



Report of the Queensland Ombudsman



QUEENSLAND
ombudsman

The Pacific Motorway Report

An investigation into the actions of the Department of Main Roads in relation to noise and safety issues concerning the Pacific Motorway.

March 2007

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6 March 2007

The Honourable John English MP
Acting Speaker of the Legislative Assembly
Parliament House
George Street
BRISBANE QLD 4000

Dear Mr English

In accordance with s.52 of the *Ombudsman Act 2001*, I hereby furnish to you my report, *The Pacific Motorway Report: An investigation into the actions of the Department of Main Roads in relation to noise and safety issues concerning the Pacific Motorway*.

Yours faithfully

A handwritten signature in black ink, appearing to read "D Bevan".

David Bevan
Queensland Ombudsman

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Foreword

Every year my Office receives thousands of complaints from Queenslanders about Queensland public sector agencies. Some complaints go beyond the circumstances of individual complainants and may best be described as 'systemic' complaints because the actions of the agency may affect many people. This is a report of such a case.

Following a Queensland Government public announcement on 15 April 1996, the Department of Main Roads upgraded the Pacific Highway between the Logan Motorway and Nerang to motorway standard. The new motorway was opened to traffic in October 2000.

This report presents the findings of an investigation into complaints lodged with my Office by two executive members of a community group known as the Residents Against Increased Noise (RAIN). RAIN claims to represent many people living adjacent to the Pacific Motorway.

The complaints concern the administrative actions of the Department of Main Roads in upgrading the Pacific Motorway, particularly its decision to construct some sections of the pavement with concrete rather than asphalt. The decision to use concrete has caused RAIN members to be concerned about the effects of noise on their everyday lives and to express safety concerns for the motoring public in terms of the potential for aquaplaning on the concrete surface and poor visibility in wet weather conditions.

Because the issues dealt with in the report are of significant public interest, I have decided to present the report to the Speaker for tabling in the Legislative Assembly as provided for in s.52 of the *Ombudsman Act 2001*.

I take this opportunity to thank the executive members of RAIN who complained to my Office, and the RAIN membership, for their patience and cooperation during the conduct of this investigation. Likewise, I extend my appreciation to the Department of Main Roads, which has cooperated fully with my Office's investigation.

Finally, I would like to thank (now former) Deputy Ombudsman Rodney Metcalfe, Assistant Ombudsman Craig Allen and Investigating Officer Ed Perry for their dedication and professionalism in conducting the investigation and preparing this report.



David Bevan
Queensland Ombudsman

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Abbreviations and Dictionary

AAPA	Australian Asphalt Paving Association
architectural treatment	Noise attenuation measures for individual premises, and includes one or more of a range of measures identified in Part 2.4.2 of this report
ARRB	Australian Road Research Board (now known as the ARRB Group)
Board of Review	The Pacific Motorway Board of Review: a DMR committee comprised primarily of senior departmental officers to manage the Pacific Motorway Project
BPEM	Best Practice Environmental Management (in the context of the EP Act)
CCAA	Cement and Concrete Association of Australia
CoRTN	Calculation of road traffic noise – a traffic noise prediction model
dB	Decibel, a measure of sound level
dB(A)	A widely used measure of sound pressure, in decibels, responsive to frequencies sensitive to the human ear
DGAC	Dense-graded asphaltic concrete
Director-General	Director-General, or chief executive, of DMR, Mr Alan Tesch, who was Acting Director-General at the time my investigation commenced
DMR	Department of Main Roads
DoE	Department of Environment, now EPA
Dr Samuels	Dr Stephen E Samuels, PhD MEngSci BE FIEAust CPEng FAAS MASA, Principal, TEF Consulting
EIS	Environmental Impact Statement, in the context of the SD Act
EPA	Environmental Protection Agency
EP Act	<i>Environmental Protection Act 1994</i>
EP Noise Policy	<i>Environmental Protection (Noise) Policy 1997</i> , made under the EP Act
IMP	Impact Management Plan for the Pacific Motorway Project
IMP documentation	The 4-volume set of documentation, including the IMP, REF and technical papers publicly released by DMR in January 1997

IMP noise commitment	The commitment in the IMP about noise in the construction and operation of the motorway, set out at Part 1.3 of this report
Interim Noise Guidelines	<i>Interim Guidelines and Technical Notes for Road Traffic Noise Amelioration</i> approved by State Cabinet on 16 December 1991, as amended
IPA	<i>Integrated Planning Act 1997</i>
IRT	Independent Review Team, comprising Professor L Brown and Dr S Samuels, which undertook the IRT Review in 2002 and prepared the IRT Report
IRT Report	Brown, L & Samuels, S <i>Review of implementation of the Impact Management Plan on the Pacific Motorway with respect to road traffic noise</i> , 5 June 2002
IRT Review	Review undertaken by the IRT
KSI	Killed and seriously injured persons, in the context of road traffic accidents
my investigating officers	Includes (now former) Deputy Ombudsman, Rodney Metcalfe, Assistant Ombudsman, Craig Allen, and Investigating Officer, Ed Perry (or one or some of them)
Noise Code	<i>Road Traffic Noise Management: Code of Practice</i> as amended, adopted by DMR in January 2000 to replace the Interim Noise Guidelines
Noise descriptors (e.g. L_{10} , $L_{10(18\text{Hour})}$, L_{eq} , L_{Amax})	See Dictionary in Schedule 4 of EP Noise Policy
OA	<i>Ombudsman Act 2001</i>
OGAC	Open-graded asphaltic concrete
Pacific Highway	The road existing before the construction of the motorway
PCC	Portland cement concrete
PIRs	Police Incident Reports, in the context of road traffic accidents
PR	Pavement reduction treatment (using OGAC) for noise attenuation
Project Director	DMR's Project Director for planning, design and construction of the motorway
QPS	Queensland Police Service
RACQ	Royal Automobile Club of Queensland
RAIN	Residents Against Increased Noise (a community group)

Reassessment Project	A project undertaken in 2003 on behalf of the DMR by consultants Richard Heggie Associates Pty Ltd and ASK Consulting Engineers to implement recommendations of the IRT Report
REF	Review of Environmental Factors: Human, Natural and Economic, Volume 2 of IMP documentation
revised Noise Code	Revision of the Noise Code following DMR's implementation of relevant recommendations from the IRT Report
RRPM	Retro-reflective pavement marker
RTA	Roads and Traffic Authority of New South Wales
Rust-PPK	Consultancy firm which prepared the IMP documentation for DMR
SD Act	<i>State Development and Public Works Organisation Act 1971</i>
SMA	Stone-mastic asphalt (pavement surface)
the complainants	Two executive members of RAIN
the motorway	The Pacific Motorway, particularly the new section between Logan Motorway and Nerang, also referred to as (part of) the M1
TI Act	<i>Transport Infrastructure Act 1994</i>
VicRoads	The road authority for the State of Victoria
VKT	Vehicle Kilometres Travelled, in the context of vehicle exposure to incidents/accidents (the product of average daily traffic volume over a given period [number of days] and the length of road in kilometres)

Executive Summary

Investigative context

I have completed my statutory investigation into the administrative actions of the Department of Main Roads (DMR) in relation to the upgrading of the Pacific Motorway (the motorway).

Concerns about noise from the motorway as well as safety issues were brought to my attention by two executive members (the complainants) of a community group known as the Residents Against Increased Noise (RAIN). This group's membership is said to be approximately 500 people from residential areas adjacent to the concrete pavement (PCC) sections of the motorway. RAIN claims that noise from the concrete pavement between Albert River and Gaven adversely affects more than 10,000 people residing adjacent to the motorway and up to one kilometre on either side.

The complainants state that noise from the motorway impacts on residents' sleep and their health, has caused a loss of enjoyment, and has reduced the value and resale potential of their properties.

The investigation has proved to be a difficult one for my Office because of the technical complexity of the issues involved and the complainants' frustration arising from their belief that their concerns are not being addressed.

I found it necessary, during the course of the investigation, to advise the complainants of my role and responsibilities because of their expectation that my Office would be 'checking' the findings of experts engaged by the DMR to carry out noise monitoring and modelling work.

My role, in responding to this complaint, is to investigate whether the actions taken by the DMR in respect of noise issues and pavement selection were unlawful, unfair, unreasonable or wrong. This means that my investigation focused on the basis on which the DMR made its decisions, including whether, where relevant, the agency acted in accordance with the advice of appropriately qualified experts.

I have therefore considered the advice provided by experts engaged by the DMR in relation to noise monitoring and noise modelling but only to determine whether DMR had appropriate regard to that advice in making its decisions.

Although I am able to seek the advice of private consultants, I would only be able to justify that course of action if I considered that there were clear grounds to doubt the advice provided by the experts engaged by the DMR and that the provision of that further advice would be likely to resolve the technical issues in dispute.

In the circumstances of this investigation, while it is clear that the complainants do not accept the advice provided by the experts engaged by the DMR, I did not consider there were sufficient grounds for seeking the advice of another expert. However, I did obtain further information from one of the experts engaged by the DMR to verify the reasonableness of actions taken by the DMR purportedly on the basis of the advice of that expert and other experts.

My investigation has been conducted informally under s.24(a) of the *Ombudsman Act 2001*, without the need to invoke my coercive powers under Part 4.

The circumstances

Following a Queensland Government public announcement on 15 April 1996, the DMR upgraded the Pacific Highway between the Logan Motorway and Nerang to motorway standard in recognition of its essential role as a commuter, tourist and commercial route between Brisbane and the Gold Coast and as part of the major interstate link between Brisbane and Sydney. The upgraded section (approximately 43 km) forms part of the Pacific Motorway.

The upgrading work involved:

- a 35 km, eight lane, dual carriageway from Logan Motorway at Loganholme to Smith Street Motorway (west of Southport); and
- an 8 km, six lane, dual carriageway from Smith Street exit to Pappas Way, Nerang.

The eight-lane carriageway has a plain concrete pavement surface (Portland cement concrete – PCC) for a distance of approximately 28 km from Albert River, Beenleigh to Coombabah Creek, Gaven (south of Gold Coast Highway Interchange at Helensvale). The balance of the new carriageway (approximately 15 km) has an open-graded asphaltic concrete (OGAC) pavement. Actual road construction took about three years and the new motorway was opened to traffic in October 2000. The estimated cost of the project was \$630 million in 1996.

In conjunction with the planning stage for the motorway, the DMR prepared an Impact Management Plan (IMP) that, at the strategic level, set out the proposed measures for maximising the benefits of the new motorway and minimising the adverse impacts arising from its construction and operation. The IMP was finalised after the completion of an extensive public consultation process and then presented as, in effect, a ‘contract’ between the community and the DMR for the project. It contained a range of commitments and design principles relating to, among other things, noise and safety. One of the key design principles was the construction of a low noise road.

The essence of RAIN’s concerns is that the construction of the concrete pavement breached certain undertakings given by the DMR during the consultation process on the motorway upgrade in that it generates greater road traffic noise for residents adjacent to the motorway than alternative pavement surfaces, such as OGAC.

RAIN also raised safety issues relating to the potential for aquaplaning and motorist visibility in wet weather conditions on the concrete section of the motorway.

This report focuses on noise and safety issues on the PCC section of the new motorway, from Albert River, Beenleigh to Coombabah Creek, Gaven.

In raising the complaint, RAIN strongly asserted that, as the DMR had failed to satisfy its contract with the community regarding the construction of a low noise road, the PCC sections of the motorway should be resurfaced with OGAC, which is approximately 6 dB(A) quieter than PCC. In particular, the complainants allege that, during the 1996-97 public consultation process, the DMR and/or its consultants represented that the noise environment for the new motorway would be no worse than the noise environment for the old Pacific Highway.

Role of Ombudsman

The Ombudsman's responsibility under the Ombudsman Act is to investigate complaints involving the administrative decisions and actions of public sector agencies and to recommend remedial action where appropriate.

The Ombudsman also has a responsibility under the Act to improve the quality of public administration by examining particular practices and procedures in agencies that have been the subject of a complaint.

The Ombudsman considers whether the actions of an agency or its officers are (among other things):

- unlawful, unreasonable or unjust;
- taken on irrelevant grounds or having regard to irrelevant considerations;
- based wholly or partly on a mistake of law or fact; or
- wrong.

The Ombudsman is also empowered by the Act to make recommendations to the principal officer of the appropriate agency that action be taken to rectify the effects of maladministration or to improve the practices and procedures of the agency.

De-identification

This report is about the administrative actions of the DMR. Therefore, it is unnecessary in most cases to publicly identify individuals connected with my investigation and I have deleted references to the names of:

- officers and former officers of the DMR;
- the executive members of RAIN who complained to my Office; and
- other persons who have assisted the investigation.

However, it has been necessary in some instances to identify individuals (by name or position) to aid comprehension.

The investigation

My Office's investigation involved:

- obtaining written and oral submissions from the complainants;
- obtaining written responses, relevant documentation and information from the DMR and its independent consultant Dr S Samuels, a noted Australian authority on road traffic noise;
- interviewing senior DMR officers; and
- contacting interstate road authorities and other relevant third parties, including the Queensland Police Service and the RACQ.

I have complied with my obligation under the Ombudsman Act to provide the Director-General with an opportunity to comment on the subject matter of the investigation.

I have also complied with my obligation to give procedural fairness to persons who may have been the subject of my adverse comment in the report by giving them an opportunity to make submissions in relation to the proposed adverse comment.

The responses of those persons, who were all former officers of the DMR, were either sent directly to my Office or were incorporated into the DMR's response to my proposed report. After considering the responses and making further inquiries, I am satisfied that there are no grounds for making adverse comment in relation to any of those persons.

Public report

This report summarises my investigation and contains my opinions and recommendations and is provided to the Speaker of the Queensland Legislative Assembly pursuant to s.52 of the Ombudsman Act for tabling in the Assembly. I have taken this step because the matters raised are of considerable public concern and importance.

Outcome of investigation

The DMR's commitment in the IMP documentation was in two parts:

1. the noise levels associated with the motorway would not exceed 68 dB(A); and
2. it would endeavour to mitigate any sustained increase in noise levels for the new motorway compared with the baseline noise levels for the old Pacific Highway.

The main way in which DMR has endeavoured to meet the first noise commitment is by constructing noise barriers. The noise barrier program has almost been completed and further noise monitoring needs to be undertaken before DMR can establish that it has met this commitment.

I have formed the opinions that:

- DMR's actions in taking approximately three years since the 2003 Reassessment Project to complete the noise barrier program are unreasonable.
- DMR has not yet fully met the second noise commitment.

I have also formed the following opinions:

- DMR incorrectly assumed from the advice of its consultants that the PCC surface it selected for the motorway had a similar noise profile to DGAC (referred to in this report as the 'pavement correction factor').
- Although there was no intention to mislead the public, it is probable that incorrect statements were made by the DMR, or its consultants, during or for the purpose of consultation for the motorway, to the effect that the traffic noise environment for the new motorway would be no worse than the traffic noise environment for the old Pacific Highway.
- Noise levels along the PCC section of the motorway (at the source) are approximately 8.8 dB(A) higher than noise levels for the old Pacific Highway. Therefore, it is understandable that the complainants believe that the motorway does not constitute a 'low noise road'. The IMP documentation stated that this would be a major feature of the proposed motorway.
- DMR failed to make and/or keep adequate records of the reasons for key decisions in relation to the type of pavement to be used on various sections of the motorway.

I have recommended that the DMR offer architectural treatments to reduce motorway noise for the following properties identified through noise modelling as not adequately protected by noise barriers:

- properties experiencing noise levels above 68 dB(A); and
- properties, existing in 1996, that will be exposed to a sustained increase in their noise level by the 2011 planning horizon.

Implementation of this recommendation by the DMR will benefit at least 300 properties, and possibly substantially more once further noise modelling and monitoring work has been undertaken following the finalisation of the noise barrier program.

Architectural treatments (as defined in my report) include one or more of the following:

- mechanical ventilation/air-conditioning;
- upgraded windows and glazing and solid core doors on exposed facades;
- upgraded windows and door seals;
- sealing of wall vents; and
- installation of external screen walls.

I have recommended that:

- as soon as practicable, DMR develop a works program for the completion of all individual architectural treatments and make key aspects of the program publicly available including the relevant timeframe for completion of the work; and
- priority for individual architectural treatments be determined having regard to the extent of noise increases.

I have also made a number of recommendations relating to the DMR's Noise Code, which currently does not specify any night-time level or a single event maximum noise level. In this regard, the Code is inconsistent with the EP Noise Policy.

The standard in the Noise Code for major upgrades of roads is also higher than the standard in nearly all other Australian states and territories. I have recommended that the DMR attempt to promote a uniform system.

I have not recommended to the DMR that the PCC sections of the motorway be resurfaced with another pavement material because:

- my inquiries did not reveal any resurfacing option for PCC that would be guaranteed to achieve significant reductions in noise levels emanating from the motorway in the medium to long term;
- resurfacing would cause enormous disruption to traffic, which would potentially be ongoing because of the higher maintenance requirements associated with OGAC surfaces; and
- resurfacing would be an expensive process (the DMR's estimate was \$40 million in 2005).

I appreciate that the complainants and the members of RAIN will be disappointed with this aspect of my report but I have to consider all relevant issues, including cost and practicability, before making a recommendation to the principal officer of an agency.

Finally, I am satisfied that the complaints about the safety of the motorway have not been substantiated in that available accident data show that:

- the motorway provides a traffic environment that is at least twice as safe as the traffic environment provided by the Pacific Highway during the five year period immediately preceding the commencement of construction of the motorway;
- the accident rate on the motorway is relatively low compared to other major roads in South-East Queensland;
- wet weather has not significantly affected the accident rate on the motorway;
- the accident rate on the PCC section is substantially lower than the accident rate on OGAC sections; and
- the risk of aquaplaning on the PCC section of the motorway is no greater than on any other major road in South-East Queensland.

My opinion that the motorway provides a safe traffic environment is another reason for my not recommending that the PCC section of the motorway be resurfaced.

Maladministration

My investigation did not identify any unlawful or otherwise improper administrative action on the part of the DMR or its officers. However, I have formed the opinion that in some instances the DMR's actions amounted to defective administrative action within the meaning of s.49(2) of the Ombudsman Act.

My investigation also identified a number of less significant administrative deficiencies and I have made recommendations to assist DMR to address those deficiencies.

Opinions

I have formed the following opinions for the purpose of s.49 of the Ombudsman Act:

Opinion 1

The DMR Noise Code is not sufficiently comprehensive as it does not cover the night-time level and the single event maximum noise level contained in the EP Noise Policy.

Opinion 2

There was no intention on the part of DMR's officers and/or its consultants to mislead the public during the consultation process.

Opinion 3

It is probable that statements were made by the DMR (through its officers and/or its consultants) during, or for the purpose of, public consultation for the motorway to the effect that the traffic noise environment associated with the new motorway, irrespective of the pavement type, would be no worse than that associated with the old Pacific Highway. These statements were incorrect.

Opinion 4

It is likely that the Board of Review, notwithstanding its charter to make recommendations to the Director-General or to his authorised delegates, in fact made the relevant decisions on pavement types and locations for the motorway.

Opinion 5

The DMR failed to make and/or keep adequate records of the reasons for key decisions in relation to the type of pavement to be used on various sections of the motorway. The failure constitutes unreasonable administrative action within the meaning of s.49(2)(b) of the Ombudsman Act.

Opinion 6

The DMR has substantially met the undertaking given in the IMP to conduct a post-construction continuous noise monitoring program to assess the effectiveness of noise barriers constructed in conjunction with the roadworks, but considerably later than specified in the IMP.

Opinion 7

DMR's statements in the IMP documentation that:

- light longitudinally-textured concrete has the same noise correction factor as DGAC; and
- a concrete pavement with light texturing and transverse tining and an OGAC pavement are both low noise surfaces,

were based on the advice DMR obtained from appropriately qualified consultants.

Opinion 8

DMR incorrectly assumed from the advice of its consultants that the PCC surface it selected for the motorway had a similar pavement correction factor to DGAC. This constitutes administrative action that was wrong, within the meaning of s.49(2)(g) of the Ombudsman Act.

Opinion 9

There is insufficient evidence to substantiate the allegation that the results of the 2003 Reassessment Project in relation to 1996 baseline noise levels and the 2003-2011 predictions are not valid.

Opinion 10

The DMR has not yet met its IMP noise commitment in relation to endeavouring to mitigate any sustained increase in baseline ambient noise levels at sensitive receptors adjacent to the motorway corridor. The time taken by DMR to complete this work, comprising individual architectural treatments, constitutes unreasonable administrative action within the meaning of s.49(2)(b) of the Ombudsman Act.

Opinion 11

Having regard to the commitment in the IMP that noise levels would not exceed 68 dB(A), the DMR's actions in taking approximately three years since the Reassessment Project to complete the noise barrier program constitutes unreasonable administrative action within the meaning of s.49(2)(b) of the Ombudsman Act.

Opinion 12

As the noise barrier program is nearing completion, further review of the DMR resurfacing report is not warranted.

Opinion 13

There is insufficient justification for resurfacing the PCC sections of the motorway for the following reasons:

- Available resurfacing options for the PCC sections would not guarantee significant reductions in noise levels arising from the motorway in the medium to long term.
- Resurfacing would cause enormous disruption to traffic, which would potentially be ongoing because of the greater maintenance requirements associated with OGAC surfaces.
- Resurfacing would not be cost-effective.
- Accident statistics support the conclusion that the motorway is safer than the old Pacific Highway including in wet weather.

Opinion 14

There is no evidence that the risk of aquaplaning on the PCC section of the motorway is any greater than exists on any other major road in South-East Queensland.

Opinion 15

From an analysis of compiled accident data (summarised in Part 14.3 of this report) it can reasonably be concluded that:

- the new motorway provides a traffic environment that is at least twice as safe as that which existed on the Pacific Highway during the five year period immediately preceding the commencement of construction of the motorway;
- the accident rate on the motorway is relatively low compared to other major roads in South-East Queensland;
- wet weather has not been a significant factor in the cause of accidents on the motorway; and
- the accident rate on the PCC section is substantially lower than the accident rate on OGAC sections.

Opinion 16

Visibility of lane markings on the PCC section of the motorway is poorer in wet weather than on the OGAC sections.

Recommendations

I make the following recommendations under s.50 of the Ombudsman Act:

Recommendation 1

If any variation is made to Schedule 1 in the EP Noise Policy in relation to the planning levels for beneficial assets (public roads), DMR review the design levels in its Noise Code for state-controlled roads.

Recommendation 2

DMR undertake and complete further research by the end of 2008 with a view to developing an appropriate design level for night-time noise having regard to the relevant planning level in the EP Noise Policy and, in due course, include that design level in its Noise Code.

Recommendation 3

In the interim, DMR make reference in its Noise Code to all planning levels in the EP Noise Policy relevant to state-controlled roads and specify in the Code its reasons for not including night-time and single event maximum road traffic noise levels.

Recommendation 4

DMR actively promote, through Austroads, a national traffic noise standard for different road classifications that is achievable, technically feasible and gives due recognition to the impact of road traffic noise on the community, with a view to the standard being adopted by all Australian road authorities.

Recommendation 5

If, by the end of 2008, a uniform national road traffic noise standard is not achieved, DMR review its design levels by the end of 2009 to assess whether they are justifiable compared with the levels adopted by the majority of state and territory road authorities in Australia and, if appropriate, amend its Noise Code in accordance with the outcome of the review.

Recommendation 6

DMR review its Noise Code at least every two years and update it in line with emerging scientific, engineering, technical and administrative developments regarding road traffic noise issues.

Recommendation 7

DMR ensure that its codes of practice regarding road design, construction and maintenance:

- *identify the national and international standards and best practice that are relevant to the particular provisions of each code; and*
- *include reasons for decisions not to follow any such standard.*

Recommendation 8

DMR ensure that, wherever practicable, all public commitments and undertakings about proposed roadworks, including associated noise attenuation works, are achievable and are met in a timely manner.

Recommendation 9

DMR ensure that full and accurate records are created of all significant decisions (and of the reasons for the decisions) about roadworks or other issues affecting members of the community and that such records are maintained in accordance with the Public Records Act 2002.

Recommendation 10

DMR review its records management system by 30 June 2007 to ensure that records are maintained and stored in a manner that facilitates their ready location and retrieval.

Recommendation 11

DMR, after reviewing its records management system, undertake regular audits of project records to ensure they are maintained and stored in a manner that facilitates their ready location and retrieval and in accordance with the Public Records Act and DMR's records policies.

Recommendation 12

To satisfy the IMP commitment about baseline noise levels, DMR offer individual architectural treatments for all premises existing in 1996 that, based on the 1996 noise scenario as modelled in 2003, and within the 300m zone of accuracy of the CoRTN model, will be exposed to a sustained increase in their respective baseline noise levels having regard to the predicted levels for the 2011 planning horizon. Such offers should not be limited to premises that will be exposed to an increase of at least 3 dB(A).

Recommendation 13

To satisfy the IMP commitment about baseline noise levels, DMR undertake modelling to determine premises existing in 1996, beyond the 300m accuracy zone of CoRTN, that will be exposed to a sustained increase in their baseline noise levels having regard to the predicted levels for the 2011 planning horizon. Where a sustained increase is determined, the DMR offer individual architectural treatments for those premises. Such offers should not be limited to premises that will be exposed to an increase of at least 3 dB(A).

Recommendation 14

As soon as practicable, DMR develop a works program for the completion of all individual architectural treatments and make key aspects of the program publicly available including the relevant timeframe for completion of the work.

Recommendation 15

Priority for individual architectural treatments be determined having regard to the extent of noise increases.

Recommendation 16

DMR ensure that:

- *wherever practicable, noise attenuation works associated with proposed roadworks are completed at the same time as the construction of the roadworks;*
- *any additional noise attenuation works, identified as being necessary after construction of roadworks, are completed as soon as possible.*

Recommendation 17

As soon as practicable the DMR undertake noise monitoring in order to ensure that noise from the motorway does not exceed the 68 dB(A) threshold in the IMP noise commitment along the PCC section of the motorway and take any necessary remedial action.

Recommendation 18

If the DMR decides to further upgrade the motorway (for example, by adding lanes), any noise mitigation treatment associated with the upgrading should, wherever practicable, be undertaken in conjunction with the corresponding road construction work.

Recommendation 19

The section on complaint management in the revised Noise Code be amended to provide details of potential remedial measures for complainants whose complaints are substantiated, including reimbursement of noise testing costs.

Recommendation 20

DMR should consider any reasonable request for reimbursement of expenses incurred by a complainant in engaging a noise consultant where the DMR is satisfied that the complainant's case is established using the DMR noise criteria and methodology.

Recommendation 21

Where a person establishes to the DMR's satisfaction that the noise level at the person's residence exceeds DMR's modelled results for that location, the DMR consider whether a reassessment of other sites in the same locality should be undertaken to gauge the validity of the modelled data and take any corrective measures that are appropriate.

Recommendation 22

DMR continue to investigate and, as appropriate, implement measures to improve motorist visibility of lane markings in wet conditions on the PCC section of the motorway.

Chapter 1: Background

1.1 Introduction

I have completed my statutory investigation of complaints to my Office about the administrative actions of the Department of Main Roads (DMR) in approving the construction of a concrete pavement over part of the Pacific Motorway (the motorway). The essence of the complaints is that the construction of the concrete pavement breached certain undertakings given by DMR during the consultation process in that the material used generates greater road traffic noise for residents adjacent to the motorway than alternative pavement surfaces, such as open-graded asphaltic concrete (OGAC).

The complainants also raised safety issues relating to the potential for aquaplaning and motorist visibility in wet weather conditions on the concrete section of the motorway.

This report deals with both the noise and safety issues raised by the complainants.

The complainants are executive members of a community group called Residents Against Increased Noise (RAIN) that was formed at about the time of completion of the new motorway in October 2000. They state that they represent the interests of the entire RAIN membership (said to be approximately 500 people from residential areas adjacent to the motorway), at least in respect of the noise aspects of their complaints. They also claim that noise from the concrete pavement adversely affects more than 10,000 people residing adjacent to the motorway and up to one kilometre on either side.

1.2 Events leading to construction of concrete pavement on motorway

Following a Queensland Government public announcement on 15 April 1996, DMR upgraded the Pacific Highway between the Logan Motorway and Nerang to motorway standard in recognition of its essential role as a commuter, tourist and commercial route between Brisbane and the Gold Coast and as part of the major interstate link between Brisbane and Sydney. The upgraded section (distance: approximately 43 km) forms part of the Pacific Motorway (M1)¹. The upgrading work involved:

- 35 km, eight lane, dual carriageway from Logan Motorway at Loganholme to Smith Street Motorway (west of Southport); and
- 8 km, six lane, dual carriageway from Smith Street exit to Pappas Way, Nerang.

The eight lane carriageway has a plain concrete pavement surface (Portland cement concrete – PCC) for a distance of approximately 28 km from Albert River, Beenleigh to Coombabah Creek, Gaven (south of Gold Coast Highway Interchange at Helensvale). The balance of the new carriageway (approximately 15 km) has an OGAC pavement. Actual road construction took about three years and the new motorway was opened to traffic in October 2000. The estimated cost of the project was \$630 million in 1996.² Noise barrier construction along the motorway route is nearing completion at the time of issuing this report.

In conjunction with the planning stage for the motorway, DMR (in consultation with consultants Rust-PPK) prepared an Impact Management Plan (IMP) that, at the strategic level, set out the proposed measures for maximising the benefits of the new motorway and minimising the adverse impacts arising from its construction and operation.

¹ The gazetted route of the motorway is Captain Cook Bridge (Brisbane River) to Gold Coast Highway, Tugun.

² IMP, Volume 1, Jan 1997, p.iv (Executive Summary).

The IMP was finalised after the completion of a comprehensive public consultation process and then presented as, in effect, a 'contract' between the community and DMR for the project.³ It contained a range of commitments and design principles relating to, among other things, noise and safety. One of the key design principles was a low noise road.⁴

My report summarises the key events leading up to the release of the IMP (Chapter 3) and the decision-making on the type of surface selected for the motorway (Chapter 5).

Documentation furnished to my Office by DMR indicates that its Pacific Motorway Board of Review proposed the following pavement types for the motorway at its meeting on 21 January 1997:

- heavy-duty asphalt between:
 - Logan Motorway and Albert River Bridge; and
 - Gold Coast Highway Interchange to Pappas Way, Nerang; and
- concrete between Albert River and Gold Coast Highway Interchange.

The concrete pavement was ultimately extended approximately one kilometre south – to Coombabah Creek, Gaven.

1.3 Allegations made to Ombudsman

The complainants have alleged that:

- scientific acoustic studies over many years have consistently shown concrete road pavements to be noisier than asphalt pavements at vehicle speeds in excess of 80 km/h.⁵
- DMR should have been aware of this research when the decision to construct a concrete pavement was made.
- Community traffic noise concerns were compromised for other considerations such as traffic safety and reduced whole-of-life costs for the motorway.

Furthermore, the complainants allege that DMR did not abide by its undertaking to construct a low noise road and did not fulfil its IMP commitment that:

Design, construction and operation of the Pacific Motorway shall be based on (DMR's Interim Noise Guidelines) and shall endeavour to mitigate any sustained increase in baseline ambient noise levels at sensitive receptors adjacent to the motorway corridor (the IMP noise commitment).

Baseline noise levels were taken by the DMR in 1996 at 15 noise sensitive locations along the Pacific Highway. Chapter 4 of this report describes the work undertaken. In simple terms, baseline noise levels, in the context of the IMP noise commitment, were noise levels generated by vehicle tyre/road interaction on the Pacific Highway by average traffic volumes travelling at the then posted maximum speed of 100 km/h. This is generally referred to in this report as the 1996 traffic noise environment.

In support of their allegations of significantly higher noise levels, the complainants referred to the use of a PCC pavement, significantly increased traffic volumes travelling on the motorway compared to the volumes on the old Pacific Highway (pre-motorway construction) and the higher speed limit of 110 km/h. All of these factors can increase road traffic noise.

³ IMP, Volume 1, *op cit*, p v.

⁴ IMP, Volume 2, Jan 1997, *Review of Environmental Factors*, P.84.

⁵ The posted maximum speed on the PCC section of the motorway is 110km/h.

Related issues raised by the complainants are:

- information was disseminated during the planning and design phases for the new motorway, particularly at community information sessions, that the noise environment along the motorway route would be no worse than existed for the Pacific Highway;
- incorrect information was included in the IMP documentation about concrete and asphalt pavements, to the effect that both have similar pavement correction factors⁶ and both are low noise surfaces⁷, resulting in the DMR's decision to use PCC;
- an independent report commissioned by the DMR was highly critical of the methodology employed by DMR (through its noise consultants) for conducting noise modelling and calculating predictions for the purposes of noise attenuation;⁸
- noise modelling undertaken in the 2003 Reassessment Project was flawed because the increases predicted for the 2011 planning horizon did not reflect actual noise increases being experienced by residents along the motorway corridor;
- the accuracy of the 1996 baseline noise levels was questionable given the low number of sites (15) monitored and the comparison with calculations derived from the 2003 Reassessment Project;
- the noise barrier program was not completed in conjunction with the road construction project, and was still not completed after more than six years of motorway operation;
- DMR did not undertake promised noise monitoring within six months of completion of road construction to evaluate the actual noise results;⁹
- DMR refuses to resurface the PCC section of the motorway with a low noise surface such as OGAC;
- the noise levels in the EP Noise Policy¹⁰ and the DMR Noise Code are unacceptably high compared to levels adopted by other state and territory road authorities in Australia;
- the DMR process for dealing with individual noise complaints was deficient in that it primarily relied on modelling, rather than actual results; and
- in relation to safety issues, the PCC section of the motorway is unsafe in wet weather conditions as:
 - there is a high risk of vehicles aquaplaning on the concrete surface and becoming involved in accidents (due to water ponding on the surface); and
 - mist is sprayed up from the interaction between tyres and roadway, significantly reducing motorist visibility.

The complainants contend that the decision to use a concrete surface was wrong and that the process followed by DMR in reaching that decision was fundamentally flawed.

⁶ IMP, Volume 4, *Technical Paper No. 13 Noise Assessment*, Jan 1997, pp.20&43.

⁷ IMP, Vol 2, *op cit*, p.84.

⁸ Brown, L & Samuels, S (Independent Review Team) *Review of implementation of the Impact Management Plan on the Pacific Motorway with respect to road traffic noise*, 5 June 2002 (IRT Report).

⁹ IMP Volume 1, *Op cit*, p.56.

¹⁰ *Environmental Protection (Noise) Policy 1997*, provisions relating to **beneficial assets** (public roads).

1.4 Issues for investigation

The following issues were identified for investigation:

- (a) the appropriateness of noise levels in the EP Noise Policy and the DMR Noise Code for beneficial assets (public roads);
- (b) consistency of information disseminated by or on behalf of the DMR during the public consultation stages in 1996 and 1997 with information contained in the IMP;
- (c) whether post-construction noise monitoring was undertaken within the stipulated six month period and, if not, the reasons for not undertaking that work;
- (d) DMR's acceptance of certain assumptions/statements in the IMP documentation that were incorrect and actions flowing from those statements, including the decision to employ a PCC pavement on part of the motorway;
- (e) the validity of the 1996 baseline noise levels and 2011 predictions, both of which are relevant in determining whether the IMP noise commitment has been met;
- (f) the intent of the noise commitment in the IMP and the extent to which DMR met that commitment, including the basis for offering architectural treatments to owners of residential premises where noise has not been able to be appropriately ameliorated in accordance with the IMP noise commitment;
- (g) the delay in completing the noise barrier program along the motorway route;
- (h) the reasonableness of the DMR's decision not to resurface the motorway;
- (i) the appropriateness of the DMR complaint management process for individual noise complaints; and
- (j) safety issues relating to aquaplaning potential and poor motorist visibility on the PCC section of the motorway in wet weather conditions.

My investigation focused on that part of the motorway between Logan Motorway and Pappas Way, Nerang (43 km) and, in particular, on the 28 km concrete section between Albert River, Beenleigh and Coombabah Creek, Gaven, the subject of the IMP documentation. Accordingly, references to the motorway in this report relate to that 43 km length of state-controlled road, unless the context indicates otherwise.

1.5 Jurisdiction

The DMR is an "agency" for the purposes of the OA and I have responsibility for investigating complaints about its administrative actions.

I am satisfied that DMR's decision to employ a PCC pavement on part of the motorway, and its subsequent decisions to vary the length of the PCC section are "administrative actions" and are therefore within my jurisdiction to investigate.

My Office has been contacted by various members of RAIN since the motorway opened in relation to the effects of these decisions. I decided to commence an investigation of the two executive members' complaints because of the public interest in doing so. I have exercised my discretion under s.20(3)(c) of the OA to investigate the complaints in circumstances where the administrative actions complained of may have been judged to be 'out of time' under s.20(1)(c) of the OA.

The circumstances warranting the exercise of my discretion in that way are that the complainants had previously been asked by my Office to await the outcome of the DMR's various reviews of the motorway noise issues.

1.6 DMR response to investigation of complaints

The then Acting Director-General, by letter dated 7 July 2005, provided a comprehensive response to a series of questions detailed in my letter of 26 May 2005 in relation to several complaint issues, namely:

- the extent to which DMR had implemented each of the 12 recommendations arising out of the 2003 IRT Report;
- the legislative, policy or other bases for road traffic noise standards in Queensland;
- the rationale for the noise level criteria applied to the motorway project;
- whether DMR intended to review its road traffic noise standards in the foreseeable future, having regard to the generally lower standards adopted in other states and territories; and
- comments on the safety issues raised by the complainants.

Following my assessment of the DMR response, arrangements were made to interview relevant DMR officers to obtain further particulars about the issues for investigation. A series of detailed questions was developed, and electronically recorded interviews were conducted in my Office on 12 and 24 October 2005.

DMR subsequently provided my Office with written responses to all questions, together with a comprehensive set of supporting documents, including full IMP documentation, a series of independent research papers, internal and consultancy reports, noise monitoring results, various estimates of cost and accident statistics for the motorway.

Following a meeting my officers held with representatives of RAIN on 27 June 2006, a series of further questions was formulated and sent to the DMR. These questions focused on a number of technical issues about noise measurement and modelling programs undertaken for noise attenuation works in conjunction with motorway roadworks construction. DMR was asked to obtain a response from Dr S Samuels, a noted Australian authority on acoustic science in the context of road traffic noise, who has been retained by the DMR as an independent acoustic consultant.

1.7 Procedural fairness

I subsequently provided the Director-General with the opportunity to comment on the subject matter of investigation in accordance with my obligation under s.26(3) of the OA by providing him with a copy of my proposed report, which also contained my proposed opinions and recommendations.

In addition, to comply with s.55 of the OA, I forwarded letters to two former Directors-General of DMR and the Project Director for the motorway advising them of adverse comments that I proposed to make and inviting them to lodge submissions. The letters also advised the recipients that I intended to present a report on the investigation to the Speaker for tabling in Parliament. The Director-General of DMR was similarly informed.

A detailed submission was duly received from the Director-General of DMR to my proposed report. The submission incorporated the responses of one of the former Directors-General and the Project Director. A separate submission was received from the other former Director-General. After reviewing the responses and making further inquiries, I was satisfied that there were no grounds to make adverse comment in relation to any person, including those who received a notice of proposed adverse comment.

I have taken the Director-General's submission into account in formulating my final report and included relevant parts, or fairly stated the effect, of the submission as appropriate. However, for completeness I have included in my report a copy of the Director-General's responses to my proposed opinions (Appendix One) and to my proposed recommendations (Appendix Two).

To assist my analysis of the Director-General's response to my investigation I directly engaged Dr Samuels to give me expert advice on questions pertaining to research on road pavement noise as at the time of the IMP, the findings of the IRT Report and subsequent work undertaken by him on noise monitoring and modelling on the motorway.

Chapter 2: Regulatory framework and DMR's noise standards

2.1 Transport Infrastructure Act 1994

The motorway is declared under s.27 of the *Transport Infrastructure Act 1994* (TI Act). It is a state-controlled road under the jurisdiction of the DMR chief executive (Director-General). Chapter 6, Part 3 of the TI Act, vests powers in the chief executive of DMR for all matters relating to the construction, maintenance and operation of state-controlled roads.

Under Chapter 3 of the TI Act, the Director-General is obliged to ensure value for money for resources applied to the construction, maintenance and operation of road transport infrastructure to which the Act applies. Under s.9 of the TI Act¹¹ the Director-General must ensure that:

- (a) *the construction, maintenance and operation of all government supported transport infrastructure for which the chief executive is responsible are carried out in accordance with standards published by the chief executive that are designed to achieve—*
 - (i) *efficiency; and*
 - (ii) *affordable quality; and*
 - (iii) *cost effectiveness; and*
- (b) *construction, maintenance or operation is carried out in a way that—*
 - (i) *takes into account national and international benchmarks and international best practice; and*
 - (ii) *promotes, within overall transport objectives, the safe transport of persons and goods; and*
 - (iii) *encourages efficient and competitive behaviour in the construction and maintenance of transport infrastructure; and*
- (c) *contracts that are let for the construction, maintenance or operation of transport infrastructure are designed in a way that encourages efficient performance by the contractor.*

For transport infrastructure involving the construction, maintenance and operation of state-controlled roads, the Director-General has adopted a number of codes of practice.¹² For example, in relation to noise, the *Road Traffic Noise Management: Code of Practice* (Noise Code) was formally adopted in January 2000.

The Noise Code was prepared by DMR to help it achieve both the acoustic environmental objective and long-term planning levels in the EP Noise Policy.¹³ DMR intends, through its Noise Code, to demonstrate its commitment to its *general environmental duty*¹⁴ by establishing and implementing *best practice environmental management*¹⁵ (BPEM).

¹¹ s.9 (Obligations about government supported transport infrastructure).

¹² The Noise Code is one of a series of manuals published by DMR to provide guidance on BPEM (see Note 16). Page i of the Overview in the Noise Code lists a number of other BPEM manuals produced by DMR for its roads infrastructure functions.

¹³ Page.i of the Noise Code. See also Parts 2.3 and 2.4 of this report.

¹⁴ See s.319 of *Environmental Protection Act 1994* (EP Act) for the definition of **general environmental duty** for a person who proposes to carry out an activity that causes, or is likely to cause, environmental harm. The EP Act also binds the Crown – see s.22.

¹⁵ See s.21 of EP Act – BPEM refers to the assessment of measures against national and international benchmarks, consistent with s.9 of the TI Act.

The Noise Code provides guidance for the assessment, design and management of the impact of road traffic noise arising from the use of the state-controlled road network. Among other things, the Noise Code provides performance criteria for the construction of new roads and upgrading existing roads. The noise criteria in the Noise Code are consistent with the planning noise level of $L_{10(18\text{Hour})}$ 68 dB(A) specified in Schedule 1 of the EP Noise Policy for state-controlled public roads that are 'beneficial assets'.¹⁶

Prior to the adoption of the Noise Code, the *Interim Guidelines and Technical Notes for Road Traffic Noise Amelioration* (Interim Noise Guidelines) was in existence. These guidelines were approved by Cabinet by Decision No 01849 dated 16 December 1991. The Interim Noise Guidelines were applicable to the planning, design and construction of the Pacific Highway upgrade to motorway standard.

DMR is currently revising the Noise Code in response to recommendations arising out of the IRT Report.¹⁷ The revised Noise Code will contain provisions about (among other matters) the measurement, calculation, prediction and assessment of road traffic noise in accordance with the IRT Report recommendations. I understand that the revision is likely to be completed in interim form by 31 March 2007.

Both the Interim Noise Guidelines and its successor, the Noise Code, contain provisions that are generally consistent with the EP Noise Policy in relation to noise levels associated with the use of beneficial assets, such as public roads under the DMR's jurisdiction.

Neither document contains any direct reference to s.9(b)(i) of the TI Act in the form of a statement to the effect that national and international benchmarks and international best practice have been taken into account in preparing the policy documents or that the policy represents particular benchmarks or best practice, other than purporting to provide guidance on BPEM. However, the Noise Code does not cite the source of the BPEM that has been adopted or provide any evidence that the contents of the document do, in fact, reflect BPEM.

2.2 State Development and Public Works Organisation Act 1971

When preparing the IMP documentation in 1996, s.32 of the *State Development and Public Works Organisation Act 1971* (SD Act) provided for the declaration of a prescribed development where the Governor-in-Council was satisfied that a proposed development was of major economic significance to the state. The motorway project was not declared a 'prescribed development' under the SD Act 'essentially because the project only involved the widening/upgrading of an existing road'.¹⁸ The issuing of a declaration would have triggered the impact assessment study provisions of the Act.

In this regard, the IMP states that the base structure for the plan's development generally conformed to the requirements of the relevant International Standard and the then guidelines of the Department of Environment (DoE - now the Environmental Protection Agency [EPA]) for an Integrated Environmental Management System.¹⁹

¹⁶ See s.5 of EP Noise Policy for the definition of 'beneficial asset'.

¹⁷ See Chapter 8 of this report.

¹⁸ IMP, Vol.1, *op cit*, p.1.

¹⁹ *ibid*, p.5.

The IMP documentation, comprising a comprehensive four-volume package, was published following:

- the formulation of draft terms of reference in consultation with key stakeholders in the project;
- a public consultation process;
- the completion of final terms of reference; and
- a review of environmental factors (REF) to investigate the impacts and benefits of the proposed upgrading project.

As the validity of the IMP process has not been challenged in any of the complaints made to me, I have proceeded on the basis that all statutory requirements for construction of the motorway have been satisfied, including any environmental authorities required under the EP Act. Accordingly, the principal issues in this report address the extent to which the DMR has met the commitments and undertakings in the IMP with respect to road traffic noise and motorway safety issues.

2.3 Environmental Protection (Noise) Policy 1997

The EP Noise Policy recognises the concept of beneficial assets which, under s.3, includes an airport, an approved industrial estate, a navigable waterway, a public road and a railway. Section 3 also recognises that, although the operation or use of beneficial assets may have significantly adverse effects on environmental values, they are necessary for the community's environmental, social and economic wellbeing. However, the EP Noise Policy, through the operation of s.11(2), intends that, so far as practicable, any significantly adverse effects from the use or operation of beneficial assets be progressively reduced over the long term.

The object of the EP Noise Policy is to achieve the object of the EP Act in relation to Queensland's acoustic environment.²⁰

Section 11 of the EP Noise Policy provides:

- (1) *The **acoustic quality objective** of the policy is the objective of achieving an ambient level of 55 dB(A) or less for most of Queensland's population living in residential areas.*
- (2) *It is intended that the acoustic quality objective be achieved as part of progressively achieving the object of this policy over the long term.*
- (3) *It is not intended that, in achieving the acoustic quality objective, any part of the existing acoustic environment be allowed to significantly deteriorate.*
- (4) *For subsection (1), the ambient level in a residential area is measured over 24 hours as the long-term L_{eq} outside a dwelling in the area.*

²⁰ s.8 of the policy; under s.3 of the EP Act, the object of the Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

I am of the view that the reference to 'most' in s.11(1) acknowledges the impact of noise from the operation of beneficial assets and recognises that, in some cases, the long-term planning noise levels for beneficial assets (in Schedule 1 of the EP Noise Policy) may be significantly higher than the acoustic quality objective. Accordingly, the 'objective' may not be realistically achievable for those residential areas in close proximity to a beneficial asset. Moreover, the 'planning levels' criteria for beneficial assets do not purport to fully protect the environmental values of the human environment.

The development of the IMP appears to have been a reasonable method for DMR to demonstrate how it intended to achieve the appropriate level of environmental protection.

Section 15 of the EP Noise Policy provides:

- (1) *This section applies if a noise relevant activity is the use or operation of a beneficial asset.*
- (2) *Schedule 1 specifies noise levels (**planning levels**) that may be used as a guide in deciding a reasonable noise level for the activity.*
- (3) *In deciding a reasonable noise level for the activity, the administering authority—*
 - (a) *may have regard to any relevant planning levels; but*
 - (b) *must have regard to the acoustic quality objective and all the relevant circumstances for the particular case.*

Example—

Without limiting any other relevant circumstances, it may be appropriate to apply the relevant planning levels in Schedule 1 to the operation of a new railway. However, for an older railway, it may be reasonable to apply the levels only in the long term, to allow time to progressively reduce any significantly adverse effects on the environmental values from its operation.

- (4) *If the administering authority decides a reasonable noise level for the activity that is not less than a planning level specified for the activity, it must also consider the ways in which the noise can be abated.²¹*

Schedule 1 of the EP Noise Policy provides, for public roads:²²

The planning levels for a public road are the following noise levels, assessed 1m in front of the most exposed part of an affected noise sensitive place²³—

- a) *the following levels assessed as the $L_{10(18\text{Hour})}$ level—*
 - (i) *for a State-controlled road—68 dB(A);*
 - (ii) *for another public road—63 dB(A);*
- b) *60 dB(A), assessed as the highest 1 hour equivalent continuous A-weighted sound pressure level [$L_{\text{eq}(1\text{Hour})}$] between 10.00pm and 6.00am;*
- c) *80 dB(A), assessed as a single event maximum sound pressure level (L_{Amax}).*

²¹ The administering authority for the motorway IMP was nominally DoE, which was also a party to the decision not to apply the SD Act to the motorway project – see Part 2.2 of this report.

²² A public road is a 'beneficial asset' under the EP Noise Policy.

²³ See Schedule 4 (Dictionary) in EP Noise Policy. A noise sensitive place includes a dwelling, library, childcare centre, educational institution, medical institution and a public park primarily used for passive recreational purposes.

Schedule 3 of the EP Noise Policy specifies some appropriate models that may be used for assessing the impact of noise from a public road, as follows:

- a) AS 2702; or
- b) the document titled 'The calculation of road traffic noise' (CoRTN), published in 1988 by Her Majesty's Stationery Office, London; or
- c) either of the following documents published by the United States Department of Transportation Federal Highway Administration—
 - (i) the document titled 'The federal highway administration highway traffic noise prediction model, report FHWA-RD-77-108';
 - (ii) the federal highway administration traffic noise model, version 1.0 or a later version.

The EP Noise Policy took effect on 1 December 1997, post-dating the decision of the Board of Review on 21 January 1997 for the selection of the motorway pavement²⁴. Before the EP Noise Policy commenced, DMR policy on road traffic noise was governed by the Interim Noise Guidelines. The Guidelines (generally based on the United Kingdom *Noise Insulation Regulations 1975*) contained the basic principle that was carried forward into the EP Noise Policy, namely that, when upgrading an existing access-controlled road,²⁵ the benchmark for the $L_{10(18\text{Hour})}$ noise level was 68 dB(A).

The planning levels in Schedule 1 of the EP Noise Policy are regarded by the DMR as desirable long-term goals to be progressively implemented over the 'life' of the policy. The DMR does not consider the achievement of those levels for existing roads to be mandatory and considers that the levels are not design goals. However, the planning level specified in paragraph (a)(i) has been adopted by DMR as the design goal for upgrading an existing access-controlled road in both the Interim Noise Guidelines and its successor, the Noise Code. A design goal of 63 dB(A) has been adopted for the construction of new roads on the basis that DMR has greater control over noise factors in a new road corridor.

The EP Noise Policy does not differentiate between new and existing roads in the prescribed planning levels, but it does differentiate between state-controlled roads (68 dB(A)) and other roads such as those under local government control (63 dB(A)). State-controlled roads are primarily used to connect cities and towns, whereas the prime function of council roads is generally internal traffic circulation in the particular area with consequentially lower traffic speeds in residential localities.

Moreover, as a generalisation, it seems logical that the long-term 24 hour average noise measurement specified as the acoustic quality objective in s.11 of the EP Noise Policy would be less than the corresponding $L_{10(18\text{Hour})}$ parameter because the former measure takes into account lower noise levels between midnight and 6.00am due to the high likelihood of reduced traffic volumes during these hours.

Advice has been received from the DMR that it has not adopted the planning levels in paragraphs (b) and (c) of Schedule 1 in its current Noise Code for design purposes. However, the DMR contends that from its own experience in analysing noise measurements, the general conclusion can be drawn that if the $L_{10(18\text{Hour})}$ criterion of 68 dB(A) is achieved in a particular location, then the $L_{\text{eq}(1\text{Hour})}$ night-time criterion is also likely to be achieved in that location. DMR has no control over maximum noise events caused by emergency vehicle sirens, vehicle engines/equipment, and driver behaviour such as drag racing and tyre burnouts. Consequently, there are many stakeholders in the management of road traffic noise.

²⁴ See Chapter 5 of this report.

²⁵ The M1 is a 'limited access road' under s.54 of the TI Act.

In accordance with s.54 of the *Statutory Instruments Act 1992*, the EP Noise Policy is due to expire on 1 September 2008 unless a regulation is made under that Act exempting the policy from expiry. At this juncture the EPA has not decided whether an exemption will be sought for the policy or it will be remade and, if so, whether the planning levels in Schedule 1 for public roads (as beneficial assets) will be varied in any respect.

Moreover, s.36(1) of the EP Act previously provided that the responsible Minister must review each environmental policy made under the Act within seven years of the policy's commencement. Advice has been received from the EPA that the Minister reviewed the policy in 2004 but the policy was retained in its current form pending any action arising from the scheduled expiry of the policy under the *Statutory Instruments Act 1992*. The provisions of the EP Act (s.36) requiring review of environmental policies by the Minister were repealed by the *Environmental Protection and Other Legislation Amendment Act 2005*.

2.4 DMR Noise Guidelines

2.4.1 Interim Noise Guidelines

The IMP noise commitment was that design, construction and operation of the motorway would be based on the Interim Noise Guidelines.

Section 1.5.2 (*Upgrading of Existing Access Controlled Roads*) of the Interim Noise Guidelines states:

Ameliorative measures within the road reserve will be considered when the $L_{10(18\text{Hour})}$ (measured or predicted) noise level is 68 dB(A) or greater, and has increased by ≥ 3 dB(A) from the level prior to the current upgrading. This will only apply when substantial upgrading of existing access controlled roads through residential or noise sensitive development occurs (eg duplication, additional lane/s). Under this category priority for ameliorative measures will be given to the following:

- (a) *Where DMR has previously unconditionally consented to an application forwarded by the (relevant council) concerning adjacent land developments.*
- (b) *Where resumption of private property occurs as part of the upgrading work. Cases involving resumption need to be considered on an individual basis as noise ameliorative works may form part of a claim for compensation.*

Provision of any treatment will be subject to section 1.3 of the Guidelines.

Section 1.3 of the Guidelines states:

Although the criteria for installation of noise attenuation devices may be met, their provision is subject to cost effectiveness, technical feasibility and priority of works. Cost effectiveness must be a requirement when assessing alternative amelioration measures under all categories. In some instances it is not feasible to provide certain types of attenuating measures for reasons of space or topography.

The motorway project was essentially regarded as an upgrading of the existing Pacific Highway and, therefore, section 1.5 of the Guidelines applied. Accordingly, consideration of the installation of ameliorative measures would be applicable for the motorway once the $L_{10(18\text{Hour})}$ (measured or predicted) noise level reached 68 dB(A) or greater and had increased by ≥ 3 dB(A) from the level relating to the operation of the old highway.

DMR has advised that the section of the motorway between Upper Ormeau Road and Pacific Springs Drive, Kingsholme (approx 3 km) was classified as new road to which section 1.5.1 of the Guidelines would apply. The road is located in a new corridor, being land formerly used as a golf course. Section 1.5.1 (*New Access Controlled Roads*) of the Guidelines states:

This will apply to cases of new access controlled roads in newly acquired or existing unused corridors adjacent to existing residences or noise sensitive buildings or ... (a council development approval is current at the material time).

When the $L_{10(18\text{Hour})}$ noise level (measured or predicted) at the reception point, within or during the 5 year period following construction is:

- (a) 63 dB(A) or greater, and has increased by ≥ 3 dB(A) above the ambient level prior to construction, ameliorative measures will be considered as part of the initial planning and construction; or*
- (b) below 63 dB(A), ameliorative measures will be considered when the noise level increases by at least 10 dB(A) above the ambient level prior to construction, resulting in a level of ≥ 60 dB(A).*

The Interim Noise Guidelines also contain details about other special classes of noise sensitive receptors (such as educational and health buildings and park and recreation areas), details about typical sources and propagation of traffic noise, the methodology adopted for the measurement and prediction of traffic noise and details about typical amelioration measures and the circumstances in which their use is suitable.

The Interim Noise Guidelines were superseded by the Noise Code in January 2000.

2.4.2 Noise Code

DMR has advised that, at the time of its adoption, the Noise Code represented a comprehensive revision of the Interim Noise Guidelines, which was undertaken in the late 1990s to take account of:

- learnings from the use of the Interim Noise Guidelines;
- review of past noise assessment, design and management practices;
- enactment of the EP Noise Policy; and
- emerging issues facing the DMR and industry with the introduction of the *Integrated Planning Act 1997* (IPA).

The criteria adopted in the Noise Code are said to represent a compromise between the need to improve acoustic amenity and the technical cost/constraint in providing measures for noise attenuation.²⁶

In essence, the noise level design criteria in the Interim Noise Guidelines for constructing new and upgrading existing access-controlled roads were unchanged in the Noise Code, remaining at 63 dB(A) and 68 dB(A) respectively and equating with the 68 dB(A) planning level criterion in the EP Noise Policy for beneficial assets - state-controlled roads.

As mentioned in Part 2.3 of this report the night-time noise and maximum event planning level criteria in Schedule 1 of the EP Noise Policy have not been included in the Noise Code for road design purposes. DMR has advised that it does not propose to adopt the night-time descriptor of $L_{Aeq(1\text{Hr})}$ (10.00pm – 6.00am), as the noise model used to calculate L_{Aeq} in Queensland has not yet been satisfactorily validated.

²⁶ Noise Code, Version 2, January 2000, p.B-1.

The statistical samples taken to date are considered by DMR to be insufficient from a scientific perspective to provide the appropriate calibration factors. Furthermore, the DMR advised that it has no intention of including the maximum single event planning level of 80 dB(A) in its Noise Code as, to do so, would be likely to create a community expectation that it will be met when, clearly, the DMR has no control over individual motorist behaviour.

The revised Noise Code now includes an intervention criterion of 68 dB(A) $L_{10(18\text{Hour})}$ for upgrading an existing access controlled road, to accord with DMR's stated aim that road traffic noise levels should not exceed that threshold for residential premises. The requirement for an increased level of ≥ 3 dB(A) to qualify for consideration of noise attenuation measures has been omitted. DMR generally now regards its noise criteria as fixed, with the proviso that it may not be possible to achieve the criteria in all circumstances. Most other state and territory road authorities have flexible criteria.²⁷

In addition, the revised Noise Code provides for individual architectural and other treatments (herein referred to as architectural treatment/s for brevity)²⁸ for noise sensitive premises where the installation of noise attenuation measures in the road reserve (for example, noise barriers) would be ineffective in reducing noise levels for the particular premises below the intervention criteria in the Code.

Typical works for individual architectural treatments depend on the degree to which the road traffic noise threshold is exceeded and might include one or more of:

- mechanical ventilation/air-conditioning;
- upgraded windows and glazing and solid core doors on exposed façades;
- upgraded window and door seals;
- sealing of wall vents; and
- installation of external screen walls.

Chapter 3 of the revised Noise Code also contains provision for the following treatments for noise attenuation outside the road reserve for individual dwellings where predicted outdoor noise levels exceed the criterion level:

- Where predicted outdoor noise levels exceed the criterion level by 1 dB(A) or greater, but less than 3 dB(A), mechanical ventilation will be offered so that windows can remain closed or partly closed to reduce the noise entering habitable rooms.
- Where predicted outdoor noise levels exceed the criterion level by 3 dB(A) or greater, but less than 10 dB(A), air-conditioning and mechanical ventilation will be offered so that windows can remain closed to reduce the noise entering habitable rooms.
- Where predicted outdoor noise levels exceed the criterion level by 10 dB(A) or greater, building upgrade treatments, air-conditioning and mechanical ventilation will be offered in order to meet an internal noise level at least 10 dB(A) below the external noise criterion level.

A maximum amount of \$15,000 per dwelling applied via a supplementary policy exemption under the Noise Code if traffic noise from the motorway was less than 10 dB(A) above intervention criteria and \$20,000 if equal to or greater than 10 dB(A) above the criteria.

²⁷ Austroads Internal Report No. IR-110/05 *Issues Relating to the Management of Road Traffic Noise*, 2005, Appendix C *Summary of Noise Policies*.

²⁸ The DMR generally considers that 'architectural treatment' does not include mechanical ventilation/air conditioning.

The revised Noise Code does not specify any maximum amount for a treatment, ostensibly in recognition that the DMR will take whatever action is necessary in each particular case to ensure that its noise criteria are not exceeded. This undertaking is subject only to the qualifications in section 1.3 of the Interim Noise Guidelines (set out above) which have effectively been incorporated into the revised Noise Code.

2.5 Comparison of interstate road noise standards

Austrroads commissioned ARRB to conduct research with a view to the *Development of a National Road Traffic Noise Policy*.

The resultant draft research paper published in 1999²⁹ contained a simplified summary, in tabular form (extract from Table ES-1), of each state's policy in 1999 for daytime residential noise levels:

Table 1: Comparison of noise thresholds in other jurisdictions

State	Residential Noise Objective (L ₁₀)			
	New Roads	Upgraded Roads	Existing Roads (no roadworks)	Averaging Period (hours)
ACT	63	63	-	18
NSW	58	63	-	15
Qld	63	68	68	18
SA	58-63	58-68	-	15
Tas	63	63	-	18
Vic	63	63	68	18
WA	63	63	-	18

The draft paper noted the following matters:

- most state agencies (including Queensland at the time) apply the noise level criteria as non-mandatory 'desirable objectives' with the aim of meeting them as far as practicable;³⁰
- each increase of 10 dB(A) represents an approximate doubling of perceived loudness to the human ear,³¹ and
- the (former) Queensland DMR Noise Code was based on ten year noise forecasts and provides for ameliorative measures only when the noise level increases by ≥ 3 dB(A), in recognition of research that an increase of less than 3 dB is not perceptible to the majority of people.³²

As previously noted, the DMR regards its Noise Code criteria as mandatory for the installation of noise attenuation measures and operates on that basis, subject to certain provisos in the code. While the DMR acknowledges that the numerical criteria for most other state road authorities are lower, it counters that, in general terms, the other states have advisory and flexible criteria which can be relatively complex to implement and manage.

²⁹ The paper is still in draft form, having never been adopted by Austrroads. Informal advice from the DMR, RTA and VicRoads is that this lack of finality is no doubt due, at least in part, to Austrroads members (the various state road authorities) failing to agree on the recommendations in the draft report about, among other things, the ideal road noise level/s (ie a national standard) for all Australian roads.

³⁰ *ibid*, Executive Summary & p.18.

³¹ *ibid*, p.8.

³² *ibid*, p.18. The requirement for an increase of ≥ 3 dB(A) to qualify for ameliorative measures has been removed from the revised Noise Code.

Some of these interstate criteria are set relatively low but, according to the DMR, can be adjusted upwards on a case-by-case basis if compliance with the criteria is undesirable or impracticable.³³

The ARRB draft paper recommended that the ideal noise level settings (which should be regarded as goals to be strived for as far as practicable in established areas, and set as a design objective for new roads and residential developments) are:

- 55 dB L_{eq} (external) for daytime population exposure; and
- 45 dB L_{eq} (external) for night-time population exposure.³⁴

It is noted that the daytime measure recommended in the paper is the same as the EP Noise Policy acoustic quality objective set out at Part 2.3 of this report.

2.6 Appropriateness of noise levels in EP Noise Policy and DMR Noise Code

2.6.1 EP Noise Policy

The complainants state that officers from Logan and Gold Coast City Councils had commented that the noise level criterion in the DMR guidelines (that is, 68 dB(A)) was unacceptably high and should not be used. These comments were said to have been made in October 1996 in response to the draft IMP documents and in the context of existing EPA guidelines at the time for noise control generally – that is, prior to the EP Noise Policy taking effect on 1 December 1997.

The EP Noise Policy recognises the concept of beneficial assets, which includes roads constructed and operated for public purposes. Beneficial assets are necessary for the community's environmental, social and economic wellbeing.

DMR had input into the development of the EP Noise Policy in 1997. The policy adopted the design level of 68 dB(A) $L_{10(18Hour)}$ for an existing road in the Interim Noise Guidelines as one of the planning levels.

Other planning levels were included in the EP Noise Policy for night-time noise and single events associated with traffic operation on a public road, which have never been included in a DMR noise code.

To give effect to the intent of the EP Noise Policy, the DMR has adopted different design levels for new roads and roads which undergo a major upgrading. Neither design level exceeds the planning levels in the EP Noise Policy. These design levels apply when construction works for a new or upgraded road are completed and are required to continue to be met until the planning horizon for the particular road is reached – usually ten years after completion of construction.

Existing roads that do not undergo major roadworks/upgrading are dealt with under the intent of the EP Noise Policy in relation to long-term planning levels. This intent is achieved through the Noise Code and the District Road Traffic Noise Management Strategy for the particular district.

³³ This contention is not inconsistent with information in Austroads Report IR-110/05. See Note 27.

³⁴ According to Austroads, a 'rough rule' for conversion is $L_{Aeq} = L_{A10} - 3dB(A)$, (but not for low flow traffic conditions).

A review of the EP Noise Policy was conducted by the responsible Minister in 2004, but no changes were made in relation to beneficial assets. The policy is due for further review before September 2008 under the *Statutory Instruments Act 1992*. Information from the EPA is that no decision has yet been made as to whether any variation will be proposed for the planning levels for beneficial assets.

Recommendation 1

If any variation is made to Schedule 1 in the EP Noise Policy in relation to the planning levels for beneficial assets (public roads), DMR review the design levels in its Noise Code for state-controlled roads.

In DMR's response to my proposed report, it suggested that I include the words 'continue to review' in recognition of its claim that it already periodically reviews its codes and takes into account other relevant policies and codes. However, my recommendation is directed to DMR conducting the review if the EP Noise Policy on planning levels for beneficial assets is varied. Therefore, I have not amended my recommendation.

2.6.2 DMR Noise Code

The planning levels for beneficial assets under the EP Noise Policy are intended as guidelines, which may be exceeded or lowered by the operator of the asset. However, the EPA will approve a higher operational noise level for a particular class of beneficial asset only if satisfied there are reasonable grounds for doing so.

For its Noise Code, the DMR has adopted different design levels for two classes of roads: new road corridor – 60 dB(A) or 63 dB(A) depending on the existing noise climate; and upgrading an existing road – 68 dB(A). The latter noise level is at the same level as the planning level for a state-controlled road in the EP Noise Policy and, in the DMR's view, represents a reasonable compromise between what is realistically achievable and the cost effectiveness, technical feasibility, visual amenity and funding levels associated with noise reducing treatments (for example, noise barriers). People's sensitivity to noise and noise nuisance (including road traffic noise) varies considerably. DMR advises that it cannot take individual sensitivity to noise into account and operates on an objective basis in its design of noise mitigation measures.

Part 2.4.2 of this report refers to the absence of a direct link in the DMR Noise Code between the specific planning levels in the EP Noise Policy and the DMR design levels. Nor is there any reference in the Noise Code to the planning levels relating to night-time noise levels and maximum noise events.

Opinion 1

The DMR Noise Code is not sufficiently comprehensive as it does not cover the night-time level and the single event maximum noise level contained in the EP Noise Policy.

In my proposed report, I recommended that:

DMR commission further research by the end of 2007 with a view to developing an appropriate design level for night-time noise having regard to the corresponding planning level in the EP Noise Policy and, in due course, include the adopted design level for night-time noise in its Noise Code.

DMR's response to this recommendation was:

- *DMR research is prioritised in accordance with various factors.*
- *DMR cannot commit to a fixed time frame, as this recommendation implies, to conduct complex research into night-time noise criteria.*
- *However, it is something that DMR plans to develop and it may eventually form part of the DMR Noise Code, for example, research of $L_{10}(18H)$ with $L_{eq}(1h)$ from measurements that have already been undertaken.*

DMR suggested that I amend my recommendation to read:

DMR undertake further research into night-time noise levels that addresses EPA guidelines, feasibility, desirability, implementation and management practicality, as part of the ongoing development of the DMR Noise Code.

I am concerned that the DMR's suggestion does not provide any timeframe in which it will undertake the further research. I consider that the community is entitled to expect that DMR will give some priority to this issue. In my view, an appropriate completion date is the end of 2008.

Recommendation 2

DMR undertake and complete further research by the end of 2008 with a view to developing an appropriate design level for night-time noise having regard to the relevant planning level in the EP Noise Policy and, in due course, include that design level in its Noise Code.

Recommendation 3

In the interim, DMR make reference in its Noise Code to all planning levels in the EP Noise Policy relevant to state-controlled roads and specify in the Code its reasons for not including night-time and single event maximum road traffic noise levels.

This recommendation is in substantially the same terms as in my proposed report, except for the words 'in the interim'. DMR, in its response to my proposed report, advised that it agrees with the recommendation.

Part 2.5 of this report contains a table illustrating the noise level thresholds adopted by other state and territory road authorities in Australia. As a general observation, the DMR noise levels for existing roads are among the highest in Australia, with the most common approach in the other jurisdictions being 63 dB(A) for both new roads and major upgrades.

A survey undertaken by ARRB in 1999 found that state/territory agencies generally apply their road noise levels as non-mandatory 'desirable' objectives, with the aim of meeting them as far as practicable. DMR claims that it views its noise criteria as fixed or mandatory. However, its Noise Code gives it the discretion to exceed the relevant threshold for a new or upgraded road if it considers that it is not technically feasible or cost effective to meet that threshold.

Therefore, there may be little difference in how DMR and road authorities elsewhere interpret their obligations to meet a noise threshold in the circumstances of a particular case.

In these circumstances, I consider that I am not in a position to express an opinion on whether or not the thresholds adopted by DMR for new and upgraded roads are reasonable.

A 1999 ARRB draft research paper recommended that each state and territory road authority set ideal noise level goals as outlined in Part 2.5 of this report. The ARRB research paper is still in draft form, having never been formally adopted by Austroads. Various sources in a number of state road authorities have suggested to my investigating officers that the reason the paper has not been adopted is that the authorities have been unable to agree on a national standard for maximum road traffic noise.

While the recommendation has not yet been adopted by the major road authorities, it seems a reasonable one which could be pursued, given the contention that the Queensland thresholds are high compared with most other jurisdictions. I consider that the DMR should actively promote a national road traffic noise standard for different road classifications that is achievable and gives appropriate recognition to the impact of road traffic noise on the community.

Another relevant issue is the criteria for classification as a new road. The generally accepted view among the national road authorities is that a road is classified as new only if it is to be constructed through a 'greenfield site' – in a new corridor. Their argument is that, in such cases, the road authority is more able to control adjoining development so that noise does not become an issue for prospective residents and others.

Roadworks in an existing road corridor/reserve, even if substantial widening and consequential resumptions of property are involved, are classified as the upgrade of an existing road even where the whole character of the former road has been changed by the widening. Again, the issue of road classifications could be considered within the scope of a national code for traffic noise levels.

Recommendation 4

DMR actively promote, through Austroads, a national traffic noise standard for different road classifications that is achievable, technically feasible and gives due recognition to the impact of road traffic noise on the community, with a view to the standard being adopted by all Australian road authorities.

DMR, in its response to this recommendation in my proposed report, advised that:

Noise issues have been considered in the past by Austroads and that it is a vexing issue for all state road authorities. Past initiatives have not been able to reach a national agreement.

DMR suggested that the recommendation be amended as follows:

DMR continue to promote through Austroads, a national road traffic noise standard for different road classifications that is achievable, technically feasible, reasonable and gives due recognition to the impact of road traffic noise on the community.

I have inserted the words 'technically feasible' in my recommendation in response to DMR's suggestion, but have not otherwise adopted DMR's suggestion as it changes the focus of my recommendation which is that DMR actively promote a national standard – that is, that DMR take the initiative to reactivate negotiations on this issue.

Recommendation 5

If, by the end of 2008, a uniform national road traffic noise standard is not achieved, DMR review its design levels by the end of 2009 to assess whether they are justifiable compared with the levels adopted by the majority of state and territory road authorities in Australia and, if appropriate, amend its Noise Code in accordance with the outcome of the review.

In its response to this recommendation in my proposed report, DMR submitted that the timeframe is unrealistic 'given the complexity and variability of this research' and also suggested other amendments. DMR suggested that the recommendation be amended as follows:

If a uniform national road traffic noise standard is not achieved, DMR review its design levels to achieve road traffic noise thresholds that can be justified compared with the majority of state and territory road authorities in Australia.

I have not adopted DMR's suggestion as I consider the timelines I have specified are reasonable and that the suggested wording of DMR is too open-ended. However, I have incorporated into the recommendation some of the DMR's other suggestions.

Following the recommendations of the 2002 IRT Report³⁵, Dr Samuels was commissioned by the DMR to assist it to implement the 12 recommendations in the report, including the scientific work to be undertaken for the purpose of refining the DMR's noise modelling techniques, the development of a pavement surface noise resource manual and the review of the DMR's Noise Code to take account of the IRT recommendations.

Dr Samuels' work in this regard has been substantially completed, while the revision of the Noise Code is a 'work in progress'.

Nevertheless, the revised Noise Code is being progressively implemented by the DMR as new sections are completed. The document is expected to be finalised by the end of March 2007.

In my proposed report, I recommended that:

DMR review its Noise Code every two years and update it in line with emerging scientific, engineering, technical and administrative developments.

DMR considered that this timeframe was unduly restrictive. However, I think this is a reasonable interval for ensuring that a code that has such a significant impact on the community is relevant and reasonable.

³⁵ See Chapter 8 of this report.

I also recommended in my proposed report that:

DMR ensure that its codes of practice regarding road design, construction and maintenance:

- *clearly reflect the requirements of the TI Act in terms of linkages with national and international standards and best practice;*
- *describe the national and international standards and best practice that are relevant to the issue being addressed in the particular code of practice; and*
- *state whether the standards and practices set out in each code of practice are consistent with the relevant national and international standards and best practice and, if not, the reasons for any variation.*

In its response to this proposed recommendation, the DMR stated:

- *it is committed to continually improving its standards, guidelines and practices*
- *it continually scans national and global practice, and undertakes its own research and development to supplement gathered knowledge*
- *it considers national and international standards and best practice when a code of practice is developed and reviewed*
- *it is confident in the robustness of the decision-making process used to determine the codes of practice appropriate at the time*
- *documenting the process followed and stating the inconsistency does not necessarily improve the outcome of the code. Comparisons of the DMR code with other codes within the body of the DMR code could be confusing to users and is not practised elsewhere.*

I remain of the view that DMR should reference in its codes relevant provisions of national and international standards and explain briefly why a code does not follow a relevant standard. This could be done in footnotes and would not be confusing for users and would enhance transparency.

After considering the DMR's response, I make the following recommendations:

Recommendation 6

DMR review its Noise Code at least every two years and update it in line with emerging scientific, engineering, technical and administrative developments regarding road traffic noise issues.

Recommendation 7

DMR ensure that its codes of practice regarding road design, construction and maintenance:

- *identify the national and international standards and best practice that are relevant to the particular provisions of each code; and*
- *include reasons for decisions not to follow any such standard.*

Chapter 3: IMP public consultation process

3.1 Community consultation program

As part of the IMP, an extensive consultation program was developed to facilitate community participation by all identified primary and secondary stakeholder groups in the pre-construction stage of the motorway.³⁶ The four-stage program was conducted from April to December 1996, as follows:

Stage 1	Issues identification and development of alignment options, including presentations to local community groups and the placement of advertisements in local papers to encourage and motivate community participation
Stage 2	Public display of draft options at convenient locations along the proposed route
Stage 3	Public exhibition of IMP and preferred planning layout with further presentations to local community groups for feedback
Stage 4	Final IMP and motorway alignment

Details about the results of the consultation process are contained in Technical Paper No 5.³⁷ In relation to potential noise pollution associated with the new motorway, there was wide public support for noise barriers to be located along residential strips, preferably before the commencement of roadworks.³⁸

The technical paper concluded:

*Community input and local knowledge have been valuable in planning for a road which will be responsive to both current and future community needs. Significant changes were made to the initial draft plans in response to community requests and ideas throughout the consultation process.*³⁹

Examples are listed in the paper of direct community input into the preferred planning layout. The paper noted that not all requests and preferences were accommodated.⁴⁰

³⁶ IMP, Vol 4, *Technical Paper No. 5 Community Consultation*, pp.5-16.

³⁷ *ibid.*

³⁸ *ibid.*, p.24.

³⁹ *ibid.*, p.28.

⁴⁰ *ibid.*

3.2 Information dissemination

Technical Paper No. 5 contains detailed information about the community consultation program undertaken by and on behalf of DMR in its development of the motorway upgrading project. Community information sessions played a significant role in the consultation program.

One of the issues raised by the complainants is that the DMR (or its consultants) gave verbal assurances at these workshops/information sessions that the operation of the motorway would be managed so as to minimise noise impacts on the community.⁴¹ Specifically, the complainants claim that they can produce statutory declarations from residents who attended the meetings to the effect that DMR committed at the time to building the road with a low noise pavement, with no significant noise impacts to the community resulting from the road's operation.⁴²

The complainants contend that they, and the community generally, took the commitments and statements in the IMP as being effectively a 'contract' with the community and a clear indicator of the DMR's intent to construct a low noise pavement, with noise levels no higher than pre-construction levels.

DMR's Project Director for the motorway told my investigating officers that he attended most of the public information meetings.⁴³ He stated that information given at these sessions was always in the context of the commitments and statements made in the IMP. The IMP noise commitment is set out in Part 1.3 of my report.

The Project Director further stated that because of the sensitivity of the noise issue for residents in the vicinity of the new motorway, the DMR speakers were careful to ensure that all statements pertaining to noise were limited to the terms of the IMP.

In providing information at public meetings, the Project Director says he made reference to the Interim Noise Guidelines, noise mitigation measures to be determined by modelling, and management of noise impacts to prevent (to the extent practicable) any increase in baseline noise levels. He emphasised that no absolute commitments regarding noise levels were ever given, other than those in the IMP.

It is noted that the DMR has included a chapter in its revised Noise Code outlining the preferred consultation protocol for community engagement for future major roadworks on state-controlled roads. The purpose of the protocol is to provide the community with realistic appraisals of the post-construction noise environment for those persons residing near the roadway. An important principle of the protocol is that the expectations of the community are not raised to a level where they cannot reasonably be met.⁴⁴

⁴¹ IMP, Vol 2, p.48. There were several locations along the old Pacific Highway where the 68dB(A) $L_{10(18\text{Hour})}$ criterion was already exceeded.

⁴² I have not considered it necessary to seek any statutory declarations to this effect, particularly having regard to how long ago the contested commitments were made.

⁴³ The Project Director prefaced his comments by stating that the public information meetings happened a long time ago (1996-97) and that, as he did not have any records available, he had to rely on memory. At the time of discussions with my investigating officers, he was not in DMR's employ.

⁴⁴ See section 5.4.4 of DMR's revised Noise Code.

3.3 Analysis of the public consultation process for IMP

This part deals with the consistency of information disseminated by, or on behalf of, the DMR during the public consultation phases in 1996 and 1997 with information contained in the IMP.

There appear to have been two separate public consultation stages:

- Technical Paper No. 5 outlined the consultative processes, including presentations to community groups, undertaken by the consultants (Rust-PPK) leading up to the preparation of the formal IMP documentation and its public release in January 1997. The paper refers to presentations by a community consultant and a highway planner from Rust-PPK. No mention is made of any DMR officer being in attendance.
- The Project Director refers to public meetings he attended at which he says information was provided consistent with the statements in the IMP, thereby indicating these meetings were held after the IMP documentation had been released.

At the time consultation took place, the consultants and the DMR officers believed that the noise correction factors for dense-graded asphaltic concrete (DGAC) and concrete pavements were similar, but the assumption was later shown to be wrong⁴⁵. Because of this incorrect assumption, it is probable that the DMR and/or its consultants drew the inference that the traffic noise for residents from the proposed motorway would be no worse than from the old Pacific Highway.

In DMR's response to my proposed report, it said that during consultation:

DMR was careful to advise residents during consultation that the noise generated by the proposed concrete surface would be similar to that generated by a DGAC surface. This was based on the premise that research at the time (of the IMP) concluded that a concrete surface with light texturing plus transverse tining has similar noise generating attributes to DGAC.

DMR appears to assert that its officers and/or its consultants did not provide incorrect information to the public in that the information then available to DMR supported the conclusion that, 'irrespective of the two pavement types constructed, the resulting traffic noise would be no worse than that associated with the DGAC surface'.

My proposed report did not assert that the DMR had intentionally provided incorrect information to the public but simply that it had provided incorrect information.

Opinion 2

There was no intention on the part of DMR's officers and/or its consultants to mislead the public during the consultation process.

Opinion 3

It is probable that statements were made by the DMR (through its officers and/or its consultants) during, or for the purpose of, public consultation for the motorway to the effect that the traffic noise environment associated with the new motorway, irrespective of the pavement type, would be no worse than that associated with the old Pacific Highway. These statements were incorrect.

⁴⁵ See Part 8.2.3 of this report.

It is vitally important that public sector agencies ensure that any information provided during public consultation is clear and accurate. Therefore, I am of the opinion that the DMR should take appropriate measures to ensure that in future public consultation processes, the information provided is unambiguous and consistent with the relevant roadworks proposal. It is noted that the revised Noise Code includes a consultation protocol in relation to noise issues associated with major road construction, which appears to be appropriate.

Recommendation 8

DMR ensure that, wherever practicable, all public commitments and undertakings about proposed roadworks, including associated noise attenuation works, are achievable and are met in a timely manner.

In DMR's response to my proposed report, it stated that it always intends such an outcome in accordance with its 'documented community consultation processes and procedures'. It suggested that I use the words 'continue to ensure' in my recommendation. However, this implies that DMR met its commitments in this case, which I do not accept.

Chapter 4: 1996 baseline noise levels and supplementary noise modelling

4.1 Technical Paper No. 6 Noise Monitoring⁴⁶

From Technical Paper No. 6, it is noted that a baseline noise survey was undertaken by the DMR's IMP consultant (Rust-PPK) over continuous ten day periods in June and October 1996 to characterise roadside noise levels generated by traffic on the Pacific Highway.

Continuous 24 hour noise monitoring was conducted at 15 locations along the highway between the Logan Motorway and Nerang. The measurements were carried out in accordance with EPA guidelines and the relevant Australian Standards. Spot-check monitoring was also conducted at the location of each fixed monitoring point and at an additional eight locations along the route in order to validate the results of the continuous monitoring program and to further characterise the existing noise environment adjacent to the road corridor.

The monitoring sites were chosen as representative of worst-case noise levels along the motorway route. Sensitive receptors such as schools and a retirement village were specifically targeted in the monitoring program.⁴⁷

Details of the monitoring strategy, methodology, results and analysis of the monitoring program are contained in this technical paper. Table 3.1 in the paper indicates that, in summary, the actual 1996 baseline survey results for $L_{10(18\text{Hour})}$ noise levels for the 15 monitoring locations ranged from 60-72 dB(A) and varied as a function of proximity to the highway, perspective of the alignment, road geometry and the hourly variations in daily traffic distribution.

4.2 Technical Paper No. 13 Noise Assessment

The purpose of this technical paper was to apply noise-modelling techniques to the baseline noise survey results referred to in Part 4.1 to calculate predicted noise impacts associated with the operation of the motorway to the 2011 planning horizon. The paper examined the modelling methodology, which was based principally on the CoRTN method, and the interpretation/analysis employed by the IMP acoustic consultant to predict noise levels. Use of this modelling methodology was endorsed by the EPA.

Noise modelling data included annual average daily traffic counts - actual 1996 vehicles per day (vpd) and predicted 2011 vpd (based on information in *Technical Paper No. 1 Traffic*), a traffic speed of 110 km/h for the eight lane section of the motorway, a traffic composition of 85% light vehicles and 15% heavy vehicles, and an allowance for traffic flow differences between day (95% vpd between 6.00am and midnight) and night (8% vpd between 10 pm and 6 am).⁴⁸

⁴⁶ Technical Papers Nos 6 & 13 (see also Part 4.2 of this report) formed part of the IMP documentation (Vol 4). A total of 14 technical papers were produced covering a broad range of road design topics.

⁴⁷ pp.1-4.

⁴⁸ pp.8-16. According to the technical paper other predictive models typically use 10% for heavy vehicles. The IMP model claims to provide a conservative result of noise levels generated, given that heavy vehicles generate greater road noise when they comprise more than 10% of the traffic stream.

DMR's Interim Noise Guidelines specified that the maximum permissible noise level one metre in front of the most exposed façade of any domestic premises overlooking an existing road is $L_{10(18\text{Hour})}$ 68 dB(A) between 6.00am and midnight (the noise reference level). The $L_{10(18\text{Hour})}$ level is defined as the average of the $L_{10(1\text{Hr})}$ levels over this 18 hour period. The $L_{10(1\text{Hr})}$ level is the level exceeded for 10% of the time in each of these hours. A formula was devised in the modelling program to calculate night-time $L_{\text{eq}(8\text{Hour})}$ noise levels from the corresponding L_{10} results provided in the CoRTN model to accurately reflect real conditions along the motorway alignment.⁴⁹

The noise reference level derived through the model for each premises is determined from a number of factors, namely:⁵⁰

- basic noise level from the monitoring program
- speed correction – generally assumed to be the proposed speed limit
- heavy vehicle adjustment – allowance for 15% of total traffic distribution
- correction for gradient – allowance for both rising and falling gradients
- road surface correction – options included both asphalt and PCC
- sensitive receptors – calculated for the worst-affected façade of the affected building
- reflection – allowance for each floor level of building
- spreading – noise from line sources was calculated in two dimensions
- air absorption – calculated as per International Standard ISO 3891.

For the road surface correction factor, the technical paper assumed for modelling purposes that light longitudinally-textured concrete has the same noise correction factor as DGAC while OGAC typically offers a 2-3 dB(A) noise reduction at the receptor when initially laid.⁵¹ Ultimately, only the Loganholme-Beenleigh and Gaven-Nerang sections of the new motorway were paved with OGAC.

Results of the modelling were validated against other computer modelling software. The outcome of this exercise was that the average monitoring results for the highway locations were within ± 4 dB(A). This differential was consistent with the EPA noise modelling guidelines at the time which allowed ± 5 dB(A) for an acceptable model.⁵²

Results of the noise modelling, including their detailed analysis, are contained in the technical paper. The primary purpose of the initial modelling was to identify noise 'black spots' along the motorway route. From the modelling results the location and type of any necessary noise amelioration measures were determined.⁵³ Table 10.1⁵⁴ in the technical paper contains details about the recommended location, specifications, etc of the proposed noise barriers based on the predicted 2011 traffic noise scenario. It is noted from the table that a number of the locations are marked 'PR', meaning that pavement reduction treatment (or OGAC pavement) is required to complement the adjacent noise barrier.

⁴⁹ pp.17-18.

⁵⁰ pp.19-21.

⁵¹ pp.20&43. The 3dB(A) reduction steadily decreases as the asphalt surface degenerates. Asphalt requires resurfacing every 8-10 years.

⁵² p.22.

⁵³ p.44. An adjunct to the IMP noise commitment was that noise mitigation measures would be implemented in affected areas identified by detailed modelling. (IMP, pp.IX&52)

⁵⁴ See Appendix Three of my report.

DMR has advised that the information in Table 10.1⁵⁵ was the result of preliminary assessments only, consistent with the intent of the IMP as a strategic document. These assessments were always intended to provide general guidance only for potential barrier locations. The exact specifications for noise barriers, as the primary noise control strategy, and other noise reduction methods were always to be subject to more thorough analysis during the detailed design of the motorway when predicted noise levels could be more accurately gauged.

Ultimately, no pavement reduction treatments (for sites marked 'PR') were undertaken on the PCC pavement sections except where OGAC was used in response to constructability issues (bridges and the Coomera River approaches).⁵⁶

In the final analysis, the 1996 noise monitoring results were never modelled to determine baseline noise levels for all noise sensitive receptors likely to be affected by motorway operations. Baseline levels for 1996 were determined through the 2003 Reassessment Project.⁵⁷

4.3 1997-98 supplementary noise modelling project

As noted in Part 4.2 of this report, noise modelling conducted in conjunction with the preparation of the IMP was intended merely to provide general information regarding the potential location of noise barriers. Further detailed modelling was undertaken by the DMR's noise consultants in 1997-98 to determine the ameliorative treatments to be constructed in conjunction with the motorway roadworks, based on 2011 predictions.

The initial barriers were constructed in various locations along both the PCC and OGAC sections. For the PCC section, they were erected, among other places, in the vicinity of Pimpama State School, Coomera Motel, Studio Village, Helensvale and Glade Drive, Gaven.

During the course of my investigation, Dr Samuels advised that there was agreement at the time between the consultants and the DMR to use the same road surface noise correction factor for PCC as for DGAC. Accordingly, the barriers were designed using the DGAC pavement correction factor (based on the IMP assumptions) which was subsequently found to be not applicable to PCC⁵⁸.

Dr Samuels advised that this decision had the potential to cause over or under predictions in the final predicted levels with consequential effects on the design of noise barriers and/or the extent of noise criteria exceedances.⁵⁹

Deficiencies in the initial noise barrier program were addressed in the IRT Report.⁶⁰

⁵⁵ See Appendix Three of this report

⁵⁶ See Part 5.3 of this report for further details regarding constructability issues.

⁵⁷ See Part 8.4.2 of this report.

⁵⁸ See Chapter 8 of this report.

⁵⁹ Dr Samuels' report to my Office dated 20 July 2006.

⁶⁰ See Chapter 8 of this report.

Chapter 5: DMR decision-making for PCC pavement

5.1 Overview

Approval for the motorway project was announced by the Queensland Government in April 1996. The obligation fell on DMR to design and construct the road in accordance with the government's intentions, the provisions of s.9 of the TI Act and acceptable community standards. The broad design principles in the IMP documentation noted that an asphalt or concrete pavement would be necessary to satisfy the nominated design criteria.⁶¹

Accountability for the decision as to pavement surface was ultimately one for the then Director-General, acting under the general powers vested in that officer by the TI Act in relation to roads infrastructure. The Director-General is empowered by s.57(1) of the *Public Service Act 1996* to delegate decisions of this nature to other officers of DMR.⁶² Instruments of delegation were provided to my Office evidencing that a broad spectrum of the Director-General's statutory and other powers had been delegated to officers.

Information obtained from the DMR indicates that as early as 3 April 1996, the Project Director had informed the road pavement industry of the DMR's preference for a concrete pavement on the through lanes of the motorway, and sought road construction industry feedback on the proposal. This appeared to follow a Transport Technology Division (an internal division of the DMR – TTD) assessment that concrete be recommended as the preferred pavement type for the total length of the motorway upgrade.

The Australian Asphalt Paving Association (AAPA) prepared a submission that questioned some of the assumptions of the TTD study and proposed an alternative modified asphalt pavement design.

DMR subsequently established the Wallace Review Team to review the TTD conclusions and to determine the preferred pavement type. This review was undertaken concurrently with the process for developing the IMP and culminated in a report by the Review Team in July 1996. Public release of the IMP documentation occurred in January 1997.

This chapter outlines some of the critical steps that DMR took leading up to and following the initial pavement selection decision. However, I had difficulty obtaining a clear picture of the decision-making process (which involved the Board of Review, the Director-General and the Project Director) from the available documentation and interviews with DMR officers.

The length of time since these decisions were made contributed to that difficulty.

⁶¹ IMP, Volume 2, Jan 1997, *op cit*, p.84.

⁶² The TI Act does not appear to contain any specific provisions about the delegation of powers under that Act.

5.2 The Wallace Review Team Report

DMR established an independent team under the chairmanship of Professor K Wallace (Dean of the Faculty of Built Environment and Engineering, QUT) to consider and recommend a preferred pavement type. The prime issue for the team’s consideration was the provision (consistent with the design criteria to be nominated in the IMP documentation) of a heavy-duty, durable, low maintenance pavement that was designed, specified and constructed in accordance with international best practice, including noise impacts. The team also considered safety including the effect of spray.

Consultations were held with a number of key stakeholders, including the AAPA and the Cement and Concrete Association of Australia (CCAA).

The team introduced the concept of ‘noise critical areas’ into its deliberations. These were sections of the motorway alignment along which it would not be possible, aesthetically or economically, to achieve the required noise reduction with mounds and barriers alone. The team considered each of the following scenarios in detail:⁶³

Scenario One	noise critical areas in which an OGAC pavement is provided on all of the heavy-duty alternatives at the time of construction
Scenario Two	noise critical areas in which OGAC is not provided in the asphalt alternatives at the time of construction, but is added to the concrete surfacing 10 years after construction
Scenario Three	areas which are not noise critical and it has been decided not to apply OGAC to the concrete, and the external effect of the extra noise from the concrete is ignored by DMR
Scenario Four	areas which are not noise critical and it has been decided not to apply OGAC to the concrete – in this case the effect of the extra 4 dB of noise from the concrete ⁶⁴ has been included in the equivalent external cost of \$360,000/carriageway kilometre for noise barriers

A detailed financial assessment of each alternative was undertaken by the team. Its conclusion was that only the third alternative, for a concrete surface, offered a significant difference in whole-of-life-cycle costs - \$69-\$72/m² for PCC and \$78-85/m² for OGAC. The team also concluded that there was little difference between the PCC and OGAC alternatives when noise is included in the economic evaluation.

The outcome of the team’s deliberations was its recommendation that the optimum pavement type for the motorway be determined by competitive tender.

⁶³ Wallace Review Team Report July 1996.

⁶⁴ The increased noise level from concrete compared to OGAC was later established by Dr Samuels to be 6.2 dB(A).

It is noted from the IMP documentation that only two types of pavements satisfied the nominated design principles for the motorway project – concrete or deep-lift asphalt, with the following specific surfacings⁶⁵:

- the concrete pavement requires light texturing plus transverse tining soon after paving to dissipate water at the tyre/road interface and avoid hydroplaning at high speeds;
- the asphalt pavement requires an open-grade (highly voided) surface course to similarly relieve water film effects at the tyre/road interface.

Subject to the outcome of the tendering process, DMR had to decide whether an asphalt or concrete pavement would be employed or, if a combination, the particular locations where each type of pavement would be suitable.

5.3 Briefing note to Director-General

The Project Director provided a briefing note to the then Director-General on 18 July 1996, following a presentation by the Wallace Review Team on its preliminary findings.

The briefing note put forward the following options to progress the pavement issue:

Option A	Select a preferred pavement type for through lanes based on information available in July 1996 (the Wallace Review Team did not support this option)
Option B	Select the pavement type on the basis of competitive tender (resulting in additional design and tender costs because of two designs and the necessity for prior agreement with industry on the tender evaluation criteria)
Option C	Select the pavement type after the IMP is complete to allow the Project Team to fully quantify in the IMP, the 'noise critical' and 'noise not critical' sections along the motorway

Option C was recommended by the Project Director and subsequently adopted. However, there does not appear to be any specific reference in the IMP relating to the quantification of noise critical sections along the new motorway route, other than in Table 10.1 concerning the provisional location and height of noise barriers.⁶⁶

Professor Wallace provided further feedback on pavement issues on 16 October 1996 to both AAPA and CCAA. He proposed that the noise critical sections would be determined out of the IMP process. In addition, it was noted that the pavement type would be affected by constructability issues at the Logan and Nerang ends of the motorway, all bridge decks and embankments over soft soils such as the Coomera River approaches, and the overall budget. OGAC was ultimately applied in all areas affected by constructability issues.

5.4 Decision-making authority of Board of Review

The Board of Review was established by the DMR in 1996 to manage the planning and construction of the motorway at a strategic level – to operate as a steering group for the delivery of the motorway project. A charter was adopted to govern the Board's operations. According to the charter, the Board had no direct decision-making powers. Where the Board agreed to a change to the program, scope or budget for the project, its role was to make a suitable recommendation to the appropriate level of authority in the DMR for approval. The Board's role effectively ceased following completion of the motorway project.

⁶⁵ IMP, Volume 2, Jan 1997, *Op cit*, p.84.

⁶⁶ See Appendix Three for Table 10.1 Technical Paper No. 13.

The Board primarily comprised senior DMR officers who, individually, had extensive delegated authority to exercise a broad range of the Director-General's statutory and other powers and, according to the DMR, to approve the recommendations of the Board.

In relation to decisions about pavement type on the motorway, the only records the DMR has been able to produce to me relate to the decisions/recommendations of the Board.

5.5 Consideration by Board of Review

An In-Confidence Discussion Paper was prepared by the Project Director on the pavement issue, prior to the public release of the IMP documentation, for consideration by the Board of Review at its meeting on 21 January 1997. The paper was accompanied by the briefing note referred to in Part 5.3 together with a longitudinal plan illustrating the noise critical areas and constructability factors that would influence the decision on pavement type. Variations to the options mentioned in Part 5.3 were explored to a limited extent (some advantages and disadvantages for each option were identified), with the preferred option now being a range of heavy-duty pavement types based on such factors as traffic noise reduction in 'noise critical' areas and other constructability issues. Different construction contracts were ultimately awarded for each section of the motorway.

The paper identified particular lengths of the motorway (divided into six sections for design and construction purposes) that were suitable for either asphaltic or concrete pavement and included preliminary costings. Sections 1, 4, 5 and 6 were considered by the Project Director to be suitable for an asphalt pavement, apparently on the basis of noise critical areas and constructability issues, while a concrete pavement was proposed for Sections 2 and 3.⁶⁷ Preliminary designs had been prepared for both pavement options.

The Project Director recommended the use of an asphalt pavement for the motorway at Helensvale (part of Section 4), which the Project Director classified as a noise critical area.

After considering the discussion paper, the Board decided at its meeting on 21 January 1997 that the Project Director should prepare a position paper setting out a recommendation for a pavement type for each section of the motorway.

5.6 DMR decision to use PCC

5.6.1 Decisions on location for pavement types

The IMP documentation specified the features of the new motorway, including the desired pavement characteristics. In broad terms, these pavement characteristics included:

- long-life
- heavy-duty
- low maintenance to minimise traffic disruption
- facilitation of worker safety in maintenance situations
- safe travel at the posted speed in normal weather conditions
- a smooth ride
- a low level of noise
- environmentally sensitive in all relevant respects
- cost effectiveness.

⁶⁷ The sections, in approximate suburb locations only, were Section 1 (Beenleigh), 4 (Helensvale), 5 (Gaven), 6 (Nerang), 2 (Yatala and Ormeau), 3 (Pimpama, Coomera and Oxenford). Appendix Four of this report contains a map that shows the location of the various pavement types used on the motorway.

The goal was the construction of a world-class motorway. Ultimately, the motorway cost in the vicinity of \$1 billion when completed in 2000.

The IMP concluded that only two types of pavements, concrete and deep-lift asphalt with particular treatments, would be appropriate for the motorway project. Both pavement types satisfied the criteria prescribed in the IMP, to differing degrees.

Consideration of pavement issues occurred contemporaneously with the preparation of the IMP documentation.

Notwithstanding the Project Director's recommendation that the Helensvale section have an asphaltic pavement as a noise critical area, the Board proposed a PCC pavement for that section. I also note that the IMP documentation did not provide for any PR treatment along the relevant part of the section (that is, between Coomera River and the Gold Coast Highway Interchange).⁶⁸

In my proposed report, I expressed the opinion that it appeared that the Director-General had made the original decision on pavement type on or about 22 January 1997 following the Board's meeting on 21 January 1997. In response to my proposed report, the DMR stated on this issue:

There were varying levels of delegated authority within the Board of Review to approve the recommendations of the Board. In contentious issues, the view of the Director-General and sometimes the Minister was sought. Notwithstanding the above, DMR acknowledges that the Director-General would be ultimately accountable for the actions of the Board.

DMR also challenges the implication that a definitive decision had been made at this early stage of the project regarding what type of pavement was going to be constructed at all locations along the project.

Also in response to my proposed report, the DMR forwarded a copy of an undated document listing follow-up actions arising from the Board's meeting of 21 January 1997. The document seems to have been prepared for the information of the Board's meeting on 11 February 1997. The document states:

Item 11 - (Project Director) to set out position paper with recommendation for pavement types on different sections of the project:

The Director-General endorsed approach at briefing session on 22 January 1997. In view of latest advice on the cost of heavy duty asphalt pavement and the intention to lower the highway at Oxenford – instead of raising the highway – it is proposed to:

- *use heavy-duty asphalt between:*
 - *Logan Motorway and Albert River Bridge; and*
 - *Gold Coast Highway Interchange to Pappas Way, Nerang; and*
- *use concrete between Albert River and the Gold Coast Highway.*

Can we announce a decision on the preferred pavement type at the industry briefing on 13 February 1997?

⁶⁸ See Appendix Three of this report for Table 10.1 of Technical Paper No. 13.

I interpret the reference to the approach endorsed by the Director-General to mean that he endorsed the proposal that the Project Director prepare a position paper on pavement issues rather than that he endorsed the proposal that particular surfaces be used. However, the DMR has not been able to produce this position paper to me.

I also note that the document recording the actions arising from the Board's meeting of 21 January 1997 does not refer to pavement noise as an issue considered by the Board in proposing the use of particular pavement types.

The minutes of the Board's meeting of 11 February 1997 in relation to the Project Director's Progress Report No. 14 stated that meetings were to be arranged on 4 and 11 March 1997 to discuss pavement issues. These were not meetings of the Board, but meetings of certain officers to discuss pavement design issues.

The evidence available to me indicates that the document recording the actions arising from the Board's meeting of 21 January 1997 was the one that was relied on by the DMR officers for the purposes of detailed pavement design and calling of tenders for construction. The pavement was ultimately constructed in the manner outlined in that document, subject to two variations during the construction phase (on 12 December 1997 and 13 June 2000).

In relation to the 12 December 1997 decision, the Board, acting on the recommendation of the Project Director, varied its decision of 21 January 1997, by approving that the PCC pavement be extended to the Smith Street Exit. The Board subsequently varied that decision on 13 June 2000 by approving the termination of the PCC pavement near Coombabah Creek bridge.

In relation to these variations, DMR stated, in its response to my proposed report, that:

*A single pavement was proposed by the Project Director for the construction of Package 4 from Oxenford to Smith Street Motorway. This decision was **approved by the Board of Review** on 12 December 1997. **The Board had previously approved** the construction of the concrete pavement from Oxenford to Gold Coast Highway Interchange and this decision effectively extended the concrete pavement to the Smith Street Interchange. (emphasis added)*

Package 4 of the Pacific Motorway Project was completed as an alliance and as part of the alliance process, it was decided to reduce the extent of the concrete pavement from the Smith Street Interchange back to Coombabah Creek bridge. This decision was based on multi-criteria assessment.

The archival system has identified documents referring to this decision but the decision document has not yet been recovered.

DMR has had sufficient time to provide to my Office any document recording reasons for these decisions. The only documents provided are the minutes of the meeting of 12 December 1997 and, in relation to the meeting of 13 June 2000, an entry in the Opportunities and Risks Register stating "Current program and target cost relies on this approval".

However, verbal advice from DMR officers is that the primary reason for the variation of 12 December 1997 was to provide a longer, more economical length for laying the concrete pavement, given that it was going to be difficult for the contractor to build under heavy traffic conditions.

Opinion 4

It is likely that the Board of Review, notwithstanding its charter to make recommendations to the Director-General or to his authorised delegates, in fact made the relevant decisions on pavement types and locations for the motorway.

5.6.2 Record keeping and reasons for decisions

Other than the minutes of the Board's meeting of 21 January 1997 and 11 February 1997, (and the document recording actions arising from the former meeting, referred to earlier), the DMR has been unable to produce any documentation providing details of the Board's reasons for extending the PCC pavement to the highway interchange, contrary to the Project Director's recommendation in relation to noise critical areas.

Therefore, it is probable that the records were not created or, if they were, that they have not been retained.

An important component of any sound administrative decision-making process, particularly significant decisions like this one, is the making and retention of full and accurate records of decisions and the reasons for decisions.

I have reached a similar conclusion in relation to the decisions made by the Board during the construction phase (12 December 1997 and 13 June 2000), which effectively extended the PCC pavement from the Gold Coast Highway Interchange to Coombabah Creek bridge.

In response to my proposed report, DMR submitted that the facts did not support my opinion that its record keeping was inadequate. It stated that:

- *“As the records relating to this project are stored in a hard copy system retrieval of specific documents is time consuming and labour intensive. When evidence of specific issues was requested at short notice DMR Officers sought these documents from the most readily available source such as records kept by individuals involved in the project. As such the documents presented to the investigating officer are not necessarily those residing in the document management system set up for this project. ...*
- *The submission of the Project Director was considered by the Board of Review and based on the multi-criteria assessment, the decision was made to design for concrete pavement from Albert River to the Gold Coast Highway interchange (Helensvale section).*
- *The record trail detailing and supporting this decision has been located.”*

The DMR said in its response that it was including records of the relevant decisions on pavement selection which had been located. However, the only documents the DMR provided relevant to the decisions on 21 January 1997 and 12 December 1997 were those already described in this section and, in relation to the 12 December 1997 meeting, a monthly progress report from Connell Wagner dated 5 December 1997. Item 6 of that report states:

“Concrete pavement will be used on the motorway from the connection with Package 3 (also concrete) to the point at which the fourth lane starts to taper back to 3, at the Smith Street interchange”.

No reasons were provided in the Connell Wagner report for that decision.

Opinion 5

The DMR failed to make and/or keep adequate records of the reasons for key decisions in relation to the type of pavement to be used on various sections of the motorway. The failure constitutes unreasonable administrative action within the meaning of s.49(2)(b) of the Ombudsman Act.

Recommendation 9

DMR ensure that full and accurate records are created of all significant decisions (and of the reasons for the decisions) about roadworks or other issues affecting members of the community and that such records are maintained in accordance with the Public Records Act 2002.

In response to this recommendation in my proposed report, the DMR suggested that the recommendation be amended to read:

DMR continue to ensure that full and accurate records are created of all significant decisions (and of the factors leading to the decisions) about roadworks and that such records are kept and maintained in accordance with the Public Records Act 2002.

I have not adopted DMR's suggestion, which implies that it currently maintains and stores records in a manner that facilitates their ready location and retrieval. I am not satisfied that this is the case. Furthermore, DMR's wording restricts the recommendation to decisions relating only to roads. My recommendation has general application to all significant decisions made by DMR that may impact adversely on members of the public.

Recommendation 10

DMR review its records management system by 30 June 2007 to ensure that records are maintained and stored in a manner that facilitates their ready location and retrieval.

In response to this recommendation in my proposed report, the DMR suggested the following amendment to this recommendation:

DMR undertake regular records audits to ensure that records are maintained and stored in a manner that facilitates their ready location and retrieval in accordance with DMR records policies.

I agree that regular audits of records are good practice but consider that these should follow a more detailed review by DMR of its records management system.

Recommendation 11

DMR, after reviewing its records management system, undertake regular audits of project records to ensure they are maintained and stored in a manner that facilitates their ready location and retrieval and in accordance with the Public Records Act and DMR's records policies.

5.6.3 Reasons subsequently provided by DMR for pavement selection

DMR advised my investigating officers that, in general terms, the reasons for the decision to use the concrete pavement surface were:

- minimised maintenance interventions and therefore less disruption to the travelling public, safety, and maintenance costs; and
- minimised whole-of-life costs (as set out in Table 2, in percentage terms) in non-noise critical areas based on the findings of the Wallace Review Team for cost \$/m² (see Part 5.2 of this report).

The DMR also referred my investigating officers to the following table in the Wallace Report:

Table 2: Minimised whole-of-life costs

	Initial Cost (%)	Maintenance (%)	Noise Allowance (%)	Total (%)
OGAC	75.0	25.4	0	100
PCC	72.0	9.0	18*	99

* \$360,000 per carriageway kilometre was to be provided for noise barrier construction.

As the Wallace Report concluded, the overall costs for PCC and OGAC are similar, once noise attenuation costs are included. It seems that the real benefit of PCC lies in its low maintenance and long-life characteristics resulting in significantly less disruption to traffic flow. All routine maintenance on the motorway is undertaken at night to minimise traffic disruption.

As mentioned, the Project Director's Discussion Paper recommended an asphalt pavement for Section 4 of the motorway (Oxenford to Smith Street Motorway Exit). However, DMR advised my investigating officers that the Board's decision for Section 4 was that PCC be used as far as the Gold Coast Highway Interchange because of:

- design initiatives in lowering the grade and moving the alignment away from Studio Village;
- constructability and trafficability issues; and
- the purchase of proposed noise-sensitive land with development potential between the motorway and Highvale Drive, Helensvale.

These reasons were not reflected in the relevant documents the DMR provided to my Office in relation to its decisions on pavement type and location.

5.7 Constructed PCC pavement characteristics

The IMP documentation did not describe in detail the characteristics of the proposed concrete pavement. The references in Technical Paper No. 13 were limited to 'light longitudinally-textured concrete' and in the REF to 'a concrete pavement with light texturing plus transverse tining'.

The tender specifications for each of the PCC sections of the motorway contained very precise descriptions of the characteristics of the desired PCC surface.

Ultimately, the concrete pavement was constructed using plain-jointed, unreinforced sections that were hessian-dragged and then transversely tined. Transverse tining of PCC facilitates drainage, tyre grip and skid resistance, but adds to the tyre/road noise levels, depending on the depth of the tining.

To further enhance surface drainage, each carriageway was constructed with a crown so that the inside (high-speed) lane had its crossfall towards the median while the three outside lanes fell to the left shoulder in the direction of travel. Shorter flow paths were adopted to keep water film thickness across the road surface at levels below those known to cause aquaplaning, having regard to legal tread depth on vehicle tyres. DMR states that pavement features were designed to accommodate rainfall at 17mm/hour in terms of providing adequate skid resistance for motorists to safely drive at the posted maximum speed of 110 km/h on the PCC section.

Chapter 6: Post-construction noise monitoring

6.1 Overview of monitoring activity

Under the IMP statements, DMR was required to conduct continuous noise monitoring in selected locations over a 14 day period within six months of completion of road construction in order to evaluate the performance of the noise mitigation methods. Spot-check monitoring was to be undertaken in response to consistent validated complaints.⁶⁹

Road construction is taken to have been completed by 6 October 2000, the date of the official opening of the new motorway.

A DMR internal report, dated 28 November 2003, was prepared on the post-construction noise monitoring program.⁷⁰ According to the report, post-construction spot-check monitoring was carried out at 54 locations between March 2000 and September 2001. Continuous noise monitoring was conducted at 26 locations between February and May 2002. There were 20 locations where both pre-construction (baseline) monitoring and post-construction monitoring were conducted at the same position. According to the internal report, all noise monitoring was undertaken in accordance with the relevant Australian Standards, with suitable allowance made for adverse weather conditions, to provide an indication of the following factors in the context of the Noise Code criteria for the consideration of ameliorative measures:

- the noise levels following opening of the motorway;
- whether the 68 dB(A) $L_{10(18\text{Hour})}$ criterion level would be achieved by the 2011 planning horizon; and
- whether the noise level had increased by more than 3 dB(A) above the pre-construction (baseline) level for the original 15 sites at which continuous monitoring was conducted in 1996.

Post-construction measurements were compared in the report with those from the baseline noise tests to determine any further requirements for noise mitigation measures along the motorway alignment. All results from this exercise have been superseded by the 2003 Reassessment Project.⁷¹

As a result of the 2003 Reassessment Project and supplementary modelling undertaken in late 2004, a number of new barriers were found to be required on the PCC sections because the incorrect pavement correction factor was used. Noise barriers and other noise mitigation works are still under construction, with an expected completion date of 30 June 2007.

6.2 Compliance of post-construction noise monitoring program with IMP

Post-construction spot-check monitoring was carried out at 54 locations between March 2000 and September 2001 and continuous noise monitoring was conducted at 26 locations from February to May 2002. Under the IMP, continuous noise monitoring should have been conducted in selected locations within six months of completion of construction to evaluate the performance of the noise mitigation methods.

⁶⁹ IMP, Vol. 1, p.56.

⁷⁰ *Pre and Post Construction Noise Monitoring Report*.

⁷¹ See Part 8.4.2 of this report.

The monitoring report noted that only two locations adjacent to the PCC section registered a noise level in excess of the 68 dB(A) $L_{10(18\text{Hour})}$ threshold. The IRT Review was undertaken contemporaneously with the continuous monitoring, although the two projects were not necessarily interdependent.

It is noted that the IRT Report⁷² included a series of recommendations, all of which were accepted and implemented by the DMR for:

- remodelling of the 2011 noise environment based on the proper pavement correction factors for PCC; and
- the subsequent design of further noise barriers required to achieve the 68 dB(A) criterion.

Opinion 6

The DMR has substantially met the undertaking given in the IMP to conduct a post-construction continuous noise monitoring program to assess the effectiveness of noise barriers constructed in conjunction with the roadworks, but considerably later than specified in the IMP.

However, as explained in Chapter 11, I am of the opinion that the DMR should undertake further noise monitoring to assess the effectiveness of the completed noise barrier program.

⁷² See Chapter 8 of this report.

Chapter 7: Pavement noise research

7.1 Pre-1997 research

The purpose of this chapter is to outline information on the road noise differences between concrete and asphalt pavements that was known, or should have been known, to DMR as the state road authority for Queensland, to assess whether the statements in the IMP documentation about pavement correction factors and low noise surfaces were reasonable in all the circumstances.

The following information was provided through the Manager of VicRoads Environmental Services in response to a series of questions put by my investigating officers:

Road surface texture has been a traffic noise issue for many years. The question is 'For how long have Road Authorities and Road Research institutions known about the noise characteristics of concrete road surfaces?' Basically, a long time!

The relevant research prior to 1997 can be summarised as:

In Australia, Dr Stephen Samuels whilst working for the (ARRB), produced a report 'The effects of road surface texture on traffic and vehicle noise' in May 1990, with George Glazier of the (New South Wales Road and Traffic Authority). The references in this report include a report by Samuels in 1982 'The generation of tyre /road noise', ARR No 177.

The results of the 1990 report are as follows:

(Results relative to DGAC)

Road surface type	Cars SPL	Trucks SPL
PCC – DG	6.7	4.7
CS	3.6	1
COSS	2.4	0.4
DGAC	0	0
PCC – SG	-0.1	-1.4
PCC – HD	-0.3	-1
OGAC – 75	-3.6	-2.6
OGAC – SF	-3.6	n/r
OGAC – MP	-4	n/r
OGAC – 87	-7.7	-6

Legend

SPL - Sound Pressure Level

DG - deep-grooved, SG – shallow-grooved, HD – hessian-dragged, 75 = 1975, 87 = 1987, SF – sealflex surface, MP - mobilplus surface, COSS - cold overlay slurry seal, CS - 14 mm chip seal.

In the 1982 Samuels report 'The generation of tyre/road noise' there is a quote in Part 6 that is useful, 'For the road components this would generally involve minimising the road surface macrotecture, since the results have revealed a strong relationship between increasing roadside noise and increasing macrotecture coarseness. As indicated previously these results are in general agreement with others reported in the US, Europe and the UK'. This report references a further Samuels ARRB report of 1979 'An investigation of the effects of road surface macrotecture on roadside noise'.

In the 1979 Samuels report it concluded 'The measured roadside noise levels increased with increasing vehicle speed, road surface macrotecture coarseness and engine speed. Road surface macrotecture coarseness was found to be the most dominant of the above parameters'. Furthermore, with respect to macrotecture the report states that there was a 8-10 dB variation in the roadside noise levels from the smoothest to the coarsest road surface.

It is very clear that there would have been easily available information in Australia, prior to 1997, demonstrating that coarse road surfaces will generate more roadside noise than fine or absorbent road surfaces.

Dr Samuels has been studying road traffic noise for 30+ years. Several years ago, I performed an audit of traffic noise programs undertaken by ARRB. It was clear then that Dr Samuels generated many reports on road traffic noise and systematically built on the knowledge learnt from previous research.

I believe that the 1990 report would have formed the basis of determining the noise difference between the various road surface materials. This report has been built on since 1990, and now includes more surface types.

It is clear from this expanded set of results that concrete surfaced roads generate more noise than dense graded asphalt. Also it would appear that the research of 1990 giving the results for PCC - SG is not repeated in the current data on concrete roads.⁷³

The above comments about the state of road traffic noise research prior to 1997 have been generally endorsed by the RTA.⁷⁴

In 1994, Dr Samuels reported on his road pavement noise research undertaken for the RTA. In his re-evaluation of the noise attributes of all pavement types previously tested, Dr Samuels concluded, among other things, that:⁷⁵

- there was a clear overall gradation of noise level with road surface type. Tined and dragged PCC surfaces were found to be at the upper end of the range while asphaltic concretes were at the lower end; and
- the exposed aggregate PCC surface performed well, being comparable to the quieter asphaltic concretes.

Dash (1995) analysed previous road noise research results produced by Dr Samuels and concluded that the correlation between surface texture and road noise is less clear (than the correlation between road noise and speed), especially for trucks. Research undertaken by Dash concluded that:⁷⁶

For cars, similar noise levels about 4 dB(A) at 80kph above new OGAC were found for old OGAC, DGAC, exposed aggregate concrete and light longitudinal-dragged concrete surfaces. For trucks at 80kph, there are two groups of surfaces each spread over about 2 dB(A), the quieter group including exposed aggregate concrete, OGAC, slurry surfacing, stone-mastic asphalt (SMA) and ... while the second group, approximately 4 dB(A) noisier, comprises DGAC and other concrete surfaces.

The Samuels and Dash research papers in 1994-95 seem to conclude that exposed aggregate concrete (sometimes referred to by its proprietary name of 'whisper concrete') compares favourably with asphaltic concrete in terms of road/tyre noise emissions and that tined and dragged PCC surfaces were noisier than both. It was also noted that, generally, tyre/road noise occurs when free-flowing traffic speeds reach about 70 km/h.

⁷³ More recent research has concluded that, as a generalisation, PCC-SG generates more noise than a DGAC surface.

⁷⁴ By the Manager Environmental Monitoring.

⁷⁵ Samuels, S. *An Investigation of the Effects of Road Pavement Texture on Noise*, Unisearch, p.12.

⁷⁶ Dash, D. *Road & Transport Research*, Vol 4, No 3, September 1995, p.55. Dash prepared the paper in his then capacity as General Manager Pavements, RTA.

The posted maximum speed on the PCC section of the motorway, which has been designed as a high-speed road, is 110 km/h. Factors that influence tyre/road noise include vehicle speed and weight, tyre tread pattern, tyre type and condition, inflation pressure, tread materials, surface water and road surface texture and porosity. Noise from concrete pavements is heavily influenced by the texture finish including tine depth and width and quality of surface. Both papers also referred to the progressive changes in texturing for concrete surfaces that had occurred since the 1990 research by Samuels and Glazier.

It is noted that the 1994-95 Samuels and Dash studies referred to above were both undertaken with financial assistance from CCAA by way of research and development grants paid directly to the RTA. There is no evidence, however, that the source of the grants in any way influenced the findings or outcome in either study.⁷⁷ In both cases the research was undertaken for the RTA.

My investigating officers made specific inquiries of Dr Samuels about the tining characteristics of PCC-DG and PCC-SG surfaces studied for his 1990 research. He advised that the PCC-DG surface comprised uniformly spaced, lateral tined grooves 10mm-15mm deep at about 25mm spacings. This type of pavement generated high noise levels and, according to Dr Samuels, featured a pronounced whine (harmonic resonance) because of the uniform spacing. The PCC-SG surface comprised lateral grooves at randomised spacings which were, on average, 20mm apart with the grooves being about 5mm wide and 5mm deep.

DMR advised my Office that the tining depth of the concrete pavement on the motorway fits the category of 'shallow-grooved' based on the discussion in the Samuels and Glazier paper about texture depth. DMR's full response on the interpretation and application of the research is set out in Part 7.3 of this report.

7.2 DMR application of pre-1997 research

For noise modelling purposes, Technical Paper No.13 stated that light longitudinally-textured concrete has the same noise correction factor as DGAC while OGAC typically offers a 2-3 dB(A) noise reduction at the receptor when initially laid.

DMR contends that the results of the research referred to in Part 7.1, support the above statement in Technical Paper No. 13. These research results were also relied on to arrive at the conclusion in the IMP documentation that a concrete pavement with light texturing and transverse tining is a low noise surface relative to DGAC, being the surface on the old Pacific Highway at that time.⁷⁸ Moreover, the DMR points out that the vehicle speed of 80kph used in the Dash research was for reference purposes only. Where the speed is different to 80kph, the results are adjusted to the reference speed. According to the DMR, the pavement correction factors for different surface types are not influenced by vehicle speed in circumstances where tyre/pavement interaction dominates the road traffic noise environment.

DMR officers acknowledged to my investigating officers that they had some initial doubts about the veracity of the statements in the IMP documentation concerning noise levels from concrete pavements and, accordingly, Rust-PPK were requested to re-examine the position and provide research evidence to support their conclusions. This step was taken and the IMP statements were confirmed to the DMR's satisfaction. DMR has provided my Office with a written statement from Rust-PPK supporting its analysis of the research findings at the time.

⁷⁷ A sub-issue raised by the complainants is that the financial support from CCAA might have unduly influenced the research findings in favour of concrete pavements.

⁷⁸ IMP, Volume 2, *op.cit*, p.84.

Advice has been received from the DMR that its deliberations about suitable pavements for the new motorway were limited to PCC and OGAC only. Its consideration of PCC specifically explored the likely noise generating attributes of a pavement that was hessian-dragged and shallow-grooved having regard to the research referred to in Part 7.1. Dr Samuels has advised my Office that, according to his observations of the PCC section of the motorway, the characteristics of the as-constructed pavement could be regarded as shallow-grooved (PCC-SG) in the context of the 1990 research in that the average spacings of the tined, lateral grooves are 13 mm in two of the packages (Sections 2 and 3) and 19mm in the third package (Section 4).⁷⁹

Dr Samuels stated that in all three packages the tined grooves were 3mm wide and 3mm deep. This differs from the information provided by DMR which stated that the tining depth was 1mm but in each case the description as shallow-grooved appears to be correct (see Part 7.3 for DMR's response on tining and texture depth).

Dr Samuels has pointed out that the terminology used to describe pavement surfaces in the 1990 research was new and has evolved and been refined over the intervening years. He also advised that the PCC-SG pavement on the new motorway bears little resemblance to the PCC-SG pavements studied for the research conducted in the early 1990s, as PCC pavement construction methods have undergone a process of continuous improvement.

7.3 Assumptions in IMP regarding pavement issues

This part of the report addresses whether the IMP documentation was correct in stating that:

- light longitudinally-textured concrete has the same noise correction factor as DGAC⁸⁰; and
- a concrete pavement with light texturing and transverse tining and an OGAC pavement are both low noise surfaces⁸¹.

DMR's response to my Office stated:

- *The research papers by Samuels and Glazier and Dash were used to justify the original statements in Technical Paper 13 and the REF.*
- *A concrete pavement with light texturing plus transverse tining was the proposed concrete surface for the project. This type of concrete surface was considered to be equivalent to the PCC-SG (shallow-grooved) and PCC – HD (hessian-dragged) as described in the Samuels and Glazier paper and the light longitudinally dragged concrete surface described in the Dash paper.*
- *The tining depth of the concrete pavement fits the category of 'shallow-groove' based on the discussion in the Samuels and Glazier paper about texture depth. Samuels and Glazier define PCC-DG (deep-grooved) as being in the order of 3mm. The tining depth of the Pacific Motorway concrete pavement does not exceed 1mm, hence its classification of being shallow-grooved. This is further backed up by Dash who cites in his paper that a texture depth of not more than 1mm is desirable on noise grounds.*
- *In accordance with the findings of Samuels and Glazier and Dash, a PCC pavement that is hessian-dragged with transverse tining compares favourably with DGAC in terms of noise generation.*

⁷⁹ See Part 5.6.1 of this report for a description of each pavement section of the motorway.

⁸⁰ Technical Paper No. 13, p.20.

⁸¹ IMP Volume 2 REF, p.84

- *In order to confirm that this interpretation was correct, DMR required the IMP consultants (Rust PPK) to re-examine their conclusions in relation to the noise generating characteristics of the proposed pavement. DMR also commissioned internationally recognised experts to prepare the Wallace Report in order to independently examine the available research regarding pavement options including their respective noise generating attributes. Both reviews found that the original interpretations of the Samuels and Glazier and Dash reports were reasonable.*

DMR concludes its response by stating that:

The statements contained within Technical Paper 13 and the REF that relate to the noise generating characteristics of various pavement types cannot be defined as incorrect. These statements were consistent with the research findings that were available at the time the IMP was prepared.

Dr Samuels has since advised my Office that, in his view, the statements are consistent with the findings of research conducted in the 1990s as reported in Part 7.1 of my report. However, subsequent research undertaken by Dr Samuels in 2002 found that the average levels of traffic noise for PCC (hessian-dragged and tined), at a reference distance of 7.5m from the noise source, is, for Queensland roads and the motorway in particular:

- 3.8 dB(A) higher than DGAC; and
- 6.2 dB(A) higher than OGAC.

While noting that there were small variations (up to 1.2 dB) within each pavement type, Dr Samuels concluded that these should be regarded as negligible. Accordingly, the DMR has now adopted the above average increases as the pavement correction factors in its *Pavement Surface Noise Resource Manual*.

The outcome of Dr Samuels' 2002 research led to the conclusion in the IRT Report⁸² that the assignment of equivalent correction factors for both PCC and DGAC pavements was incorrect for modelling purposes when assessing the traffic noise environment for the purpose of initially determining the noise barriers required along the proposed PCC section of the motorway. However, the IRT accepted that the assignment was made on the basis of genuine attempts by both the DMR and its consultants to interpret an extensive array of pavement noise data available at the time of preparing the IMP documentation in 1996.

In response to my further inquiries, Dr Samuels offered the following comments as to the reasons for the difference between the 1990s research findings about similar noise levels for DGAC and PCC-SG pavements and the 3.8 dB(A) difference now accepted by DMR (on the basis of his research) as applicable to the PCC section of the motorway:

- There are variabilities in noise levels within each surface type, but no allowance was given to these variabilities when formulating the statement in the IMP documentation that OGAC and PCC-SG were both low noise surfaces.
- The terminology employed to describe pavement types was new in 1990 and has evolved over time, with the effect that each class of PCC pavement now has different characteristics to the detailed descriptions adopted in 1990, thus making it difficult for DMR to match the surface proposed for the motorway with that described in the relevant research.
- There were, and still are, several different ways of constructing PCC pavements, with the different processes resulting in varying surface characteristics.

⁸² See Chapter 8 of this report.

- The pavement type used on the motorway is similar to the PCC-SG surface studied by Samuels and Glazier in 1990, but exhibits some of the characteristics of the PCC-DG surface examined in the same study.
- **In applying the relevant research, DMR and its consultants appear to have confounded the acoustic characteristics of transversely tined PCC pavement surfaces with those of light longitudinally-textured concrete (PCC-HD in Samuels and Glazier 1990).** (emphasis added)

Dr Samuels' opinion, highlighted above, is supported by the following extract from the IRT Report in which he discusses the interpretation of DMR's officers and some of its consultants of the results in the table in Part 7.1 of my report:

On the basis of these discussions the Team concluded that there were several different interpretations made of the findings and how they should be applied to the predictions and assessments of Phases 2 and 3. One consistent factor that emerged was the difficulty encountered by both QDMR and its consultants in deciding which of the pavements included in the earlier publications referred to above were similar or equivalent to those adopted on the Pacific Motorway. This difficulty was particularly apparent in relation to the PCC pavements. It was also confounded by the within-type variability mentioned above.⁸³

In my proposed report, I expressed the opinion that the statements in the IMP documentation (specified at the commencement of this part) were incorrect. Having considered Dr Samuels' further advice, I accept that the statements were generally consistent with research at the time. However, the DMR assumed from this research that the particular type of PCC pavement it selected for the motorway had a pavement correction factor that was the same as, or similar to, the pavement correction factor for the PCC surface on which the research was based.

Opinion 7

DMR's statements in the IMP documentation that:

- light longitudinally-textured concrete has the same noise correction factor as DGAC; and
- a concrete pavement with light texturing and transverse tining and an OGAC pavement are both low noise surfaces,

were based on the advice DMR obtained from appropriately qualified consultants.

Opinion 8

DMR incorrectly assumed from the advice of its consultants that the PCC surface it selected for the motorway had a similar pavement correction factor to DGAC. This constitutes administrative action that was wrong, within the meaning of s.49(2)(g) of the Ombudsman Act.

DMR, in its response to my proposed report, submitted that it had acted reasonably in that it had relied on research available at the time and on the advice of appropriately qualified consultants.

⁸³ IRT Report, p.22. Phases 2 and 3 are parts of a four-phase road traffic noise program for the motorway undertaken by DMR or on its behalf.

I am aware of the views expressed by the complainants that contrary research on road pavement noise characteristics existed, in both Australia and internationally, at or about the time the IMP was produced and that the DMR should have known that a higher noise environment could be expected from concrete surfaces than from asphaltic surfaces.

However, even assuming the research existed, I remain of the view that the DMR took reasonable steps to obtain expert advice. Unfortunately, it incorrectly applied that advice.

Chapter 8: The 2002 IRT Report

8.1 Overview of study

In response to concerns expressed by residents adjacent to the motorway about traffic noise and the results of post-construction noise monitoring, the DMR formulated terms of reference and subsequently commissioned an independent study by Dr Samuels and Professor Lex Brown (the Independent Review Team – IRT) in early 2002 to:

- assess the intent of the IMP with respect to road traffic noise;
- determine whether the DMR had met the intent of the IMP and the commitments outlined in that document; and
- determine whether the DMR adequately addressed the differences in tyre/road noise that have been found to exist between PCC and DGAC pavements.

The post-construction noise monitoring referred to in Chapter 6 of this report was underway at the time of the IRT review.

In preparing its report, the IRT reviewed relevant documentation and met with representatives of RAIN to discuss their complaints in relation to motorway noise.

8.2 Intent of IMP in relation to road traffic noise

8.2.1 IRT interpretation of IMP intent

The intent of the IMP was interpreted by the IRT in the following manner, to the extent the IMP relates to residential premises:⁸⁴

A	the road traffic noise $L_{10(18\text{Hour})}$ level of 68 dB(A) should not be exceeded at the building façade and there would be no sustained increase in baseline noise levels
B	certain methods were indicated for achieving noise mitigation, with recommendations for the types and locations of noise reduction devices such as noise barriers and low noise road surfaces
C	certain statements were made in the IMP specifying a range of social outcomes, including future land use management in the motorway corridor
D	specific post-construction noise monitoring and spot-check monitoring were to be conducted in response to validated complaints, with a commitment to review the performance of the IMP and revise it as required.

The IMP indicated that either concrete or asphalt pavements were needed to satisfy the road design criteria. PCC was chosen by the DMR as the appropriate concrete pavement treatment. The IRT accordingly adopted PCC for its review purposes.

The IRT's conclusions about Intents A, B, C and D of the IMP are outlined below.

⁸⁴ IRT Report, pp.8-10. The IMP noise commitment extended to all noise sensitive receptors along the motorway route.

8.2.2 IRT conclusions on Intent A of IMP

For Intent A, the IRT concluded that from the limited testing completed at the date of its report (June 2002), the IMP noise level criterion for dwellings had been achieved, subject to the following caveats:

- (a) where noise measurements for the tested sites exceed 60 dB(A), audits should be conducted to ensure their validity and reliability;
- (b) until all testing is completed, there is no guarantee at this time (June 2002) that all dwellings in the motorway corridor will meet the specified noise criterion; and
- (c) there were only five dwellings for which before and after measurements were available (some had increases that could approach 2-3 dB(A) when measurement error was taken into account) and therefore no conclusion could be reached on whether there had been any sustained increase in baseline noise levels.

8.2.3 IRT conclusions on Intent B of IMP

For Intent B, the IRT concluded that:⁸⁵

- (a) from the results of a separate research project being undertaken by Dr Samuels:⁸⁶
 - (i) the traffic noise levels from PCC are some 3-4 dB(A) higher than for Queensland DGAC pavements, while DGAC was about 2 dB(A) higher than OGAC; and
 - (ii) the traffic noise generated on the motorway PCC pavement could be subjectively assessed as noticeably different from that generated by a DGAC pavement;
- (b) in the light of the results in (a), it is now apparent that the IMP and DMR processes did not address the differences in tyre/road noise that exist between PCC and DGAC;
- (c) **the statement in the IMP that, for modelling purposes, PCC and DGAC should be assigned equivalent noise attributes, was now recognised as being incorrect;** however, the IRT accepted that the assignment was made on the basis of genuine attempts by both DMR and its consultants to interpret an extensive array of pavement noise data available at the time of preparing the IMP documentation in 1996;⁸⁷ (emphasis added)
- (d) there was evidence of insufficient quality control in the noise modelling work for the reasons outlined in the report,⁸⁸
- (e) in relation to noise mitigation measures determined by modelling, the IRT made the following observations about the success of the measures taken to try to ensure no 'exceedances' of noise level criteria at receptors:⁸⁹
 - (i) the noise barrier systems designed through the modelling framework were generally being constructed at the locations specified in the initial modelling results;
 - (ii) due to a lack of information, the IRT was unable to provide a definitive statement on the number and locations of sensitive receptors at which modelled noise levels would still exceed the criterion after the barriers had been constructed;

⁸⁵ *ibid*, p.36.

⁸⁶ *The noise attributes of some pavements on the Pacific Motorway*, Final Draft for the DMR, 20 August 2002.

⁸⁷ IRT Report, p.30.

⁸⁸ *ibid*, p.37.

⁸⁹ *ibid*, pp.37-38.

- (iii) the noise barriers were designed, in the modelling studies, to achieve the criterion level by not exceeding 68 dB(A), whereas the Interim Noise Guidelines provided for the consideration of noise attenuation measures to prevent the noise level reaching 68 dB(A);⁹⁰
- (iv) modelling was based on estimated traffic conditions for a planning horizon in the year 2011.

In response to the IRT recommendations, the DMR agreed to undertake further comprehensive and independent measurement and modelling.⁹¹

I sought clarification from Dr Samuels in relation to paragraph (c) above. He has advised as follows:

... two brief but important points must be made. Firstly, ... the data (in the Table in Part 7.1 of this report) are the average (mean) values of the measured noise levels of cars and heavy trucks which are also plotted in ... Samuels and Glazier (1990). In addition, (the plotted levels) show the standard deviations associated with each mean value. These standard deviations are typically around 3 dB(A) for all the pavement surfaces studied and for the PCC-SG surface were 2 dB(A) for the cars and 4 dB(A) for the heavy trucks. Therefore an example of the interpretation of these data is that the average noise level from cars on the PCC-SG surface would be 83 dB(A) (at a distance of 4.4m from the noise source and using a reference speed of 80kph) but could lie between 81 and 85 dB(A) (ie one standard deviation either side of the mean). Secondly, observe the data (elsewhere) in Samuels and Glazier (1990). These are L₁₀(1hr) traffic noise data. The average L₁₀(1hr) for the PCC-SG surface was 83.8 dB(A) and could lie between 82.3 and 85.3 dB(A) (again one standard deviation either side of the mean).

... the variability in the noise data as discussed immediately above must be borne in mind. It is therefore my view that the statements in TP 13 concerning 'light longitudinally-textured concrete' are about right and consistent with Samuels and Glazier (1990). This particular pavement surface would be equivalent to the PCC-HD of Samuels and Glazier (1990)... Similarly the statements in TP 13 concerning OGAC are also about right and consistent with Samuels and Glazier (1990). The REF refers to 'light textured and transverse tined concrete' which is a pavement surface that would be equivalent to PCC-SG of Samuels and Glazier (1990). Again bearing in mind the data variability discussed above, it is also my view that the statements in the REF concerning this pavement surface are consistent with Samuels and Glazier (1990).

... the PCC pavement surfaces used on the Pacific Motorway are similar to the PCC-SG surface studied in Samuels and Glazier (1990). Also they do exhibit some of the characteristics of the PCC-DG surface of Samuels and Glazier (1990).

Dr Samuels emphasised that minor pavement noise variations can occur for the same type of pavement under constant conditions due, perhaps, to subtle differences in construction methods and mix of materials. Moreover, minor variations can also occur between different locations on the same stretch of pavement. Noise generation characteristics of pavement surfaces can also change over time due to ageing, wearing from tyre interaction and weathering effects.

In light of his observations about between surface and between vehicle variability, Dr Samuels concluded in his 1994 research that the pavement correction factors relative to DGAC were as set out in the following table:

⁹⁰ The difference in criteria has been addressed in the revised Noise Code. See Part 2.4.2 of this report.

⁹¹ See Part 8.4 of this report.

Table 3: Road pavement correction factors (relative to DGAC)

Surface Type	Noise level variation dB(A)		
	Traffic Noise	Individual vehicle pass-by noise	
		Cars	Trucks
<i>14mm chip seal</i>	+4	+4	+4
<i>Portland cement concrete: tined and dragged</i>	0 to +3	+1 to +3.5	-1 to +1
<i>Cold overlay</i>	+2	+2	+2
<i>Portland cement concrete: exposed aggregate</i>	-3	-0.1	-6.7
<i>Open graded asphalt</i>	-3 to -4	-0.2 to -4.2	-4.9

The values in the above table were also referred to by Austroads in its 2005 Research Report as typical of relative surface noise for new surfacings.⁹²

Dr Samuels confirmed, in his advice to my Office, the difficulty that would have been encountered by the DMR and its consultants in matching the construction processes to be adopted for the motorway with those used on the PCC pavement surfaces studied in the research referred to in Part 7.1 of this report. However, he is of the view that the DMR and its consultants handled this difficulty as well as could reasonably be expected, based on the information available to them at the material time.

While Dr Samuels is also of the view that the statements in the IMP documentation are consistent with the research findings available at the time of preparing that documentation, he stated that no allowances were made for variabilities in pavement surface noise. Moreover, Dr Samuels also confirmed to my Office that the DMR, in applying the relevant research to its decision on pavement selection, appears 'to have confounded' the acoustic characteristics of transversely tined PCC surfaces with those of light longitudinally-textured concrete (the PCC-HD of Samuels and Glazier 1990).

In Dr Samuels' opinion, the factors outlined in Part 7.3 of my report have led to his finding, subsequent to construction of the motorway, that the PCC pavement used on the motorway has a pavement correction factor of about 4 dB(A) higher than DGAC used on Queensland roads.⁹³ This finding led to the conclusion that the noise barriers installed in association with the motorway construction may have been inadequate which, in turn, was the impetus for the 2003 Reassessment Project. Further noise modelling in conjunction with that project resulted in the decision to build additional noise barriers along the PCC section of the motorway to satisfy the IMP commitment that road traffic noise levels would not exceed 68 dB(A) $L_{10(18\text{Hour})}$.

To that extent, the noise commitments associated with Intent B have not yet been fully realised. Construction of the noise barrier installation program and other noise reduction techniques, including specific architectural treatments for certain individual premises, are still in progress. However, noise barriers along the PCC section were completed by 30 September 2006. The only barrier to be constructed abuts the OGAC section at Nerang.

⁹² Austroads Research Report AP-R277/05, *op.cit.*, p.40

⁹³ See, for example, the DMR *Pavement Surface Noise Resource Manual*, March 2005, p.85.

8.2.4 IRT conclusions on Intent C of IMP

For Intent C, the IRT concluded that, based on evidence available to it of DMR's interactions and communications with residents, businesses and the broader community, DMR had largely met its commitments.⁹⁴

8.2.5 IRT conclusions on Intent D of IMP

For Intent D, the IRT concluded that DMR appears to have met its commitments in relation to spot-check monitoring in response to complaints. With its proposed program of post-construction monitoring, it will have met the corresponding commitments in the IMP, though much later than required by the IMP (that is, within six months of completion of construction). The IRT was of the view that this delay was justifiable given that the barrier construction program was still in progress.⁹⁵

8.3 Recommendations arising from IRT Report

As the outcome of the review, the IRT Report contained a number of mild criticisms about the DMR's handling of the overall noise issue in the design of the motorway. It also contained 12 recommendations for future action. Most of these recommendations were directed at issues about motorway noise, but some were directed at longer-term matters concerning DMR processes and procedures regarding road traffic noise generally (in the light of the criticisms in the report). The recommendations were formulated without consideration of the financial and other resources required for their implementation.

8.4 DMR responses to recommendations in IRT Report

8.4.1 Recommendations re post-construction noise measurements

IRT Recommendation 1

Independently establish the location of all potential sensitive receptors in the motorway corridor at which achievement of the intents of the IMP (as interpreted by the IRT) need to be tested.

IRT Recommendation 2

Complete the post-construction noise monitoring program for the motorway. Redesign the measurement program so that there is full spatial coverage of all potential noise-sensitive receptors.

IRT Recommendation 3

Apply the outcomes of the measurement program in Recommendation 2 to assess compliance with Intent A in Part 8.2.2 of this report.

⁹⁴ IRT Report, p.38.

⁹⁵ *ibid.*

8.4.2 DMR response to IRT Recommendations 1, 2 & 3 and supporting information

Two independent acoustic consulting firms⁹⁶ were engaged by DMR in the 2003 Reassessment Project to undertake comprehensive post-construction monitoring and modelling of road traffic noise associated with the new motorway – one firm for the northern section and the other for the southern section.

Some 130 individual clusters were identified within the two sections as the most exposed noise-sensitive receptors. Identification was undertaken in accordance with the DMR Noise Code and having regard to the contents of the IRT Report.

Measurements were taken over 1 to 2 days (24 hour period). The resultant noise data were subjected to detailed modelling to ascertain the theoretical 1996 (pre-construction) baseline noise levels at sensitive receptors and the predicted 2011 noise levels.⁹⁷ Results obtained by each firm were further modelled and compared to ensure consistency of approach and compliance with the intents of the IMP. The remodelled results were used to determine the location and specifications for noise attenuation measures along the motorway route.

From the consultants' combined reports, the summarised results of the remodelling exercise after the construction of all proposed noise barriers (based on 1996 baseline noise levels and the predicted levels for 2011 planning horizon) were as set out in Table 4:⁹⁸

Table 4: Premises exceeding relevant noise levels

Affected premises adjacent to upgraded road	Meet criterion level in 2011 =68 dB(A)	Exceedance in 2011 >68 dB(A)	Increase 1996 - 2011	
			≤ 3 dB(A)	>3 dB(A)
Number	17	27	169	122

Affected premises adjacent to new road	Meet criterion level in 2011 =63 dB(A)	Exceedance in 2011 >63 dB(A)	Increase 1996 - 2011	
			≤ 3 dB(A)	>3 dB(A)
Number	0	3	0	3

I note that for the new road section (approximately 3 km) in the Kingsholme area, the Interim Noise Guidelines specified a maximum noise level criterion of 63 dB(A) $L_{10(18\text{Hour})}$. Modelling indicates that predicted noise levels in this area in 2011 will exceed this criterion by up to 5 dB(A) for the three premises mentioned in the above table. As there was no other noise receptor development in this locality when the new road was constructed, reduction of noise levels will be dealt with through the imposition of appropriate conditions in any development application lodged with the Gold Coast City Council (as the relevant assessment manager) under its planning scheme and IPA. DMR has confirmed this approach.

⁹⁶ Richard Heggie Associates Pty Ltd & ASK Consulting Engineers.

⁹⁷ The 1996 terrain data, road layouts and receptor locations were used to establish the remodelled 1996 baseline noise levels.

⁹⁸ The Heggie & ASK traffic noise modelling reports dated January 2004.

The reports also include modelled noise readings for particular noise-sensitive receptors (other than residences) such as educational and health buildings and passive recreation areas, as provided for in the DMR Noise Code. In recording the noise results, the reports noted:⁹⁹

A change of less than 3 dB(A) in the level of sound is difficult for most people to detect (even in ideal listening conditions), whilst a 3 dB(A) to 5 dB(A) change corresponds to a small but noticeable change in loudness. A 10 dB(A) change corresponds to a perceived doubling in loudness.

Similarly, the DMR *Road Traffic Noise Management Strategy* for the South Coast-Hinterland District notes that distant traffic noise is often observed to be constant. However, this is not the case when in close proximity to a road since the sound level changes with each passing vehicle. Consequently, residents close to the road experience a greater range of fluctuating traffic noise.¹⁰⁰

When upgrading an existing road (as in the case of the new motorway), the Interim Noise Guidelines and Noise Code provided for noise attenuation measures when the predicted ten year $L_{10(18\text{Hour})}$ traffic noise level reached 68 dB(A) or greater and an increase of ≥ 3 dB(A) occurred over pre-construction noise levels. The aim of the measures under the revised Noise Code is to prevent noise levels exceeding 68 dB(A). Noise barriers within the road reserve are not effective for dwellings adjacent to the motorway where the habitable rooms are above the noise barriers and there is direct line-of-sight to the motorway.

In terms of the Noise Code, only those premises which exceed the relevant noise threshold (with or without noise barriers) would be offered specific architectural treatments by DMR. Advice from DMR is that only five offers have been made to date, of which three have been accepted.¹⁰¹ Terrain, source-to-receiver distance, and location and height of any existing or proposed noise barrier are factors to be taken into account when determining noise levels and, consequently, the extent of architectural treatment that is necessary in each particular case. The revised Noise Code also provides for measures outside the road reserve (that is, individual architectural treatments) where noise barriers will not achieve the relevant criterion.

Following complaints from RAIN about traffic noise after the motorway opened, DMR arranged for noise testing at the residences of two RAIN committee members in 2002. DMR advised that testing was undertaken in accordance with the procedures prescribed in the relevant Australian Standard. The results were provided to my investigating officers, together with modelled results for the residences of all of the then committee members for comparison purposes. The closeness of the test results to the modelled levels demonstrates the good correlation between the 2003 modelling and actual measurements and, accordingly, the validity of the CoRTN model.

The model is claimed to be valid for receptors up to 300m from the noise source. DMR states that according to the CoRTN documentation/procedures, extrapolation beyond that distance can lead to progressive and significant error, but calculations can be extended for the purpose of assessing changes in noise levels. The rigorous calibration and validation processes applied in the motorway situation have led DMR to the conclusion that the overall predictions calculated via the model are highly reliable. Dr Samuels has supported this position.

⁹⁹ See, for example, Heggie Report, p.21.

¹⁰⁰ September 1997, p.7.

¹⁰¹ No offer has yet been made to any of the three premises adjacent to the 'new' road section that exceed the 63dB(A) threshold. DMR considers these of lower priority than the 68dB(A) class of premises.

In Chapter 10 of this report, I discuss the DMR's proposal to undertake further modelling outside of the 300m zone.

In response to questions I raised about the accuracy of the 2003 modelling exercise in the context of the 1996 and 2011 predictions, Dr Samuels responded in the following manner:¹⁰²

The predicted $L_{10(18 \text{ hour})}$ noise levels at five residences of R.A.I.N committee members were provided to the present Author (Dr Samuels) by QDMR following the issues raised by R.A.I.N in January 2004. Having reviewed these predictions, this Author then looked over all the data and other materials to hand in his office relating to the noise predictions conducted by Consultants ASK and RHA (Heggie). Specifically this involved all the materials involved in conducting the predictions This process reinforced the present Author's opinions that the predictions, as documented in the Consultants' reports, are of generally good quality and high standard.

From there, this Author studied, in as much detail as possible, the noise predictions at the R.A.I.N committee residences and formed the view that these particular predictions were conducted correctly in accord with the good quality and high standard mentioned above. Consequently it was confidently concluded by the present Author that these predicted noise levels represent estimates of the traffic noise levels at the five residences which are the best that could possibly be obtained.

An issue raised by the complainants is that many residents along the PCC section of the motorway corridor claim that noise levels are now far worse than pre-construction levels. Moreover, they claim that the modelled noise results do not accurately reflect the actual noise levels being experienced by residents.

DMR's opinion, supported by Dr Samuels, is that the difference may be attributable, at least in part, to the complex sound propagation effects between the motorway and the receptor locations, which can be some distance from the motorway (for example, the premises occupied by the complainants).¹⁰³ Sound is attenuated over distance. The higher frequencies are absorbed by the air, while the lower frequencies are absorbed to a much lesser extent.

8.4.3 Recommendations for noise modelling

IRT Recommendation 4

Re-examine any noise barriers already constructed based on 'the flawed modelling data' in the light of the newly modelled results and take any necessary corrective action in relation the those barriers to meet the intents of the IMP.

IRT Recommendation 5

Through modelling, ascertain the baseline ambient noise levels to enable a determination to be made as to whether Intent A of the IMP has been met – of no sustained increase in those levels.

IRT Recommendation 6

Remodel the baseline noise levels to determine the predicted levels for the planning horizon of 2011, ensuring that existing noise barriers are taken into account, for the purpose of determining the proper noise attenuation measures that are required to meet the criteria in the Noise Code.

¹⁰² Dr Samuels' report to my Office dated 20 July 2006, pp.32-33. Dr Samuels went on to state that, despite the five residences being located well in excess of 300m from the motorway, it was his "strong opinion that noise levels predicted at the RAIN committee residences by this calibrated version of CoRTN may be confidently accepted."

¹⁰³ See Chapter 9 of this report for further discussion on 'sound propagation effects'.

8.4.4 DMR response to IRT recommendations 4, 5 & 6 and supporting information

The new noise data obtained by the consultants was remodelled through the CoRTN methodology. Dr Samuels was consulted for the purpose of determining the appropriate road surface correction and calibration factors for PCC and OGAC to be applied in the remodelling process. The PCC correction factor calculated for the motorway was 7 dB(A) higher than OGAC¹⁰⁴. Well-established, scientific and statistically robust techniques were employed to accurately evaluate, calibrate and validate the model for future $L_{10(18\text{Hour})}$ predictions along the motorway. Predicted 2003 and 2011 road traffic noise levels were calculated accordingly.

A separate exercise was undertaken in 2003 to model the 1996 baseline ambient noise levels based on the environment that existed in 1996. Dr Samuels, through DMR, has provided me with a detailed written explanation of the modelling process and states he is confident that the results for the 1996, 2003 and 2011 scenarios are 'very accurate' and, in particular, that the 1996 baseline noise levels calculated in 2003 have a sound factual basis for the road traffic noise environment that existed in 1996.¹⁰⁵

In amplification, Dr Samuels contends that a noise model is considered to be well validated if the means of the validation process are close to zero and the standard deviations, derived from statistical analysis of the relevant data, are similar to those derived from the evaluation process. Dr Samuels and two DMR officers prepared a joint paper in 2004 which stated that this was the case for the model used in the remodelling process and, in achieving a 95% confidence level for future noise predictions, they considered the model to be well validated.¹⁰⁶ The paper asserted that the 2003 Reassessment Project was one of the most comprehensive noise monitoring and modelling studies ever carried out on any road in Australia.¹⁰⁷

It would appear that the work undertaken by the two noise consultancy firms has, to a large extent, addressed the concerns expressed by the IRT, subject to completion of the noise barrier construction program and the specific architectural treatments that have been offered for certain individual premises that meet the criteria under the Noise Code for such treatments. It is further noted that the IMP provided for the installation of noise mitigation measures in affected areas as identified by detailed modelling.¹⁰⁸ The IMP did not suggest that individual noise monitoring should be carried out for all premises for this purpose, although some localised testing has since occurred in response to a number of particular noise complaints.

¹⁰⁴ In 2002, Dr Samuels calculated the PCC correction factor to be 6.2dB(A) higher than OGAC.

¹⁰⁵ Dr Samuels' report to my Office dated 20 July 2006, pp.22&37.

¹⁰⁶ *Reassessment of the impact of road traffic noise for the Pacific Highway Upgrading (Logan Motorway to Nerang)*. Paper presented to Conference of Acoustics, November 2004, p.511 of Conference Proceedings.

¹⁰⁷ *ibid*, p.512.

¹⁰⁸ IMP, Vol 1, pp.IX&52.

8.4.5 Recommendations re DMR processes for future traffic noise investigations

IRT Recommendation 7

Prepare a rigorous specification for how modelling is to be conducted to avoid the variety of assumptions and procedures previously adopted by consultants.

IRT Recommendation 8

Establish a series of modelling 'test cases' by which the ability of consultants to conduct accurate, high quality modelling may be assessed.

IRT Recommendation 9

Introduce a quality control system for future modelling.

IRT Recommendation 10

Recognise and further investigate the differences in noise attributes that exist between PCC, OGAC and DGAC pavements and ensure that differences are appropriately allowed for in modelling.

IRT Recommendation 11

Institute procedures so that noise investigations and remedial works for major projects are primarily based on sound scientific principles.

IRT Recommendation 12

Develop a consultation protocol to ensure that the community is provided with realistic appraisals of the likely post-construction environment for those residing near a roadway, to ensure that their expectations are not raised beyond the reality of what is to be delivered.

8.4.6 DMR response to IRT recommendations 7-12

DMR has comprehensively revised its Noise Code in the light of Recommendations 7-9 and 11. The revised Noise Code, which is still in draft form, contains an upgraded section on measurement, calculation, prediction and assessment of road traffic noise. The revision is being undertaken in close collaboration with Dr Samuels. This revised section is currently being 'road-tested' to ensure the reliability, validity and completeness of information in the draft document.

For Recommendation 10, Dr Samuels conducted research and then developed a *Pavement Surface Noise Resource Manual* for DMR in March 2005. It is subject to ongoing review.

The outcomes of the research have been incorporated into the revised Noise Code with respect to the correction factors to be applied for different pavement surface types on state-controlled roads in Queensland.¹⁰⁹

For Recommendation 12, a protocol on community engagement has been developed and included in the revised Noise Code. Similarly, a protocol on managing noise complaints is being incorporated in the code. DMR has requested Dr Samuels to review these sections of the code for consistency with current road traffic noise research results and best practice.

¹⁰⁹ See Part 7.3 of this report.

The revised Noise Code is currently being trialed by DMR to gauge its efficacy and operational effectiveness.¹¹⁰ Amendments will be made if necessary before the revised code is formally adopted.

8.5 Current status re implementation of IRT Report recommendations

Dr Samuels has confirmed he was retained by DMR as an independent reviewer to oversee the program of work established by DMR for implementation of the IRT Report recommendations. He assumed scientific responsibility for the conduct and technical outcomes of the program and, in addition, has continued to provide technical advice to the DMR on a range of issues concerning road traffic noise along the motorway corridor.¹¹¹

Evidence, including relevant documentation, has been furnished to my Office to indicate that the IRT Report recommendations have now been implemented.

However, in response to my proposed report, the DMR advised that it was willing to undertake further noise monitoring to establish the effectiveness of the noise barrier program. This issue is dealt with in Chapter 11 of my report.

¹¹⁰ DMR expects to finalise the Code by 31 March 2007.

¹¹¹ Dr Samuels' report to my Office dated 20 July 2006.

Chapter 9: Accuracy of modelled noise predictions

9.1 Explanation for difference in noise modelling results and residents' perceptions

The complainants assert that noise modelling undertaken in the 2003 Reassessment Project is flawed because the noise levels calculated for 2003 and the 2011 planning horizon do not reflect actual levels being experienced by residents or, as perceived by them, along the motorway corridor. In support of this assertion, they point to the basic increase of 8.8 dB(A) at the source of the traffic noise (that is, the road surface) between 1996 and 2003 due to the use of PCC pavement, significantly increased traffic volumes and an increase in the speed limit to 110 km/h.¹¹² The surface on the old Pacific Highway was DGAC with a speed limit of 100 km/h.

The perception of one of the complainants is that the noise level at his residence has risen from 'hardly noticeable' in 1996 to 'overwhelming' and 'impossible to live with' in 2006. My investigating officers considered that, during their discussions with this complainant, his references to noise levels were usually in the context of (L_{Amax}) rather than the noise descriptor of $L_{10(18Hour)}$ adopted in the Noise Code.

In response to questions my investigating officers put to Dr Samuels about this 'apparent discrepancy' in noise levels raised by the complainant, Dr Samuels stated he:

is personally familiar with the road traffic noise environment at exposed residences along the Pacific Motorway, including the residence (owned by this particular complainant). This is because he (Dr Samuels) has conducted numerous site inspections at many relevant locations during and after the Reassessment work program. Specifically, he has spent some time on a number of occasions sitting on the vacant lot adjacent to (the complainant's premises) listening to and personally assessing the traffic noise environment at a receptor location which is essentially equivalent to that of the most exposed façade of his residence. He has also done this at several other receptor locations near to the residences of R.A.I.N members and indeed at a number of other residences along the Pacific Motorway.

Dr Samuels has offered the following explanation as to why some people adjacent to the PCC section of the motorway perceive the post-construction noise levels to be worse than indicated by testing and modelling. He has described the phenomenon as 'complex noise propagation effects':

Road traffic noise propagates from a roadway to receptor locations in a complex manner. It is attenuated over distance, which means that as the distance from the roadway increases, the level of traffic noise arriving at the receptor locations decreases. The primary factors involved in this attenuation process are ground effects, geometrical spreading and atmospheric absorption. While the relative importance of these primary factors varies from site to site, they all have some influence on the attenuation process. Temperature and wind gradients can also affect the attenuation in some circumstances. Again, the influences of wind and temperature are extremely complicated. The resulting effects of all these factors are frequency dependent - the degree of road traffic noise attenuation experienced at any particular receptor location is influenced by the acoustic frequency content of the road traffic noise.

When the ground between a roadway and the receptor locations is soft, the ground effects involved in the road traffic noise attenuation process are much greater than when the intervening ground is hard. Typically, soft ground comprises foliage such as grass, trees and shrubs. Typical hard ground features include concrete, asphalt, bare earth and water.

¹¹² Dr Samuels supports this statement about an increase at the road surface in the order of 8.8dB(A) – Report provided to my Office dated 20 July 2006, p.34.

The receptor locations at Helensvale (where this complainant resides) are some distance from the motorway (≥ 300 metres) and on a ridge which overlooks the motorway. At these receptor locations the attenuation process would mostly be dominated by ground effects and atmospheric absorption.

Under these circumstances the high frequency components of the road traffic noise spectrum are attenuated more than the low frequency components. Therefore it is possible that the residents at these receptor locations perceive more of the low frequency "rumble" from distant traffic, especially at night. They may be perceiving that the noise level they are experiencing is louder when, in fact, it is just that they are experiencing different characteristics of the noise.

By specific reference to this complainant's residence, Dr Samuels has elaborated on the reasons why residences along the motorway are experiencing noise level increases of less than 8.8 dB(A) generated at the source of the noise.¹¹³

This premise (that residents would experience an equivalent increase of 8.8 dB(A)) would be true if all other factors remained constant. For example, the Old Pacific Highway was paved with a DGAC surface. In 1996 this road was a four lane highway with known traffic conditions. As explained (elsewhere in his report), the noise generating attributes of PCC pavement surfaces in Queensland are about 5 dB(A) greater than those of Queensland DGAC pavement surfaces. Consider, therefore, the scenario of that Old Pacific Highway road pavement surface being converted from a DGAC to a PCC while nothing else changed. That is the alignments of the four lanes remained unchanged. In addition the traffic conditions, the traffic noise propagation characteristics and all the other relevant factors listed elsewhere (in his report) ... also remained constant. Then, the road traffic noise exposure of receptors along side the Old Pacific Highway, such as those (at the complainant's residence), would have increased by around 5 dB(A). The increase may not have been exactly 5 dB(A) because the propagation of road traffic noise depends on several factors in ways that vary with the frequency characteristics of the noise and the frequency characteristics of road traffic noise generated on PCC pavement surfaces differ from those of road traffic noise generated on a DGAC pavement surface.

However, this particular scenario is not what eventuated as far as residential receptors such as those (at the complainant's residence) are concerned. Rather what happened was that the change from the Old Pacific Highway to the Pacific Motorway introduced a number of changes in the factors listed (elsewhere in his report) which are involved in the generation and propagation of traffic noise. In relation to the road traffic noise generation factors (such as) traffic volume, traffic speed, traffic composition, traffic conditions, road type and alignment and road pavement surface, it would be fair to say that each of these was altered considerably in the change from the Old Pacific Highway to the Pacific Motorway.

In addition, the acoustic frequency characteristics of the traffic noise generated on the Pacific Motorway PCC pavement surface differed from those of the traffic noise generated previously on the Old Pacific Highway DGAC pavement surface.

As far as the propagation factors (such as ground cover, distance, screening and weather conditions) are concerned, it must firstly be understood that the manner in which each of these factors affects the propagation of road traffic noise varies in rather complicated ways with the frequency characteristics of the road traffic noise. Ground cover conditions would have changed somewhat over the transition from the Old Pacific Highway to the Pacific Motorway in that much of the vegetation has grown over the period from 1996 to 2003 and will continue to grow from 2003 to 2011. This is particularly true of the vegetation along the median of the Pacific Motorway, which this Author has personally observed to grow substantially over the last few years. The source-receiver distances have also changed considerably. As explained (elsewhere in his report), the Old Pacific Highway had 4 noise source lines while the Pacific Motorway has 8 noise source lines. Screening effects have changed as well, with the introduction of safety barriers, with the altered noise source lines and with the construction of noise barriers at various locations along the Pacific Motorway. On average it may be deemed that the weather and atmospheric conditions have remained essentially the same. Similarly, the reception factors would have also remained effectively unchanged at receptor positions such as the complainant's residence.

¹¹³ Dr Samuels' report to my Office dated 20 July 2006, p.38.

As a consequence of what has been presented in the three paragraphs above, the generation and the propagation of the road traffic noise from the Pacific Motorway are both markedly different from those of the Old Pacific Highway. Traffic noise prediction models including CoRTN are very good at quantifying the effects of the road traffic noise generation factors. CoRTN also does a reasonable job of dealing with the effects of the propagation factors (such as ground cover, distance, screening and weather conditions). Because these factors behave in such complex ways, CoRTN, along with most other traffic noise prediction models available around the world, adopts a simplified approach to quantifying the effects of these factors. Nevertheless this approach is satisfactory and any shortcomings it might induce in the accuracy of the predicted road traffic noise levels are accounted for in the model calibration factors determined during the processes of evaluating, calibrating and validating the model.

As previously noted in Part 8.4.2 of this report, Dr Samuels is confident that the modelling results for the 1996, 2003 and 2011 scenarios have been accurately determined.

9.2 Validity of 1996 baseline noise levels and 2003-2011 predictions

Preliminary modelling was undertaken before construction of the motorway commenced to determine the location and type of noise barriers. This modelling was based on the incorrect pavement correction factor for PCC. That error was brought to the DMR's attention in 2002 and led to the 2003 Reassessment Project.

During my investigation, I have considered whether the actions taken by the DMR, after the error was brought to its attention, were reasonable.

As mentioned, the complainants have questioned the validity of modelling results obtained in the 2003 Reassessment Project for the 1996 baseline noise levels and, by extension, the 2003 and 2011 predictions.

However, none of the complainants has produced any technical evidence to support their claims, other than the 'common sense' factor (that is, if the noise level at the road pavement has increased by 8.8 dB(A), there must be a corresponding or partial increase at their premises). Dr Samuels has attributed the negligible increase in noise levels at the premises of one of the complainants (who asserts noise levels have increased significantly) to what he describes as 'complex noise propagation effects' and has provided the detailed explanation of the phenomenon outlined in Part 9.1 of this report.

In responding to my investigating officers' inquiries, Dr Samuels (through the DMR) reiterated his confidence in the accuracy of predictions for the 1996, 2003 and 2011 scenarios. Documentation furnished by the DMR in relation to these matters, and supported by Dr Samuels, indicates that the work was undertaken in accordance with the relevant Australian Standards and accepted scientific practice.

In these circumstances, there is no justification for me to seek the opinion of another expert to check the validity of the DMR's noise testing and modelling work. The information furnished by the complainants does not provide this basis.

Opinion 9

There is insufficient evidence to substantiate the allegation that the results of the 2003 Reassessment Project in relation to 1996 baseline noise levels and the 2003-2011 predictions are not valid.

Chapter 10: DMR's compliance with the IMP noise commitment

10.1 IMP noise commitment

The complainants allege that DMR did not abide by its undertaking to construct a low noise road and did not fulfil its IMP commitment that:

Design, construction and operation of the Pacific Motorway shall be based on (DMR's Interim Noise Guidelines) and shall endeavour to mitigate any sustained increase in baseline ambient noise levels at sensitive receptors adjacent to the motorway corridor (the IMP noise commitment).

10.2 Analysis of compliance

This part deals with the intent of the IMP noise commitment and the extent to which the DMR has met that commitment.

My investigation revealed that the noise levels from the motorway, particularly the PCC sections, since its opening in October 2000, exceeded the DMR guidelines for road traffic noise at many noise sensitive receptors along the motorway corridor. This is substantially attributable to the use of the incorrect pavement correction factor for PCC. This affected the completion of the noise barrier program and other noise attenuation measures.

The guidelines referred to in the IMP were the DMR 1991 Interim Noise Guidelines which, in the case of upgrading an existing access-controlled road (in this instance, the Pacific Highway), stated:

Ameliorative measures within the road reserve will be considered when the $L_{10(18Hour)}$ (measured or predicted) noise level is 68 dB(A) or greater, and has increased by ≥ 3 dB(A) from the level prior to the current upgrading.

The revised Noise Code has varied this threshold slightly, with the effect that ameliorative measures will be considered (subject to cost effectiveness and technical feasibility) for any location where the noise level **exceeds** 68 dB(A) $L_{10(18Hour)}$. The requirement for an increase of at least 3 dB(A) has been removed. Advice from the DMR is that its aim is to ensure, where practicable, that road traffic noise does not exceed this level.

However, the noise barriers designed as the outcome of the 2003 Reassessment Project were based on the premise that noise levels **should not reach** 68 dB(A), consistent with the Interim Noise Guidelines and the now superseded Noise Code. Experts advise that the difference between the two criteria is imperceptible to the human ear.

In my proposed report, I expressed the following opinion:

DMR has not met its IMP noise commitment in relation to mitigating any sustained increase in baseline ambient noise levels at sensitive receptors adjacent to the motorway corridor. As the motorway was officially opened approximately six years ago, DMR's failure constitutes unreasonable administrative action within the meaning of s.49(2)(b) of the OA.

The DMR, in its response to my proposed report, submitted as follows:

*The commitment made in the IMP in relation to noise was that the design, construction and operation of the Pacific Motorway shall be based on the DMR Interim Guidelines and **shall endeavour** to mitigate against any sustained increase in baseline ambient noise levels at sensitive receptors adjacent to the Motorway corridor (emphasis added).*

In the text of the IMP supporting this commitment it also states that 'wherever possible' noise impacts shall be managed such that there will be no sustained increase in baseline ambient noise levels and 'wherever practical' noise levels shall not exceed baseline ambient noise levels.

The Interim Guidelines do not allow for traffic noise amelioration or attenuation works outside of the road reserve so the option of treating individual properties with mechanical ventilation and air-conditioning and architectural treatment if necessary was not available.

As noise barriers were the only option available and given the caveats contained in the IMP relating to 'shall endeavour', 'wherever possible' and 'wherever practical' it was a reasonable conclusion that if barriers were not effective or suitable in certain areas then no further action in relation to noise could reasonably be taken.

Following the finalisation of the Reassessment Report in late 2003 DMR re-examined its IMP commitment in relation to the mitigation against any sustained increase. DMR then actively sought an exemption from the Interim Guidelines and current Noise Management Code of Practice to enable it to address residents defined as having a sustained increase. The additional noise barriers constructed since the reassessment and current plans to do substantial works outside the road reserve at individual properties are directed not only at addressing properties exceeding the criteria but also those defined as having a sustained increase.

DMR has not only met its commitment in the IMP with respect to mitigating any sustained increase in baseline ambient noise levels but will in fact exceed the original intent of this commitment once all planned work is completed.

In my proposed report I recommended that:

To satisfy the IMP commitment about baseline noise levels, DMR offer individual architectural treatments for all premises existing in 1996 that, based on the 1996 noise scenario as modelled in 2003, will be exposed to a long term increase in their respective baseline noise levels for the 2011 planning horizon.

The DMR submitted in its response that:

- *The rationale for 'No sustained increase' (terminology used in the IMP) to be interpreted by Main Roads as less than 3 dB(A) is based on the definition in Table 2 of the Interim Guidelines and Technical Notes for Road Traffic Noise Amelioration (July 1992), 'Significance of Environmental Noise Exposure Changes', as 'Insignificant Change'. That is, by definition, an increase in noise levels by less than 3 dB(A) is accepted by road authorities as insignificant.*
- *To keep faith with the use of the term 'No sustained increase' in the IMP, DMR commits to appropriate remedial action to dwellings where noise levels are below the fixed noise criteria (68 dB(A)) but which, as verified via modelling, may experience a greater than or equal to 3 dB(A) increase by 2011.*
- *The zone of accuracy of the CoRTN model is 300m from the road. CoRTN states 'extrapolation outside this range can lead to progressive and significant error but calculations can be extended outside the quoted range for the purpose of assessing changes in noise levels'.*

On this basis, DMR submitted that my proposed recommendation be redrafted as follows:

- 1.1 *To satisfy the IMP commitment about baseline noise levels, DMR offer mechanical ventilation/air conditioning and individual architectural treatments (if necessary) for only those premises existing in 1996 that, based on the 1996 noise scenario as modelled in 2003, and within the 300m zone of accuracy of the CoRTN model, will be exposed to a forecast increase, by 2011, of at least 3 dB(A) above baseline noise levels existing in 1996.*
- 1.2 *DMR undertake modelling to determine which premises that existed in 1996, beyond the 300m accuracy zone of CoRTN, will experience a forecast increase, by 2011, of at least 3 dB(A) above baseline noise levels existing in 1996 and subsequently offer mechanical ventilation and air conditioning and individual architectural treatments (if necessary).*

I make the following comments about DMR's response:

- The DMR's redrafted recommendation would limit my recommendation's application to a smaller number of affected, or potentially affected, premises.
- The DMR argues it could only offer individual treatments after seeking an 'exemption' from the Interim Noise Guidelines and current Noise Code as such treatments were not provided for in those documents. However, those documents are internal ones that DMR can change at any time.
- Furthermore, it is unlikely that DMR officers explained during public consultation that the Interim Noise Guidelines did not provide for individual architectural treatment.
- DMR has not yet provided these treatments in most cases.

Although it appears to be scientifically accepted that an increase of under 3 dB(A) is not perceptible, I do not support the DMR's suggested change to my recommendation limiting offers of architectural treatment to premises that will experience a sustained increase in noise levels of least 3 dB(A) for the following reasons:

- I am not satisfied that DMR's suggested recommendations are consistent with the intent and scope of the IMP noise commitment.
- The IRT interpreted the IMP noise commitment as meaning that "the road traffic noise $L_{10(18\text{Hour})}$ level of 68 dB(A) should not be exceeded at the building façade and there would be no sustained increase in baseline noise levels".
- Some allowance should be made in favour of residents for the fact that noise levels have (mostly) been calculated from modelling and predictions, which inevitably involve a margin of error.
- The 68 dB(A) noise threshold for upgraded roads is substantially higher than in most other Australian jurisdictions, although I have noted the DMR's claim that those other jurisdictions generally regard these noise levels as desirable rather than mandatory.
- There appears to be an inconsistency between DMR's Noise Code regarding its policy of offering treatments for premises with noise levels exceeding the 68 dB(A) threshold and DMR's proposal that treatments for premises experiencing sustained increased above baseline noise levels should only be provided where the increase is at least 3 dB(A).¹¹⁴

Opinion 10

The DMR has not yet met its IMP noise commitment in relation to endeavouring to mitigate any sustained increase in baseline ambient noise levels at sensitive receptors adjacent to the motorway corridor. The time taken by DMR to complete this work, comprising individual architectural treatments, constitutes unreasonable administrative action within the meaning of s.49(2)(b) of the Ombudsman Act.

Consistent with that opinion, I believe the DMR should also offer individual treatments for all premises (that existed in 1996) that, based on the 2003 Reassessment Project, will be exposed to any sustained increase in their respective baseline noise levels having regard to the predicted levels for the 2011 planning horizon.

However, I accept the DMR's view about the need for further modelling for premises beyond the CoRTN accuracy zone and have modified my recommendation accordingly.

¹¹⁴ See Part 2.4.2 of this report.

Recommendation 12

To satisfy the IMP commitment about baseline noise levels, DMR offer individual architectural treatments for all premises existing in 1996 that, based on the 1996 noise scenario as modelled in 2003, and within the 300m zone of accuracy of the CoRTN model, will be exposed to a sustained increase in their respective baseline noise levels having regard to the predicted levels for the 2011 planning horizon. Such offers should not be limited to premises that will be exposed to an increase of at least 3 dB(A).

Recommendation 13

To satisfy the IMP commitment about baseline noise levels, DMR undertake modelling to determine premises existing in 1996, beyond the 300m accuracy zone of CoRTN, that will be exposed to a sustained increase in their baseline noise levels having regard to the predicted levels for the 2011 planning horizon. Where a sustained increase is determined, the DMR offer individual architectural treatments for those premises. Such offers should not be limited to premises that will be exposed to an increase of at least 3 dB(A).

Recommendation 14

As soon as practicable, DMR develop a works program for the completion of all individual architectural treatments and make key aspects of the program publicly available including the relevant timeframe for completion of the work.

Recommendation 15

Priority for individual architectural treatments be determined having regard to the extent of noise increases.

In its response to my proposed report, the DMR accepted Recommendation 15.

In respect of the complainants' premises, DMR has provided the following noise details based on the $L_{10(18\text{Hour})}$ descriptor:

Table 5: Modelled noise results for complainants' premises

Location	1996 modelled base level	2002 measured level	2003 modelling	2011 predicted ¹¹⁵
Pimpama	56 dB(A)	N/A	N/A	56 dB(A)
Helensvale	60 dB(A)	61.2 dB(A)	61 dB(A)	63 dB(A)

The table indicates that the Helensvale residence of one of the complainants will experience a sustained increase whereas the Pimpama residence of the other complainant will experience no sustained increase. Therefore, subject to further noise modelling to be undertaken by DMR confirming the above noise levels, the Helensvale complainant would be eligible for an offer from the DMR for noise mitigation treatment¹¹⁶. Other premises in the immediate locality may be eligible for a similar offer from the DMR. On the other hand, the complainant whose residence is at Pimpama would not be so eligible subject to the results of further noise modelling.

¹¹⁵ After construction of any relevant noise barrier(s). A noise barrier would be ineffective for the Helensvale residence, given its high elevation. Accordingly, DMR does not propose any barriers in that locality.

¹¹⁶ Both premises are outside the 300m CoRTN zone of accuracy.

The motorway included a section of 'new road' (approximately 3 km in length) in the Kingsholme area. Under the Interim Noise Guidelines and the revised Noise Code, a 63db(A) maximum noise level applies for a new road. This new road section was constructed through land formerly used as a golf course (and purchased by the DMR for motorway purposes). DMR noise remodelling indicates that noise levels for only three premises will exceed the 63 dB(A) threshold after construction of the noise barrier program is complete. These premises are eligible for architectural treatment. (My opinion and recommendations regarding the commitment about baseline noise levels also apply to premises adjacent to the new road section of the motorway.)

It is noted that the IRT Report concluded that the IMP noise commitment had been achieved subject to certain caveats, which were addressed in a series of recommendations in that report. The clear inference is that full implementation of those recommendations would remove the caveats. I agree, subject to DMR implementing my recommendations to address any sustained increase in baseline noise levels.

In Chapter 11, I discuss the completion of the noise barrier program and the conduct of further noise monitoring and modelling.

10.3 Is the motorway a low noise road?

The complainants also allege that the DMR has breached its undertaking to construct a 'low noise road'. Of course, such terminology is open to different interpretations. However, in the context of the motorway, it is reasonable in interpreting those words to have regard to the specific noise statements in the IMP documentation (quoted at Part 7.3 of my report). I also note the following reference to this topic in the IMP under the heading 'Major features'.

...

Heavy duty and low maintenance concrete or asphalt pavements are needed, and the surfacing would be:

- *high friction;*
- *textured to reduce hydroplaning potential; and*
- *a smooth ride and a **low level of noise.*** (emphasis added)

As I state at Chapter 3 of my report, it is probable that statements were made by or on behalf of DMR during, or for the purpose of, public consultation to the effect that the traffic noise environment for the motorway would be no worse than that associated with the old Pacific Highway. Therefore, I think it understandable that the complainants believe that the new motorway does not constitute a 'low noise road', particularly as they are aware that the noise level at the source is 8.8 dB(A) higher than the old Pacific Highway.

In my view, this is a further factor the DMR should take into account in making decisions about offering individual architectural treatments to owners of premises.

Chapter 11: Noise barrier program

11.1 Overview

Chapter 4 of my report describes the noise monitoring and modelling work to determine the likely location of noise barriers along the motorway.

DMR has indicated that there were four stages of construction of noise barriers on the motorway. The first comprised 13,900 metres of barriers in conjunction with the initial roadworks. After completion of the motorway, a further 4,200 metres were installed. A further 4,980 metres were erected as the outcome of the 2003 Reassessment Project.

The fourth stage will be based on further monitoring work that DMR has undertaken to carry out to gauge the effectiveness of noise barriers constructed to date along the PCC section of the motorway. Individual architectural treatments will be offered during that stage.

Chapter 10 of my report outlines my opinion (Opinion 10) that DMR has not yet met the IMP noise commitment.

This chapter deals with the time taken to complete the noise barrier program and future noise monitoring work.

11.2 Completion of the noise barrier program

The time taken to complete the noise barrier program and related noise attenuation measures appears to be a legitimate cause for concern for residents along the motorway route, particularly those along the PCC section. It is now more than six years since the motorway became operational.¹¹⁷ There was a reasonable community expectation that the program would be undertaken in conjunction with the roadworks construction or shortly after.¹¹⁸ This expectation was based on:

- the commitment in the IMP that there would be no sustained increase in baseline noise levels; and
- the stated intent in the IMP to conduct noise monitoring in selected locations within six months of completion of road construction in order to evaluate the performance of the noise mitigation methods.¹¹⁹

Detailed modelling in 1997 and 1998 identified the locations and specifications for noise barriers with a view to preventing the 68 dB(A) threshold being exceeded for residential premises in existence at that time. As mentioned, this modelling was based on the use of the incorrect pavement correction factor. Consequently, some of the barriers initially constructed along the new motorway alignment do not comply with the design parameters for PCC. As a result of the IRT Report, some of those barriers were found to be inadequate and had to be enhanced.

¹¹⁷ Many of these concerns might have abated with the reduction in noise levels because of the recent DMR activity in completing the noise barrier program along the PCC section.

¹¹⁸ See Part 3.1 of this report.

¹¹⁹ See Chapter 6 for further discussion.

It is likely DMR became aware that the noise levels were above those anticipated soon after the motorway was opened in October 2000 when the roadworks speed limit of 80 km/h was increased to 100 km/h and 110 km/h. Post-construction monitoring was carried out at some 80 locations along the motorway route between March 2000 and May 2002. Early results from this monitoring program and the noise complaints from residents along the PCC section of the motorway no doubt alerted the DMR to the prospect that PCC was a noisier surface than DGAC.

This led to the commissioning of the IRT Review in early 2002, the formulation of the accurate pavement correction factor for PCC, remodelling of the 1996 baseline and predicted 2011 noise environments and the development of a supplementary noise barrier program for the PCC sections. An adjunct to the supplementary program was the availability of individual architectural treatments for premises that, for topography or location reasons, could not be protected by noise barriers from exposure to noise levels beyond 68 dB(A).

The DMR's reliance on the incorrect pavement correction factor for PCC also contributed to the delay in completing the noise barrier program in that it influenced the location of the noise barriers constructed in conjunction with the initial roadworks (including the OGAC sections). It is likely that, had the DMR known and employed the proper correction factor for PCC, all necessary noise barriers would have been constructed at that time.¹²⁰

The 2003 Reassessment Project culminated in the release of the ASK and Heggie reports in January 2004 as the basis for the supplementary noise barrier program, involving the design of new barriers along the PCC section and the augmentation of a number of original barriers. Completion of this supplementary program took nearly three years. Again, this length of time seems excessive, given that the original roadworks, including initial noise barriers, for the whole motorway were completed in a similar timeframe.

In DMR's response to my proposed report, it agreed that there had been a delay since 2003, but did not accept there had been an unreasonable delay from the opening of the motorway. The response stated:

DMR agrees that the timeframe to construct the new noise barriers was excessive but this was due to the following:

- a) limited number of contractors available to undertake this type of work;*
- b) one of the available firms had some financial risk at the material time (which has since been resolved); and*
- c) availability of suitable materials and lag times for delivery despite pre-ordering prior to awarding of construction contracts.*

The 2003 Reassessment Project identified nine locations for the construction of further noise barriers, at a cost of approximately \$8.875 million, based on the projected 2011 noise scenario and development existing at the time the Reassessment Project was undertaken. Eight of the packages related to the PCC section of the motorway. Construction of all eight packages was completed by 30 September 2006.

Notwithstanding the reasons given by the DMR, I remain of the view that there has been an unreasonable delay by DMR in completing the barriers.

¹²⁰ It seems likely that PCC would still have been preferred as the cost of noise barriers was factored into PCC pavement costs – see Part 5.6 of this report.

Opinion 11

Having regard to the commitment in the IMP that noise levels would not exceed 68 dB(A), the DMR's actions in taking approximately three years since the Reassessment Project to complete the noise barrier program constitutes unreasonable administrative action within the meaning of s.49(2)(b) of the Ombudsman Act.

It is noted that the DMR, with Dr Samuels' assistance, has now calculated the accurate pavement correction factors for all Queensland pavement types, and the motorway in particular. In those circumstances it seems reasonable to conclude that the DMR is now in a position to install all necessary noise reduction measures contemporaneously with the construction of a new or upgraded road. Such action should, hopefully, prevent residents along the relevant road corridors being unnecessarily subjected to road traffic noise in excess of the design levels in the revised Noise Code.

Recommendation 16

DMR ensure that:

- *wherever practicable, noise attenuation works associated with proposed roadworks are completed at the same time as the construction of the roadworks; and*
- *any additional noise attenuation works, identified as being necessary after construction of roadworks, are completed as soon as possible.*

This recommendation is in accordance with DMR's advice that noise attenuation works are often undertaken as a two stage process, namely works based on predictions and post-construction works based on monitoring of actual noise levels.

11.3 Future noise monitoring

The DMR undertook to conduct further monitoring to confirm whether the noise barrier program had been effective in meeting the 68 dB(A) threshold.

As the noise barrier program along the PCC section of the motorway has been completed, it seems that the DMR can now commence the proposed noise monitoring and modelling for the areas adjacent to the PCC sections as these are the areas most affected by road traffic noise.¹²¹

In Chapter 10, I accepted the need for DMR to undertake further modelling work for premises beyond the CoRTN zone of accuracy (300m).

The final modelling results will also assist the DMR in determining whether any further premises should be offered individual treatment on the grounds that their respective noise exposure will exceed 68 dB(A) $L_{10(18Hour)}$ in 2011 or, in the case of premises existing in 1996 (not vacant land), will experience a sustained increase in their baseline noise level beyond 2011.

Recommendation 17

As soon as practicable the DMR undertake noise monitoring in order to ensure that noise from the motorway does not exceed the 68 dB(A) threshold in the IMP noise commitment along the PCC section of the motorway and take any necessary remedial action.

After the completion of all noise mitigation measures and beyond 2011, the motorway will be treated as an existing road (Category 3) under the revised Noise Code. The effect of this revised classification is that the motorway will have a lower priority (relative to new roads and the major upgrading of existing roads) for any further noise mitigation treatment that may be warranted.

Recommendation 18

If the DMR decides to further upgrade the motorway (for example, by adding lanes), any noise mitigation treatment associated with the upgrading should, wherever practicable, be undertaken in conjunction with the corresponding road construction work.

¹²¹ The only noise barrier that remains to be constructed is adjacent to the OGAC pavement at Nerang.

Chapter 12: Pavement resurfacing issues

12.1 Pacific Motorway resurfacing investigation

Contemporaneously with the conduct of the IRT study referred to in Chapter 8 of this report, the DMR also commissioned an internal investigation regarding noise-reducing pavement treatments/resurfacing options suitable for use on plain concrete pavements in the context of the PCC surface on the motorway.

It is noted from the resultant report¹²² that the investigation included a literature survey and visits by DMR officers to New South Wales, Victoria, United Kingdom and Belgium to inspect roads where concrete pavements had been used and discussions about relevant issues with the respective road authorities. A number of alternative surfaces were considered during the investigation relevant to PCC in terms of noise, safety (texture, skid resistance and spray), pavement performance (changes in condition over time), cost (initial and whole-of-life), risk (pavement reliability and failure) and traffic disruption.

Section 4.5 of that report outlined the approach adopted by the investigation team in ranking the merits of each resurfacing option:

The alternative surface treatments have been documented in this report along with the advantages and disadvantages of each and a brief summary of the issues. A structured approach was then taken to ranking the alternatives, which included reducing the issues to decision criteria. Then the criteria were scored by the Regional and District Director to arrive at weightings for each. The alternatives were then scored with respect to each criterion and the weightings applied to allow the ranking of the alternatives.

DMR has also indicated that subjective ratings were obtained in discussions with experienced surfacings engineering staff and by reference to the Austroads *Guide to Road Resurfacings*. These subjective ratings were turned into a score by a marking scheme.

Weightings, according to the report, were developed in light of the DMR's community responsibilities as the state road authority, and included the:

- criticality of the safety of road users;
- requirement for efficient and economic use of the funds available;
- high importance placed on concerns of local residents about noise;
- importance placed on minimising work zone related delays to motorists; and
- high importance of ensuring that any work done will not require replacement due to early failure.

¹²² *Pacific Motorway Plain Concrete Pavement Resurfacing Investigation*, 20 March 2002.

Scores out of 100 were then assigned for each treatment and objective, with the best surface receiving a score of 100 and zero allocated for the worst surface. The final weights and scores for each surface treatment and criterion, as ascribed through the aforementioned process, are contained in the following table¹²³ of the report, as follows:

Table 6: Summary of resurfacing weights and scores

Criteria		Safety			Risk	Cost	Traffic Delay
Weights	70	100			70	50	62.5
Sub-weights		50	100	50			
Surfacing Treatment:		<i>Texture</i>	<i>Skid resistance</i>	<i>Spray</i>			
PCC tined & dragged	0	50	50	0	100	100	100
SMA	75	75	75	75	90	18.3	27
DGAC	50	25	50	0	90	23.1	27
OGAC	100	100	75	100	90	14.7	0
LoNoise	75	50	50	75	25	16.2	27
Novachip	50	50	75	75	75	21.7	0
PCP diamond ground	75	50	50	25	50	71.0	36
Slurry seal	50	0	50	0	75	32.9	0
Calcined bauxite	85	75	100	50	50	0	27

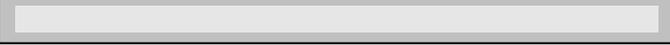
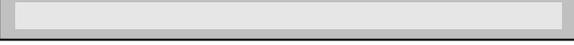
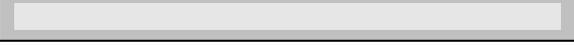
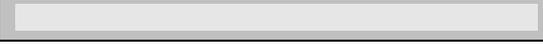
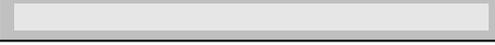
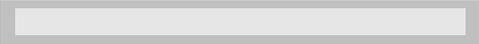
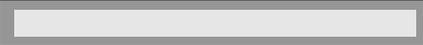
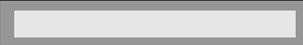
A perusal of the table indicates that the stipulated scoring process has not been consistently applied. For example, 'skid resistance' and 'risk' do not feature a 'zero', while 'spray' and 'traffic delay' have multiple zeroes.

I also note that the PCC tined and dragged surface has been allocated zero for 'noise' and for 'spray' (one of the components of *safety*).

¹²³ Table 10 of the report, as amended, for a minor transcription error by the *Supplementary Report on Pacific Motorway Plain Concrete Pavement Resurfacing for Queensland Ombudsman*, 1 August 2006,p.4.

A multi-criteria decision-making computer software package, employing a complex set of formulae based on the 'pairwise' comparison method, was applied to the data in the above table, with the following results which sum to a value of one (1):¹²⁴

Table 7: Ranking of resurfacing alternatives

Alternatives	Value	Decision Scores
Tyned concrete	0.171	
Ground concrete	0.126	
SMA	0.126	
OGAC	0.121	
Calcined bauxite	0.110	
LoNoise	0.095	
DGAC	0.092	
Novachip	0.090	
Slurry seal	0.069	
		0.00 Decision Score 0.20

From the foregoing analysis, the report concluded that the PCC surface should be retained. However, the report recommended, among other things, that any resurfacing treatment to be applied to the new concrete section of the motorway be trialed on the old concrete surface of the Reedy Creek to Tugun section of the motorway because of its deteriorated condition. While the report has been received by the DMR, it has not yet formally adopted the 'trialing' recommendation.

¹²⁴ The software used in this case was *Criterion Decision Plus* produced by *InfoHarvest*. Other multicriteria decision-making software is commercially available but, with the application of different formulae, may yield different results.

12.2 Ministerial Statement

Following completion of the IRT Report and the resurfacing investigation referred to in Chapter 8 and Part 12.1 respectively of this report, the then Minister for Main Roads made the following Ministerial Statement in Parliament on 18 April 2002:¹²⁵

Although the (IRT) report finds that there were some deficiencies in the way in which some early aspects of the IMP, and in particular the noise monitoring processes, were conducted, overall the report found that the terms of the IMP had been complied with. The IMP stipulated that noise levels would not reach above 68 decibels, the state-wide level above which noise mitigation might occur. The report found that current noise levels comply, that is, current noise levels were found to be below 68 decibels.

The second study, conducted by my department, was a review of current practice elsewhere in Australia and overseas with respect to the use of asphalt surfacing over concrete. The members of RAIN have been strongly insistent that an asphalt overlay will provide the appropriate level of noise reduction. The advice I have received is to the contrary. I am advised that there is no technical reason for resurfacing and noise levels are unlikely to be reduced in the longer term.

This second study, involving extensive research and site visits to Sydney, Melbourne and the United Kingdom casts serious doubt on the effectiveness of resurfacing the concrete surface with asphalt. Indeed, the study found a range of significant problems exist with overlaying concrete with asphalt, problems such as cracking of the asphalt surface where there are concrete joints underneath; higher long-term noise levels from vehicles driving over the cracks; and major disruption to traffic during initial and subsequent resurfacing of the road. I am advised that to resurface that section there would be significant disruptions to traffic between Brisbane and the Gold Coast over a 12-month period and then regular disruptions during maintenance. Once again, the report concludes that no action should be taken. These facts, combined with the estimated \$40 million cost of asphalt resurfacing, have lead me to form the view that resurfacing is an inappropriate option to pursue.

The government has sought the advice of the experts. We have listened to the community. We have given serious consideration to the views of local residents. In particular, we have looked very seriously at whether a resurfacing of the concrete section of the M1 would deliver the outcome sought by RAIN. Even if we spent the \$40 million on asphalt overlay, as suggested by RAIN, the noise benefits are unlikely to be significant over the long term and other costly maintenance and operational issues are likely to emerge. It was important for the government to get independent advice. This independent advice has told us that noise levels are within the allowable levels in place throughout Queensland. I seek leave to table those two reports I have referred to. (Leave granted).

Under s.16(1)(a) of the OA, a decision made by a Minister is not subject to review by the Ombudsman. However, under s.7(1)(d) of the Act, the making of a recommendation to a Minister is an 'administrative action' under the Act and, as such, is an action reviewable by the Ombudsman. Documentation provided to my Office by the DMR indicates that the Ministerial Statement was based on advice contained in a document dated 16 April 2002 prepared for the Minister's information by the then District Director (South Coast-Hinterland). Accordingly, my review of the administrative action the subject of the complaints, primarily concerning the use and retention by the DMR of a PCC pavement on the motorway, focuses on the actions of the DMR rather than the decision of the Minister.

¹²⁵ Hansard, P.1173. Extract from full statement.

12.3 Crumbed Rubber Asphaltic Concrete Study Tour Report

As a further outcome of the RAIN noise complaints to the DMR, a departmental officer undertook a study tour to Arizona and California in March 2003 to investigate the potential use of crumbed rubber modified open-graded asphalt as an overlay for plain concrete pavements in the South-East Queensland environment.¹²⁶ Concrete pavements have been employed extensively in the US highway system.

After visiting a number of sites where the crumbed rubber technology had been utilised by the relevant state highway authorities to resolve noise issues, the study concluded that this material has superior durability (lasting up to ten years), crack resistance and fret resistance to other asphaltic concrete mixes, but inferior drainage characteristics (which is an important factor for wide carriageways such as those on the motorway). The study also concluded that the rubber mix being trialled as an overlay on the plain concrete pavement on Highway I-280 in San Mateo County, California would (of the mixes observed on the study tour) be the most suitable for the motorway environment provided it has adequate permeability and rut resistance. A photograph in the report of Highway I-280 indicates that the highway (with an open-graded rubber asphaltic concrete overlay in 2003) has similar characteristics to the motorway – an eight lane, dual carriageway road.

However, in response to my Office's investigation of the complaints, the author of the report has made the oral observation that the application of crumbed rubber overlay in Arizona and California has generally (but not in all cases) been confined to older concrete pavements that have markedly deteriorated and are in need of rehabilitation to prolong their trafficable use.

Recommendations of the report were:

- the DMR should either develop or encourage commercial development of quiet crumbed rubber asphalt surfacings for use in Queensland similar to those used in Arizona and California; and
- any new crumbed rubber modified mixes developed for the DMR should be subjected to controlled trial before use.

Advice from DMR is that its senior management has 'noted' the report, but has not yet taken any action towards implementation of the above recommendations. It is understood this position was taken principally because the crumbed rubber technology referred to in the report is not yet available in Australia and the asphalt industry is not yet prepared to invest in its research and development to suit Australian conditions.

Accordingly, the DMR is of the view that resurfacing the concrete section of the motorway with a crumbed rubber overlay is not a feasible option from a technical risk perspective at this time. DMR says that 'it needs to design, test, specify, trial, manufacture and lay the crumbed rubber open graded mixes along with an appropriate *tac* coat and strain alleviating membrane with the local industry, successfully, before the technical risk could be lowered to a reasonable level.'

¹²⁶ The DMR officer was the Principal Engineer (Pavements and Materials Development).

12.4 Interstate resurfacing experiences

12.4.1 New South Wales – RTA

The following information was received from the Manager, RTA Environmental Monitoring in response to questions put by my investigating officers about the use of concrete pavements in NSW:

Basically there are many design issues regarding thin layer overlays of concrete pavements ...In terms of acoustic properties, there is, as I understand, very little information on the performance of these overlays, particularly when they age.

There are several examples of overlays on concrete pavements in NSW, all of which are located in highly trafficked areas of Sydney ... Apart from the F3 Newcastle Freeway these roads generally carry slow moving traffic particularly in peak times.

You may already be aware that below a speed of around 40 km/h for cars and about 70 km/h for trucks the dominant external noise source is from the engine and drive train. Above these speeds it is tyre/road interaction that becomes the dominant noise source.

Therefore there is very little difference, if any, between the various types of pavements at lower speeds. At speeds around 100 km/h there is a noticeable difference between the noise generated on these various types of pavements. The difference is greatest for cars and much less for heavy vehicles.

At this point it should be noted that because heavy vehicles are around 10 dB or more louder than cars, once the heavy's make up about 10% of the traffic mix it really doesn't matter about the cars because the trucks dominate the noise catchment.

Getting back to what we know about asphalt overlays. Because of reflective cracking we get serious jointing problems that become seriously annoying when driving upon them at high speeds both because of internal noise and in some cases vibration. While we do not currently have any quantifiable data it would appear that there is also an issue with noise externally, although probably not as pronounced as it is internally.

To improve our understanding we are scheduling some measurements to be undertaken on the Newcastle Freeway in late November. This will ultimately feed into a bigger study on all types of pavements that should be finished by March 2006. This will include both internal and external noise measurement and a spectral analysis of the generated noise.

There are no overseas studies of which I am aware that look specifically at overlays to quieten noisy concrete pavements.¹²⁷ There is however data from the US that suggests that in some instances diamond grinding of the surface can produce a wearing surface that generates less noise than the original pavement generated.

The RTA is currently considering this as an option to remove the asphalt overlay on the Newcastle Freeway.

Therefore, despite having serious reservations about the effectiveness of any type of overlay for a concrete pavement at the moment, we do not have any quantifiable data on the noise generated.

¹²⁷ The existence of the DMR *Crumbed Rubber Asphaltic Concrete Study Tour Report* referred to in Part 12.3 of this report has been drawn to the Manager's attention. See his subsequent comments in this part.

The Manager has provided the following additional information and professional opinions relative to the above matters:

- *The pavement study has been completed. Its purpose was to investigate quieter pavements for use in conjunction with future major road construction in NSW.*
- *The retrofitted asphalt overlay on a section of the F3 Freeway 'has not worked well'. It is probably now the loudest noise road surface in NSW because of reflective cracking and deterioration in the overlay. RTA is still considering the removal of the overlay and diamond-grinding the old concrete pavement to restore it to a serviceable condition (no final decision has yet been made as the required technology is still in the developmental phase).*
- *Concrete is the preferred pavement surface in NSW because of its longwearing and low-maintenance qualities, subject to noise considerations.*
- *The M4 motorway was designed with a combined concrete base/asphalt surface pavement to address noise concerns.*
- *There is very little difference in practical terms between the standard NSW (non-mandatory) noise descriptor of 60 dB(A) $L_{Aeq(15Hour)}$ (with its attendant policy qualifications/exceptions) and the corresponding Queensland ('fixed') descriptor of 68 dB(A) $L_{A10(18Hour)}$.*
- *RTA has no experience in the use of crumbed rubber technology (of the type described in Part 12.3 of this report).*

The following further information was provided by the Acting General Manager, RTA Infrastructure Maintenance in response to questions put by my investigating officers:

A short section of F3 Freeway north of Sydney has a 45mm OGA layer over plain concrete base. The asphalt was replaced soon after construction in the mid 1980s. Cracking has since occurred in the overlay, reflected from joints in the concrete pavement.

Maintenance on this F3 section has comprised crack sealing except for one instance in a small area that experienced a condition known as 'shoving' due to braking of heavy vehicles on a steep downhill grade requiring replacement.

Reflective cracking in the thin asphalt layers over concrete pavements will occur and measures to slow the rate of deterioration include:

- *crackfilling and application of geostrips to cracks prior to overlay;*
- *application of bitumen overbanding immediately reflective cracking appears;*
- *use of asphalts containing scrap rubber crumb and/or polymer modified binding.¹²⁸*

12.4.2 Victoria – VicRoads

The following information was provided by the Senior Environmental Officer, VicRoads, in response to questions put by my investigating officers:

VicRoads does not construct concrete roads on any large scale. The length of concrete roads in Victoria would be only a few kilometres. There is only a small section of un-resurfaced concrete road in an urban area (Dandenong Road between Glenferrie Road and Tooronga Road, Malvern). This road is unreinforced concrete with a relatively fine tyned finish. As there is a noise issue with the road I believe that the concrete carriageway will be resurfaced with DGAC to reduce the noise.

¹²⁸ The materials referred to in this dot point are chemically different from the process referred to *Crumbed Rubber Asphaltic Concrete Study Tour Report* addressed in Part 12.3 of this report. See also the Manager RTA's subsequent comment that the asphalt overlay on the F3 'has not worked well'.

I believe all the other major VicRoads managed concrete roads have been resurfaced with a bitumen material. For example, I believe that parts of Keilor Park Drive, East Keilor may be resurfaced concrete road. I don't believe that there is an issue with an asphalt overlay on this concrete road.

There are some old Council managed concrete roads, however most exposed concrete roads are in residential areas, whilst the concrete main roads are mostly resurfaced with bituminous material.

The roads referred to above are in suburban Melbourne. They are not high-speed motorways in the nature of the eight lane, dual carriageway motorway. However, it is noted that an asphalt overlay on a concrete pavement appears to be technically achievable. The issue then becomes one of maintenance and its attendant traffic disruption. Placement of an asphalt overlay on the concrete section of the motorway would defeat the IMP requirements for a low maintenance pavement with minimal traffic disruption, but would contribute to a lower noise environment though, perhaps, only in the short to medium term in view of the potential problems mentioned in Part 12.4.1.

12.5 DMR position on resurfacing concrete pavement on motorway

DMR has furnished the following information as its assessment of the relevant issues relating to the possible construction of a 50mm asphaltic overlay on the motorway concrete pavement (length: 28 km) to reduce road traffic noise:

- *Initial cost (in \$2005): OGAC \$30-40m; SMA \$40-50m.*
- *Construction time in excess of one year. All work would be night work where two lanes would be closed at a time. The sequence of work per carriageway kilometre would be: clean (1 night); prime and overlay (4 nights); sawing over joints and lane marking (1 night). The work would require a total of 6 nights per carriageway kilometre. There are 200 lane kilometres of plain jointed concrete pavement on the 8 lane M1.*
- *It would be necessary to seal cracks which reflect through the asphalt over the joint in the concrete. This is a significant task, would require redoing every three years and be virtually ongoing. There are 7000 metres of joints per kilometre, half longitudinal between lanes and half transverse.*
- *Asphalt would need to be milled and the overlay reapplied about every ten (10) years. As traffic increases, this operation will become more difficult.*
- *DGAC has been used in Sydney and Melbourne over plain concrete pavements, but not on 8 lane roads. The texture depth of DGAC is too low and may cause aquaplaning. It has little spray reduction improvement over concrete.*
- *OGAC will provide the greatest noise and spray reduction, but as water drains through the OGAC it is not advisable to cut and fill joints in OGAC over concrete joints. This leaves a significant maintenance issue at the cracks that will occur over joints in the concrete.*
- *SMA provides noticeable noise reduction. SMA has higher texture than DGAC but does not drain internally like DGAC. It can be cut over joints and the saw cuts filled without interfering with draining paths. It has noticeable spray reduction.*

DMR would be reluctant to asphalt overlay the concrete pavement. If an overlay was to be placed over the concrete pavement, it would have to be undertaken over long lengths as the asphalt overlay cannot be feathered down to the concrete surface. Only 2 options would be available as follows:

- *Cut out the concrete to the depth of asphalt overlay at the end of a section so that the integrity (depth) of the overlay could be maintained. This would create a weakness in the concrete pavement at this location most likely resulting in cracking of the concrete pavement which could not be controlled. The depth of the concrete is critical to the design life of the pavement and should not be reduced at any location.*
- *Overlay from one bridge structure to another as the asphalt overlay would be able to join to the asphalt on the bridges.*

In addition, DMR is reluctant to 'trial' an overlay at any location on this 8 lane pavement because it would not be possible to clearly justify treating one section rather than others. DMR is of the view that any trial (if it were ever to be conducted) should be on a concrete pavement narrower than the M1 to ensure drainage is adequate.

12.6 Consultation with AAPA

RAIN, in proposing the resurfacing of the PCC section of the motorway with a low noise surface such as OGAC, submitted that the DMR estimate of \$40 million for the work was grossly exaggerated. In support of this claim, the complainants stated that they were verbally informed by an AAPA officer that the 28 km length of PCC pavement on the motorway could be resurfaced with asphalt for about \$10 million.

When questioned by this Office about his remarks, the AAPA officer responded in the following way:

He acknowledged making an ad hoc remark to a RAIN meeting some 5 years ago (about 2001) that the new concrete section of the M1 could be resurfaced with asphalt for approx \$10 million. The statement was made on the basis of a minimum overlay of some 30mm depth during daylight hours and without traffic conditions (assuming no disruption to work due to traffic flow/volume) - basically a 'no frills' approach.

His proposal did not make allowances for treatment of concrete joints to prevent subsequent cracking of the asphalt. He could not guarantee that such a treatment would be effective in the long term on a heavily trafficked motorway such as the M1.

The DMR estimate of \$40 million might well now be a reasonable estimate for a first-class, long-life treatment for the world-class motorway. This would depend on DMR specifications and any competitive tenders received for the job. Heavy-duty asphalt typically has a life expectancy of 8-12 years. It would then have to be removed and re-laid.

The AAPA officer has indicated to my investigating officers that he believes the RAIN representatives took his remarks out of context and that the standard of work required to meet any likely DMR specifications for eventual resurfacing of the PCC section of the motorway could well cost in the vicinity of \$40 million today (in 2006).

12.7 Analysis of resurfacing options

A DMR internal report in March 2002 assessed eight options for resurfacing the concrete section of the motorway.

As PCC achieved the highest score in the report, the DMR concluded it should remain in place. The complainants suggest that the internal DMR investigation was merely an exercise that was manipulated to justify the DMR decision to choose a PCC pavement.

One option would be to have the report reviewed by an independent expert. However, the noise barrier program is nearing completion and it seems that the DMR is making reasonable attempts to deal with the effects of the noise caused by the PCC pavement. On this basis, further review of the DMR resurfacing report does not, in my opinion, appear to be necessary or justified.

Opinion 12

As the noise barrier program is nearing completion, further review of the DMR resurfacing report is not warranted.

I note that the Wallace Review Team (1996) included a scenario about preferred pavement types where, in noise critical areas, a concrete pavement could be laid initially, but resurfaced with OGAC after ten years.¹²⁹

According to the DMR, there are technical difficulties in resurfacing the PCC section of the new motorway because of its intricate and integrated design. However, OGAC would be the DMR's preferred resurfacing material if that option were ever pursued. The RTA also advised my Office that there are technical difficulties in applying an asphalt surface over a PCC pavement that has been specifically designed for a 40 year life.

Mention is made in the Noise Code that while OGAC may be a low noise surface when newly laid, its acoustic effectiveness deteriorates (by 2-3 dB(A) according to the DMR¹³⁰) with the passing of time, as the surface wears/degenerates.

Crumbed rubber asphaltic concrete, presently being employed on a limited basis in the US for resurfacing of some concrete road pavements, does not appear to have been sufficiently developed in Australia for use in Australian/Queensland conditions.

Opinion 13

There is insufficient justification for resurfacing the PCC sections of the motorway for the following reasons:

- Available resurfacing options for the PCC sections would not guarantee significant reductions in noise levels arising from the motorway in the medium to long term.
- Resurfacing would cause enormous disruption to traffic, which would potentially be ongoing because of the greater maintenance requirements associated with OGAC surfaces.
- Resurfacing would not be cost-effective.
- Accident statistics support the conclusion that the motorway is safer than the old Pacific Highway including in wet weather.

¹²⁹ See Part 5.2 of this report, Scenario No 2.

¹³⁰ Austroads Research Report No. AP-R277/05, *op cit*, p.40.

Chapter 13: Management of individual noise complaints

13.1 Overview – DMR noise code requirements

Chapter 8 of the revised Noise Code deals with managing noise complaints arising from the operation of state-controlled roads. Provision is made in the code for complaints to be recorded, acted upon and reported on with a view to continuous improvement in DMR's business systems and ensuring a consistent approach in the handling of individual complaints. The complaint management system will also enable the DMR to benchmark its processes against other state road authorities.

The process provides for the identification and monitoring of noise-affected properties and dealing with road traffic noise in accordance with the criteria and priorities outlined in the revised Noise Code, having regard to the status of the road in question (for example, new or upgraded road or an existing road without any recent major roadworks).

Where the DMR receives numerous complaints about the same road (as in the case of the motorway), the revised Noise Code provides for cluster-based site selection and sampling for measurement, monitoring and assessment purposes, on the understanding that it is not practicable to undertake all of those actions for every property. Computerised monitoring equipment converts the data into a range of noise descriptors, including $L_{10(18\text{Hour})}$. Verified modelling techniques are then applied to accurately calculate the predicted noise level for every property in the cluster based on a ten year planning horizon. As mentioned, a planning horizon of 2011 was initially adopted for the motorway upgrade.¹³¹

For individual complaints, or multiple complaints from the same locality, about road traffic noise emanating from the motorway, the DMR process provides for the initial complaint to be responded to in terms of the methodology outlined in the preceding paragraph.

13.2 Appropriateness of DMR complaint management processes

Because of the sheer number of sensitive noise receptors along the motorway corridor, the DMR has adopted the reasonable approach of employing scientifically developed noise modelling techniques to calculate noise levels for individual premises using random sampling cluster methods. DMR is reluctant to conduct individual noise testing for particular premises (unless there are exceptional circumstances) because of the number of properties potentially involved and the associated cost. Any procedure that provides for individual testing as a standard response to noise complaints could lead to an avalanche of requests.

No mention is made in the revised Noise Code of reimbursing a complainant's reasonable costs of engaging a noise consultant to test noise levels and where the complainant's case is proved using the DMR noise criteria and methodology.

Moreover, where the consultant's results are inconsistent with the DMR's modelled results, the DMR may have to reassess other sites in the same locality to gauge the validity of the modelled data and take any corrective measures that are appropriate.

¹³¹ Further assessments may be necessary after that date in light of any noise complaints still being received by the DMR.

In my proposed report, I put these propositions to the DMR. DMR was opposed for the following reasons:

Payment for noise testing costs could become very resource wasteful particularly when noise modelling requiring fewer but strategically placed measurements is the accepted industry practice.

The measurement, analysis and interpretation of noise data and the calibration of noise models requires high level expertise. It is not as simple as taking single noise measurements.

DMR is committed to consistency in the way it addresses complaints and has included a comprehensive complaints management section in its revised Noise Code.

No mention should be made to DMR reimbursing the complainants' reasonable costs. DMR does not intend to suggest that the complainant engage a noise consultant.

An important aspect of effective complaints management is to provide an appropriate remedy where the complaint is justified. Wherever practicable, complainants should be restored to the position they were in if things had not 'gone wrong'. Remedies include compensation or financial assistance, such as an ex-gratia payment, reimbursement, refund etc. Further, public sector agencies should be open to applying remedies to classes of people who might be adversely affected by an administrative action.

It is my view that the DMR should generally reimburse a complainant's noise consultant's expenses where the complainant's case is established to the DMR's satisfaction using the DMR noise criteria and methodology and a request is made for reimbursement.

Recommendation 19

The section on complaint management in the revised Noise Code be amended to provide details of potential remedial measures for complainants whose complaints are substantiated, including reimbursement of noise testing costs.

Recommendation 20

DMR should consider any reasonable request for reimbursement of expenses incurred by a complainant in engaging a noise consultant where the DMR is satisfied that the complainant's case is established using the DMR noise criteria and methodology.

Recommendation 21

Where a person establishes to the DMR's satisfaction that the noise level at the person's residence exceeds DMR's modelled results for that location, the DMR consider whether a reassessment of other sites in the same locality should be undertaken to gauge the validity of the modelled data and take any corrective measures that are appropriate.

Chapter 14: Safety issues

14.1 Subject matter of complaints

The complainants claim that the concrete section of the motorway is unsafe in wet conditions due to:

- the potential for vehicles to aquaplane because of ponding of water on the PCC pavement surface, owing to its lack of porosity compared with OGAC; and
- reduced motorist visibility because of mist and spray arising from tyre-roadway interaction – some motorists claim that they are unable to see lane markings, particularly during daylight hours.

14.2 Motorway design and construction

DMR publicly announced that it was committed to best practice in constructing, operating and maintaining the motorway as a safe, world-class smart road, meeting the expectations of the community.¹³² The IMP stated that design standards for the new motorway would take into consideration Austroads and the DMR's guidelines, supplemented by other worldwide standards and guidelines.¹³³ Details of the features of the proposed road pavements and the issues that would be taken into consideration in the design phase to deal with hydroplaning/aquaplaning concerns were outlined in the IMP documentation.¹³⁴

A commitment in the IMP was that the motorway would be safe for road users to drive at the posted maximum speed (110 km/h on the PCC section). However, this commitment was qualified by the further statement that, in relation to aquaplaning, 'research also indicates that it is not possible to drive (safely) at high speed in heavy rain due to visibility limitations'.¹³⁵ According to the DMR, the pavement crossfalls, texturing and tining were designed to accommodate rainfall of 17mm/hour (corresponding to a 1.5mm water film on the pavement) for safe driving at the posted speed of 110 km/h on the PCC section.¹³⁶

Texturing and tining of the concrete pavement were undertaken during construction to enhance vehicle safety by improving skid resistance and tyre grip. Transverse tining also facilitates faster surface drainage than would otherwise occur, to reduce the water film on the pavement surface. Moreover, the report on the motorway resurfacing investigation referred to in Part 12.1 of this report rated safety as the most important factor in the design and construction of the motorway. However, safety was not the only factor taken into account when choosing the appropriate pavement (PCC or OGAC) for the motorway. A range of pavement design principles was taken into consideration.¹³⁷

The Final Audit Report by the DMR's consultants Rust-PPK concluded that the motorway had been designed and constructed generally in accordance with the standards enunciated in the IMP, but with some modifications of a positive nature to enhance the overall effect of the road facility. The management principles in the IMP were incorporated into the design of the motorway and service roads.¹³⁸

¹³² See, for example, the DMR's *Road Maintenance Alliance Agreement* for the motorway. Media advertisements featuring Dick Johnson, motor racing driver, about the time of the completion of construction in October 2000, referred to the attributes of the new motorway as a 'smart road'.

¹³³ Vol 2, pp.38 & 66.

¹³⁴ *ibid*, p.84.

¹³⁵ *ibid*.

¹³⁶ Section 7.4.9, Road Pavement, REF, Vol 2 January 1997

¹³⁷ IMP, Vol 4, *Technical Paper No 2 Design Guidelines*, p.17.

¹³⁸ Rust-PPK, *Compliance Report for Design, Construction and Operation (of the motorway)*, January 2001, p.43. Report required by IMP, Vol 1, p.87.

While the IMP design parameters may have been met, DMR has no control over individual motorist behaviour in operating vehicles on the motorway.

14.3 Motorway accident statistics

DMR has furnished the crash data analysis for the motorway compiled from Police Incident reports (PIRs). The data compares traffic incidents¹³⁹ on the motorway under the following headings:

- Five year incident data for the Pacific Highway (Logan Motorway – Pappas Way, Nerang: 40.49 km) from January 1991 to December 1995, as reported in the IMP¹⁴⁰;
- Five year incident data for new section of the motorway (Logan River¹⁴¹ – Nerang: 39.72 km) from October 2000 to September 2005, based on PIRs;
- PCC (26.8 km) and OGAC (12.92 km) sections of the new motorway (total distance: 39.72 km);
- Wet and dry weather conditions; and
- Incidents involving human fatalities, hospitalisation and other reported injuries (incidents involving property damage only are excluded from the data and subsequent analysis – not all property damage incidents are reported to Police).

The analysis of data is based on incidents/100,000,000 vehicle kilometres travelled (100M VKT). The exposure rate of vehicles to incidents on the motorway is calculated as the product of length of motorway for PCC and OGAC sections, average traffic volume per day over each five year period and the number of days in the five year period.

DMR has calculated that the exposure rate on the Pacific Highway between 1991 and 1995 was 33.99 per 100M VKT, whereas the exposure rate for the new motorway between 2000 and 2005 was 71.5 per 100M VKT.

These exposure rates are used for the purposes of the crash data analysis as follows:

- For crash data for the old highway in the IMP, the number of incidents in which people were killed or seriously injured (and requiring hospitalisation) (KSI) was 9.91/100M VKT; and
- For crash data for the new motorway based on PIRs:
 - overall motorway incidents were eight fatalities, 152 seriously injured and 226 other injuries
 - overall KSI - 4.87/100M VKT, with 3.01/100M VKT on OGAC section (12.92 km) and 1.86/100M VKT on PCC section (26.8 km)
 - overall other injury crashes - 11.96/100M VKT, with 7.67/100M VKT on OGAC section and 4.29 100M VKT on PCC section
 - there were eight incidents involving fatalities (one on OGAC and seven on PCC), but all occurred in dry conditions (there were no wet weather fatalities)¹⁴²
 - for OGAC:
 - KSI in wet was 0.17/100M VKT and dry was 2.85/100M VKT
 - other injuries in wet was 0.6/100M VKT and dry was 7.07/100M VKT
 - for PCC:
 - KSI in wet was 0.24/100M VKT and dry was 1.62/100M VKT
 - other injuries in wet was 0.49/100M VKT and dry was 3.8/100M VKT.

¹³⁹ The data is reported on the basis of incidents, not the number of vehicles involved or people injured in a particular incident.

¹⁴⁰ IMP, Vol 1, p.11.

¹⁴¹ Boundary of the DMR South Coast District commences at Logan River.

¹⁴² It is acknowledged that wet weather conditions occur only for a small percentage of the time, and that dry conditions predominate to a very large extent. Conversely, wet conditions, when they occur, potentially create a higher risk for traffic incidents.

A further analysis undertaken by the DMR of accident rates based on 100M VKT indicates the new motorway has the lowest accident rate for motorways in South-East Queensland.

14.4 QPS perspective

The Regional Coordinator of Traffic, South Coast Region, Queensland Police Service (QPS) furnished the following advice regarding safety issues on the concrete section of the motorway in wet conditions in response to my investigating officer's inquiries:

- Wet conditions on the motorway do not affect police operations, but it was acknowledged that visibility can be difficult because of the light colour of the concrete pavement (compared to the dark colour of bitumen), particularly during daylight hours. Night-time vision is somewhat better because of the reflective pavement markers.
- He was formerly a motorcycle traffic officer operating on the motorway and commented that, while more exposed to the elements than the occupants of enclosed vehicles, he did not feel the mist and spray were worse than on asphalt. It only appeared worse, in his opinion and from a visual perspective, because of rain blending in with the light concrete background.
- Motorists should drive according to the prevailing conditions. They should slow down if conditions so require. This advice applies to every road where, for example, heavy fog, rain or hail might impact on visibility.
- He is not aware of any aquaplaning problems or other complaints due to wet weather/visibility problems on the motorway, or that aquaplaning is a problem to any greater extent than on any other road where there are sheets of water on the pavement during heavy rainfall events.
- Accident statistics indicate that the motorway is relatively safe for motorists and vehicles, as evidenced by the massive reduction in crash incidents on the motorway compared to the Pacific Highway.

14.5 RACQ perspective

The RACQ furnished the following advice regarding safety issues on the concrete section of the motorway in wet conditions in response to a series of specific questions put to the organisation by my investigating officers:¹⁴³

Question 1

What is the RACQ's interpretation of the accident data (compiled from the PIRs)?

The crash data reveals that the overall safety performance on the Pacific Motorway (M1) has markedly improved since the upgrade.

- *Killed and Seriously Injured (KSI) and all injury crashes per 100M vehicle kilometres have reduced by at least four times since the upgrade, with over eight times less fatalities occurring over the selected five year periods.*
- *Comparing the crash rates of the asphalt section versus the concrete section after the upgrade (2000-2005) indicates that the asphalt section has recorded approximately 62% more KSI crashes and 56% more all injury crashes than the concrete section.*
- *Fatalities however, are greater on the concrete section but with a total of only 8 fatalities in the five year period (for the total section of the new motorway) this is a small sample. Further analysis into the fatality crash details such as atmospheric conditions, wet/dry road surface and other contributing circumstances may provide a better understanding of any safety concerns in the wet due to the concrete surface.¹⁴⁴*

Question 2

What is the RACQ's view on the safety of the concrete section for vehicles in wet conditions?

RACQ encourages drivers to lengthen following distance at any time when visibility decreases due to adverse weather conditions. In the case of the Pacific Motorway's concrete section, it is appropriate to increase following distance if mist / spray from vehicles ahead reduces visibility.

Visibility immediately behind vehicles travelling at high speed is reduced, however, the tail lights (including rear fog lights) help to distinguish a vehicle. Maintaining a safe following distance would allow more time for the water spray /mist to dissipate enough and provide a safe 'clear vision buffer zone' between vehicles.

Question 3

Is RACQ aware of any problems re aquaplaning and poor visibility?

The RACQ is unaware of any aquaplaning issues with the concrete road surface but is aware that the concrete surface does not drain water away as efficiently as more porous asphalt/bitumen. The Department of Main Roads has guidelines on minimum pavement friction/skid resistance as well as maximum water film thickness to prevent aquaplaning.

The RACQ is aware of visibility issues while on the concrete surface due to mist/spray from vehicles. The mist / spray seems to be exacerbated on the concrete section due to the non-porous nature of the concrete.

¹⁴³ Advice from the RACQ Manager Traffic and Safety.

¹⁴⁴ RACQ subsequently acknowledged that all eight fatalities occurred in dry conditions.

Question 4

Other than the reported (PIR) crash data referred to, is RACQ aware of any incidents of aquaplaning and/or poor visibility for motorists? Have any complaints or submissions been made to RACQ about these issues?

Motorists have reported visibility issues on the concrete section since the Motorway was constructed. Outside of the RACQ Unroadworthy Roads Survey, numbers of complaints received are relatively low, with approximately four or five complaints received by telephone and written correspondence in the previous 3-4 years. The 2001 and 2005 Unroadworthy Roads Survey results (were provided).

Complaints that have been received include the mist / spray issue as well as the poor contrast of the white pavement markings to the concrete surface. The RACQ drafted a letter to the Pacific Motorway Project Director on 27 July 2000 on these issues in question.

Ombudsman comment

The survey results indicated that with 13 adverse responses in 2001, the motorway (respondents particularly referred to the concrete section) ranked 16th in the Nation's worst major roads. In the 2005 survey, the motorway also ranked 16th worst road, but only six responses were received on this occasion. It is noted that RACQ is a Queensland-based organisation with membership comprising predominantly Queensland residents, thus skewing any survey results for roads in other states.

Members are therefore likely to be more exposed to Queensland roads, with a consequential tendency to be more critical of local roads if dissatisfied with a particular aspect. The small samples appear insufficient to warrant any meaningful conclusions on the merits of the motorway in relation to the surveyed issues.

Question 5

Does RACQ have any other relevant comments that might assist in our investigation?

RACQ has no other comments.

Question 6

Does RACQ have any suggestions for improving visibility on the relevant section of the motorway in wet conditions?

The RACQ is unaware of any remedial works that may improve visibility (reduce vehicle spray) on the concrete section of the Pacific Motorway other than resurfacing with a more porous asphalt/bitumen.

The RACQ's general recommendations are that in adverse/wet weather conditions it is best practice to:

- *Drive to the prevailing conditions by reducing the vehicle's speed to a suitable limit (and maintain a safe following distance).*
- *Make the vehicle easily identifiable by turning the vehicle's headlights on (and rear fog light also, if visibility is minimal, that is, if spray / mist from vehicles is reducing visibility of vehicles).*

- *Maintain at least double the safe dry weather following distance of two seconds during wet weather (that is, for cars, at least a four second gap between your vehicle and the vehicle in front in the wet). Maintaining a safe following distance during rain on the M1 will also increase visibility by allowing the water spray generated by vehicles to partially subside.*

NOTE - due to the propensity for a high amount of mist / spray on the concrete section of the Pacific Motorway, the Club's recommendation would be to choose an appropriate following distance suitable to the visibility conditions.

- *If visibility is extremely limited the driver should pull into a safe area, put on the hazard lights and wait until the hazard passes.*

14.6 Anecdotal perspective

Information available to me from some regular users of the motorway is that there is merit in the complaint that visibility on the concrete section of the motorway is difficult in wet conditions during daylight hours. Vision appears easier on the OGAC sections in wet conditions, perhaps because of the contrast between the black asphalt and white line marking.

On the other hand, night-time vision in wet conditions on the concrete section is said to be marginally better because of the reflective pavement markers on all lane markings.

14.7 DMR actions to improve visibility on concrete section

Advice from the DMR is that at the time of the opening of the motorway in October 2000, the lane markings, in lieu of painted lines, consisted of a raised reflective pavement marker (RRPM) followed by three pavement markers at spacings recommended in the Manual of Uniform Traffic Control Devices that was current at the time. A number of complaints were received by the DMR after the first rainfall event that the lane markings 'disappeared' on the concrete section of the motorway during wet conditions. DMR officers were of the view, at that time, that there may not have been enough colour contrast between the white pavement markers and the cream colour of the newly laid concrete and any contrast was being lost in the rain.

Therefore, the DMR trialed a black boundary line that circumscribed each RRPM with a view to making the markers more prominent. This trial did not provide any noticeable improvement in visibility of the lane markings in wet conditions. DMR then trialed a 150mm wide white lane line to complement the pavement markers, which in its opinion, has somewhat improved visibility and has been retained. A standard lane line is 80mm wide.

14.8 Analysis of safety issues

14.8.1 Crash data for motorway

The IMP contained crash data for the Pacific Highway between the Logan Motorway Interchange and Pappas Way, Nerang for the five year period from January 1991 to December 1995. DMR has compiled crash data for the equivalent section of the motorway based on PIRs for the five year period from October 2000 to September 2005. The RAIN complaint was specifically about safety on the 28 km concrete section of the motorway in wet conditions and the potential for vehicles to aquaplane due to pooling of rainwater on the pavement because of its alleged inadequate drainage.

From an analysis of compiled accident data (summarised in Part 14.3 of this report) it can reasonably be concluded that:

- the motorway provides a traffic environment that is at least twice as safe as that which existed on the Pacific Highway during the five year period immediately preceding the commencement of construction of the motorway;
- the accident rate on the motorway is relatively low compared to other major roads in South-East Queensland;
- wet weather has not been a significant factor in the cause of accidents on the motorway; and
- the accident rate on the PCC section is substantially lower than the accident rate on OGAC sections.

DMR advises that motorway pavement drainage has been designed to accommodate a rainfall intensity of 17mm/hour, which should normally allow motorists to drive at the posted speed of 110 km/h on the concrete section. However, all motorists should exercise common sense and drive at a speed no greater than is appropriate for the conditions at the material time. Neither QPS nor RACQ consider aquaplaning to be a problem on the PCC section of the motorway to any greater extent than exists on any other major road. Motorist behaviour and tyre tread are factors that can contribute to aquaplaning.

There is no evidence that the risk of aquaplaning on the PCC section of the motorway is any greater than exists on any other major road in South-East Queensland. QPS accident data do not indicate that aquaplaning is a noticeable cause of accidents on the motorway. My investigation did not reveal any evidence suggesting that the PCC section of the motorway is unsafe in either wet or dry weather conditions.

Opinion 14

There is no evidence that the risk of aquaplaning on the PCC section of the motorway is any greater than exists on any other major road in South-East Queensland.

Opinion 15

From an analysis of compiled accident data (summarised in Part 14.3 of this report) it can reasonably be concluded that:

- the new motorway provides a traffic environment that is at least twice as safe as that which existed on the Pacific Highway during the five year period immediately preceding the commencement of construction of the motorway;
- the accident rate on the motorway is relatively low compared to other major roads in South-East Queensland;
- wet weather has not been a significant factor in the cause of accidents on the motorway; and
- the accident rate on the PCC section is substantially lower than the accident rate on OGAC sections.

14.8.2 Motorist visibility in wet conditions

RAIN's other allegation about the safety of the motorway is that there is poor motorist visibility on the PCC section in wet weather caused by excessive mist from pavement/tyre interaction. Again, the accident statistics (discussed in Part 14.3) do not support the claim that wet weather has been a significant factor in the cause of accidents on the motorway or that the PCC surface increases misting to the point where it has been responsible for accidents. As both QPS and RACQ have suggested, it is likely that most motorists (rightly) adjust their driving behaviour in such conditions by reducing speed and increasing the distance/time between the vehicle immediately ahead in the same lane.

From Table 6 in Part 12.1 of this report, it is apparent that the DMR considers spray to be an adverse factor on the PCC pavement, assigning it a score of zero for that criterion compared with 100 (highest score) for OGAC.

Anecdotal evidence obtained during my investigation indicates that visibility is reduced in wet conditions on the PCC section and sighting of lane markings is difficult. A senior QPS traffic officer suggested that this may be because of the blending of the rain/spray with the light coloured background of the concrete road surface.¹⁴⁵

There is also anecdotal evidence that similar conditions are not encountered on other concrete pavements in Queensland (for example, Nambour–Yandina section of Bruce Highway) in wet conditions. This difference may be due to the vastness of the motorway pavement with a carriageway width of four lanes and relatively wide road shoulders for safety purposes compared to the Bruce Highway with two lane carriageways and generally narrower shoulders.

In response to complaints about poor visibility, the DMR has acted by:

- installing RRPMs on each lane marking (to assist motorist's auditory and feeling senses);
- highlighting each RRPM with a black border against the light coloured concrete surface/white line marking; and
- widening the lane markings.

The complainants claim that none of these actions has been particularly successful in significantly improving motorist visibility in wet conditions, especially during daylight hours. However, the RRPMs should at least improve visibility at night because they reflect vehicle headlights.

¹⁴⁵ Better visibility on bitumen roads in wet conditions may be due to the stark contrast of white linemarkings on the black pavement.

Opinion 16

Visibility of lane markings on the PCC section of the motorway is poorer in wet weather than on the OGAC sections.

Recommendation 22

DMR continue to investigate and, as appropriate, implement measures to improve motorist visibility of lane markings in wet conditions on the PCC section of the motorway.