9. GENERAL DISCUSSION AND FINDNGS

This Chapter draws together the findings from the road validation study and the three laboratory experiments in an attempt to find general principles and conclusions for the perception of speed in rural, semi-rural and urban environments. Each of the independent and dependent variables is discussed separately, along with other important issues raised during the course of this research. The need for additional research in this area is also highlighted.

9.1 THE RELEVANCE OF LABORATORY TESTING

A laboratory and road validation study was undertaken in the early stages of this research programme to ensure that laboratory testing would elicit data relevant to road speed perception.

The findings described in Chapter 5 showed that laboratory experimentation was satisfactory for evaluating road speed perceptions. With strict control on maintaining a road-like perspective view and with moving stimulus materials, subjects' laboratory responses closely mirrored those collected on the road, albeit at a different overall level of safety. In other words, a small penalty was incurred in terms of the absolute level of safety from laboratory testing. As the experimental design was primarily aimed at assessing relative effects of the variables under test, this was unlikely to have any consequences for the project.

9.2

This variable was the strongest effect observed in all three experiments and was surprisingly consistent in form. Presentations that were 15 per cent slower than the posted speed limit for each site were judged slower than that considered as an ideal safe operating speed at these sites. Estimates of actual travel speed, however, were quite accurate. Fast presentations

(15 per cent above the posted speed) were judged to be too fast for safety and travel speeds were under-estimated. These results have important ramifications for speed perception and road behaviour and need to be elaborated upon.

9.2.1 The Success of the Experimental Method

First, the responsiveness of subjects to this variable confirms that the experiment was successful. Subjects were able to discriminate between the various road scenes presented and responded in the expected manner. The fact that this variable had such a strong effect in this experiment indicates the importance that subjects placed on presentation speed when making these judgements. It was argued earlier that static presentations would not capture the important characteristics of speed perception and this result supports this hypothesis.

The tendency for speed estimates of fast moving road scenes to be under-estimated in the laboratory has been reported elsewhere (Hakkinein, 1963; Salvatore, 1968, 1969; Reason, 1974). These results, however, are different to those collected on the road. Evans (1970a) found that high speeds were only slightly under-estimated, compared to the substantial under-estimate at low speeds. Presumably, the absence of feedback from a moving vehicle would explain the difference between Evans' results and the findings here.

9.2.2 Road Safety Consequences

The question of whether this result bears directly on a driver's feelings of safety on the road is not clear cut. It could be argued that the safe operating speed result shows that the posted speed limits are accurate for these environments (drivers estimated slow speeds as too slow and fast speeds as too fast). However, one must be careful when making this claim. The validation study showed that road responses were consistently judged much slower than film responses (the mean estimate on the road was in the "too slow" region of the scale, whereas the laboratory average was around the centre of the scale). Laboratory estimates, then, appear to be less sensitive measures of road safety per se than those collected on the road itself.

The tendency for mean free speeds to be around or below the posted speed limit is also not all that helpful here as these responses reflect <u>both</u> sensory and decision making aspects of speed behaviour. In other words, drivers may moderate their perceptions of what constitutes a safe operating speed on the road with their desire to be law abiding citizens.

This should not be taken as condemnation of the laboratory method as it was never intended as a measure of road safety per se. The sensitivity of subjects to speed variations confirms its suitability for assessing the <u>relative effects</u> of road and environment changes on drivers' perceptions of speed. Any potential crash countermeasure highlighted from these laboratory studies would clearly need to be validated on the road itself to establish its potential road safety benefit.

9.3 TYPE OF ROAD

The type of road variable included differences in the road category (primary arterial, secondary arterial, collector or local road) and the number of lanes. While there are substantial differences in the standards for urban and rural roads, it is still possible, nevertheless, to compare the findings for this variable from the three experiments. One needs to be careful, though, not to extrapolate too much from these results.

9.3.1 The Importance of the Road Pavement

The most consistent finding for rural, semi-rural and urban environments was that drivers' perceptions of safety improved and speed estimates were increasingly under-estimated as the road category and the number of lanes increased. This suggests that the width and quality of the road, irrespective of the level of urbanization, has a strong influence on the perception of speed.

This finding offers considerable support for the notion that speed perception is closely related to the road structure.

It is normally assumed by road designers and safety authorities that higher quality roads are safer and more desirable and this was generally supported by the perceptual data collected here. However, the tendency for subjects to under-estimate travel speed on major roads should be of some concern to road safety authorities. Presumably, these under-estimates reflect some loss of visual sensitivity by drivers in these environments, quite separate from any speed adaptation or fatigue effects.

While it is not clear how the ability to estimate travel speed influences the driving task, it would still be potentially dangerous for drivers to approach critical driving manoeuvres, such as curve negotiations or overtaking situations, believing they were travelling much slower than they actually were. The role of driver's perceptions in these critical driving manoeuvres, therefore, warrants further investigation.

9.3.2 The Role of Lane Width

The role of lane width alone is not clear from these results. While increasing lane width generally led to greater safety responses, there was a tendency, however, for divided-wide roads in rural and urban situations to be judged to be less safe (with more accurate speed estimates) than divided-narrow roads. This did not occur for semi-rural sites. There are several possible explanations for this result.

It could be that the sites selected in this experiment may not have been typical examples of these road configurations. Reviewing the films and photographs taken at these sites, however, failed to reveal any apparent anomalies. Furthermore, as there were two different sites for each configuration and each site was filmed twice for the experiment, the effect of any particular anomaly would be greatly attenuated in averaging the data across presentations and repetitions. It would seem unlikely, then, that the sites themselves could have caused this result.

Alternatively, wide divided roads with no traffic can be perceptually similar to 4-lane roads, especially for walled environments. Indeed, safe operating speed estimates, travel speed estimates and free speed measures for these two road configurations are quite similar. However, if this were the sole explanation, then one would also expect consistency between divided-narrow roads and 2-lane roads and this was not the case. Road design requirements do vary considerably between 2-lane, 4-lane and divided rural roads. In addition, divided rural roads tend to be more recent structures than many of the two-lane, two-way rural highways in this State and these newer major highways tend to have more generous geometric specificatons of alignment and flatness than the older two-way roadways. Quite possibly, then, road design influences may also be compounding this result.

Finally, the travel lane used for filming these wide sites may also be exerting some influence. The rule adopted for site filming was to position the vehicle in the lane that placed the camera as near as possible to the centre of the travel path. On 2-lane undivided roads, this meant the vehicle was in the inside lane, while for 3-lane and 4-lane roads, the vehicle was positioned in the second inner lane. It could be that the greater expanse of roadway visible on the left side of the view for divided-wide roads may have resulted in less safe perceptions. Perhaps the sense of being in a passing lane may have unduly influenced perceived safety, although it is not clear how this would occur at the sensory level. Further testing is warranted here to clarify this anomalous result.

9.4 ROADSIDE ENVIRONMENT

The literature review on the likely effects of roadside environment or development was equivocal. Early free speed studies showed that spot speeds were positively correlated with roadside developments (Leong, 1968; Joscelyn et al, 1970). More recent studies by Troutbeck (1976) and Rankin and Hill (1974), however, showed little or no correlation. The free speed results obtained in these experiments suggest that vehicle speed is influenced in part by the roadside environment. However, the perceptual results for this variable are not so clear cut.

9.4.1 The Discriminatory Effect of the Roadside

While roadside environment was either a significant main effect or a significant interaction in all experiments, its effect was not particularly systematic across experiments. Moreover, roadside environment had more effect on safe operating speed estimates than travel speed estimates. As the type of roadside environment was not consistent for each area, it is not too surprising that the effects tended to be discriminatory, rather than exerting an overall blanket effect on all roads. It would be more useful then to summarise the conditions under which roadside development affected the perception of speed on the road for each separate environment.

9.4.2 Rural Environments

Spacious rural roads, comprising mainly open uninterrupted farming paddocks, were consistently judged to have a higher safe operating speed than walled, heavily treed, rural roads. This was especially so at faster travel speeds. Thus, the immediate surrounding environment in these rural areas seems to have a strong influence on drivers' perceptions of what is a safe operating speed.

Such a result supports the notion of retinal streaming in driving and the importance that peripheral vision plays in the perception of speed on the road (Gordon, 1966b; Moore, 1968; Salvatore, 1968, 1969; Triggs, 1986). The type of road in rural areas, however, was not influenced significantly by the roadside environment.

9.4.3 Semi-rural Environments

In semi-rural environments, roadside development also affected safe operating speed estimates. Spacious environments were judged more safe than walled environments for 2-lane wide roads, while the reverse was true for 2-lane narrow roads.

Roadside environments in rural and semi-rural areas predominantly consisted of open paddocks and roadside trees, although in 2-lane semi-rural sites, there were some instances of housing and other urban-like features. Thus, changes in the walling characteristics at these sites would seem to be responsible for the interaction observed between roadside environment and type of road in the semi-rural experiment.

9.4.4 Urban Environments

Urban roadside developments, on the other hand, were noticeably different to both rural and semi-rural environments. Whereas roadside environment comprised mainly open paddocks or trees in country settings, a spacious urban environment consisted of residential (housing) settings while urban walled environments comprised industrial and commercial complexes.

In this experiment, roadside environment again had a main effect on the subjects' safe operating speed judgements. Residential (spacious) settings were generally assessed to be more safe than industrial or commercial environments. An interaction was observed, however, between roadside environment and type of road, where walled roadsides were judged less safe for 4-lane and 2-lane roads, but actually more safe on divided urban roads.

This result is not consistent with either of the previous two findings and seems counterintuitive. However, divided roads in commercial or industrial urban areas often provide off-street parking and service roads in many instances. **The actual** buildings in these walled environments, therefore, can be set back further from the roadway than spacious residential housing. Thus, walled urban sites (commercial or industrial locations) may be really more open and spacious than residential urban sites and this would explain the apparent paradox in these results. Moreover, this is further support for the retinal streaming hypothesis where near object movement in the visual field exerts a strong influence on the perceived safety of movement.

9.5 DRIVER VARIABLES

Driver experience (first year or more than 3 years driving) and the sex of the driver were also evaluated in each experiment. Unfortunately, though, it was only possible to test nine subjects in each of these between-subject conditions. Thus, there were considerably fewer data points for these two factors in the analyses than the other repeated measure conditions. Nevertheless, the findings are still most interesting.

9.5.1 Driver Experience

The amount of driving experience in previous studies has been shown to influence driving performance (Seal and Ellis, 1979; Cowley, 1983; Wasielerski, 1984), the perception of risk (Quimby and Watts, 1981; McKeown, 1985) and visual performance in driving (Mourant and Rockwell, 1972; Riemersma, 1982). However, there is very little evidence available of how driving experience affects sensory perceptions on the road.

The results from these three experiments show there was essentially no difference in the perception of speed for experienced and inexperienced drivers. Driver experience was never a main effect and except for two higher-order interactions in the rural and semi-rural speed analyses, it did not interact with any of the other variables. Moreover, this factor accounted for practically none of the variance in all 3 experiments.

While this may seem a surprising result, it does suggest that the source of any difference in driving behaviour between experienced and novice drivers is not at the sensory level of perception. Speed performance differences on the road between these two groups of road users, then, is more likely a function of their attitudes, motivations or driving skills than the way they process speed information arriving at their sensors.

9.5.2 <u>The Sex of the Driver</u>

The sex of the driver, however, did seem to have some marginal effect on the perception of speed. Female estimates on occasions tended to be less safe than male estimates and they appeared to under-estimate travel speed more than males in some circumstances. This was particularly so in rural environments, and especially at high speeds.

This could have been a function of the lack of driving experience in rural areas of the female subjects recruited for this experiment (they were all predominantly urban residents, albeit from the outer metropolitan region of Melbourne). The previous null result for driver experience, however, casts some doubt on the role of experience in speed perception.

Alternatively, there could be fundamental differences in speed perception between males and females at high speeds, where males perceive high speed in rural environments as being more safe than females do. It would be worth testing the role of driver experience and sex further in any additional speed perception experimentation.

9.6 SAFETY AND SPEED MEASURES

Two dependent variables were used in each experiment as subjective measures of speed perception. These were estimates of how safe each scene was, compared to an ideal safe operating speed, as well as travel speed estimates in km/h. The role and importance of each of these measures can now be summarised.

9.6.1 The Safe Operating Speed Response

The safe operating speed responses were by far the most direct and satisfactory means of measuring sensory effects in the perception of speed. Subjects were able to systematically assess what was a safe operating speed across the range of road scenes used in each experiment, even though they were not able to explain how their responses related to the stimulus materials. The pattern of results was consistent and there were no apparent difficulties or confusions reported by the subjects with this task. Furthermore, the pattern of results could also be explained in direct meaningful terms using this scaling technique.

9.6.2 Estimate of Travel Speed

The travel speed estimates were also successful in that they generally confirmed many of the safe operating speed results and findings from previous research. However, while speed estimates have high face validity for measuring road speed effects, they really didn't add much more than the safe operating speed results. Moreover, it was difficult on occasions to interpret some of the effects of the independent variables in terms of speed estimation accuracy. One might question, then, the need for both measures.

Collecting speed estimates for each scene, though, did not make the task too arduous for the subjects. In fact, many commented on how the two responses seemed to complement each other in this context. In addition, there is some merit in knowing the relationship between the perception of safety and the ability to estimate travel speed under certain circumstances (it is useful to know, for instance, that subjects are not lulled into a false sense of safety, believing they are travelling much slower than they really are). Thus, experimental redundancy by the use of both a safety and a speed response would seem to be justified.

9.7 PERCEPTION AND FREE SPEED ON THE ROAD

Free speed measures were also collected at most of the sites filmed for the three experiments. It was argued earlier that free speeds may not necessarily reflect perceptual differences on the road because the added involvement of driving skill and attitude influence driving performance. Nevertheless, the results were remarkably similar to the perceptual findings, especially when the mean speed was below the speed limit in many walled roadside environments. These findings suggest a rather compelling, albeit speculative, account of the interaction between perception and behaviour on the road.

9.7.1 The Role of Perception in Driving

Perceptual judgements were judged to be less safe and free speeds were recorded below the speed limit in certain walled urban and rural environments. This suggests that sensory information does play an important (primary) role in deciding what speed to travel under certain circumstances. When faced with a situation where a driver's perception of road speed is around or below that considered to be an ideal safe operating speed, changes to the critical sensory features, such as the road surface or roadside environment, will directly affect vehicle speed. The relative speed information arriving at the retina of the eye in this situation seems to have a direct influence on a driver's decision about what speed to travel at. This is one area, then, where modifying the perceptual environment may be an effective countermeasure against excessive speed.

In more spacious environments, however, sensory perception seems less influential or predictable. Here, the more open (less-crowded) surrounding terrain may result in a desire to travel faster, but these sensory perceptions can be modified or offset by other considerations, such as a desire to be law abiding or not to take unnecessary risks. In this situation, then, a perceptual countermeasure is less likely to influence travel speed as any reduction in perceived safety will only tend to offset the mis-match between perception and behaviour.

It should be noted that while this explanation is only speculative, the findings were particularly robust and consistent. Thus, it would be worth following up in future testing in this area.

9.8 SPEED LIMIT DETERMINATION

There were several instances where the mean free speeds reported were above the posted limit. This seemed to be especially so in urban and many semi-rural environments, where travel speeds are limited to 75 and 60 km/h. While it is acknowledged there were only 20 sites studied in each environment, they were, nevertheless, randomly selected and included many of the road characteristics typical of Victorian driving. Thus, it could be argued that there is a need for reviewing speed limits in this State. This finding is consistent with the recent recommendations of the Speed Management Task Force in Victoria (Road Traffic Authority, 1987).

The tendency for mean free speeds to be above the speed limit has been reported elsewhere (Joscelyn and Elston, 1970; Mostyn and Sheppard, 1980; Sanderson and Corrigan, 1984; 1986). This has been used for arguing why speed limits should be based on the 85th percentile speed patterns of the driving population (Witheford, 1970; Joscelyn, Jones and Elston, 1970; Sanderson and Corrigan, 1984; 1986).

9.8.1 Speed Zone Index

The speed zone index (Traffic Commission Victoria, 1976) was discussed earlier as an attempt to determine speed limits based on subjective perceptual features. The results from these experiments show the need to include perceptual factors in any model which seeks to predict vehicle speeds in the absence of road data. Thus, the speed zone index approach is commendable.

It was noted earlier that the basis on which these factors were determined for the speed zone index was not clear from this earlier document. The findings here show that some of these factors are more important than others for predicting vehicle speeds on the road. In addition, there is also a need to evaluate the role of other listed factors. Moreover, there is a pressing need to formulate and "weight" mathematically the particular involvement of each of these factors to arrive at an objective and rational prediction of vehicle speed.

In short, there is a need for additional urban research to determine the perceptual features involved and their degree of invovement in predicting free speeds on the road.

9.9 FURTHER RESEARCH IN SPEED PERCEPTION

This project examined the effect of several road and environment factors on a driver's perception of speed on the road. The long-term aims were to increase the general understanding of speed perception on the road and to identify potential perceptual countermeasures against excessive speed. Additional research is still required to achieve these aims fully and this will now be detailed, along with other relevant research in this area, in order of importance.

9.9.1 Additional Variables for Testing

Fifteen road and environment factors were identified in Chapter 2 as likely to influence the perception of speed on the road (see Table 2.3 on page 32). These factors were identified from other crash and performance studies and have not been previously tested for perceptual effects. Six of these factors were evaluated in this project, leaving nine variables still requiring testing. These include:

Horizontal curvature,
Vertical curvature,
Day versus night vision,
Road delineation,
Sight distance,
Traffic density & mix,
Parked vehicles & pedestrians,
Weather, and
Gradient.

Some of these outstanding factors, however, were given a low research priority in terms of their likely importance to perception. Moreover, some of the factors would be irrelevant in certain environments (eg: parked vehicles and pedestrians are not of prime interest in rural areas) while others do not lend themselves readily to testing using the method developed here (eg: traffic volume and mix).

Thus, future testing in speed perception using this particular paradigm need only involve four or five of these additional variables, namely horizontal curvature, vertical curvature, day and night vision, road delineation and weather.

9.9.2 Follow-up Anomalous Findings

There were several irregular findings in the results of the experiments conducted so far which were described in detail earlier on. These include;

- the role of lane width and road category on rural and urban roads,
- the effect of travel lane on speed perception for multi-lane divided and undivided roads,
- the full extent of driver sex and experience on speed perception, and
- whether there are any driver sex differences in free speeds on the road.

While all of these findings require further testing, it would be particularly useful to include driver sex and experience again in any future testing in speed perception.

9.9.3 Countermeasures Against Excessive Speed

The potential for perceptual countermeasures to reduce excessive speed was alluded to in the introduction to this report. Previous researchers argued that road and roadside countermeasures are more likely to have long-term benefits than attitudinal or enforcement approaches to speed reduction (Klein & Waller, 1970; McLean, 1977; Hauer, Ahlin & Bower, 1982). Indeed one of the long-term aims of this project was to identify possible perceptual and engineering countermeasures against excessive speed.

The results from this project highlighted many critical factors in a driver's perception of speed on the road. Travel speed, road width, level of design and the roadside environment in certain circumstances all influenced safety and speed estimates in rural, semi-rural and urban environments. Moreover, it would be expected that any further experimentation proposed in 9.6.1 would identify other potential cues that could be exploited to reduce excessive travel speeds in hazardous locations.

Countermeasure identification in this area, then, would be dependent on the completion of additional variable testing and follow-up evaluation of anomalous findings. Because of the potential danger of road crashes from any exploratory testing, research involving speed countermeasures in the first instance should involve laboratory testing.

A range of potential countermeasures could be applied to various road scenes (either real or geometric representations) to assess their perceptual effects and likely road user benefits in the first instance. If these results are encouraging, further performance testing could be initiated by applying particular treatments to a sample of low usage roads for on-road testing. Final evaluation would involve applying those treatments that seem to be successful at selected installations and evaluate them in terms of performance improvements and crash reduction.

9.9.4 Speed Zone Index

The speed zone index purportedly defines a means of quantifying speed limits on roads where 85th percentile speed values cannot be directly measured (Traffic Commission Victoria, 1976). The findings from this research so far suggest that the approach outlined in Traffic Commission Victoria (1976) for the speed zone index is fundamentally sound. To estimate the 85th percentile speed value without the benefit of on-road speed measurement, it is necessary to make an objective rational assessment of the likely speed patterns.

There are two major weaknesses with the approach outlined in Traffic Commission Victoria (1976):

- there is no justification for why these particular factors were chosen, and whether they are the only factors that will influence speed perception, and

- there is no ranking or weighting of the relative importance of each factor in determining travel speed.

In addition, it calls for an an evaluation based on "several years of experience", rather than a less subjective method. Thus, the speed zone index is not a definitive model for predicting speed limits and may be subject to bias and exploitation in its application.

In order to make the speed zone index more objective, there is a need for additional urban and semi-rural research to invesitgate the critical variables and to develop a strict mathematical approach to estimating travel speeds from these factors.

9.9.5 Perception and Other Driving Manoeuvres

It may be possible to adapt the procedure developed for testing drivers' perceptions of speed on the road to other driving behaviours or manoeuvres. The overtaking manoeuvre, for instance, has long been recognised as an action drivers are not proficient at performing (Bryant, 1978; Troutbeck, 1979; Johnston and Perry, 1980). Travelling too close to the vehicle in front, too, has been shown to be unsafe (Hills, 1980; Reinhardt-Rutland, 1985; Probst, 1986; Cavello, Laya and Laurent, 1986).

The filming technique and laboratory assessment of safety can provide a safe and practical means of assessing drivers' perceptions of these potentially dangerous behaviours off-the-road and determine whether there is any perceptual basis for these undesirable actions.

A preliminary study would be required initially to validate the use of the laboratory method for this purpose. Moreover, a minor literature review would be needed to identify potentially unsafe driving actions and the driver, road or environment factors likely to be relevant perceptually. This research would help establish the need and provide direction for any future perceptual testing of unsafe driving manoeuvres on the road.

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APPENDIX A

DESCRIPTIONS OF TEST SITES USED IN THE VALIDATION STUDY AND THE RURAL, SEMI-RURAL AND URBAN EXPERIMENTS.

CONTENTS

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A-11 Urban 2-lane undivided sites

Laboratory validation of study sites

SITE NUMBER	SITE DESCRIPTION	AREA	ROAD CATEGORY	SPEED LIMIT	FREE SPEED (mean)	FREE SPEED (std dev)	SEAL WIDTH	LANE WIDTH	ROADSIDE ENVIRONMENT	SHOULDER WIDTH	SIGHT DISTANCE
1	Eastern Freeway (45F2)	Urban	8-lane divided freeway	100km	96.0	7.0	14m	3.5m	Golf course semi-rural	subst	1000m
2	Eastern Freeway (32F11)	"	4-lane divided freeway	100km	97.5	9.6	7m	3.5m	Parkland semi-rural	subst.	750m
3	Doncaster Road (47B1)	"	6-lane divided arterial	75km	75.1	6.9	10m	.3m.	Golf course residential	3.5m	750m
4	Doncaster Road (48A1)	"	6-lane divided arterial	60km	72.0	8.2	9m	3.0m	Residential	3.0m	800m
5	Elgar Road (47B7)	"	4-lane undivided arterial (second)	60km	72.1	7.8	13m	3.3m	Residential	4.0m	800m
6	Belmore Road (47A4)	"	4-lane undivided collector road	60km	71.0	8.2	13m	3.3m	Residential	4.0m	500m
7	Belmore Road (46C4)		4-lane undivided collector road	60km	72.2	9.1	13m	3.3m	Residential	4.0m	.000m
8	Sackville Street (45J8)	"	2-lane undivided collector road	60km	-	-	9m	4.5m	Residential	6.0m	800m
9	Harcourt Street (45J9)	"	2-lane undivided collector (unmark)	60km	-	-	15m	7.5m no c/l	Residential	3.5m	800m
10	Liddiard Street (45F9)		2-lane undivided collector	60km	-	-	6m	3.0m	Close residential	2.0m	600m
11	Burwood Road (45C10)	"	4-lane undivided arterial (second)	60km	55.6	6.7	14m	3.5m	Commercial	3.0m	800m
12	Sth East Freeway (44K12)	"	4-lane divided freeway	100km	-	-	14m	3.5m	Parkland semi-rural	3.5m Barrier	800m

APPENDIX A-2

Rural divided sites

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
1	WIDE >4 LANES	SPACIOUS	GEELONG ROAD, WERRIBEE 207 D1	10.5	3.5	5.0	OPEN FARMING	> 800m	100	100 9	110	9.1
2			GEELONG ROAD, LAVERTON 53 K3	10.5	3.5	5.0	OPEN FARMING	> 800m	100	99.8	110	10.1
3		WALLED	WESTERN HIGHWAY, PYRES CREEK 255 E1	10.5	3.5	5.0	RURAL CUTTING	> 800m	100	94 8	108	13.0
4			GEELONG ROAD, WERRIBEE 203 F12	10.5	3.5	3.0	RURAL TREED	> 800m	100	100 9	111	10.3
5	NARROW 4 LANES	SPACIOUS	WESTERN HIGHWAY, BALLAN 255 D1	7.4	3.7	4.0	OPEN FARMING	> 80	100	102 2	112	9.3
6			SOUTH GIPPSLAND HIGHWAY, KOO-WEE-RUP 256 R8 (McDONALD ROAD)	7.3	3 6	16.0	OPEN FARMING	> 800m	100	102 3	115	12.3
7		WALLED	GEELONG ROAD, WERRIBEE 255 H4	7.5	3.7	3.0	RURAL TREED	> 800m	100	105 8	116 8	10 6
8			WESTERN HIGHWAY, PYKES CREEK 255 E1	7.4	3.7	3.0	RURAL CUTTING	> 800m	100	101.1	114	12.4

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
9	WIDE 4 LANES	SPACIOUS	SOUTH GIPPSLAND HWY, KOOWEERUP 256 R7	15.0	3.7	5.0	OPEN FARMING	> 800m	100	102 2	113	11.2
10			WESTERN HIGHWAY, MELTON 216 K12	14.0	3.5	3.0	OPEN FARMING	> 800m	100	–	–	–
11		WALLED	CALDER HIGHWAY, BLACK FOREST 255 G10	15.0	3.7	4.0	RURAL FOREST	> 800m	100	102 1	113	10.6
12			WESTERN HIGHWAY, MELTON 114 C10	1 0	3 5	[illegible].0	RURAL TREED	> 800m	100	93 1	102	8.9

APPENDIX A-4

Rural 2-lane undivided sites

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
13	WIDE > 7.2m	SPACIOUS	CALDER HWY, KYNETON 253 F9	7.4	3.7	3.0	OPEN FARMING	> 800m	100	100 8	111	9.9
14			BALLAN - DAYLESFORD ROAD, BALLARAT 253 D12	7.4	3.7	4.0	OPEN FARMING	> 800m	100	98 0	111	13.2
15		WALLED	SOUTH GIPPSLAND HWY, GURDIES 256 R9	7.4	3.7	4.5	RURAL TREED	> 800m	100	96.7	108	10 8
16			TRENTHAM ROAD, DAYLESFORD 253 D10	7.4	3.7	2.0	RURAL FOREST	> 800m	100	87.1	101	13.9
17	NARROW < 7.2m	SPACIOUS	LANG LANG ROAD, LANG LANG 256 R8	5.5	2.7	10.0	OPEN FARMING	> 600m	75	78.8	89	11.2
18			LAURISTON ROAD, KYNETON 253 F9	5.5	2.75	5.0	OPEN FARMING	> 800m	100	89.0	104	14 7
19		WALLED	CAPE SCHANCK ROAD, CAPE SCHANCK 200 G7	6.0	3.0	2.0	COASTAL FOREST	> 800m	100	75.5	88	11.9
20			DRUMMOND ROAD, LAURISTON 253 E9	5.5	2.75	3.0	RURAL FOREST	> 800m	100	85.9	97	11.3

Rural gravel sites

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
21	WIDE > 7.2m	PACIOUS	KITTY MILLERS BAY ROAD, PHILLIP ISLAND 256 N11	7.4	3.7	3.0	OPEN FARMING	> 600m	75	-	-	-
22			HOPPERS LANE, WERRIBEE 206 H5	7.5	3.8	6.0	OPEN FARMING	> 600m	75	67.2	80	11.8
23		WALLED	KITTY MILLERS BAY ROAD, PHILLIP ISLAND 256 N11	7.4	3.7	3.0	LIGHT TREED	> 600m	75	-	-	-
24			REEF HILLS ROAD, BENALLA 254 U1	7.4	3.7	1.4	RURAL FOREST	> 600m	75	-	-	-
25	NARROW < 7.2m	PACIOUS	HIGHLANDS ROAD, MOLESWORTH 254 R8	5.5	2.7	6.7	OPEN FARMING	> 600m	75	-	-	-
26			NEALE ROAD, DEAR PARK 255 J2	6.8	3.4	7.0	OPEN DEVELOPMENT	> 600m	75	-	-	-
27		WALLED	OFF BASS HIGHWAY, ANDERSON 256 Q11	5.0	2.5	2.5	HEAVILY TREED	> 600m	75	-	-	-
28			SPARGO-BLAKEVILLE ROAD, DAYLESFORD 253 D11	5.0	2.5	2.5	RURAL FOREST	> 600m	75	-	-	-

APPENDIX A-6

Semi-rural divided sites

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
29	WIDE >4 LANES	SPACIOUS	BANKSIA STREET, HEIDELBERG 32 C5	10.5	3.5	6.0	CREEK RIVERINE	> 600m	75	70.9	79	8.3
30			NEPEAN HIGHWAY, MORNINGTON 104 H12	11.0	3.6	5.0	PARKLAND	> 600m	75	74.9	84	8.8
31		WALLED	EASTERN FREEWAY, COLLINGWOOD 44 K2	17.5	3.5	3.0	URBAN CUTTING	> 800m	100	95.1	106	10.3
32			NEPEAN HWY, MORNINGTON (BUNGOWER ROAD) 104 H11	11.0	3.6	3.0	TREED PARKLAND	> 600m	75	75.5	83	7.8
33	NARROW 4 LANES	SPACIOUS	NEPEAN HIGHWAY, MORNINGTON 105 C7	7.4	3.7	6.0	LIGHT RESIDENTIAL & FARMING	> 600m	75	87.2	98	10.6
34			STUD ROAD, DANDENONG 90 F2	11.0	5.5	5.0	LIGHT RESIDENTIAL	> 600m	75	76.3	88	11.3
35		WALLED	FRANKSTON ROAD, FRANKSTON 102 G1	7.4	3.7	3.0	HEAVILY TREED	> 800m	100	91.8	102	10.5
36			NEPEAN HIGHWAY, MORNINGTON 104 J11	7.5	3.7	3.0	TREED PARKLAND	> 600m	75	83.4	93	9.7

Semi-rural 4-lane undivided sites

SITE DESCRIPTION				SITE DETAILS						SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
37	WIDE 4 LANES	SPACIOUS	BEACH ROAD, HAMPTON 76 E5	14.0	3.5	7.0	BEACH FRONT	> 600m	75	72.5	82	9.5
38			KINGSTON ROAD, HEATHERTON 78 K11	13.0	3.3	6 0	LIGHT RESIDENTIAL & PADDOCKS	> 600m	75	78.2	89	10 6
39		WALLED	MACEDON STREET, KEILOR 14 H6	14.0	3.5	3.0	TREED PARKLAND	> 600m	75	67.2	75	7.5
40			DORSET ROAD, BORONIA 65 A12	13.0	3.3	3.0	LIGHT RESIDENTIAL	> 600m	75	66 4	74	6.6

APPENDIX A-8

Semi-rural 2-lane undivided sites

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
41	WIDE > 7.2m	SPACIOUS	KEILOR-MELTON ROAD, KEILOR NORTH 14 C2	14.0	7.0	5.0	LIGHT RESIDENTIAL & PARKLAND	> 600m	75	75.7	87	11.2
42			KOROROIT CREEK ROAD, ALTONA 54 H6	7.4	3.7	8.0	LIGHT INDUSTRIAL PADDOCKS	> 600m	75	81.4	91	9.4
43		WALLED	CALDER HIGHWAY, WOODEND 253 G10	7.4	3.7	3.0	TREED PADDOCKS	> 600m	75	92.7	103	10 6
44			NEPEAN HIGHWAY, MT MARTHA 145 D12	7.4	3.7	1.0	CUTTING	> 800m	100	84 8	94	9.2
45	NARROW < 7.2m	SPACIOUS	CENTRE-DANDENONG ROAD, MOORABBIN 87 J3	7.0	3.5	5.0	AIRPORT & PADDOCKS	> 600m	75	78.0	89	10.5
46			CYANAMID ROAD, LAVERTON NORTH 54 A1	5.0	2.5	3.0	HOLDING YARDS	> 600m	75	65.8	75	8.5
47		WALLED	BOUNDARY ROAD, DINGLEY 79 A12	7.2	3.6	3.0	LIGHT RESIDENTIAL & PADDOCKS	> 600m	75	74.2	83	8.3
48			DORSET ROAD, BAYSWATER 65 A1	7.2	3.6	3.0	TREED PADDOCKS	> 600m	75	76.1	84	7.8

Urban divided sites

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
49	WIDE >4 LANES	SPACIOUS	MANNINGHAM ROAD, LOWER TEMPLESTOWE 33 A9	9.0	3.0	3.5	RESIDENTIAL	> 600m	75	74.5	82	7.2
50			DONCASTER ROAD, DONCASTER 47 B1	10.0	3.3	3.5	RESIDENTIAL	> 600m	75	75.1	82	6.9
51		WALLED	PRINCES HIGHWAY, DANDENONG 90 H11	10.5	3.5	8.0	INDUSTRIAL	> 700m	90	77.6	86	8.4
52			NEPEAN HIGHWAY, MORNINGTON 145 G1	11.0	3.7	6.0	COMMERCIAL	> 600m	75	70.8	79	7.9
53	NARROW 4 LANES	SPACIOUS	SOUTH ROAD, MOORABBIN 76 J4	10.0	3.7/6.3	4.0	RESIDENTIAL	> 500m	60	68.4	82	3.2
54			HIGH STREET, ASHWOOD 60 F10	7.4	3.7	4.0	RESIDENTIAL	> 500m	60	71.4	78	6.6
55		WALLED	SPRINGVALE ROAD, SPRINGVALE 79 K10	10.0	3.7/6.3	3.5	COMMERCIAL	> 500m	60	62.9	71	8.1
56			MAIN ROAD, LOWER PLENTY 21 A8	9.0	4.5	4.0	COMMERCIAL	> 500m	60	69.5	77	7.2

APPENDIX A-10

Urban 4-lane undivided sites

SITE DESCRIPTION				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
57	WIDE 4 LANE	SPACIOUS	HIGHBURY ROAD, BURWOOD 61 D8	14.0	3.5	5.0	RESIDENTIAL	> 500m	60	74.3	83	8.3
58			BELMORE ROAD, BALWYN 46 C5	13.0	3.3	4.0	RESIDENTIAL & PARKLAND	> 500m	60	72.2	81	9.1
59		WALLED	BURWOOD RO HAWTHORN 45 C10	14.0	3.5	3.5	COMMERCIAL	> 500m	60	62.7	69	6.2
60			FRANCIS STREET, YARRAVILLE 41 E9	14.0	3.5	4.0	INDUSTRIAL	> 500m	60	68 0	76	7 8

Urban 2-lane undivided sites

SITE DESCRIPTI				SITE DETAILS					SPEED DETAILS			
SITE NUMBER	ROAD/LANE CATEGORY	ROADSIDE CATEGORY	SITE DESCRIPTION	ROAD SEAL WIDTH	ROAD LANE WIDTH	SHOULDER WIDTH	ROADSIDE ENVIRONMENT	SIGHT DISTANCE	SPEED LIMIT (kph)	FREE SPEED (mean kph)	FREE SPEED (85% kph)	STANDARD DEVIATION
61	WIDE > 7.2m	SPACIOUS	CENTRE DANDENONG ROAD, CHELTENHAM EAST 87 D2	14.0	7.0	6.0	RESIDENTIAL	> 500m	60	75.8	84	8.1
62			HIGHBURY ROAD, MOUNT WAVERLEY 61 H8	14.0	7.0	5.0	RESIDENTIAL & SCHOOL	> 500m	60	71.8	81	9.0
63		WALLED	SOMMERVILLE ROAD, FOOTSCRAY 41 E7	14.0	7.0	3.5	INDUSTRIAL	> 500m	60	65.5	72	6.7
64			HIGH STREET ASHBURTON 60 D9	13.0	6 5	3.0	COMMERCIAL	> 500m	60	70.1	78	7.4
65	NARROW < 7.2m	SPACIOUS	SACKVILLE STREET, KEW 45 J8	7.2	3 6	3.0	RESIDENTIAL	> 500m	60	63.2	71	7.2
66			MADELINE STREET, BURWOOD 60 F8	6.0	3.0	4.0	RESIDENTIAL	> 500m	60	63.2	73	9.3
67		WALLED	LIDDIARD STREET HAWTHORN 45 E9	6 0	3.0	1.5	RESIDENTIAL & COMMERCIAL	> 500m	60	55.5	64	8 0
68			BALMAIN STREET, RICHMOND 2G H12	6.0	3.0	2.0	INDUSTRIAL	500m	60	48 3	55	6 2

APPENDIX B

EXPERIMENTAL INSTRUCTIONS FOR ROAD AND LABORATORY TESTING

CONTENTS

B-1 Instructions for the road speed experiment

B-2 Instructions for the laboratory speed experiment

APPENDIX B-1

INSTRUCTIONS FOR THE ROAD SPEED EXPERIMENT

The purpose of the driving test today is to measure how safe you consider driving to be in a variety of road and traffic situations. You will be asked to make a series of judgements about whether you feel the speed you are travelling at in a particular road situation is too fast or too slow. There is no need to be unduly concerned about your safety as you will not be put through any dangerous exercises. We are only interested in your perceptions of speeds over a range of different travel speeds and road environments.

The pad on your knees is for recording your responses. You will note that each page has a line on it marked at each end as either too fast or too slow. For each site, you make your speed assessment by simply scribing across the response line at a position indicating your speed assessment. You may not wish to use either of the two extreme positions. **However, you should try to use a range of** responses somewhere between them. There will be differences in travel speed and your feeling of safety, for each of the sites you will be tested on.

A second response is also required at each site. Immediately following the slash-line response, would you please estimate to the nearest 5 kilometres per hour what speed you think you are travelling at and record it in the box in the right-hand corner of the response page. Remember, however, that the slash-line response should always be your first response and that the speed estimate response is secondary.

The course we will be travelling on has 12 sites for assessment. In addition, we will give you some practice before we start the main experiment. There will be plenty of warning when a site is approaching. When instructed, look down at the response pad and only look up when asked to do so. You will be given 5 seconds to view the road and then instructed to look down again and make your response. Please do not respond until after the full 5 seconds of viewing time.

When viewing the road during a test trial, try to concentrate on looking straight ahead and not be distracted by objects in any of the side windows. Also, try not to use any car cues about travel speed but rely entirely on the road and the environment immediately ahead of you.

Are there any questions?

APPENDEX B-2

INSTRUCTIONS FOR THE LABORATORY SPEED EXPERIMENT

The purpose of this experiment today is to measure how safe you consider driving is in a variety of road and traffic situations. You will be shown a series of road scenes as viewed from the driving position of a moving car. Your task is to judge whether the speed you are travelling at is too fast or too slow compared to what you consider is a safe operating speed. There is no need to be concerned about speed limits when making your judgements. We are not interested in knowing what speed limit is appropriate but rather what you believe is a safe operating speed for a range of different travel speeds and road environments.

The pad in front of you is for recording your responses. You will note that each page has a line on it marked at each end as either too fast or too slow. For each site, you make your speed assessment by simply scribing across the response line at a position indicating your judgement. You may not want to use either of the two extreme positions, however, you should try to use a range of responses somewhere between them. There will be differences in travel speed and your feelings of safety for each of the road scenes you will be tested on.

A second response is also required for each scene. Immediately following the slash-line response, would you please estimate to the nearest 5 kph what speed you think you are travelling at and then record that in the box in the right-hand corner of the response page. Remember, however, that the slash-line response should always be your first response and that the speed estimate response is secondary.

You will be shown 12 different road scenes for assessment. Each road scene will be displayed on the screen in front of you for 5 seconds followed by 10 seconds of blank screen. During each road presentation, you should concentrate at looking only at the screen. When the road scene disappears, then look down at your response book and quickly make your assessments. We will give you warning when another scene is about to appear. In addition, you will also be given practice at making these judgements before we start the main experiment.

And finally, when viewing the road during a test trial, try to concentrate at looking straight ahead as you would if you were driving. Try not to be distracted by anything happening around you during a test trial.

Are there any questions ?

APPENDIX C

ANALYSIS OF VARIANCE SUMMARY TABLES OF THE SAFE OPERATING SPEED AND SPEED ESTIMATE ERROR ANALYSES FOR THE VALIDATION STUDY AND THE RURAL, SEMI-RURAL AND URBAN EXPERIMENTS.

CONTENTS

C-1 ANOVA results for safe and speed data from the validation study

C-2 ANOVA results for the rural safe data in experiment

C-3 ANOVA results for the rural speed data in experiment

C-4 ANOVA results for the semi rural safe data in experiment

C-5 ANOVA results for the semi rural speed data in experiment

C-6 ANOVA results for the urban safe data in experiment

C-7 ANOVA results for the urban speed data in experiment

APPENDIX C-1

TABLE 1

ANALYSIS OF VARIANCE SUMMARY TABLE

SPEED ESTIMATE ERRORS

VALIDATION STUDY

SOURCE	ss	df	MS	F	ω^2
Experiment	625	1	625	<1	0
Site	2,910	11	265	2.8**	.007
Exp x site	2,282	11	217	2.3*	.005

* p <05   *** p<.01   *** p<.001

TABLE 2

ANALYSIS OF VARIANCE SUMMARY TABLE

SAFE OPERATING SPEED DATA

VALIDATION STUDY

SOURCE	ss	df	MS	F	ω^2
Experiment	11,077	1	11,077	21.1***	.165
Site	20,851	11	1,895	9.7***	.292
Exp x site	4,875	11	443	2.3*	.042

* p<.05   ** p<.01   *** p<.001

APPENDIX C-2

ANALYSIS OF VARIANCE SUMMARY TABLE

SAFE OPERATING SPEED

RURAL EXPERIMENT

EFFECT	SS	df	MS	F	ω^2
SPEED	152,727	1	152,727	118.3***	.0895
ROADS	86,506	6	14,418	18.7***	.0484
ROADSIDE	28,719	1	28,719	40.2***	.0165
SEX	17,649	1	17,649	3.9	.0077
SPEED x ROADSIDE	2,845	1	2,845	6.3*	.0014
SPEED x ROADS	5,489	6	915	1.8	.0014
EXPERIENCE x SPEED x ROADS	5,087	6	847	1.6	.0012
SEX x SPEED	3,315	1	3,315	2.6	.0011
EXP x SEX x SPEED x ROAD x R'SIDE	5,526	6	921	1.5	.0011
SEX x SPEED x ROADS	4,771	6	795	1.5	.0009
EXPERIENCE x SPEED x ROADSIDE	1,919	1	1,919	4.2	.0008
ROADS x ROADSIDE	4,694	6	782	1.4	.0007
SEX x ROADS x ROADSIDE	4,334	6	722	1.3	.0006
SEX x SPEED x ROADS x ROADSIDE	4,539	6	756	1.3	.0005
SEX x SPEED x ROADSIDE	759	1	759	1.7	0
EXPERIENCE	93	1	93	<1	0
EXPERIENCE x SEX	306	1	306	<1	0
EXPERIENCE x SPEED	527	1	527	<1	0
EXPERIENCE x SEX x SPEED	0	1	0	<1	0
EXPERIENCE x ROADS	552	6	92	<1	0
SEX x ROADS	996	6	166	<1	0
EXPERIENCE x SEX x ROADS	2,610	6	435	<1	0
EXP x SEX x SPEED x ROADS	2,699	6	450	<1	0
EXPERIENCE x ROADSIDE	619	1	619	<1	0
SEX x ROADSIDE	373	1	373	<1	0
EXPERIENCE x SEX x ROADSIDE	138	1	138	<1	0
EXP x SEX x SPEED x ROADSIDE	6	1	6	<1	0
EXPERIENCE x ROADS x ROADSIDE	3,167	6	528	<1	0
EXP x SEX x ROADS x ROADSIDE	2,957	6	493	<1	0
SPEED x ROADS x ROADSIDE	1,746	6	291	<1	0
EXP x SPEED x ROADS x ROADSIDE	1,059	6	177	<1	0

*** $p<.001$ ** $p<.01$ * $p<.05$

APPENDIX C-3

ANALYSIS OF VARIANCE SUMMARY TABLE

SPEED ESTIMATE ERRORS

RURAL EXPERIMENT

EFFECT	SS	df	MS	F	ω^2
SPEED	106,990	1	106,998	285.4^{***}	.1398
ROADS	80,764	6	13,461	59.4^{***}	.1041
ROADS x ROADSIDE	11,910	6	1,985	15.9^{***}	.0146
SEX x ROADS	9,519	6	1,586	7.0^{***}	.0107
SEX x SPEED	3,279	1	3,279	8.7^{**}	.0038
SPEED x ROADS	2,410	6	402	5.5^{***}	.0025
SEX	8,813	1	8,813	1.2	.0019
EXP x SEX x SPEED x R'SIDE	544	1	544	4.7^{*}	0
EXP x SEX x ROADS x R'SIDE	1,321	6	220	1.8	0
SEX x SPEED x ROADS	695	6	116	1.6	0
EXPERIENCE x SEX x SPEED	481	1	481	1.3	0
EXPERENCE x SPEED x ROADS	579	6	97	1.3	0
EXPERIENCE x ROADS	1,808	6	301	1.3	0
SEX x ROADS x ROADSIDE	783	6	130	1.0	0
SPEED x ROADS x ROADSIDE	624	6	104	1.0	0
EXPERIENCE	213	1	213	<1	0
EXPERIENCE x SEX	5,901	1	5,901	<1	0
EXPERIENCE x SPEED	170	1	170	<1	0
EXPERIENCE x SEX x ROADS	904	6	151	<1	0
EXP x SEX x SPEED x ROADS	171	6	28	<1	0
ROADSIDE	0	1	0	<1	0
EXPERIENCE x ROADSIDE	8	1	8	<1	0
SEX x ROADSIDE	56	1	56	<1	0
EXPERIENCE x SEX x ROADSIDE	111	1	111	<1	0
SPEED x ROADSIDE	0	1	0	<1	0
EXPERIENCE x SPEED x ROADSIDE	50	1	50	<1	0
SEX x SPEED x ROADSIDE	72	1	72	<1	0
EXPERIENCE x ROADS x ROADSIDE	231	6	39	<1	0
EXP x SPEED x ROADS x ROADSIDE	480	6	80	<1	0
SEX x SPEED x ROADS x ROADSIDE	379	6	63	<1	0
EXP x SEX x SPEED x ROADS x R'SIDE	382	6	64	<1	0

*** $p<.001$ ** $p<.01$ * $p<.05$

APPENDIX C-4

ANALYSIS OF VARIANCE SUMMARY TABLE

SAFE OPERATING SPEED

SEMI-RURAL EXPERIMENT

EFFECT	SS	df	MS	F	ω^2
SPEED	138,886	1	138,886	82.8***	.1678
ROADS	28,630	4	7,158	24.0***	.0340
ROADS x ROADSIDE	7,082	4	1,770	8.3**	.0076
SPEED x ROADSIDE	1,281	1	1,281	10.8**	.0015
SPEED x ROADS x ROADSIDE	1,772	4	443	2.9*	.0014
SEX x ROADS x ROADSIDE	1,349	4	337	1.6	0010
SEX x ROADS	1,495	4	374	1.3	0
EXP x SEX x SPEED x ROADS x R'SIDE	647	4	162	1.1	0
SEX x ROADSIDE	215	1	215	1.0	0
SEX	3,751	1	3,751	<1	0
EXPERIENCE	3,484	1	3,484	<1	0
EXPERIENCE x SEX	7	1	7	<1	0
EXPERIENCE x SPEED	670	1	670	<1	0
SEX x SPEED	183	1	183	<1	0
EXPERIENCE x SEX x SPEED	565	1	565	<1	0
EXPERIENCE x ROADS	1,138	4	284	<1	0
EXPERIENCE x SEX x ROADS	1,056	4	264	<1	0
SPEED x ROADS	456	4	114	<1	0
EXPERIENCE x SPEED x ROADS	758	4	190	<1	0
SEX x SPEED x ROADS	410	4	102	<1	0
EXPERIENCE x SEX x SPEED x ROADS	792	4	198	<1	0
ROADSIDE	9	1	9	<1	0
EXPERIENCE x ROADSIDE	127	1	127	<1	0
EXPERIENCE x SEX	26	1	26	<1	0
EXPERIENCE x SPEED x ROADSIDE	4	1	4	<1	0
SEX x SPEED x ROADSIDE	60	1	60	<1	0
EXP x SEX x SPEED x ROADSIDE	6	1	6	<1	0
EXPERIENCE x ROADS x ROADSIDE	448	4	113	<1	0
EXP x SEX x ROADS x ROADSIDE	474	4	118	<1	0
EXP x SPEED x ROADS x ROADSIDE	421	4	105	<1	0
SEX x SPEED x ROADS x ROADSIDE	56	4	14	<1	0

*** $p<.001$ ** $p<.01$ * $p<.05$

APPENDIX C-5
ANALYSIS OF VARIANCE SUMMARY TABLE
SPEED ESTIMATE ERRORS
SEMI-RURAL EXPERIMENT

EFFECT	SS	df	MS	F	ω^2
SPEED	40,939	1	40,939	140.7***	.1293
ROADS	13,923	4	3,481	25.4***	.0426
ROADS x ROADSIDE	4,558	4	1,140	8.7***	.0128
ROADSIDE	2,171	1	2,171	14.2***	.0064
SPEED x ROADS x ROADSIDE	2,144	4	536	7.0***	.0058
EXP x SPEED x ROADS x ROADSIDE	1,503	4	376	4.9**	.0038
EXPERIENCE x SEX	3,028	1	3,028	1.7	.0038
EXPERIENCE	2,867	1	2,867	1.6	.0034
SPEED x ROADS	767	4	192	2.1	.0013
SEX x ROADS	862	4	216	1.6	.0010
SEX x SPEED x ROADS	605	4	151	1.6	.0007
SEX	2,026	1	2,026	1.1	.0007
EXP x SEX x SPEED x ROADSIDE	153	1	153	1.3	0
EXPERIENCE x ROADS x ROADSIDE	554	4	139	1.1	0
EXPERIENCE x SPEED	238	1	238	<1	0
SEX x SPEED	232	1	232	<1	0
EXPERIENCE x SEX x SPEED	34	1	34	<1	0
EXPERIENCE x ROADS	351	4	88	<1	0
EXPERIENCE x SEX x ROADS	257	4	64	<1	0
EXPERIENCE x SPEED x ROADS	184	4	46	<1	0
EXPERIENCE x SEX x SPEED x ROADS	240	4	60	<1	0
EXPERIENCE x ROADSIDE	2	1	2	<1	0
SEX x ROADSIDE	84	1	84	<1	0
EXPERIENCE x SEX x ROADSIDE	9	1	9	<1	0
SPEED x ROADSIDE	1	1	1	<1	0
EXPERIENCE x SPEED x ROADSIDE	72	1	72	<1	0
SEX x SPEED x ROADSIDE	114	1	114	<1	0
SEX x ROADS x ROADSIDE	490	4	123	<1	0
EXP x SEX x ROADS x ROADSIDE	379	4	95	<1	0
SEX x SPEED x ROADS x ROADSIDE	74	4	19	<1	0
EXP x SEX x SPEED x ROADS x R'SIDE	47	4	12	<1	0

*** p<.001 ** p<.01 * p<.05

APPENDIX C-6
ANALYSIS OF VARIANCE SUMMARY TABLE
SAFE OPERATING SPEED
URBAN EXPERIMENT

EFFECT	SS	df	MS	F	ω^2
SPEED	163,947	1	163,947	115.8***	.1014
ROADS	75,391	4	18,848	21.1***	.0448
ROADS x ROADSIDE	29,589	4	7,397	9.25***	.0165
EXPERIENCE x SEX x ROADS	8,589	4	2,147	2.4	.0031
SPEED x ROADS	7,504	4	1,876	2.4	.0028
SEX x SPEED	4,991	1	4,991	3.5	.0022
SEX	7,604	1	7,604	1.8	.0020
ROADSIDE	4,057	1	4,057	4.3*	.0019
SEX x ROADS	6,676	4	1,669	1.9	.0019
SEX x SPEED x ROADS	5,295	4	1,324	1.8	.0014
EXP x SPEED x ROADS x ROADSIDE	5,060	4	1,265	1.7	.0012
EXP x SEX x ROADS x ROADSIDE	4,533	4	1,133	1.4	.0008
EXP x SEX x SPEED x ROADSIDE	1,426	1	1,426	2.1	0
EXPERIENCE x SEX x ROADSIDE	1,653	1	1,653	1.8	0
EXPERIENCE x SPEED x ROADSIDE	1,205	1	1,205	1.5	0
SPEED x ROADSIDE	895	4	895	1.3	0
EXPERIENCE x ROADSIDE	1,025	1	1,025	1.1	0
EXPERIENCE x SPEED	4,992	1	4,992	1.1	0
SEX x ROADSIDE	441	1	441	1.1	0
EXP x SEX x SPEED x ROADS x R'SIDE	2,935	4	734	1.0	0
EXPERIENCE	544	1	544	<1	0
EXPERIENCE x SEX	298	1	298	<1	0
EXPERIENCE x SEX x SPEED	249	1	249	<1	0
EXPERIENCE x ROADS	2,672	4	668	<1	0
EXPERIENCE x SPEED x ROADS	1,433	4	358	<1	0
EXP x SEX x SPEED x ROADSIDE	2,147	4	537	<1	0
SEX x ROADSIDE	441	4	441	<1	0
SEX x SPEED x ROADSIDE	607	1	607	<1	0
EXPERIENCE x ROADSIDE	1,025	1	1,025	<1	0
SPEED x ROADS x ROADSIDE	2,566	1	641	<1	0
SEX x SPEED x ROADS x ROADSIDE	1,756	4	439	<1	0

*** p<.001   ** p<.01   * p<.05

APPENDIX C-7

ANALYSIS OF VARIANCE SUMMARY TABLE

SPEED ESTIMATE ERRORS

URBAN EXPERIMENT

EFFECT	SS	df	MS	F	ω^2
SPEED	28,676	1	28,676	147.0***	.1091
ROADS	26,200	4	6,550	66.3***	.0988
ROADS x ROADSIDE	20,493	4	5,123	80.5***	.0775
SEX	3,355	1	3,355	1.5	.0041
SPEED x ROADS	1,277	4	319	5.2***	.0040
EXPERIENCE x SEX	2,964	1	2,964	1.3	.0026
SPEED x ROADSIDE	481	1	481	9.8**	.0016
SEX x ROADSIDE	176	1	176	4.5*	.0014
EXPERIENCE x SEX x SPEED x ROADS	445	4	111	1.8	.0007
SPEED x ROADS x ROADSIDE	400	4	100	2.1	.0006
SPEED x ROADSIDE	125	1	125	2.5	0
EXPERIENCE x SEX x ROADSIDE	176	1	176	1.6	0
EXPERIENCE x ROADS	554	4	138	1.4	0
SEX x ROADS x ROADSIDE	354	4	89	1.4	0
EXPERIENCE x ROADS x ROADSIDE	276	4	69	1.1	0
EXPERIENCE	0	1	0	<1	0
EXPERIENCE x SPEED	7	1	7	<1	0
SEX x SPEED	152	1	152	<1	0
EXPERIENCE x SEX x SPEED	0	1	0	<1	0
SEX x ROADS	118	4	30	<1	0
EXPERIENCE x SEX x ROADS	259	4	65	<1	0
EXPERIENCE x SPEED x ROADS	163	4	41	<1	0
SEX x SPEED x ROADS	38	4	9	<1	0
ROADSIDE	65	1	65	<1	0
EXPERIENCE x ROADSIDE	45	1	45	<1	0
SEX x SPEED x ROADSIDE	0	1	0	<1	0
EXP x SEX x SPEED x ROADSIDE	1	1	1	<1	0
EXP x SEX x ROADS x ROADSIDE	65	4	16	<1	0
EXP x SPEED x ROADS x ROADSIDE	126	4	31	<1	0
SEX x SPEED x ROADS x ROADSIDE	48	4	12	<1	0
EXP x SEX x SPEED x ROADS x R'SIDE	111	4	28	<1	0

*** $p<.001$ ** $p<.01$ * $p<.05$