finalreport

Animal Health and Welfare

Project code: **AHW.125**

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Date published: **August 2007**

ISBN: **9781741911725**

PUBLISHED BY
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Locked Bag 991
NORTH SYDNEY NSW 2059

Assessing livestock land transport practices for journeys greater than 6-hours in Australia to benchmark animal health and welfare outcomes

Land Transport Study

Abstract

This study aimed to improve understanding of patterns of land transport of livestock in Australia with a focus on animal welfare outcomes and journeys longer than 6 hours. A staged approach was used to first examine the usefulness of historical records, then develop methods for collecting prospective data from transport events. The third stage involved preparation of a proposal for a follow-on project applying methods developed in stage 2 to produce a nationally representative picture of land transport practices across Australia for journeys greater than 6 hours.

Historical records do not provide sufficient detail on variables of interest to allow these data sources to be used for investigation of livestock transport characteristics and animal welfare outcomes.

Methods were developed and tested in a pilot study in Queensland for prospective collection of data from transport events. The preferred approach involved having a person present at the point of unloading to collect data. These methods were evaluated and the benefit and feasibility of conducting a national study was considered.

A detailed proposal was developed for a national study to characterise land transport practices and animal welfare outcomes across Australia for journeys greater than 6 hours.

Options for routine, ongoing collection of data for monitoring and reporting on land transport events and animal welfare outcomes were identified. Recent developments in welfare standards and quality assurance programs offer considerable promise. In the longer term development of a centralised electronic recording system perhaps integrated with the existing National Livestock Identification Scheme (NLIS) offers the best combination of functionality and benefit.

Executive Summary

This study represents an industry driven initiative to improve understanding of the complex animal/journey interactions which are part of land transport of livestock in Australia with a particular focus on animal welfare outcomes (mortalities and injury or illness) and journeys longer than 6 hours.

A staged approach was used to first examine the usefulness of retrospective information derived from stored records on transport events as a way of meeting the study objectives. The second stage involved a pilot study in one state to develop and test methods for collecting data from transport events as they occurred (prospective data collection). The third stage for this project involved the preparation of a project proposal designed to apply the methods developed in stage 2 to multiple states and territories around Australia in order to be able to produce a nationally representative picture of land transport practices across Australia for journeys greater than 6 hours.

The response to the project from industry organisations and individuals was positive and access was provided to historical records under activities associated with Objective 1. Data from 35-54 transport events per visit were collected from trucking companies, abattoirs, feedlots, agents, saleyards and a pastoral company, and from four States (NT, QLD, Vic, WA). A number of statistical quality issues were identified including incomplete or missing data, difficulties in accessing data from multiple paper records stored in ad-hoc conditions, and lack of coherence (inability to effectively trace or link mortality records from one system or database to transport information stored in paper form). Historical records (paper and electronic) concerning livestock transport events did not provide sufficient detail on variables of interest to allow these data sources to be efficiently and effectively used for investigation of associations between livestock transport characteristics and animal welfare outcomes.

Pilot study activities (Objective 2) were limited to QLD because of the proximity to main project team members responsible for these activities and because this component of the project was aimed more at developing and testing methods rather than collecting sufficient data to be able to accurately describe Australian livestock transport patterns. A major aim was gaining sufficient feedback and direct practical exposure to field conditions to determine the feasibility and value of methodologies for data collection and conducting a national study aiming to describe patterns of events and animal welfare outcomes for journeys greater than 6 hours.

The activities completed under Objective 2 collected data on the following transport events:

- Five trucks (20 decks) containing 668 yearling cattle travelling over a 7 hour journey to a saleyard,
- Three trucks of sheep travelling to a saleyard, comprising 135 mixed age sheep travelling 1.75 hours, 68 cross-bred lambs travelling 45 minutes, and 120 cross-bred lambs travelling one hour,
- One truck of 640 adult sheep travelling 17 hours to an abattoir,
- One truck of 662 adult sheep travelling 28 hours from property to property,
- One train load (44 decks) of 868 cattle travelling 10 to 12 hours to two abattoirs.

Objective 2 did not result in collection of data from as many transport events as was originally intended. The small number of transport events from which data were collected and the fact that some of these were from journeys shorter than 6 hours, meant that there was insufficient data to warrant statistical analyses of the data collected. This was not felt to invalidate the usefulness of the process for testing methodologies and getting industry feedback.

Findings of the retrospective data collection exercise (Objective 1) and activities conducted in QLD as part of the pilot study have informed the development of methodology for the proposed national study (Objective 3).

A proposed method is described for collection of data from transport events for journeys greater than 6 hours; involving cattle and sheep; involving data collection periods in winter and summer, and; involving transport by road and rail. The proposal is accompanied by a budget and draft timeline for data collection, analysis and reporting. Two alternative approaches are presented that incorporate modified designs to reduce cost. The impact of these modifications on likely outcomes is discussed.

The following recommendations have been made in this report:

i. That further investment not be made at the present time in collection of data concerning livestock transport events from historical records sourced from industry stakeholders for the purpose of describing the patterns of livestock transport across Australia and animal welfare outcomes.
ii. That effort be directed to exploring options for accessing data from the NLIS database for the purposes of research and the development of guidelines governing access and use of NLIS data for research purposes.
iii. That support be given to development of an information management system capable of collecting data on key performance outcomes for livestock transport. The recent development of industry standards for animal welfare in livestock transport and integration of these standards into an industry quality assurance program (TruckCare) is supported and offers a potential system for ongoing monitoring of livestock transport and welfare outcomes. Consideration of a longer term strategic approach is also recommended with a view to a national, electronic recording system perhaps linked in some way to the operational systems of the NLIS to facilitate collection, storage, analysis and reporting of data and information on livestock transport in Australia.
iv. That the proposed national study outlined in Objective 3 of this report be considered as a short-term, cross-sectional study designed to collect sufficient data on livestock transport events to provide a rigorous, valid, snap-shot description of transport patterns across Australia and animal welfare outcomes.

Contents

1 Background

1.1 Introduction

The land transport of livestock via road and rail is an essential element of Australian livestock production systems. Livestock may be transported within properties, between properties and between a property and various other destinations such as saleyard, abattoir, feedlot and pre-export assembly depot. The travel distance, journey duration, route and time of year of transport is generally governed by market and seasonal forces whereby producers aim to maximise their net return on livestock.

Maximising net return is dependent on livestock prices, transport costs and maximising the welfare of the animal during the transport process. Total journey times in Australia can extend to 48 hours in duration provided certain conditions are met. This study was an industry driven initiative to improve understanding of the complex animal/journey interactions which are part of land transport of livestock in Australia with a particular focus on animal welfare outcomes (mortalities and injuries) and journeys longer than 6 hours.

There are three main sources of data that are currently collected by industry concerning transport events. The first is the NVD/waybill which is either mandated in legislation or required by industry segments such as saleyards or abattoirs. The second is a variety of segment-specific recording systems used for business purposes or quality assurance (truck dockets, consignment notes, TruckCare etc). The third is the NLIS which currently records all individual cattle movements and which will be expanded to include aggregated movements of other species of livestock (sheep).

A staged approach was used to first examine the usefulness of retrospective information derived from stored records on transport events as a way of meeting the study objectives. The second stage involved a pilot study in one state to develop and test methods for collecting data from transport events as they occurred (prospective data collection). The third stage for this project involved the preparation of a proposal for applying the methods developed in stage 2 to multiple states and territories around Australia in order to be able to produce a nationally representative picture of land transport practices across Australia for journeys greater than 6 hours.

1.2 Aim of the project

The aim of the project was to assess the value of retrospective records, and develop and test prospective methods for data collection, for describing livestock land transport practices in Australia.

A number of important additional factors were defined in the terms of reference document. These included:

1. Requirement for a study design that allowed collection of sufficient, representative data so that the results would be truly representative of the Australian land transport industry and accurately reflect the state of animal welfare outcomes.
2. Inclusion of road and rail transport events.
3. Inclusion of events involving cattle and sheep.
4. Collection of data under both winter and summer conditions.
5. Collection of data from at least QLD, WA, NSW and Victoria.

1.3 Potential Industry Benefits

Australian livestock industries and associated stakeholder groups are the beneficiaries of this research. The first two stages of the project described in this report were intended to provide information on practical and feasible methods for collecting data on transport events. These findings informed the third stage which involved development of a proposal for a national study, designed to deliver a solid foundation of scientifically sound information on current land transport practices in Australia.

Information derived from the proposed national study would assist the Australian livestock industries to continue to improve practices and also to respond more effectively to adverse publicity and criticism from welfare groups.

2 Project Objectives

2.1 Objective 1

Assess the availability, accessibility and quality of historical data pertaining to livestock land transport in Australia in excess of 6 hours duration, with this assessment restricted to data from events that occurred during 2004 and 2005.

This objective will include but not be limited to the collation of the following information:

i. Numbers, livestock classes and purpose of transport,
ii. The type of transport including where possible on the nature of the stock crate or wagon,
iii. Journey routes including duration, distance, rest stops and frequency,
iv. The extent and reasons for incidents involving mortality or injury.

2.2 Objective 2

Conduct a pilot study of transport events to primarily appraise the methodology which could then be considered for use in an expanded national study that could be implemented following completion of this project. In addition, the pilot study will report on:

i. detailed and extensive consultation with industry stakeholders to learn about practices,
ii. what data are already being collected in various forms,
iii. what additional data can be collected in a feasible manner without interfering with normal, commercial practices,
iv. what data/information are stakeholders interested in getting out of the project.

2.3 Objective 3

Investigate design, timeline and budget for an expanded study with a national perspective.

3 Methodology

3.1 Methodology for Objective 1

The approach to Objective 1 was modified following discussions involving the project team, MLA staff and industry. It was felt likely that while records would exist on historical transport events, they would be likely to be stored in different locations and a wide variety of predominantly paper-based

formats. Such data may be difficult to collect, of variable quality and perhaps not able to deliver the specific information requirements outlined in Objective 1.

A number of important modifications were made in the wording and in the methodological approach to Objective 1. These included:

i. A focus on the availability, accessibility and quality of historical data pertaining to livestock land transport in Australia,
ii. Restriction of data collection to events that occurred in 2005 and possibly 2004,
iii. Collection of data from a sample of available transport events and not from all transport events from 2005 or 2004. A representative sample was considered sufficient to judge the availability, accessibility and quality of historical data.

Objective 1 involved visits by project team members to industry organisations for the purpose of collecting retrospective records on transport events that occurred during the second half of 2005. Initial discussions with industry representatives indicated that sourcing records from 2004 was likely to be more difficult than records from the immediately previous year (2005). A decision was then made to concentrate on 2005.

Data collections were completed in QLD, Victoria, WA and NT. Multiple states were selected to ensure that a wide cross section of industry records was obtained.

A standardised methodology was developed for this process and provided to all project team members as a guide. A summary of the methodology is presented below.

3.1.1 Identification of industry stakeholder groups

A number of broad industry stakeholder groups were identified as potential sources of records concerning livestock transport events. These included:

- Transport operators
- Queensland National (rail freight)
- State/Territory Departments
- Saleyards
- Transit centres
- Processing plants
- Livestock agents
- Feedlots
- Pastoral companies

A decision was made to concentrate on segments of the industry where livestock transport events were aggregated i.e. where multiple trucks arrived at a location on specified days. This decision was justified because these segments were expected to account for the majority of all transport of livestock in Australia and because of the need to efficiently collect data. It is acknowledged that this approach does not involve collection of data from transport events involving privately owned trucks moving animals from a property of origin to either another property or to a location not included in the above list. These events were considered to represent a very small component of the overall national transport picture.

3.1.2 Identification of locations & operations

For each of the stakeholder groups identified in Section 3.1.1., project team members developed a specific contact list that identified individuals and contact details (phone, address, email). Criteria for

selecting individuals/organisations included convenience (geographic proximity), size and coverage (larger operators), and willingness to co-operate.

Contact was made via email, telephone or personal visit. The project was described and a request made to be able to access records from past transport events.

3.1.3 Selection of a sample of past records

An important part of the approach was to incorporate an element of random selection in the process to ensure that no bias could be applied in the choice of transport events for inclusion in the project sample.

An estimate was made by the operator for each company/organisation of the approximate number of transport events (1 prime mover plus trailer(s) = 1 transport event) that might be recorded per month for the second half of 2005.

For paper-based recording systems, a random process (toss of a die or use of random number generation in Excel) was then used to select one month from the second half of 2005 (July to December). Records were then requested for that month. If the chosen month contained more than 50 transport records then a random sampling approach was used to select 50 records (systematic random sampling). If the chosen month contained less than 50 transport events, then successive months were added until 50 or more events were collected. If the first selected month was December then preceding month(s) were added as required to reach a sample size of 50 events. In a number of cases the selection process involved choosing a sample from records that were available. This approach was typically employed where not all records from 2005 were able to be retrieved. In one instance it was not possible to retrieve any records from 2005 and records from 2006 were selected instead.

If records were stored in electronic format then a request was made for a file (delimited file or Excel format) containing records relating to transport events from the entire year of 2005 or from a period covering several months. Records from particular transport events could then be selected using a similar random process by the project team member.

The sample size of 50 records per organisation was based on sample size estimation using statistical software designed to assist in planning scientific experiments. The decision was based on the need to achieve reasonable precision in estimating the proportion of animal welfare outcomes (injuries or mortalities) when such outcomes were expected to be relatively uncommon. More detailed information on the approach to sample size estimation is provided in Appendix 2 (Section 8.2).

3.1.4 Collection of data

Data from paper records were entered directly into either a custom-designed Access database or an Excel file. In most cases data entry was completed on-site to avoid any need for project team members to take records away from the office. Data from electronic records were obtained as a delimited file or Excel file or on occasion re-entered on-site.

Standardised data collection forms or pre-defined entry formats on computer were not possible because the precise details of available data (field names, data types, number of variables, etc) differed from organisation to organisation. The approach therefore involved a recognition that data

could only be collected from what was available in the record systems though there was also a recognition of the need to concentrate on data relating to the following areas:

i. Animals on the truck:
    a. species
    b. class: age group, gender, pregnancy status
    c. number loaded for each class and gender
ii. Reason for transport:
iii. Truck information
    a. type of truck: single (body truck or semi-trailer with only one trailer), B-Double, semi-trailer (where trailer is replaced by the number of trailers being pulled by the prime mover)
    b. stock crate information
iv. Railway information (only relevant for QLD)
v. Journey
    a. origin location (address and/or PIC)
    b. loading date & time
    c. arrival date and time (at destination)
    d. destination location (address and/or PIC)
    e. duration of travel
    f. distance of travel
    g. rest stops: number, duration, where in journey
vi. Morbidity
    a. number for each class and gender on each truck
    b. type of morbidity (defined classes)
vii. Mortality
    a. number for each class and gender on each truck
    b. type of morbidity (defined classes)

3.1.5 Data analysis

Data were collated and subjected to descriptive analysis involving summary statistics. There was particular interest in assessment of quality of available information using methods adapted from the field of statistical quality. A more detailed summary of aspects of statistical quality is presented in Appendix 3 (Section 8.3) as additional background to the assessment of data collected during this project.

3.2 Methodology for Objective 2

The aim of the pilot study was to develop and trial methods for prospective data collection on land transport events to determine methods that may be applicable in an expanded Australia-wide study aiming to collect data on land transport events. The pilot study was therefore more focussed on feasibility of methods for collecting data and assessment of outcomes associated with accuracy and validity than on the analysis and results of any data that were collected. The pilot study did not attempt to collect a sample that was either large enough or selected in a manner that allowed the results to be considered representative of the state's transport picture.

Where possible data that were collected during the pilot study would be subjected to statistical analysis partly to demonstrate the application of analytical methods on the types of data that may be collected in the expanded study as well as to report interim results from data collected during the pilot study.

Findings from Objective 1 informed the development of methods used for Objective 2. The major impact of the results from Objective 1 on the methodology used for Objective 2 was the recognition that the only approach that would ensure collection of the necessary data to allow the study objectives to be met was to have a person at the point of unload to record data.

Two alternative approaches were considered in the planning phase for Objective 2. The first involved the collection of records such as NVD/waybills and truck dockets without requiring someone to be present when a truck unloaded to collect data. This approach would allow more efficient collection of data on larger numbers of events by focussing on collection of paper records. However, the findings from Objective 1 (Sections 4.1 and 8.4) indicated that paper records would not provide sufficient information to address the study Objectives.

The second approach considered was to investigate whether the NLIS database might offer an avenue for collection of data on cattle transport events that once again could facilitate rapid collection of data on a larger number of transport events without requiring someone to be present at an unload point. The NLIS database was also identified as a potential source of ancillary information on transport events that may complement data collected by project team members at unload points. Initial discussions with members of the national NLIS committee indicated that there were issues associated with gaining access to data derived from the NLIS database for research purposes and that any such data would not provide sufficient information to address the study Objectives. Findings from enquires concerning NLIS data are presented in Section 4.3.3.

The consequence of these findings was that the methodology adopted and implemented for the pilot study involved having a project team member physically present at the unload point as a truck was unloaded in order to collect data on that transport event.

3.2.1 Journey time

The criterion defined in the terms of reference involved a particular focus on journeys that were greater than 6-hours in duration.

For the purposes of this project the journey time was defined as starting at the point of initiation of the journey after completion of loading of the truck (or rail car) at the point of origin. The journey time was defined as stopping on completion of unloading at the destination. Where a truck unloaded at multiple destinations, separate journey times would be recorded for each group of animals unloaded at each destination. The reason for defining a start point as the start of the journey was to facilitate relatively clear determination of journey time.

There was interest in additional activities prior to loading and in particular the time off water for animals. Methods were developed to ensure collection of data from vendors on mustering time, time spent in the yards prior to loading, and separate estimates of curfews for water and feed prior to loading as well as time taken to load. These additional data points would then allow estimation of a variety of time measurements associated with different sub-intervals within the broader time from the start of mustering to the arrival of animals onto water at their ultimate destination.

3.2.2 Selection of locations for data collection

The pilot study was completed only in Queensland largely because the project team members with primary responsibility for activities under this objective were located in Toowoomba and Gatton. A similar approach was used to the methodology for Objective 1. A list was made of major stakeholder groups within the industry, and representative organisations and individuals were then identified

within each stakeholder group and contact was made with one or more of these individuals. A project team member then travelled to an unload destination and recorded information on transport events at the point of unload.

The focus for the pilot study was on aggregation points where multiple trucks were likely to be unloaded on one day. The planning for Objective 2 defined the following objectives for data collection:

- QLD Rail: 3 transport trains
- Road transport of cattle: minimum of 6 and preferably 10 transport events including
    - events selected on arrival at a feedlot
    - events selected on arrival at a processing plant
    - events selected on arrival at a saleyard
    - events selected through an agent
    - events selected through a pastoral company
- Road transport of sheep: minimum of 6 events
    - events selected on arrival at a saleyard
    - events selected through an agent
    - events selected through a transport company

The sample sizes identified for the pilot study were not based on statistical techniques designed to estimate sample sizes required to achieve a specified precision for any measured result. The aim for the pilot study was to have the opportunity to speak to at least one (and preferably more than one) individual from each major stakeholder group and to test the data collection process (including observations of unloading and asking questions from receival agents, drivers and vendors) on several people. This process was designed to ensure that the methods under development would actually be feasible when applied at an abattoir or saleyard unloading ramp and that individuals in the industry would understand and respond to the questions being asked.

3.2.3 Data collection

A list of variables was developed in a consultative process involving project team members and industry stakeholders. The draft list contained a total of 76 questions requiring information to be collected by observation of the unloading, from the NVD/waybill or truck docket, by asking questions of the truck driver and by contacting the vendor of the animals to ask questions about the animals prior to loading.

The issue of what data to collect (and therefore which questions needed to be asked), was governed by three broad priorities. The first was the need to describe broad transport patterns and focus on journeys greater than 6 hours. This dictated the need to collect fundamental information about the journey (origin and destination), distance and drive time. The second was the need to describe animal welfare outcomes and particularly mortalities and injuries that were detected either during the journey or at the point of unload (events that could be considered to be associated with the journey itself). The third broad priority area was to collect data on factors that might influence the risk of mortalities and injuries during a journey. These factors may be called risk factors and could be divided into those factors associated with the property of origin (yarding time prior to loading, curfews, feed shortages), those associated with the animals themselves (breed, sex, age, condition), those associated with the truck (trailer type, size, flooring, number of pens) and those associated with the journey (driving conditions, climate, road, distance, driving time, stops). The number of possible risk factors that could influence the risk of morbidity or mortality during a livestock transport event is potentially very large and the interaction between various risk factors may be complex.

The most important areas for data collection were to characterise the journey (greater than 6 hrs, origin and destination), the animals (species, breed, age, class and count), and animal welfare outcomes. Collection of some additional risk factor information would allow limited analyses to explore which risk factors might be associated with risk of animal welfare outcome (mortality or morbidity). However, the project design was not intended to identify all major causes of mortality or morbidity in transport events.

In developing the final set of questions it was recognised that the data collection process involved potentially interfering with busy people in the course of their day-to-day activities. At large aggregation points there may be a number of trucks waiting to unload and the process needs to be managed as efficiently as possible. It was considered critical to keep the number of questions to a minimum to ensure that the project did not generate any resentment amongst industry. There was also a need to ensure that the questions that were asked would not be viewed with suspicion by any members of the industry.

An objective approach used to assess the draft list of questions and identify those that were most important, that were simple and easily understood and easy to ask and that were likely to result in accurate answers. Questions needed to be relatively simple because people were being asked for information without requiring them to refer to records or check with other sources of data. Each question was then assessed according to two criteria:

i. importance of the data from that question to the core objectives for the project (ranked from 1 to 3 with 1 being most important),
ii. combination of expected ease of collecting the information and quality of the data (ranked from 1 to 3 with 1 being easiest and highest quality).

Each of the two assessment criteria was assigned a value from 1 to 3. A total score was then estimated for each question by summing the two individual scores. Questions that scored 5 were removed from the draft list and questions that scored 4 were considered for removal while those questions scoring 2 and 3 were retained.

Questions that involved subjective responses with no standardised framework were considered unlikely to deliver useful information and scored poorly on ease and quality. An illustrative example is a question asking for an opinion of the driver on the quality of the road on which the truck had travelled. It was considered likely that different drivers may rate the same road differently – a road described as rough by one driver may be described as reasonable or good by another driver. Variability in scales and responses for a particular question mean that it was unlikely to be of real use in statistical analysis.

Standardised data collection forms were developed to ensure collection of the same data from all transport events. These forms are presented in Appendix 1 (Section 8.1).

Four separate one-page data-collection forms were developed:

i. Site visit sheet: A single sheet identifying the site, date, project team member and key local contact.
ii. Arrival sheet
    a. Initial part completed by project team member while observing unloading. Includes description of truck & trailer and observations of the unloading including presence of any mortalities or injuries at the point of unload.
    b. Second part completed by asking questions of the driver immediately after unloading and focussing on information about the journey.

iii. NVD/Waybill: Information recorded directly from the NVD/waybill at the point of unload including property of origin (PIC, property name, owner), destination, animal details (class, number, etc).
iv. Owner/Vendor sheet: Completed at a later date by telephoning the owner (using details from the NVD/waybill) and asking questions about management of the animals prior to loading (date and time mustered, curfew times, loading times, reasons for movement).

The proposed management of data collection was for a project team member to complete one site visit sheet on arrival at a particular site to collect data. Then each transport event (truck for example) will have an arrival sheet and a NVD sheet completed at the time of unloading. The vendor sheet will then be completed at a later date once the vendor has been contacted by phone. Each site visit will therefore have data collected from one or more transport events.

3.2.4 Data analysis

Data from truck events would be entered directly into a spreadsheet or database program for management. Collated data would be subjected to two levels of analysis – the first being a descriptive picture of transport patterns and the second exploring relationships between explanatory factors (journey time/distance or conditions, geographical location, time of year, etc) and major outcomes of interest (proportion of animals that were injured or killed during a journey).

3.3 Methodology for Objective 3

Findings from Objectives 1 and 2 were used to inform the preparation of a detailed proposal and accompanying budget for prospective collection of data from transport events from multiple states around Australia.

During discussions with industry stakeholders in the course of completing Objectives 1 and 2, it became apparent that there was a very high level of interest in this project and support for the aims and objectives of the project from across the industry. Staff from government departments in the Northern Territory and South Australia expressed interest in the project and both NT and SA were identified as being involved in long distance transport events. Most cattle raised in the NT are subjected to a long distance transport event at some stage in their lifetimes with the most common routes being to the northern coast to embark on live export shipment; to the east into QLD to saleyards, grower/finisher properties, feedlots and abattoirs, to the south into SA to saleyards and abattoirs and occasionally to the west into WA. South Australia is also the recipient state for a number of livestock transport events that originate in WA and involve road transport across the Nullarbor Plain as well as other intra-state movements that were likely to exceed the 6-hour journey threshold.

The methodology under development was therefore expanded to include data collection in QLD, NSW, Victoria, SA, WA and NT. Transport events originating in ACT or Tasmania were considered unlikely to be associated with journey times longer than 6 hours unless they involved a destination point in another state or territory in which case collection of data in the six mainland states and territories identified would have a probability of incorporating those events.

Statistical sample size estimation using specific software[1] designed for this purpose was used to inform estimates of the required number of transport events to be collected in each state and

[1] PASS, Power Analysis and Sample Size. NCSS, 329 North 1000 East Kaysville, Utah 84037,USA http://www.ncss.com/pass.html

territory. Details of the approach are provided in the Appendix 2 (Section 8.2). Based on these estimations a decision was made to set the desired number of transport events at a minimum of 30 for each of cattle and sheep and each combination of state/territory and season (winter and summer).

Data were obtained where possible on throughput for sheep and cattle saleyards, abattoirs, feedlots and live export departure points for locations around Australia. These data were used to identify major aggregation points for data collection.

Individuals were identified in each state and territory where possible to assist in data collection. Estimates were made of professional time involved to collect data and travel and accommodation costs. Flight costs were based on economy fares derived from websites for major airlines servicing the relevant destinations. Accommodation and per diem costs were based on Australian Tax Office estimates of allowances for overnight travel to metropolitan and rural centres around Australia.

Allowance was made for a graduate student scholarship of $20,000 per annum to be awarded to one person. A particular individual was identified at University of Queensland (Gatton campus) at the time this proposal was generated. There is a risk that a delay of several months between submission of this proposal and approval may mean that this individual is no longer available. An attempt will be made to source another graduate student for this project if it is funded. Failure to enrol a suitable graduate student means that alternative and more costly labour would need to be sourced to ensure the project is completed in a timely manner.

It was recognised that the proposed national study represented a major cost for industry to consider and options have been explored for reducing costs including presentation of two alternative designs along with discussion of the impact of these alternatives on the ability of the proposed study to meet the objectives.

4 Results and Discussion

4.1 Objective 1: Historical records

This section presents conclusions from the findings relating to Objective 1. A detailed discussion of the findings can be found in Appendix 4 (Section 8.4).

During the course of the study project team members contacted a number of organisations involved in livestock transport. The response from industry organisations and individuals was positive and supportive and access was provided to retrospective data where requested with conditions generally being associated with protection of confidential information concerning client identity and financial details and with ease of access to stored records.

Data on transport events were collected from trucking companies, abattoirs, feedlots, agents, saleyards and a pastoral company, and from four states (NT, QLD, Vic, WA). Tables 1 and 2 display summary information on the records collected from each of 14 visits. The goal was to collect 50 records from each visit and the project achieved between 34 and 55 records per visit.

Sufficient records were collected to allow interpretive conclusions to be made concerning the statistical quality of retrospective data for investigations of adverse events in long distance livestock transport in Australia. The data examined in this study indicated that it was not possible to collect a complete and auditable dataset from stored records of historical transport events that provided

information on variables of interest to this project and that was capable of being subjected to any formal review of statistical quality. The main statistical quality issues interfering with this aim were incomplete or missing data, difficulties in accessing data from multiple paper records stored in ad-hoc conditions, and lack of coherence (inability to effectively trace or link mortality records from one system or database to transport information stored in paper form).

Of the visits completed in the course of this project, records on mortalities that could be linked to transport events were obtained from a sheep abattoir and from three cattle enterprises (abattoir, cattle trucking company and a cattle feedlot). It was not possible to describe mortalities for journeys that were less than or greater than 6 hours because data on journey times were not reliably recorded. The resulting Incidence rate estimates for mortalities in sheep and cattle as presented below were derived from a very limited subset of records and without any attempt to distinguish journey times. Incidence rate estimates and 95% confidence intervals were:

- 0.038 deaths per 100 sheep transported (95% CI: 0.016 to 0.092), equivalent to one death for every 2,630 sheep transported,
- 0.017 deaths per 100 cattle transported (95% CI: 0.0043 to 0.07), equivalent to one death for every 5,900 cattle transported.

Data on morbidities (injuries and other non-fatal conditions) were considered to be unsuitable for estimating incidence measures because most organisations did not collect data on morbidities that could be related to transport events.

While it may be possible to collect additional retrospective data from selected companies to more accurately describe and characterise transport events, it was not considered to be a cost-effective approach to describing and investigating long-distance transport in Australia because of the statistical quality issues and inability to achieve outcomes of interest.

During the course of preparation of this report, a joint initiative between the Victorian DPI and the Australian Livestock Transporters Association (ALTA) has seen the release of industry standards for animal welfare for livestock transport. It is understood that these standards will be incorporated into TruckCare, an industry quality assurance program managed by ALTA. The standards provide a valuable source of information for use in industry supported quality assurance programs based on optimising animal welfare during the transport of Australian livestock by road and rail. In addition, the documentation contains example administrative systems for the purposes of assisting implementation, audit and record keeping. The standards provide an admirable framework for collection of data relating to livestock transport as part of quality assurance. The proposed data collection form presented in the standards is reproduced in Appendix 6 (Section 8.6). If this form were widely adopted, implemented and completely filled in, retrieval of data from completed forms would allow animal welfare outcomes and explanatory factors including journey duration and other factors to be monitored on an ongoing basis.

Table 1: Summary data from visits to industry stakeholders involved in livestock transport from NT, QLD, Victoria and WA. Columns are counts of the number of valid data entries that were observed for each variable. The column labelled Total Records represents the total number of records reviewed at each organisation. 0 means that there were areas where information could have been recorded on this variable and there were zero (0) observed entries. NR= not recorded and is used to indicate the situation where data were known to have been recorded but the project team member did not collect the information.

		Variables	Total	Date	Date	Time	Time	Travel		Origin	Animal				Morbidity	Mortality
Group	Animal	Data record	Records	load	unload	load	unload	dist	time	PIC	class	Breed	Count	Curfew	count	count
Trucking	Cattle	NVD & docket	53	52	40	43	35	47	0	0	53	0	53	0	some	some
Abattoir	Sheep	Docket	51	43	51	16	22	0	9	some	51	some	51	1	2	9
Abattoir	Sheep	NVD	34	33	0	21	0	0	0	33	32	25	34	30	0	0
Feedlot	Cattle	NVD, waybill, other	38	38	38	19	34	0	0	38	38	0	38	0	0	0
Feedlot	Cattle	NVD, other	55	55	55	55	51	0	0	55	55	0	55	0	0	0
Abattoir	Sheep	NVD/other	50	50	0	0	0	8	0	11	50	4	50	9	0	1
Abattoir	Cattle	other	52	52	0	0	0	0	0	0	52	0	52	0	52	52
Agent	Sheep	NVD	50	49	49	17	0	0	0	34	49	36	39	44	50	50
Agent	Cattle	NVD	50	50	0	0	0	0	0	50	50	40	50	0	12	12
Trucking	Cattle	other	50	50	0	0	0	21	0	0	50	0	50	0	0	0
Trucking	Sheep	other	51	51	0	0	0	28	0	0	49	0	49	0	0	0
Abattoir	Cattle	other (NVD & note)	50	48	48	35	0	0	0	NR	48	16	50	NR	0	50
Feedlot	Cattle	other (NVD & note)	50	50	50	7	1	0	0	0	41	0	50	0	0	50
Trucking	Cattle	other	50	50	0	0	0	50	36	0	42	0	50	0	0	0

The top row is described in detail here to better illustrate interpretation of this table. The top row describes data derived from a cattle trucking operation. A total of 53 records were inspected. Of these, 52 had valid entries recorded from the date of loading (1 record had nothing entered for date of loading) and 40 had valid entries recorded for the date of unloading (13 records had nothing entered for date of unloading). The time of day of loading was recorded in 43 records and unloads time in 35. Travel distance was recorded in 35 records and travel time in 47. The PIC of origin for the animals was not recorded in any docket and neither was animal breed or curfew time. Every docket contained the count of animals loaded and the class of animals. Some dockets recorded a count of deaths and a count of morbidity but many dockets had nothing entered in these fields.

Zeros indicate fields that were present in the various forms but where no data were recorded (missing data). Absence of any entered value does not necessarily mean that the correct value is in fact zero.

Table 2: Summary data from visits to industry stakeholders involved in livestock transport from NT, QLD, Victoria and WA.

Table 2 presents the same data as in Table 1 but each entry is expressed as a percentage of fields that contained valid entries. The percentage is calculated by taking the count of valid entries in any one cell of Table 1 and dividing it by the total number of records examined for that row.

		Variables	Total	Date	Date	Time	Time	Travel		Origin	Animal				Morbidity	Mortality
Group	Animal	Data record	Records	load	unload	load	unload	dist	time	PIC	class	Breed	Count	Curfew	count	count
			count	%	%	%	%	%	%	%	%	%	%	%		
Trucking	Cattle	NVD & docket	53	98	75	81	66	89	0	0	100	0	100	0	some	some
Abattoir	Sheep	Docket	51	84	100	31	43	0	18	some	100	some	100	2	4	18
Abattoir	Sheep	NVD	34	97	0	62	0	0	0	97	94	74	100	88	0	0
Feedlot	Cattle	NVD, waybill, other	38	100	100	50	89	0	0	100	100	0	100	0	0	0
Feedlot	Cattle	NVD, other	55	100	100	100	93	0	0	100	100	0	100	0	0	0
Abattoir	Sheep	NVD/other	50	100	0	0	0	16	0	22	100	8	100	18	0	2
Abattoir	Cattle	other	52	100	0	0	0	0	0	0	100	0	100	0	100	100
Agent	Sheep	NVD	50	98	98	34	0	0	0	68	98	72	78	88	100	100
Agent	Cattle	NVD	50	100	0	0	0	0	0	100	100	80	100	0	24	24
Trucking	Cattle	other	50	100	0	0	0	42	0	0	100	0	100	0	0	0
Trucking	Sheep	other	51	100	0	0	0	55	0	0	96	0	96	0	0	0
Abattoir	Cattle	other (NVD & note)	50	96	96	70	0	0	0	NR	96	32	100	NR	0	100
Feedlot	Cattle	other (NVD & note)	50	100	100	14	2	0	0	0	82	0	100	0	0	100
Trucking	Cattle	other	50	100	0	0	0	100	72	0	84	0	100	0	0	0

The highest compliance in recording data was for the count of animals loaded, followed by class of animal and date of loading. These are all variables that have direct value to the management of the various businesses. The percentage of fields where data were recorded for other pieces of information was much more variable and often zero (nothing entered at all). The few operations that recorded entries in all fields for mortalities and morbidities were predominantly recording values of zero i.e. an entry was recorded on the forms. In other cases, some forms had values recorded (zero or a number greater than zero) for mortality or morbidity but entries were not recorded on every record.

4.2 Objective 2: Pilot study

This section provides summary information from the results of Objective 2. A more detailed description of activities and findings can be found in Appendix 5 (Section 8.5).

Pilot study activities were confined to QLD because of the proximity to the project team management and because these activities were focussed on obtaining sufficient feedback and direct practical exposure to field conditions to guide the development of a methodology for data collection that could be successfully applied in an expanded national study.

Consultative meetings were held with:

- Livestock agents
    - Representatives from the QLD head office (Brisbane) and branch representatives from different organisations at 3 locations (Roma, Toowoomba and Warwick).
- Transport operations
    - Representatives from the head office of a large transport company in SE QLD,
    - Discussions were also held with drivers from several companies at the point of unload during the data collection process.
- Abattoirs
    - Representatives from management of 2 abattoirs in SE QLD, one processing sheep only and the other processing general livestock,
    - Discussions were also held with receival agents (stock managers) at two abattoirs.
- Feedlot
    - Representatives from management of two cattle feedlots in SE QLD.
- Pastoral company
    - Representatives from management of a large northern beef pastoral company
- QLD Rail
    - Representative from livestock sector of QLDNational

A number of visits were made to unload points for collection of data as part of the Pilot Study. These visits involved project team members using the draft questionnaires to collect information from receival agents, transport operators and vendors. The act of collecting data was designed to test whether questions made sense, were understood by industry operators and whether the information collected in the form of answers from operators and records of observations by project team members, met the requirements as intended when the methods were developed.

An important part of the process also involved a more subjective determination of feasibility and practicality including issues such as whether the process could be implemented without causing any undue interference in day-to-day activities and whether the response was favourable and positive when individuals were contacted and asked for information with relatively little warning and background preparation.

Information was collected on the following transport events:

- Five trucks (20 decks) containing 668 yearling cattle travelling over a 7 hour journey to a saleyard,
- Three trucks of sheep travelling to a saleyard, comprising 135 mixed age sheep travelling 1.75 hours, 68 cross-bred lambs travelling 45 minutes, and 120 cross-bred lambs travelling one hour,
- One truck of 640 adult sheep travelling 17 hours to an abattoir,
- One truck of 662 adult sheep travelling 28 hours from property to property,

- One train load (44 decks) of 868 cattle travelling 10 to 12 hours to two abattoirs.

Activities completed under Objective 2 achieved an important goal of developing and testing a methodology for subsequent incorporation in the proposal under Objective 3 for a national study to collect data on transport events and describe patterns of events and animal welfare outcomes for journeys greater than 6 hours. The method used of having a person present at unload points to capture information on trucks as they were unloaded and then telephone the vendor at a later date to collect additional information relating to pre-load management of the animals, was determined to be feasible and well accepted by industry stakeholders. All questions were answered and industry stakeholders appeared to be interested in and supportive of the project. The questionnaires were modified as a result of feedback received during the process and the modified questionnaires are presented in Appendix 1 (Section 8.1).

Objective 2 did not result in collection of data from as many transport events as was originally intended. The small number of transport events from which data were collected and the fact that some of these were from journeys shorter than 6 hours, meant that there was insufficient data to warrant statistical analyses of the data collected. This does not invalidate the achievements of Objective 2 in terms of development and validation of a method for collecting transport data.

Data collection from transport events that originated at a saleyard and ended at some other location such as a feedlot or abattoir, were identified as being problematical. During this study this issue was identified in sheep and cattle transport events that originated at a saleyard and terminated at abattoirs and feedlots. Detailed discussion of this issue can be found in Section 8.4. The issue reinforces the fact that information collected at the point of unload can really only be sourced for the immediate journey ending at that location, and not for any previous journeys.

4.3 Objective 3: Proposed national study

4.3.1 Background

The major destinations for livestock land transport events involving driving times of greater than 6 hours were identified as:

i. saleyard,
ii. feedlot,
iii. abattoir,
iv. live export assembly point,
v. other properties either under the same owner or involving change of ownership (includes movement of animals from breeder farm to grower or finisher farm, agistment, etc).

The major end points in terms of numbers of animals are destinations 1 through 4 recognising that saleyards are an interim destination only and that animals will progress from saleyards to one of the other destinations. Feedlots may similarly be classified as interim destinations in that animals tend to leave feedlots to move to processing plants. End points 3 and 4 are considered terminal end points and once animals reach these destinations there is no opportunity for further land transport information to be collected from the animals.

Two additional industry stakeholder groups that are responsible for arranging transport events include trucking companies and livestock agents. Discussions with the QLD Livestock Manager for a major livestock agency indicated that about 60% of the total volume of livestock movements handled by QLD branches for that agency involved animals moving to a saleyard. The proportion of livestock

movements that do not involve transition through a saleyard was reported to be increasing over time.

Saleyards are major aggregation points for livestock but saleyard operators are generally not sources of transport information. Discussions have been held with saleyard management in QLD, Victoria and WA and have indicated that saleyards essentially provide a facility for hire to livestock agents. Saleyards do not collect information on livestock transport (NVD/waybill, truck dockets etc). This information is collected by the agents and trucking companies who handle the movement of livestock into and out of the yard. Therefore when data on transport events is planned for a particular saleyard it is expected that this will involve discussion with livestock agents primarily and that the saleyard is simply the geographic location where data are collected as livestock are unloaded.

There are a small number of livestock land transport avenues that may not involve animals either travelling on a commercial transport service, that do not involve agents handling the transaction and that do not result in animals arriving at one of the major destination points identified above. These movements involve privately owned trucks and generally involve smaller numbers of animals moving to other properties or to particular destinations such as shows and bull sales. Many of these movements may not exceed 6 hours in driving time. Data collection methods described in this report will not collect data from these transport events. This is not considered likely to have any adverse impact on the findings of the work outlined in this report.

Findings of the retrospective data collection exercise (Objective 1) and activities conducted in QLD as part of the pilot study have informed the development of methodologies described in this section for a proposed national study.

All segments of the industry that have been contacted to date have expressed support for the project and have indicated that they are interested in collaborating in the project. This process has definitely been helped by the fact that project personnel have not been asking industry to collect additional data but have been asking more for access to particular locations and for the opportunity to collect data by observing events, speaking to people and recording information from current records such as NVDs and dockets.

With few exceptions, use of routine data collection and recording systems in current use across the industry do not provide sufficient data to allow the objectives to be met. This was an important finding of the retrospective data collection exercise and has ramifications for the prospective study, particularly for the following issues:

- Very few industry segments are currently collecting data on transport events that allow accurate determination of time of departure from origin and time of arrival at destination and hence journey time. This information is critical in determining whether an event meets the 6-hour threshold,
- Very few industry segments are currently collecting data on morbidity and mortality in animals that can be linked in an auditable way to a specific journey and group of animals. Most industry operators collect data on mortality and some on morbidity (rejects) but often these counts are stored in a different information system and it is not easy to verify completeness or to link these data to specific journey information.

These factors were major determinants of the decision to propose a methodology that was dependent on having project personnel collect data in-person. The most efficient way to achieve

this was to propose that a project person be physically present at a selected destination to observe trucks as they arrive and unload. This has a number of important benefits:

- facilitates accurate collection of standardised data,
- ensures collection of all of the data that is intended to be collected,
- allows questions to be asked directly to the driver of the truck about the journey,
- ensures collection of data from NVD/waybill at the time animals are unloaded,
- allows collection of a data on a range of other variables that are of interest and that are not routinely collected by any industry segment.

The need to have project personnel at destination points presents a resource challenge that is best managed by collecting most of the data from aggregation points. The proposed approach outlined below involves selection of aggregation points from saleyards, abattoirs, feedlots and live export assembly points based on throughput and on proportion of transport events involving durations greater than 6 hours.

4.3.2 Proposed methodology for the national study

4.3.2.1 Saleyards

Information has been obtained on annual saleyard throughput for sheep and cattle saleyards around Australia. These data have been compiled and reported in two recent reports commissioned by DAFF[2]. These data were be used to identify saleyards in each state in Australia with higher volumes.

Livestock agents in areas servicing the saleyards would be contacted to obtain anecdotal information about the proportions of animals that undergo land transport durations greater than 6 hours to get to a saleyard. Initial contacts would be made with national livestock agencies and other agencies may be contacted in particular locations depending on which agents deal with livestock sales at particular locations. Preliminary discussions have been held with national livestock agencies indicating that agencies would be willing to assist in the project.

Saleyards would be identified based on a combination of higher annual volume and transport durations greater than 6 hours for livestock travelling to the saleyard. Visits would then be made to selected locations to collect data. It is anticipated that one to two saleyard locations would be selected for each of sheep and cattle sales in each state.

An important issue was identified in Objective 1 and Objective 2 associated with transport events involving sheep or cattle that originated at a saleyard (see Sections 8.4.1, 8.4.2, 8.4.5 and 8.5.4.4). Animals sold through a saleyard typically experience two journeys:

i. Journey 1: from property of origin to saleyard, which is accompanied by a NVD/waybill that identifies the vendor, vendor PIC and number and class of animals.
ii. Journey 2: from the saleyard to the new destination (feedlot or abattoir). In this instance the truck may be carrying a load that is comprised of part consignments purchased from multiple consignments at the sale and depending on mandatory requirements in different states the truck driver may or may not be required to carry a waybill for this journey.

The impact of this issue is that data collected at the end of any one journey can only be reliably applied to the journey just completed i.e. data collected from a journey 2 transport event cannot be reliably used to characterise journey 1. It will be important to collect data from a number of transport

[2] A review of the structure and dynamics of the Australian beef cattle industry, 2006 and The structure and dynamics of Australia's sheep population, 2006.

events that originate at a property or origin and end at a saleyard in order to characterise and describe examples of journey 1 as well as a number of transport events that originate at a saleyard and end at some other destination in order to characterise and describe examples of journey 2. As long as both these steps are completed this issue does not provide any risk to the ability of the proposed study to meet its objectives.

Table 3: Saleyard locations and estimated annual throughput for sheep and cattle sales. Data restricted to those centres with the highest annual throughputs listed for all locations around Australia.

Sheep			Cattle		
State	**Location**	**2006 total**	**State**	**Location**	**Ave (2002-2004)**
NSW	Wagga Wagga	1,680,299	QLD	Roma	330,100
NSW	Dubbo	1,429,402	NSW	Dubbo	242,205
SA	Adelaide Plains	1,317,233	QLD	Dalby	217,064
Vict	Ballarat	1,262,140	Vict	Wodonga	213,999
Vict	Bendigo	1,236,229	Vict	Pakenham	151,699
WA	Katanning	1,115,966	QLD	Gracemere	146,362
Vict	Hamilton	1,047,226	NSW	Wagga Wagga	143,828
NSW	Forbes	1,017,003	WA	Midland	136,578
WA	Midland	865,695	NSW	Gunnedah	131,152
SA	Naracoorte	652,823	NSW	Casino	121,986
Vict	Horsham	466,799	QLD	Toowoomba	118,852
NSW	Corowa	449,378	SA	Mt Gambier	113,925
NSW	Griffith	407,844	QLD	Emerald	112,396
NSW	Narromine	391,513	NSW	Tamworth	111,375
NSW	Goulburn	373,575	NSW	Inverell	107,939
NSW	Cowra	340,404	Vict	Warrnambool	99,372
NSW	Tamworth	296,780	Vict	Shepparton	97,737
NSW	Bathurst	288,085	NSW	Bathurst	92,788
NSW	Deniliquin	268,118	SA	Naracoorte	82,055
SA	Mt Gambier	254,936	NSW	Scone	78,819
Tas	Launceston	200,000	QLD	Longreach	76,517
Vict	Swan Hill	196,431	NSW	Maitland	75,165
NSW	Inverell	176,960	SA	Adelaide Plains	74,462
Vict	Ouyen	165,217	NSW	Armidale	70,346
NSW	Dunedoo	135,100	Vict	Bairnsdale	67,823
NSW	Glen Innes	133,533	NSW	Singleton	67,500
Vict	Geelong	129,812	QLD	Gympie	66,032
NSW	Cooma	121,367	WA	Plantagenet	64,373
Vict	Wycheproof	114,478	NSW	Mossvale	62,031
NSW	Jerilderie	109,924	NSW	Orange	60,792
Vict	Warracknabeal	104,300	Vict	Camperdown	60,182
NSW	Young	102,522	QLD	Warwick	53,987
NSW	Cootamundra	99,419	NSW	Narrabri	53,966
NSW	Armidale	99,404	NSW	Taree	49,695
QLD	Warwick	97,871	QLD	Charters Towers	49,369

4.3.2.2 Abattoir

Information has been obtained on output volumes from abattoirs around Australia from the DAFF reports identified above. Contact would be made with abattoir management from the higher volume plants to enquire about the proportion of incoming livestock that are likely to have experienced transport durations (driving time) greater than 6 hours.

One to two abattoirs for sheep and the same for cattle from each state participating in the study would be selected and visits made to those abattoirs to collect data on transport events ending at those locations.

Table 4: Throughput estimates for sheep abattoirs (data limited to larger centres)

Sheep			
State	**Company**	**Location**	**Size**
NSW	Fletcher International	Dubbo	A
NSW	Southern meats	Goulburn	A
SA	Conroys	Port Pirie	A
SA	T&R Pastoral Pty Ltd	Murray Bridge	A
SA	Tatiara Meat Company Pty	Bordertown	A
Vict	MC Herd Pty Ltd	North Geelong	A
Vict	Midfield Meat International	Warrnambool	A
Vict	Norvic Food Processing	Wodonga	A
WA	Fletcher International	Albany	A
WA	V & V Walsh	Bunbury	A
NSW	Cowra abattoir	Cowra	B
NSW	GM Scott Pty Ltd	Cootamundra	B
NSW	Hirino Pty Ltd	Gundagai	B
NSW	Narasell Pty Ltd	Junee	B
NSW	Peel Valley Exporters	Armidale	B
NSW	Woodbrae Holdings	Harden	B
SA	Lobethal abattoir	Lobethal	B
TAS	Devonport City Abattoir	Quoiba	B
TAS	Longford Meat Company	Longford	B
Vict	Ashton Pty Ltd	Swan Hill	B
Vict	Castricum Bros Pty Ltd	Dandenong	B
Vict	CRF Pty Ltd	Colac	B
Vict	Fresh Packed Pty Ltd	Patterson	B
Vict	Frewstal Pty Ltd	Stawell	B
Vict	GA Gathercole Pty Ltd	Wangaratta	B
Vict	GA Gathercole Pty Ltd	Tatura	B
Vict	Hardwicks Meatworks Pty	Kyneton	B
Vict	Ovens River Pty Ltd	Yarrawonga	B
Vict	Tasman Group Services	Altona North	B
WA	WAMMCO International	Victoria Park	B

A = >1,000,000; B= >370,000 & <1,000,000

Table 5: Major beef abattoirs and estimated throughput

Company	Size (tonnes per annum - 2003)	Locations	State
Australian Meat Holdings	400,000	Dinmore	QLD
		Rockhampton	QLD
		Beef City	QLD
		Townsville	QLD
Nippon Meat Packers	170,000	Mackay	QLD
		Oakey	QLD
		Wingham	NSW
Teys Brothers	167,000	Beenleigh	QLD
		Biloela	QLD
		Innisfail	QLD
		Katherine	NT
		Naracoorte	SA
		Rockhampton	QLD
Cargill Foods Australia	120,000	Tamworth	NSW
		Wagga Wagga	NSW
Bindaree Beef	97,000	Inverell	NSW
		Murgon	QLD
T&R (Murray Bridge)	36,000	Murray Bridge	SA
Midfield Meat International	39,000	Warrnambool	Vict
Rockdale Beef	53,000	Yanco	NSW
Australian Country Choice	52,000	Cannon Hill	QLD
HW Greenham & Sons	51,000	Smithton	Tasmania
		Tongala	Vict
EG Green & Sons	47,000	Harvey	WA
Kilcoy Pastoral Co	42,000	Kilcoy	QLD
G&K O'Connor	38,000	Pakenham	Vict
V & V Walsh	22,000	Bunbury	WA

4.3.2.3 Feedlot

The same approach as described for abattoirs would be used for cattle feedlots. It is anticipated that there may be less opportunity for collection of data on sheep transport events that end at feedlots and that involve transport for durations greater than 6 hours.

Information from the ALFA website indicates that there are about 700 accredited feedlot operations in Australia with a total capacity of ~1.1 million cattle. Most of these (>70% in terms of numbers) are located in three regions: southern Queensland; northern slopes of New South Wales; and the Riverina of New South Wales. Collection of data from cattle arriving at feedlots would concentrate on these areas. One of the project team leaders has extensive experience in the cattle feedlot industry and would contribute to identification of candidate locations for contact.

4.3.2.4 Live export

Information is available on live export assembly points and volumes of sheep and cattle that are prepared for export. The same approach as described above would be used for collection of data from these locations. Most data associated with sheep export would be collected in Victoria, South Australia and Western Australia. Data for cattle exports would be collected primarily from QLD, NT and WA.

Table 6: Estimated annual number of sheep and cattle departing Australian ports via live export shipments.

Sheep		
Port	**State**	**Annual Ave**
Fremantle	WA	4,600,000
Portland	Vict	928,000
Port Adelaide	SA	770,000
Devonport	TAS	58,000
Gladstone	QLD	10,000
Geraldton	WA	9,800
Broome	WA	7,500

Cattle		
Port	**State**	**Annual Ave**
Darwin	NT	340,000
Wyndham	WA	72,000
Broome	WA	109,000
Townsville	QLD	93,000
Portland	Vict	92,000
Fremantle	WA	158,000

4.3.2.5 Property to property movements

The above methods were specifically designed to concentrate on aggregation points where data can potentially be collected from multiple transport events at a single point in time because of the volume of animals arriving at various locations. This approach does not allow collection of data from transport events that involve direct movement of animals from property to property.

Two approaches have been identified to allow collection of data from property to property movements.

The first involves discussions with senior state management from national livestock agencies to identify branches in various states and individual agents that are associated with higher volumes of animal movement that do not involve movements to saleyards or direct to abattoirs. Identification of larger volume branches that are associated with property to property movements would be followed by direct contact with those branches to collect data from a sample of these transport events for sheep, cattle. It is anticipated that some of these transport events may involve data collection by phone as opposed to physical attendance at destination points depending on the origin and destination for selected journeys. In addition, it is anticipated that only a relatively small number of transport events would be collected from this segment since it is likely that these movements would only account for a small proportion of total movements. The use of phone or email and a small sample size for this subset of data are intended to avoid the higher cost alternative of a project team member travelling to a property to collect data on one transport event that had originated at another property.

The second approach is to contact representatives from larger pastoral companies that are involved in movement of animals from property to property, often within an integrated operation (breeder to grower to finisher and feedlot operations). Examples include:

- North Australian Pastoral Company (NAPCO)

- Australian Agricultural Company (AACo)
- Consolidated Pastoral Company
- Kidman & Co
- Heytesbury Beef

Preliminary discussions have been made with representatives from two of these companies and a visit has been conducted to one of the component enterprises of one company as part of Objective 1 activities. Contact would be made with management from other companies in the final preparation stages for activities. It is anticipated that much of the required information would be able to be sourced by phone or email or by visiting centralised management, reducing the need to travel to widely separated property locations throughout QLD and other northern regions.

4.3.2.6 Trucking companies

Trucking companies are heavily involved in all of the above data collection exercises and in most cases data would be collected directly from truck drivers as part of the exercise. There is no requirement for a separate and additional data collection exercise involving trucking companies for the main part of the data collection exercise as outlined in the above sections. However, it is proposed that a small, nested study be initiated to collect data on temperature and humidity during commercial livestock journeys.

It is proposed that contacts be made with a small number of trucking companies from QLD and possibly from Victoria or southern NSW (temperate regions) and from NT (tropical region) to explore placement of data loggers in trucks for collection of data on temperature and humidity during commercial journeys. This has been tested with installation of 8 data loggers in a truck that travelled empty from QLD to SA and then returned with 662 sheep. The loggers performed well and the method for installation, activation and removal appears to be feasible for inclusion in the proposed national study. A more detailed description of this test of loggers is presented in Section 8.5.4.3. The expected benefit of this component is the ability to describe patterns of temperature and humidity during the journey time in both summer and winter as a measure associated with animal welfare. Data would also be collected on the journey and animal welfare outcomes as for all other transport events.

4.3.2.7 Queensland Rail

Discussions with Mr David Rathbone (QRNational) indicate that QRNational is supportive of the project and willing to assist in data collection from rail-transport events involving cattle.

Table 7: Annual average (data from 2002-2004) number of cattle loaded at railheads in QLD

Location	State	Cattle loaded (annual)
Clermont	QLD	64,000
Cloncurry	QLD	46,000
Julia Creek	QLD	41,000
Quilpie	QLD	40,000
Dalby	QLD	36,000
Winton	QLD	31,000
Charters Towers	QLD	29,000
Mt Isa	QLD	24,000
Emerald	QLD	23,000
Longreach	QLD	21,000
Richmond	QLD	11,000

There are two opportunities to collect data associated with QRNational activities. The first involves a team member being present at the loading yard for arrival of trucks carrying cattle from property of origin. These data would relate to transport by road from property of origin to the rail head.

The second involves a team member being present at the destination yards where cattle are unloaded from the train and relates to long-distance transport by rail.

4.3.2.8 Nested abattoir study

Preliminary discussions have been held with Drs Andrew Fisher and Drewe Ferguson (CSIRO, Armidale) over the possibility of collecting blood and urine samples at the time of slaughter from animals after arrival at an abattoir on a truck monitored through the study (for which transport data have been collected as part of this study). This approach has been identified as an opportunity to lever additional valuable data out of this project for no additional cost. These data would complement existing work on the effects of transport on dehydration and other animal welfare outcomes.

These activities would only occur if there was a separate, approved and funded project under the control of Drs Fisher and Ferguson that incorporated activities such as collection and analysis of samples. The benefit of this collaboration is through the ability to relate data collected on the transport events through the activities described in this proposed study, to additional findings from assay of any biological samples collected on the same animals.

These activities have no cost or resource implications to the proposed national study. Progressing joint activities would mean collaborative planning between personnel involved in the proposed national study and Drs Fisher and Ferguson to ensure that information collected during the proposed transport study involved transport events from which animals might subsequently be selected for sampling under a separate, approved and funded project led by Drs Fisher and Ferguson. If the proposed national study is approved, further discussions will be held with Drs Fisher and Ferguson to determine feasibility of a collaborative nested study.

4.3.3 National Livestock Identification System (NLIS)

There was considerable interest in investigating the potential value of the NLIS database for the objectives of this project. Discussions have been held with state and federal government agencies, the national NLIS committee and from other industry stakeholders. A brief summary of key points is presented here:

- State departmental use of NLIS data is authorised and limited by state legislation such as the QLD Stock Act 1915 that authorises use of NLIS data for activities associated with investigation and control of disease outbreaks,
- Privacy legislation also limits use of data to those purposes that were outlined prior to the data being collected,
- There is uncertainty over access to and use of NLIS data for research purposes and particularly where the use is not able to be directly linked to legislative authority associated with investigation and control of notifiable diseases or to purposes outlined prior to the collection of the data. Uncertainties also extend to who has the authority to grant such access (state/territory departments or the national NLIS committee).
- The NLIS committee of MLA is understood to have agreed at an executive meeting on March 5th 2007 to develop guidelines for how to manage requests from researchers for access to NLIS data. The indication is that the committee would be likely to approve requests for aggregated

data that do not include any individual animal identity information or PIC records, provided that the requesting researcher(s) are reputable and prepared to pay for costs incurred in extracting data.

There also appear to be uncertainties over the potential value of the NLIS database to this project. The NLIS database currently contains data on movements linked to individual cattle identity for all cattle in Australia. The core data stored in the NLIS database includes individual animal ID, PIC of origin, PIC of destination; date movement was completed for every movement, and the associated NVD/waybill number. The database then stores the life-time record of movements for every animal to allow tracing and identification of in-contact animals at each step.

There is scope to record additional information in the system including fields such as health status of the animal. Health status codes are managed by the various states and territories and mainly relate to disease status for notifiable diseases or chemical residues or other outcomes relevant to state/territory legislation. These codes may be applied to a property (PIC) or to an animal and they may be permanent or temporary. Additional voluntary fields may be added to the system to extend functionality for the benefit of users. Examples include fields such as animal age, birth date, breed, sex and colour.

The core function of the NLIS is in recording information relating to animal movements so that tracing can be completed rapidly in the event of a disease outbreak. The NLIS is not designed to act as a census-like store of information. When an animal dies or goes missing there is an opportunity to code the health status of the individual animal as DEAD or INACTIVE but there appears to be no intention at this stage to maintain an accurate record of when an animal might have died and in particular no intention to record information on cause of death such that a mortality may be linked to some other event such as transportation.

The potential value of the NLIS database to the current project lies in the ability to retrieve data allowing a broad description of total cattle movements across Australia. There is not believed to be value in attempting to use the NLIS database to retrieve data on animal mortalities because the database is not designed to collect this form of data in any reliable way.

There are currently no clear guidelines that specify conditions under which NLIS data can be used for research. The NLIS committee is currently developing guidelines to govern conditions for access to and use of NLIS data for research purposes. Discussions with representatives from the NLIS committee indicate that it is extremely unlikely that data identifying individual cattle identity and PIC (either relating to origin or destination) would be released from the NLIS database in response to any request associated with a research project, because of constraints associated with privacy legislation. It was further suggested that data may be able to be released in aggregated form for example based on counts of animals by shire of origin and shire of destination. PIC data can also apparently be coded into categories such as grazing property, saleyard, abattoir, feedlot.

It is suggested that a request be forwarded to the Manager NLIS, asking for NLIS data aggregated to the shire or RLPB level that includes:

- data from a calendar year (depending on availability of data),
- for every shire/RLPB in Australia a count of all animals that were transported from that shire and details on their destination shire/RLPB,
- data on origin and destination categorised by type of PIC into classes including grazing property, saleyard, feedlot, abattoir, live export, etc.

These data could be used to derive population estimates of total numbers of cattle transported within Australia including details on shire of origin, shire of destination and class of origin and destination. These data can also be used to determine crude measures of distance of travel based on identifying locations of individual shires throughout Australia and estimating distance between shires of origin and destination. While not allowing estimation of mortalities or morbidities associated with transport events, NLIS data would provide a valuable description of overall patterns of movement and a crude measure of distance.

It is expected that there may be costs associated with provision of NLIS data in response to this request. No budget item has been incorporated into the estimated budget because there has been no indication of what the cost might be. This request would only be further actioned once a cost and timeline and deliverables are agreed on by all relevant parties. It is also expected that as time progresses the NLIS database may be expanded to incorporate additional functionality of value to end users. In addition clearer guidelines governing access to NLIS data and its use by researchers may also be expected.

NLIS is intended to also store data on aggregated movements of sheep (sheep will carry a property identification tag and not an individual animal tag) but the database does not yet store all sheep movement information. The timetable for implementation of sheep movement recording varies between States.

4.3.4 Budget for national study

A detailed budget has been prepared in discussion with project team members from various states and territories.

A number of factors have influenced preparation of the budget.

i. Aim to collect data from a minimum of 30 transport events for beef and sheep from each of summer and winter periods and from each of QLD, NT, WA, NSW and SA and Victoria. Details of the approach taken to identify sample size are presented in Appendix 2 (Section 8.2).
ii. For most industry segments it is estimated that 2 visits would need to be made to each location in each of summer and winter. An attempt would be made to arrange visits to coincide with anticipated arrival of long distance trucks and to collect data from as many trucks as possible at the visit. Having two (and occasionally more) visits per site per season should ensure that 10 or more events would be observed for each site/season combination.
iii. The project does require extensive travel even allowing for efforts to concentrate on aggregation points and to plan trips to ensure that multiple visits are completed on each trip. Travel costs are based on economy airfare estimates, ATO allowances for meals and accommodation and estimates of mileage or hire car and fuel costs for vehicular travel.

A number of individuals have been identified to assist in data collection activities. Additional individuals would be contacted as required. At the time this report was prepared the core project team consisted of two project leaders (Dr Nigel Perkins and Dr John Gaughan) from QLD and additional people serving as focal points in NT, Victoria and WA. Personnel from state/territory

government agencies have expressed willingness to provide liaison services in all states and territories included in the design.

Discussions have been held with State/Territory departmental staff and a decision made to avoid enlisting the use of state government staff, particularly stock inspectors for the purposes of data collection. The main reason for this decision was to explicitly avoid any confusion over responsibilities given that these staff has important roles in regulatory and compliance matters relating to animal welfare and animal transport. It was felt that relationships with industry stakeholders and collection of valid data would be facilitated by having independent data collection personnel. State and Territory departmental personnel have made important contributions to the project to date particularly through provision of information and liaison with industry. Every effort would be made to maintain effective communication with relevant individuals during the course of the project. All individuals contacted have expressed a willingness to assist and are expected to contribute important functions in liaison and problem solving during the project. All individuals assisting in the collection of data would be subcontracted to AusVet Animal Health Services.

Table 8: Estimated budget for proposed national study

State	location	Activity	Visits per season	Days per season	No of seasons	Total days
QLD	Roma	Cattle sale	2	6	2	12
	Rockhampton	Cattle sale & AMH abattoir	2	8	2	16
	Townsville	Live export	1	4	2	8
	Cloncurry	QR cattle loading	1	5	2	10
	Quilpie	QR cattle loading	1	3	2	6
	Dinmore/Oakey/Beenleigh	Cattle abattoir	2	6	2	12
	SE QLD	Cattle feedlot	2	4	2	8
	Warwick	Sheep abattoir	2	4	2	8
	Kilarney	Sheep abattoir	2	4	2	8
	Trucking company	Loggers for truck movements	2	6	2	12
	Brisbane	NAPCO, AA Co	1	2	2	4
	QLD locations	Agents for sheep & cattle movements	2	2	2	4
			Subtotal	**54**		**108**
NSW	Dubbo & Tamworth area (north NSW)	saleyards, abattoirs, agents, feedlot	2.5	20	2	40
	Wagga Wagga area (south NSW)	saleyards, abattoirs, agents	2	16	2	32
	Trucking company	Loggers for truck movements	2	12	2	24
	NSW locations	Agents for sheep & cattle movements	2	2	2	4
			Subtotal	**48**		**100**
Vict	Wodonga / Pakenham	Cattle saleyards	2	3	2	6
	Ballarat / Bendigo / Hamilton / Horsham	Sheep saleyards	2	3	2	6
	Warrnambool / Tongala / Pakenham	Cattle abattoir	2	3	2	6
	Geelong / Warrnambool / Wodonga	Sheep abattoir	2	3	2	6
	Portland	Live export	2	8	2	16
	Victorian locations	Agents for sheep & cattle movements	2	2	2	4
			Subtotal	**22**		**44**
SA	Adelaide plains/Naracoorte/Mt Gambier	saleyards - sheep & cattle	1	10	2	20
	Port Pirie/Naracoorte/Murray Bridge	Sheep abattoir & cattle abattoir	1	6	2	12
	Two Wells	Sheep live export	1	4	2	8
			Subtotal	**20**		**40**
NT	Darwin	Live export assembly yards	3	6	2	12
	NT	Pastoral company	2	2	2	4
	Frasers transport	Loggers for truck movements	0	0	2	0
			Subtotal	**8**		**16**
WA	Broome	Live export assembly yards	3	3	2	6
	Broome	Dipping yards (southern transport)	2	2	2	4
	Midland	sheep sale	3	3	2	6
	Midland	cattle sale	3	3	2	6
	Albany/Bunbury	sheep abattoir	3	3	2	6
	Harvey	cattle abattoir	2	2	2	4
	Freemantle	live export (sheep & cattle)	2	6	2	12
	agent		2	2	2	4
	cattle from Broome		2	4	2	8
	Team member from QLD (NRP)	Travel for set up & live export	1.5	9.5	2	19
			Subtotal	**37.5**		**75**
			Total			**383**
All states	Professional fees		days	rate/day		
	Data collection		280			
	Project management	14 person-days	14			
	Organisation of visits	5 person days per state	30			
	Data collection from vendors	3 person-days per state	18			
	Analysis & report writing	10 person-days	10			
	Report revision	2 person-days	2			
			354	$ 1,250	$ 442,500	
	Post-graduate student	12 mnths @ $20,000 per annum			$ 20,000	
	Travel & accommodation				$ 96,740	
	Consumables and equipment				$ 2,000	
	Communication (phone, fax, mail, printing)				$ 3,000	
			TOTAL		**$ 564,240**	

Budget estimates do not incorporate costs that may be associated with provision of data from the NLIS database.

The proposal includes a one-year stipend for an honours student who would be expected to play a key role in data collection in QLD and NSW and in the collation and analysis of data collected through the course of the project. The project team has identified a student who is currently enrolled at the School of Animal Studies, University of Queensland, Gatton and is under the supervision of Dr John Gaughan. Graduate student costs were estimated as a 12-month scholarship/stipend valued at $20,000. This allowed a reduction in professional fees since the number of data collection days that were valued at the full daily rate of $1250 per day (ex GST) was 280 instead of 383. If a graduate student cannot be enrolled in the study there is a risk of additional cost due to the need for employment of alternative sources of labour for data collection. If the study was fully costed (removal of $20,000 cost of a graduate student and funding all 383 data collection days at $1250 per day), the impact on the proposed budget would be an additional cost of $108,750. The total budget cost would then move to $672,990.

4.3.5 Timeline for national study

It is proposed that data be collected on transport events in the summer of 2007-2008 and the winter of 2008. The first round of data collection would be planned for December 2007 to March 2008 with an exception being cattle properties in the far north of Australia. The wet season generally prevents movement of animals until March-April. With this in mind it is expected that hot season data collection for far northern regions would be delayed until March or April of 2008 depending on when movements resume following the wet.

The second round of data collection would then occur between June and September 2008.

An interim report on the summer data collection period would be delivered in June 2008 and a final report in December 2008.

4.3.6 Risks associated with national study

A number of risks were identified with the proposed national study.

i. Logistical and personnel requirements. The proposed study is large and complex and is dependent on sourcing and retaining personnel who can work independently to collect data. Every effort has been made to utilise personnel who have been involved in the Stage 1 project or who are known to be reliable and resourceful.
ii. Difficulty in collecting sufficient data from transport events greater than 6 hours. This is a particular risk in Victoria where a smaller proportion of transport events appear likely to be greater than 6 hours. Discussions have been held with Dr Richard Shephard (focal point for Victoria) and approaches have already been identified to concentrate on routes where longer journeys tend to occur. Close contact would be maintained with Dr Shephard to monitor data collection in Victoria and it may be necessary to transfer resources from Victoria to other states in the event that there are few transport events meeting the journey time criteria from Victoria. In other states it seems very likely that the project would collect data from more than 30 transport events per season for sheep and cattle.
iii. Lack of industry cooperation. All stakeholders contacted to date have appeared to be very willing to assist in the project. Vendors contacted by phone were very willing to provide additional information. Truck drivers and trucking companies are very sensitive about regulations governing driver hours and about log books. However, explanation of the project aims and the fact that the project has no requirement to view log books and

would not release data to regulatory groups, has generally been sufficient to satisfy driver concerns. There is a risk that a small number of stakeholders would not freely provide information but this is not expected to interfere with achievement of the project objectives.

iv. Difficulty in collecting information at the end of a particular journey that may relate to a previous journey. The main example of this issue was animals (sheep or cattle) arriving at a feedlot or abattoir after having been bought from a saleyard the day before. The issue is considered to be a general issue pertaining to any two linked journeys. Information collected at the end of any one journey can really only be applied to that specific journey and not to any prior journey(s). This means that the proposed study cannot be reliably expected to collect sufficient data at the end of a journey originating from a saleyard to allow characterisation of both the journey from a property of origin to the saleyard (journey 1) and the journey from the saleyard to the new destination (journey 2). Data collection at the end of any journey can be used to describe and characterise the immediate journey that has just finished. This is not considered to be a major issue since the proposed study expressly intends to collect information from a reasonably large number of different transport events so there will be data collected from journeys to a saleyard (examples of journey 1 from the above description) as well as journeys that originate at a saleyard and end somewhere else (examples of journey 2 from the above description).
v. Uncertainty over availability and cost of NLIS data. It is not yet clear whether NLIS data may be accessed or what the cost might be to the project. NLIS data are not considered essential to the project and failure to collect any NLIS data would not have an adverse impact on the proposed project, mainly because NLIS data would not provide information on specific journeys or on animal welfare outcomes. Availability of NLIS data may allow broader characterisation of general transport patterns for Australian cattle in a way that is likely to enhance the final report.
vi. Availability of a graduate student to work on aspects of the study. The total number of days identified for data collection in Table 8 was 383. Of these, approximately 30% were assigned to a graduate student along with tasks associated with literature review, analysis and report writing.
vii. The cost of the proposed national study is high and may prevent approval in its current form. Alternatives are presented in the following section for reducing cost of the proposed national study along with potential implications of various cost saving measures on the ability of the proposed study to meet objectives.

4.4 Options to reduce cost

The design of the proposed study was based on the need to deliver information sufficient to meet aims and objectives as described in Sections 1.2 and 2 of this report. It is acknowledged that the proposed design is associated with a significant cost. A number of options have been considered in order to reduce cost.

The major impact of reducing the level of activities is in reducing the ability of the project to produce a representative picture of national livestock transportation.

4.4.1 Alternative 1

Alternative 1 involves selective removal and modification of a number of activities including:

- Elimination of data collection from sheep transport events in QLD and concentration on NSW for sheep transport events. This decision was based on the fact that relatively few sheep are sold

through saleyards or processed in QLD and that most of the major aggregation centres for sheep in the eastern states are in NSW.

- Elimination of a planned visit to Rockhampton, QLD to collect data from saleyards and abattoir.
- Elimination of proposed activities associated with placement of data loggers on a small number of transport events in QLD, NSW and NT.
- Elimination of attempts to collect data from a small number of property to property transport events.
- Reduction in days allocated to Victoria in association with an intent to use local knowledge to identify routes with longer journeys and collect data on a smaller number of transport events while concentrating on these routes. This represents an attempt to ensure some data collection from Victoria while reducing cost.
- Elimination of data collection from the far north of Western Australia and concentration on the southern part of that state.
- Reduction in number of days allocated to collection of data from live export assembly depots in Victoria and Western Australia
- Reduced allocation of days to organisation of visits in each state from 5 days per state to 4.

The impact of these changes on cost of the proposed project is to reduce the cost from $564,240 to $408,450, representing a saving of $155,790 (28% of the original project cost).

The main impact of the changes on data and results would be to reduce the number of transport events from which data could be collected. The level of reduction is difficult to estimate with confidence. Different approaches have been used to attempt to quantify the level of reduction in sample size that may result from the reduced activities outlined in Alternative 2:

1. The changes represent a reduction in the total number of days allocated to data collection from 383 to 261 (68%). Applying this reduction to the planned number of 30 (minimum) transport events from which data were to be collected for each state/territory, species (sheep and cattle) and season (winter and summer), results in a revised estimate of a minimum of 20 transport events for each combination of state/territory, species and season.
2. A total of 36 days of data collection were allocated in Table 8 to the use of data loggers to collect data on temperature and humidity from selected transport events. If these days were excluded from total days allocated in Table 8 to data collection then the days drop from 383 to 347. The revised total data collection days in Table 9 of 261 days then represents a drop to 75% of 347 days. Applying this percentage to the planned sample size indicates a minimum of 22 transport events for each combination of state/territory, species and season.

The reduction in expected minimum sample size would reduce the precision for estimates derived from the proposed national study and may be expected to have the following impacts on the ability of the study to address the desired objectives:

- Reduced ability to detect relatively rare events such as adverse welfare outcomes that may only occur on a small proportion of transport events;
- Reduced ability to statistically assess associations between possible explanatory risk factors and key welfare outcomes.

These impacts would be more likely to be experienced if data were to be analysed to generate summary statistics and comparisons at the smallest level of aggregation i.e. within one species, during one season and within one state or territory. When data are aggregated to a national perspective for one species, the sample size would be expected to exceed 100 transport events in

each season and this provides adequate numbers to achieve reasonable precision and a representative description of transport practices.

Table 9: Budget for Alternative 1

State	location	Activity	Visits per season	Days per season	No of seasons	Total days
QLD	Roma	Cattle sale	2	6	2	12
	Rockhampton	Cattle sale & AMH abattoir	0	0	2	0
	Townsville	Live export	1	4	2	8
	Cloncurry	QR cattle loading	1	5	2	10
	Quilpie	QR cattle loading	1	3	2	6
	Dinmore/Oakey/Beenleigh	Cattle abattoir	2	6	2	12
	SE QLD	Cattle feedlot	2	4	2	8
	Warwick	Sheep abattoir	0	0	2	0
	Kilarney	Sheep abattoir	0	0	2	0
	Trucking company	Loggers for truck movements	0	0	2	0
	Brisbane	NAPCO, AA Co	1	2	2	4
	QLD locations	Agents for sheep & cattle movements	0	0	2	0
			Subtotal	**30**		**60**
NSW	Dubbo & Tamworth area (north NSW)	saleyards, abattoirs, agents, feedlot	2	16	2	32
	Wagga Wagga area (south NSW)	saleyards, abattoirs, agents	2	16	2	32
	Trucking Co.	Loggers for truck movements	2	0	2	0
	NSW locations	Agents for sheep & cattle movements	2	0	2	0
			Subtotal	**32**		**64**
Vict	Wodonga / Pakenham	Cattle saleyards	2	5	2	10
	Ballarat / Bendigo / Hamilton / Horsham	Sheep saleyards	0	0	2	0
	Warrnambool / Tongala / Pakenham	Cattle abattoir	0	0	2	0
	Geelong / Warrnambool / Wodonga	Sheep abattoir	0	0	2	0
	Portland	Live export	1	5	2	10
	Victorian locations	Agents for sheep & cattle movements	2	2	2	4
			Subtotal	**12**		**24**
SA	Adelaide plains/Naracoorte/Mt Gambier	saleyards - sheep & cattle	1	10	2	20
	Port Pirie/Naracoorte/Murray Bridge	Sheep abattoir & cattle abattoir	1	6	2	12
	Two Wells	Sheep live export	1	4	2	8
			Subtotal	**20**		**40**
NT	Darwin	Live export assembly yards	3	6	2	12
	NT	Pastoral company	2	2	2	4
	Transport operators	Loggers for truck movements	0	0	2	0
			Subtotal	**8**		**16**
WA	Broome	Live export assembly yards	0	0	2	0
	Broome	Dipping yards (southern transport)	0	0	2	0
	Midland	sheep sale	3	3	2	6
	Midland	cattle sale	3	3	2	6
	Albany/Bunbury	sheep abattoir	3	3	2	6
	Harvey	cattle abattoir	2	2	2	4
	Freemantle	live export (sheep & cattle)	2	4	2	8
	agent		0	0	2	0
	cattle from Broome		2	4	2	8
	Team member from QLD (NRP)	Travel for set up & live export	1.5	9.5	2	19
			Subtotal	**28.5**		**57**
			Total	**130.5**		**261**

All states	Professional fees		days	rate/day	
	Data collection		183		
	Project management	14 person-days	14		
	Organisation of visits	4 person days per state	24		
	Data collection from vendors	3 person-days per state	18		
	Analysis & report writing	10 person-days	10		
	Report revision	2 person-days	2		
			251	$ 1,250	$ 313,750
	Post-graduate student	12 mnths @ $20,000 per annum			$ 20,000
	Travel & accommodation				$ 70,700
	Consumables and equipment				$ 1,000
	Communication (phone, fax, mail, printing)				$ 3,000
			TOTAL		**$ 408,450**

Alternative 1 also assumes involvement of a graduate student with 30% of all data collection days being assigned to the graduate student along with tasks associated with literature review, data analysis and writing. The budget impact for Alternative 1 of having no graduate student and of funding all data collection days at $1250 per day is made up of a saving of $20,000 (no graduate student stipend) and an additional cost of $97,500 (78 days at $1250 per day) resulting in an overall increase to the budget of $77,500 making the total budget cost equal to $485,950.

4.4.2 Alternative 2

A second alternative approach has been developed for consideration. This approach involves a shift away from attempting to collect sufficient data from all major types of journeys to allow a nationally representative picture of livestock land transport to be developed for journeys greater than 6 hours. Instead Alternative 2 involves a concentration of efforts on particular segments of the industry where longer distance journeys are considered to be more likely to occur.

An important part of this approach would involve a focus on saleyards and abattoirs as two major aggregation points serving as a potential destination for almost all classes of livestock. Live export assembly depots also offer an opportunity to collect data from transport events though animals arriving for live export would generally be expected to exclude older or cull classes of livestock and would therefore be expected to be less representative than those animals arriving at saleyards and abattoirs.

Data presented in Tables 3 to 7 were used to identify larger venues in several states for saleyards, abattoirs and live export assembly points. Discussions with industry stakeholders allowed identification of a number of livestock movement patterns that have a high likelihood of being associated with longer journey times. Examples of these are presented below.

Approximately 540,000 cattle moved out of NT in 2006 with most of these animals travelling via three routes:

- Movement of cattle from NT properties to live export assembly depots in Darwin and to a lesser extent Wyndham and Broome. About 230,000 animals left NT on live export shipments in 2006.
- Movement from NT down the Stuart Highway through Alice Springs and into South Australia. About 140,000 animals moved in this direction during 2006 with the major identified destinations being the Adelaide Plains saleyards at Dublin, South Australia and abattoirs at Murray Bridge or Naracoorte.
- Movement of cattle from NT over the Barkly Highway into QLD. About 170,000 animals moved in this direction in 2006 with major destinations being Cloncurry (loaded onto QRNational rail transport to export from Townsville or to abattoirs in Rockhampton or Dinmore), saleyards at Roma or Longreach and direct to backgrounding or finishing properties mostly in the Channel country.

Roma saleyard has the largest annual throughput of any saleyard in Australia and regularly draws cattle from across QLD as well as from origin properties as far a field as NT, NSW, Victoria and SA.

The last few years have seen regular shipments of animals (particularly sheep) across the Nullarbor Plain from WA to SA with the main destinations being abattoirs in SA (Murray Bridge) and Victoria (Warrnambool). In 2005 approximately 500,000 sheep and 50,000 cattle were transported along this route. This movement is driven by supply and demand and tends to be active when there is a

shortage of sheep in particular in the eastern states and a plentiful and relatively cheap supply in Western Australia.

The information summarised above has been used to derive a modified plan involving data collection at the following locations:

- QLD:
    - Cattle saleyards at Roma;
    - QRNational rail heads at Cloncurry and either Clermont or Quilpie;
    - Cattle abattoirs in the south east of the state at Dinmore and Beenleigh.
- NSW:
    - Saleyards at Dubbo and Wagga Wagga (sheep and cattle);
    - Abattoirs at Dubbo (sheep), Wagga Wagga (cattle).
- SA:
    - Saleyards at Adelaide Plains (sheep and cattle) and Naracoorte (sheep and cattle);
    - Abattoirs at Murray Bridge (sheep and cattle), Naracoorte (cattle), Port Pirie (sheep);
    - Live export assembly depot at Two Wells.
- WA:
    - Saleyards at Katanning (sheep), Midland (sheep and cattle);
    - Abattoirs at Albany (sheep), Bunbury (sheep and cattle) and Harvey (cattle);
    - Live export assembly depot at Fremantle (sheep and cattle)
- NT:
    - Live export assembly depot at Darwin (cattle).

Activities outlined under Alternative 2 were designed to collect data from a minimum of 200 transport events involving sheep (100 in each of winter and summer) and 200 transport events from cattle (100 in each of winter and summer). There was no specific design intention to collect equivalent numbers from any state or territory and locations and segments were chosen because they were considered likely to be larger volume destinations and also to involve transport over longer durations. Efforts were focussed on saleyards and abattoirs because these destinations involve aggregations (multiple transport events arriving on a given day) and all classes of animals were considered likely to be included in the population of animals transported to these destinations. There are between 12-15 locations identified for sheep and cattle in the list above and it is anticipated that data would be collected from a minimum of 8 to 10 transport events at each location to ensure a total of 100 events for each combination of species and season.

Alternative 2 would not provide results that could be considered as being representative in a statistical sense of national livestock land transport for journeys greater than 6 hours. This is because selection of locations and industry segments does not involve randomisation and does not draw transport events from all types and locations of transportation.

However, Alternative 2 would provide a great deal of information about selected long distance transport events. In designing Alternative 2 an effort has been made to purposefully target locations and routes that were associated with some of the longer land journeys that an animal may encounter in Australia. Alternative 2 would therefore offer the ability to describe patterns of transport and animal welfare outcomes for selected longer distance journeys. It would provide a strong foundation of science-based evidence for health and welfare of animals in longer distance land journeys in Australia and should identify any issues or problems that may need addressing.

Table 10: Budget for Alternative 2

State	location	Activity	Visits per season	Days per season	No of seasons	Total days
State	**location**	**Activity**				
QLD	Roma	Saleyards (cattle)	2	6	2	12
	Cloncurry	QR cattle loading	2	8	2	16
	Quilpie	QR cattle loading	1	3	2	6
	Dinmore/Oakey/Beenleigh	Abattoir (cattle)	3	6	2	12
			Subtotal	**23**		**46**
NSW	Dubbo	Saleyards, abattoirs (sheep & cattle)	3	15	2	30
	Wagga Wagga	Saleyards, abattoirs (sheep & cattle)	3	9	2	18
			Subtotal	**24**		**48**
SA	Naracoorte, Murray Bridge, Port Pirie, Adelaide Plains	Saleyards, abattoirs (sheep & cattle)	2	18	2	36
	Two Wells	Live export (sheep)	1	4	2	8
			Subtotal	**22**		**44**
NT	Darwin	Live export assembly yards (cattle)	3	9	2	18
			Subtotal	**9**		**18**
WA	Midland	Saleyards (sheep & cattle)	3	6	2	12
	Albany/Bunbury	Abattoir (sheep)	3	3	2	6
	Harvey	Abattoir (cattle)	2	4	2	8
	Freemantle	Live export (sheep & cattle)	2	2	2	4
	Team member from QLD (NRP)		2	18	2	36
			Subtotal	**33**		**66**
			Total	**111**		**222**
All states	Professional fees		days	rate/day		
	Data collection		156			
	Project management	14 person-days	14			
	Organisation of visits	4 person days per state, 2 for NT	18			
	Data collection from vendors	3 person-days per state	15			
	Analysis & report writing	10 person-days	10			
	Report revision	2 person-days	2			
			215	$ 1,250	$ 268,750	
	Post-graduate student	12 mnths @ $20,000 per annum			$ 20,000	
	Travel & accommodation				$ 61,200	
	Consumables and equipment				$ 1,000	
	Communication (phone, fax, mail, printing)				$ 3,000	
			TOTAL		**$ 353,950**	

Alternative 2 also assumes involvement of a graduate student with approximately 30% of all data collection days being assigned to the graduate student along with tasks associated with literature review, data analysis and writing. The budget impact for Alternative 2 of having no graduate student and of funding all data collection days at $1250 per day is made up of a saving of $20,000 (no graduate student stipend) and an additional cost of $82,500 (66 days at $1250 per day) resulting in an overall increase to the budget of $62,500 making the total budget cost equal to $416,450.

5 Success in Achieving Objectives

5.1 Success in Achieving Objective 1

Objective 1 was successfully completed.

Activities completed under Objective 1 involved collection of data derived from a sample of historical records concerning transport events and the assessment of availability and quality of historical records as a potential means of addressing the requirements of Objective 1 as outlined in Section 2.1.

Data on transport events were collected from trucking companies, abattoirs, feedlots, agents, saleyards and a pastoral company, and from four states (NT, QLD, Vic, WA). The goal was to collect 50 records from each visit and the project achieved between 34 and 55 records per visit from a total of 14 different companies.

Sufficient records were collected to allow interpretive conclusions to be made concerning the statistical quality of retrospective data for investigations of adverse events in livestock transport events involving transport durations greater than 6-hours in Australia. The data examined in this study indicate that it was not possible to make accurate statements about adverse welfare events in livestock subjected to transport of greater than 6-hours in duration using retrospective records.

5.2 Success in achieving Objective 2

Objective 2 was considered to have been successfully completed though data were collected on fewer transport events than anticipated. This was not felt to have had any impact on the role of Objective 2 in developing and field testing methodologies for incorporation in a proposed national study.

A major goal for Objective 2 was to field test a proposed method for collecting data on land transport events under commercial conditions and involving real-world industry personnel involved in the livestock industry and particularly in livestock transport. This process was considered critical to the development of a robust methodology that would enable collection of accurate and representative data from transport events in a proposed national study. This goal was achieved.

In addition the project team successfully completed a pilot trial involving installation of data loggers that recorded temperature and humidity readings in a truck for a journey of 2,000 km, while carrying a load of Dorper sheep from SA to QLD.

An additional important outcome of the activities completed under both Objectives 1 and 2 was the development of an extensive network of contacts within the broader livestock industries which would be essential for the successful completion of a proposed national study.

The activities completed under Objective 2 did not achieve successful data collection on the specified number of transport events with a journey time greater than 6 hours that had been identified in the planning documents (and presented in Section 3.2). Information was collected on the following transport events:

- Five trucks (20 decks) containing 668 yearling cattle travelling over a 7 hour journey to a saleyard,
- Three trucks of sheep travelling to a saleyard, comprising 135 mixed age sheep travelling 1.75 hours, 68 cross-bred lambs travelling 45 minutes, and 120 cross-bred lambs travelling one hour,
- One truck of 640 adult sheep travelling 17 hours to an abattoir,
- One truck of 662 adult sheep travelling 28 hours from property to property,
- One train load (44 decks) of 868 cattle travelling 10 to 12 hours to one of two abattoirs.

The limited number of successful data collections from transport events greater than 6 hours was also contributed to by the decision to limit Objective 2 activities to QLD. This was particularly the case for sheep transport events where most transport events travelling to the major saleyards and abattoirs in QLD for sheep were likely to be from journeys shorter than 6 hours. This does not in any way invalidate the usefulness of the process for testing methodologies and getting industry feedback on the questions intended to be asked in a proposed national study on land transport.

No statistical analyses were conducted on data collected during activities under Objective 2. This was because of the small sample size, the fact that a number of the transport events involved journeys less than 6 hours in duration and some truck events involved animals transported from

saleyards where it was not possible to match arriving animals with vendor details. The limited number of successful data collections from transport events greater than 6 hours was not considered to have any adverse impact on the project. The Pilot Study aimed to collect data from a very small number of transport events at a single point in time and the results could not have been interpreted as being indicative of the national transport picture.

5.3 Success in achieving Objective 3

Objective 3 has been achieved with the description of proposed methodologies, timeline and budget for a national study on land transport events involving journeys greater than 6 hours.

Two alternative designs have also been described as options that allow reduction in cost. The impact of these alternative designs on the ability of the proposed study to meet the objectives is also discussed.

6 Impact on Meat and Livestock Industry

This report describes work completed on assessment of the value of historical transport records for use in the retrospective investigation of transport events (Objective 1), a pilot study aiming to develop and test methodologies that would be feasible and effective for collection of prospective data on transport events (Objective 3) and the design and costing of a proposed study aiming to implement the methods in a national study of livestock transport events (Objective 3).

The impact of the findings of the current study may be summarised under each of the three objectives.

6.1 Impact of Objective 1 - summary

The findings indicated that historical records (paper and electronic) concerning livestock transport events did not provide sufficient detail on variables of interest to allow these data sources to be efficiently and effectively used for investigation of associations between livestock transport characteristics and animal welfare outcomes. These issues were compounded by variability in statistical quality of data records.

A second impact of these findings is that data recording systems such as NVD/waybills, NLIS, and quality assurance programs such as TruckCare, do offer potentially useful options for routine recording of data that could be used to monitor animal welfare aspects of livestock transport in an ongoing manner with a number of benefits flowing on from this including reporting of outcomes in an industry wide quality assurance program, early identification of problems and assessment of the impact of changes in guidelines or operational systems. In order for this to occur, there would need to be standardised collection of data on required variables, high levels of commitment/compliance amongst industry stakeholders, and implementation of systems for storing, retrieving, analysing and reporting data and information (information management systems).

6.2 Impact of Objective 2 - summary

The findings derived from activities completed under this Objective were related to the development of methodologies for the effective and efficient collection of data from livestock transport events to allow collection, analysis and reporting of data and information from a representative sample of

transport events from around Australia and concentrating on events involving journeys greater than 6 hours in duration.

Methods were developed and tested in a pilot study and were found to be feasible and practical. Feedback obtained during the project resulted in modification and improvement in the questionnaires.

Findings from Objectives 1 and 2 were used to inform the development of a proposed national study as part of Objective 3.

6.3 Impact of Objective 3 - summary

Objective 3 concerned the development of a proposal outlining the methods, timeline and budget for a large scale study aiming to collect data from livestock transport events around Australia. The potential impacts of the proposed national study include improved understanding of: the patterns of livestock transport around Australia; animal welfare outcomes from and risk factors associated with transportation, and; rigorous scientific information that describes industry performance and identifies problems.

7 Conclusions and Recommendations

7.1 Conclusions

Historical records (paper and electronic) concerning livestock transport events do not provide sufficient detail on variables of interest to allow these data sources to be efficiently and effectively used for investigation of associations between livestock transport characteristics and animal welfare outcomes. Further investment in retrieving and analysing historical data records for the purpose of investigations into land transport events is therefore not warranted.

There are a number of paper-based recording systems currently in use by livestock transport operators but none of these allow reliable collection of sufficient data to characterise livestock transport patterns and animal welfare outcomes as described in the Objectives.

Current NVD/waybill records do allow identification of property of origin and destination, vendor PIC and animal numbers and characteristics (species, class etc). They do not allow simple or accurate determination of distance travelled or journey time, do not record any information on type of truck/trailer and do not record details of mortalities or morbidities that are detected during the journey or on arrival.

Some form of consignment note or truck docket is used by many transport operators though there is variation in design, information collected and level of compliance in filling in the forms. As a result consignment notes currently do not offer a reliable source of data for investigating transport events.

There is value in the routine collection of data from transport events that would allow analysis and reporting on transport events. There is not yet any standardised information management system that routinely collects sufficient data to allow this to occur. In order for this approach to be effective the data required would need to be standardised across the broader industry and collected in the course of regular day-to-day operations. This could be done by integrating data requirements in with existing systems such as NVD/waybill, NLIS or quality assurance programs such as TruckCare.

Care would need to be taken to ensure that information was only collected on key indicators to minimise recording and reporting burdens and help ensure accurate and valid data.

In the longer term there are considered to be benefits in moving towards electronic capture and flow of transport information and perhaps integration with the NLIS database. Development and implementation of an information management system capable of collecting on a routine basis data on livestock transport events and collating and analysing data and preparing reports for industry, is considered to be a relatively complex goal requiring longer term strategic commitment.

The proposed study described in this report under Objective 3 was designed to collect data on livestock transport events with a focus on describing patterns of livestock transport for journeys greater than 6 hours and on animal welfare outcomes. The study describes data collection processes during winter and summer in order to capture information at either end of the climatic extremes in Australia. The study would provide a snap shot description of industry patterns and outcomes. It would not deliver ongoing, routine data collection and management. In the short term, collection of quality science-based data to deliver a representative picture of Australian transport patterns is considered to be an important need. In the longer term, implementation of an information management system capable of delivering ongoing monitoring and reporting on transport events is also considered worthwhile.

7.2 Recommendations

That further investment not be made at the present time in collection of data concerning livestock transport events from historical records sourced from industry stakeholders for the purpose of describing the patterns of livestock transport across Australia and animal welfare outcomes.

That effort be directed to exploring options for accessing data derived from the NLIS database for the purposes of research and the development of guidelines governing access and use of NLIS data for research purposes.

That support be given to development of an information management system capable of collecting data on key performance outcomes for livestock transport. The recent development of industry standards for animal welfare in livestock transport and integration of these standards into an industry quality assurance program (TruckCare) is supported and offers a potential system for ongoing monitoring of livestock transport and welfare outcomes. Consideration of a longer term strategic approach is also recommended with a view to a national, electronic recording system perhaps linked in some way to the operational systems of the NLIS to facilitate collection, storage, analysis and reporting of data and information on livestock transport in Australia.

That consideration be given to completion of a short-term study aiming to collect sufficient data on livestock transport events to provide a scientifically rigorous, valid, snap-shot description of transport patterns across Australia and animal welfare outcomes. A proposal for such a study has been presented in Objective 3 of this report.

8 Appendices

8.1 Appendix 1: Data collection sheets

Four data collection sheets were developed as described in Section 3.2.3. The sheets are reproduced here. A number of minor changes have been made to the sheets during the course of the project. Additional information on body condition scoring in the form of a photographic guide will be provided to all project team members to assist them in assigning an average condition score to cattle as they are unloaded. Any further suggestions for modifications to the sheets will be considered using the same criteria applied in developing the forms and a final design agreed prior to the start of the project.

AHW.125 **Land Transport Project**

SITE VISIT COVER SHEET

Project team member name: _____ date _____

Industry segment _____

saleyard
feedlot
trucking company
abattoir
pastoral Co
QLD rail
transit centre
agent

location/address _____

state _____

Contact name _____

Contact details
phone _____
mobile _____
email _____

Fill out one **SITE COVER SHEET** for each site visit
Then fill out as many **ARRIVAL, NVD** sheets as needed
Later, fill out **VENDOR** sheet

AHW.125	**Land Transport Project**					
ARRIVAL SHEET						
Truck company name						
Address1			Town:			
Ph (landline)			State:			
Ph (mob)			Rego:			
Truck & unload Info		trailer type	decks	# pens/d	# empty pens	
body truck						
B-double	trailer 1	**B-train**				
	trailer 2	**std trailer S**				
Other combination	trailer 1					
	trailer 2					
	trailer 3					
Unload date						
Time unload started			*Unload duration (min)*			
Access to water on unload						
Temperature at unload			*Relative Humidity*			
Soiling score of animals at unload		**none**	**mild**	**mod**	**heavy**	
Soiling score of truck	**none/little**	**mod/dry**	**mod/wet**	**heavy & very wet**		
Flooring	**grooved floor**		**mesh**		**other:**	
Was the truck completely unloaded at the one location				**yes**	**no**	
Ease of unloading	**easy**	**moderate**	**hard**			
if hard, why?						
DRIVER						
Date animals loaded			Time taken to load (hrs)			
Time of day loading completed			Time from load to departure (hrs)			
Distance travelled from loading (km)			Driving time (hrs)			
% journey on sealed road						
Any animals removed from truck during the journey?	#	Where?	Why?			

ANIMALS				
Description	*BCS*	*Total unloaded*	*Dead*	*Other (count & code)*

Use these entry codes for Other: ***K*** *= killed or put down;* ***S*** *= salvage slaughter;* ***R*** *= rejected*

BCS= Body Condition Score (1 to 5) ***V*** *= veterinary attention;* ***O*** *= other*

Comments

AHW.125 **Land Transport Project**

NVD SHEET **NVD number**

Owner name

Property of origin **PIC origin**

ANIMALS

Species	Count	Year born	Description	Shear mnth	PIC

Consigned to

QA program **yes** **no** Name of program

Owned since **2mnths** **2-6 m** **6-12 m** **>12 m** **Born on property**

Comment

AHW.125 **Land Transport Project**

VENDOR SHEET

Vendor name					
Phone		Mobile			
Contact log					
Date		Time rung			

Date animals were yarded						
Time from start of muster to yarding (hrs)						
Time of day when yarding completed						
Did animals have feed available in yards?			yes	no		
Type of feed	hay	grain	pellets	mixed	other:	
Was water available in yards?			yes	no		
Duration of feed curfew prior to loading						
Duration of water curfew prior to loading						
Date loaded						
Time of day when loading commenced						
Time of day when loading finished						
Delay between completion of loading and start of journey					<30 min	0.5 - 1 hr	>1 hr

Was this movement influenced by shortage of feed at property?					yes	no
Were animals being fed supplementary feed prior to yarding?					yes	no
type of suppl feed	cut scrub	hay	grain	mix	other	
Had animals lost any condition in the month prior to transport?					yes	no

Comment

8.2 Appendix 2: Sample size deliberations

Sample size estimations were based on the following assumptions:

- final sample size needs to be sufficient to allow description of summary data (primarily incidence or prevalence measures) with reasonable precision. The term precision refers to half the width of a 95% confidence interval.
- The primary unit of interest is considered to be the truckload and most measurements of variables related to the journey will be at the level of the truck. Each truck may contain multiple consignments where a consignment is a group of animals on one truck and with the same owner & property of origin. The situation becomes a little more complex for railway events since one train may contain many carriages and therefore more total stock than one truck. Sample size estimations were done at the truck level.
- Estimations were based on determination of the sample size required to detect an expected proportion with alpha=0.05, beta=0.2 and a 95% confidence level. Expected proportions used in estimations ranged from 0.l (uncommon events) to 0.5 (common events).
- Unpublished data from transport events observed by one of the project team members indicated that 20% of trucks carrying sheep destined for live export, had one or more dead sheep at the time of arrival at the assembly depot, providing a truck-level proportion of 0.2 for an outcome of interest. Cumulative incidence estimates of deaths during transport were estimated to range from 0.5 to 1.2 per 1000 animals.

Table 11: Estimated precision (equal to half the width of the 95% confidence interval) for varying sample sizes (20 to 150) and varying expected proportions of the outcome under measurement (0.1, 0.2, 0.3, 0.4, 0.5).

	Expected proportion				
Size	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**
20	0.1	0.15	0.2	0.2	0.2
25	0.1	0.16	0.18	0.2	0.18
30	0.10	0.13	0.17	0.17	0.17
40	0.10	0.13	0.15	0.15	0.15
50	0.08	0.10	0.12	0.14	0.14
60	0.07	0.10	0.12	0.12	0.13
70	0.07	0.10	0.10	0.11	0.11
80	0.06	0.09	0.10	0.11	0.11
90	0.07	0.08	0.09	0.10	0.10
100	0.06	0.08	0.09	0.10	0.10
110	0.05	0.07	0.08	0.09	0.09
120	0.05	0.08	0.08	0.08	0.09
130	0.05	0.07	0.08	0.08	0.08
140	0.05	0.06	0.08	0.08	0.09
150	0.05	0.07	0.07	0.08	0.08

It is intuitively understood that a smaller sample has a higher risk of failing to detect the outcome of interest. Conversely larger samples have a higher probability of detecting the outcome of interest if the outcome of interest is actually present. It is also intuitively understood that as the outcome of interest becomes more common (higher probability of occurring) then a smaller sample may detect one or more events with the outcome. Conversely as the outcome becomes more rare, we should need a larger sample to detect the outcome if it is present. The question is, how big a sample do we

need in order to be fairly confident of detecting the outcome of interest if it is present? In order to address this we make some assumptions:

- Outcome of interest is one or mortalities in one transport event (one truck of animals),
- We expect to observe this outcome in a small proportion of events (less than 10% and probably less than 5% of events).
- If the outcome occurs in 10% of events, we want to be pretty certain that we have a large enough sample to detect it. For statistical purposes the common definition of "pretty certain" is usually 80% and this is called statistical power. We want to have a large enough sample to achieve an 80% probability of detecting the event if it is present. In sample size estimations we set power by defining beta (power = 1-beta) so by saying we have set beta=0.2, it means we are saying we wish to achieve a power of 80%.

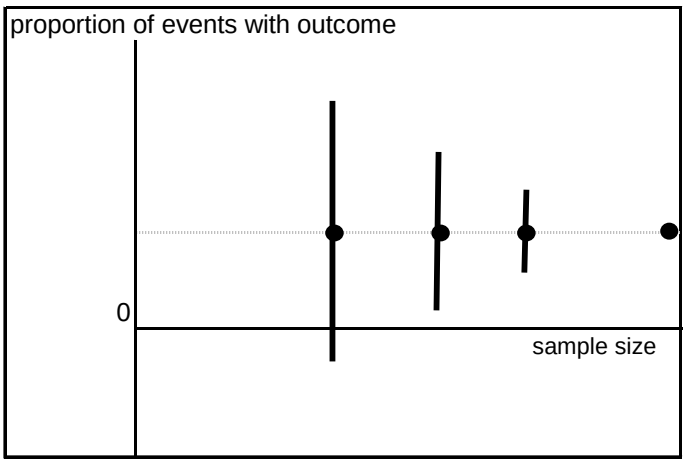

Figure 1: Diagrammatic representation of estimates presented as average proportion (black circle) and 95% confidence interval (bar extending either side of the average)

Figure 1 illustrates a number of concepts associated with sample size estimates. The confidence interval is generally symmetrical around the average i.e. half the width of the interval is above the average and half below. The term precision is used to describe half the width of the confidence interval. The faint, horizontal dotted line is meant to represent the true but unknown value of the outcome of interest (say 0.1). Statistical theory says that if we randomly select a sample of events and measure the outcome, the average for the sample will be a valid measure of the true but unknown mean – and therefore we expect the average to be close to the dotted line. The reality is that for any one sample, the mean of that sample may differ from the true but unknown mean. This variation is captured by the precision (and by extension the confidence interval). The precision is a measure of how well the sample might represent the true but unknown mean. A simple interpretation is that for any one sample the average of that sample may be expected to lie anywhere within the line formed by the confidence interval. As the sample size is increased the precision gets smaller (better) meaning that the sample mean for any one sample will vary from the true but unknown mean by a smaller amount. If we measured every single event (a census and not a sample), then the average would be exactly equal to the true but unknown mean and the precision would be zero (represented by the circle on the right hand side of the figure).

Looking at the estimate on the left hand side of Figure 1, the lower edge of the confidence interval crosses zero. This means that even if the true but unknown value for the outcome were 0.1, then for any one sample, the measured outcome in that sample could be zero i.e. there could be no

outcomes detected in the sample. As the sample size increases the confidence interval shrinks (gets better) and the lower bound draws above zero. This means that our sample estimates can be expected to be always above zero i.e. if the true but unknown probability is 0.1, our samples will always detect some outcomes of interest.

If the sample size is such that the precision is equal to or exceeds the estimate of the true but unknown value then the lower bound of the confidence interval will be zero (or less than zero).

Table 11 indicates that a sample size of ~50 or more is needed to ensure that the lower 95% confidence interval value for a rare event (expected proportion =0.1) is greater than zero.

An illustrative example is presented to demonstrate the impact of these estimations.

Assume the true (but unknown) probability of an untoward event is 10% i.e. on average 10% (0.1) of transport events will incur an untoward event.

a. if we collect information from a very small number of events (say 1 or 2), it is quite possible that we could completely miss an untoward event and report that the prevalence of untoward events is 0%.
b. It turns out that we could collect information from up to 40 randomly selected events and still have some probability of detecting zero events (estimated precision for up to 40 events is 0.1 and therefore the lower bound of the 95% confidence interval is zero.
c. As the number of events rises to 50 and above, the precision falls below 0.1. This means that if the true (but unknown) probability of untoward events was 0.1 and we sampled 50 trucks, the proportion of untoward events in our sample of 50 should range from 0.02 to 0.18. The important issue here is that we should always detect some untoward events.

Sample sizes lower than 40 have some risk of failing to detect any outcomes even if the true but unknown probability of an outcome occurring was as high as 10%. Sample sizes of 50 and above should always detect some outcomes. Looking at the change in precision the return from further increases in sample size tends to get progressively smaller.

If the expected proportion for the outcome of interest was below 0.1 then the sample estimates will need to be larger to achieve a similar result. For expected proportions of 0.05 (5%), the required sample size to ensure the lower 95% CI value was greater than zero was estimated to be 90. For expected proportions of 0.025 (2.5%) the required sample size to ensure the lower 95% CI value was greater than zero was 170.

The study will be repeated within each of six states and territories (QLD, NSW, Vic, SA, WA, NT) and within each combination of transport type (road vs. rail) and species (cattle, sheep). Enrolling a minimum of 30 transport events of one type and species in one state and then repeating this over six states/territories would result in a total sample of 180 or more transport events for that species/transport type combination. This approach would allow precise estimates at the national level for various outcomes even when the expected proportion for outcomes of interest was as low as 2.5% or lower. Approaching 50 events within one state for each season will still allow reasonable precision for estimates within each state and season and will provide sufficient overall samples at the national level to allow reasonable precision for outcomes that may only occur in 1% of transport events.

8.3 Appendix 3: Assessment of statistical quality

8.3.1 Background

Data obtained from different sources may have a variety of inherent biases and errors that are due to different mechanisms. These biases may be further confounded when data from different sources are merged into one combined dataset. This is particularly relevant when, during the process of merging and combining data, interim calculations are used to construct further derived variables such as age categories or other population characteristics that depend on merged data. While it is accepted that it is not possible to provide error–free data, efforts should be focussed on ensuring that errors are understood and minimised or accounted for in subsequent analyses and reports.

There appears to be no universally agreed definition of quality. Fitness for purpose is a commonly expressed term which incorporates the notion that quality cannot just be defined in relation to some abstract concept of "excellence", but should be seen in relation to the demands of the user of the final product 2. There is therefore a requirement to understand the needs of particular users with respect to data and information.

Given that data when combined are used in statistical analyses to produce or support reports that may reach a variety of conclusions of potential value to end users, the notion of statistical quality is also extended to the outputs and reports that might depend in turn on underlying data and statistics. There is a need to provide users with
information about the quality of statistics and about the analytical techniques used to derive figures and summary statistics such that users can assess fitness for particular purposes3.

This document describes the development of a quality assessment framework that can be used to assess records relating to historical land transport events. The approach in developing this framework has been to apply principles as described in mainstream statistical quality assessment guidelines in a manner similar to that outlined by Paiba et al (2006) in a veterinary surveillance example.

8.3.2 User needs

The principal user of outputs in relation to this project is Meat & Livestock Australia Limited (MLA) and indirectly through MLA the industry stakeholders that MLA represents including livestock producers, processors, exporters, foodservice operators and retailers.

Specific needs with respect to this part of the project have been defined in Objective 1 from the project proposal.

The following specific variables can be defined from this objective:

i. Animals on the truck:
    a. species
    b. class: age group, gender, pregnancy status
    c. number loaded for each class and gender
ii. Reason for transport:
    a. Truck information
    b. type of truck: single (body truck or semi-trailer with only one trailer), B-Double, semi-trailer (where trailer is replaced by the number of trailers being pulled by the prime mover)

c. stock crate information

iii. Railway information (only relevant for QLD)

iv. Journey
   a. origin location
   b. loading date & time
   c. arrival date and time (at destination)
   d. destination location
   e. duration of travel
   f. distance of travel
   g. rest stops: number, duration, where in journey

v. Morbidity
   a. number for each class and gender on each truck
   b. type of morbidity (defined classes)

vi. Mortality
   a. number for each class and gender on each truck
   b. type of mortality (defined classes)

8.3.3 Outputs of value to the user

Compilation of a combined dataset containing records from multiple sources on the above variables would allow the following outputs to be considered:

i. Statements about the number of animals transported and number of transport events as a representation of all transport events in Australia.
   a. Depending on the data collected about various other variables and sub-categories, the summary information could be presented in various strata organised by space (state or territory or local area), time, class of animal, etc.
   b. This would only be possible if the collected data were considered to be representative of the population of all transport events and therefore of all animals transported within Australia.

ii. Statements about morbidity and mortality probably expressed as cumulative incidence measures organised in various strata as above.
   a. This outcome could be achieved without necessarily requiring a nationally representative sampling process but it would really only be of genuine value if it were representative at least of separate segments of the transport industry for example animals transported through saleyards or to slaughter or live export and so on.

iii. Use of available data in risk factor assessment
   a. If data on adverse outcomes (morbidity and mortality) were available as well as data on a variety of possible risk factors (date, distance travelled, month of year, stock age and class) then it is possible to consider analyses aimed at identifying putative risk factors associated with morbidity and mortality.

8.3.4 Potential sources of transport data

Any organisation involved in the transportation of animals and that keeps records of such events was considered a potential source of data that may be of value. These included:

- National vendor declarations (NVDs): transport company, vendor & purchaser keep copies. Current NVD forms have only been out for 2 years and components of these forms are optional in some states and mandatory in others. Privacy issues concerning sourcing these data that will need clarification.

- NLIS: not of value concerning retrospective transport events (2004-2005) but may be of value for future monitoring,
- Invoice records for transport companies,
- Arrival information at aggregation points – processing records for saleyards, feedlots, processing plants, transit centres.
- Pastoral companies particularly those with vertically integrated operations involving transport of animals from breeder to grower to finisher and slaughter.
- Livestock Agents
- QLD Rail records

8.3.5 Steps in the process where statistical quality might be assessed

There are a number of chronological steps that must occur for data on historical transport events to be sourced, combined, processed and analysed and finally reported. There are statistical quality issues that are relevant at each of these steps.

1. Issues relating to data at each of the potential sources
2. Sampling of sources and data within each source
3. Data entry, processing and analysing
4. Data analysis and primary outputs

Dimensions of statistical quality

The UK Office for National Statistics describes six dimensions of statistical quality, presented in Figure 2.

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Dimensions of quality	Comment
1. RELEVANCE	The degree to which the statistical product meets user needs in coverage, content and detail
2. ACCURACY	The closeness between an estimated result and the unknown true value
3. TIMELINESS AND PUNCTUALITY	Punctuality refers to the time lag between the actual delivery date of data & the target date when the data should have been delivered. Punctuality is the degree to which data produced are up to date.
4. ACCESSIBILITY AND CLARITY	Accessibility is the ease with which users are able to access the data, including formats & supporting information. Clarity refers to quality & sufficiency of the metadata & additional advice.
5. COMPARABILITY	The degree to which data can be compared over time and domain (sub-population)
6. COHERENCE	The degree to which data that are derived from different sources or methods but which refer to the same phenomena are similar.

Figure 2: Dimensions of statistical quality

It is necessary to determine which statistical quality dimensions are relevant for this task and then to develop appropriate specific measures that can be used to assess different dimensions. Every measure or indeed every dimension need not be assessed for every output or data source. The

assessment framework can be considered as a toolbox from which appropriate measures may be selected and applied when and if required.

For the purposes of this project, the quality dimensions of most interest are relevance, accuracy, accessibility and clarity, comparability and coherence. Timeliness and punctuality are less relevant given that this project is focussed on historical data relating to transport events during the 2005 and 2004 calendar years.

8.3.6 Specific measures of statistical quality

8.3.6.1 Relevance

Each time a sample of transport records is obtained from one of the potential sources of transport data, direct comparisons will be made against the list of variables identified in User Needs to determine:

i. summary description: variable name, data type (text, categorical, ordinal, continuous, distribution pattern, summary statistics),
ii. source of original data, collection method and intended use,
iii. relatedness to one or more of the desired variable (how closely does the data collected for a variable match the desired variable in terms of definition, format, scale),
iv. completeness: missing data and how uniform the data are through the sample (are all the data coded and entered in the same manner such that they are suitable for analysis)

8.3.6.2 Accuracy

Likely to be able to be assessed only for a subset of data where data from more than one source are intended to be representing the same variable. If these requirements are met then a direct comparison can be performed to look for level of agreement.

8.3.6.3 Accessibility and clarity

Each time any of the potential sources of transport data is contacted (or an attempt made to contact the source), data will be collected on the following:

i. Log of communication including organisation contacted, individual, date, method (phone, visit, email etc), outcome.
ii. Description of records that are kept by the organisation that are related to livestock transport.
iii. What was involved in gaining approval for access to records? Was it a simple process completed in a single phone call or did it require more complex communications or meetings?
iv. Contact person and contact details for individual responsible for providing access to records.
v. Description of records that are made available to the project including:
    a. location (address),
    b. centralised or not (number of repositories, coverage),
    c. type: paper vs. electronic,
    d. can records be provided for requested months (Oct-Dec, Jul-Sept),
    e. time from agreement to provision of records,
    f. level of ease for access to records once approval had been granted
vi. Metadata: what explanatory information is available about records including information about source, date collected, variable definitions, format, explanation of abbreviations, comments.

8.3.6.4 Comparability

i. Over time:
   a. comparisons of data within each organisation from 2004 and 2005,
   b. does the organisation continue to collect data on the same variable(s) currently or have there been any changes in the way information is collected or the type of information?

ii. Over domain:
   a. comparisons of data collected on the same (or similar) variables between different organisations and different states/territories.

8.3.6.5 Coherence

Can data from different sources be combined in a broader (perhaps national) database and be used to make inference about the national transport picture? This incorporates information from several of the above measures.

8.3.7 Summary result

Much of the statistical quality framework outlined above is subjective in nature and will not result in quantitative measures of quality. It is anticipated that descriptive summary statements and discussion will be generated about:

i. Dimensions of statistical quality for each of the broad industry groupings and for the different variables or types of information obtained in relation to user needs.
ii. Assessment of feasibility, application, usefulness (in relation to user needs) of a larger and more representative collection of records concerning historical transport events.
iii. If a larger and more representative collection of transport records is deemed feasible and useful, then a protocol will be developed to describe sampling methodology, data entry and processing, analysis and reporting.

8.3.8 Reference List

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8.4 Appendix 4: Activities and results for Objective 1

8.4.1 Queensland

8.4.1.1 Sheep abattoir

Paper records were retrieved from stored cardboard boxes. Transport related data relevant to the project objectives were generally not recorded in electronic form.

Data relating to transport events were recorded in two sources:

- Waybill or NVD/Waybill,
- Truck dockets.

There appeared to be a difference in the accompanying waybill information for trucks carrying sheep direct from property of origin to the abattoir compared to trucks carrying mixed consignments purchased by feedlot buyers at a saleyard.

Trucks travelling direct from property of origin to the abattoir were accompanied by a NVD/waybill that identified the property of origin, vendor and provided details about the animals. This form of journey represented a single journey from property to abattoir.

Trucks arriving at the abattoir from a saleyard represented a more complex journey made up of two component parts. The first part (journey 1) was the journey from property of origin to the saleyard and would be expected to be accompanied by a NVD/waybill containing details of the property of origin, PIC, vendor and information about the animals. The second part (journey 2) was from the saleyard to the abattoir and a truck completing journey 2 may carry sheep purchased from multiple different consignments at the saleyard. Waybills observed from these journeys may simply identify the property of origin as the saleyard and provide an aggregate number of the total sheep of each class being carried on the truck. The waybill (or truck docket) on journey 2 may not provide identifying information on the property of origin/vendor/PIC from the vendor at the origin of journey 1. This prevented linkage of information obtained on arrival at the abattoir (end of journey 2) to information identifying property of origin, PIC, or information relating to journey 1 from property of origin to the saleyard. These difficulties were compounded by the fact that abattoir buyers may purchase part consignments and a truck arriving at an abattoir may contain a mixture of small numbers of animals from each of multiple different consignments at the saleyards.

Many transport operators have their own custom truck docket system. Some truck dockets contain more detailed information than is recorded on the NVD while others are relatively simple and contain little more than a count of animals by class. In addition more detailed truck dockets appear to be less likely to be completely filled in.

Each consignment of sheep was assigned a lot number on arrival at the abattoir and this lot number was used to trace that consignment through the processing plant. The lot number was recorded on a separate abattoir receival sheet along with the number and class of animals and if there were any dead or reject animals on arrival. The receival sheet was updated each day if the sheep remained in pens or paddocks at the abattoir before being processed. Lot numbers ranged from 1 to 100 and when the stock manager got to lot 100, the next lot was assigned the number 1 again since it was unlikely that any animals remained on the premises from the previous lot 1.

In order to complete data collection activities for Objective 1 it was necessary to collect matched data from multiple pieces of paper (NVD/waybill, truck docket, abattoir receival sheet). The NVD contained information on the vendor and PIC of origin as well as number and class of stock. The truck docket did not always record the vendor PIC but did identify the vendor by name (or property name) and location. Both docket and NVD contained information on curfew and journey start time but these fields were not always filled in. Only the truck docket contained fields for date and time of arrival and again these fields were rarely filled in. Deaths and injuries were recorded in the abattoir receival sheet though this sheet did not record NVD number, PIC or vendor details. Linkage of receival sheet and docket was done by the abattoir lot number and if the various paper records were stapled together. There appeared to be no unique identifying code that was recorded on all different types of records and that could be used to trace consignments. This was particularly apparent when sheep arrived in a mixed truckload from a saleyard data records (truck docket, waybill and receival sheet) did not allow tracing of sheep to a PIC identifying the property of origin.

8.4.1.2 Cattle feedlot

A project team member visited two feedlot operations.

Feedlot A was part of an integrated pastoral company. Cattle were transferred from properties in north and western Queensland to the feedlot on a regular basis. All of these events involved journeys greater than 6 hours. Feedlot B bought cattle from private suppliers and sale yards in Qld, NSW and VIC. These journeys included events shorter and longer than 6 hours. In both cases it was not an easy task to collect retrospective data for 2004 or 2005 because of the time and effort involved to retrieve data from record stores. Therefore data from 2006 was used for both feedlots.

All data were available in paper format, from NVDs, truck dockets and feedlot receival records. Both feedlots were in the process of implementing electronic recording systems and were interested in guidance on the information that they should record.

A number of Issues were noted during the data collection process that related to data quality including:

- NVD number did not always match between NVD and feedlot arrival records, probably due to data entry error.
- Departure times were often not recorded or departure time was always the same (it is not mandatory to complete Part B of the NVD form so transport events from other states often had no departure times recorded).
- Trucks carrying consignments from saleyards to the feedlot presented confusing record sets because they may carry part consignments derived from multiple truckloads into the saleyard. A truckload arriving at the feedlot may be accompanied by multiple NVDs, each with different dates and times relating to the journeys from property of origin to the saleyard. The number of animals did not always match the NVDs because the truckload from the saleyard to the feedlot may carry partial purchases from multiple consignments. Dates on NVD's from northern NSW were sometimes dated 2 or 3 days before arrival at the feedlot. The assumption was that the cattle must have been rested somewhere after sale, but there is no way of knowing for sure. This issue was similar to the observation made on sheep transport events from saleyards to abattoir in Section 8.4.1.1.
- reports on cattle morbidity and mortality were incomplete, poorly defined or vague (e.g. cattle look tired), and in many cases it appeared that no entry had been made (missing data).

8.4.1.3 Saleyards

Two saleyards were visited during the course of this part of the project. Neither saleyard was responsible for collection of data on livestock transport. Both facilities were maintained by saleyard management and livestock agents were then responsible for organising animal movements into and out of the yards and for collecting, managing and storing data relating to animals.

8.4.1.4 Queensland Rail

There are three main rail-lines in QLD that currently transport livestock:

- originating in Quilpie and travelling east to Brisbane,
- originating in Winton and Longreach and travelling east to Rockhampton and then south to Brisbane,
- originating in Mt Isa, travelling east to Townsville and then south to Brisbane.

QRNational is the state's largest carrier of livestock operating a scheduled service primarily sourcing cattle from western and northern regions to move to the east and south-east for delivery to processing plants, export operations or other outcomes.

QRNational has implemented a Stockcare programme for livestock movement by rail. The programme includes standardised data recording forms for movement records (Stockcare Movement Record) and recording details each time stock are checked during transit (Stockcare Attendant Checklist). QRNational also publishes a set of stock handling guidelines (QR Stock Handling Guidelines) that provides information on QRNational processes for animal transport as well as guidelines for management of livestock to ensure optimal welfare.

QRNational has a very strong commitment to implementing processes designed to minimise animal stress and optimise animal welfare during transportation. QRNational has developed a number of initiatives aimed at improving animal welfare including feedback and education of clients delivering animals to QRNational for transport, training of personnel associated with rail transportation and monitoring of livestock and provision of guidelines and systems for recording and reporting data related to animal transport and acting on issues as they arise.

The QRNational transport system involves transporting animals from a defined number of loading yards at fixed locations and on trains that run according to pre-defined schedules. This means that dates and times and distances of travel are well defined. Meetings were held with Mr David Rathbone from QRNational to discuss the information recording system used by QRNational. QRNational is willing to cooperate with the project and a project team member has visited Dinmore and Beenleigh to observe cattle being unloaded from a freight train. Historical records were not retrieved from QRNational during this part of the project. This is not believed to have any adverse impact on this part of the project.

8.4.2 Victoria

8.4.2.1 Sheep abattoir

Records were stored in paper format (diary, trucking invoices, NVD/waybill) and a customised SQL database that was confined to data necessary for invoicing. The SQL database contained counts (but no reasons) for rejections and mortalities. Rejections included either morbidities or animals not meeting specifications and either rejection or mortality may be the result of events that occurred during transport or in the receival yards.

The project team member had access to a box of stored paper records including NVDs and dockets and all data collected were derived from these records.

Animals arrived via two main routes and this had a major impact on data accessibility:

- Purchased by abattoir buyers at saleyards and then arrived at the abattoir in mixed lots often with no NVD/waybill. The only paper record accompanying these animals were often some form of truck docket that contains very little information other than class of animal and numbers. This issue has been noted in previous sections.
- Direct from vendor property to abattoir, accompanied by a NVD/waybill that typically contained more detailed information on property of origin (PIC) and animals.

The only information that was easily accessed was the total number of animals killed and processed. There was no auditable system that was easily accessed and that could provide information on denominator numbers by animal type (breed, class, age etc), travel information (truck, crate, distance, time etc) or adverse outcomes (morbidity and mortality).

8.4.2.2 Cattle abattoir

Records were similarly arranged to those reported for the sheep abattoir above. Animals arriving at the abattoir that were transported directly from a property were accompanied by a NVD/waybill. Animals that had been purchased at a saleyard by an abattoir buyer tended to arrive at the abattoir with just a truck docket of varying quality (some were more detailed than a NVD and others just reported a count of animals on a torn piece of paper).

A separate electronic recording system was used for recording rejects and mortalities for insurance and to adjust farmer payouts by reconciling kill sheets with loading numbers. This recording system was used as the basis for payments but project personnel were not permitted to access information stored in this system because of commercial in-confidence reasons. Electronic records contained information on loading date, origin name, count of animals by class and counts of morbidity and mortality. No information was recorded on PIC, arrival date/time, journey distance/time or details on animal class or reasons for morbidity or mortality.

During data collection the project team member sat with a box of paper records (NVDs and truck dockets), while a member of staff from the abattoir retrieved electronic records from an online database. As a transport event was noted from NVD or docket, the staff member accessed the electronic database and matched the paper record with the electronic record using date and owner information primarily. There was no unique ID code that could be used for matching information from the paper records to that recorded in the database.

8.4.2.3 Trucking company

Trucking companies were working extended hours and were stretched due to conditions at the time this project was being undertaken. Most information on animal movements was recorded in a paper-based event diary system. A separate mortality diary was used to record livestock injuries and deaths during transport but the company did not allow this diary to be reviewed because of commercial sensitivities. Driver log books were supported and maintained but were not reviewed – mainly because this is a sensitive issue for transport operators. Driver log books and TruckSafe records could be expected to contain information on journey routes, times and rest stops. The company did have an electronic recording system for invoicing purposes but the staff member who maintained this system was not at work the day the project team member collected data and no

information was obtained from this database. The project team member collected data from the paper based diary of activities.

A comment was made that many jobs appeared to be for repeat customers and were charged a set rate i.e. the distance was known or agreed on based on previous experience and was therefore not entered into the recording system.

8.4.2.4 Agent – sheep

The project team member accessed paper NVD records to collect data and was able to match (with assistance from office personnel) information from drafting dockets. Drafting dockets were used by agents to record and reconcile NVD records with counts and management of animals in the yards and also included data on rejects and mortalities. It was not possible to determine reasons for rejects (to differentiate morbidity from other causes) or to determine whether rejects or mortalities were associated with transport events or with events that occurred in a yard.

8.4.2.5 Agent – cattle

The project team member accessed paper NVD records to collect data and was able to match (with assistance) information from mortality reports covering the same period. Mortality reports were a paper-based recording system used for claiming losses for those livestock that were insured during transport. If livestock were not insured by the vendor/purchaser then mortality records were not completed i.e. it was only used for insurance claim purposes. Losses were anecdotally reported to occur in uninsured animals and these were typically not noted by the agents – they were left for the vendor, purchaser and truck driver to sort out.

8.4.2.6 Saleyards

Two saleyards were visited during the project. Both operations were found to act as independent providers of a service without taking any part in the transaction between vendor and purchaser. As a result no records relating to animal movements and health/welfare outcomes were identified. All records relevant to this project were under the control of other groups using the facilities (agents, vendors, purchasers, trucking companies etc).

8.4.3 Western Australia

8.4.3.1 Cattle abattoir

Data were drawn from NVDs and a paper-based Receival Docket system maintained by abattoir staff that was used to collect data on losses (deaths) and to reconcile animal numbers. Receival dockets were stored with NVDs. There was no auditable way to link receival dockets with NVD records other than by name of vendor (often abbreviated on the receival docket) and date. There was also no auditable trail to provide assurance that all mortalities (or morbidities) were recorded in this system.

The national NVD form does contain information on origin of the journey which is usually property of origin or saleyard. There is no information on distance or hours travelled and these data would need to be estimated using digital or paper based mapping facilities in order to determine whether journeys were greater than 6 hrs.

8.4.3.2 Cattle feedlot

The project team member was given access to paper records stored according to feedlot lot number. Of these records, only NVDs and trucking consignment notes (truck dockets) contained information relating to animal transport.

There were no records on morbidities at arrival (relating to transport events). Truck dockets were used to record mortalities on arrival and to reconcile numbers of animals to the NVD. There was no auditable way to ensure that this information was accurate or complete. Truck dockets had a field labelled deaths but this field typically contained no entry at all. It seems reasonable to infer that absence of any data may indicate zero deaths but there was no way to verify this and an alternative explanation was that data were not recorded regardless of whether any deaths occurred. Transport duration and distance were not recorded though journey origin (name of a town or city) was recorded and could be used in conjunction with mapping information to derive estimated distances.

8.4.3.3 Cattle trucking company

The project team member was given access to a customised, electronic record system that was based on information derived from NVDs and truck dockets and stored in spreadsheet format. The system stored only part of the data that could be retrieved from the original paper records (NVD and truck docket) and was designed for invoicing rather than for recording all available data from paper records.

The record system did contain data on collection and delivery locations, the number of kilometres travelled by trucks on any journey and in many cases the number of hours. There was no data stored on morbidities or mortalities and vendor data was not released by the company.

8.4.3.4 Cattle saleyards

The project team member was given access to reports from a customised data recording system that recorded animal deaths in the saleyards. Animals were identified by owner (generally property name) and by tail tag but there was no information on transport and no linkage to NVD or truck docket other than by property name and date. These data were primarily associated with deaths that occurred in the saleyard after delivery of animals and prior to pick-up. While some of these deaths may have been the result of transport events there was no way to ascertain this.

8.4.4 Northern Territory

8.4.4.1 Cattle transport

The project team member was given access to paper records consisting of NVD/waybill records and truck dockets or consignment notes. The company had recently increased in size due to a merger between the two major transport providers in NT. Each of the two component companies had their own truck docket system. The two docket systems varied in the amount of information recorded (number of fields) and in the level of compliance (completeness of records). The two systems provided an example of the range of information recording systems and compliance with systems that may be experienced.

8.4.5 Summary assessment of results

Many records were only accessible by retrieving stored paper records, mostly copies of NVDs and some form of customised docket (truck docket, arrival or receival docket). In many cases there was no standardised approach for paper recording systems. Record storage tended to be ad hoc with

papers typically stored in cardboard boxes that were mostly organised by month or year but not sorted within any one box. Retrieval of information then involved the project team member getting a box and looking through it. There was typically no simple way to determine whether the records were complete and in many cases the observed information indicated that records were likely to be incomplete based on factors such as missing lot numbers for receival records. Electronic records tended to concentrate on those variables that were necessary for invoicing purposes and did not tend to record information on transport variables that were of interest to this project.

The most complete records in all cases were observed for variables associated with invoicing and in particular for the count of animals and the class of animals. There was variability in the coding for animal class and there may not be any standardised method of classification for this variable. Details on individuals/organisations for billing purposes were also routinely stored but in several cases were not made available due to concerns about privacy and release of potentially sensitive information. In many cases this information was more likely to be a trading name rather than PIC.

Date of loading was almost always recorded (84 to 100%) with the exception of saleyard reports in WA that concentrated on recording mortalities and the date when they were observed in the saleyards.

Unload date was much more variable and likely to be not recorded. Although there was a space under Parts B and C of the NVD and on most truck docket systems to record dates and times of departure and arrival, these sections of most paper based recording systems seem to be highly likely to be incompletely filled in or not filled in at all. Times for either loading or unloading were poorly filled in with the possible exception of a vertically integrated cattle feedlot operation and one trucking company with a customised truck docket program where a high level of compliance was observed for these particular variables.

Few operations collected information on travel distances or times despite several truck docket systems having specific items on their recording sheets for this purpose. Exceptions were two trucking companies in northern Australia where compliance with this particular piece of recording seemed to be high. Some companies seemed to use previously agreed distances for many repeat jobs. This appears to be an example of corporate knowledge being invested in office staff and not entered into record systems.

Animal breed was not well recorded, probably because it is less important for billing purposes compared to information on class (steer, heifer, calf, bull, cow etc).

Curfew information was generally not recorded in any record system and was only available when team members were able to access paper copies of NVDs. In some cases project team members did not record data on curfew times even though they were reviewing NVDs because of confusion over data recording requirements. The estimates of ~88% completion indicate that curfew data are recorded on most NVDs but not all. It was unclear how curfew time was defined and there was no way of relating a single value recorded for curfew to indicate time off feed as distinct from time off water.

Morbidity and mortality data were particularly problematical. There were a number of issues identified with these data:

- Acknowledgement by operators that not all mortality and morbidity events may be recorded:

  - mortalities were only recorded by agents (cattle, Victoria) if they occurred on transport events where vendor/purchaser had taken out livestock insurance,
  - where recording systems (TruckCare, custom truck dockets) had specific field for recording morbidities and mortalities, these were not always filled in.
- General inability to determine whether no entry in a space on a paper record for rejects or mortalities indicated zero cases or that information had not been recorded.
- Morbidities were mostly specified in recording systems as rejects (eg at abattoirs and saleyards). In many cases there was little or no additional information on factors such as animal class, explanation or reason recorded for rejection and often no information to allow determination of whether a reject could be considered to be the result of a transport event or an event that occurred before or after transport.
- Mortalities were typically recorded as a simple count with little or no reason recorded. The main purpose of keeping the tally was to reconcile the number of animals that arrived with the number of carcasses processed for invoicing and payment purposes. Many truck dockets have specific labelled spaces for recording mortalities and entries were observed in some of these spaces. While observed entries were most likely to indicate deaths that occurred during transport, there were also occasions where deaths were recorded on receival dockets and not on truck dockets indicating that absence of entry does not necessarily mean zero deaths.
- In some cases there was no direct and auditable link between mortality and morbidity (reject) records that were stored in one recording system and transport event information derived from different paper records (NVDs and truck dockets). In one case (cattle abattoir) these two differently sourced records were matched in direct discussion with staff while reviewing both paper records and an electronic database. In other cases (sheep abattoir) matching required finding two records (NVD and receival docket) that were stapled together or making assumptions based on similarities between dates and trading names.
- Difficulties in matching mortality records to transport event records, assessing contributing factors and particularly whether transportation may have contributed to mortality in some way and variability in quality of mortality records mean that there was little value in further analysis of mortality records as an indirect indicator of transport associated mortality.

Review of the list of variables of interest (see 3.1.4) indicates that there were a number of variables of interest where data are not presented in Table 1. The following comments may be made on these variables:

- Reason for transport: There appeared to be little or no opportunity on the data recording systems encountered during this project for collection of information specifically relating to the reason for transport. This information was considered to be not available for collection. It was possible to make some inference about reason for transport based on other information for example animal class and destination. However, identification of or distinction between different reasons for transport such as lack of feed vs. opportunistic generation of income etc simply was not possible.
- Truck information: Retrospective records collected in this project did not contain data relating to type of truck or trailer i.e. data were not available for collection. One organisation (trucking company, WA) recorded the number of trailers that were involved in a particular transport event and appeared to identify specific trailers in this record set but this information was only recorded for some transport events and not all, and there was no additional data on trailer design or size.
- Rest stop data: A number of customised truck docket systems have space for recording the number of checks made on the livestock during a journey. This was usually presented as a count (2, 5, 9 etc). No further information appeared to be available on rest stops and in many cases there was no entry in the space for recording the number of checks. These data were therefore considered to be unavailable.

Movements from saleyards to other end points such as feedlots and abattoirs also presented problems with respect to data collection. This issue requires consideration of the two component journeys associated with these movements. Journey 1 was the journey from property of origin to the saleyard. Information on these journeys is best collected by having a project team member present at a saleyard when trucks arrive to unload. Journey 2 was the journey from a saleyard to another destination typically feedlot or abattoir in this project. Data collected at the end of journey 2 could only be related to journey 2 (origin = saleyard) and it was not possible to reliably collect data at the end of journey 2 that could be used to describe factors associated with journey 1. This issue was experienced in sheep transport (saleyard to abattoir) and cattle transport (saleyard to feedlot and saleyard to abattoir). The main impact of these findings was that data collected at the end of any individual transport event can only be reliably applied to that individual journey and can not be reliably used to describe any previous journeys that the animals may have undergone.

8.4.6 Statistical quality

The primary dimensions of statistical quality considered of relevance for this project were identified as relevance, accuracy, accessibility and clarity, comparability, and coherence. Comments are made below on each of the dimensions of statistical quality in relation to the data collected during the project.

8.4.6.1 Relevance

The data considered most critical to the objectives for this project were those relating to animals (numbers and animal class), journey time or distance and adverse outcomes (morbidity and mortality) that occurred during the journey or were noticed shortly after the journey ended. A range of additional variables were considered of value to the objectives and these are identified at the beginning of this report.

Issues mostly associated with the other dimensions of statistical quality mean that historical data records were considered to be of low relevance in meeting user needs as defined by Objective 1 and described in the beginning of this report.

8.4.6.2 Accuracy

Data relating to counts of animals by class were considered to be highly accurate. In some cases there was evidence of correction of NVD counts when animals were unloaded and counted again at the destination. Since invoices were often dependent on animal counts there was a strong incentive to ensure that these data were routinely collected in an accurate manner.

Data relating to all other variables were less consistently accurate in almost all occasions as a result of incomplete or missing data and in other cases due to problems with coherence. In many cases recording systems had specified variables on paper forms that were not filled in, creating missing or incomplete data. Affected variables with incomplete or missing data included in particular: departure dates and times, arrival dates and times, distances and times of travel, rest stops, morbidity and mortality data and reasons for morbidity or mortality.

8.4.6.3 Accessibility and clarity

Organisations that were contacted in the course of this project were supportive of the project and willingly provided time and information when requested. There were concerns about confidentiality of information and several organisations provided limited or controlled access to records and stipulated conditions for access to and use of information. Examples included blocking access to: information

that could be used to identify a client, financial information, and in one case refusal to allow access to mortality records. In most cases these conditions were understandable and did not interfere with the ability of the project team members to collect data related to the project objectives. Inability to collect detailed information on vendor (PIC, identity, location) meant that estimation of distance travelled by use of mapping software might be problematical. No attempt was made to source data from truck log books or similar record systems due to sensitivities surrounding these particular records.

In most cases visits by project personnel were arranged through phone calls without any major difficulty. In some instances there were difficulties because particular people responsible for records management in an organisation were away at the time the project team member was trying to collect records and in one case this prevented access to electronic records.

Records accessed during the course of this project were predominantly stored in paper form, and mostly in a central location (company offices). However, it appeared most common for records to be stored in a semi-sorted manner and commonly grouped in cardboard boxes by month or year. There was no auditable trail to ensure that records were complete and project team members reported instances where retrieved records appeared to be out of chronological order and incomplete based on inspection of component variables such as lot numbers and attempts to match different sources of data (NVDs and receival dockets for example). Retrieval of specific records was difficult on occasion leading to instances where records were chosen in a non-random manner from those that were accessible.

Electronic record systems were used by most of the companies that were contacted during this project but the electronic systems were generally designed to store only those data that were specifically useful for invoicing purposes. In several cases electronic data relating to 2005 had been backed up onto external media (magnetic tapes, CD-rom, DVD, external hard drive) and were not easily retrievable for data collection purposes.

Metadata was very limited. Electronic records typically did not identify the source of input data (NVD, truck docket, other). There appeared to be little standardisation or written definition for abbreviations and coding systems in recording systems. NVDs and TruckCare generally were associated with consistent and standardised procedures for how to complete the forms. Customised recording systems were common for many organisations and there appeared to be little evidence of a standardised and consistent set of procedures for filling these out. Examples included coding systems used for animal classes and reasons for rejection (morbidity) and mortality.

8.4.6.4 Comparability

Comparability involved planned comparisons of data within each organisation over time and particularly between 2004 and 2005. In this instance a decision was made based on initial discussions with project team members and with representatives from organisations to focus on collecting data from 2005. This decision was based on an expectation that more recent records were likely to be more easily retrieved, that asking for older records may in fact result in less enthusiasm for cooperation in the project, and that review of records from one year would allow the more important dimensions of statistical quality to be effectively assessed. Comparability was deemed to be less important than relevance, accuracy and coherence.

8.4.6.5 Coherence

Coherence involved an assessment of whether information from multiple sources could be integrated to make inferences about a larger picture.

In this case there were multiple levels of coherence. The first involved the ability to integrate data from different sources within the one organisation. The major issue identified was separation of recording systems in several organisations for data relating to transport events (NVD, truck dockets) and data relating to rejects (morbidity) and mortality events. There was no unique identifying code that could be used to link transport information with morbidity/mortality information in a reliable and auditable manner. Each NVD or waybill is identified by a unique number. This unique number was rarely recorded in any information management system to identify a shipment of animals. Alternative identifying information (PIC, trading name of vendor, vendor surname) may allow identification of a particular shipment of animals when combined with additional information such as date of departure/arrival, animal details (class, number etc). However, many vendors were associated with multiple shipments of animals and morbidity/mortality data in many cases were identified only by vendor name or lot number (internal identifier applied to animals after arrival at an abattoir or feedlot or saleyard often with no relationship to NVD or truck docket identification details). As a result it was not always possible to determine a link between a mortality record recorded for a particular lot number, and NVD or truck docket information for a particular transport event. In some cases linkages were made by involving personnel from the organisation in the data retrieval process, going through records one-by-one and matching NVD data with mortality data stored in a different database. In other cases matches were made by project personnel using the same approach and looking for matches on multiple fields such as date, vendor, animal class etc. This was a laborious and error-prone process.

A second issue concerning coherence was the ability to integrate data from different organisations to produce a state-wide or nation-wide perspective on transport events. Given the problems encountered at the individual organisation level in producing reliable, accurate estimates of adverse outcomes associated with transport events, attempts to combine data to state or national estimates were not pursued.

8.4.7 Adverse welfare outcomes

Two main types of adverse welfare outcomes were identified in the planning stage of this study: mortality and morbidity. Mortality referred to animal deaths that occurred during transport or shortly after arrival at the destination where transport events were considered likely to have contributed to the death of the animal. Morbidity was used to refer to injuries and illness or any condition that was considered to have occurred during transport or where transport events had contributed to the occurrence of the condition in animals soon after arrival at their destination.

Morbidity data were considered to be unsuitable for estimating incidence measures because most organisations did not collect data on morbidities that could be related to transport events.

Of the visits completed in the course of this project, records on mortalities that could be linked to transport events were obtained from a sheep abattoir and from three cattle enterprises (abattoir, cattle trucking company and a cattle feedlot).

8.4.7.1 Sheep mortalities

Of 51 transport events involving 26,136 sheep (average of 512.5 sheep per transport event), there were 6 transport events that had one or more mortalities (1, 1, 1, 1, 3, and 4 deaths). Of the 51 transport events for which data were collected a total of 9 events had time of loading and unloading recorded so that a journey duration could be estimated. None of the 6 transport events that were associated with mortalities had data recorded on both load and unload time. None of the 51 records had information on travel distance recorded in kilometres. Most of the records (49 of 51) had a text entry in the property of origin and these entries included property names and townships so an indirect estimate of travel distance could be made by identifying the location of the origin on a map.

A Poisson regression model was run using truck as a random effect to generate an incidence rate estimate of deaths per 100 sheep transported:

IR = 0.038 deaths per 100 sheep transported
95% confidence interval: 0.016 to 0.092 deaths per 100 sheep transported.

Using the point estimate of 0.038 deaths per 100 sheep, this is equivalent to one death for every 2,630 sheep transported.

These estimates are an overall average for all data gathered and do not take into account time of travel or distance.

8.4.7.2 Cattle mortalities

Mortality and transport data were linked in a total of 143 trucking events for cattle. Of these, two events (1.4%) were associated with one death each and the remaining 141 trucking events were associated with a report of zero deaths. Data on distance travelled were recorded on 47 events from one recording system but none of these involved any mortalities. None of the transport events recorded sufficient data on date and time of load and unload to allow journey duration to be estimated.

A Poisson regression model was run using truck as a random effect to generate an incidence rate estimate of deaths per 100 sheep transported:

IR= 0.017 deaths per 100 cattle transported
95% confidence interval: 0.0043 to 0.07 deaths per 100 cattle transported.

Using the point estimate of 0.017 deaths per 100 cattle, this is equivalent to one death for every 5,900 cattle transported.

These estimates are an overall average for all data gathered and do not take into account time of travel or distance.

8.5 Appendix 5: Activities and results for Objective 2

While discussions over Objectives 1 and 2 were held with industry stakeholders from around the country, field activities associated with Objective 2 were confined to QLD because of the proximity to project team leaders. This was not felt to have any adverse impact on findings because these activities were focussed on obtaining sufficient feedback and direct practical exposure to field conditions to guide the development of a methodology for data collection that could be successfully

applied in an expanded national study. Feedback from QLD-based stakeholders was considered likely to be representative of stakeholders in other states.

8.5.1 Industry feedback

Project team members attended a meeting of the Livestock Transport Taskforce in Canberra on 20 April 2006 to discuss the project with a range of industry stakeholders. Attendants expressed support for the project.

A transport project consultative committee was formed and project team members attended a meeting of this committee in Sydney on 20 June 2006. A range of industry stakeholder groups were present at this meeting and strong support was expressed for the project. Stakeholder groups represented included Australian Livestock and Property Agents Association (ALPA), Goat Industry Council of Australia (GICA), Sheepmeat Council of Australia (SCA), Cattle Council of Australia (CCA), Australian Livestock Transporters' Association (ALTA), Australian Meat Industry Council (AMIC), Livestock Saleyards Association of Australia (LSAA), Dairy Australia, and MLA.

8.5.2 State and Territory departments

Discussions were held with representatives of the Queensland (DPI&F), NSW (DPI and Rural Lands Protection Board), Victoria (DPI), South Australia (PIRSA), Northern Territory (DPIFM) and Western Australia (DAFWA). There was support from all individuals contacted and interest in being involved in the project in some way including liaison activities, general advice and assistance in identifying movement patterns and organisations as well as the possibility in some cases of assistance in data collection. Contacts were pursued with personnel from QLD DPI&F as part of the activities for the Pilot Study. Contacts with other state or territory personnel were maintained through periodic updates since activities for the Pilot Study were confined to QLD.

Some reservation was expressed by departmental personnel over direct involvement of departmental staff in collecting data for the project, particularly stock inspectors. The main reason for this was the fact that departmental staff are tasked with enforcing compliance with legislation and codes of practice concerning animal transport and animal welfare. Direct involvement of stock inspectors and other departmental personnel in data collection for this project could potentially result in confusion over authority and responsibility and also interfere with open dialogue with industry stakeholders who may be concerned over reporting and compliance issues. As a result of these discussions it was determined that every effort would be made to continue to consult and liaise with state and territory department personnel for advice on issues associated with the project but that where possible data collection activities would involve individuals independent of state and territory government agencies.

8.5.3 Contacts with QLD organisations

A series of consultative meetings were held with representatives from industry stakeholder groups during activities under Objective 1. Information derived from these meetings and from data collection visits completed under Objective 1 also contributed to Objectives 2 and 3.

A further series of consultative meetings were then held with representatives of QLD-based organisations during the conduct of the Pilot Study, including:

- Livestock agents

  - Representatives from the QLD head office (Brisbane) and branch representatives from different organisations at 3 locations (Roma, Toowoomba and Warwick).
- Transport operations
  - Representatives from the head office of a large transport company in SE QLD,
  - Discussions were also held with drivers from several companies at the point of unload during the data collection process.
- Abattoirs
  - Representatives from management of 2 abattoirs in SE QLD, one processing sheep only and the other processing general livestock,
  - Discussions were also held with receival agents (stock managers) at two abattoirs.
- Feedlot
  - Representatives from management of two cattle feedlots in SE QLD.
- Pastoral company
  - Representatives from management of a large pastoral company
- QLD Rail
  - Representative from livestock sector of QLDNational

All individuals contacted through this consultative process expressed support for the project and interest in assisting in some way with the data collection process. There was recognition that the process of data collection needed to be designed and implemented in a way that imposed minimal or no requirements for additional work to be done by staff from the industry organisations themselves and that did not interfere with the day-to-day activities of staff. There was also recognition of the importance of being able to relate to the issues being faced by livestock industries and the need to develop a sense of trust with industry stakeholders so project team members could ask questions and collect data in a positive environment.

8.5.4 Data collection

A number of visits were made to unload points for collection of data as part of the Pilot Study. These visits involved project team members using the draft questionnaires to collect information from receival agents, transport operators and vendors. The act of collecting data was designed to test whether questions made sense were understood by industry operators and whether the information collected in the form of answers from operators and records of observations by project team members, met the requirements as intended when the methods were developed.

An important part of the process also involved a more subjective determination of feasibility and practicality including issues such as whether the process could be implemented without causing any undue interference in day-to-day activities and whether the response was favourable and positive when individuals were contacted and asked for information with relatively little warning and background preparation.

8.5.4.1 Cattle saleyard

A visit was made to the Roma saleyard to collect information on cattle trucks arriving at the yard in preparation for the weekly sale. The visit was planned in discussion with a livestock agent from Roma and timed to coincide with the arrival of the trucks at the yard. The agent and a representative from the saleyard were present to receive the cattle.

A total of five road-trains (20 decks) arrived carrying a total of 668 yearling cattle. The cattle had travelled from Tambo in a journey of 511 km that involved 7 hours of journey time. Unload times for each truck ranged from 10 to 15 minutes. Each truck pulled alongside the unload ramps and made a single stop. Unloading was smooth and without incident. All animals were in good condition and had travelled well. All animals were unloaded directly onto feed and water.

Data collection forms developed for the pilot study was completed by observation of unloading, discussion with drivers and through inspection of waybills at the time of unload. A phone call was then made to the vendor a day or two later and additional data collected concerning the property of origin and on-farm management of the animals prior to transport. No problems were encountered during any of these steps. All individuals contacted through this process responded in a positive manner and provided information in response to all questions from the questionnaires.

A number of issues were identified that were of relevance to the proposed national study:

- Importance of having a project team member present at the time of unload to collect data,
- Importance of developing and maintaining a trusting relationship with industry stakeholders during this process,
- Importance of having an awareness of industry issues and the ability to listen – individuals involved in the industry (truck drivers, agents and livestock handlers) wanted to raise and discuss issues during the process that were not directly relevant to the project objectives. An example of this was the level of interest amongst truck drivers over driving hours and fatigue management.
- The project offers an opportunity to appreciate industry concerns over a range of transport related issues that may not necessarily be directly related to the project outcomes.
- Vendors were very happy to talk and provide information on the phone when contacted about their animals.
- There are 3 critical processes to information collection at the point of unload:
    - observation of unload to get unload start and end times and observe animals,
    - speaking directly to drivers to get details on journey (start and end times, distance, stops, problems etc),
    - viewing of waybill to collect data relating to vendor (PIC, vendor name etc).

  These 3 processes all take a little time. The data collection process completed above was done at night and without additional trucks waiting to unload. Collecting data at a busy unload site with possibly multiple ramps and trucks waiting to unload is likely to mean that there will be time pressure on the data collection process. It will be important to minimise the number of questions that are being asked to make the process as efficient as possible while ensuring that core information is collected. Having two people present at particularly busy locations would be helpful. An alternative is to plan data collection for part of the day or for transport events that arrive 1-2 days prior to the sale when unload pressures are not so heavy.

8.5.4.2 Sheep saleyard

A visit was made to the Warwick saleyard to collect information on sheep trucks arriving at the yard in preparation for the weekly sale. The visit was planned in discussion with a livestock agent from Warwick and timed to coincide with the arrival of trucks at the yard. Sheep normally arrive on the morning of the sale since the sale begins in the afternoon. Occasionally sheep trucks that have travelled from further away will arrive one or even two days prior to the sale. Discussions with the agent indicated that there were no expected arrivals in the days prior to the planned visit. There were multiple agents and saleyard representatives present to receive sheep.

Project team members attended the yard, discussed the project with agents from two different companies and collected data from sheep trucks as they arrived and unloaded. The data collection process was generally smooth and able to be conducted without interfering unduly with the activities of the driver, agents or saleyard staff.

Data were collected in the following manner:
- observation of unloading of sheep,
- interview with driver just after sheep were unloaded to collect data on the journey,
- inspection of waybill through discussion with the agent after sheep had been unloaded,
- telephone contact with vendor in the days following the sale visit to collect data relating to the property of origin and animal management prior to transport.

Data were collected from three truck events:
- 114 Merino ewes and 21 crossbred lambs (135 total) with a travel time of 1.75 hours,
- 68 crossbred lambs with a travel time of 45 minutes,
- 120 crossbred lambs with a travel time of 1 hour

Discussions with the livestock agents indicated that it was uncommon for sheep delivered to the Warwick saleyard for the regular sale to involve journey times of 6-hours or more. Almost all sheep sold at Warwick were likely to be from properties in the immediate district.

Issues of relevance to the proposed national study:
- Agents indicated that most sheep sold at Warwick were from properties in the immediate district and may not involve journeys greater than 6 hours. NLRS data indicated that the largest sheep saleyards in QLD are Warwick (98,000 sheep in 2006) and Dalby (53,000 in 2006), followed by Toowoomba (4,400 in 2006) and Oakey (<500). These figures coupled with anecdotal reports from livestock agents indicate that QLD sheep saleyards may not offer much opportunity for data collection from journeys greater than 6 hours under the proposed national study. It seems more likely that longer distance sheep movements will end at locations in NSW (saleyards and abattoirs) and that some longer distance movements may involve property to property movement in QLD.
- Smaller loads and consignments travelling shorter distances may present in a wider variety of truck and trailer designs. Longer journeys tend to involve a much more standardised truck format with fewer variations and including mainly B-Doubles and road trains.

8.5.4.3 Transport company

Discussions were held with a major transport operator in SE QLD. The company expressed interest in cooperating with the project through two broad approaches:
- Providing information and assistance in identifying patterns of livestock movements and in particular property to property movements to assist in collection of data from this category of events in the proposed national study,
- Allowing temporary insertion of data loggers onto a small number of trucks to collect data on temperature and humidity during a transport operation.

A planned livestock movement was then selected to test the feasibility of installing data loggers for collection of data on temperature and humidity data during a commercial transport event. The primary purpose of this part of the pilot study was to determine the best way to secure loggers within a stock crate and to evaluate their function under commercial conditions. Humidity sensors need to be exposed to the air, but at the same time they need to be protected from water. The loggers were

placed in a custom housing and wired to the inside of the stock crate in a position relatively free from direct animal contact.

Eight temperature humidity loggers (HOBO RH/Temp Onset Computer Corporation) were placed on a B-double that travelled empty from SE QLD to South Australia to pick up a load of sheep for return to SE QLD. Loggers were placed on the top and bottom decks on both trailers, and set to log temperature and humidity at 15 minute intervals. The duration of the trip was approximately 5 days (approximately 2 days down, ½ day loading, and 2 days return). The driver removed the loggers on return to the company depot and they were recovered from the depot by a project team member.

This transport event involved the movement of 662 Dorper ewes from South Australia to QLD. The ewes had previously been trucked from Western Australia to South Australia so this trip was the second leg of a trans-Australia journey. The shipment involved 2,000 km of journey on sealed roads, 28 hours of driving time and the sheep travelled very well. The driver reported that no sheep had to be stood up during the journey and that there were no cases of injuries or mortalities during the trip.

Rolling average values were estimated for illustrative purposes and are shown in Figures 1 and 2 below. Maximal rolling average temperature was 31.9 C and the minimum was 15.6 C. The maximal individual temperature value was 36.2C and the minimum was 13.7C. Figure 1 also shows an estimate of variation between the 8 loggers over time, expressed as a 2-hourly rolling average of the standard deviations calculated at each time period. There was relatively little variation over much of the journey indicating that the 8 loggers recorded values that were relatively similar at each time period. However, in the period between about 4 and 8 am on the final morning of the journey, the rolling average standard deviation appeared to increase over time to a maximal value and then decline.

The thicker black bars indicate time periods when the truck was stationary (rest stops, meal breaks etc). A rest stop of approximately 6 hours occurred between 9:15 pm and 3:15 am. During this time, average temperature fell and then subsequently rose, presumably due to heat production within the sheep and the lack of air movement to dissipate this heat. Towards the end of this time period the standard deviation started to rise indicating more variation between different loggers. It may be that more protected parts of the truck (bottom deck, front pens for example) started to experience an increase in temperature while the upper decks and back pens may have experienced a drop in temperature.

Relative humidity (Figure 2) showed a gradual rise in average values as well as the level of variability between loggers as the journey proceeded. It is not clear whether this might be due to external climate conditions or due to local conditions i.e. changes within the pens due to respiration for example.

Issues of relevance to the proposed national trial included:

- Loggers are feasible for collection of temperature and humidity data from transport events though they require installation and removal,
- Loggers are capable of continuously storing data points at 15-minute intervals for up to 42 days,
- Interpretation of data generated from loggers will require some care and recording of ancillary information from the driver about stops and climatic conditions during the journey,
- It is necessary for the loggers to be removed on completion of the journey before the trailers are washed with a pressure hose since they may not tolerate being immersed during washing. This means that either a driver must be enrolled for removal of loggers and storage until such time as

they can be picked up by the project team or a team member must be present when the truck arrives at its destination to remove the loggers,

- installing 8 loggers allowed monitoring of temperature and humidity from the front and back of each deck (top and bottom) for each trailer (front and rear trailer of a B-Double). The results indicated relatively little variability between loggers for most of the trip and therefore it may be possible to use fewer loggers per truck in the future.

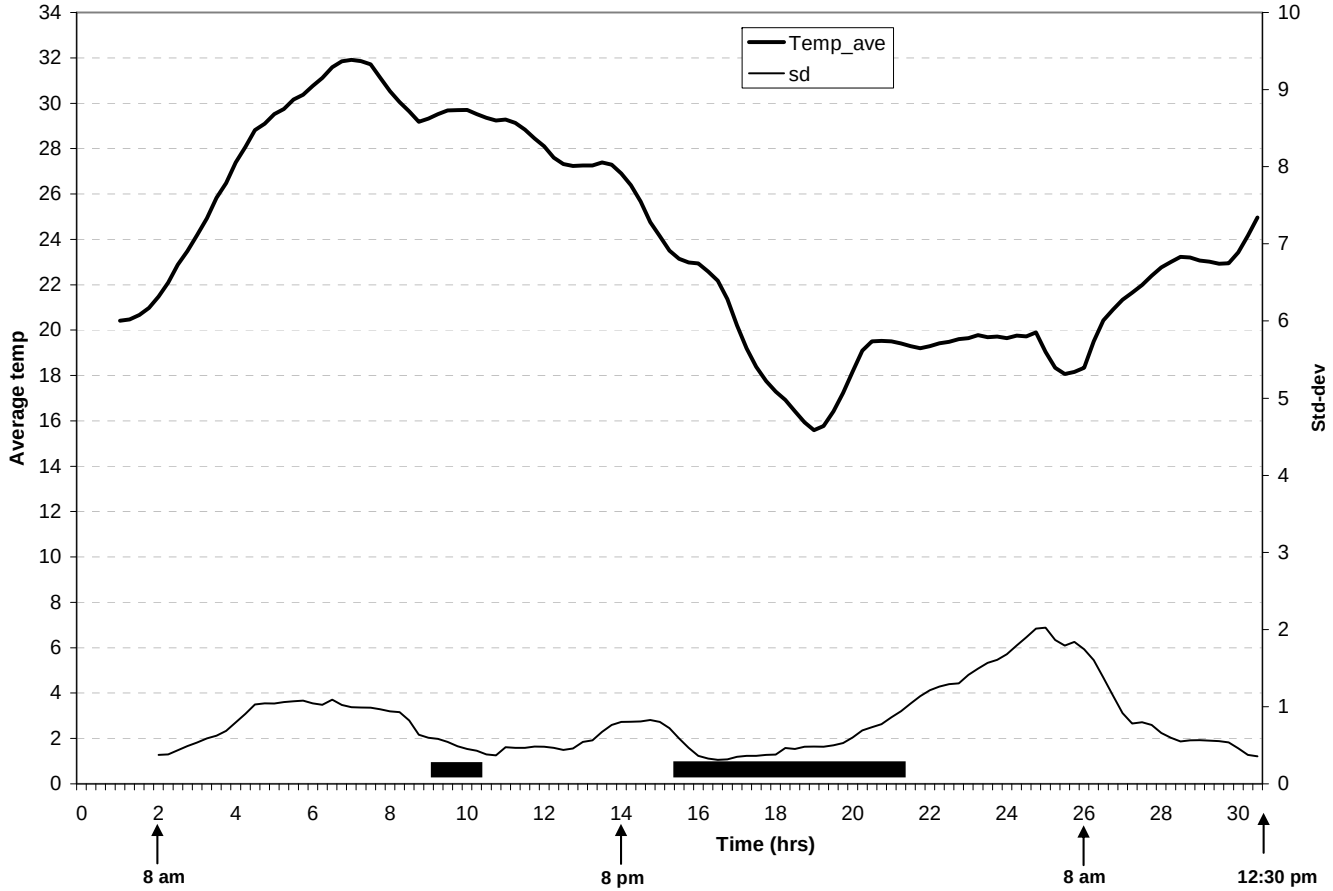


Figure 3: Average temperature (top line) based on a 1-hourly rolling average from 15 minute recordings taken from 8 data loggers distributed throughout a B-Double (front and rear trailers and upper and lower decks), during a 28 hour journey from South Australia to QLD. The bottom line is the rolling 2-hourly average standard deviation for the temperature values. The thick black bars represent rest stops greater than 1 hour in duration. Time is measured in hours from the start of loading. Actual time is shown at periodic intervals. Loading commenced at 6:00 am. The journey commenced at 8:30 am and ended at 12:30 pm the following day.

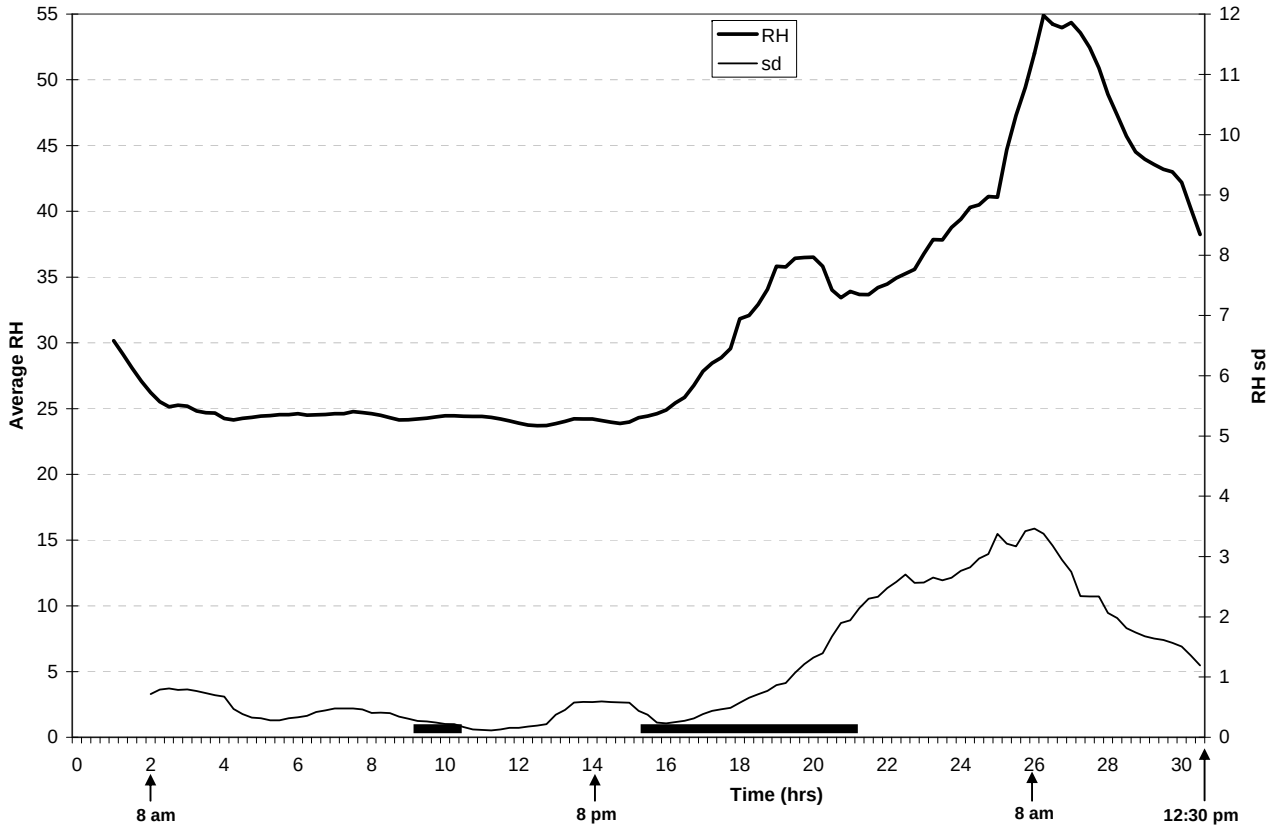


Figure 4: Average relative humidity (top line) based on a 1-hourly rolling average from 15 minute recordings taken from 8 data loggers distributed throughout a B-Double (front and rear trailers and upper and lower decks), during a 28 hour journey from South Australia to QLD. The bottom line is the rolling 2-hourly average standard deviation for the relative humidity values. The thick black bars represent rest stops greater than 1 hour in duration. Time is measured in hours from the start of loading. Actual time is shown at periodic intervals. Loading commenced at 6:00 am. The journey commenced at 8:30 am and ended at 12:30 pm the following day.

8.5.4.4 Sheep abattoir

Data were collected on a single transport event involving sheep arriving at a sheep abattoir after a journey of 820 km and 17 hours (including some time taken for meal and rest stops along the way). The truck carried 640 sheep and 1 was dead on arrival and 2

required euthanasia (downers). The driver said the one dead sheep was noticed within 2 hours of starting the journey, perhaps indicating that the animal had been suffering from a condition prior to being loaded on the truck.

While the data collection process was uneventful this transport event illustrated an issue that was noted in Objective 1 and described in Sections 8.4.1, 8.4.2, and 8.4.5. This truck carried a load of mixed-age Merinos that had been purchased in a saleyard the day prior to arriving at the abattoir. The purchases represented part-consignments from a number of different consignments present in the saleyard. Documentation travelling with the truck consisted of the truck docket that included the number of animals and the source (saleyard). The truck did not carry any specific information identifying vendors or sheep class or other information derived from the NVD/waybills that had accompanied the sheep from their properties of origin to the sale. The NVD/waybills from these journeys (property of origin to the saleyard) were sent directly by the abattoir buyer to the abattoir head office but they did not accompany the sheep on the truck. Since the truck docket that did accompany the sheep on the truck did not contain any specific information identifying original vendors or their PIC, it was not possible to trace the consignments on the truck back to a specific vendor. Matching sheep on arrival to their original vendor would have required obtaining the NVD/waybills from the original journey (property to saleyard) and then going through the truck docket and NVD/waybills with the receival manager and possibly the abattoir buyer to match the characteristics of the sheep that were unloaded to various records.

The impact of these findings is that animals purchased at a saleyard and then transported to destinations such as feedlots and abattoirs, may be difficult to match to a property of origin and a journey from the property of origin to the saleyard. Saleyard animals managed in this way typically have two journeys:

i. Journey 1: from property of origin to saleyard, which is accompanied by a NVD/waybill that identifies the vendor, vendor PIC and number and class of animals.
ii. Journey 2: from the saleyard to the new destination (feedlot or abattoir). In this instance the truck may be carrying a load that is comprised of part consignments purchased from multiple consignments at the sale and depending on mandatory requirements in different states the truck driver may or may not be required to carry a waybill for this journey.

Unless an entire consignment from Journey 1 is bought for inclusion in Journey 2, the number of animals in any part consignment under Journey 2 will not match the number listed in the NVD/waybill under Journey 1. The optimal way to match the consignments would presumably be to list the specific NVD/waybill numbers from Journey 1, on the NVD/waybill or truck docket relating to Journey 2, along with information on number and class of animals. An alternative may be to list the vendor PIC. Neither of these options appear to be routinely followed. In some occasions paper work accompanying Journey 2 may include a waybill specific to Journey 2 and multiple NVD/waybills relating to the Journey 1 consignments from which the Journey 2 truck load has been compiled. In other occasions (as in the instance described in this section from a sheep abattoir), the Journey 1 NVD/waybills did not accompany the truck on Journey 2.

This issue was identified in the findings of Objective 1 in relation to sheep and cattle transport events that originated in a saleyard and travel to other destinations. The practical implication is that collection of data at the point of unload can really only be relied on to characterise the immediate journey (the journey that has just concluded) and cannot reliably be used to characterise any prior journeys that may have occurred.

8.5.4.5 Queensland Rail (QRNational)

QRNational is supportive of the project and interested in assisting with data collection. Mr David Rathbone (Account Executive Livestock, QRNational) has indicated that QRNational senior management will support cooperation with the project on the condition that senior management have the opportunity to review and comment on material in any report that concerns QRNational.

Two members of the project team accompanied Mr Rathbone to Dinmore and Beenleigh to observe cattle being unloaded after transport from Dalby. The livestock journey observed in this process is understood to represent one of the shorter durations for QRNational with longer journeys involving trains that originate in Quilpie or Winton. However, the observed journey involved animals being loaded onto the training the night before and the loaded train departed Dalby at 11:00 pm, arriving at Dinmore at 9:00 am the following morning (10 hour journey) before travelling on to Beenleigh, arriving at Beenleigh at around 11:00 am (12 hour journey). The purpose of this visit was to become familiar with the process of transportation by rail and to ensure that effective data collection could be implemented as part of the proposed national study into livestock transport.

A total of 458 cattle (23 decks) were unloaded at Dinmore and destined for processing at the Dinmore AMH plant. The train then travelled on to Beenleigh and unloaded an additional 410 animals (21 decks) at Beenleigh for processing at Teys Bros Pty Ltd, Beenleigh. The animals had travelled from Dalby after a stock sale the previous day. Animals were unloaded by a QRNational employee who was travelling on the train and by sub-contractors (livestock transport operators from Ipswich and Beenleigh) who operate under contract to the receiving organisation (AMH or Teys) and QRNational to manage the receival yards. Receival yards are the property of QRNational. Animals were unloaded directly onto water. Animals are understood to be the responsibility of QRNational while travelling and are then transferred to the responsibility of the purchaser (processing plant) once they are unloaded.

Paperwork accompanying the cattle was passed at the time of unloading to the receiving stockman. The paperwork includes the QRNational loading docket and the waybill/NVD. The loading docket records a number identifying each trailer and the number of animals in that trailer and a code identifying the class of those animals. The waybill records the number of animals from each vendor and the vendor PIC number. When a train loads cattle purchased from a saleyard, the waybill will simply record one row per vendor with the number of cattle identified and the vendor PIC (aggregated waybill and not the original waybill that accompanied animals from property of origin to the saleyard). When a train loads cattle directly from a particular origin property, those animals will travel with a waybill that provides more detailed information on the property of origin.

It is not possible to determine from these two pieces of information which vendors have contributed animals to any particular trailer when the train has loaded cattle purchased in a saleyard. However, it is possible to identify vendor PIC for all vendors who have provided animals to the consignment being unloaded at that location. When a train loads cattle direct from a property of origin (no involvement of a saleyard transaction), it would be possible to directly link a specific property waybill to a particular trailer-load of cattle. This is an example of the tracing difficulties experienced for journeys that involve animals purchased in a saleyard and transported to another destination and this issue has been discussed in the previous section.

Once animals arrived at the destination, the paper work is checked by the receiving agent and animals were unloaded into pens and straight onto water. The paperwork (loading docket and waybill) was then taken to the livestock office of the receiving organisation (AMH or Teys).

Copies of the loading docket, movement record and attendant checklist are sent by fax to QRNational head office in Brisbane.

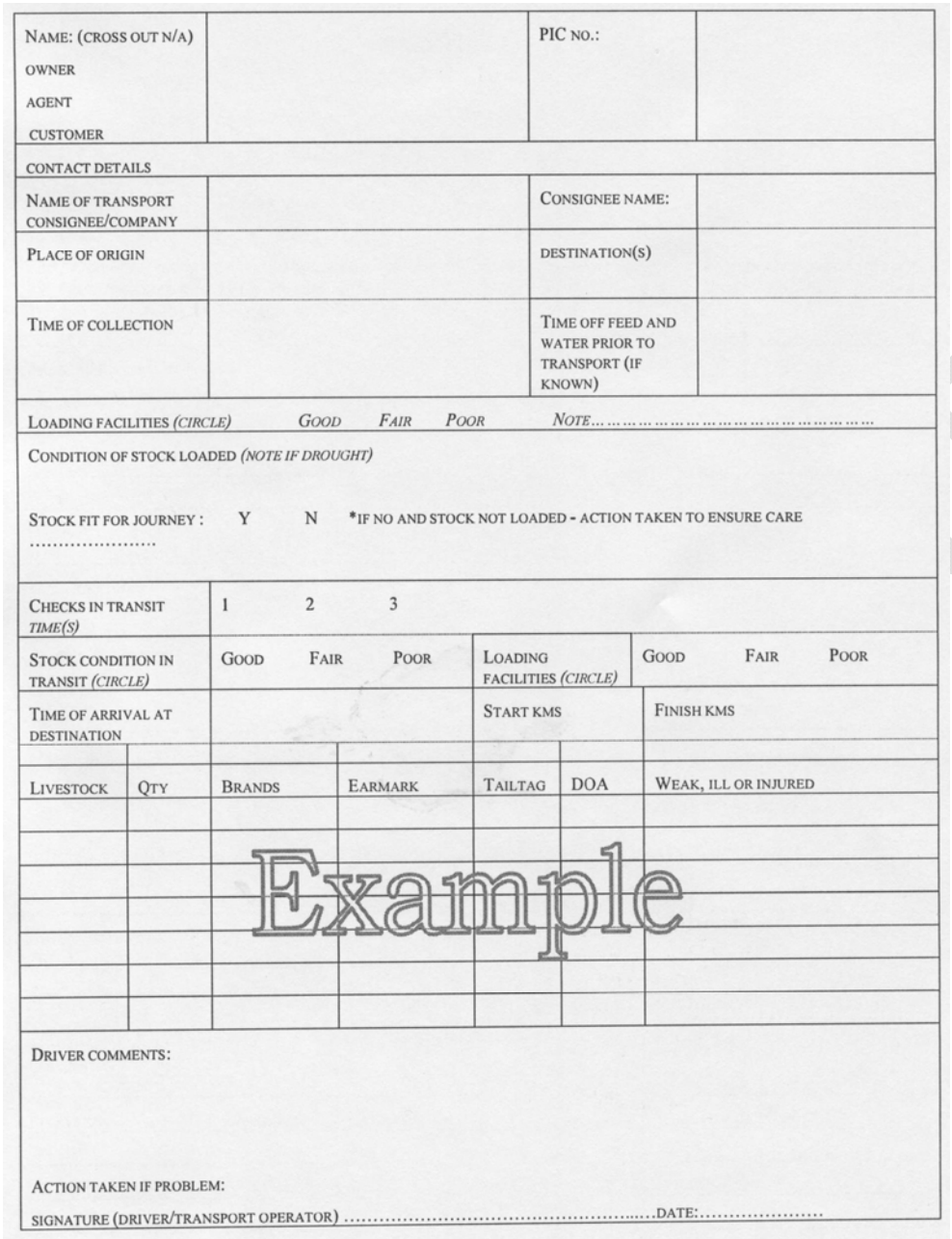
A number of issues were raised by QRNational personnel and are presented here because they were considered to be related to the broader areas of animal welfare and livestock transport:

- Uncertainty over responsibilities for funding and delivering education and awareness on animal welfare issues to the livestock industries and for auditing practices related to animal welfare?
- Perception that animal welfare in QLD appeared to be dominated by enforcement of legislated thresholds and responding to detected problems rather than education aimed at raising awareness, building commitment and preventing issues.
- Perception that industry stakeholders appeared to only be supportive of animal welfare if it does not impose costs or affect returns.
- Perception that personnel with responsibilities associated with animal welfare inspection may have little knowledge of livestock and livestock industries including animal movements.
- Perception that producers appeared to be wary of animal welfare and reluctant to tale ownership of the issue, perhaps due to concerns over compliance and penalty aspects of animal welfare.
- Perception that there was a lack of engagement with producers over animal welfare issues.
- Stock handling schools have been developed by QRNational and are considered to provide a positive impact on improving animal welfare outcomes associated with management of livestock during rail transport.
- Animal welfare initiatives should be developed in consultation with bodies such as the RSPCA and WSOPA.
- Many animal welfare problems that have been identified by QRNational have been associated with preventable livestock issues including in particular pre-existing health conditions and management of cattle prior to loading on rail carriages:
    - existing diseases, pregnant cows, old age,
    - dehydration, exhaustion & stress from poor handling, long travel and lack of exposure to good quality water & feed prior to loading,
    - adverse weather,
    - stock that have not travelled before or that have not had exposure to people, yards etc,
    - poor stockmanship.

8.5.4.6 Live export assembly depots

One of the project team members has been involved in a separate MLA project that is currently in progress and that has been collecting data from sheep being transported to live export assembly ports in southern Australia (LIVE.123). Collaboration between the current project (AHW.125) and LIVE.123 has been discussed between the project team members and there is a great deal of existing knowledge and experience within the current project team regarding practicalities of data collection from the export assembly depots for the current project. It was not considered necessary to trial the current proposed data collection methodology in the live export assembly depot as a result of this existing knowledge and experience.

8.6 Appendix 6: Industry recording form



NAME: (CROSS OUT N/A)
OWNER
AGENT
CUSTOMER

PIC NO.:

CONTACT DETAILS

NAME OF TRANSPORT CONSIGNEE/COMPANY

CONSIGNEE NAME:

PLACE OF ORIGIN

DESTINATION(S)

TIME OF COLLECTION

TIME OFF FEED AND WATER PRIOR TO TRANSPORT (IF KNOWN)

LOADING FACILITIES *(CIRCLE)* GOOD FAIR POOR NOTE……

CONDITION OF STOCK LOADED *(NOTE IF DROUGHT)*

STOCK FIT FOR JOURNEY : Y N *IF NO AND STOCK NOT LOADED - ACTION TAKEN TO ENSURE CARE ……

CHECKS IN TRANSIT *TIME(S)* 1 2 3

STOCK CONDITION IN TRANSIT *(CIRCLE)* GOOD FAIR POOR

LOADING FACILITIES *(CIRCLE)* GOOD FAIR POOR

TIME OF ARRIVAL AT DESTINATION

START KMS

FINISH KMS

LIVESTOCK	QTY	BRANDS	EARMARK	TAILTAG	DOA	WEAK, ILL OR INJURED

Example

DRIVER COMMENTS:

ACTION TAKEN IF PROBLEM:

SIGNATURE (DRIVER/TRANSPORT OPERATOR) ……DATE:……

Figure 5: Proposed recording form for quality assurance programs such as TruckCare. Taken from Animal welfare industry standards for livestock transport, Part 2: Working manual for implementation, 2007.

The proposed data collection form presented in Figure 5 was part of an initiative released in June 2007 by ALTA. It is understood that this form would be integrated into TruckCare, an industry quality assurance program. There is a great deal of similarity between the information collected in this

proposed form and that collected in the custom designed forms developed during Objective 2. Routine collection of all of the data fields in this form would allow ongoing monitoring of animal welfare outcomes for transported livestock and consideration of key explanatory factors associated with pre-loading management and the journey itself.

8.7 Appendix 7: Abbreviations

AACo	Australian Agricultural Company
ALTA	Australian Livestock Transporters' Association
AMH	Australia Meat Holdings
AMIC	Australian Meat Industry Council
AMPC	Australian Meat Processor Corporation Ltd
ATO	Australian Tax Office
CCA	Cattle Council of Australia
CI	Confidence Interval
CSIRO	Australian Commonwealth Scientific and Research Organization
DAFF	Department of Agriculture Fisheries and Forestry
DAFWA	Department of Agriculture and Food, Western Australia
DPI&F	Department of Primary Industries and Fisheries, Queensland
DPIFM	Department of Primary Industry, Fisheries and Mines, Northern Territory
GICA	Goat Industry Council of Australia
LSAA	Livestock Saleyards Association of Australia
MLA	Meat and Livestock Australia
NAPCO	The North Australian Pastoral Company Pty Limited
NLIS	National Livestock Identification System
NLRS	National Livestock Reporting Service
NSW DPI	New South Wales Department of Primary Industries
NVD	National Vendor Declaration
PIC	Property Identification Code
PIRSA	Department of Primary Industries and Resources of South Australia
QRNational	Queensland Rail National Freight Service
RLPB	NSW Rural Lands Protection Boards
SCA	Sheepmeat Council of Australia
Vic DPI	Victorian Department of Primary Industries