Temperature in Vehicles Survey

2008/2009

Conducted by

RACQ Vehicle Technologies Department

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Introduction

The temperatures attained inside parked cars is a topical issue and RACQ receives many related member enquiries. These typically range from vehicle buyers seeking to choose the coolest colour for a new vehicle, to those attempting to determine the benefits of window tinting film.

More significantly, there are likely severe health risks posed by elevated cabin temperatures for humans (frequently babies or children) and pets deliberately left or inadvertently trapped inside parked cars. This has attracted considerable media attention when a person has to be rescued from a locked vehicle, or in those cases where fatalities have resulted.

RACQ is becoming increasingly involved in these events due to its policy of offering assistance in freeing people and animals from locked vehicles, and recent media activity to raise awareness of the issue. Such incidents currently account for approximately 1,500 RACQ assistance calls each year.

RACQ has conducted two previous studies of internal temperature in cars. The first, King and Negus 1982, investigated the heating characteristics and variables of a number of vehicles. The second, RACQ Traffic and Safety 1995, looked at the effects of advances in vehicle design on heating characteristics of modern cars under typical Brisbane winter and summer conditions.

Given that the last study of temperature in cars was conducted almost 14 years ago, it was considered appropriate to revisit the subject using a range of current model vehicles.

This study duplicates some of the previously conducted tests, and goes on to conduct two tests, the effects of windscreen sunshades and window tinting film, that were not part of the previous studies.

Duplication of some aspects of previous tests is not intended to cast doubt on the validity of the earlier tests, it is merely a reflection of their relevance to the subject. In fact the result of this latest study show a strong correlation with the findings of the RACQ Traffic and Safety 1995 study and some aspects of the King and Negus study of 1982.
**Methodology**

**Test 1.** Light vs dark paint colour – how much influence does the body paint colour have on interior temperatures?

**Test 2.** Windows up vs all windows lowered 45mm – is this beneficial in reducing cabin temperatures?

**Test 3.** Typical peak surface temperature at the steering wheel.

**Test 4.** Reflective sunshades (heat reflecting efficiency) – do they make a real difference?

**Test 5.** Window tinting film vs no tinting – does film reduce cabin temperatures?

**Test equipment**

The tests used a Centre 309 four-channel Data logger thermometer fitted with four thermocouple air temperature bead probes. One of the air temperature bead probes could also be replaced by a surface temperature probe for specific tests requiring this.

Ambient temperatures were recorded with one of the air temperature thermocouples fitted to a Stevenson Screen to minimise the influence of wind and direct sunlight. The unit was located adjacent to the vehicles.

The accuracy of the thermocouples was tested for probe-to-probe variation. A maximum 0.4°C variation at 50°C and 0.2°C at 22°C being recorded.
Note: Given the stated accuracy of the thermocouples and the Data logger, of which the former is the less accurate, variations recorded during testing of 0.5°C or less could reasonably be considered inconsequential even though they have been reported herein.

Test area

The test area was the car park of RACQ Tingalpa, Brisbane, which is a typical bitumen surfaced open car park. Vacant car spaces were left between and either side of the test vehicles to ensure full sun exposure.

The test vehicles were oriented East-West to ensure full sun exposure for the whole period of the test. During testing of sunscreens the vehicles were oriented North-South. This was to ensure maximum sun load on the screened/unscreened windscreens for the test duration.

The location selected ensured there was no shading of the vehicles during the period of the tests.

Test period

Testing was carried out during summer from mid December 2008 to early February 2009.

Method

In all tests involving vehicles, the starting temperature of the vehicles was normalised by parking them in an under-building car park for several hours prior to each test sequence. Air conditioning was on and set at low fan speed, maximum cooling, immediately prior to parking the vehicle in its test position and commencing the test, in order to replicate typical driving conditions. This also allowed us to report on the time needed for a cooled vehicle to reach ambient temperature.

Prior to moving the vehicles to the test area, temperature probes were installed inside each. Probes were fitted to the approximate centre of the passenger compartment approximately 100mm below the hood lining.

In all two-car comparison tests the vehicles were driven to the test area at the same time (by two drivers) to avoid, as far as possible, introducing variations in internal temperatures. The temperature recording equipment was connected as quickly as possible and the recording function activated.

Within reasonable practical limits, the test start cabin temperatures within a particular test were matched vehicle to vehicle.

The vehicles were locked and not opened for the duration of the test.

Two Isuzu D-Max dual cab Utilities, one white and the other dark blue were used for Test1.
For the window up vs window lowered test (Test 2), both probes were shielded by short open ended cardboard cylinders to minimise any transient distortion of the recorded air temperatures that are likely to result from the influence of external prevailing breezes that may enter the lowered windows. A trial test had shown shielding to be necessary. All side windows on the ‘windows lowered’ car were set at 45mm, lowered from their full up position. Two identical white Toyota Camry sedans were used.

The sunshade test (Test 4) used two Holden Epica sedans of the same model and colour, neither had additional window tint, only the standard equipment tinted glass. A typical fold-up style, foam backed foil covered sunshade was placed inside the windscreen of one vehicle and cabin air temperatures were recorded in both, along with ambient air temperature and results compared.

The following measurements were taken during vehicle-based tests:

- **Channel 1** – Ambient temperature (in the Stevenson Screen)
- **Channel 2** – Interior air temperature of vehicle A
- **Channel 3** – Interior air temperature of vehicle B (in two car tests)
- **Channel 4** – Surface temperature (where required)

Sampling time was set at one minute intervals on the data logger in order to provide a detailed plot of temperature changes. In Test 5, the logging interval was set to ten seconds to give improved resolution. The additional cool down re-test in Test 5 used a 30 second logging interval.

The logged data for all tests was downloaded to computer enabling graphs of the test results to be produced.

As there was no attempt to make detailed direct correlations between tests, it was not considered necessary to use the same make and model vehicle for each of the specific tests. Notwithstanding, the similarities between results and trends in tests have been noted where appropriate.

The test method specific to Test 5, window tint film, is outlined in the relevant section of this report. The test was designed to limit heat transfer to an enclosed volume of air through the glass panels and, where appropriate, the tint film. All glass samples were side windows from the same make and model vehicle and should therefore have the same physical properties.
RESULTS

Test 1

Light colour vs Dark colour

This test was conducted on a clear sunny day using two Isuzu D-Max dual cab Utilities, one dark blue and the other white. It started at 12:33:18 pm after the vehicles were normalised in an under-building car park for several hours and with use of the vehicles’ air conditioning. Start temperatures were within 0.2°C of each other.

The lowest ambient temperature recorded during the test was 29.1°C at 12:51 pm and the highest was 33.0°C at 2:46 pm. Through averaging of all ambient readings at the one minute sample rate, this represents an average ambient temperature of 31.6°C.

The peak cabin temperature recorded for the light coloured vehicle was 57.3°C. This was reached in 124 minutes of beginning the test. At this point the temperature inside the dark coloured vehicle was recorded at 60.1°C, with a maximum temperature of 60.5°C being recorded ten minutes later. Ambient temperatures at the peak interior temperature points were 31.8°C and 33.4°C respectively.
At one hour from the start of the test, both vehicles were within 3.1°C of their maximum recorded cabin temperatures. In one hour the light coloured vehicle attained 91.3% of its maximum temperature and the dark coloured vehicle 91.7%.

In the first eight minutes of the test interior temperatures rose from 19.2°C and 19.4°C to 40.5°C and 40.8°C respectively for the light and dark coloured vehicles. At this point there was only 0.3°C variation between vehicles. Given the recorded start temperature variation the temperature rise to this point is for all practical purposes identical, both in rate and quantum.

From a starting temperature of 19.2°C with the doors closed, the interior temperature rose to the ambient temperature (30.4°C) within 1.5 minutes. Therefore the further rise in temperature from ambient to 40.5°C took approximately 6.5 minutes.

After approximately 10 minutes from the start of the test, the cabin temperatures of the two vehicles began to diverge with the dark coloured vehicle being slightly hotter, and the margin between the two widening somewhat.
The high rate of temperature rise early in the test is clearly visible on both the above graphs plotting recorded temperatures.

At the maximum recorded cabin temperatures, the difference between the two vehicles was 3.2°C, with the light vehicle showing the lower temperature.

The very short time required for internal vehicle temperatures to exceed a point considered by medical authorities to be potentially dangerous is significant in itself, and is apparently little altered by paint colour.

For the dark coloured vehicle 79.1% of the temperature rise occurred in the first 30 minutes of the test. This equates to a temperature rise of 32.5°C, out of a total temperature increase of 41°C. 52.1% of the rise occurred in the first eight minutes of the test with a temperature rise of 21.4°C.

For the light coloured vehicle 79.8% of the temperature rise occurred in the first 30 minutes of the test, with a 55.9% rise in the first 8 minutes.

This suggests that vehicle paint colour has very little impact on interior temperatures and rate of rise.

Temperatures of the external surfaces of the metal roof panels of both vehicles were recorded with the surface temperature probe at the end of the test. The light coloured vehicle achieved 49.6°C while the dark coloured vehicle registered 55.2°C. These temperatures are likely to be indicative of the temperatures of utility tray surfaces after standing in the sun. This is potentially significant for dogs or other animals left in utility trays.

**Conclusions**

Both vehicles rose to ambient, exceeded 40°C and reached their peak temperatures of 57.3°C and 60.4°C in a very similar time, regardless of the paint colour. Therefore colour has negligible impact on the rate of temperature rise. At their peak, the temperatures of the two vehicles were only 3.1°C apart, suggesting that paint colour also has insignificant impact on peak interior temperatures.

This test also suggests interior vehicle temperatures on a clear Brisbane summer day will typically reach at least double the ambient air temperature. Other tests in this study appear to confirm this.

This test confirms the findings of King and Negus (1982) and RACQ Traffic and Safety (1995), that exterior paint colour has little impact on interior temperatures.

Interior temperatures rise very rapidly and were found to reach the critical temperature of 40°C in about eight minutes on a typical Brisbane clear summer day.

External panel temperatures were found to approach or exceed 50°C. This temperature would be potentially harmful to animals left on a utility tray in summer weather.

The peak cabin temperatures attained in this test are likely to be representative of a typical summer day in Brisbane and were found to be approximately double ambient. However as ambient summer temperatures can often be significantly higher than those recorded during this test (≥38°C), peak cabin temperatures would also be substantially higher.
This test involved two white Toyota Camrys and was conducted on a clear sunny day. The test started at 10:06 am and ran for 124 minutes. The interior temperatures of both vehicles were normalised in an under-building car park for several hours prior to starting the test.

The lowest ambient temperature recorded was 30.1°C at the beginning of the test and the highest was 33.2°C at 10:38 am. By averaging the data recorded at one minute intervals, an average ambient temperature of 32.3°C was calculated.

The peak cabin temperature recorded in the vehicle with the windows up was 65.8°C and was attained in 115 minutes from beginning the test. The vehicle with the windows down reached a peak of 53.7°C at 113 minutes. The difference between the two vehicles when the windows up car reached its peak was 12.2°C.
Average interior temperature with windows down was 47.6°C and with windows up 58.2°C. (Calculated by averaging the data logged at one minute intervals)

The difference in average interior temperatures for the test period was 10.6°C, with the vehicle with windows up being the hotter. This is very close to the peak-to-peak variation of 12.1°C.

From ambient temperature the window down vehicle reached 40.7°C in 16 minutes, while the window up vehicle reached a similar temperature in 6 minutes.

Conclusions

This test demonstrates that leaving windows partly lowered slows rate of rise by a measurable amount. In this case the windows up car reached a temperature exceeding 40°C 2.6 times quicker than the windows down vehicle. In a practical sense, the rate of cabin temperature rise with windows down to a temperature greater than 40°C is still quite rapid though.

Peak temperatures reached dangerously high levels in both cars though the windows down peak measured in this test was lower at 81.7% of the windows up car.

The windows up car again demonstrated a peak approximately double ambient air temperature. Despite some measurable positive effect of windows lowered, there are clear risks for vehicle security and given the high temperature rate rise and peaks it fails to suitably address issues of vehicle occupant comfort and safety.
Test 3

Peak Temperatures

This test was conducted using a black WM Holden Statesman oriented East-West. The day was clear with a minimum ambient during the test of 31.0°C and a peak ambient temperature of 34°C. By averaging the data recorded at one minute intervals, an average ambient temperature of 32.5°C was calculated.

As this was a test designed to compare peak air and surface temperatures rather than rate of rise from a cooled state, the ‘normalising’ was carried out but did not include additional cooling with the vehicle’s air conditioner. The test commences a few degrees above the prevailing ambient temperature.

The temperature probe was installed in the approximate centre of the cabin space 100mm below the hood lining and a surface temperature probe was fitted to the steering wheel. A peak cabin temperature of 75.1°C was recorded while surface temperature for the steering wheel reached 82.6°C.
Cabin air temperature rises rapidly as shown in the other tests in this study, though the steering wheel surface temperature rises more slowly. After 115 minutes (11:59:21 am) the surface temperature of the steering wheel increases beyond the air temperature, with its temperature rising further against a now relatively stable air temperature.

The higher surface temperature eventually recorded on the black leather steering wheel is likely to be due to increased direct sun exposure by this point in the test and the higher localised heat load this would produce.
Test 4

Sunshade vs No Sunshade

This test was conducted on two identical white Holden Epica sedans one of which had a sunshade installed inside the windscreen. It was a clear sunny day with an ambient air temperature range during the test period of 27°C to 31.2°C. Vehicle orientation ensured there was sun on the vehicle throughout the test period, with maximum sun-load on the windscreen zone throughout. The potential for possible benefit from the sunshade should therefore be maximised.

The graph of the recorded interior temperatures for both vehicles shows a steep rate of rise early in the test very similar to the results from Test 1.

Temperature Variance With & Without Windscreen Sunshade
Holden Epicas (white) 14/1/09

Graph 5
At the start of the test interior temperatures were within 1.3°C, with the sunshade car the cooler of the two. Both cars had risen above external ambient temperature after two minutes (31.9°C and 28.7°C). Both cars were above 40°C at eight minutes from test start (40.9°C and 41.2°C). This also mirrors the results of Test 1.

The sunshade at this point in the test has had no beneficial effect on the temperature rise rate or recorded temperatures.

In the first twelve minutes the non-sunshade car records a total rise of 23.0°C while the sunshade car records a rise of 24.4°C. However this variation is not considered to be significant.

After twelve minutes the sunshade car temperatures are marginally cooler than the non-sunshade vehicle, a trend that remains through the test. However the variation, even at the extremity is very small.

After one hour, cabin temperatures are 54.2°C in the sunshade car and 55.6°C in the non-sunshade car, a variation of 1.4°C. Respectively, in the first hour temperatures have risen by 86% and 85% of the peak temperatures achieved.

Peak temperatures were recorded 1hr 52mins after test start, with the sunshade car showing 62.7°C and the non-sunshade 65.2°C. The sunshade car is cooler by an inconsequential 2.5°C. The maximum car-to-car variation found throughout the test was recorded at 2:01:59 pm with the sunshade car 4.7°C cooler.

This is likely to be attributable to the movement of the sun relative to the cars by that time of the day producing a greater level of sun intrusion into the non-sunshade car’s cabin through the windscreen. The effectiveness of a sunshade in reducing cabin temperatures appears marginal, though the quantum of any benefit appears to have some relationship to the vehicle windscreen orientation to the sun.

Ambient air temperature at peak cabin temperature is 30.3°C. In general terms both cars achieve peak temperatures approximately double ambient air temperature as shown in Test 1.

**Conclusions**

In this test, the fitment of a sunshade made an insignificant difference to the rate of temperature rise and only a marginal difference to the final peak cabin temperatures. However use of a sunshade may help to limit peak surface temperatures on items such as steering wheels having regard to the results of Test 3. A sunshade may also help limit the exposure of the dash trims to damaging UV radiation.
Test 5

Window Tinting vs No Tinting

For this test three identical clear glass automotive side windows were sourced. Two were fitted with good quality commercially available tint films and the other was left untinted. Tint films used were T35, the darkest tint legally permitted in Queensland, and the darker but currently illegal T20.

‘T’ refers to the film’s light transmittance factor, with T35 allowing 35% of the light to pass through the film.

Each of the three windows was then bonded to identically sized (approx. 35.7 litres internal capacity) polystyrene boxes. The thick polystyrene walls provided insulation qualities and the bonding formed an airtight seal.

This method allowed an accurate test of the heat transfer through the various pieces of glass, while removing as far as possible other factors and heat paths that may influence temperature rise.

The temperature probes were suspended in the air space in the centre of each box by inserting the probe through the side of the box. The openings around the probes were then sealed.

The three pieces were normalised in an air-conditioned room for several hours before being moved outside. Recording equipment was connected and temperature logging commenced before the three test pieces were moved outside.

The boxes were positioned on an unpaved area to minimise heat transfer from the ground and were oriented East-West in full sun.

It was a mostly clear sunny day with only occasional cloud. The ambient air temperature ranged from 27.2°C to 31.2°C during the test period.
The temperature of the clear glass test piece rose very quickly when placed in the sun and exceeded ambient in less than one minute. A peak temperature of 66.1°C was recorded at 24 minutes from commencement of the test.

The temperature of the T35 test piece was slower to rise and reached ambient in 2 minutes. A peak temperature of 61.8°C was recorded at 32 minutes from the start of the test.

The temperature of the T20 test piece also reached ambient in 2 minutes. A peak temperature of 59.7°C was recorded at 32 minutes.

Tint film was found to slow the rate of temperature rise, with both films producing about the same rate of rise. However ultimately both tinted test pieces reached a temperature within 2.1°C of each other, while the untinted piece reached a temperature only 6.4°C higher than the coolest tinted test piece.

During the test a passing cloud produced a drop of half a degree in the ambient temperature and a drop of 2.4°C in the temperature of the clear glass sample. However the tinted samples showed little change. This change could be readily observed ‘live’ on the logger display.

It was also observed during testing that very briefly inducing a shadow across the clear glass sample would quickly result in a drop in associated temperature readings. The tinted glass units showed far less reactivity to this.

The test pieces were then simultaneously moved back into air-conditioned room and allowed to cool with the temperature readings (T2, T3, T4) still being logged, the aim being to ascertain the relative rate of built up heat loss. Ambient air temperature was also logged through the test, though the data and graph initially show a loss of T1 data due to the relocation and reconnection of the ambient probe.

Clearly though, having been re-located to an air-conditioned area, the ambient temperature was significantly lower than that recorded outside prior to relocation. Despite a temporary lack of T1 data, the relative reactivity of the clear glass sample is visible in the T2 trace.
The initial part of the trace for the clear glass piece shows a slightly steeper drop in temperature compared to the tinted samples.

It should be noted that the test start temperatures for the units were different. The clear unit was at 37.7°C, the T35 at 38.0°C and the T20 at 42.6°C. Table 1 shows the total degrees of temperature drop at five, ten and fifteen minutes from test start. In the first five minutes the clear glass has dropped approximately 2°C more than the tinted samples. This is in spite of having a slightly lower start temperature and therefore lower temperature differential to the surrounding cool air which might potentially slow rate of heat transfer.

<table>
<thead>
<tr>
<th>Total degrees of drop from start at fixed time intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 5 mins</td>
</tr>
<tr>
<td>Clear</td>
</tr>
<tr>
<td>T35</td>
</tr>
<tr>
<td>T20</td>
</tr>
</tbody>
</table>

Table 1

The initial part of the trace for the clear glass piece shows a slightly steeper drop in temperature compared to the tinted samples.

Table 2 shows the temperature drops in any given five minute period. It will be seen that this also shows clear glass dropped a greater number of degrees initially, but after the first five minutes the rate of heat transfer dropped slightly behind the tinted samples.

<table>
<thead>
<tr>
<th>Degrees dropped in a 5 minute interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start to 5 mins</td>
</tr>
<tr>
<td>Clear</td>
</tr>
<tr>
<td>T35</td>
</tr>
<tr>
<td>T20</td>
</tr>
</tbody>
</table>

Table 2
Given the small variations in temperatures, which would have had some influence on the temperature differential with the surrounding air and possibly therefore the resulting rate of heat transfer, a further test was carried out (see below). Start temperatures were more tightly controlled in this subsequent test.

**Cooling Rate – Retest (19/02/09)**

In this re-test the objective was to have the internal temperature of the units, within practical limits, equal and recheck cool down rates. The three test units as previously set up were allowed to heat in a covered Utility tray parked in the sun for approximately 2.5 hours and the temperatures checked. They were then moved to the air-conditioned area, the logger and probes including an ambient temperature probe were connected. Logging interval was 30 seconds and at the commencement of recording, the maximum temperature variation between the units was 1.5°C. Within four minutes the temperature variation was 0.3°C or less. See graph 8.

![Graph 8](image)

It should be noted that the graph traces temperature drop from the start of logging, though in the interests of using a common test start temperature, our comparisons are based on the four minute point noted above. This will be used and noted from hereon as the test start.

The graph trace for the clear glass sample drops more steeply initially than either of the two tinted samples. This matches the previous in-test observations of the clear glass’s higher reactivity.

By the end of the test, the end temperatures of the three samples show a maximum recorded variation of 0.4°C.
Reference to Table 3 shows the temperature of the clear glass unit at five, ten and fifteen minute points is slightly lower than either of the tinted units by a margin greater than the maximum variation at test start.

**Cool down cycle**

<table>
<thead>
<tr>
<th></th>
<th>Start point</th>
<th>Temp in 5 mins</th>
<th>Temp in 10 mins</th>
<th>Temp in 15 mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient</td>
<td>22.8°C</td>
<td>21.8°C</td>
<td>24.1°C</td>
<td>21.2°C</td>
</tr>
<tr>
<td>Clear</td>
<td>39.5°C</td>
<td>32.3°C</td>
<td>27.7°C</td>
<td>25.3°C</td>
</tr>
<tr>
<td>T35</td>
<td>39.8°C</td>
<td>33.7°C</td>
<td>29.7°C</td>
<td>27.1°C</td>
</tr>
<tr>
<td>T20</td>
<td>39.5°C</td>
<td>33.2°C</td>
<td>28.9°C</td>
<td>26.2°C</td>
</tr>
</tbody>
</table>

*Table 3*

Tables 4 and 5 also show that the clear glass unit drops a greater number of degrees temperature in the given total time periods or in a given five minute interval than either of the tinted samples. The only exception is the temperature drop between ten and fifteen minutes where the clear unit lags the tinted samples by 0.3°C.

**Total degrees of drop from start at fixed time intervals**

<table>
<thead>
<tr>
<th></th>
<th>@ 5 mins</th>
<th>@ 10 mins</th>
<th>@ 15 mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>7.2°C</td>
<td>11.8°C</td>
<td>14.2°C</td>
</tr>
<tr>
<td>T35</td>
<td>6.1°C</td>
<td>10.1°C</td>
<td>12.7°C</td>
</tr>
<tr>
<td>T20</td>
<td>6.3°C</td>
<td>10.6°C</td>
<td>13.3°C</td>
</tr>
</tbody>
</table>

*Table 4*

**Degrees dropped in a 5 minute interval**

<table>
<thead>
<tr>
<th></th>
<th>Start to 5 mins</th>
<th>5 - 10 mins</th>
<th>10 – 15 mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>7.2°C</td>
<td>4.6°C</td>
<td>2.4°C</td>
</tr>
<tr>
<td>T35</td>
<td>6.1°C</td>
<td>4.0°C</td>
<td>2.6°C</td>
</tr>
<tr>
<td>T20</td>
<td>6.2°C</td>
<td>4.3°C</td>
<td>2.7°C</td>
</tr>
</tbody>
</table>

*Table 5*

The darker T20 sample appears throughout to give up its heat content faster than the T35 sample, though it must be said the observed differences are very marginal indeed.
Conclusions

The tint films tested were found to slow the rate of temperature rise, with both films producing about the same rate of rise. However ultimately both tinted test pieces reached a temperature within 2.1°C of each other, while the untinted piece reached a temperature only 6.4°C higher than the coolest tinted test piece.

Clear glass appears to have greater reactivity to external temperature fluctuations compared to the tested film samples, which appear to act as a ‘damper’. The cool down tests suggest that film also has a similar effect on heat loss with the clear glass again more reactive and the film samples slowing the rate of heat loss.

The observed differences in heat loss are small and given equipment tolerances it could be suggested that based solely on these results this conclusion has little justification. However when taken in context with test physical observations and given an apparent ability to produce a slowing in temperature rate rise, it appears reasonable to conclude that temperature loss will also be slowed.

The films tested were taken as being representative of good quality tint film. However it is acknowledged that other film types and grades could potentially deliver different outcomes.

It should be noted that windscreens (i.e. no film permitted in primary vision zone) and body panels are also significant entry paths for heat; therefore any gains produced by tint film are likely to be very small. Our test was designed to eliminate these other heat paths and limit heat entry to the treated or untreated glass panels.

While it is acknowledged that the air spaces of the test pieces were smaller that those found in a typical car, the rate of temperature rise and peak temperatures recorded are consistent with those demonstrated in other tests by RACQ involving actual motor vehicles.

Our thanks to the following for their assistance:

- SIDS Cannon Hill
- Doug Barton Holden & Mitsubishi
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- Dr. Ruth Barker, Qld Injury Surveillance Unit
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- RACQ Technical Training & Support
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