The Management and Benefits of Automated Survey Data Collection

Pam Ball
The New Zealand Transport Agency

Abstract

The New Zealand Transport Agency manages a state highway network of about 11,000 kilometres, valued at twenty five billion dollars. This network is vital for the transportation and freight demands of New Zealanders and New Zealand businesses. The Transport Agency's Highways and Network Operations business group has a direct responsibility to provide safe, efficient and reliable journeys for our customers. The business activities we undertake to achieve this are reflected in our customer service targets. One of the key service targets is pavement condition, which in turn impacts on safety performance rating, road safety improvements and maintenance intervention.

In order to fulfil the measurement and analysis requirements to identify any gaps in performance level, the Transport Agency's national performance management team procure high quality survey data for the entire network on an annual basis. Having a national survey, repeated annually, serves to standardise the performance framework across twenty four network management areas that make up the entire national network. As a result, long term trends can be analysed, national technical specifications can be developed and learning can be disseminated to support decision makers who have local knowledge of network conditions and customer expectations.

This paper will describe the survey contracts used and how they are managed to ensure the timeliness and accuracy of the data.

The result from the survey is an annual snapshot of the condition of our national state highway network, loaded into the Transport Agency's asset information database. This includes: skid resistance, texture, roughness, rutting, geometry, GPS and also network video. The paper will describe how the information from the survey is used to provide annual trends enabling better management of the state highway asset.

1 INTRODUCTION

Using technologies that deliver high quality reliable road data contributes to the New Zealand Transport Agency's vision to be a world leader in roading solutions. There are multiple stakeholders within the Transport Agency using pavement condition data to develop policies and procedures for asset management, safety and performance. The project to deliver reliable pavement condition data involves two key contracts, one for the annual surveys and one for professional services.

Clear communication of client requirements, right from the procurement stage, is vital to success and suppliers also need to understand the characteristics of the state highway network and the management structure of the Transport Agency. Accordingly, this project is run as a three way partnership with lively interactive meetings at the start and end of each survey season.

Through the contract specifications the Transport Agency defines the scope and deliverables for each contract. The survey contracts include management, equipment specifications, calibration and validation standards and procedures, survey methodology, data delivery and reporting. The professional services contracts include project management, technical expertise and advice, data validation and loading, reporting, and developing physical works contracts.

The project and data requirements are the responsibility of the Transport Agency's national information team from procurement through to storage and availability of survey information. The team works together with the key stakeholders within the organisation to ensure the information is useful for supporting fundamental asset condition analysis and decision making.

1.1 SURVEY HISTORY

The first survey contract was let in 1991 which was only for SCRIM and was carried out by VicRoads. The results from this survey indicated a significant amount of the state highway network was below a desired skid resistance level. Another SCRIM survey was carried out by WDM in 1995. This confirmed the findings of the first survey and provided locational details accurate enough to be able to investigate and treat sites as appropriate. Since then the Transport Agency has experimented with various formats including surveying alternate side of the road each year. By 1999 it was agreed that both sides of the road needed to be surveyed each year for SCRIM and for other data such as profile, rutting, texture and geometrics.

The procurement model from 1999 to 2002 split data collection into two separate survey contracts, one for the survey of Skid condition data (SCRIM) and the other for survey of geometric and pavement condition data (HSD). The tenderers had the option of tendering for individual contracts or a combined contract. WDM won with a combined tender, providing considerable cost savings by using one vehicle for all data collection. Although splitting the contracts allows for more competition, these cost savings resulted in subsequent contracts developed in 2006 and 2012 continuing with full data collection as one single physical works contract.

The long tenure of the HSDC contract by WDM has resulted in a consistency of survey data that the Transport Agency not only depends on but has a high investment in.

The earlier HSD contracts in the 1990s were managed without an independent MSQA role. In the late 1990's expert technical support, analysis and advice was provided by the then

named Opus Central Laboratories which resulted in the development of validation methodology using reference devices along with a 100km trial. The advantage of having technical support for the contract was recognised through the introduction of a Management, Surveillance & Quality Assurance of Physical Works (MSQA) contract for professional services to the contract. As well as technical support, the professional services role addresses the demands for project management and independent data quality auditing and loading. Starting from 2001 there have been two contracts completed prior to the current one and both of these have been successfully won by Opus International Consultants Ltd. It should be noted that the development of the validation methodology, that is so crucial to the reliability of the survey project, was also shared with other agencies, particularly Austroads and individual State Authorities and the World Bank.

1.2 PROCUREMENT

1.2.1 Strategy

The current High Speed Pavement Condition Survey Contract (NO 11-754) is an openly tendered traditional 7 year measure and value contract. Commencing in 2013, the contract has been allocated an initial period of 3 years with the provision of two 2 year extensions. The supplier selection method was based on a non-price attribute weighting of 70% to ensure appropriate value was given to quality attributes. Letting the survey contract as a physical works contract allows the Transport Agency to contract out an MSQA contract for the professional services.

The latest professional services contract (NO 13-904) also commenced in 2013 and has been let for 3 years with a provision of two 1 year extensions. The supplier selection method used was the simple price quality method, with a non-priced attribute weighting of 80%. The terms for the contract length and the allocated attribute weighting are aligned with the Transport Agency's maximum recommended procurement strategy thresholds for this type of contract. The 80% non-priced attribute weighting is indicative of the value placed on continued supply of quality data and was used to minimise the risk to data quality should a new supplier be successful.

The professional services contract covers the project management of high speed pavement condition surveys, Falling Weight Deflectometer surveys and also, advice on a new Traffic Speed Deflectometer Survey which is being introduced. To maintain total separation of the professional services and physical works components of the survey project, the selected supplier for the professional services contract is not eligible to tender for any of these physical works contracts (surveys) which are let by the Transport Agency as part of the services to the professional services contract.

1.2.2 Market Analysis

Due to the very specific requirements the Transport Agency has for the survey machine, the 2012 HSDC contract procurement strategy identified two aspects of the contract that would need extending in order to enable competitive tendering. Firstly, was the lead in time to the contract and secondly, the length of the contract period.

The supplier market had been restricted in the past by the Transport Agency's specification for the equipment which required skid resistance to be measured using sideways force coefficient compatible with previous surveys, and that all other condition data must be collected by the same vehicle. Also, unique to the Transport Agency is the specification for two skid measurement wheels on the skid machine, one in the left wheel path and one in the right. These requirements mean that any new tenderer would need to have a vehicle built or extensively modified to satisfy the contract conditions.

A lead in time of 18-20 months was deemed necessary to give the supplier sufficient time to get a new survey vehicle built and then fully road tested in New Zealand conditions prior to the survey. The large capital investment required to build a suitable vehicle was recognised in the recommendation for a seven year contract rather than five, giving a more reasonable timeframe to recoup the investment costs.

1.2.3 Performance Assessments

The Transport Agency runs a Performance Assessment Coordinated Evaluation system (PACE) to record each supplier's scores from annual appraisals. The appraisal is used to assess the supplier's culture and measure the supplier's success in meeting key contract objectives.

Most significantly these PACE scores are directly applicable to evaluation scores for suppliers of current contracts when awarding the one or two year extensions applicable to the contract and for future contracts when working out a supplier's track record score during the tender evaluation process of awarding a contract.

1.3 NETWORK FEATURES

The NZ State highway network has a number of different areas and sites that are significant to the operation of the survey:

24 Network Management Areas

The New Zealand Transport Agency operates through 10 regional offices. The state highway network is divided into 24 Network Management Areas (NMAs), with each regional office responsible for a number of these. For any national project such as the High Speed Data Survey this means working with multiple client representatives as well as consultants providing professional services for maintenance contract areas. The survey programme is designed to collect the survey measurements for each NMA at a consistent time each year and as each area is completed, the data is delivered and the results are distributed to the NMA staff.

15 Seasonal Skid Resistance Control Zones – 114 Seasonal Correction Sites

Throughout the network there are 114 seasonal correction sites which are five kilometers long, these are grouped within 15 seasonal control zones. Each year these sites are surveyed at evenly spaced intervals, before, during and after the main survey run. A correction factor is produced from the sites within each zone and applied to the survey results to normalise the variance in skid resistance, both within the year, the Mean Summer SCRIM Coefficient (MSSC) and between years, the Equilibrium SCRIM Coefficient (ESC).

3 Traffic Management Levels

The extent of the survey incorporates three different traffic management levels reflecting intensity of traffic and associated risk. All survey activities must be carried out with a Traffic Management Plan (TMP) which is approved by the Road Controlling Authority (RCA) or delegated person. Development of TMPs requires accreditation in the NZTA Code of Practice for Temporary Traffic Management (COPTTM) system. For the survey a generic national TMP is supplied by the survey contractor for approval and provided to each NMA. A second NMA specific TMP is produced to address local conditions and restrictions.

68 Territorial Local Authority Boundaries

New Zealand also has 68 Territorial Local Authorities (TLAs) managing local road networks. The survey contractor must liaise with local authorities as necessary for approval or formal consent to obtain water for the survey vehicle. Additionally, although the Transport Agency's survey does not include local authority networks it is expected that survey services will be available to be carried out if requested.

23 Validation Sites

A set number of sites generally representative of the pavements to be surveyed are selected by the contractor so that all equipment can be operated in a normal survey configuration and repeatedly demonstrate consistency of results in New Zealand conditions. These validation sites are marked so that the contractor can return for repeat validation when necessary. The sites can be on the state highway network or on a TLA network, providing they meet defined characteristics. If they are on TLA networks then approval from the TLA is necessary.

The number of validation sites for each function of the survey equipment is detailed below:

Parameter	Minimum No. of sites	Minimum site length
Roughness	5	500m
Transverse profile (rutting/shoving)	4	300m
Skid Resistance	5	500m
Texture	5	200m
Geometry	4	500m

As long as a selected site meets the specified texture and surfacing requirements it could be used for more than one of the validation parameters, so there can in fact be less than 23 sites although 23 validation runs will be required.

A 100km Trial Validation Route

Similar to the validation sites the purpose of the 100km trial route is to evaluate the equipment and operator working in normal survey conditions. This route is selected by the consultant and all normal survey data requirements and reporting outputs are generated and validated.

56 Benchmark Monitoring Sites

The Transport Agency has approximately 56 benchmark sites on the state highway network that are part of a long term pavement performance (LTPP) programme. These sites are monitored closely and maintenance work is restricted in order to develop trends over time and understand the natural pavement life cycle. The sites are monitored both in terms of more detailed inventory knowledge and more detailed survey information independently to the national pavement condition survey.

The benchmark sites are surveyed at consistently spaced annual intervals and four repeat survey runs are collected for high speed data and SCRIM under the High Speed pavement Condition survey. Locational accuracy is highly important for this benchmark data so a trigger device is used to record the start and end of each run.

5 State Highway Classifications

State highway classifications are used to categorise highways based on their function and different levels of service are applied to different classifications. The criteria for each category include thresholds for size of population centres, traffic volume, freight volume and tourist numbers.

The New Zealand State Highway Classification categories are: National Strategic, National Strategic High Volume, Regional Strategic, Regional Connector and Regional Distributor. Although state highway classification does not directly affect the collection of survey data, it is implicit in pavement design and the evaluation criteria of pavement condition when planning treatments. It is also important in providing a relevant method of comparing pavement condition trends across NMAs.

2 USING SURVEY DATA

The following policies and practices demonstrate ways in which the survey data is integrated with asset management, safety and performance.

2.1 SKID RESISTANCE POLICY

In order to provide a consistent, proactive approach to the management of skid resistance, the Transport Agency has developed and implemented T10, the Specification for State Highway Skid Resistance Management.

The measurements for SCRIM and macrotexture provide the basis for identifying safety thresholds and investigatory levels which enable nationally managed prioritisation of treatments. The Transport Agency's regional performance managers are responsible for confirming or changing these investigatory levels to ensure national thresholds accurately reflect local conditions.

There are two cycles of programming each year. Immediate reactive programming of treatments can occur when each NMA receives their Exception Report which is a list of accurately located 10m sites that are 0.1 below the Investigatory Level (IL) or below a set threshold level for macrotexture (ILM). Then, at the end of the survey once the data has been seasonally corrected, further analysis and longer term planning is carried out using equilibrium scrim coefficient (ESC) measures.

2.2 SKID SITE CATEGORIES

Essentially the network is divided up into sections referred to as Skid Assessment Lengths and these are given a site category based on either a geometric or operational characteristic. Curves, gradients, approaches to crossings and intersections, etc., determine ILs for skid resistance whereas surface type and traffic speed are factors that are considered when determining the ILMs. The site category determines the acceptable or safe ESC threshold for a specific section of road.

Site categories were historically provided by the contractor for each 10m section using survey measurements and manually entered event codes. From 2011 these event codes and the associated ILs have been stored in the state highway database in the Skid Site Category table and provided to the contractor prior to the survey. The Transport Agency's regional performance managers review the ILs to confirm they are appropriate or allocate alternative ILs and notify national office of the amendments and the reasons for change.

2.3 EXCEPTION REPORTS

As each NMA survey is completed, selected survey data is delivered to the consultant, processed through further data quality checks, and even before loading into the state highway database it is sent to the NMA in the form of a SCRIM & Texture Exception Report. The Exception Report allocates a priority 'A' rating to any section that has SC or Macrotexture below the safety threshold level. For further information please refer to a paper in this conference by Whitehead and Donbavand "Prioritising State Highway Skid Resistance in New Zealand – A policy for all budgets". The purpose of delivering the report as early as possible after the survey data is collected is to highlight sites that need urgent investigation and if necessary, reactive treatment, which can then be carried out during the same summer season as the survey. Accompanying the Exception Report is a Skid Event Discrepancy Report. Skid event codes that are hardwired in the state highway database are cross checked with event codes entered manually during the survey to supply network information relating to incorrect codes or network changes that need resolving.

2.4 ANNUAL PLANNING

Forward Work programmes are developed for 1, 3 and 10 year periods and planned work must be justified. Pertinent evidence supporting a programme comes from the condition data. Due to tightly constrained budgets, each NMA is allocated a Base Renewals Preservation Quantity for rehabilitation and resurfacing and the programme is developed within these bounds. Prioritisation analysis is a new process to improve objectivity of selection of proposed treatments. The bulk of the information comes from the high speed data survey. The network is broken into 100m lengths and parameter scores for each survey measurement, categorised by state highway classification are used to establish

whether a site needs investigating. During investigation, sites are inspected and prioritised for treatment.

2.5 PAVEMENT CONDITION REPORTING

Each year pavement condition data from the annual survey is combined with traffic volume estimates, surfacing records and crash data to create the State Highway National Pavement Condition Report. This report shows the trends occurring over the latest 10 years and allows comparisons between NMAs to be made. Four primary uses for condition information, are:

- To demonstrate stewardship of network performance as published in its annual report
- To satisfy stakeholder interest in how the network is performing
- To allow road users to match expectations of condition with physically measured condition factors
- To allow network Managers to assess the results of their investment decisions and request adjustments to the annual allocations to meet the service levels for network condition

Condition measures are reported in terms of State Highway Classification due to the link between classification and service levels.

2.6 TRANSFER OF SURVEY DATA TO OTHER SYSTEMS

A number of software applications aside from the state highway database use the annual pavement condition data. There is a cost involved in providing data to other systems and there are also coordination challenges in keeping the supplied datasets up to date. So there is a trade-off between having 'one source of truth' and opening up the availability of the data for maximum benefit. The Transport Agency safety team's KiwiRAP Analysis Tool (KAT) has been developed by Argonaut Ltd and is used for rating road safety potential including 'what if' scenarios for planning. Also developed by Argonaut is the web based video application Road Runner. This adaptation of the network video collected as part of the HSD survey has proven to be extremely useful for Transport Agency staff and external suppliers. Demand for the latest video starts with requests to national office well before the survey ends each year. For the last two years the Transport Agency has also engaged Juno Services Ltd to provide access and training for their JunoViewer software which is used to view and analyse network condition data in multiple graphical formats and incorporating other datasets such as forward works programmes.

3 PROJECT MANAGEMENT

This project starts from a point of certainty that pavement condition data is crucial to decision making and measuring levels of service. The objective of the project is to ensure that the Transport Agency remains at the international forefront of survey condition technology and that maximum leverage is gained from the data collection outputs. For every aspect of the survey there is a team or person with the necessary interest and technical skill to take responsibility for the detail.

Responsibilities for the management of the project by national office include support from experts in procurement, finance, and information management for:

- Procurement and management of survey and MSQA Contracts
- Undertaking and storing supplier performance appraisal information
- Financial management including allocation of budgets and approval of payments
- Providing and maintaining a database structure to store survey data and related information such as seasonal correction factors, site categories, skid assessment lengths, etc.
- Providing annual network information including GPS triggers
- Data management procedures for loading survey data and coordinating the supply of other datasets such as crash, traffic volumes, surfacing records and maintenance activities
- Managing research projects
- Defining a project programme

The successful utilisation of the survey information relies on ownership of the systems, procedures and the resulting data by Transport Agency staff who may not necessarily be directly involved in the project management. In particular the teams responsible for pavements, asset management and safety are relied on to:

- Provide technical advice leading to research initiatives relating to either the reliability, effective use or improvement opportunities for survey data collection
- Develop and implement a skid resistance policy
- Develop and implement annual planning processes using survey measures, including nationally managed treatment site selection and inspections
- Manage the Skid Technical Advisory Group (STAG) to promote a wider regional understanding of skid resistance issues
- Review and approve generic Traffic Management Plans

Representatives from the Transport Agency meet with key personnel from the contracts at the start and end of each survey. Each meeting is an all-day event and the result is that all those involved have a clear understanding of the detail of the project and what the client requirements are.

Clear communication of client requirements underpins the success of the project, from contract documents, to formal reports, to website information, to informal communication. The contracts are run in a culture of partnership between the client, the professional services supplier and the survey contractor.

3.1 THE HIGH SPEED PAVEMENT CONDITION SURVEY CONTRACT

The ultimate objective of the survey contract is for the delivery of high quality, reliable road condition data. Fundamentally, this means completion of the annual surveys, covering approximately 23,500 lane kilometres, collecting the following data:

- Skid resistance in both wheel paths measured using a Sideway-force Coefficient Routine Investigation Machine
- Texture (both wheel paths and mid lane)

- Longitudinal profile in both wheel paths, to collect roughness and profile variance
- Transverse profile, to collect rut depth and shoving
- Geometry, to collect gradient, cross fall and curvature
- GPS coordinates for mid lane
- Network video

Additional survey runs are undertaken prior to the survey for validation purposes and throughout the survey to collect benchmark and seasonal control site measures.

Due to the high reliance of the Transport Agency on the survey data, detailed explanations of the deliverables required to achieve a satisfactory outcome are documented in the project specification of the physical works contract. The following sections contain a summary of core components of the contract.

3.1.1 Contract Management

A Contractor's Quality Plan (CQP) is developed by the contractor to provide evidence that the contract requirements are fully understood and that the appropriate processes are in place to insure the delivery of the contract works. The plan includes documented protocols for systems, staff and procedures, not limited to the actual road condition survey but also including contingency planning, monitoring compliance, auditing, implementing corrective actions and measuring effectiveness of those actions. It also covers procedures for equipment calibration and validation, software validation and data management. The CQP is delivered in year one of the contract and audited and reviewed annually. The consultant must agree to the CQP before any programmed work begins.

The contractor supplies an initial programme showing the baseline programme and the proposed cash flow for the contract period. An updated programme is provided each month during the survey in order to monitor progress, track deliverables and delivery timeframes and report survey results to NMAs.

As well as reporting on programme progress through the delivery of weekly and monthly reports, the contract provides a number of technical reports. Each year, reports on the outcomes of calibration, pre-validation and validation of equipment must be signed off by the consultant prior to the survey commencing. Exception reports and Skid Event Discrepancy reports are delivered for distribution to NMAs as the programme progresses, this enable reactive work to be identified and carried out during the summer sealing season if safety is an issue. A Traffic Management Plan is also required for each NMA prior to the start of the survey.

3.1.2 Equipment

It is essential that the data is collected to a high standard and is comparable with data from successive annual surveys. For that reason, there are comprehensive calibration and validation procedures; these are detailed in the following section. Additionally, the contract specifies minimum requirements for all survey equipment, from the vehicle configuration, to the on board instruments, to software and video equipment.

Using one multifunction vehicle is preferred by the Transport Agency as it means less cost and better spatial agreement of skid resistance, texture, road geometry and video. The

vehicle must be capable of surveying at or near the operating speed of the highway so as not to disrupt traffic and all equipment housings are limited to the legal width and height maximums. Video equipment is aligned parallel to the centre of the vehicle axis and mounted to minimise vibration.

The on board equipment is located at defined wheel path spacing's. Separate minimum standards are set for skid resistance, longitudinal profile, transverse profile and GPS. The parameters for resolution, range, sampling interval, frequency, operating temperature, long term drift and repeatability are tabulated in the contract.

The equipment incorporates software capable of recording and processing all data. The software systems are flexible and provide additional processing power and additional data storage capacity for potential future demands.

3.1.3 Calibration and Validation

The importance of equipment calibration and validation cannot be stressed enough. Confirmation that each survey will result in reliable, reproducible, and repeatable data is critical to the project; almost half the project specification defines requirements and acceptance criteria for this process. Reports on equipment calibration and validation are supplied by the contractor and the consultant is entitled to be present during the validation and can request samples of data at any time. The annual survey only begins after the consultant gives approval that all equipment is satisfactorily calibrated and validated.

All equipment and measuring systems must have current and appropriate calibration certification, traceable to international standards. The Transport Agency requires independent confirmation that the vehicle performing the skid resistance measurements would be accepted for use on the UK Highways Agency network. This means the survey equipment needs to participate in an approved TRL correlation trial. The objective of this is to be certain the measures made by the machine are within certain precision limits and comparable to the other machines in the trial.

Another UK certificate the contractor must obtain is an accreditation certificate to carry out SCANNER accredited surveys and provide evidence that the algorithms and software codes align with those for which the accreditation certificate applies.

The process for validation involves the four stages listed below, with each stage being a prerequisite to the next.

- **A Pre-Validation Report** is delivered, advising what equipment is to be validated, what the proposed validation sites are and how the reference data will be established for use assessing the performance of the equipment during validation. (Texture measurements are collected using a reference device meeting the minimum requirements of ISO/13473-1.)
- **Equipment Validation** is carried out by operating the vehicle in normal survey configuration to test that all functions of the equipment meet pre-defined acceptance criteria based on modified requirements to Austroads Test Methods.
- **A 100km Trial Validation** route encompassing all conditions is selected by the consultant and surveyed by the contractor. This is to validate the survey equipment and

operator and to validate the data processing and reporting procedures in operational mode.

- **A Validation Report** consolidating all the information relating to calibration and validation is provided to the consultant to review and return within 2 weeks. Responses and corrective actions are formal and itemised. Once the report is signed off by the consultant the survey can begin.

During the survey period test methods for ongoing repeatability and bias checks are carried out at least monthly and the results are reported to the consultant.

3.1.4 Pavement Condition Surveys

The annual survey programme is planned in such a way as to enable completion of an entire NMA where possible, before commencement of the next. In this way data is processed and delivered throughout the season as each NMA survey is completed.

Each year the national information team supply the contractor with two datasets from the state highway database:

- A reference network, this is a road list with linear displacements at 10 meters and corresponding GPS coordinates.
- Hard coded event codes

The methodology for recording location is based on the Transport Agency's Linear Reference Management System. The contract specifies the locational tolerances, remedial procedures should the measurement not be within tolerance and the methodology for fitting measurements to road lengths.

The survey measures are taken from the outside lane in both directions and along all ramps. For motorway sections in the four main cities all lanes are measured. In addition to the standard survey requirements each year the contractor is required to perform repeat runs of specially identified sections for benchmark monitoring and seasonal control sites.

Network video is collected to have an historical record of the roading network and provide evidence of road condition and deterioration. Efficient capture of video simultaneously with other survey measures limits the contractor to operating during daylight hours.

3.1.5 Data Delivery and Reporting

The contractor supplies two levels of data for each NMA, raw data and processed data. Raw data is the record of measurements recorded by equipment and differentially corrected GPS coordinates for lane centrelines. Processed data is raw data processed and supplied in a format for loading into the state highway database. This is summarised to 10m or 20m intervals and also in the case of roughness, aggregated to 100m intervals.

The data and associated reports have a contractual delivery timeframe of 10 days. If the consultant finds discrepancies when reviewing the data, the contractor is asked to correct the error and redeliver within 5 working days. If there are still problems with the resubmitted data, the cost for further review can be charged directly to the contractor.

Network video files have a different delivery timeframe, being delivered on the 20th of the following month. As well as providing video and video calibration files the contractor supplies software and technical support for viewing\reviewing the video footage.

The data delivery includes associated data and trending reports. These are data summaries which assist the consultant in pinpointing anomalies and confirm the survey is comparable with previous years.

There are also two contract reports relating to data. One is a Data Formats and Definitions Report which is a reference document providing detail to enable the replication of processed data. The other is a report providing year to year changes to the equipment or data processing algorithms. This will alert the client to any changes that will impact on trends. At the end of each survey an Annual Survey Report is supplied summarising all the operational issues encountered and any actions taken.

3.2 THE PROFESSIONAL SERVICES CONTRACT

The decision to acquire a Management, Surveillance and Quality Assurance (MSQA) consultant for the survey was carefully considered by the Transport Agency in 2002 when the first professional services contract was let. This decision has been revisited during the procurement strategy development procedure when subsequent contracts were let in 2006 and 2013.

The two key considerations are:

- The need for an independent expert adviser to the contracts
- The need to devolve the project management of the contracts to an outside supplier

The Transport Agency has found from experience that throughout the contract period there are times when independent expert advice on technical matters is essential. This advice is specifically valuable to ensure the annual calibration and validation for the high speed data survey is thoroughly checked and audited. Having the project management in house would require additional internal resource and would divert the Transport Agency's role from strategic to operational due to the day to day demands of contract management.

With formal approval to acquire the services of a consultant to fulfil this role, the current contract has been awarded and includes the following activities (with approximate value as percentage of contract value).

Activity	% of contract value
Project management / PQP /Reporting	2%
Tender documentation / administration / evaluation	5%
MSQA of HSD validation trials	7%
MSQA of annual HSD surveys	52%
MSQA of annual FWD surveys	6%
Additional services – research and expert advice	28%

3.2.1 Technical Expertise

There are five specific tasks that require technical expertise:

- Verification of calibration reports and advice on survey equipment and instrumentation including equipment used to collect reference measurements
- Review of validation reports supplied by the contractor and input into refining the procedure
- Validation of survey data prior to loading to the state highway database
- Reviewing seasonal correction factors
- Proposing and carrying out research projects

The consultant also understands of the development and application of the Transport Agency's skid resistance policy and works with the national pavements team by being a member of STAG.

3.2.2 Project Management

It is the allocation of project management and in particular contract management responsibilities that frees up Transport Agency staff from the day to day running of the contracts. The consultant:

- Attends to project Quality Plans, Contractors Quality Plans and Traffic Management Plans
- Ensures the appropriate bonds and insurances are in place and kept current
- Issue certificates of practical completion and defects liability
- Monitors the contractors programme
- Completes annual evaluations of the contractors performance
- Undertakes financial management including budget forecasts, accruals, payment certificates and release of retentions
- Maintains a risk register itemising potential risks and risk mitigation measures
- Responds to client, customer and stakeholder requests
- Develops the relationship with the contractor to support the delivery of contract outcomes

3.2.3 Data Validation and Loading

The consultant carries out a full range of data checks for errors and suspect data. Validation of data prior to loading covers all deliverable datasets outlined in the survey contract. Any concerns are communicated back to the contractor for correction or explanation. This feedback is an important efficiency improvement for the delivery of quality data from the contractor. A high level summary defining robustness of data (key statistics) in terms of regional and year to year variation is completed prior to uploading data to the state highway database. In order to safeguard timely delivery of quality survey data, each stage of this data delivery flow has contractually agreed timeframes.

3.2.4 Business Communication and Reporting

Various formal reports are required throughout the progress of the surveys including a comprehensive annual report. Examples are:

- The validation report and 100km trial review
- Seasonal correction methodology and results
- Exception reports and discrepancy reports

Survey progress is tracked and the consultant is responsible for the Transport Agency's website publication of each current survey programme. To monitor survey progress in more detail, the programme deliverables are reported weekly to show survey completion, data delivery, reporting and loading timeframes achieved.

The consultant issues formal notifications to the contractor as well as being available 24/7 by phone to support and advise the contractor when required.

The current professional service contract specifies that reporting should transition to a web-based communications workspace rather than email to enable:

- Efficient knowledge transfer
- Transparency of programme delivery
- Enhanced team co-ordination

This is seen by the Transport Agency as a preferred communication tool for weekly reports, weekly, monthly and annual programmes, and quality assurance and compliance information.

3.2.5 Tender Documentation / Administration / Evaluation

A significant benefit is gained by having an MSQA consultant when the physical works contracts need renewing. The current High Speed Pavement Condition Contract was prepared by the consultant during the period of the 2006-2013 professional services contract. The consultant was included in the tender evaluation team and post award discussions and as a result they have in-depth knowledge of the survey contract specifications. The same service is provided for contract documentation of other surveys.

As the Transport Agency is an active member of Austroads, the consultant also provides ongoing advice regarding the alignment of requirements with the Austroads draft specification and ensures that the contracts are written with appropriate insight.

4 CONCLUSION

Since the 1990s the Transport Agency has worked in conjunction with cooperative suppliers to develop robust procedures for procurement, validation, and data quality control. A strong relationship of trust has developed which has proven to be beneficial in the delivery of pavement condition data critical to the Transport Agency in managing asset preservation and safety investments.

Author Biography

Pamela Ball in her role as Asset Information Manager for the Highways and Networks Operations group at the New Zealand Transport Agency, Pam is responsible for the project management of collection and supply of nationally managed asset information contracts including high speed data, skid, falling weight deflectometer surveys and professional services. She provides support services to the Transport Agency staff as well as external suppliers using the Transport Agency's asset information systems regarding functions, procedures, data quality and interpretation. She is also a member of the Skid Technical Advisory Group - the group responsible for overview and management of the state highway skid resistance policy.