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NATIONAL TRAFFIC DATABASE

CONTENT & OPERATION OF DATABASE

Transit New Zealand Research Report No. 53

NATIONAL TRAFFIC DATABASE

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WORKS CONSULTANCY SERVICES LTD,
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AN IMPORTANT NOTE FOR THE READER

The material contained in this report is the output of research and should not be construed in any way as policy adopted by Transit New Zealand, but may form the basis of future policy.

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GLOSSARY & ABBREVIATIONS

AADT	The Annual Average Daily Traffic volume on a road section, generally the result of an estimate, and sometimes the result of an actual count, using tube counters.
ADT	The Average Daily Traffic volume on a road section, a measure that is not based on a year of data.
ARCHER	A type of portable traffic counter, giving data which enable distinction between vehicle classes.
ASCII	The American Standard Character set: numbers and characters which are able to be read on a computer screen using standard DOS commands, and are not dependent on software for translation.
AUSTROADS	Association of Road Transport and Traffic Authorities in Australasia, the successor to NAASRA.
CBD	Commercial Business District.
CVIU	The Commercial Vehicles Investigations Unit of the New Zealand Police, who are tasked with enforcement of heavy vehicle standards and laden weights.
DKW	A system of vehicle classification, based on the AUSTROADS system, and modified by DK Wanty, Transit New Zealand, to accommodate the New Zealand vehicle fleet.
EDA	Equivalent Design Axle: this is an axle carrying 8.2 tonnes on two sets of dual tyres.
ESAL	Equivalent Standard Axle: this is an axle carrying 8.2 tonnes on two sets of dual tyres, but of slightly different wheel spacings and tyre-road contact area than an Equivalent Design Axle.
Field Names	Names used for fields in the Database tables, designated by italics using an initial capital, e.g. *Dkw_c* identifies DKW Class.
HVADT	Heavy Vehicle Average Daily Traffic volume.
NAASRA	National Association of Australian State Roads Authorities (now operating as AUSTROADS).
National Traffic Database	A collection of data about traffic flows and vehicles using New Zealand roads. It contains selected fields from a working spreadsheet, plus the weight distribution of heavy vehicles and the statistically averaged estimates of vehicle classification.
PAT	A system of measuring and classifying vehicles, based on axle spacings. (From its manufacturer's name, Pietzsch Automatisierungstechnik.)

PAT DAW — Weigh-in-motion instruments used on some state highways in New Zealand to weigh and classify vehicles. (PAT - see above, DAW from its trade name, Dynamische Achslastwaage.)

RAMM — Road Assessment and Maintenance Management system: the computer-based databases of road sections and road conditions, developed and maintained by each RCA.

RCA — Road Controlling Authority, which is Transit New Zealand in the case of state highways, and a Territorial Authority in the case of local roads.

Road section — A length of public road identified by its location that is described in each line of the RAMM database.

Road use category — A classification system for identifying the main use of a road section. Description is based on the daily pattern of traffic volumes using the road.

RUC — Road User Charge: the system of charges made by the Ministry of Transport on all heavy vehicles using the New Zealand road network. It depends on the vehicle's axle configuration and total weight, as well as distance travelled.

TA — Territorial Authority: the body given jurisdiction over local roads in respective territorial districts of New Zealand.

Transit New Zealand, TNZ — The body given jurisdiction over state highways in New Zealand.

VDAS — A type of portable traffic counter, giving data which enable distinction between vehicle classes.

WCSL — Works Consultancy Services Ltd, New Zealand: consultant undertaking the research for this report.

WIM — A system for Weigh-In-Motion of vehicles - the weight of each vehicle passing at highway speeds over the WIM detector is estimated and recorded. Data from three permanent WIM sites in New Zealand (at Drury, Pukerua Bay and Waipara) have been interrogated for the Database.

Working Spreadsheet — The LOTUS spreadsheet developed for each RCA, consisting of an expansion of the RAMM descriptive inventory and vehicle volume tables. The working spreadsheet contains basic classification survey information on a site by site basis, as well as the factors used to improve the ADT values.

EXECUTIVE SUMMARY

1. The National Traffic Database

The National Traffic Database is a system for storing traffic data, including traffic volume, vehicle class and vehicle weight, collected from each of approximately 120,000 sections of public roads (i.e. the state highway and local road network) in New Zealand. It incorporates data collected by each Road Controlling Authority (RCA), i.e. by Transit New Zealand Regional Offices for state highways and by Territorial Authorities (TAs) for local roads. The road sections are those defined and used in the RAMM (Road Assessment and Maintenance Management system) databases of each RCA.

As far as can be ascertained from international literature, such a compilation of traffic data has not been made elsewhere in the world.

2. Objective of Project

This project, begun in 1994, has the objective of establishing a database recording where travel is occurring on New Zealand public roads, measured in terms of Annual Average Daily Traffic (AADT), traffic composition and weights of heavy vehicles required to pay Road User Charges (RUC).

3. Structure of Project

The project is reported in three parts:

Content and Operation of Database: Transit New Zealand Research Report No. 53,

1. Research Report: Transit New Zealand Research Report No. 54A,
2. Quality Plan: Transit New Zealand Research Report No. 54B.

This report, *Content and Operation of Database*, gives a summary of the project, in particular a description of the resulting Database, as well as instructions for loading the Database. It is complete in itself, and full descriptions of the project and the quality plan are contained in the other two parts. It includes two diskettes containing the Database files in DBase format.

The Database was developed by bringing traffic count data to a common base of AADT as at June 1994 for every road section. Distributions of heavy vehicle classes associated with each road use category (a description of the main function[1] of the road section) were obtained from field surveys. Vehicle weight distributions for heavy vehicle classes were obtained from field surveys and from weigh-in-motion (WIM) data.

A Pilot Study was carried out in Regions 5 and 6 (Gisborne and Hawke's Bay) to test the proposed methodology. This task was completed in September 1994, and then the Quality Plan was refined.

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[1] For example *urban residential*, *rural arterial*, etc.

The Quality Plan details the actions needed by all parties involved in assembling the Database, and is an extension of the methodology produced for the Pilot Study for applying to the remainder of the public road network.

Working spreadsheets were developed from selected fields of the RAMM database held by each RCA. Assembly of this information and its subsequent enhancement involved the co-operation of 73 TAs and 7 Transit New Zealand Regional Offices. The compilation has highlighted a lack of inventory information in some TAs, particularly that about unsealed roads. In order to obtain a nationally complete Database, data for some of these sections have been estimated and judgment has been exercised.

4. Structure of the National Traffic Database

The Database consists of three data files in DBase format:

- *Road section data (NTDB.DBF),* which are the data on each road section, including length, road use category, and AADT.

- *Vehicle classification distribution data (VEHPROP.DBF),* which describe the proportions of AADT in each of 15 classes of light or heavy vehicles. (Currently a separate distribution is made for each road use category.)

- *Vehicle weight distribution data (WGTDIST.DBF),* which describe the vehicle weight distribution for each vehicle class to assist in generating synthetic vehicle weight data. (Distributions depend not only on the particular vehicle class, but also on the road use category, and RCA.)

The availability of the National Traffic Database will lead to

- Accurate information on vehicle volume demand on all RAMM road sections at a common period in time (currently June 1994),

- An estimate of vehicle kilometres and heavy vehicle kilometres for road use categories within RCAs,

- The basic information needed for making comparison of average ESALs (Equivalent Standard Axle) per year between RCAs at a network level or at road use category level.

The following table summarises the estimates that are possible to obtain from the Database, as well as the recommended levels for the operations.

While summary information can be calculated reliably when several road sections are aggregated, the lack of precision of estimate of heavy vehicle distribution at present does not permit meaningful conclusions to be drawn when only a few road sections are involved in the calculation.

Estimates that can be obtained from the Database, and recommended levels of operation.

Estimate of daily/yearly total for:	**Recommended levels of operation***
Vehicle kilometres travelled	N, R, TA
Tonne-kilometres travelled	N, R, TA
Vehicle kilometres by vehicle class	N, R, TA
Tonne-kilometres by vehicle class	N, R, TA
Vehicle kilometres by road use category	N, R, TA
Tonne-kilometres by road use category	N, R
Vehicle kilometres by vehicle class by road use category	N, R
Tonne-kilometres by vehicle class by road use category	N, R

* N = National level, R = Regional level, TA = Territorial Authority level

5. Vehicle Classification System, Road Use Category, Vehicle Weight Distribution

A *vehicle classification system* adopted for the New Zealand vehicle fleet is an adaptation of the AUSTROADS system. This DKW system divides the vehicle fleet into 15 classes, of which 12 are heavy vehicles.

Road use categories, used for classifying the road sections, have been derived from a separate Transit New Zealand Research Project[2]. The distribution of vehicle classes obtained from field classification surveys differs between the nine road use categories.

An estimate of *distribution of weight* for each class of heavy vehicle was made using data from three WIM sites[3], as well as from specially designed field surveys executed by the Police Commercial Investigation Unit (CVIU).

6. Verification of the National Traffic Database

The integrity of the Database was checked by computing values and comparing outputs with independent sources. The following table lists items chosen for comparison between predictions obtained from the Database and from independent data.

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2 Transit New Zealand (in prep.) Traffic stream data. TNZ Research Project PR3-0025.

3 Continuous weight recording stations, located on state highways at Drury, Pukerua Bay and Waipara.

Comparison of predictions obtained from Database and from independent data.

Item compared	Precision of prediction calculated from Database compared with independent data
Petrol consumption	91% of statistics for domestic transport and resellers
Diesel consumption	59% to 102% of statistics depending on proportions sold to public transport by domestic transport and resellers
Heavy vehicle kilometres travelled	60% of distance of RUC licences purchased
Heavy vehicle tonne-kilometres	79% of result recorded in independent database
Road User Charges	57% of annual national revenue

7. Improvements and Maintenance of the National Traffic Database

Because of budget and time constraints, surveys were carried out at only five of the randomly selected forty[4] sites in each RCA. Currently, the Database can nevertheless be used to generate meaningful comparisons between road use categories on a national basis or between RCAs. To improve the accuracy and usefulness of the Database, the additional classification surveys that have already been designed need to be completed. The improved Database could then be used to provide meaningful comparisons between smaller aggregations of road sections.

In the longer term, an ongoing programme of importing current RAMM data, including vehicle volume information to replace superseded information, as well as a programme of vehicle classification and vehicle weight surveys, needs to be implemented to maintain the currency of the Database.

8. Summary

The National Traffic Database is able to provide estimates of basic traffic information, including total volume, vehicle class and weight data, for the network of public roads in New Zealand, both state highways and local roads.

The methodology which has been developed and applied has produced a Database that includes for each RAMM road section:

- The best available estimate of AADT,
- Categorisation of each road section by use,
- A distribution of heavy vehicle classes (by DKW system) as a proportion of AADT for each road use category,
- Distribution of heavy vehicle gross weight by road use category and by geographic locality.

---

[4] The exact number of selected sites necessary to achieve the target level of precision varied between RCAs, depending on the distribution of AADT between road sections, but was around forty in general.

Arising from this methodology is the basis for systematic upgrade of the Database, including:

- A pre-defined sampling plan (by RCA),
- Estimates of reliability of the data.

From the Database, estimates can be made for daily, yearly totals and average values for

- Total and heavy vehicle volumes,
- Total and heavy vehicle kilometres,
- Tonne-kilometres,
- ESAL-kilometres,
- RUC revenue,

at a national and regional level. Further subdivision of some of these outputs is possible at an RCA level, as well as by vehicle class and road use category.

The Database has internal consistency of measurements on a nationwide basis for traffic volumes. A prepared programme of vehicle classification surveys needs to be completed to improve the precision of the estimate of distribution of heavy vehicles. Regular updating of the Database is also required to ensure that it reflects changes in road networks, and changes in the nature of traffic, such as in vehicle classes, weights, and travelled road sections.

ABSTRACT

The National Traffic Database is a system for storing traffic data collected from each of approximately 120,000 sections of New Zealand public roads (i.e. the state highway and local road network). It incorporates data collected by each Road Controlling Authority (RCA), i.e. by Transit New Zealand Regional Offices for state highways and by Territorial Authorities (TAs) for local roads. The road sections are those defined in the RAMM (Road Assessment and Maintenance Management system) databases of each RCA.

The National Traffic Database describes the relative traffic demand on New Zealand public roads, in terms of traffic volume (Annual Average Daily Traffic - AADT), traffic composition by vehicle class and by vehicle weight. Such a compilation of these data has not been made elsewhere in the world, according to international literature.

The availability of the National Traffic Database will provide:

- Accurate information on vehicular travel,
- Comparative information for traffic demand both in terms of volume and of ESALs (Equivalent Standard Axles) between RCAs or between road use categories on an aggregated national basis.

To improve the accuracy and usefulness of the Database, the additional classification surveys that have already been designed need to be completed. In the longer term, an ongoing programme of vehicle classification surveys and vehicle weight surveys needs to be implemented.

The project, begun in 1994, is reported in three parts:

Content and Operation of Database: Transit New Zealand Research Report No. 53. This report gives a summary of the project, in particular a description of the resulting Database, as well as instructions for loading the Database. It includes two diskettes containing the Database files in DBase format.

1. Research Report: Transit New Zealand Research Report No.54A,
2. Quality Plan: Transit New Zealand Research Report No. 54B.

1. DESCRIPTION OF NATIONAL TRAFFIC DATABASE

The National Traffic Database (also called the Database) is a compilation of data collected from approximately 120,000 road sections of the New Zealand public road network (state highways and local roads). Road sections are divisions of the network used as basic units for the inventories in the RAMM databases held by each RCA. The road sections are described in terms of length, traffic volume as at June 1994, type of road use, and whether sealed or unsealed, urban or rural, and the data have been exported from the RAMM databases of the RCAs.

2. OBJECTIVE OF PROJECT

The overall objective of the National Traffic Database project is:

> *to establish a database that records where travel is occurring on New Zealand public roads, measured in terms of Average Daily Traffic (ADT), traffic composition and weights of Road User Charge (RUC) (heavy) vehicles.*

The Database developed for this study consists of three files of data. One lists the data of each section of public roads in the RAMM database of every RCA[5], each with an associated estimate of AADT, the road use category of the road section, and whether sealed or unsealed, urban or rural.

A second file contains an estimate of the distribution of traffic volume between 15 vehicle classes (including 12 classes of heavy vehicle) for 11 different road use categories.

The third file provides an estimate of the vehicle weight distribution in each of the heavy vehicle classes, calculated from a survey of heavy vehicle classes at random locations.

3. STRUCTURE OF PROJECT

The essential steps in this study, which was undertaken in three stages beginning in 1994 and continuing to 1996, are described in Sections 3.1 to 3.6.

3.1 Pilot Study

A Pilot Study was carried out in Regions 5 and 6 (Gisborne and Hawke's Bay). The purpose was to prove and refine the proposed methodology which had been developed as Stage 1 in 1994. This task was referred to as Stage 2 and was completed in September

[5] The Chatham Islands network is not included in the Database, however, because it operates essentially independently of the remainder of New Zealand's public roads network.

1994, and included liaison with the 5 TAs in Regions 5 and 6 and the Transit New Zealand Regional Office at Napier.

3.2 Quality Plan

The methodology used for executing the project following the Pilot Study is detailed in a Quality Plan. This is contained in a separate report (Transit New Zealand Research Report No. 54B) and should be applied when the Database is updated.

3.3 Completion of New Zealand-wide Data Collection

After training personnel from 17 of Works Consultancy Service's (WCSL) offices, working spreadsheets containing the basic information obtained from the Pilot Study were assembled. This phase of the project, referred to as Stage 3, involved the co-operation of TAs (a total of 68 TAs) and Transit New Zealand Regional Offices (a total of 6 offices).

3.4 Vehicle Classification Surveys

From the spreadsheets, random sites were generated, with the selection method recognising the relative importance of high volume road sections. About 40 sites were identified in each RCA at which 24 hour "classification surveys" (surveys to determine numbers of different vehicle classes) are to be carried out. In Stage 3 of the project, however, budgetary and time constraints permitted surveys at only five sites in each RCA.

3.5 Vehicle Weight Surveys

Frequency distributions of vehicle weights were obtained for each class of heavy vehicle from two sources: the WIM data collected at three state highway sites (Drury, Pukerua Bay and Waipara), and surveys at other road locations carried out by the CVIU.

3.6 Procedure for Enhancing and Updating the Database

As part of Stage 3 of the project, the procedure for enhancing and updating the Database has been developed. Enhancement will be achieved through completion of the vehicle classification surveys, and regular updates will serve to incorporate changes in total vehicle volumes, proportions of vehicle classes and heavy vehicle weight distributions, and road section data (e.g. new roads, seal extension).

3.7 Documents

The project is reported in three parts:

Content and Operation of Database: Transit New Zealand Research Report No. 53. This report, which gives a summary of the project, in particular a description of the resulting Database, as well as instructions for loading the Database. It includes two diskettes containing the Database files in DBase format.

1. Research Report, Transit New Zealand Research Report No. 54A.

2. Quality Plan, Transit New Zealand Research Report No. 54B.

4. PILOT STUDY

A Pilot Study was carried out in Regions 5 and 6 (Gisborne and Hawke's Bay). State highway and local roads were included. The purpose of the study was to confirm the methodology to subsequently be applied nationally.

Independent regional statistics were used to confirm the completeness of the Database, although in some cases the regional information was deduced from national statistics and so was less reliable. The methodology was refined following the Pilot Study.

5. QUALITY PLAN AND EXECUTION OF STUDY

The Quality Plan was aimed to ensure consistency in:

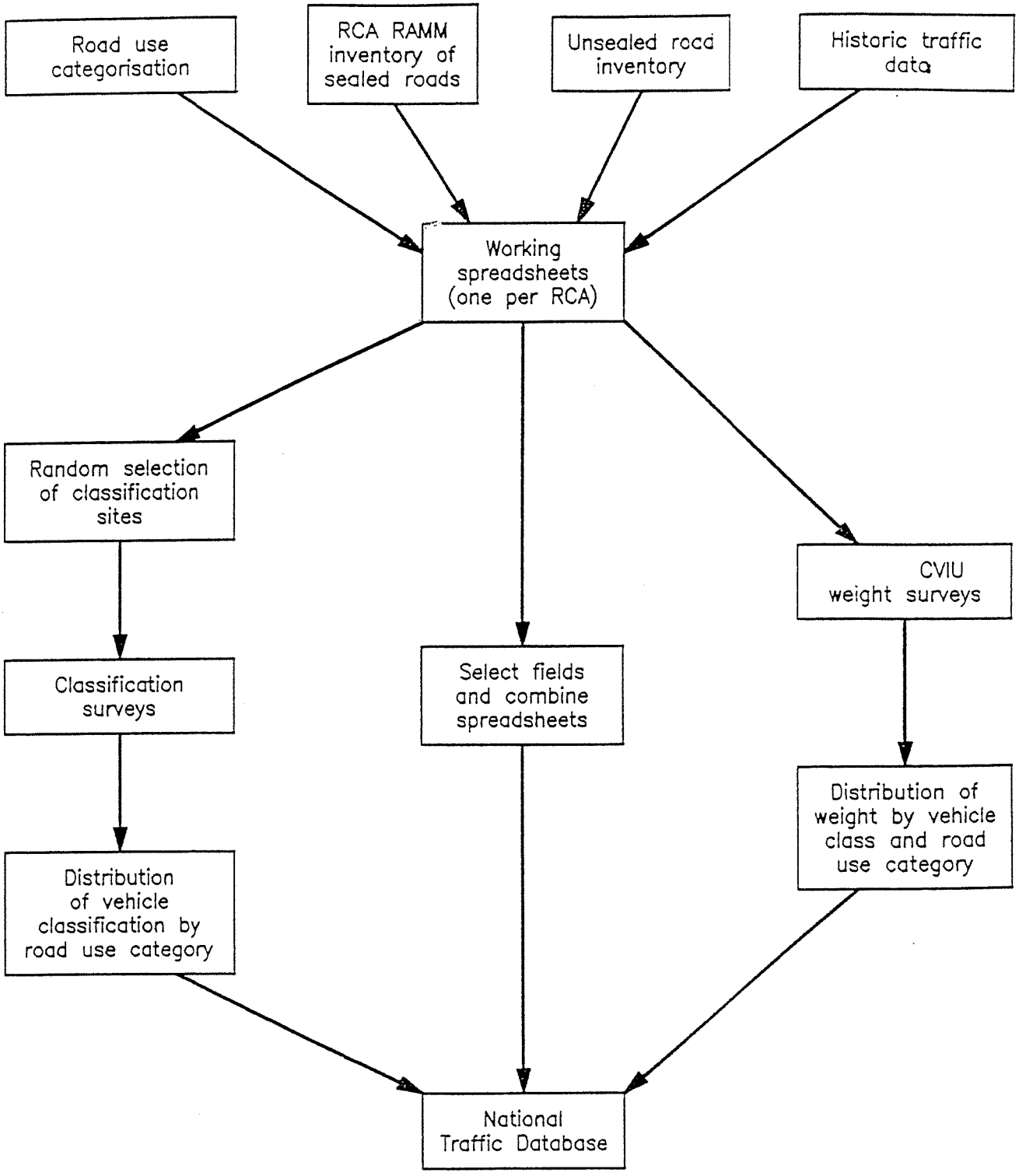
- Quality of information, and
- Format of electronic data spreadsheets.

Personnel from 17 offices from WCSL throughout New Zealand were involved in the study, and a total of 80 spreadsheets were produced. Control at each step was essential to ensure that the information received was consistent.

The Quality Plan contained in a separate report (Transit New Zealand Research Report No.54B), deals with each phase of the project, as follows:

1. Preparation of Work Instructions in the Quality Plan
2. Preparation and execution of written and verbal publicity for project
3. Design of working spreadsheets
4. Design of Database
5. Design of classification sampling scheme
6. Contact with RCAs
7. Interview of RCA personnel, including completion of prepared questionnaires

Figure 5.1 Flow of operations followed to assemble the National Traffic Database.



8. Download of inventory of road sections and associated volume information from the RCA RAMM database, and other sources held by RCA
9. Completion of road section inventory, including unsealed roads, and category of road use
10. Analysis of historical traffic volume data to obtain growth rates
11. Confirmation of resulting inventory against published statistics, and review of spreadsheet
12. Generation of random sites for classification survey from spreadsheets
13. Execution of classification surveys for five of the random sites per RCA, including briefing of four teams, and downloading of information
14. Analysis of classification survey information
15. Execution of vehicle weight surveys, including WIM sites, and CVIU surveys
16. Analysis of weight survey information
17. Assembly of Database, and preparation of reports

The operation of the study is summarised in Figure 5.1.

6. STRUCTURE OF THE NATIONAL TRAFFIC DATABASE

6.1 Data Files in the Database

The Database consists of three data files:

- *Road section data* which are the data on each road section, including section length and AADT.

- *Vehicle classification distribution data*, which describe the proportions of AADT in each of 15 classes of light or heavy vehicles. (Currently a separate distribution is made for each road use category.)

- *Vehicle weight distribution data*, which describe the vehicle weight distribution for each vehicle class to assist in generating synthetic vehicle weight data. (Distributions depend not only on the particular vehicle class, but also on the road use category, and RCA.)

6.2 Road Section Data

The principal datum is one record for each RAMM road section. A description and the format of each field in a row is given in Table 6.1, and there are 123,953 rows in the Database. Note that to link the field to an RCA RAMM inventory, the *Road_id* and *Start* fields need to be linked, following removal of data from other RCAs by filtering. Table 6.2 gives a sample of road section data from the Database.

Table 6.1 Road section data file: fields used for the Database.

Field name	Description of field	Type of field*	Length of field**
NTDB	Number of the row	N	6
Tnz_region	Number of Region: 1 to 14	N	2
Tla_number	Number of Territorial Authority: 1 to 73	N	2
Road_id	Identifies road section	N	4
Start	Start position of section (metres)	N	6
Finish	Finish position of section (metres)	N	6
Length	Length of section - distance between start and finish (metres)	N	6
Roadname	Name of road	C	30
From_desc	Description of feature at start of section	C	30
To_desc	Description of feature at end of section	C	26
H_l	State Highway or local road	C	1
S_u	Sealed or unsealed	C	1
U_r	Urban or rural	C	1
U_r_adj	Urban or rural in terms of surrounding land use or environment	C	1
Oth_usage	Additional description of use, e.g. logging traffic	C	20
Roaduse	See Table 7.3 for list of road use categories	C	2
Count_meth	Whether Estimate, Tube Count, or Classification Count *(ARCHER* or *VDAS)*	C	5
Aadt	Value of AADT used for subsequent calculation	N	6

* Type of field: C = Character field; N = Numeric field
** Length of field: number of characters or numerals

Table 6.2. Road section data file: example of values for some road sections used for the Database.

*Tnz_ region	**Tla_ number	Road_ id	Start	Finish	Length	Roadname	From_desc	To_desc	H_l	S_u	U_r	U_r_adj	Oth_ usage	Roaduse	Count_ meth	Aadt
2	9	1	585	2010	1425	Access Road	Urban/ rural	Station Road	L	S	R	R		6	Est	1077
2	9	2	0	123	123	Agency lane	Silverdale Street	Judder bar	L	S	U	U		2	Est	7800
2	9	3	0	226	226	Ahuroa Road	Saleyards Road	Urban/rural	L	S	U	U		9	Est	251
2	9	3	226	2588	2362	Ahuroa Road	Urban/ rural	End of seal	L	S	R	R		8	Count	222
2	9	3	2588	5394	2805	Ahuroa Road	End of seal	Wenzlick Road	L	U	R	R		8	Est	105
2	9	4	0	2750	2750	Ahuroa Valley Road	Ahuroa Road	End of road	L	U	R	R		9	Est	63
2	9	5	0	59	59	Albany Heights Road	SH1	End of seal	L	S	R	R		8	Est	270
2	9	5	59	852	793	Albany Heights Road	End of seal	Start of seal	L	U	R	R		9	Count	318
2	9	5	852	969	117	Albany Heights Road	Start of seal	End of seal	L	S	R	R		9	Est	516
2	9	5	969	1797	828	Albany Heights Road	End of seal	Start of seal	L	U	R	R		8	Count	128

* See Appendix 3 for list of regions
** See Appendix 2 for list of territorial authorities

6.3 Vehicle Classification Distribution

The fields in the distribution of vehicle classes within each road use category are shown in Table 6.3 and the values in Table 6.4 (p.23). These tables contain the distribution of vehicle classes in the traffic mix which is, for the purposes of the Database, constant for all road sections of a given road use category. There is one record for each road use field, i.e. 11 records.

Table 6.3 Vehicle classification distribution file: fields used for the Database.

Field name	Description of field	Type of field*	Length of field**
VEHPROP	Number of row (11 rows)	N	2
Road_use	See Table 7.3 for road use categories	C	2
Dkw_1 to *Dkw_15* (15 fields)	Proportion of AADT in each of 15 (DKW) classes of vehicle type. See Table 7.1 for list of DKW vehicle classes.	N	6.4

* Type of field: C = Character field; N = Numeric field ** Length of field: number of characters or numerals

6.4 Vehicle Weight Distribution

Tables 6.5 and 6.6 show the fields and a sample of values for the weights of vehicle for the percentile values listed. For example, a 5 percentile value of weight (e.g. 2528 kg for set 3a) means that 95% of vehicles in that class are expected to exceed that weight. There is one record for DKW classes 3 to 15, i.e. 13 records. A sample of numerical values are given in Table 6.6 (p.24). The full list is in part 1 of Transit New Zealand Research Report No.54A.

Table 6.5 Distribution of vehicle weight: fields used for the Database.

Field name	Description of field	Comment	Type of field*	Length of field**
WGTDIST	Number of row		N	2
Set	A name attributing a set of weight distributions to particular road use categories and RCAs		C	6
Mean	Mean weight (in kg) for the particular weight stratum (DKW class, groups of RCAs and road use categories)	See Table 6.6	N	6.4
Std	Standard deviation (in kg) for the particular weight stratum (DKW class, groups of RCAs and road use categories)	See Table 6.6	N	6.4
5%ile to *95%ile* (13 fields)	Average weight (in kg) for the percentage of vehicles less than the set 13 percentile points	See Table 6.6. Percentile points are: 5%, 10%, 20%, 25%, 30%, 40%, 50%, 60%, 70%, 75%, 80%, 90%, 95%	N	6.4

* Type of field: C = Character field; N = Numeric field ** Length of field: number of characters or numerals

Table 6.4 Vehicle classification distribution file: proportions of AADT used for the Database.

Road Use Category*	**DKW Class 1 to 15** (proportions of AADT)														
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
1a	0.9386	0.0151	0.0149	0.0107	0.0063	0.0023	0.0012	0.0052	0.0015	0.0008	0.0009	0.0005	0.0009	0.0010	0.0002
1b	0.9450	0.0152	0.0107	0.0095	0.0056	0.0026	0.0012	0.0046	0.0016	0.0006	0.0013	0.0005	0.0010	0.0005	0.0002
2	0.9525	0.0122	0.0105	0.0080	0.0059	0.0017	0.0015	0.0028	0.0014	0.0009	0.0008	0.0002	0.0009	0.0005	0.0001
3	0.8860	0.0247	0.0271	0.0230	0.0141	0.0037	0.0028	0.0048	0.0047	0.0020	0.0033	0.0014	0.0011	0.0006	0.0006
4	0.9369	0.0183	0.0115	0.0100	0.0077	0.0028	0.0011	0.0034	0.0023	0.0010	0.0013	0.0009	0.0017	0.0007	0.0004
5	0.9249	0.0308	0.0107	0.0139	0.0069	0.0025	0.0053	0.0037	0.0006	0.0000	0.0000	0.0001	0.0002	0.0002	0.0000
6	0.8864	0.0238	0.0200	0.0156	0.0101	0.0032	0.0026	0.0069	0.0085	0.0032	0.0079	0.0029	0.0060	0.0017	0.0011
7a, 7b	0.8990	0.0656	0.0083	0.0087	0.0044	0.0011	0.0010	0.0027	0.0037	0.0003	0.0030	0.0002	0.0008	0.0008	0.0003
8	0.8764	0.0324	0.0189	0.0158	0.0172	0.0051	0.0028	0.0056	0.0058	0.0020	0.0081	0.0017	0.0059	0.0017	0.0006
9	0.9394	0.0195	0.0123	0.0106	0.0066	0.0016	0.0008	0.0023	0.0018	0.0005	0.0029	0.0002	0.0010	0.0005	0.0001

* See Table 7.3 for definitions of road use categories

Table 6.6 Distribution of vehicle weight: sample* of values (kg) used for the Database.

Set	Mean Weight (kg)	Standard Deviation (kg)	Percentile (kg)												
			5	10	20	25	30	40	50	60	70	75	80	90	95
3ua	5853	2824	2528	2914	3262	3586	3934	4482	5066	6024	6907	7804	8365	9781	11423
3u	6588	3617	2165	2653	3323	2918	4052	4536	5850	6378	8065	9022	9865	12601	13728
3ra	6338	3518	2559	3010	3715	4073	4241	4860	5522	6336	7365	8099	8654	10929	12563
3rb	7477	3400	2835	3112	4351	4727	5232	6052	7014	7732	9045	10020	10504	12048	14056
3rc	4542	2371	1935	1986	2342	2546	2749	3259	3564	4582	5601	6110	6619	7943	8656
WIM:3	4487	1889	2740	3010	3300	3410	3510	3710	3960	4270	4710	4990	5340	6450	7700
WIM:4	7530	3439	3600	4190	4990	5350	5710	6440	7200	8010	8880	9370	9940	11360	12480
5ur	13725	4801	6771	8855	9606	9804	10032	10870	11933	14059	17134	18775	19249	21095	21647
WIM:5	11750	4172	5670	6690	8080	8660	9200	10300	11380	12470	13660	14300	15030	17310	19450
6ur	17360	6874	9849	10352	11734	12371	12876	14433	15438	17526	20101	21912	23196	25100	27301

* The full list of values is given in Table 16.2, part 1. Research Report, Transit New Zealand Research Report 54A

7. VEHICLE CLASSIFICATION SYSTEM AND ROAD USE CATEGORY

7.1 Vehicle Classification

7.1.1 DKW Vehicle Classification System

Vehicle types are classified into one of the 15 groups that are defined in Table 7.1. The classification system is based on the AUSTROADS system as amended by Transit New Zealand. It has been referred to as the DKW system.

7.1.2 RUC System

RUC classes cannot be uniquely associated with the output from *VDAS* or *ARCHER* vehicle classification equipment. The RUC system of operation gives attention to axle number, and distinguishes between tractor and trailer units. The DKW classification system used in this project does not distinguish between such vehicle units, but between different groupings of axles.

A "many to many" relationship exists between the RUC and DKW systems, i.e. several different RUC classes are sometimes described by more than one DKW class. Associations between DKW, RUC and PAT classifications are presented in Table 7.2.

Table 7.1 (p. 26) Explanation of terms

Definitions:

Groups:	number of axle groups
Axles:	number of axles on the vehicle
sp1:	distance between first and second axles of the vehicle
sp2:	distance between second and third axles of the vehicle

Notes:

No. of Axles: Maximum spacing 10.0 m; axle spacing < 0.5 m ignored.

Vehicle Length (m):

Vehicle lengths are indicative only, being the standard lengths used for the dual loop telemetry classification sites. The law permits trucks to 11 m, articulators to 17 m, and tractor/trailers to 20 m. However loops measure vehicle length to only ± 10%.

Axle Groups:

To simplify presentation, it is assumed that "spread" tri-axles (spacing between axles up to 2.5 m) now seldom occur. Some trailers have 3 widespread axles and thus have 3 axle groups.

Short: A few light vehicles towing trailers will not be coded in this case.

Towing: e.g. jeep < 2.1 m or double-cab utility > 3.2 m towing.

Artics: 5 axle articulated truck and 5 axle truck + trailer are the same class as they have similar weights and EDA, and occur at 'low' frequency.

6 axle artic is a separate class as it is the primary WIM calibration vehicle and most common vehicle type.

7 axle B train is a separate class as it may be used as a WIM calibration vehicle.

8 axle B train is a separate class as it may be used as a WIM calibration vehicle, and has comparatively low EDA.

Table 7.1 Vehicle type classification according to the DKW system.

Level 1	Level 2		Level 3	Class	Other Critical Parameters
Type Vehicle Length	**No. of Axles**	**Axle Groups**	**Vehicle Type Description**		
Short	**LIGHT VEHICLES**				
< 5.5 m	2	1 or 2	Short vehicle	1	sp1 ≤ 3.2 m
Medium	3 4	3 3	Short vehicle towing Short vehicle towing	2	2.1 ≤sp1≤ 3.2; 2.1 ≤sp2≤ 5.9 2.1 ≤sp1≤ 3.2; 2.1 ≤sp2≤ 5.9
5.5 - 11m	2	2	Light truck	3	3.2 < sp1 < 4.1
	HEAVY VEHICLES				
(coaches	2	2	2 axle truck/bus	4	sp1 ≥ 4.1 m
> 13 m)	3	2 2	3 axle truck 3 axle coach	5	
	4,5	2	4 (5) axle truck	6	
Long	3	3	3 axle artic truck + light trailer	7	sp1 > 3.2 or sp2 > 5.9
11 - 17m	4	3 3 4	4 axle artic truck + light trailer truck + heavy trailer	8	sp1 >3.2 or sp2 <2.1 or >5.9 sp1 > 3.2
	5	3 ≥3	5 axle artic truck + trailer	9	
	6 7	3 3	6 axle artic 7 axle transporter	10	
V Long	6	4 or 5	truck + trailer	11	
17 - 35m	7	4	B train	12	2.1 ≤ sp1 < 4.4
	7,8	4 or 5	truck + trailer	13	sp1 < 2.1 or sp1 ≥ 4.4
	7,8 7,8 9-11	5 6 ≥4	A train A train transporter	14	2.1 ≤ sp1 < 4.4
	8	4	B train	15	2.1 ≤ sp1 < 4.4

Table 7.2 Relationship between DKW, RUC, and PAT Vehicle Classifications.

DKW	RUC Class	Vehicle Description, Axle Configuration	PAT
3	2	o-o (w/b 3.2-4.1)	20
4	2	o--o (w/b > 4.1)	21
4	2	o--o (bus,coach)	22
5	6	oo--o	31
5	6	o--oo (bus,coach)	32
5	5	oo--o	34
6	14	oo--oo	45
6	14	o--ooo	46
6	19	oo--ooo	58
7	2,24	o-o--o (Artic)	30
8	2,30	o--o-o--o (T&T	40
8	2,29	o-o--oo	41
8	6,24	o-oo--o	42
9	2,24,30	o-o--o-o--o	50
9	2,37	o--o-o--oo	51
9	6,30	o--oo-o--o	52
9	2,37	o--o-oo--o (T&T)	521
9	6,29	o-oo--oo	53
9	5,30	oo--o-o--o	54
9	5,29	oo-o--oo	55
9	2,33	o-o--ooo	57
10	6,33	o-oo--ooo (Artic)	69
10	14,33	oo-oo--ooo (Artic)	791
11	2,24,37	o-o--o-o--oo	61
11	2,29,30	o-o--oo-o--o	62
11	6,24,30	o-oo--o-o--o	621
11	6,37	o--oo--o-o-o (T&T)	622

Table 7.2 continued:

DKW	RUC Class	Vehicle Description, Axle Configuration	PAT
11	6,37	o--oo-o--oo (T&T)	63
11	2,43	o--o-oo--oo (T&T)	631
11	6,37	o--oo-oo-o (T&T)	632
11	5,37	oo--o-o--oo (T&T)	65
11	14,30	oo--oo-o--o (T&T)	66
11	14,30	o--ooo-o--o (T&T)	67
12	6,29,29	o-oo--oo--oo (B-train)	751
13	6,43	o--oo-oo--oo (T&T)	752
13	5,29,30	oo-o--oo-o--o (A&T)	76
13	14,37	oo--oo-o--oo (T&T)	77
13	14,37	oo--oo-oo--o (T&T)	771
13	14,24,30	oo-oo--o-o--o (A&T)	772
13	19,24	oo-ooo-o--o (T&T)	773
13	14,37	o--ooo-o--oo (T&T)	78
13	14,43	oo-oo-o--ooo (T&T)	871
13	19,37	oo-ooo-o--oo (T&T)	873
13	14,43	oo--oo-oo--oo (T&T)	891
14	2,29,37	o-o--oo-o--oo (A&T)	73
14	6,24,37	o-oo--o-o--oo (A&T)	731
14	6,29,30	o-oo--oo-o--o (A&T)	74
14	6,29,37	o-oo--oo-o--oo (A&T)	85
14	2,33,37	o-o--ooo-o--oo (A&T)	88
14	6,33,30	o-oo--ooo-o--o (A&T)	89
15	6,33,29	o-oo--ooo--oo (B-train)	851
		oo-o--o	44
		o-oo--ooo-o (A&T)	781
		o-ooo-oo--oo (T&T)	852

7.2 Road Use Category

Road use categories are defined in Table 7.3, and have been derived from a separate Transit New Zealand Research Project PR3-0025 (in prep.). The distribution of vehicle classes differs between the nine road use categories.

Table 7.3 Definition of road use categories.

Road Use Category		Comment
1a	Urban Arterial a	Urban road characterised by 7-8 am and 5-6 pm peak traffic flow of about twice the interpeak low flow
1b	Urban Arterial b	Urban road characterised by 8-9 am and 4-5 pm peak traffic flow of about 1.5 times the interpeak low flow
2	Urban Commercial	Urban road primarily in CBD
3	Urban Industrial	Urban road that carries local industrial traffic
4	Urban Other	Urban roads not otherwise described
5	Rural Urban Fringe	Road that is either rural or urban and has a high Sunday usage and 7-8 am and 5-6 pm weekday peaks of about 1.5 times the interpeak flow
6	Rural Strategic	Rural roads not otherwise described
7a	Rural Summer Recreational	Rural road characterised by high traffic volumes - e.g. beach in summer
7b	Rural Winter Recreational	Rural road characterised by high traffic volumes - e.g. skifield in winter
8	Rural Feeder	Rural road characterised by low traffic flows
9	Urban Residential	Road within a residential area in a city / town

8. HEAVY VEHICLE WEIGHT DISTRIBUTION

Two sources of data were used to construct statistical distributions of weight for each of the heavy vehicle classes. In the first place, the WIM data from TNZ stations at Drury (Auckland), Pukerua Bay (Wellington), and Waipara (Canterbury) were interrogated. This information was supplemented for remaining road use categories by a specially commissioned series of weight measurements carried out by the CVIU.

The WIM equipment logs vehicle data in terms of its PAT system of vehicle classes. A relationship between these and the DKW classification has been established for this study, although there is often more than one possibility for relating a particular PAT vehicle class to a DKW class.

Because CVIUs travel all road use categories, and the officers of the CVIUs are skilled at estimating the weight of a vehicle, the CVIU operation provided the reliable means needed to obtain weight information from road categories not covered by WIM equipment.

Following discussions with the Commanding Officer of the CVIU, WCSL prepared a brief requesting a sample of 8,000 vehicles in nominated regions and road use categories. At least 5% of these were to be weighed after the weight had been estimated. These pairs of data were used to adjust individual officers' estimates to reflect the actual weight. A total of 6,488 vehicle weight estimates were achieved from units operating in Auckland, Taranaki, Hawke's Bay, Wellington, Christchurch and Dunedin.

To obtain a large pool of similar data, possible combinations of results were examined. In the first instance, tests were carried out to see if the difference for a particular road use category between police districts was significant. The next step was to see if the difference between road use categories was significant. The previously pooled data were further aggregated where differences were shown to be not significant. Testing for aggregation of road use categories was carried out in two stages, first with rural and urban use categories being kept separate, and then with the resulting rural sets tested against urban sets.

Finally, the WIM data (summarised as means, standard deviations and counts) were tested against the pooled CVIU data to see if CVIU data could be ascribed to additional road use categories. Where the difference between the CVIU data and the WIM data was insignificant, then the CVIU data were discarded because the WIM information gave about 100 times as much information.

The final product was a set of distributions of vehicle weight for the 12 DKW heavy vehicle classes, and in many cases the distribution depended on the road use category as well as the geographic locality. A total of 33 distributions resulted for the 12 classes[6].

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[6] Six distributions resulted for DKW 1, four for DKW 9, five for DKW 10, and two for the remainder with the exception of DKW 4 and DKW 14 where the WIM distribution alone was used.

9. OPERATION OF THE NATIONAL TRAFFIC DATABASE

9.1 Main Database

The main Database is an assembly of RAMM road section data in file NTDB. DBF. This Database is useful as a stand-alone database, and will handle all enquiries except those relating to vehicle classes and weights. The two diskettes containing the Database files are inlcuded with this report.

Territorial authority number (Appendix 2) and region number (Appendix 3) have been separately identified. This separation enables several possibilities in selecting information. For example, all roads (state highway and local roads) in a TL district can be selected to compare the vehicle-kilometres on the state highway in that district with those on the local roads. The same information can be obtained using, instead, the region as the traffic catchment.

9.2 Vehicle Classification Tables

The classification data is in the file VEHPROP. DBF. The vehicle classification distributions depend on the particular vehicle class, as well as on the road use category. This split results from analysing for differences between sets of data collected from around the country. As with the weight distribution, it is more efficient to avoid manifold repetition of the values.

Both classification and weight files are presented in a manner suitable for a relational database join, or for use as a lookup table in packages that do not support the "join" procedure. The data is in DBase format.

The inter-relationship of weight distribution data to road section data is discussed in Section 9.6 of this report.

9.3 Weight Distribution Tables

The weight distribution table data depend on road use category and RCA area, as well as on the particular vehicle class. It would be superfluous and inefficient in space and processing overheads to store the actual distributions in every road section record.

The weight distribution table data are in the file WGTDIST. DBF.

9.4 Installing the Database

Instructions for installing the Database are given in Appendix 1 of this report.

9.5 Database Files

The Database files that are installed following the instructions in Appendix 1 are:

NTDB. DBF The road section data file.
This is the main data file on which all enquiries will be based. It is in DBase format. Data fields are those defined in Section 6.2 of this report.

VEHPROP. DBF The vehicle class distribution file.
This file is used to generate synthetic vehicle class data. It is in DBase format. The data fields are those defined in Section 6.3 of this report.

WGTDIST. DBF The vehicle weight distribution file.
This file is used to generate synthetic vehicle weight data. It is in DBase format. The data fields are those defined in Section 6.4 of this report.

Note that the files can be imported into other database systems. However, the road section file is too large for spreadsheets.

9.6 Relationship between Files

Table 9.1 shows the relationship between the road section data, the vehicle class data, and the vehicle weight distribution data. For traffic volume analysis that does not require detail on vehicle class, the VEHPROP data are not required and, if vehicle weights are not needed, the WGTDIST data are not required. If either of these two files of data are required to be associated with the road section data, then inclusion is achieved either by forming a lookup table, or by formally linking common fields with identical values.

Table 9.1 Relationships between operations and files needed for traffic volume analysis.

Operation		Files Needed		
		NTDB.DBF	VEHPROP.DBF	WGTDIST.DBF
AADT	Average by RCA	Yes	No	No
	Average by Region	Yes	No	No
	Average by road use category	Yes	No	No
	Average by vehicle class	Yes	Yes	No
Vehicle-kilometres	Average by RCA	Yes	No	No
	Average by Region	Yes	No	No
	Average by road use category	Yes	No	No
	Average by vehicle class	Yes	Yes	No
Tonne-kilometres	Average by RCA	Yes	Yes	Yes
	Average by Region	Yes	Yes	Yes
	Average by road use category	Yes	Yes	Yes
	Average by vehicle class	Yes	Yes	Yes

9.7 Limits on Possible Operations

9.7.1 Use of Vehicle Class Distribution Table

The vehicle class distribution table will have optimum precision when applied to the sum of every road section in New Zealand. Lesser subsets of section data will yield results with errors of varying amounts depending on the (generally unknown) relationship of the subset to the whole. Technical staff should ensure that results have qualifying comments to warn readers of a significant level of imprecision.

9.7.2 Use of Vehicle Weight Distribution Table

Summing of vehicle weight data across DKW classifications is possible in a simple manner only, using a common characteristic such as a selected percentage of vehicles in any class with weight exceeding the measured value. Even this summarisation will require approximation.

Categorisation into weight categories and similar summaries is possible with some complexity of programming, but only by approximation. Programmers should be aware that these approximations are additional to the synthetic nationwide nature of the class and weight distribution tables. The difficulties are intrinsic in the data, and cannot be overcome by database manipulation or programming.

9.8 Dependence of Operating Systems

The data files as imported from other databases are dependent on DOS programs to copy the data off disk and to expand it.

Once the data are loaded onto a PC, there is no obstacle to their use under UNIX, VMS or any other operating system. Translating the record delimiter, end of file marker, etc., to a different operating system will require the use of standard utilities, e.g. the DOS2UNIX utility to convert files to UNIX conventions.

9.9 Technical and Performance Issues

9.9.1 Time Required for Operations

Appropriate hardware should be used. A PC with a 486-DX66MHz processor, 8Mb memory and a 200Mb disk is the standard configuration for running modern PC packages on any significantly sized data collection, such as this Database. Timings range widely depending on package, hardware, operating system and programming technique. Expected times for some representative reports are:

- Loading the entire Database, both files - 8 minutes
- Summing volume parameters across every road section in New Zealand - 45 seconds

9.9.2 Convenience and Efficiency

If the intention is to work only on the road sections within a geographic area, pruning the Database before loading will reduce disk space requirements and processing times. The reduction will be slightly less than proportional, but a TA may need only about one eightieth of the data. The time required for queries will reduce as well, depending on the indexing method of the particular package and how it was being used.

10. VERIFICATION OF THE NATIONAL TRAFFIC DATABASE

To verify the overall accuracy and completeness of the Database, a number of independent checks were made between totals that were derived from the Database on a national basis, and other separately published information. Given the uncertainty of some of the information contained in the Database (e.g. many AADT values were estimated, the vehicle classification was based on limited surveys) and the vagaries of some of the published data (e.g. the proportion of New Zealand's diesel fuel used by road transport is not well quantified), the agreement from most checks was considered acceptable. A summary to show the agreement is presented in Table 10.1.

Table 10.1 Comparison of predictions obtained from Database and from independent data.

Item compared	Precision of prediction calculated from Database compared with independent data
Petrol consumption	91% of statistics for domestic transport and resellers
Diesel consumption	59% to 102% of statistics depending on proportions sold to public transport by domestic transport and resellers
Heavy vehicle kilometres travelled	60% of distance of RUC licences purchased
Heavy vehicle tonne-kilometres	79% of result recorded in independent database
Road User Charges	57% of annual national revenue

10.1 Petrol Consumption

A correlation of 91% with independent data is considered a satisfactory outcome. The following considerations should be borne in mind:

- Many of the ADT values in the Database are estimates.
- The distribution of vehicle classes is based on a very limited number of samples.

10.2 Diesel Consumption

The correlation in this case is much less satisfactory, with the wide range of 59% to 102%. The NZ Road Transport Association advises that to quantify end point outlets for diesel sales is very difficult, and Statistics New Zealand confirms that it is difficult to further break down the information. Therefore, the main reason for the relatively poor correlation appears to lie in the quality of external data when used for this purpose, rather than with the Database. (Unlike petrol consumption, a more significant proportion of diesel is used for purposes other than road transport, e.g. agricultural uses, rail transport, shipping.)

10.3 Heavy Vehicle Kilometres

The correlation of 60% is disappointing. To improve this correlation a large quantity of classification sampling is required.

10.4 Heavy Vehicle Tonne-kilometres

The result of 79% correlation with the independent data is considered reasonably satisfactory.

10.5 Road User Charge Revenue

The independent data for both tonne-kilometres and for RUC revenue comes from the same source (the RUC database), and yet there is a large discrepancy between the tonne-kilometre comparison and the revenue comparison. The difference is probably because RUC revenue rises very rapidly even with slight increases in vehicle weight (approximately by the fourth power). Thus if the average distribution of weight is slightly in error, then the error in the RUC revenue will be grossly magnified, but magnification will not be great in the case of tonnes.

It appears that there is a lack of data for the "heavy" end of the heavy vehicle weight distribution. The discrepancy between the Database calculation and independent data may also be contributed to the lack of vehicle classification survey data.

The order of accuracy of the first four indicators in Table 10.1 suggests that the Database has an overall integrity. The large discrepancy in the calculated RUC revenue cannot be readily explained (the discrepancy should be similar to that for the heavy vehicle tonne-km), and suggests a possible error in reporting. This matter needs to be investigated further.

11. STATISTICAL CONFIDENCE IN NATIONAL TRAFFIC DATABASE DATA

11.1 Estimate of Annual Average Daily Traffic

The roads in each RCA were divided into five strata of AADT, obtained from the RAMM database. The values of AADT encompassed in each stratum vary between RCAs, and depend on the frequency distribution of AADT between RAMM road sections. Sites were selected randomly within each stratum in order to provide coverage of the spectrum of road usage within the RCA. A 24-hour continuous survey was obtained for five of approximately 40 sites for each RCA. (The exact number of sites needed depends on the overall distribution of AADT for an RCA.)

On the basis of the vehicle flow data from the five surveyed sites, the precision of the estimate of the average AADT for each RCA is approximately ±28%. If all AADT values are used, not just those from the five *VDAS* sites, then the precision will be much better but it cannot be quantified. The concept of an "average AADT" for each RCA is useful for statistical comparison: the objective of the site selection scheme is to estimate the average AADT for an RCA to a precision of ±10%.

The information can also be associated with the total length of road (km) within the RCA to give an estimate of total vehicle-kilometres.

11.2 Estimate of Distribution of Heavy Vehicle Classes at a Site

The random sampling of sites led also to an estimate of the distribution of heavy vehicle classes at each site. Road use category was not considered in the random selection of sites. As a result, the precision of the estimate of the average heavy vehicle AADT for the RCA will be slightly worse than the precision of estimate of average AADT. On a national basis it has been possible, from the surveyed sites, to identify differences in heavy vehicle distributions for different road use categories. Estimates of the proportions of vehicle classes for the different road categories have been produced for the Database. As further sites are surveyed and more information becomes available, differences which occur on a regional basis may be able to be identified.

11.3 Estimate of Distribution of Vehicle Weights at a Site

The population of CVIU information is of the order of 100 times less than the WIM information. However, the information has the potential of giving a reliable estimate of distributions of heavy vehicle weight for road use categories that are not represented in the WIM database.

In order to increase the pool of CVIU data, individual sets were combined for a particular vehicle class whenever their mean values did not differ significantly. A 5% level of significance was used in the statistical test for significant difference of means.

Where significance between CVIU pooled data and the WIM data was not significant, then the CVIU data were discarded in favour of the larger pool of WIM information for the particular vehicle class.

As a result of pooling following confirmation of statistical similarity of sets of data for a particular vehicle class, a minimum population of 64 samples resulted within the 25 sets of pooled CVIU data. Of these data, 20 sets numbered 100 or more in their populations.

Further comment about the reliability of the CVIU data results from considering the following attributes of the summary information:

- With the exception of sets 6a3, and 12br which have abnormally low values of standard deviation, the remaining sets of standard deviation within each DKW class are relatively consistent. While these low values might genuinely be reflecting the narrowness of distribution of weight, this assumption is doubtful in the case of the 12br set which has a relatively low population of 64.

- The correction of CVIU data to account for police officer error is quite small, with factors generally near 1.00 and ranging between 0.82 and 1.05.

- The form of cumulative distribution of weight is similar within each set, for cases where several sets of CVIU data can be compared with WIM data.

12. USES OF THE NATIONAL TRAFFIC DATABASE

The Database is of significant use in assessing relative demand by traffic on road sections of the New Zealand public road network. The results can be interpreted with more confidence when they are grouped, e.g. average of a parameter from the following road section, for a road use category at either national level or at the RCA network level.

12.1 Uses at National Level

12.1.1 State Highway versus Local Road

The Database can be used to sum vehicle kilometres or heavy vehicle kilometres on state highways and on local roads, to compare their utilisation.

Both these sums can be compared with corresponding values obtained for the complete network of public roads.

12.1.2 Sealed versus Unsealed Roads

The Database can be used to report vehicle kilometres, or heavy vehicle kilometres, on all sealed roads (whether state highway or local road), and compare those travelled on unsealed roads.

Both these quantities can be compared with the values obtained for the complete network of public roads.

12.2 Uses Between RCAs

12.2.1 AADT

The Database can be used to generate the average AADT of the network from the survey information. This information offers a single measure by which the road data from the RCAs may be compared.

12.2.2 Vehicle-kilometres

The total vehicle-kilometres travelled per day (or per year) can be estimated from the Database. If only data from the randomly selected classification survey sites are used, then the precision associated with this estimation can be calculated. However, it is more likely that all historical information would be used, whether estimate or actual count. When such information is used the answer is intuitively more accurate but the precision cannot be quantified. (The data are a mixture of types, and there is no statistical basis for the quantification.) Calculation of total vehicle-kilometres travelled involves multiplying each road section length by AADT and summing the product.

12.2.3 Tonne-kilometres

By including the vehicle weight information in the Database, tonne-kilometres can also be estimated for the roads in the RCAs.

12.3 Uses Within RCAs

12.3.1 Aggregation by Groups of Road Sections

Using the Database to aggregate information by road use category within a particular RCA road network may be of interest, and results should be relatively stable and directly comparable between RCAs. However, the accuracy of results cannot be calculated. Where a large number of road sections are involved in calculating a particular quantity, then the result should be reasonably stable. Hence, calculation of proportion of total RCA road length with AADT between nominated bounds is meaningful, providing that many sections are involved in each calculation (more than about 10).

12.3.2 Calculation on a "Per Road Section" Basis

The Database should not be used for road section by road section comparison of any information other than AADT. This is because the precision of estimate at road section level is relatively poor.

13. IMPROVEMENTS AND MAINTENANCE OF THE NATIONAL TRAFFIC DATABASE

13.1 Immediate Needs

13.1.1 Classification Sampling

Further sampling using *VDAS* counts has to be done if the Database is to achieve the targetted precision of 10% for the average AADT in each RCA. The randomly selected sites are identified in the Quality Plan.

13.1.2 Vehicle Weight Sampling

A plan for sampling by the CVIU is required, with operations determined on a random (non-biased) basis, to enable estimates of precision of vehicle weights to be calculated from the Database. Regional differences and differences between road use categories will also be tested for.

13.2 Longer Term Sampling

Road use patterns are changing quite rapidly in New Zealand. The growth of the demand from forestry is often mentioned as an example. As a more general example, annual heavy vehicle use for heavy trucks in excess of 20 tonnes has increased by 44% between 1987 and 1993 (BCHF 1994).

As a result, an ongoing sampling programme needs to be developed in order to keep track of the apparently rapid change in demand. These changes are likely to be much more pronounced in some RCA areas than others. Updates of vehicle volume, distribution of vehicle class and weight distributions are needed.

13.3 Annual Sampling Plan

13.3.1 Vehicle Classification Surveys

These vehicle classification surveys should be carried out on a regular basis, and should be considered in favour of the more traditional axle counts. As well as updating information at previously measured sites, additional sites should be selected on a random basis in order to improve the coverage of the network.

13.3.2 Vehicle Weight Surveys

Development of vehicle weight surveys will rely on two factors:

1. The ability of the CVIU to provide a service. This service is governed by financial and operational constraints. The CVIU information gathered to date is less than 1% of the quantity obtained from WIM stations, and needs to be boosted in order to improve data quantity.

The CVIU data will provide coverage of a range of road use categories and will enable differences in weight distribution for each vehicle class to be determined.

2. Commissioning of further WIM sites. These sites are ideally spread between different road use categories. A key issue is the question of ownership of both the instruments and the data, and co-ordination of the operation.

14. SUMMARY

The National Traffic Database is able to provide estimates of basic traffic information, including total volume, vehicle class and weight data, for the network of public roads in New Zealand, both state highways and local roads.

The methodology which has been developed and applied has produced a Database that includes for each RAMM road section:

- The best available estimate of AADT,
- Categorisation of each road section by use,
- A distribution of heavy vehicle classes (by DKW system) as a proportion of AADT for each road use category,
- Distribution of heavy vehicle gross weight by road use category and by geographic locality.

Arising from this methodology is the basis for systematic upgrade of the Database, including:

- A pre-defined sampling plan (by RCA),
- Estimates of reliability of the data.

From the Database, estimates can be made for daily, yearly totals and average values for

- Total and heavy vehicle volumes,
- Total and heavy vehicle kilometres,
- Tonne-kilometres,
- ESAL-kilometres,
- RUC revenue,

at a national and regional level. Further subdivision of some of these outputs is possible at an RCA level, as well as by vehicle class and road use category.

The Database has internal consistency of measurements on a nationwide basis for traffic volumes. A prepared programme of vehicle classification surveys needs to be completed to improve the precision of the estimate of distribution of heavy vehicles. Regular updating of the Database is also required to ensure that it reflects changes in road networks, and changes in the nature of traffic, such as in vehicle classes, weights, and travelled road sections.

15. REFERENCES

Beca Carter Hollings and Ferner (BCHF). 1994. *Changing energy efficiency of petroleum products in the transport sector.* Energy Efficiency and Conservation Authority. May 1994.

Transit New Zealand. 1994. *A guide on estimating AADT and traffic growth, and a traffic count monitoring programme basis. Traffic count guideline.* Transit New Zealand, Wellington.

Transit New Zealand (in prep.) Traffic stream data. Transit New Zealand Research Project PR3-0025.

APPENDICES

APPENDIX 1. INSTALLING THE NATIONAL TRAFFIC DATABASE

The Database is on two diskettes included with this report, inside the back cover. The diskettes contain the data in three compressed files: Diskette 1 contains files DB.E01 and TRAFCOPY.EXE, and Diskette 2 contains DB.E02. Before the data can be used, these files must be expanded onto the hard disk of a PC.

A1.1 Loading the Data on PC

Steps 1 to 3 explain to a competent PC user how to load the data onto a PC.

Step 1: Check that the PC has enough space on the hard disk

The data will occupy 20.1Mb, and during the loading process a further 2.2Mb of disk space is required to work with. Therefore, check that at least 23.0Mb of disk space is available.

The DOS command **DIR C:** is the normal way to find out how much disc space is available. The list should show more than 23,000,000 bytes free at the end. Do not proceed until this amount of free space is available.

Step 2: Copy the data from the two diskettes

The TRAFCOPY.EXE program on Diskette 1 will copy the data from the diskette to your hard drive. Create a separate directory on your hard drive, e.g. type in

MKDIR C:\TRAFDATA

and press Enter.

Insert Diskette 1 in the PC diskette drive. Make this drive current by typing in

A:

and press Enter.

Start the copy program by typing the command and the full path name of the directory in which the data is to go, e.g. type in

TRAFCOPY A: C:\TRAFDATA

and press Enter.

Messages will appear on the screen about the SPLICE program, and that DB.EXE is being restored.

When requested to insert Diskette 2, remove Diskette 1, insert Diskette 2, and press any key. Be sure to remove Diskette 2 from the PC when the data have all been copied.

Step 3: Expand the compressed data

Change the working drive to your hard disk, and change directory so your data are in the current directory, e.g. type in

C:CD\TRAFDATA

The copy process has left one file in this directory, called DB.EXE. Check that this file is there, e.g. by typing in **DIR**. This is a self-expanding file, and it is expanded by typing in

DB

A set of messages indicates the progress of the expansion.

On completion of the expansion, check that all the files are now in place. Type in

DIR

and check that files:

DB.EXE - the compressed file
NTDB.DBF - the section data file
VEHPROP.DBF - the vehicle class distribution table
WGTDIST.DBF - the vehicle weight distribution file

are all present.

Clean up by deleting the compressed file, which is no longer required, e.g. by typing in

DEL DB.EXE

Type in

EXIT

to return to the computer menu.

Then open the DBase program and load the three remaining files to use the data.

A1.2 Technical Notes

The distributed data are in a self-expanding ZIP file, split between the two diskettes.

The following number of records should be in the files:

NTDB.DBF - 122,650 records, size 19,869,878 bytes, no header
VEHPROP.DBF - 11 records, size 1,569 bytes, no header
WGTDIST.DBF - 33 records including header, size 3,747 bytes

APPENDIX 2. LIST OF TERRITORIAL AUTHORITIES

1 FAR NORTH	26 WHAKATANE	51 MARLBOROUGH
2 KAIPARA	27 GISBORNE	52 NELSON CITY
3 WHANGAREI	28 CENTRAL HAWKE'S BAY	53 TASMAN
4 AUCKLAND	29 HASTINGS	54 ASHBURTON
5 FRANKLIN	30 NAPIER	55 BANKS PENINSULA
6 MANUKAU	31 WAIROA	56 CHRISTCHURCH
7 NORTH SHORE	32 NEW PLYMOUTH	57 HURUNUI
8 PAPAKURA	33 SOUTH TARANAKI	58 MACKENZIE
9 RODNEY	34 STRATFORD	59 SELWYN
10 WAITAKERE	35 HOROWHENUA	60 TIMARU
11 HAMILTON	36 MANAWATU	61 WAIMAKARIRI
12 HAURAKI	37 PALMERSTON NORTH	62 WAIMATE
13 MATAMATA-PIAKO	38 RANGITIKEI	63 BULLER
14 OTOROHANGA	39 RUAPEHU	64 GREY
15 SOUTH WAIKATO	40 TARARUA	65 WESTLAND
16 TAUPO	41 WANGANUI	66 CENTRAL OTAGO
17 THAMES-COROMANDEL	42 CARTERTON	67 CLUTHA
18 WAIKATO	43 KAPITI COAST	68 DUNEDIN
19 WAIPA	44 LOWER HUTT	69 QUEENSTOWN LAKES
20 WAITOMO	45 MASTERTON	70 WAITAKI
21 KAWERAU	46 PORIRUA	71 GORE
22 OPOTIKI	47 SOUTH WAIRARAPA	72 INVERCARGILL
23 ROTORUA	48 UPPER HUTT	73 SOUTHLAND
24 TAURANGA	49 WELLINGTON	
25 WESTERN BAY OF PLENTY	50 KAIKOURA	

APPENDIX 3. LIST OF REGIONS

1 FAR NORTH
2 AUCKLAND
3 HAMILTON
4 ROTORUA
5 GISBORNE
6 HAWKE'S BAY
7 NEW PLYMOUTH
8 WANGANUI-MANAWATU
9 WELLINGTON
10 NELSON-MARLBOROUGH*
11 CHRISTCHURCH
12 WEST COAST
13 OTAGO
14 SOUTHLAND

* Unitary authorities that have been grouped for the purpose of compiling the Database