The Experience of Running a Survey Contract in Tasmania

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ABSTRACT

The Department of Infrastructure, Energy and Resources (DIER) Tasmania looks after 3,500km of roads. To assist in managing the asset, the Asset Branch of DIER has implemented a program of pavement condition surveys. These surveys have been conducted by contracts since 1995.

The contracting out of road maintenance work began in 1998, since then knowledge of the network condition has become a critical tool for measuring performance, particularly as one of the three maintenance contracts is long-term performance based.

Whilst laser profiler surveys are conducted annually, the contracts were awarded for several years duration and resulted in one contractor providing the service over 10 years. This was not the case with other surveys, including skid resistance. The initial policy of conducting skid resistance surveys every three years resulted in one-year contracts going to different contractors operating different equipment. The incompatibility between the different sets of data, together with the long spacing between surveys for relatively short-lived seals, triggered off a revision of the strategy adopted for skid surveys.

Individual skid resistance surveys, that is, one every three years covering all or part of the road network, are useful to give a snapshot of the network. However, under these terms, it is unlikely that the same equipment would be secured by contract. More frequent and related surveys are critical when any longer-term monitoring of network skid resistance is required. If the testing is to be undertaken by contract, longer-term contracts have to be put in place to secure continuity of the equipment used in consecutive surveys.

1.0 INTRODUCTION

Tasmania is an island state with 0.5M population. The Department of Infrastructure, Energy and Resources (DIER) Tasmania looks after 3,500km of roads valued at A$2.6 billion (DIER 2004). To assist in managing the asset, the Asset Branch of DIER has implemented a program of pavement condition surveys conducted by contracts since 1995.

Since the contracting out of road maintenance work in 1998, knowledge of the network condition has become a critical tool for measuring performance, particularly as one of the three maintenance contracts is long term performance based.

2.0 BACKGROUND

The DIER network is divided into three operational regions. The NE and NW regions are under maintenance contracts where the contractor is responsible for routine and minor maintenance services. Long-term management, involving rehabilitation and reseal programming rests with DIER.

The Southern region maintenance is under a 10-year Long Term Performance Based (LTPB) contract which has another 3 years to go. Under this arrangement most responsibility is with the maintenance contractor, ie. rehabilitation and reseal programming, etc. DIER is contractually obliged to provide specific pavement data to the long-term maintenance contractor during the contract life. Long-term maintenance contract payments are linked to minimum performance criteria. Skid resistance assessment is linked indirectly into the payment.

Laser profiler surveys collecting roughness, rutting and surface texture have been conducted annually for the past ten years. The contracts were awarded for several years' duration and resulted in one contractor providing the service over ten years generating a comprehensive database. This has not been the case with skid resistance surveys. The initial policy of conducting skid resistance surveys every three years resulted in one-year contracts going to different contractors operating different units and even different types of equipment. The resultant incompatibility between the different sets of data, together with the long spacing between surveys for relatively short-lived seals, triggered off a revision of the strategy adopted for skid surveys.

3.0 WHY DO SKID RESISTANCE SURVEYS

The usefulness of skid resistance data has been debated and given various degrees of support in Australia and New Zealand (Austroads 2003). Questionable reproducibility of results, association with crashes, and significant costs associated with the testing have resulted in different levels of acceptance amongst state authorities.

DIER Tasmania included skid resistance in the pavement surveys for asset management of the network in 1995. The use of the skid resistance information has grown.

- Data is used as part of the criteria for selection of sealing and rehabilitation program candidates.
- It has been included as one of the performance indicators although not directly linked to payments in the long-term maintenance contract.
- It is used to monitor life performance of various sealing aggregates.
- The information is also used in selecting the right quality sealing aggregates for the right jobs.
- Although anecdotal evidence indicates links between wet surface and crashes, it has not been proven in Tasmania. Leaving proof aside, the number of wet crashes on DIER roads is significant. Wet crashes form about one quarter of over 2000 crashes reported annually (Table 1). The crash statistics list the highest order only, ie. each crash is listed only once.

Austroads, in Guidelines for Management of Road Surface Skid Resistance, 2005 quotes Dunlop, 2003 that implementation of a specific skid resistance strategy on the state highway network in New Zealand has reduced crash rates in wet conditions by 30% over 10 years. If only a small fraction of wet crashes can be prevented as a result of wiser management, the social and economical benefits are enormous. Bureau of Transport Economics (BTE 2000) 1996 costs per different severity crash are listed in Table 2. The new Crash System being introduced by DIER will allow a ready link between crashes and pavement condition data in Road Information Management System (RIMS).

Wet State Crashes	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
Property damage Not towed	140	165	191	188	194	218
Property damage towed	150	148	216	153	217	197
First aid	24	23	37	32	40	37
Minor injury	92	101	112	121	112	130
Serious injury	42	39	36	42	25	37
Fatal	5	1	9	5	3	7
Total	453	477	601	541	591	626
Wet - Proportion of All State Crashes						
Total (%)	18.9	19.4	26.4	25.2	21.2	26.3

Table 1 DIER Tasmania Reported Crashes - highest order only listed, (DIER 2005)

Crash Severity	*Per Crash (in 1996 A$)*
Fatal	1,652,994
Serious	407,990
Minor	13,776

Table 2 Summary of Crash and Injury Costs, (BTCE 2000)

4.0 SKID RESISTANCE SURVEY HISTORY

DIER has limited resources with most of its technical services outsourced under an alliance contract in 1998, the same time as maintenance contractors were appointed to look after the three regions. DIER has retained some technical expertise in asset management and contract delivery. Apart from one year of the LTMC looking after pavement performance surveys in 1999/2000, DIER has managed the data collection surveys via external contracts. It is unrealistic to expect that DIER will undertake future surveys in-house.

The skid resistance survey history is listed in Table 3. Table 4 describes contractual arrangements of the skid resistance work.

Year	*Activity*
1995	Pavement data collection program introduced. It included a skid resistance survey every three years, starting 1996. Carriageways to be tested in one direction only.
1996	First successful Scrim contract undertaken.
1998	Three maintenance contracts signed. Southern region's LTMC included pavement testing.
1999	GripTester used in the Southern region. Under variation to the LTMC, the survey was extended to include the other two regions. DIER was looking at a permanent changeover to GripTester. Return to Scrim was proposed on the completion of the 1999 survey.
2001	DIER negotiated takeover of the pavement condition surveys in the Southern region from LTMC. In addition, three years between the skid resistance surveys were seen as too long in the life of seals and surveys every two years were proposed.
2002	Scrim specified in one-year contract.
2004	Decision to have three years consecutive surveys (one contract) to build up coherent database. First survey under the new contract.
2005	Second survey included testing in both directions in one of the regions. Comparison of both directional data will help to confirm (or otherwise) DIER theory that one directional survey is representative of the network.
2006	Last of the three consecutive years surveys. Using the three-year data, DIER will establish skid resistance management strategy. This will also include the frequency of the surveys to be conducted.

Table 3 Skid Resistance Surveys History

Year	*Equipment*	*Type of Contract*	*Duration of Contract (years)*	*Contractor*
1996	SCRIM	Tender	1	RTA, NSW
1999	GripTester	LTMC (variation)	1 +	CSRE (Certs Inter)
2002	SCRIM	Tender	1	GeoPave, VicRoads
2004	SCRIM	Tender	1+1+1	WDM Ltd
2005	SCRIM			WDM Ltd
2006	SCRIM			WDM Ltd

Table 4 DIER Skid Resistance Contracts

5.0 CONTRACT

5.1 PLANNING

Being an island, there is a higher set up and validation cost. To optimise this, the skid surveys have been traditionally done on the whole network, one direction per carriageway. The assumption made, one direction representing both, is to be tested with 2005 data when both directions in the Southern region were tested. Subject to certain conditions, both directions in the other two regions will be tested in 2006. Whilst not proven, compatible network results with variation at local level are expected.

A combination of profiler survey with the Scrim was considered by DIER in 2004 but rejected based on a desire to maintain roughness surveys with the long-term provider as roughness is a performance directly linked into the LTMC payment.

The type and frequency of all pavement condition surveys will be influenced by the type of maintenance contracts to replace the existing maintenance contracts expiring in 2008.

5.2 TENDERING

As a government agency, DIER is required to put service purchases over a certain value to tender. DIER advertised the early skid resistance tenders in the national press. As there is a limited number of skid resistance service providers, and this field narrows further when specifying Scrim equipment, there was no public notice and the invitation to the last tender went to the Scrim owners operating in Australia and New Zealand only. Three were invited to tender, two responded.

5.3 PRICE

The tender prices for pavement data collection services may be erratic and increases of up to 140% in charges in consecutive tenders over two years have been experienced. This type of cost fluctuation is hard to justify to senior management when securing funding. Long-term contracts help eliminate this problem by securing a steady price for the duration.

5.4 TIMING

Tasmania has four defined seasons. The annual rainfall varies from more than 3 metres in the West to a tenth of this on the East coast. January to March, and possibly April, is the period of most stable weather and is the preferred time for pavement surveys. It minimises seasonal effect on the results and also coincides with the lowest Skid values as demonstrated in ARRB seasonal variation study (Oliver at al. 1988). DIER British Pendulum test data was also used in the study. The January to March timing of the surveys allows for the data to be provided to the LTMC by the end of April and is in time for DIER sealing program. DIER has been fortunate to secure all Scrim surveys in the January to April period. Unfortunately, because of the suitable weather all other road activities happen at the same time, resulting inevitably in data being missed because of roadworks.

5.5 TRAFFIC MANAGEMENT – SAFETY

The Traffic Management Plan is a prerequisite for tendering. In addition, surveys are advertised in the local press and traffic police in each region are kept aware of the activity. The safety aspect of all pavement surveys is taken seriously. Serious accidents have happened during past surveys. Traffic attenuators were used on a 20km/h PMS manual survey in 2002. They were considered inappropriate for the 50km/h travelling Scrim.

DIER is happy to work with the contractor and if possible, make his work more efficient without jeopardising safety. For example, some requests by contractors to work over Christmas and Easter breaks have been approved. This followed risk assessment and DIER staff being available on call.

5.6 REFERENCING

The road network has been segmented into manageable lengths called links, each on average approximately 10km long. The inaccuracy of link start/end locations is considered to be a significant contributor to poor repeatability. DIER uses a linear referencing system and copies of link maps are provided to the contractor. The start/end of links is marked on the pavement by a 450mm long thermoplastic line across each lane. Despite requests that markers be replaced after resealed over or otherwise or destroyed and regular upkeep by the asset group, a number of markers are missing at each survey.

GPS referencing is being considered as a back up for the markers. It is not the total solution as some sites with poor overhead clearance, such as forested areas or narrow road cuts, limit GPS usability.

5.7 REPORTING

The reporting format has been standardised and a comments column has become part of data reporting. Comments/entries relating to irregularities occurring during the survey, or any information that could shed light on the quality of data or indicate potential problems that may occur on later surveys, are a valuable source of information. Video, if taken during the survey, has a similar role.

5.8 METHODOLOGY

The RTA NSW Scrim Test Method T189 Determination of Skid Resistance by Sideways Force Measuring Equipment has been specified in all DIER Scrim contracts. Variations to this method had to be negotiated with non-RTA contractors. Changes included calibration and reporting. DIER accepted contractors' own temperature and speed corrections.

5.9 DATA QUALITY

Having confidence in data and knowing the data quality limitations are two major requirements for accepting the data.

The contractor's Quality Plan includes equipment calibrations, internal quality checks, etc. It represents the contractor's quality control. DIER asks for comparison of the equipment + team performance to 'others' traceable – at national or international level.

DIER has a sequence of quality assurance steps consisting of:

- Repeatability trials conducted at the start of the work are linked to a Hold Point. Ideally they are also linked with the previous survey data. Conclusion trials include repeated runs on the 'Repeatability trial' circuit. The circuit is about 6km long.
- Two road links, each 10km in length, are selected by DIER and testing is repeated.
- A third party appointed by DIER conducts a contractor's system audit during the survey.

Data provisionally accepted by DIER goes through a DIER validation process before it is accepted and entered into the RIMS database. The second contract payment (50%) is subject to the acceptability of the data.

6.0 WHAT IS ACHIEVABLE

6.1 EQUIPMENT CHANGES – SCRIM / GRIPTESTER / SCRIM

The 1999 survey by GripTester agreed to in the Southern region LTMC was extended to the other two regions for uniformity. DIER research of the equipment and its usage in Australia and New Zealand indicated GripTester could be a viable long term alternative to sideway-force action Scrim. Some of the appealing characteristics were GripTester's tyre used and its fixed-slip action resembling more a common car tyre and its action. GripTester's major drawback listed was its light duty construction. The correlation between Scrim and GripTester was seen as relative for straight flat roads with over/under estimation in corners and on grades (Cenek at al. 1999). PIARC's harmonisation trials in Europe in 1994 came up with a correlation formula (PIARC 1995) which was used to translate GripTester Numbers to SFC. The results were also corrected by the '0.78 factor' that relates to the early development of the Scrim device and its subsequent licensing in Australia (Austroads 2005).

Following the 1999 GripTester survey and the subsequent recovery of DIER responsibility for the condition surveys in the Southern region, return to Scrim was suggested and accepted by DIER and the LTMC. Scrim was seen as more suitable for the Tasmanian roads, the majority of which are rural roads, many with narrow and windy pavements. Scrim was more robust and testing was done in the travelling path. Local observations indicated that GripTester, towed behind the vehicle, had a tendency to diverge from the wheel path in tight bends, where accurate readings were considered critical. In addition, Scrim tested both wheel paths.

The 1999 GripTester data has been treated as a separate set when linking various skid resistance surveys.

6.2 OTHER CORRELATIONS

Based on 2002, 2004 and 2005 DIER Scrim surveys, following results were achieved:

- Repeatability trial results on the day, $r^2 > 0.80$, average values within 5%.
- Conclusion tests against the initial repeatability, $r^2 > 0.50$, average values 1-9%.
- Audit repeated tests against the original, $r^2 > 0.75$.

The correlation improved further when four-point rolling average (VicRoads/RTA 1996) or 100m instead of 5m data was used.

Comparison of annual surveys, based on average network values and without excluding the road network upgrades, average values 0-4% over two years, within 1.5% over one year.

7.0 CONTRACTING ISSUES

- Limited number of Scrim providers.
- Tendering process cannot guarantee continuity of association with one contractor or use of one machine from year to year.
- Linking consecutive surveys from potentially different providers results in unconformity of the equipment, test methods, etc. Whilst annual surveys ‘on their own’ have a merit, trying to model the network over time is a challenge.
- Long term condition key indicators restrict changes from one year to another, ie. linking pavement condition to payments in LTPB contract.
- Changes make 10 year long LTPB contract hard to administer. Often resulting in addition of new parameters without dropping any off.
- Balance between continuity and compatibility of data from year to year versus improvement / inclusion of technology advancement.
- Commitment of funding – always an ‘issue’.

8.0 WHERE IS DIER HEADING

- Whilst completing the existing LTMC, cannot make major changes.
- The type of maintenance contracts to replace the existing once in 2008 will influence the frequency and type of surveys in the future.
- The results of the three-year Scrim survey will be used to establish DIER’s strategy for management of skid resistance. Part of the strategy will be the

testing program. It will include determining network's representative sample (extent and direction) and frequency of the surveys.

- Reporting on the condition of the asset to the government is essential and has become conditional for national roads funding.
- Applications for increased funding have a better success rate if supplemented by relevant data justification.
- Commitment to HDM4 modelling has made data quality and currency essential.
- Once a solid database has been established and behavioural trends are understood, we may aim to reduce the frequency of surveys.
- There is a possibility of combining some of the automated surveys in the future to reduce costs and exposure to the travelling public.

9.0 WHAT HAVE WE LEARNED OVER 10 YEARS

Understanding your network is vital. DIER needs reliable pavement performance data to manage its network. It is essential for monitoring the network under maintenance contracts.

- DIER will depend on the specialised pavement surveys to be conducted under contract arrangements external to the agency.
- There is only a limited knowledge available elsewhere and some of this not applicable to Tasmanian conditions.
- DIER's understanding of what is happening with the skid resistance on the network should increase with the analysis of three consecutive annual Scrim surveys to be completed in 2006.
- Continuity of the same type of testing equipment helps in correlating individual surveys. Scrim has proved to be robust and suitable for Tasmanian roads.
- We need to maintain Scrim surveys, frequency and extent yet to be decided.
- Securing the same test unit to conduct consecutive surveys is critical.
- Securing a suitable site for long term monitoring is important.
- Safety aspect for the survey - working under open traffic conditions, minimise risks. There is the tendency of the contractor to get the most out of the field crew. Have imposed a maximum limit on field crew, 10 hours/day, work 6 out of 7 days.
- Impact attenuators are not suitable for the majority of the DIER network.
- Long-term commitment with the right contractor has huge benefits. One-off surveys have limited application.
- We cannot re-do tests ourselves but knowledge of the network, data checks and field inspections by experienced DIER staff are essential components of the surveys.
- We depend on available testing services as DIER cannot do the survey work internally.
- Recognition that the survey is not under standard laboratory conditions. There are too many variables. Reduction of the variables should result in better quality of data.
- DIER's commitment to HDM4 modelling leads to expectations of quality data.
- Test data can help justify maintenance funding to both state and federal governments.

10.0 CONCLUSION

Individual, ie. three yearly, skid resistance surveys are useful to give a snapshot of the network condition. However, under these terms, it unlikely to secure the same equipment/unit by contract for the next survey.

More frequent and related surveys are critical when any longer-term monitoring of network skid resistance is required. If the testing is to be undertaken by contract, longer-term contracts have to be put in place to secure continuity of the equipment used in consecutive surveys.

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