seconds</td><td>244 seconds</td><td>61</td><td>35</td></tr><tr><td>Post intervention</td><td>24 seconds</td><td>79 seconds</td><td>41</td><td>28</td></tr></table><br><u>Knowledge about idling</u><br><br><u>Bus Drivers (n=324)</u><br>Drivers demonstrated a significant increase in Idling knowledge (7.3/10 to 8.5/10 correct answers, $p<0.05$).<br><br><u>Staff and parents</u></td><td>Limitations identified by the author<br>Limited follow up period, voluntary nature of participating in the assessments, and limited data of idling at some schools. Individual interpretation of pre and post educational assessments may result in biased results of the impact of the campaign.<br><br>Limitations identified by the review team<br>No bus driver or community members data, nor the intervention questions tested were published.</td></tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / Comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>educational message aimed at decreasing children's exposure to traffic related air pollution and reduce asthma morbidity.<br><br>Location and setting<br>USA<br><br>Source of funding<br>National Institute of Environmental Health Sciences</td>
<td></td>
<td>providing responses to a pretest. After a brief training video was watched the participants then completed a post education test.</td>
<td>Following open house, community and school assembly training of staff, parents and children, the mean test score significantly increased from 2.5/4 correct answers pre-test to 3.6/4 after the educational intervention ($p<0.05$).<br><br><u>CPS Staff and Administrators (n=214)</u><br>Pre and post online training questions and responses completed by CPS staff and administrators<br><br>
<table>
<tr><th>Question</th><th>Correct answer</th><th>Pretest Correct</th><th>Post-test Correct</th><th>Improvement</th></tr>
<tr><td>1. Does CPS have an anti-idling policy?</td><td>True</td><td>35%</td><td>97%</td><td>177%</td></tr>
<tr><td>2. Does the yellow bus service provider for CPS have an anti-idling policy?</td><td>True</td><td>35%</td><td>94%</td><td>169%</td></tr>
<tr><td>3. It is important to warm up the engine with an idling period of 5 minutes or more, especially in cold weather.</td><td>False</td><td>74%</td><td>97%</td><td>31%</td></tr>
<tr><td>It is better for an engine to run at low speed (idling) than to run at regular (i.e., 30 mph) speed</td><td>False</td><td>78%</td><td>93%</td><td>19%</td></tr>
<tr><td>Children and adults are equally sensitive to air pollution</td><td>False</td><td>90%</td><td>97%</td><td>8%</td></tr>
<tr><td>It is better to leave the engine idling because a "cold start" produces more pollution</td><td>False</td><td>54%</td><td>69%</td><td>28%</td></tr>
</table>
<br>Analysis<br><br><u>Idling time</u><br>Overall, following the intervention there was a reduction in idling time amongst bus drivers and parents. In addition, the mean number of vehicles at the school also reduced after the intervention.</td>
<td></td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / Comparator</th><th>Results</th><th>Notes</th></tr>
<tr><td></td><td></td><td></td><td><u>Anti-idling knowledge</u><br>Following the intervention, there was a significant increase in knowledge amongst bus drivers, CPS staff, and teachers and students.</td><td></td></tr>
<tr><td>Full citation<br>Rutty, Michelle, Matthews, Lindsay, Andrey, Jean, Matto, Tania Del, Eco-driver Training within the City of Calgary's Municipal Fleet: Monitoring the Impact, Transportation Research: Part D: Transport and Environment, 24, 44-51, 2013<br><br>Quality score<br>-<br><br>Study type<br>Before and after study<br><br>Aim of the study<br>To determine the effect of eco-driver training on driving behaviour and emissions from a municipal fleet of cars<br><br>Location and setting<br>Canada<br><br>Length of study<br><br>Source of funding<br>Not reported</td><td>Number of participants<br>n=15<br><br>Participant characteristics<br>Fleet drivers working within the Development & Building Approvals Business Unit, City of Calgary.<br><br>Inclusion criteria<br>Not reported<br><br>Exclusion criteria<br>Not reported</td><td>Intervention / Comparison<br>Drivers undertook Eco-driver training focusing on a 'smart driving style' which entails gentle accelerations, following speed limits, anticipating traffic flow, coasting to decelerate, shortening distance driven and reducing unnecessary idling. Selected driving parameters were collected for 1 month prior to the intervention. Participants were then provided with individualized feedback based on their results for these parameters The same driving parameters were then measured post intervention.</td><td>Outcomes<br><br>Results pre-intervention (averages)<table><tr><td></td><td>Gasoline car (n=11)</td><td>Hybrid car (n=4)</td></tr><tr><td>Distance (km)</td><td>40.0</td><td>34.5</td></tr><tr><td>Idling time (hours)</td><td>1.6</td><td>0.5</td></tr><tr><td>Fuel consumed from idling (L)</td><td>2.4</td><td>0.6</td></tr><tr><td>Hard acceleration (number of times)</td><td>0.6</td><td>1.1</td></tr><tr><td>Hard deceleration (number of times)</td><td>1.4</td><td>1.0</td></tr></table><br>Results post-intervention (averages)<table><tr><td></td><td>Gasoline car (n=11)</td><td>Hybrid car (n=4)</td></tr><tr><td>Distance (km)</td><td>38.1</td><td>24.5</td></tr><tr><td>Idling time (hours)</td><td>1.2</td><td>0.3</td></tr><tr><td>Fuel consumed from idling (L)</td><td>1.9</td><td>0.4</td></tr><tr><td>Hard acceleration (number of times)</td><td>0.7</td><td>1.2</td></tr><tr><td>Hard deceleration (number of times)</td><td>1.2</td><td>1.1</td></tr></table><br>Analysis<br>Average daily distance driven decreased per vehicle for both gasoline and hybrid groups post intervention. The gasoline group saw a decrease of 1.9 km and the Hybrid 10 km.<br>Average daily idling time decreased per vehicle for both gasoline and hybrid groups post intervention. The gasoline group saw a decrease of 0.4 hours and the Hybrid 0.2 hours. These decreases brought about a reduction in average fuel consumption from idling with a 0.5L decrease in the gasoline group and a 0.6L decrease in the Hybrid group.<br>Behavioural changes are noted in both the gasoline and hybrid groups. For the gasoline group, average daily hard decelerations decreased an average of 0.2 counts per vehicle following the</td><td>Limitations identified by the author<br>None reported<br><br>Limitations identified by the review team<br>Participants were self-selected and therefore may not be representative of the study population.</td></tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / Comparator</th><th>Results</th><th>Notes</th></tr>
<tr><td></td><td></td><td></td><td>intervention although hard accelerations increased by 0.1 counts. In the Hybrid group, average daily hard decelerations and accelerations increased an average of 0.1 counts per vehicle following the intervention.</td><td></td></tr>
<tr><td>Full citation<br>Ryan, Patrick H., Reponen, Tiina, Simmons, Mark, Yermakov, Michael, Sharkey, Ken, Garland-Porter, Denisha, Eghbalnia, Cynthia, Grinshpun, Sergey A., The impact of an anti-idling campaign on outdoor air quality at four urban schools, Environmental science. Processes & impacts, 15, 2030-7, 2013<br><br>Quality score<br>-<br><br>Study type<br>Uncontrolled before and after study<br><br>Aim of the study<br>To determine the impact of an anti-idling campaign on outdoor air pollution at schools.<br><br>Location and setting<br>USA<br><br>Length of study<br><br>Source of funding<br>National Institute of</td><td>Number of participants<br>4 public schools:<br>(1) major road <400m from school, low bus traffic (School A)<br>(2) major road >400m from school, high bus traffic (School B),<br>(3) major road <400m from school, medium bus traffic (School C), and<br>(4) major road >400m, low bus traffic(School D).<br><br>Participant characteristics<table><tr><td></td><td colspan="4">School</td></tr><tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td></tr><tr><td>Distance to the nearest major road* (m)</td><td>303</td><td>526</td><td>243</td><td>2083</td></tr><tr><td>Average number of buses per arrival / departure</td><td>5</td><td>39</td><td>11</td><td>9</td></tr><tr><td>Average number of cars / drop off</td><td>18</td><td>77</td><td>27</td><td>24</td></tr><tr><td>Prevalence of parental reported asthma</td><td>10%</td><td>10%</td><td>15%</td><td>12%</td></tr></table>Inclusion criteria<br>Participating schools were chosen whose prevalence of parent reported asthma exceeded 10% as well as potential exposure to TRAP from nearby major roads and school buses.<br><br>Exclusion criteria<br>Not reported</td><td>Intervention / Comparison<br>The impact of the Cincinnati Anti-Idling Campaign(CAIC) intervention on idling time and knowledge was assessed in a separate study (see Eghbalnia 2013 evidence table)<br>The campaign briefly consisted of a school driver education program given to all bus drivers followed by an anti-idling pledge<br>drive. Information was also provided to parents accompanied with a pledge to reduce idling. Other activities included school bus monitoring, all school air quality assemblies, and anti-idling signs placed near the school drop-off/pick-up zones. Pre- and post-anti-idling campaign air monitoring was conducted for each school and their corresponding community sites (used to provide associated background levels of TRAP).<br><br>For each selected school, an outdoor air monitoring site was established. In addition, the geographic area where children attending each school reside was identified and an outdoor community air monitoring site was established within this catchment area.</td><td>Outcomes<br>Average difference in $PM_{2.5}$ between school and community sampling sites.<table><tr><td></td><td></td></tr><tr><td></td><td>$PM_{2.5}$ (μg $m^{-3}$)</td></tr><tr><td>School A<br>Pre-anti-idling<br>Post anti-idling</td><td><br>-0.95<br>-0.52<br>p= 0.77</td></tr><tr><td>School B<br>Pre-anti-idling<br>Post anti-idling</td><td>4.11*<br>0.99*<br>p= 0.04</td></tr><tr><td>School C<br>Pre-anti-idling<br>Post anti-idling</td><td>0.9<br>-4.71<br>p= 0.33</td></tr><tr><td>School D<br>Pre-anti-idling<br>Post anti-idling</td><td>0.48<br>-1.35<br>p= 0.03</td></tr></table>* indicates difference in school and community concentrations ($p<0.05$)<br><br>Analysis<br><br>$PM_{2.5}$<br>Prior to the intervention, the concentrations of $PM_{2.5}$ at schools exceeded those of the community sites at three of the four schools, and was significantly greater at School B, the school with the highest number of buses (average difference 4.11 μg $m^{-3}$, $p<0.01$).<br><br>Following the intervention, the average level of $PM_{2.5}$ at School B was the only location exceeding the background site (average difference 0.99 μg $m^{-3}$, $p<0.01$). The change in average school-background differences were significant for Schools B and D.<br>In the case of School D, average community concentrations of $PM_{2.5}$ exceeded school concentrations after the anti-idling campaign.</td><td>Limitations identified by the author<br>None reported<br><br>Limitations identified by the review team<br>Concentrations of selected air pollutants were not available for all days of sampling.</td></tr>
</table>

| Study details | Population | Intervention / Comparator | Results | Notes |
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| Environmental Health Sciences | | | | |

***Review question 11: The context in which information, education and training interventions are effective at reducing the health impact of, or people's exposure to, traffic-related air pollution.***

<table>
<tr><th>Study details</th><th>Research parameters</th><th>Inclusion / Exclusion criteria</th><th>Population</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Full citation<br>Campbell-Hall, V., Dalziel, D., Eco-driving: factors that determine take-up of post-test training research, 94, 2011<br><br>Quality score<br>+<br><br>Study type<br>Qualitative<br><br>Aim of the study<br>To determine how eco-driving take up can be increased including factors/incentives and promotion of the initiative.<br><br>Location and setting<br>UK<br><br>Source of funding<br>Driving Standards Agency (DSA)</td>
<td>Data collection<br>Stakeholder telephone interviews: Ten semi-structured telephone interviews (45 minutes)<br>Driver focus groups: Eight focus groups (2 hours)<br>Employer/fleet manager depth interviews: Nine semi-structured depth interviews (60 minutes)<br><br>Method of analysis<br>The interviews and discussions were recorded and transcribed and then analysed through matrix mapping. Based on the researchers' experiences of conducting the fieldwork and their preliminary review of the data, a thematic framework was constructed.</td>
<td>Inclusion criteria<br><u>Driver focus groups</u><br>Eight focus groups were conducted with drivers across the north and south of England, as well as the Midlands. The primary quotas were:<br>1) Type of vehicle – car, light van and Taxi/Minibus 8 seats.<br>2) A split between whether they were driving only for personal purposes or whether they drove commercially.<br>Additional quotas were age and number of years qualified as a driver which enabled a good spread of views from new and younger drivers as well as more experienced and older drivers. Light van drivers and taxi drivers were split into self-employed or employed.<br><br><u>Employer/fleet manager depth interviews</u><br>Nine depth interviews were conducted with employers and fleet managers.<br>• Employers with company vehicles that require a Category B license (Medium to large fleet - 26+ vehicles; Small fleets - 10-25 vehicles).<br>• Employers where employees drive own Category B vehicles only (Large employer - 200+ employees; Small/medium sized employer - 10-50 employees).<br>• Driving schools (Large -</td>
<td>Number of participants<br>Training providers = 9<br>Stakeholders (such as transport delivery bodies, road safety organisations and trade unions) = 10<br>Drivers = 69<br>Employer/fleet managers = 9<br><br>Participant characteristics<br><u>Drivers</u>
<table>
<tr><th>Group</th><th>Vehicle</th><th>Driver</th><th>Use of car for work</th><th>Location</th></tr>
<tr><td>1 (n=7)</td><td>car</td><td>Under 30 years Qualified 2-5 years</td><td>No</td><td>Midlands</td></tr>
<tr><td>2 (n=9)</td><td>car</td><td>Under 35 years Qualified 2-10 years</td><td>Yes (mix of fleet and own care use)</td><td>North</td></tr>
<tr><td>3 (n=8)</td><td>car</td><td>35 years and over Qualified 10 years plus</td><td>Yes (mix of fleet and own care use)</td><td>South</td></tr>
<tr><td>4 (n=9)</td><td>car</td><td>35 years and over Qualified 10 years plus</td><td>No</td><td>South</td></tr>
<tr><td>5 (n=9)</td><td>light van</td><td>21 and over Qualified 2 years and over</td><td>Self employed</td><td>Midlands</td></tr>
<tr><td>6 (n=9)</td><td>light van</td><td>21 and over Qualified 2 years and over</td><td>Employed by company with fleet</td><td>North</td></tr>
<tr><td>7 (n=9)</td><td>Taxi/mini bus 8 seats or under</td><td>21 and over Qualified 2 years and over</td><td>Self-employed</td><td>South</td></tr>
<tr><td>8 (n=9)</td><td>Taxi/mini bus 8 seats or under</td><td>21 and over Qualified 2 years and over</td><td>Self-employed</td><td>Midlands</td></tr>
</table>
<table>
<tr><th>Gender</th><th>Ethnicity</th></tr>
<tr><td>Male (n=44)</td><td>Black African (n=6)</td></tr>
<tr><td>Female (n=25)</td><td>Black Caribbean (n=1)</td></tr>
</table></td>
<td>Key themes<br><u>Stakeholder and training provider</u><br>• <u>L</u>ow take-up of post-test interventions due to current economic climate and high quality of the current standard driving test.<br>• Clear, tangible and specific emphasis on the cost saving of using eco-driving techniques will help providers to sell eco driving as part of their course offering.<br>• 'In-vehicle training' in driver pairs, with comparison of fuel consumption pre- and post-training, viewed as an effective, engaging and convincing format to create sustained behaviour change. This would be enhanced by measures and systems for drivers to keep track of their fuel consumption.<br><br><u>Drivers and Fleet managers</u><br>1. Awareness and perceptions of eco-driving usage<br>• The term 'eco-driving' was felt to be unclear and over-emphasises the environmental</td>
<td>Limitations identified by author<br>None reported<br><br>Limitations identified by review team<br>The relationship between the researchers and participants is not described although the researchers' experiences of conducting the fieldwork are taken into account in the analysis of the data.<br>It is not clear how the participants were recruited or ethical approval/consent was gained.<br>It is not reported if transcripts were coded or feedback from participants was sought.<br>The implications for social policy and marketing are clearly linked to the findings of the research. However, no further explanations are explored for the findings. There is no discussion about the limitations of the study.</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Research parameters</th><th>Inclusion / Exclusion criteria</th><th>Population</th><th>Results</th><th>Notes</th></tr>
<tr>
<td></td>
<td></td>
<td>25+ vehicles; Small/medium - 2-10 vehicles).<br><br>For firms where employees only drive their own vehicles, a minimum 10% of employees driving their own vehicles for business was set.</td>
<td>
<table>
<tr><td></td><td>White British (n=50)</td></tr>
<tr><td></td><td>White Irish (n=2)</td></tr>
<tr><td></td><td>White other (n=1)</td></tr>
<tr><td></td><td>Asian Pakistani (n=9)</td></tr>
</table>
<u>Employer / fleet managers</u>
<table>
<tr><td></td><td>Medium to large fleet (26+vehicles)</td><td>Small fleets (5-25 vehicles)</td><td>Total</td></tr>
<tr><td>Type of employer</td><td></td><td></td><td></td></tr>
<tr><td>Company vehicles requiring category B license</td><td>2</td><td>2</td><td></td></tr>
<tr><td></td><td>Large Employer (200+ employees)</td><td>Small/Medium-sized employer (10-50 employees)</td><td></td></tr>
<tr><td>At least 10% of employees drive own category B vehicles</td><td>2</td><td>1</td><td></td></tr>
<tr><td></td><td>Large (25+ vehicles)</td><td>Small/Medium (2-10 vehicles)</td><td></td></tr>
<tr><td>Driving schools</td><td>2</td><td>0</td><td></td></tr>
<tr><td>Total</td><td>6</td><td>3</td><td>9</td></tr>
</table>
</td>
<td>focus rather than the economical aspect.<br>• Most drivers were aware of some eco-driving techniques but not all were aware of the full range<br>• The inclusion of eco-driving in the driving test was viewed as an opportunity to embed basic eco-driving techniques into the driving habits of new drivers and encourage sustainability after passing the test.<br><br>2. Increasing take-up of eco-driving post-test driving interventions<br>• The main barriers impacting on take up of post-test training were: cost of training; feeling expert enough in driving skill and fuel efficient driving; doubts about sustainability of eco-driving practices; and lack of evidence.<br>• Motivation for using eco-driving techniques was a cost saving from reduced fuel consumption and from less wear and tear on the vehicle.<br>• Reducing $CO_2$ emissions ranked very low for ordinary drivers but was still</td>
<td></td>
</tr>
</table>

| Study details | Research parameters | Inclusion / Exclusion criteria | Population | Results | Notes |
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| | | | | considered important to larger employers<br>• Motivations identified as affecting the take up of post-test driver training were: financial incentives; social norms, monitoring impact; corporate image; and element of fun.<br>• In-vehicle training was viewed as appealing and deemed the 'gold standard' approach in getting the eco driving message across. | |

***Review question 11: Are driver information, education and training interventions cost effective at reducing the health impact of, or people's exposure to, traffic-related air pollution? Modelling studies***

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / Comparator</th><th>Method of analysis</th><th>Model results</th><th>Notes</th></tr>
<tr>
<td>Full citation<br>Barth, Matthew, Boriboonsomsin, Kanok, Energy and Emissions Impacts of a Freeway-Based Dynamic Eco-driving System, Transportation Research: Part D: Transport and Environment, 14, 400-410, 2009<br><br>Quality score<br>-<br><br>Aim of the study<br>To investigate the concept of dynamic eco-driving, where advice is given in real-time to drivers changing traffic conditions in the vehicle's vicinity.<br><br>Source of data<br>Driving trajectory data was collected using 3 probe passenger vehicles on freeways in Southern California during September 2005, May 2006 and March 2007 to estimate the standard deviation of traffic speeds for different "levels of service" (road congestion categories) values.<br><br>In addition to the probe vehicle data,</td>
<td>Number of participants<br>n/a<br><br>Participant description<br>A basic segment of a freeway was used for simulation. The simulated vehicle fleet was calibrated to a typical vehicle population for Southern California.<br><br>Inclusion criteria<br>Not reported<br><br>Exclusion criteria<br>Not reported</td>
<td>Intervention / Comparison<br>The study assessed the effect of a dynamic eco-driving system where advice based on changing traffic speed, density and flow conditions is provided in real-time to drivers to reduce fuel consumption and $CO_2$ emissions.<br><br>The effects of the dynamic eco-driving system were assessed through simulations and real-world experiments.</td>
<td>Type of model<br>Simulations were undertaken using a microscopic traffic simulation tool PARAMICS (a suite of high performance software tools for microscopic traffic simulation) with CMEM (Comprehensive Modal Emissions Model). Using this modelling tool, a number of freeway traffic scenarios were analysed.</td>
<td>Outcomes<br>Simulation results: Fuel consumption and travel times for example vehicle trajectories for typical passenger vehicle
<table>
<tr><th>Velocity trajectory</th><th>Non-eco driving</th><th>Eco-driving</th><th>difference</th></tr>
<tr><td>Max (km/h)</td><td>80.5</td><td>48.9</td><td>-31.7</td></tr>
<tr><td>Min (km/h)</td><td>10.3</td><td>22.7</td><td>+12.4</td></tr>
<tr><td>Ave (km/h)</td><td>43.3</td><td>40.2</td><td>-3.05</td></tr>
<tr><td>CO2 (g)</td><td>1605.13</td><td>1044.81</td><td>-34.9%</td></tr>
<tr><td>Fuel consumption (g)</td><td>531.23</td><td>333.29</td><td>-37.3%</td></tr>
<tr><td>Travel time (min)</td><td>8.9</td><td>9.6</td><td>+7.7%</td></tr>
</table>
Real-world experimentation results: Fuel consumption and travel times for experimental runs
<table>
<tr><th>Velocity trajectory</th><th>Non-eco driving</th><th>Eco-driving</th><th>difference</th></tr>
<tr><td>Max (km/h)</td><td>117.9</td><td>93.6</td><td>-24.3</td></tr>
<tr><td>Min (km/h)</td><td>0.00</td><td>0.00</td><td>0.0</td></tr>
<tr><td>Ave (km/h)</td><td>33.9</td><td>32.1</td><td>-1.9</td></tr>
<tr><td>CO2 (g)</td><td>5439</td><td>4781</td><td>-12%</td></tr>
<tr><td>Fuel consumption (g)</td><td>1766</td><td>1534</td><td>-13%</td></tr>
<tr><td>Travel time (min)</td><td>38.9</td><td>41.2</td><td>+6%</td></tr>
</table>
Analysis<br>The results of the simulation indicated that there were reductions in fuel consumption and $CO_2$ emissions with little difference in the overall travel time. The real world experiments demonstrated smaller reductions in fuel consumption and $CO_2$ emissions.</td>
<td>Limitations identified by the author<br>Not reported</td>
</tr>
</table>

| Study details | Population | Intervention / Comparator | Method of analysis | Model results | Notes |
|---|---|---|---|---|---|
| macroscopic traffic data were gathered simultaneously. Using information about latitude, longitude, and time stamps, the probe vehicle data were spatially and temporally matched with the macroscopic traffic data.<br><br>**Location and setting**<br>Freeway, Southern California, USA<br><br>**Length of study**<br>Not reported<br><br>**Source of funding**<br>The University of California's Digital Media Initiative and the University of California Transportation Center partially sponsored this research. | | | | | |

# Appendix 2 Quality of included studies

## EPOC Checklist

| | Question | | | | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | |
| **Caulfield et al., 2014** | - | Unclear | - | - | Unclear | + | Unclear | ++ | - | - |
| **Nakayama 2005** | - | - | ++ | - | ++ | - | Unclear | ++ | - | - |
| **Sargeant 2004** | - | Unclear | - | - | - | Unclear | Unclear | ++ | - | - |

**Key to questions:**

1. Was the allocation sequence adequately generated?
2. Was the allocation adequately concealed?
3. Were baseline outcome measurements similar?
4. Were baseline characteristics similar?
5. Were incomplete outcome data adequately addressed?
6. Was knowledge of the allocated interventions adequately prevented during the study?
7. Was the study adequately protected against contamination?
8. Was the study free from selective outcome reporting?
9. Was the study free from other risks of bias?

## EPHPP Checklist

| | Question | | | | | | | | | | | | | | | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | |
| **Eghbalnia et al., 2013** | Can't tell | Can't tell | Cohort | No | N/A | N/A | N/A | N/A | N/A | Can't tell | Can't tell | Can't tell | N/A | Can't tell | Can't tell | No | No | Individual | Individual | No | No | - |
| **Rutty et al., 2013** | Can't tell | <60% | Cohort | No | N/A | N/A | N/A | N/A | N/A | Can't tell | Can't tell | Can't tell | No | 80 – 100% | 80 – 100% | Can't tell | No | Individual | Individual | No | No | - |
| **Ryan et al., 2013** | Somewhat likely | Can't tell | Cohort | No | N/A | N/A | N/A | N/A | N/A | Can't tell | Can't tell | Can't tell | N/A | N/A | 80 – 100% | No | No | Organisation / institution | Organisation / institution | Yes | N/A | - |
| **Watts 2000a** | Somewhat likely | <60% | Cohort | No | NA | NA | NA | - | NA | Yes | Yes | Can't tell | Yes | <60% | 80-100% | No | Can't tell | Individual | Individual | No | No | - |

**Key to questions:**

1. Are the individuals selected to participate in the study likely to be representative of the target population?
2. What percentage of selected individuals agreed to participate?
3. What is the study design?
4. Was the study described as randomised?
5. Was the method of randomisation described?
6. Was the method of randomisation appropriate?
7. Were there important differences between groups prior to the intervention?
8. If yes, what percentage of relevant confounders were controlled (either in the design [e.g. stratification, matching] or analysis)?
9. Was/were the outcome assessor/s aware of the intervention or exposure status of participants?
10. Were the study participants aware of the research question?
11. Were data collection tools shown to be valid?
12. Were data collection tools shown to be reliable?
13. Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?
14. What percentage of participants completed the survey?
15. What percentage of participants received the allocated intervention or exposure of interest?
16. Was the consistency of the intervention measured?
17. Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?
18. What is the unit of allocation?
19. What is the unit of analysis?
20. Are the statistical methods appropriate for the study design?
21. Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?

## A.4 Methodology checklist: Qualitative studies

| | Question | | | | | | | | | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | |
| **Campbell-Hall et al., 2011** | Appropriate | Clear | Defensible | Appropriately | Unclear | Clear | Reliable | Rigorous | Rich | Not sure / not reported | Convincing | Relevant | Not sure | Not sure / not reported | + |
| **Watts 2000b** | Appropriate | Mixed | Not sure | Not sure / inadequately reported | Not described | Unclear | Unreliable | Not sure / not reported | Poor | Not sure / not reported | Convincing | Relevant | Inadequate | Not sure / not reported | - |

**Key to questions:**

1. Is a qualitative approach appropriate?
2. Is the study clear in what it seeks to do?
3. How defensible/rigorous is the research design/methodology?
4. How well was the data collection carried out?
5. Is the role of the researcher clearly described?
6. Is the context clearly described?
7. Were the methods reliable?
8. Is the data analysis sufficiently rigorous?
9. Is the data ‘rich’?
10. Is the analysis reliable?
11. Are the findings convincing?
12. Are the findings relevant to the aims of the study?
13. Conclusions
14. How clear and coherent is the reporting of ethics?

## Modelling studies

| | Relevance | | | | | Credibility | | | | | | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **Overall** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **Overall** | |
| **Barth 2009** | Yes | No | Yes | No | Sufficient | Yes | No | Not enough info | Yes | Yes | Yes | No | Not enough info | No | No | NA | Insufficient | - |

**Key to questions:**

***Relevance***

1. Is the population relevant?
2. Are any critical interventions missing?
3. Are any relevant outcomes missing?
4. Is the context (settings and circumstance) applicable?

***Credibility***

5. Is external validation of the model sufficient to make its results credible for your decision?
6. Is internal verification of the model sufficient to make its results credible for your decision?
7. Does the model have sufficient face validity to make its results credible for your decision?
8. Is the design of the model adequate for your decision problem?
9. Are the data used in populating the model suitable for your decision problem?
10. Were the analyses performed using the model adequate to inform your decision problem?
11. Was there an adequate assessment of the effects of uncertainty?
12. Was the reporting of the model adequate to inform your decision problem?
13. Was the interpretation of results fair and balanced?
14. Were there any potential conflicts of interest?
15. If there were potential conflicts of interest, were steps taken to address these?