An Integrated Traffic Model for Auckland Cities, New Zealand

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- RoadNet, Bovis Management Consultants and Transit New Zealand provided various sets of traffic counts, including link counts, SCATS counts at intersections, motorway ramp counts, and ATMS counts on the motorway carriageways.
- Jim Cater and John Peppiatt of Information Systems of Manukau Institute of Technology (MIT), who were keen to involve their students in a challenging task of developing such an interface.

Australian organisations involved with discussions concerning SCATS, among others, and specific staff members were:

- David Stewart of Queensland Department of Main Roads,
- Dennis Campbell and Jim Griffin of Roads & Traffic Authority (RTA) of New South Wales, and
- Paul Ormonde-James and Peter Jacka of Plessey.

Traffic Design Group, Auckland, was also consulted.

Barry Coghlan, of Coghlan Traffic Consultants, reviewed the study reports we produced in February 2001 and in June 2002.

Preface

The work described in this Transfund New Zealand Research Report No. 243 completes the Transfund New Zealand Research Project No. PR3-0426 *An Integrated Traffic Model for Auckland Cities*.

In February 2001, *Progress Report at Milestone 1* was presented. This report was peer-reviewed by Barry Coghlan of Coghlan Traffic Consultants, and his comments were presented in a report dated March 2001. Following a spell of discussions between the peer reviewer and the consultants, the reviewer produced closing remarks in May 2001. The Draft Final Report (produced in June 2002) was reviewed by Coghlan Traffic Consultants, who presented a response in November 2002.

The current 2003 report completes the original project and responds to unresolved issues raised by the earlier work. The many issues that were raised ranged from obtaining and financing the software; changes made to the study network for improving traffic flow; changes in personnel; tapping the expertise having first-hand knowledge of applying the models, to name a few.

The consultants involved in the project (and listed in the Acknowledgments) who have used the simulation models (which are the focus of this project), are as follows:

- GHD Limited (previously Manukau Consultants) who had extensive, up-to-date experience in the use of the TRANSYT model;
- Meritec Consultants (previously Worley Consultants) who have had some experience in TRANSYT analysis, and were gaining experience in the use of the AIMSUN2 model. They were also conducting an AIMSUN2 study of the Tristram Avenue Interchange for Transit New Zealand in North Shore City.
- In addition, other Meritec staff had been using AIMSUN2 for two years on the vehicle emission project for the NZ Ministry of Transport.

At the inception of the work, the project team held discussions with Jim Cater and John Peppiatt of Information Systems of Manukau Institute of Technology (MIT), as they were keen to involve their students in the challenging task of developing such an interface.

The next step was to develop the interfaces between AIMSUN2 and TRANSYT11, or between AIMSUN2 and SCATS, for which an additional AIMSUN2 software kit had to be purchased from TSS (Transport Simulation Systems, the AIMSUN2 development company in Barcelona). However, this would have cost approximately $US10,000, and unfortunately neither MIT nor our project team had the financial resources for this expenditure.

Subsequent talks between MIT and Auckland University who, as academic users of AIMSUN2, might have had the necessary software, and between Meritec and various Australian organisations involved with SCATS (e.g. Queensland Department of Main Roads, Roads & Traffic Authority of New South Wales, and Plessey among others), did not reveal the existence of satisfactory solutions.

The only realistic option therefore was to interface the models manually. This required the coding of traffic signal settings developed by TRANSYT11 optimisation process output into an AIMSUN2 input format. It was in addition to the unavoidable AIMSUN2 input of all other network and traffic data.

In the meantime TSS had developed an interface between AIMSUN2 and TRANSYT10, which could be purchased for approximately $US3,000. However, the project budget did not allow us to purchase the package either. Moreover the project team had reservations about using the new product, which had not been debugged or refined at that stage (2000).

Traffic Design Group, Auckland, has recently used AIMSUN2 for a number of small projects (e.g. for the Cameron Road Traffic Impact Study, Tauranga). Some of the projects required interfacing TRANSYT11 and AIMSUN2. Their preferred interfacing method was however manual because of the issues noted above and because the commercially available interface is based on TRANSYT10, not on the TRANSYT11 version used in New Zealand.

Because of these setbacks and changes in approach, as well as the improvements made to the road network in East Tamaki where the study was located, the project was not completed until 2002. This Transfund New Zealand Research Report records the end-results of the modified project.

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Executive Summary

Introduction

The objective of this research, carried out in 1999-2002, was to demonstrate and quantify benefits of an integrated approach to traffic signalisation and management of urban street networks that straddle boundaries of Transit New Zealand and Local Authority jurisdictions.

The project tested a methodology based on an integrated use of two computer traffic simulation models, TRANSYT11 and AIMSUN2. The applied methodology showed quantified benefits resulting from the application of various measures of improving the efficiency of an urban network. However various deficiencies of the tested methodology as well as significant discrepancies were noted.

These measures ranged from minor upgrading of road marking, through traffic signal management to substantial intersection upgrading or new links in the network. The selected tool of network upgrading used in this case study was traffic signalisation, which was tested during one period of the day – the morning peak. The aim of the research project was to assess an integrated approach, rather than to make an economic evaluation of a specific project.

The underlying assumption was that even this somewhat narrow scope of testing would be sufficient to make a critical appraisal of the essential elements of the methodology. The methodology included technical difficulties of working with the selected computer models, the complexity of interfacing between the models, and the significance of prevailing project development issues.

Applied Methodology

The study tested whether the methodology, based on the use of two interfaced computer simulation models, would be suitable as a predictive tool for assessing the effects of the application of various measures to the network efficiency improvement.

The selected models were TRANSYT11 and AIMSUN2. TRANSYT11 is a macroscopic[1] model, which simulates and optimises the performance of traffic signal networks. AIMSUN2 is a microscopic[1] model, which simulates the performance of traffic in the networks but does not have optimisation algorithms.

The process adopted was to simulate the performance of the study network by optimising signal settings using the TRANSYT11 model in parts of the network, and inputting the resulting settings into the AIMSUN2 model, which then produced the assessment of the overall study network.

The specific AIMSUN2 capabilities required for this project included motorway links, priority controlled intersections and roundabouts, which TRANSYT11 either does not simulate or simulates with a lower degree of accuracy.

Study Network

The network selected for the study was located in the Auckland region (Manukau City), New Zealand. It consisted of four south–north routes (called Subnetworks B C E F) and two east–west routes (Subnetworks A D).

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1 See Glossary, pp. 49-50, for definitions of terms and abbreviations.

This network offered a well-developed system of alternative routes in both east–west and south–north directions, and two motorway interchanges. The intersections straddle the boundary between Manukau City Council and Transit New Zealand jurisdictions.

TRANSYT11 Analysis

Four out of the six Subnetworks (A, B, C and D) of the network contained signalised intersections. The performance of these Subnetworks was simulated using the calibrated TRANSYT11 model. The simulation produced sets of link and network-wide performance indicators quantifying the efficiency of the studied network.

Traffic signal settings were optimised in order to improve the network performance. TRANSYT11 achieves optimisation by manipulating the length of the cycle time, splits and offsets. The performance of the optimised Subnetworks showed an approximate improvement of 60 pcu-h/h[1] saved in the total time spent by all vehicles in the optimised Subnetworks A, B, C and D. This was concluded by modelling the existing and optimised layouts. TRANSYT11 was not used to optimise Subnetworks E and F as they consist of priority controlled junctions and a motorway section.

AIMSUN2 Analysis

The performance of the whole study network was simulated using AIMSUN2. The same set of inputs was used as for TRANSYT11 for Subnetworks A, B, C and D. The AIMSUN2 model contained two additional Subnetworks: E consisting of roundabouts and priority controlled intersections, and F containing the motorway section.

AIMSUN2 simulation was conducted twice: first for the existing network, and later for the network with the optimised traffic signal settings generated by TRANSYT11. The performance of the optimised network showed an approximate improvement of 9 pcu-h/h saved in the total time spent for all vehicles in the whole study network (i.e. all the Subnetworks A through to F).

Interface Between the Models

The discrepancy between the outputs of the two models (60 pcu-h/h Subnetworks A to B v 9 pcu-h/h A to F) indicates the importance of having an accurate interfacing between the models. Achieving an accurate interface is difficult because of different modelling techniques applied by each model and different definitions of parameters.

Similar network and traffic data sets were used as inputs to each of the two models. In addition, traffic signal settings developed by TRANSYT11 had to be manually coded into AIMSUN2. Potential for error during this process was small, and was not expected to contribute to the discrepancy between the modelled results.

Discussion

A comparison of the existing and optimised systems demonstrated that the developed methodology produced quantifiable results. The analysis predicted that potential improvements were achievable when one of the possible traffic network management techniques was used. In the case of this study, the management technique selected for testing was traffic signal optimisation.

The implications of this study are that other network improvement techniques could be tested, but that the interpretation of the TRANSYT11 and AIMSUN2 results have to be considered separately.

Although the study was limited to the analysis of network performance during one period of the day (morning peak) and one of the traffic management techniques (traffic signalisation), the results demonstrated the following:

- The use of the two models produced results which showed a quantified comparison between the existing situation and proposed modifications of the system. However they showed significant discrepancies.
- The two models produced inconsistent results with each other.
- The observed inconsistencies indicate that the tested methodology for better management of urban networks, based on the use of an integrated TRANSYT11 and AIMSUN2 model, is not feasible for practical use by road controlling authorities.

Compatibility of the Models

Another deficiency of the proposed methodology is manifested by the inconsistent results produced by the two models. This inconsistency is a result of different calibration techniques and different treatment of the inputs to each model. The observed input differences were:

- Model calibration;
- Traffic volume input;
- Lane configuration input;
- Signal phasing input;
- Link length treatment;
- Saturation flow treatment.

Project Development Issues

The study identified many project development issues which were detrimental to achieving the planned outcomes of the integrated network management strategy. The issues identified are:

- The size of the network;
- Availability of traffic data;
- Availability of appropriate manpower;
- Planned physical changes to the road network;
- Project time framework;
- Financial considerations;
- Implementation;
- Interpretation of results;
- Modelling ability.

Conclusions

The tested methodology demonstrated that the integrated application of the two computer simulation models, TRANSYT11 and AIMSUN2, produced results which showed quantified comparison between the existing situation and proposed modifications of the network. However substantial differences existed between the results of the two models.

The tested methodology had a number of deficiencies and issues in two areas:

- The number and complexity of project development issues;
- Incompatibility of the two simulation programs.

Because of the above deficiencies, the conclusion was that the methodology of an integrated approach using TRANSYT11 and AIMSUN2 to manage the urban networks was not suitable as a predictive tool to assess the effects of various network-upgrading measures. The number of observed deficiencies was too great to make it a practical working tool for road controlling authorities.

Other software packages can be applied in New Zealand as an integration tool. The software VISUM and its microscopic component VISSIM are possible tools, although they have yet to be trialled in New Zealand.

Recommendations

The study showed that the methodology based on an integrated application of the two traffic simulation models, TRANSYT11 and ASIMSUN2, cannot be recommended as a practical tool to predict the benefits of urban street network improvements.

However, this aim could possibly be achieved using traffic simulation models other than TRANSYT11 and AIMSUN2, such as VISUM and VISSIM, though these have yet to be trialled on urban road networks in New Zealand.

Abstract

This study carried out in 1999-2002, attempted to demonstrate and quantify benefits of an integrated approach to traffic signalisation and management of urban street networks that straddle boundaries of Transit New Zealand and Local Authority jurisdictions. A methodology based on two traffic simulation computer models, TRANSYT11 and AIMSUN2, was tested. Salient aspects of the methodology are discussed and relevant issues identified. The methodology was applied to an assessment of the performance of a street network in the Auckland region (Manukau City), New Zealand. The analysis predicted potential improvements were achievable when one of the traffic management improvement techniques was used. However, because of the large number and complexity of developmental issues, and the incompatibility of the two programs, the methodology was assessed as unsuitable as a practical tool for local road controlling authorities.

1. Introduction

1.1 Project Objective

The objective of this project, carried out in 1999-2002, was to demonstrate and quantify benefits of an integrated approach to traffic signalisation and management of roads that straddle the boundaries of Transit New Zealand and Local Authority jurisdictions. The project aimed to achieve these objectives by developing a methodology of an integrated approach to manage urban road networks. The methodology took into consideration:

- Signal co-ordination across local authority boundaries, and
- An interface between local and motorway traffic at motorway on- and off-ramps.

The methodology was based on the use of two interfaced computer simulation models. The study tested the proposed methodology to determine if it would be suitable as a predictive tool for assessing the effects of the application of various measures to improve the efficiency of the networks.

These measures ranged from minor upgrading of road marking, through traffic signal management to substantial intersection upgrading, or new links in the network.

The selected network upgrading technique used in this case study was traffic signalisation (as it requires no implementation costs). It was tested during one period of the day – the morning peak. The underlying assumption was that this narrow scope would be sufficient to make a critical appraisal of the essential elements of the methodology. The methodology included technical difficulties of working with the models, the complexity of interfacing between the models, and the significance of prevailing constraints.

The investigation was conducted on an urban street network in the Auckland region (Manukau City), New Zealand. The network was selected for its ability to represent typical traffic conditions on a range of roads, such as arterial and collector roads, a motorway, and on- and off-ramp intersections.

1.2 Glossary of Terms

Because the project is complex, the meanings of some of the traffic planning terms (marked with an asterisk) are defined so they can be used consistently throughout the report. The definitions are provided in the Glossary on pp. 49-50.

1.3 Summary of Planned Project Methodology

The project consisted of theoretical and experimental work. Brief descriptions of the project phases as originally planned are as follows:

Phase 1 – Conceptual Preparatory Work

This phase consisted of:

- Development of computer models and interfaces between them;
- Identification of potential sites (networks of traffic signalised intersections) for experimentation;
- Appraisal and selection of appropriate sites;
- Preliminary simulation and optimisation of the performance of the selected sites;
- Development of the appropriate strategy for signal integration; and
- Testing of the various options.

Phases 2 & 4 – Implementation

These phases included:

- Calibration of the computer models using the traffic surveys of the Existing Layout;
- Simulation and optimisation of the performance of the test sites;
- Implementation of the optimised signal settings on the test sites; and
- Monitoring of the performance by means of the Optimised Layout.

Phases 3 & 5 – Analysis of the Study Outputs

These phases included a conclusion of the work summarising the results of the network analysis and a comparison of the effectiveness of integration of the models based on the results of traffic surveys of the Existing and Optimised Layouts.

In addition, a comparison of the simulated and observed outputs was intended to give further insight into the operating parameters of the applied computer models. This aimed to make refinements of the procedures, and finally would enable the assessment of the most appropriate conditions and periods that are most likely to offer maximum benefits of the developed techniques in future similar analyses in other urban areas in New Zealand.

1.4 Variations from Planned Methodology

1.4.1 Reasons for Variations

The objective of the study as previously outlined would be achieved if the efficiency of the Optimised Layout resulting from the integrated approach were demonstrated by the theoretical outputs of the models. The model would be validated by the Existing and Optimised Layouts of travel time and queue length surveys.

A requirement for the validity of such surveys is a 'level playing field'. All features of the network for the Optimised Layout would have to be similar to the original features of the Existing Layout. The only differences between the Existing and Optimised Layouts would be a result of signals optimisation.

However, the project has been protracted and extended over a much longer time span than was originally envisaged. This has caused a number of problems for a variety of reasons. The long time frame has meant that a number of improvements and changes had been made to the network and therefore the Existing and Optimised Layout surveys could not be conducted on a similar network. Once the common ground of the comparison was lost, the usefulness of the Optimised Layout surveys became doubtful.

The changes to the existing configuration of the network which have been implemented since the start of the project are summarised as follows.

ETCART*

The opening of ETCART, the East Tamaki Corridor Arterial route between Howick and Manukau City (Te Irirangi Drive), had a substantial impact on the geometric layout of the network and resulting reassignment of traffic in the southern portion of the network, namely in its Subnetworks B and E.

Papatoetoe Interchange

Transit New Zealand let a contract to upgrade the northbound (NBD) Off-Ramp at the intersection of East Tamaki Road. Traffic in the morning peak stretched back from the intersection along the Off-Ramp and often onto the Motorway itself. This was becoming a safety hazard and Transit NZ took urgent steps to rectify the situation. The works involved provision of a second right-turn lane at the intersection and extending the left-turn lane beyond the queue lengths.

This work was completed early in 2002 and has significantly improved the performance of the intersection. Although the phasing of the traffic signals did not change, the timings used have altered. As additional traffic can be cleared from the Off-Ramp, the saving in green time has now been given to the main road (Node 15 – Subnetwork D). Hence the clearance time for the right-turning vehicles on to the Motorway has been lengthened. This has reduced the delays on site.

C & D Subnetworks SCATS*

In the course of running the SCATS (Sydney Co-ordinated Adaptive Traffic Signals) system operation, the Manukau City Council's signals maintenance consultant makes various minor routine modifications and adjustments aimed to improve the performance. A cumulative effect of these modifications over a period of time resulted in substantial differences between the original (1999) and current systems (2002).

The Manukau City Council's signals maintenance consultant advised that they had decided to update the offset data controlling the traffic signals along the East Tamaki Road and Great South Road routes (Subnetworks C and D). This work was carried out in September 2001. This data is the key element in the decision-making process to determine the effectiveness of the optimisation changes to the system that would have been recommended.

Growth Rate

Another factor, which had a major impact upon the ability to accurately gain reasonable comparisons, is the increase in the traffic flows over the period of the study. The anticipated growth rate for the study area was 3-4% per annum, as commonly used in economic evaluations of projects in the area and generally accepted as reasonable. However data collected by Manukau City Council indicates that certain locations immediately north of the study area have achieved a growth rate of 8% for the past nine years.

The two-year period of the study was assumed to add between 6% and 8% (lower limit) though, in light of Council's information, this is possibly as high as 18% (upper limit) to the calibrated Existing Layout traffic flows. The routes being studied were already over-saturated and this additional traffic would mean that the queues and consequently delays would be excessive and unreasonable.

1.4.2 Variations

As a result of the network and traffic changes described above, the analysis process had to be modified. The following variations had to be introduced in order to continue the work:

- Calibration of the models of the Existing Layout on the northern portion of the network only, since the impact of ETCART on traffic in this portion was very small. The ETCART impact on the southern portion was substantial.
- Abandoning the concept of Optimised Layout surveys as a means of verifying the accuracy of the implementation.
- Abandoning the implementation of resetting traffic signals to reflect the phasing derived by modelling, because in a changed network the optimisation based on the original network would not be relevant.

The project was therefore modified to consist of:

- The simulation of the Existing Layout (as planned).
- Calibration of the models using the observed Existing Layout data (as planned) from the northern portion of the network only (modification).
- Optimisation of the network performance (as planned) without the model output validation (modification).
- Comparison (as planned) of the theoretically (modification) derived results of the Existing and Optimised Layouts.

1.4.3 Impact of the Modified Scope

The original scope relied on a balanced mixture of theoretical and experimental work. The modified scope reduces the experimental component and increases the significance of the theoretical component.

The models of the existing layout at that time (1999) were thoroughly calibrated on the Existing Layout survey data and therefore constitute a solid base for the project. These calibrated models were used for optimisation of the network performance and produced a theoretical set of comparable data for the Optimised Layout.

Although the modified scope reduces a fair amount of experimental work and model validation, the solid base established by the experimental work had underlined the credibility of the project findings.

1.5 Summary of Modified Project Methodology

The project consisted of theoretical and experimental work. The brief description of the modified project phases follows.

Phase 1 – Conceptual Preparatory Work

This phase consisted of:

- Development of computer models and interfaces between them;
- Identification of potential sites (networks of traffic signalised intersections) for experimentation;
- Appraisal and selection of appropriate sites;
- Preliminary simulation and optimisation of the performance of the selected sites;
- Development of the appropriate strategy for signal integration; and
- Testing of the various options.

Phases 2 & 4 – Calibration

These phases included:

- Calibration of the computer models using the results of the Existing Layout;
- Simulation and optimisation of the performance of the test sites.

Phases 3 & 5 – Analysis of the Study Outputs

These concluding phases included:

- A summary of the results of the network analysis; and
- A comparison of the effectiveness of the Existing and Optimised Layouts based on the results of the computer simulation.

2. Preparatory Work

2.1 Computer Simulation

2.1.1 General

The modelling options were reviewed at the project proposal stage, and the models selected were TRANSYT11 and AIMSUN2. The title of the proposal was *An Integrated Traffic Model for Auckland Cities Using AIMSUN2 and TRANSYT10,* which emphasised such an approach. The main reasons for selecting these models were:

- A particular suitability of AIMSUN2, as a microscopic model, to test the impact of incidents, heavy traffic and motorway flow control, and specifically various functions of the ATMS, which is perceived as the most promising technology for the future.
- Acceptability of both models in New Zealand, especially in Auckland; Transit New Zealand's knowledge of and expressed confidence in AIMSUN2; and Auckland City Council's use of TRANSYT on various projects.
- Minimisation of the project risks by using tools familiar to the consultants involved (the Acknowledgments and Preface list the consultants).

2.1.2 Simulation Programs

The upgrade of the TRANSYT model to version TRANSYT11, which had occurred at the time (2000) of the modelling process, resulted in a change from using TRANSYT10 (DOS-based) that had been originally proposed, to TRANSYT11 (Windows-based).

TRANSYT11 has been developed by the UK Transport Research Laboratory (TRL) to simulate and optimise the performance of traffic signal networks. It is a macroscopic* simulation model, which accepts a relatively coarse level of data input, consisting of network geometric elements, traffic flows and traffic signal settings.

AIMSUN2 has been developed at the University of Barcelona, Spain, by Transport Simulation Systems (TSS), as a microscopic* simulation tool for evaluating the performance of traffic in urban networks. AIMSUN2 does not have optimisation algorithms. As a microscopic model, in addition to the input similar to that of TRANSYT11, it requires detailed vehicle performance parameters, such as acceleration rates.

While TRANSYT11 concentrates on the optimisation of traffic signal control, AIMSUN2 has a wide range of modelling capabilities. The specific AIMSUN2 capabilities required for this project included modelling of motorway links, priority controlled intersections and roundabouts, which could not be modelled by TRANSYT11.

As noted above, AIMSUN2 was recognised by Transit New Zealand for its particular suitability to test the impact of incidents, heavy traffic and motorway flow control, and specifically to test various functions of the ATMS. However the intention of this project was not to test any of these features, as they were already generally well known and accepted.

2.2 Selection of Project Sites

The methodology as originally proposed had to be modified as a result of discussions with the end users (Transit NZ and Manukau City Council), and their feedback. The original methodology was based on two distinct stages of the project:

- A pilot study conducted at a site comprising three or four signalised intersections, that was conducted in Phase 2 of the project.
- An expanded scope study conducted on three or four sites, that was conducted in Phase 4 of the project.

The discussions with the end users at an early stage of the project revealed that suitable test sites comprising a small number of signalised intersections were not available. The end users proposed two sites, both of which were relatively large and complex networks of signalised and non-signalised intersections, and operating under heavy traffic conditions.

In view of these constraints the decision was made to conduct the work on Phase 2 and Phase 4 of the project simultaneously. The completed work described below has been based on such modified methodology.

The proposed study networks were:
- Onewa Road in North Shore City;
- Great South Road in Manukau City.

The North Shore City network consisted of a system of parallel and crossing roads and the Onewa Road interchange on the Northern Motorway. The Manukau City network consisted of four south–north routes between Wiri Station Road and East Tamaki Road, and two east–west routes.

The Manukau City network was selected because it offered a well developed system of alternative routes in both east–west and south–north directions and two motorway interchanges. It also offered four subnetworks suitable for small-scale studies, although inappropriate for a self-standing pilot study. The intersections straddle the boundary between the Manukau City Council and Transit New Zealand jurisdictions.

This network was selected despite the full realisation that it may be too large to be handled within the original research project scope. Subsequently our reservations proved correct. Owing to the complexity of the studied network the analysis was delayed until after the completion of Te Irirangi Drive, because this event changed the network configuration in terms of both geometric layout and traffic flows.

By the time the study was underway, Te Irirangi Drive had been opened and as a result a portion of the network had to be identified where the impact of Te Irirangi Drive was low. A comparative analysis of historical SCATS counts revealed that the impact on the northern part of the network was negligible. The project work could therefore be continued on this part of the network.

2.3 Study Network

The selected study network consisted of the following five Subnetworks and a motorway section, and is shown in Figure 2.1:

2.3.1 South – North Routes

- Subnetwork B (nodes 24-23-22 on Figure 2.1): Great South Road – Ronwood Avenue – Cavendish Drive – Puhinui Road – Reagan Road. Note that Te Irirangi Drive was not included in this assessment.
- Subnetwork C (nodes 21-20-18-17-19): Great South Road – St Georges Street – Huia Road – Sutton Crescent – Charles Street – Kolmar Road – East Tamaki Road – Shirley Road.
- Subnetwork E (nodes 05-06-07-08-09): Redoubt Road – Everglade Drive – Hollyford Drive – Old Orlando Drive – Boundary Road – Reagan Road – Preston Road – Flatbush Road – Bairds Road.
- Subnetwork F: Southern Motorway between Manukau and Papateotoe Interchanges.

2.3.2 East – West Routes

- Subnetwork A (nodes 04-01-02-03): SH1 Manukau NDB (northbound) Off-Ramp – Great South Road – Wiri Station Road – Redoubt Road – SH1 Manukau SBD (southbound) On-/Off-Ramps and NBD On-Ramp.
- Subnetwork D (nodes 16-15-14-13-12-11-10): East Tamaki Road – Huia Road – Holroyd Road – SH11 Papatoetoe On-/Off-Ramps – Otara Road – Newbury Street – Bairds Road.

2.4 Traffic Data Requirement and Acquisition

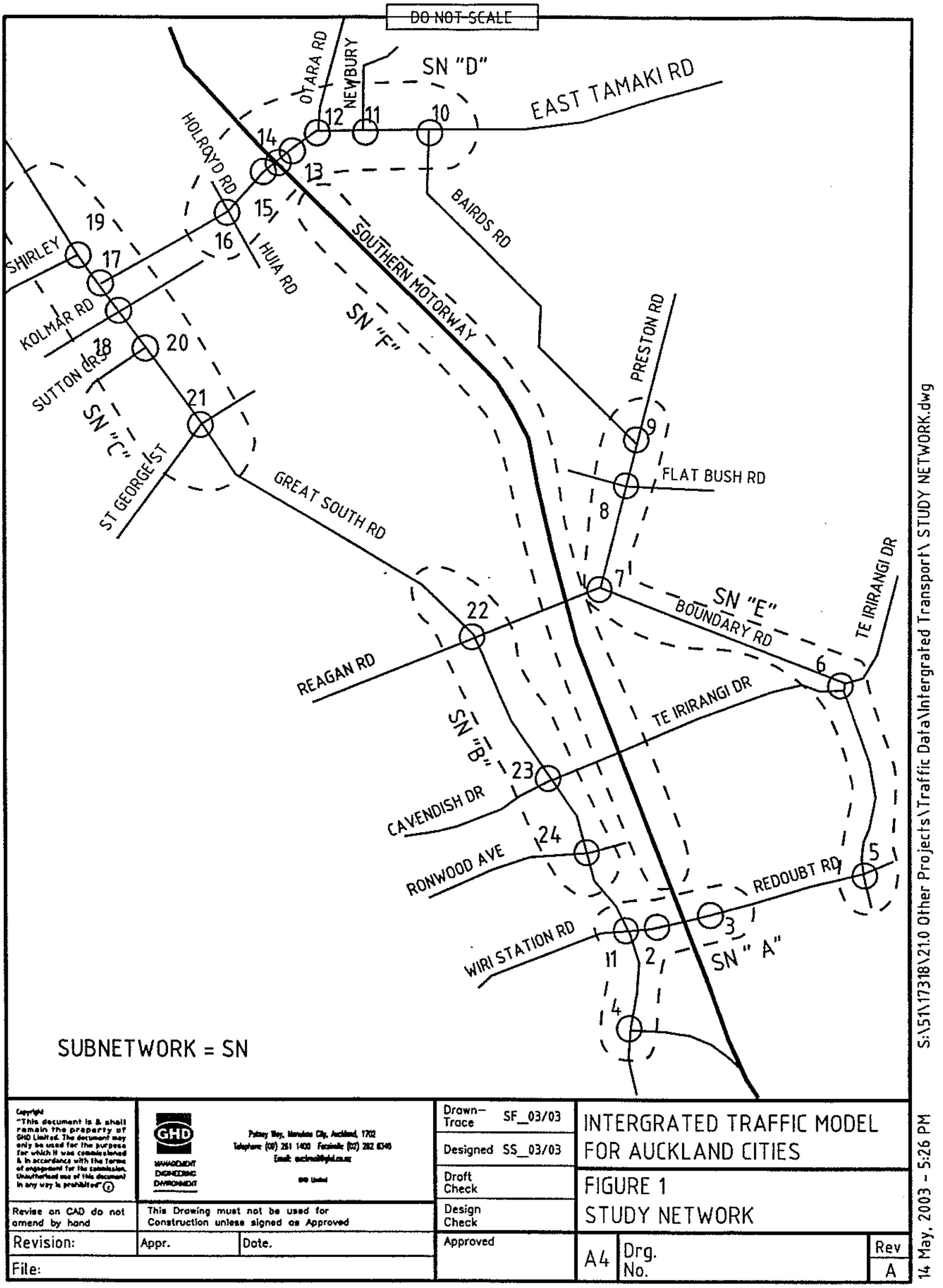
2.4.1 Data Requirement

The input data required for TRANSYT11 and AIMSUN2 models are:

- Network geometric data – link lengths and lane configurations;
- Traffic volumes, turning movements and saturation flows;
- The existing traffic signal settings;
- Traffic speed on the links; and
- Travel time and stop line saturation surveys.

Figure 2.1 The study network showing the 6 Subnetworks A – F.

(The Subnetworks straddle Manukau City Council and Transit New Zealand jurisdictions.)



2.4.2 Available Data

A certain amount of existing data was available, but this had to be supplemented and verified by means of traffic surveys.

The available data used in this study was collected from the following sources:

- Manukau City Council supplied aerial photographs of the road network, which enabled construction of the model network in AIMSUN2. RoadNet Ltd supplied intersection layouts and lane configuration.
- SCATS signal settings were obtained from Bovis Management Consultants (who were then the SCATS contractor for Manukau City Council). The data contained the historical record of signal cycle length variations, minimum green times for the various signal phases, and phasing diagrams.
- SCATS counts were also supplied by Bovis Management Consultants for all the signalised intersections in the study network. Although these counts were most recent and consistent (all collected between 1 and 7 November 1999), they had evident gaps resulting from left turns that had not been counted at some of the intersections or malfunctioning of some detectors. The counts were all 7-day hourly, with 15-min peak counts.

Various sets of traffic counts were obtained from RoadNet, Bovis Management Consultants and Transit New Zealand. They included link counts, SCATS counts at intersections, motorway ramp counts and ATMS* counts on the motorway carriageways. These counts had little compatibility as they were in different formats and data had been obtained in different times of the years.

2.4.3 Traffic Surveys

Because of the deficiencies of this data, it had to be verified and supplemented by means of additional traffic surveys. These surveys had a format of 15-minute turning movement counts during the morning peak period. They were carried out between 1st and 10th December 1999 at all the signalised intersections in the study network.

This data enabled correlation of traffic flows to be achieved satisfactorily for the modelling purpose. In addition travel time measurements and queue lengths were taken to measure the key indicators of the network effectiveness required for the calibration of the models.

3. Traffic Modelling using TRANSYT11 & AIMSUN2

3.1 Modelling Process

A two-stage modelling process was adopted. First, the performance of the study network was simulated and the signal settings were optimised using TRANSYT11. Second, both the existing study network and the optimised version were modelled in AIMSUN2.

A comparison of the two TRANSYT11 outputs produced an assessment of the individual signalised Subnetworks only. A comparison of the two AIMSUN2 outputs produced an assessment of the overall network performance. Such a two-stage process was selected because each computer model has its specific strengths.

TRANSYT11 is a tool dedicated to simulate and optimise the performance of traffic signalisation in urban networks. AIMSUN2, which is a microscopic model, is particularly well suited to simulate the performance of those networks which contain a variety of elements.

The purpose of the preliminary modelling work was to assess the compatibility of the two models, the interfacing between the models, and the general reliability of the modelling process. The results of the preliminary modelling were peer reviewed. The comments received were noted and changes made to incorporate the suggestions before the final modelling work was undertaken.

3.2 Modelling Constraints

The project work started in 1999 and went through until 2002. In 2000 a new arterial, ETCART (East Tamaki Corridor Arterial, Te Irirangi Drive), was opened between Howick and Manukau City permanently altering the physical layout and traffic assignment in the southern part of the network. An approach was therefore worked out with the end users to concentrate on the northern part of the network, because it was affected by ETCART to a minor extent only. The traffic signal modelling concentrated on Subnetworks C and D, while the more general AIMSUN2 model covered the whole network.

Both the TRANSYT11 and AIMSUN2 models could be satisfactorily calibrated on the data collected in the northern part of the network.

The second constraint was using the fixed-time models – TRANSYT11 and AIMSUN2 – to simulate the dynamic SCATS-driven signal system. This was resolved with the end users by inputting the average values in the models.

3.3 TRANSYT11 Model

3.3.1 TRANSYT11 Model Calibration

The aim of the model calibration was to ensure robust representation of traffic characteristics within the physical study area. The physical network was accurately modelled because it was based on lane configuration.

The model was calibrated using travel time values for the links measured on three routes during travel time surveys. The routes were:

- Great South Road from Tui Road to East Tamaki Road (northbound);
- East Tamaki Road from Great South Road to Bairds Road (eastbound);
- Great South Road from East Tamaki Road to Tui Road (southbound).

The observed travel time values were compared with the corresponding estimated travel time values of the existing model. Statistical analysis of the calibrated model output was conducted using the Chi Square test. The calibration of the model was achieved by manipulating, wherever required, the minimum green times* of signal phases* and saturation flows* at intersection approaches.

This operation was performed several times, until the model outputs (the estimated travel times) were close enough to the observed values to meet the conditions of the Chi Square test for a significance level of 0.05. When the test produced the value of Chi Square (data) lower than Chi Square (tables), the data fit was accepted, confirming that the model was a reasonable representation of the existing system. The results are shown in Appendix A of this report.

3.3.2 TRANSYT11 Simulation

Four portions of the network, Subnetworks A, B, C and D, contained signalised intersections. The existing layout performance of these subnetworks was simulated using the calibrated TRANSYT11 model. The model produced sets of link and network-wide performance indicators quantifying the efficiency of the studied network. The main network-wide indicators were:

- Total distance travelled by all vehicles during one hour (pcu-km/h*);
- Total time spent (pcu-h/h*);
- Mean journey speed (km/h);
- Uniform and random delay (pcu-h/h);
- Total fuel consumption (litre/h);
- Total performance index (a weighted sum of all vehicle delays and stops).

The main performance indicators were travel time on each link, delays, the performance indices and, in addition, the link degree of saturation, percentage of stopped vehicles and mean queue. The two key performance indicators selected for the project were travel time for all vehicles in the network and fuel consumption.

In the existing layout, the traffic signal network under study operates as four independent Subnetworks. Signal co-ordination between the Subnetworks does not exist, but some, although not all, signal groups within Subnetworks may be co-ordinated. The distance between Subnetworks B and C exceeds 1,400 metres, which is too far for effective signal co-ordination. The distances between Subnetworks A and B and Subnetworks C and D are relatively shorter.

The results of the simulation of the existing Subnetworks are shown in Table 3.1. The two key performance indicators – travel time of all vehicles in the Subnetwork and fuel consumption – are shown, as well as the Performance Index*. The detailed output is presented in Appendix B.

Sub-Network	Cycle Time (sec)	Performance Index	Travel Time (pcu-h/h*)	Fuel Consumption (litre/h)
A	120	2,906	235.6	539.9
B	120	1,318	157.6	392.8
C	90	1,383	105.4	277.4
D	140	4,459	333.6	732.0
Total Subnetwork			**832.2**	**1,942.1**

Table 3.1 Simulated performance of the existing network using TRANSYT11.

The models for Subnetworks C and D (north) were verified, while the Subnetworks A and B (south) were not because of the changes occurring by Te Irirangi Drive as previously described.

3.3.3 TRANSYT11 Optimisation

The traffic signal settings were optimised to improve the network performance. TRANSYT11 achieves optimisation by manipulating the length of the cycle time, splits* and offsets*. For this purpose TRANSYT11 employs various routines and associated programs:

- **EQUISAT routine**, which calculates the initial signal phasing by setting of the phase change times to give similar degrees of saturation on the conflicting links at each node.
- **STAGOR program**, which identifies the best phase order for each node in the network.
- **CYOP program**, which examines a wide range of cycle times and identifies the suitable cycle time splits.

When the overall network cycle time is long, a double cycling of lightly trafficked intersections is one of the optimisation options. The nodes which could be double cycled are identified by CYOP.

CYOP was used in the preliminary analysis, but because of its inherent limitations, a full optimisation process was used in the final analysis.

There was also a constraint concerning the use of STAGOR. Although the phase sequences identified by STAGOR were more efficient than other sequences, in some cases they could not be applied. The end user, the Manukau City Council's signals maintenance consultant, dismissed them as incompatible with their safety requirements.

In the preliminary work, signalisation of the four individual Subnetworks A, B, C and D, and the two Combined Subnetworks A & B and C & D, were optimised. However, the combined Subnetworks did not show much promise and they were omitted in the final work.

Therefore optimisation tests were finally performed on Subnetworks A, B, C and D individually. The emphasis was on the optimisation of Subnetworks C and D (north), where the model was fully calibrated.

The summary of results of the optimisation of the Subnetworks is shown in Table 3.2. The same two key performance indicators – travel time of all vehicles in the network and fuel consumption – are shown, as well as the Performance Index. The detailed output is presented in Appendix B.

Sub-Network	**Cycle Time** (sec)	**Performance Index**	**Travel Time** (pcu-h/h)	**Fuel Consumption** (litre/h)
A	120	2,713	224.2	519.6
B	120	1,220	152.4	379.4
C	90	1,219	96.6	255.9
D	140	3,922	299.9	687.2
Total Subnetwork			**773.1**	**1,842.1**

Table 3.2 Optimised performance of the modelled TRANSYT11 network.

3.4 AIMSUN2 Model

3.4.1 AIMSUN2 Model Calibration

Calibration of the AIMSUN2 model was undertaken as described in the following paragraphs. The physical network, for the most part, is accurately modelled because it was based on lane configurations. However two network geometric elements had to be modified to enable accurate representation of vehicle movements: entry/exit lanes associated with the on- and off-motorway ramps, and roundabouts.

Merge/diverge modifications mainly involved extending the length of the merge/ diverge lane to accommodate the merge characteristics of the heavy vehicles. In some instances the AIMSUN2 model identified apparent geometric deficiencies in existing networks (i.e. insufficient turning room, short merges, etc.) that large vehicles theoretically cannot traverse. Modification of the theoretical geometric deficiency enabled the actual movements to be modelled.

The application of a repetitive iteration process ensures that only the minimum modification is made to the model to enable measured assignments to be replicated. The model was calibrated using travel time values for the links measured on five routes during travel time surveys. The routes were:

- Great South Road from Tui Road to East Tamaki Road (northbound);
- Great South Road from East Tamaki Road to Tui Road (southbound);
- Bairds Road and Reagan Road from East Tamaki Road to Great South Road (southbound);
- Preston Road and Bairds Road from Reagan Road to East Tamaki Road (northbound);
- Motorway from Papatoetoe Interchange to Manukau Interchange and back (both directions).

The observed travel time values were compared with the corresponding estimated travel time values. Statistical analysis of the calibrated model output was conducted using the GEH* statistics test as described in the Transfund New Zealand Project Evaluation Manual (1997).

The requirement for the model acceptance is that 60% of the GEH values are less than 5.0. The calibrated model met this requirement with 33 links out of a total of 38 links (i.e. 87%) returning GEH values of less then 5.0. These results confirmed that the model was a reasonable representation of the existing system. The test results are shown in Appendix A of this report.

3.4.2 AIMSUN2 Simulation

The performance of the whole network was simulated using AIMSUN2. The same set of inputs was used as for TRANSYT11. However in addition to the four Subnetworks (A, B, C and D) analysed by TRANSYT11, the AIMSUN2 model contained Subnetwork E and the Southern Motorway section (Subnetwork F). These two components could not be analysed by TRANSYT11 because they do not contain signalised intersections.

The AIMSUN2 simulation was conducted twice: first for the existing network (referred to as Existing Layout), and later for the network with the optimised traffic signal settings (referred to as Optimised Layout).

The analysis was conducted for individual streams and for the network as a whole. The streams are typical routes in the network, for example Loop A denotes a trip from Wiri Station Road to Reagan Road, then along Boundary Road and back to

Wiri Station Road. Eighteen streams (nine in opposing directions) were analysed in addition to the five routes used for model calibration. These are:

- Loop A: Nodes 1, 22, 7, 5 and back to 1
- Loop B: Nodes 22, 21, 16, 10, 9, 7 and back to 22
- Loop C: Nodes 21, 17, 16 and back to 21
- Loop AB: Nodes 1, 21, 16, 10, 9, 7, 5 and back to 1
- Loop BC: Nodes 22, 17, 10, 9, 7 and back to 22
- Loop ABC: Nodes 1, 17, 10, 9, 7, 5 and back to 1
- Loop M/Way East: Nodes 2, 15, 10, 9, 7, 5 and back to 2
- Loop M/Way West B: Nodes 2, 15, 16, 21, 1, and back to 2
- Loop M/Way West B/C: Nodes 2, 15, 17, 1 and back to 2

The results of the simulation of the existing network are shown in Table 3.3. The key performance indicator selected for the analysis was travel time. The table shows the results of the individual stream simulated performances and of the overall network simulated performance.

Individual Streams	Travel Time (min:sec)	Travel Time (sec)
Route 10-22	05:38	338
Loop A1	11:50	710
Loop AB2	26:35	1,595
Loop B2	20:27	1,227
Loop C2	04:07	247
Motorway East 1	15:54	954
Motorway West B2	19:49	1,189
Overall Network		**2,084.3 pcu-h/h**

Table 3.3 Simulated performance of the existing layout using AIMSUN2.

3.4.3 AIMSUN2 Optimisation

The summary of results of the optimised layout is shown in Table 3.4 (p. 29) and the detailed output is presented in Appendix C.

3.5 Interface between the Models

3.5.1 Background Information

An important part of the process is to ensure that the interface between the two models is compatible.

Individual Streams	Travel Time (min:sec)	Travel Time (sec)
Route 10-22	05:11	311
Loop A1	12:03	723
Loop AB2	23:25	1,405
Loop B2	17:18	1,038
Loop C2	04:55	295
Motorway East 1	15:40	940
Motorway West B2	17:04	1,024
Overall Network		**2,075.8 pcu-h/h**

Table 3.4 Simulated performance of the optimised layout using AIMSUN2.

At the inception of the work the project team held discussions with Jim Cater and John Peppiatt of Information Systems of Manukau Institute of Technology (MIT), who were keen on involving their students in a challenging task of developing such an interface.

However, in order to develop the interfaces between AIMSUN2 and TRANSYT11, or AIMSUN2 and SCATS, an additional AIMSUN2 software kit had to be purchased from TSS (Transport Simulation Systems, the AIMSUN2 development company in Barcelona) at an approximate cost of $US10,000. Unfortunately neither MIT nor our project team had the financial resources for this expenditure.

Subsequent talks between MIT and Auckland University who, as academic users of AIMSUN2, might have had the necessary software, and between Meritec and various Australian organisations involved with SCATS (e.g. among others, Queensland Department of Main Roads, Roads & Traffic Authority of New South Wales, and Plessey) did not reveal the existence of satisfactory solutions.

The only realistic option therefore was to interface the models manually. This required the coding of traffic signal settings developed by TRANSYT11 optimisation process output into an AIMSUN2 input format. It was in addition to the unavoidable AIMSUN2 input of all other network and traffic data.

In the meantime TSS developed an interface between AIMSUN2 and TRANSYT10, which could be purchased for approximately $US3,000. However, the project budget did not allow us to purchase the package. Moreover the project team had reservations about using the new product, which had not been debugged or refined at that stage (2000).

Traffic Design Group, Auckland, had recently used AIMSUN2 for a number of small projects (e.g. for the Cameron Road Traffic Impact Study, Tauranga). Some of them required interfacing TRANSYT11 and AIMSUN2. Their preferred interfacing method was however manual because of the issues noted above and because the commercially available interface is based on TRANSYT10, not on the TRANSYT11 version used in New Zealand.

3.5.2 Practical Implications of Manual Interface

An assessment of the manual interface between TRANSYT11 and AIMSUN2 has been made in terms of the following issues:

- Type of data that needs to be transferred from one to the other program;
- Procedures of the manual process to transfer data;
- Complexity of the manual process and potential for errors; and
- Time involved in transferring data.

The data common to both programs are:

- Geometric features of the network (had to be coded separately because of totally different input formats);
- Traffic volumes and saturation flows (could potentially be transferred electronically); and
- Traffic signal settings (could potentially be transferred electronically).

Therefore the data that are potentially suitable for an automatic interface between the models are traffic volumes and traffic signal settings. The manual process of transferring the data involved coding traffic volumes into the AIMSUN2 model, summarising the phase sequences and duration produced by TRANSYT11 into a diagrammatic and tabulated format, and coding this information into AIMSUN2.

The potential for error is limited to the accuracy of reporting the TRANSYT11 calculated phase duration (i.e. tabulating the data) and inputting the data (i.e. correct reading of phase duration and elimination of typos). Thus sufficient time had to be allowed for quality control of the data entry.

One set of traffic volumes and two sets of signal settings had to be input, and the entire manual interfacing process took approximately 16 hours. This also included time spent on quality control. The scope of the work was determined by the network size, i.e. 23 intersections (including 17 signalised), and one period of simulation, i.e. morning peak.

4. Comparison of TRANSYT11 & AIMSUN2 Results

4.1 Key Performance Indicators

The two key performance indicators selected for the project were travel time for all vehicles in the network and fuel consumption.

In addition, other performance indicators, such as the Performance Index, total distance travelled in the network, journey speeds on links, uniform and random delays, mean number of stops per vehicle, and mean queues, were used throughout the project.

4.2 Existing Layout

The existing layout represented the network as at December 1999. The network was defined by the geometric features, traffic volumes and traffic signal settings prevailing at the time.

The results of the simulation of the existing network based on the key indicators are summarised in Table 3.1 (TRANSYT11 results) and Table 3.3 (AIMSUN2 results for travel time only).

4.3 Optimised Layout

The effectiveness of the four signalised Subnetworks was optimised using the optimisation routines available in TRANSYT11. The optimisation process introduced or modified the offsets between the intersections and modified the splits of signal phases.

The set of signal settings produced by the optimisation process was input to the AIMSUN2 model and the performance of the optimised layout was simulated. The predicted performances of the optimised layout are summarised in Table 3.2 (TRANSYT11 results) and Table 3.4 (AIMSUN2 results for travel time only).

Note that, while the results shown in Tables 3.1 and 3.2 reflect the operation of Subnetworks A, B, C and D using TRANSYT11 simulation, the results shown in Tables 3.3 and 3.4 represent the operation of the overall network using AIMSUN2 simulation.

4.4 Discussion & Conclusions

4.4.1 Comparative Results

A comparison of the existing and optimised layouts shows that the developed methodology produces quantifiable results but with significant discrepancies. A comparison of travel time for one peak period hour is shown in Tables 4.1 and 4.2.

Sub-Network	Travel Time (pcu-h/h)		Savings
	Existing	Optimised	(pcu-h/h)
A	235.6	224.2	11.4
B	157.6	152.4	5.2
C	105.4	96.6	8.8
D	333.6	299.9	33.7
Subnetwork	**832.2**	**773.1**	**59.1**

Table 4.1 Comparison of Travel Time for the existing and optimised layouts using TRANSYT11 models.

Individual Streams	Travel Time (sec)		Savings
	Existing	Optimised	(sec/veh)
Route 10-22	338	311	27
Loop A1	710	723	-13
Loop AB1	1,595	1,405	190
Loop B2	1,227	1,038	189
Loop C2	247	295	-48
Motorway East 1	954	940	14
Motorway West B2	1,189	1,024	165
Overall Network	**Travel Time** (pcu-h/h)		**Savings** (pcu-h/h)
Network Total	**2,084.3**	**2,075.8**	**8.5**

Table 4.2 Comparison of Travel Time for the existing and optimised layouts using AIMSUN2 models.

Although both models show an overall improvement of the efficiency of the optimised layout, there is a discrepancy in the time base of the models. The four Subnetworks modelled by TRANSYT11 show a total of approximately 60 pcu-h/h saved, while the overall system modelled by AIMSUN2, which includes the above four Subnetworks, the Motorway Subnetwork F, and the priority controlled Subnetwork E, shows a total saving of only 8.5 pcu-h/h.

Table 4.3 shows the differences in results between the TRANSYT11 and AIMSUN2 models summarised on an intersection by intersection basis.

Subnet-work	Node No.	Major Road	Minor Road	Time Before (pcu-h/h)	Time After (pcu-h/h)	TRANSYT Time Saved (pcu-h/h)	AIMSUN Time Saved (pcu-h/h)
A	1	Great South	Wiri Station	126.6	121.6	4.9	23.6
	2	Redoubt	NBD On-Ramp	26.3	24.2	2.1	0.2
	3	Redoubt	SBD Off-Ramp	45.6	40.7	4.9	5.6
	4	Great South	NBD Off-Ramp	36.6	37.1	–0.5	7.6
D	10	East Tamaki	Bairds	129.0	103.8	25.2	–53.8
	12	East Tamaki	Newbury	32.3	38.4	–6.0	36.8
	13	East Tamaki	Otara	30.1	29.9	0.2	44.4
	14	East Tamaki	SBD Ramps	45.6	38.7	6.8	20.2
	15	East Tamaki	NBD Ramps	40.5	35.8	4.6	4.2
	16	East Tamaki	Holroyd	55.3	52.4	2.9	26.8
C	17	Great South	East Tamaki	17.5	14.6	3.0	71.6
	18	Great South	Kolmar	14.2	13.6	0.6	147.4
	19	Great South	Shirley	19.7	18.7	0.9	–56.0
	20	Great South	Sutton	15.2	12.2	3.1	72.6
	21	Great South	St Georges	38.4	37.4	1.0	50.4
B	22	Great South	Puhinui	97.5	96.7	0.8	31.8
	23	Great South	Cavendish	22.5	19.6	2.9	24.8
	24	Great South	Ronwood	37.6	36.3	1.4	16.2

Table 4.3 Differences in results between TRANSYT11 and AIMSUN2 models.

This outcome summarised in Tables 4.1 and 4.2 could be interpreted to indicate that some major time losses occur on the motorway and in Subnetwork E. Such interpretation is however refuted by the individual results of the motorway link analysis shown in Table 4.3. Each of the simulated trips involving Motorway travel showed travel time savings ranging from 3 to 189 seconds per vehicle. Also all, except one simulated trip through the priority controlled Subnetwork E, showed clear time savings ranging from 7 to 189 seconds per vehicle.

The analysis predicted the potential improvements that are achievable when one of the traffic network management techniques is used. In this study, the management technique selected for testing was traffic signal optimisation. The implications are that other network improvement techniques could be tested but the interpretation of the two sets of results, from TRANSYT11 and AIMSUN2, would have to be considered and quantified separately.

4.4.2 Conclusions

Although the study was limited to the analysis of network performance during one period of the day (morning peak) and one of the traffic management mechanisms (traffic signalisation), the results demonstrated the following:

- The use of the two models produced results which showed a quantified comparison between the existing layout and proposed modifications of the system.
- The two models produced inconsistent results.
- The observed inconsistencies indicate that the tested methodology for better management of urban networks, based on the use of an integrated TRANSYT11 and AIMSUN2 model, is not feasible for practical use by road controlling authorities.

5. Compatibility of TRANSYT11 & AIMSUN2 Models

5.1 Introduction

As stated in Chapter 4 of this report, the outputs of the two models differ. The TRANSYT11 model, covering approximately two thirds of the network, showed a total saving of some 60 pcu-h, while the AIMSUN2 model, covering the whole network, showed 8.5 pcu-h saved.

The distribution of benefits among the signalised intersections also show discrepancies with each model showing greatly different savings at the same intersections.

In an attempt to find the source of these discrepancies, several checks were made of the following aspects:

- Inputs to both models;
- Calibration of the models;
- Modelling principles.

5.2 Inputs to Models

The input data was re-checked to verify that the input to both TRANSYT11 and AIMSUN2 models corresponded. The data entered originally was confirmed to be correct.

5.3 Calibration of Models

The TRANSYT11 model was calibrated using travel time values for the links measured on three routes during travel time surveys. The observed travel time values were compared with the corresponding modelled travel time values. The calibration of the model was achieved by manipulating, wherever required, the minimum green times of signal phases* and saturation flows* at intersection approaches.

However, calibration of the AIMSUN2 model could not be achieved by manipulation of the same two parameters: green times of signal phases and saturation flows. In the case of the AIMSUN2 model, the original physical network existing in 1999, and the same as used in the TRANSYT11 model, had to be modified to enable accurate representation of vehicle movements. This deficiency may have contributed to producing different results.

Two elements were modified in the AIMSUN2 model: the entry/exit lanes associated with the Motorway On- and Off-Ramps, and roundabouts. While the second of the two was irrelevant to the TRANSYT11 model, modifications of the ramp entry/exit lanes resulted in a difference between the TRANSYT11 and AIMSUN2 networks.

As for the TRANSYT11 model, AIMSUN2 was calibrated for the links measured on five routes using travel time surveys. This operation was performed several times for each of the existing network models, until the model outputs (the modelled travel times) were close enough to the observed values to meet the conditions of the applied statistical tests.

Although both models were deemed to be calibrated, the necessity to use different types of modifications for each model might have had bearing on the noted discrepancies between the outputs of the models.

5.4 Modelling Principles

5.4.1 Background

As noted earlier, the philosophy underlying the two models is entirely different. While TRANSYT11 is a practical tool for improving traffic signalisation on a macroscopic level, AIMSUN2 is used for assessment of proposed transportation schemes on the microscopic level.

Since TRANSYT11 outputs, of both the existing and optimised layouts, were measured on site to make sure that the improvements were achieved, the inputs have to be as close as possible to reality. AIMSUN2 operates outside these requirements, because its outputs apply mainly to schemes proposed for the future.

Therefore the different operating mechanisms between the models could be expected to have significant bearing on the differing outputs. In order to identify these differences, various modelling principles of the two models were examined. The features that were found to contain significant discrepancies are discussed in the following Sections 5.4.2 to 5.4.6.

5.4.2 Traffic Volumes

Each model uses a different technique of determining 'network flows'.

TRANSYT11 requires both 'average total flow' and 'uniform flow source' per link, 'entry flow' per link entry and 'exit flow' per link exit.

AIMSUN2 requires 'entrance flow' per vehicle type and 'turning proportion' per turning movement per vehicle type.

As a result of these input differences, the flows on the links in TRANSYT11 and AIMSUN2 models differ. When these flows are multiplied by link length or by travel time, the values of distance travelled (pcu-km/h*) or travel time (pcu-h/h) are different for each model.

5.4.3 Lane Configuration

Although in theory AIMSUN2 should be able to replicate the TRANSYT11 intersections (lane configuration, etc.) exactly, in practice non-existent additional lanes have to be introduced to provide for conflicting turning movements.

For example, on a combined through and right-turn phase, the right turns should give way to the opposing through-traffic. Modelling the right turns with a give-way command does not guarantee that the through-traffic has right-of-way. In fact, the opposing through-traffic is often stalled, as they are pictorially shown as giving way to the opposing right turns!

Similarly modelling right turns only from a combined through and right-turn lane (with a right-turn arrow for instance) is not possible as both the through-traffic and right turning traffic think they have a green signal, i.e. unopposed right-of-way.

5.4.4 Signal Phasing

TRANSYT11 signal phasing in terms of time allocation, turnings, lane association, etc., can be replicated in AIMSUN2 but only with the aid of lane re-configuration. Therefore, 'user modifications' are required to replicate the existing situation as best as possible.

5.4.5 Link Length

A direct one-to-one relation does not exist between TRANSYT11 'links' and AIMSUN2 'sections'. In general, a TRANSYT11 'link' corresponds to a set of through and/or turning movements of an AIMSUN2 'section'. AIMSUN2 polysections that are entered directly into a junction or node must be considered as being only one section, with the type of TRANSYT11 link depending on the particular characteristic of the last section of the polysection.

No statistics in AIMSUN2 show link lengths. If this information is required then it has to be manually collated (and can include, if so desired, turning distances through junctions).

5.4.6 Saturation Flow Rate & Section Capacity

Corresponding inputs of 'saturation flow rate' in TRANSYT11 and 'section capacity' in AIMSUN2 are based on entirely different principles. Each TRANSYT11 link is assigned with an individual value of the 'saturation flow rate'. It is expressed as the maximum rate at which vehicles enter the intersection (or cross the stop or limit line) during a saturated green period. The rates are determined by manual flow rate surveys, and are entered separately for individual links.

AIMSUN2 sections have an assigned 'section capacity' expressed as the maximum number of vehicles, which enter the intersection (or cross the stop or limit line) during one clock hour. Since one hour comprises periods of red as well as green, the AIMSUN2 section capacities are much lower than the saturation flow rates of TRANSYT11.

In addition, section capacities are usually predetermined as a rigid default value for the whole network, e.g. 900 pcu/h for one-lane sections, 1,800 pcu/h for two-lane sections, etc.

5.5 Conclusions

As shown above, differences exist between the models which impact on the results. The data entered into both models were as close as practicable to each other. The other two aspects which define the effects on the models – model calibration and modelling principles – resulted in significant discrepancies between the results.

These incompatibilities could be overcome if the TRANSYT11 model were a replication of the AIMSUN2 model, and if AIMSUN2 inputs, such as traffic flows, lane configuration, signal phasing and link lengths, were converted to TRANSYT11 inputs (but not the other way around).

Such an approach however is contrary to the TRANSYT11 philosophy, which requires real network data – traffic flows, lane configuration, signal phasing and link lengths – to simulate traffic performance, and to improve it by optimisation of signal setting.

The conclusion is therefore that the outputs of the two models cannot be directly compared.

6. Alternative Integrated Modelling Tools

Investigation of other traffic and transport computer modelling packages that allow for a degree of integration between macroscopic and microscopic levels has shown that a potential solution could be found in the VISUM and VISSIM Software. These were developed at the Technical University of Karlsruhe, Germany, by PTV Planung Transport Verkher AG.

6.1 VISUM Software

VISUM is a comprehensive, flexible software system for transportation planning, travel demand modelling and network data management. VISUM is used by over 600 organisations on six continents for metropolitan, regional, statewide and national planning applications.

Designed for multimodal analysis, VISUM allows users to integrate all relevant modes of transportation (i.e. SOV*, HOV*, truck, bus, train, pedestrians and cyclists) into one consistent network model. Assignment procedures and 4-stage modelling routines meet the requirements of all the different modes.

VISUM is PC-based using MS Windows and offers open data and image exchange into the total Windows environment via clipboard or other interfaces. This open concept allows users to design their own applications using Visual Basic.

VISUM has an easy to use graphical interface that enables users to rapidly design network scenarios, flexibility for importing and exporting data, and to reliably manage data. It can be used for conventional four-step modelling, including equilibrium highway assignment and frequency-based transit assignment.

It also offers specialised and advanced methods, such as activity-based models, dynamic methods or advanced transit models. Fully integrated with the microscopic traffic simulator VISSIM, the PTV Vision Suite provides demand modelling and engineering tools. In many ways it has the functions of AIMSUN2 and the transport modelling software EMME/2 combined.

Using background maps (Figure 6.1) to build a realistic road network applying exact distances and shape is both easy and accurate. Background maps give better understanding of modelled networks to professionals as well as for non-professionals.

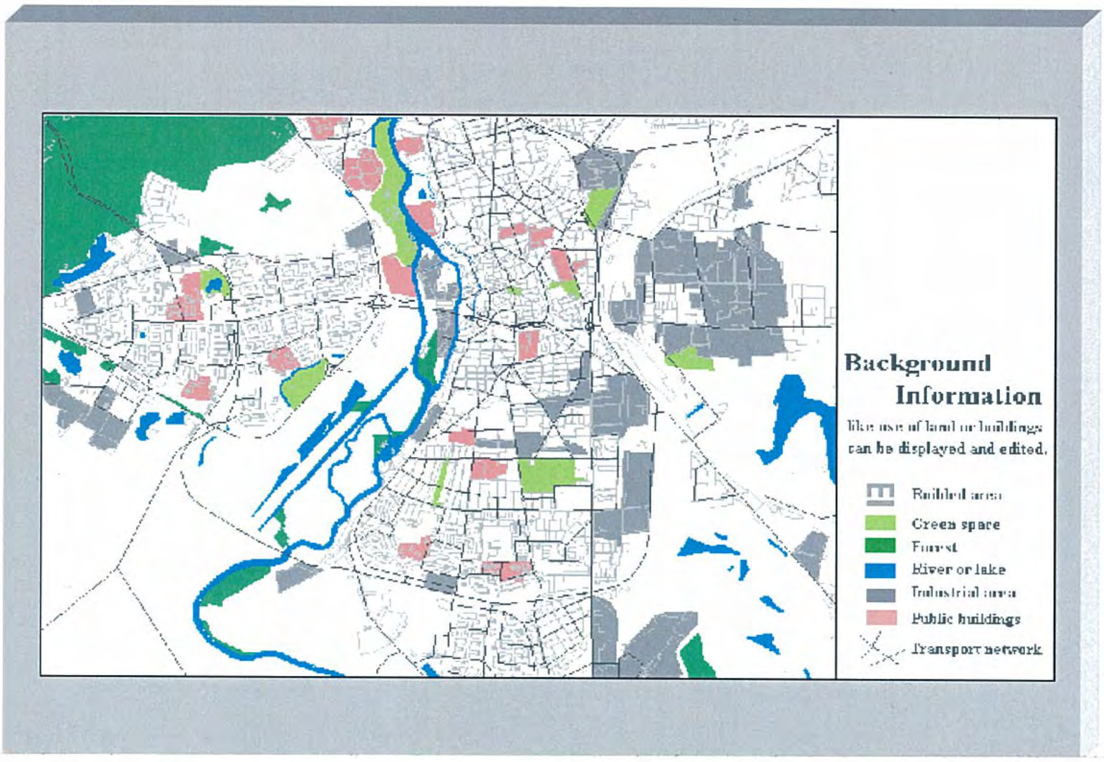


Figure 6.1 Background map of road network used in VISUM modelling.

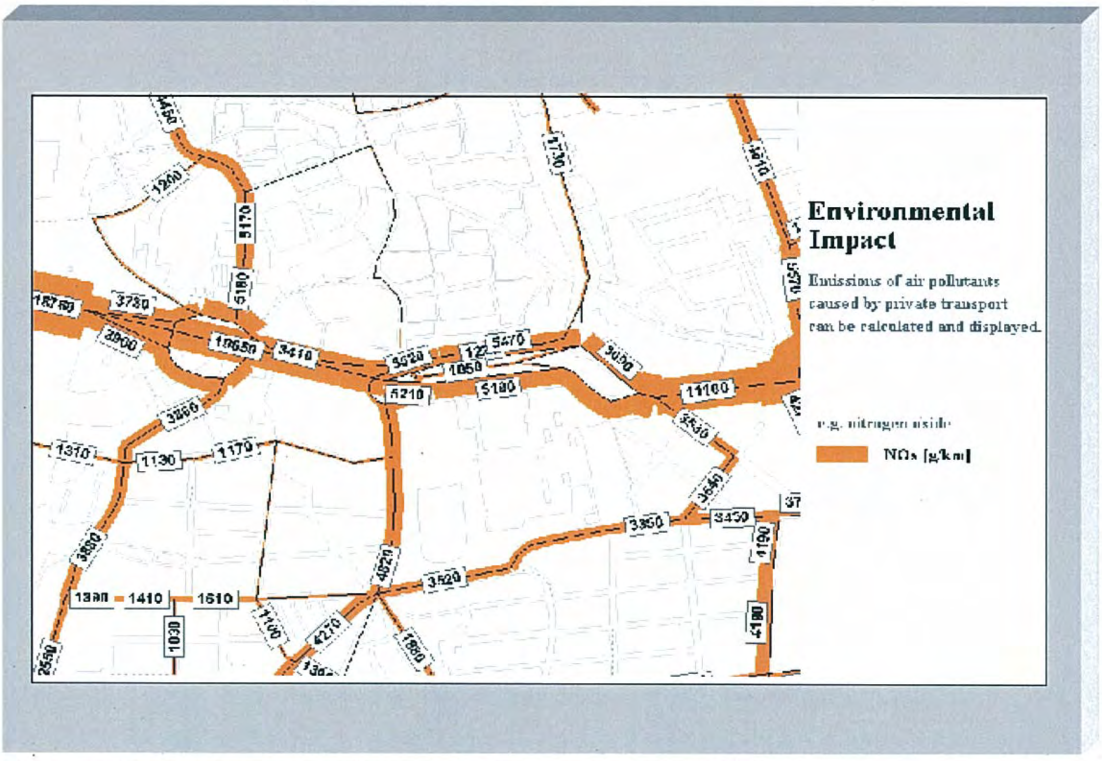


Figure 6.2 Environmental impact map generated by VISUM.

VISUM has a built-in environmental assessment routine that allows calculation of the basic parameters such as noise and emission of pollutants. It has the ability to generate maps (Figure 6.2) showing the effects and extent of these environmental impacts of a network.

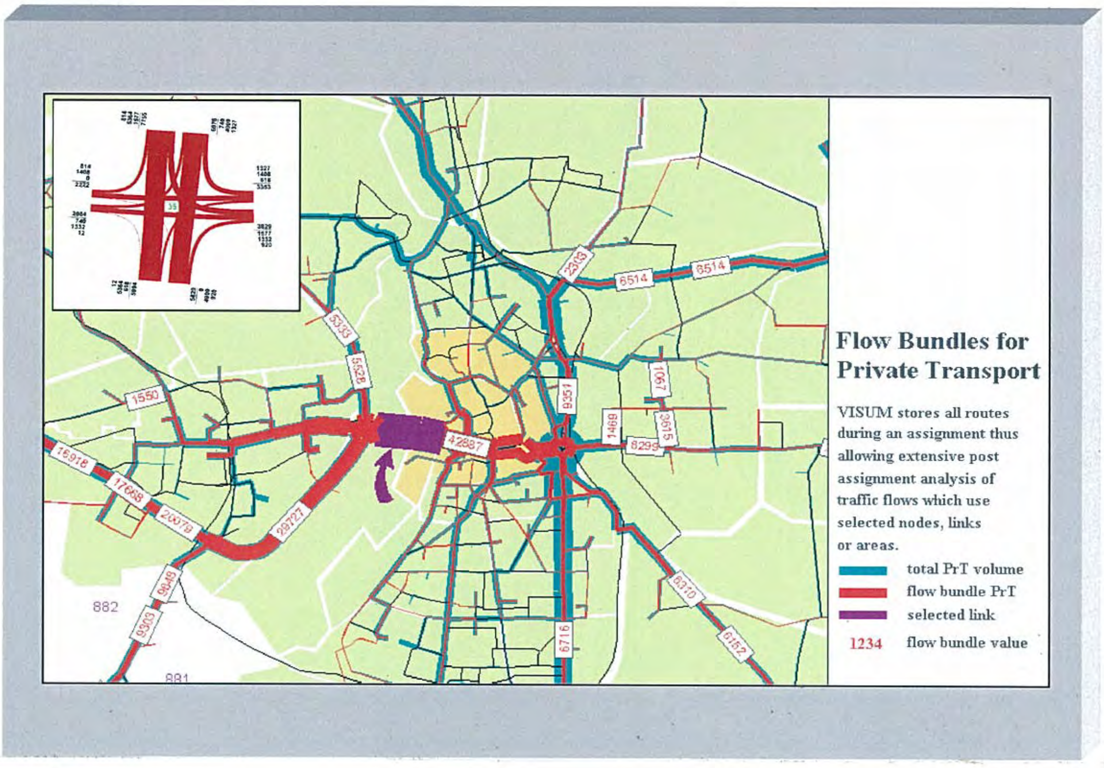


Figure 6.3 Traffic volume charts generated by VISUM.

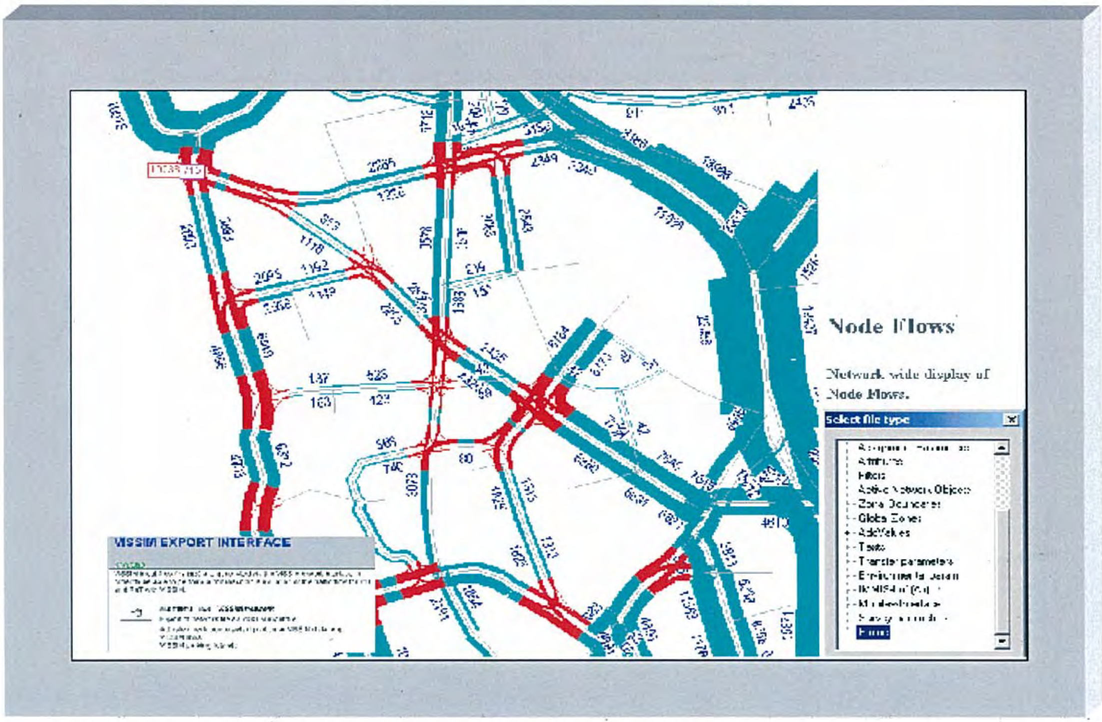


Figure 6.4 Map of node flows (based on pcu-h volumes) generated by VISUM.

VISUM allows a variety of analytical and graphic presentation capabilities (Figure 6.3). Intersection (or node) flows (Figure 6.4) do not require any special coding as is the case with AIMSUN2, but can be entered directly into the model in a way similar to that for TRANSYT11.

6.2 VISSIM Software

VISSIM is a time-step and behaviour-based stochastic microscopic simulation model capable of simulating traffic operations in urban areas with special emphasis on public transportation and/or multi-modal operations.

VISSIM consists of two different programs:
- traffic simulator, and
- signal state generator.

The traffic simulator is a microscopic simulation model comprising car-following logic and lane-changing logic. The car-following logic of VISSIM is based on the psycho-physical driver behaviour model developed in 1974. The simulator is capable of simulating up to ten times per second. The signal state generator is signal control software that polls detector information from the traffic simulator on a discrete time-step basis.

The VISSIM model provides a graphical user interface to construct the transportation network and to view animation. Its interface provides the user with guidance regarding coding errors before the simulation occurs. Users can construct networks using background images in .BMP format, which can be easily generated from CAD programs and aerial photographs.

The strongest difference of VISSIM from typical microscopic simulation models is the independence from a node-link structure. VISSIM's networks are based on links and connectors. This structure allows flexibility when constructing complex intersections or lane alignments, such as roundabouts, curvatures, and short links. This type of modelling allows greater representation of actual network conditions by creating connections which represent the actual flow of traffic, instead of computer-generated connections.

In a recent project at the Waterworks Road–Jubilee Terrace intersection in Brisbane, the model revealed some advantages of VISSIM versus PARAMICS, which is a similar type of software currently used by the RTA* in Sydney. Basic features are the same as for PARAMICS, and the advantages found are:
- Built-in network editor, network definition based on BMP files, junctions can be modelled to any level of detail.
- Explicit pedestrian and cyclist modelling both in 2D and 3D; modelling of crosswalks with any kind of vehicle conflicts; dedicated cyclist behaviour model with adjustable parameters; cycles (and other vehicles) can overtake within same lane (if it is wide enough).
- Full public transport model with stop distributions, line definition and various passenger access models.
- PTV Vision package provides integrated modelling of networks; interface from VISUM (macroscopic/strategic) to VISSIM (microscopic/real-time).

- Easy handling of big networks in VISUM; VISUM junction editor provides microscopic details for each individual junction and allows for ready-to-run VISSIM-export from VISUM.

Figure 6.5 consists of two snapshots taken during the simulation of two options (at grade and grade separated) for the Waterworks Road–Jubilee Terrace project in Brisbane.

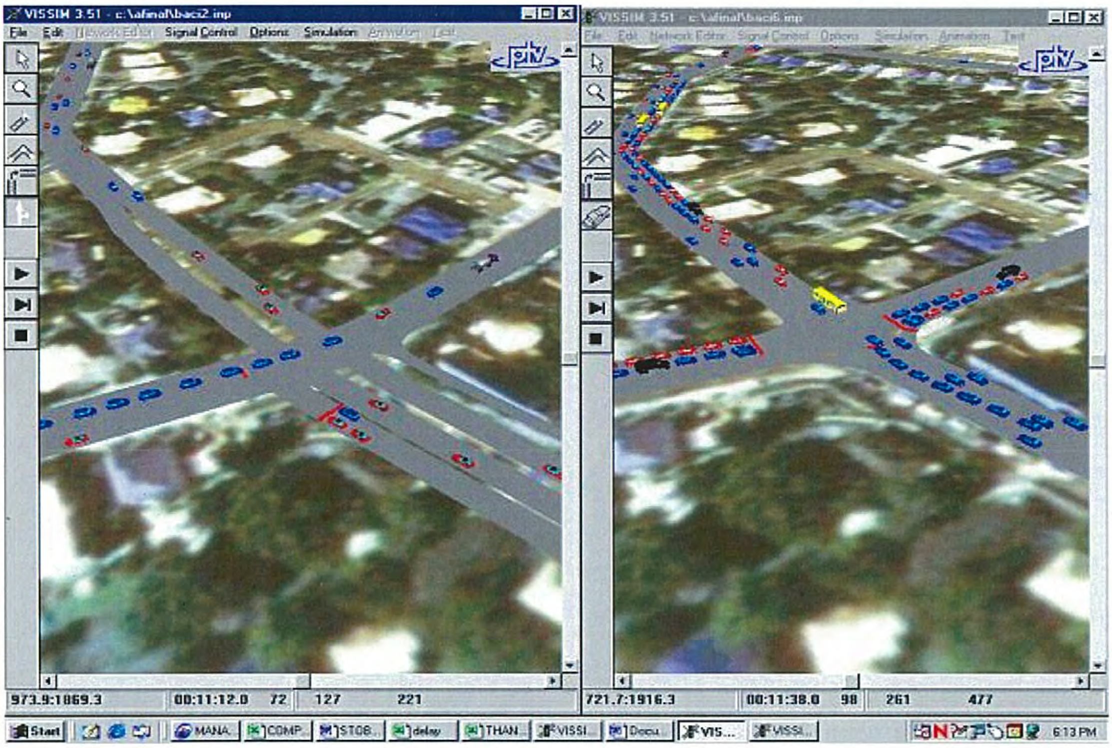


Figure 6.5 Example of a VISSIM modelling output for two options, prepared for the Waterworks Road–Jubilee Terrace project, Brisbane.

6.3 Comments

The capabilities of VISUM and VISSUM, and their ability to integrate, are precisely what this study aimed to do. As discussed earlier (Section 5.5), integration between TRANSYT11 and AIMSUN2 could not be achieved because of a number of reasons. Therefore it is essential to identify microscopic and macroscopic modelling packages that can in fact achieve integration. VISUM and VISSIM are packages that can be considered for such an objective.

7. Conclusions & Recommendations

7.1 General Comments

The purpose of the study was to develop a methodology for better management of an urban street network comprising many different road elements. Such a methodology was proposed and its feasibility tested. The tested methodology was based on an integrated application of two traffic simulation models: TRANSYT11 and AIMSUN2.

TRANSYT11 was developed by the UK Transport Research Laboratory to simulate and optimise the performance of traffic signal networks. It is a macroscopic simulation model, which accepts a relatively coarse level of data input, consisting of network geometric elements, traffic flows and traffic signal settings.

AIMSUN2 was developed at the University of Barcelona as a microscopic simulation tool for evaluation of the performance of traffic in urban networks. It does not have optimisation algorithms. As a microscopic model, it requires detailed vehicle performance parameters, such as acceleration rates, in addition to the input similar to that of TRANSYT11.

AIMSUN2 has a wide range of modelling capabilities, such as testing the impact of incidents, heavy traffic and motorway flow control, and specifically various functions of the ATMS. The specific AIMSUN2 capabilities required for this project included motorway links and priority controlled intersections and roundabouts, which TRANSYT11 either does not simulate at all, or it simulates with a lower degree of accuracy.

The use of both models ensured that both simulation and optimisation aspects of the network management have been covered.

Although the study was limited to the analysis of network performance during one period of the day (morning peak) and one of the traffic management mechanisms (traffic signals), the results demonstrated the following:

- The use of the two models produced results which showed quantified comparison between the existing situation and proposed modifications of the system.
- The two models produced inconsistent results.
- The observed inconsistencies indicate that the tested methodology for better management of urban networks, based on the use of TRANSYT11 and AIMSUN2 model, is not feasible for practical use by road controlling authorities.

7.2 Project Development Issues

The deficiency of the proposed methodology is manifested by a large number of project development issues, which were identified by the study. These issues are outlined here.

Size of the network

A critical appraisal of the size of the study area is important as it determines the quantity of required resources. The experience of the project team indicated that the relationship between the increase in the size of the study area and the resource requirement tended to be exponential rather than linear.

Availability of traffic data

A general impression gained was that adequate traffic data is not readily available. A considerable effort was required to collect additional data needed for filling the gaps and verification of poorly matching counts. This is essentially a typical situation in the case of any traffic study. However, the relatively large size of the analysed network compounds this issue further.

Availability of appropriate manpower

The work has to be carried out from start to finish without interruptions. Expertise is required in the following fields:

- TRANSYT11 and AIMSUN2 modelling;
- Traffic counts, queue lengths and saturation flow surveys;
- Traffic engineering; and
- Roading design.

Planned physical changes to the road network

These changes could include new links, new large traffic generators or even minor intersection upgrading. If the changes to the network occur after the assessment of the existing situation has been done, the project cannot be carried out.

Project time framework

An unintended extension of the project time framework can lead to serious complications because the unprogrammed or unplanned changes to the network may take place in the meantime.

Financial considerations

Since the range of possible network improvements could be large, a critical appraisal of the potential budget would determine what type of improvement measures would be fundable. The measures which would not fit the budget should be eliminated from consideration at an early stage to avoid unnecessary waste of effort. This does not suggest that viable measures should be eliminated from the process. On the contrary these should be clearly identified so that less viable options are removed in the early stages.

Implementation

In addition to the budgetary constraints, some technical difficulties may prevent the implementation of the recommended measures, such as phase changes.

Interpretation of results

The time basis of the TRANSYT11 and AIMSUN2 models are incompatible; therefore the results of each model's simulation have to be interpreted in isolation.

Modelling ability

TRANSYT11's inability to adequately simulate priority controlled junctions limits the size of the network analysed.

7.3 Model Compatibility

Another deficiency of the proposed methodology is manifested by inconsistent results of the two models. This inconsistency is a result of different calibration techniques and different treatment of the inputs to each model. The observed differences that have been described in detail in Chapter 5 were:

- Model calibration;
- Traffic volume input;
- Lane configuration input;
- Signal phasing input;
- Link length treatment;
- Saturation flow treatment.

7.4 Conclusions

The tested methodology demonstrated that the integrated application of the two computer simulation models, AIMSUN2 and TRANSYT11, produced results which showed quantified comparison between the existing situation and proposed modifications of the system.

However substantial differences existed between the results of the two models. The tested methodology had numerous deficiencies in two areas:

- The number and complexity of project development issues.
- Incompatibility of the models.

Because of the above deficiencies the conclusion was that the methodology of an integrated approach to manage urban networks, using TRANSYT11 and AIMSUN2, was not suitable as a predictive tool to assess the effects of the various network-upgrading measures. The number of observed deficiencies was too great to make it a practical working tool for local road controlling authorities.

7.5 Recommendations

The study showed that the methodology based on an integrated application of the two traffic simulation models, TRANSYT11 and AIMSUN2, cannot be recommended as a practical tool to predict the benefits of urban street network improvements.

However this aim could possibly be achieved using traffic simulation models other than TRANSYT11 and AIMSUN2, such as VISUM and VISSIM, though these have yet to be trialled on urban road networks in New Zealand.

Glossary

Some of the traffic planning terms that are less well understood are defined here.

Integration – the development of the methodology for better management of a network comprising many different road elements, not only traffic signal control.

Integrated traffic control strategy – denotes such a management methodology.

Interfacing – the process of converting the output of the TRANSYT11 model to the input of data in the form required for the AIMSUN2 model.

Macroscopic model – a traffic simulation model that accepts a relatively coarse level of data input, consisting of geometric elements, traffic volumes, traffic signal settings, etc., of the network.

Microscopic model – a traffic simulation model that requires, in addition to the parameters required by a macroscopic model, detailed vehicle performance parameters, such as acceleration rates.

Minimum Green Time – the minimum amount of green time (usually 6 seconds) that can be allocated to any traffic movement, even if only for one vehicle. It is measured in seconds/cycle.

Network – all sections of roads, motorways and intersections that fall within the six Subnetworks analysed in this study.

Node – the node (used in an offset for example) is usually one intersection in the network.

Offsets – the offset of an intersection is defined as the phase change time when the change to green for phase 1 is initiated. In this way, the offset is considered as the start of the cycle for the node concerned.

pcu – passenger car unit, used to represent the equivalent number of vehicles if they were all small cars. 1pcu = 1vehicle equivalent only.

pcu/h – number of car equivalents in one hour.

pcu-h/h – total time lapsed (in hours) in a one-hour period.

pcu-km/h – number of kilometres travelled by a car equivalent in an hour.

Performance Index (PI) – a measure which combines several performance statistics, and therefore can be used as a basis for choosing between various design options. The best design gives the smallest PI value.

Signal Phases – the phases of traffic signals (i.e. green, amber, red).

Saturation Flow – the maximum number of vehicles that can cross the stop line (at an intersection with traffic lights) in a one-hour period, as if this movement had been given a full 60 minutes of green time.

Splits – the optimisation process searches for a set of timings for the network that minimises queues and delays. The optimiser (in the program) alters both the signal offsets, which affect the co-ordination between signals, and the durations of the individual phase green times (the green slit) at each node or intersection.

vph – vehicles per hour, a quantity (equivalent to pcu/h).

vph-h = pcu-h/h.

ATMS – Advanced Traffic Management System.

ETCART – East Tamaki Corridor Arterial.

GEH – a method of calibration.

HOV – high occupancy vehicle.

LGA – a Local Government Authority.

RCA – a Road Controlling Authority, including local body councils and Transit NZ.

SCATS – Sydney Co-ordinated Adaptive Traffic Signals.

SOV – single occupancy vehicle.

TNZ – Transit New Zealand, & RCA for State Highway system of New Zealand.

TRL – UK Transport Research Laboratory, Crowthorne, Berkshire, UK (after 1992) (previously TRRL).

TSS – Transport Simulation Systems.

Appendix A

Model Calibration

TRANSFUND NEW ZEALAND

Traffic Signal Integration
TRANSYT11 Model Validation

Statistical Analysis: Chi Square Test Applied to Travel Time

Morning peak travel time was surveyed on Tuesday and Wednesday 28-29 November 2000 between 07:00 and 09:00. Travel time was recorded on three routes:

Route 21-17	Great South Road between Tui Road and East Tamaki Road
Route 17-10	East Tamaki Road between Great South Road and Bairds Road
Route 17-21	Great South Road between East Tamaki Road and Tui Road

Route 21-17

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)
			01:34
O1	02:12	132.00	94.00
O2	02:06	126.00	94.00
O3	01:16	76.00	94.00
O4	01:40	100.00	94.00
O5	01:48	108.00	94.00
O6	01:09	69.00	94.00
O7	01:59	119.00	94.00
O8	01:59	119.00	94.00
O9	00:57	57.00	94.00
O10	01:54	114.00	94.00
O11	02:06	126.00	94.00
mean		104.18	94.00

Route 17-21 .

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)
			01:55
O1	01:49	109.00	115.00
O2	02:03	123.00	115.00
O3	02:23	143.00	115.00
O4	01:21	81.00	115.00
O5	01:45	105.00	115.00
O6	01:39	99.00	115.00
O7	02:04	124.00	115.00
O8	02:52	172.00	115.00
O9	01:06	66.00	115.00
O10	01:29	89.00	115.00
O11	01:49	109.00	115.00
mean		110.91	115.00

Route 17-10

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)
			04:42
O1	04:01	241.00	282.00
O2	04:11	251.00	282.00
O3	06:08	368.00	282.00
O4	06:09	369.00	282.00
O5	04:45	285.00	282.00
O6	04:50	290.00	282.00
O7	06:12	372.00	282.00
O8	03:29	209.00	282.00
O9	04:13	253.00	282.00
O10	03:51	231.00	282.00
O11	03:35	215.00	282.00
O12	03:46	226.00	282.00
O13	04:25	265.00	282.00
O14	04:05	245.00	282.00
O15	05:26	326.00	282.00
O16	03:40	220.00	282.00
O17	02:43	163.00	282.00
mean		266.41	282.00

Chi Square Test	Route 21 - 17	Route 17 - 10	Route 17 - 21	CHI^2 data	CHI^2 0.05;2
estimated Ej	94.00	282.00	115.00		
observed Oj	104.18	266.41	110.91		
CHI^2	1.103	0.862	0.146	2.110	5.991

Results: Chi Square (data) is lower than Chi Square (tables) for a significance level 0.05. Therefore the data fit is accepted, confirming that the model is a reasonable representation of the existing system.

rid	ame strea	tfrom	tto	ctype	flow	density	spd1	spd2	ttime1	ttime2	dtime1	dtime2	stime1	stime2	nstops	travel	fuelc	qmean	qmax
1	21-17	25200	32400	0	211	10.210189	35.032799	-1	111	-1	59	-1	44	-1	2.222433	700.527405	-1	3.039365	30.333334
2	21-17	25200	32400	0	219	10.87635	34.615425	-1	115	-1	63	-1	47	-1	2.519758	734.201233	-1	3.340456	30
3	21-17	25200	32400	0	209	10.325361	34.578899	-1	114	-1	61	-1	46	-1	2.521572	700.496826	-1	3.026171	29.833334
4	21-17	25200	32400	0	204	9.858171	35.123421	-1	113	-1	61	-1	46	-1	2.253537	677.772156	-1	2.992817	29
5	21-17	25200	32400	0	198	10.25624	34.613014	-1	112	-1	59	-1	46	-1	2.300112	693.376526	-1	3.089405	33
									113										
									01:53 mins										
1	17-21	25200	32400	0	451	10.670158	34.685879	-1	100	-1	49	-1	38	-1	1.994394	782.083923	-1	1.722857	22.5
2	17-21	25200	32400	0	456	10.611988	34.505116	-1	103	-1	52	-1	41	-1	2.042033	780.316772	-1	1.763869	21.5
3	17-21	25200	32400	0	444	10.410111	34.507782	-1	102	-1	50	-1	39	-1	1.991167	755.625183	-1	1.69625	19.25
4	17-21	25200	32400	0	468	11.012609	34.141891	-1	104	-1	53	-1	42	-1	2.124086	808.111938	-1	1.859137	19.5
5	17-21	25200	32400	0	477	10.804848	34.452469	-1	103	-1	52	-1	41	-1	2.091868	798.371338	-1	1.797113	20.25
									102										
									01:42 mins										
1	10-22	25200	32400	0	15	9.279093	52.273914	-1	319	-1	161	-1	134	-1	4.348603	2140.358643	-1	4.184206	42
2	10-22	25200	32400	0	15	10.151782	52.268116	-1	342	-1	184	-1	154	-1	4.765105	2204.195313	-1	4.600238	41.166664
3	10-22	25200	32400	0	15	9.300879	52.363998	-1	323	-1	165	-1	137	-1	4.454889	2143.627441	-1	4.197361	41
4	10-22	25200	32400	0	17	11.517514	51.700043	-1	379	-1	221	-1	195	-1	5.504108	2149.838867	-1	5.909345	42
5	10-22	25200	32400	0	15	9.125952	51.960079	-1	328	-1	169	-1	138	-1	4.392362	2098.850342	-1	4.109921	34.666664
									338										
									05:38 mins										
1	7-10	25200	32400	0	142	7.775761	45.539433	-1	237	-1	71	-1	45	-1	1.246657	1976.764771	-1	2.533333	20.5
2	7-10	25200	32400	0	153	7.950131	45.609886	-1	234	-1	68	-1	45	-1	1.259012	2011.339478	-1	2.751726	22
3	7-10	25200	32400	0	129	7.519557	45.596092	-1	239	-1	73	-1	46	-1	1.38875	1923.199707	-1	2.305655	22.5
4	7-10	25200	32400	0	139	7.372101	45.757252	-1	226	-1	60	-1	41	-1	1.169667	1922.471802	-1	2.120476	21
5	7-10	25200	32400	0	130	7.244597	45.609135	-1	235	-1	69	-1	45	-1	1.211107	1858.550049	-1	2.396131	19.5
									234										
									03:54 mins										
1	14-15	25200	32400	0	1	13.536495	61.886013	-1	524	-1	198	-1	129	-1	6.690104	31160.09375	-1	9.526806	70.833336
2	14-15	25200	32400	0	1	10.751749	63.778927	-1	448	-1	123	-1	70	-1	2.778947	30322.63086	-1	4.706845	48.5
3	14-15	25200	32400	0	1	11.149924	63.350887	-1	461	-1	135	-1	76	-1	3.247486	30896.18555	-1	5.259801	51.666668
4	14-15	25200	32400	0	1	10.8154	63.507454	-1	449	-1	123	-1	66	-1	2.584477	30697.5293	-1	4.787798	44
5	14-15	25200	32400	0	1	11.107252	63.559181	-1	448	-1	123	-1	68	-1	2.736625	31058.70508	-1	4.946608	47.166668
									466										
									07:46 mins										

Random Seeds = (rid = 1) 3779, (rid = 2) 7694, (rid = 3) 5709, (rid = 4) 3449 and (rid = 5) 5696

AIMSUN 2 CALIBRATION
ESTIMATED TRAVEL TIME

TRANSFUND NEW ZEALAND

Traffic Signal Integration
AIMSUN2 Model Validation

Statistical Analysis: GEH Test Applied to Travel Time
PEM p.5-74ff

Morning peak travel time was surveyed on Tuesday and Wednesday 28-29 November 2000 between 07:00 and 09:00. Travel time was recorded on five routes:

Route 21-17	Great South Road between Tui Road and East Tamaki Road
Route 17-21	Great South Road between East Tamaki Road and Tui Road
Route 10-22	From East Tamaki Road to GSR via Bairds Road and Reagan Road
Route 7-10	From Reagan Road to East Tamaki Road via Preston Road and Bairds Road
Motorway 14-15	From East Tamaki Road interchange to Redoubt Road interchange and back

Route 21-17

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)	GEH	
			01:53		
O1	02:12	132.00	113.00	1.7	OK
O2	02:06	126.00	113.00	1.2	OK
O3	01:16	76.00	113.00	3.8	OK
O4	01:40	100.00	113.00	1.3	OK
O5	01:48	108.00	113.00	0.5	OK
O6	01:09	69.00	113.00	4.6	OK
O7	01:59	119.00	113.00	0.6	OK
O8	01:59	119.00	113.00	0.6	OK
O9	00:57	57.00	113.00	6.1	>5
O10	01:54	114.00	113.00	0.1	OK
O11	02:06	126.00	113.00	1.2	OK
Average	**01:44**	**104.18**			

Route 17 - 21

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)	GEH	
			01:42		
O1	01:49	109.00	102.40	0.6	OK
O2	02:03	123.00	102.40	1.9	OK
O3	02:23	143.00	102.40	3.7	OK
O4	01:21	81.00	102.40	2.2	OK
O5	01:45	105.00	102.40	0.3	OK
O6	01:39	99.00	102.40	0.3	OK
O7	02:04	124.00	102.40	2.0	OK
O8	02:52	172.00	102.40	5.9	>5
O9	01:06	66.00	102.40	4.0	OK
O10	01:29	89.00	102.40	1.4	OK
O11	01:49	109.00	102.40	0.6	OK
	01:50	**110.91**			

Route 10 - 22

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)	GEH	
			05:38		
O1	04:09	249.00	338.20	5.2	>5
O2	04:07	247.00	338.20	5.3	>5
O3	04:35	275.00	338.20	3.6	OK
O4	04:26	266.00	338.20	4.2	OK
O5	04:57	297.00	338.20	2.3	OK
O6	04:44	284.00	338.20	3.1	OK
Average	**04:29**	**269.67**			

Route 7 - 10

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)	GEH	
			03:54		
O1	03:41	221.00	234.20	0.9	OK
O2	03:37	217.00	234.20	1.1	OK
O3	04:55	295.00	234.20	3.7	OK
O4	04:12	252.00	234.20	1.1	OK
O5	05:59	359.00	234.20	7.2	>5
O6	03:41	221.00	234.20	0.9	OK
	04:20	**260.83**			

Motorway 14 - 15

Run No	Time (min)	Observed Oj (s)	Estimated Ej (s)	GEH	
			07:46		
O1	08:46	526.00	466.00	2.7	OK
O2	06:58	418.00	466.00	2.3	OK
O3	07:09	429.00	466.00	1.7	OK
O4	06:39	399.00	466.00	3.2	OK
Average	**07:23**	**443.00**			

NOTE OK denotes GEH less than 5

Results	Total Observations	38				
	Total GEH < 5	33	87%	>	60%	required by the PEM.

Therefore the model is a reasonable representation of the existing network

Appendix B

TRANSYT11 – Network Simulation and Optimisation Results

T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible, running under Microsoft Windows 95

Program TRANSYT 11, Analysis Program Version 1.1

Run with file:- "MODTFAAMAPR01.DAT" at 09:22 on 09/04/01

Transfund NZ : Traffic Signal Integration - Network A am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

```
NUMBER OF NODES                      =   4
NUMBER OF LINKS                      =  26
NUMBER OF OPTIMISED NODES            =   4
MAXIMUM NUMBER OF GRAPHIC PLOTS      =   0
NUMBER OF STEPS IN CYCLE             =  60
MAXIMUM NUMBER OF SHARED STOPLINES   =   0
MAXIMUM NUMBER OF TIMING POINTS      =   4
MAXIMUM LINKS AT ANY NODE            =   8

CORE REQUESTED =    6642 WORDS
CORE AVAILABLE =   72000 WORDS
```

DATA INPUT :-

CARD NO.	CARD TYPE
(1)=	TITLE:- Transfund NZ : Traffic Signal Integration - Network A am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	EFFECTIVE-GREEN DISPLACEMENTS END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	120	60	60	2	3	1	1	0	0	1	2	0	0	1550	283

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	4	1	3	1	0	0	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	14	1	0	38	40	25	71	23	98	22	0	0	0	0	0	0
5)=	11	2	0	100	0	0	0	0	0	0	0	0	0	0	0	0
6)=	13	3	0	41	41	48	92	24	0	0	0	0	0	0	0	0
7)=	12	4	0	30	49	27	0	0	0	0	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	PRIORITY LINKS LINK2 NO.	LINK1 ONLY % FLOW	GIVEWAY COEFFS. A1 X100	GIVEWAY COEFFS. A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
8)=	30	111	122	133	0	22	22	0	0	0	0	200	0	800	0	0
9)=	30	121	132	143	0	25	0	0	0	0	0	200	0	800	0	0
10)=	30	131	142	113	0	25	0	0	0	0	0	420	0	800	0	0
11)=	30	141	112	123	0	22	22	0	0	0	0	50	0	800	0	0
12)=	30	221	243	0	100	22	0	0	0	0	0	100	0	800	0	0
13)=	30	243	222	0	0	22	0	0	0	0	0	310	0	800	0	0
14)=	30	311	322	0	0	22	0	0	0	0	0	200	0	800	0	0
15)=	30	321	343	0	0	22	0	0	0	0	0	310	0	800	0	0
16)=	30	441	412	0	0	22	0	0	0	0	0	200	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	FIRST GREEN START LAG	FIRST GREEN END STAGE	FIRST GREEN END LAG	SECOND GREEN START STAGE	SECOND GREEN START LAG	SECOND GREEN END STAGE	SECOND GREEN END LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
17)=	31	112	1	3	6	4	0	0	0	0	0	200	0	3600	0	0
18)=	31	113	1	2	5	3	0	0	0	0	0	200	0	1700	0	0
19)=	31	122	1	1	6	2	0	0	0	0	0	200	0	3600	0	0
20)=	31	123	1	4	6	1	0	0	0	0	0	200	0	1650	0	0
21)=	31	132	1	3	5	4	0	0	0	0	0	420	0	3600	0	0
22)=	31	133	1	2	8	3	0	0	0	0	0	420	0	2200	0	0
23)=	31	142	1	1	6	2	0	0	0	0	0	200	0	3470	0	0
24)=	31	143	1	4	6	1	0	0	0	0	0	200	0	1900	0	0
25)=	31	222	0	0	0	0	0	0	0	0	0	140	0	3400	0	0
26)=	31	242	0	0	0	0	0	0	0	0	0	310	0	3700	0	0
27)=	31	313	3	2	8	3	0	0	0	0	0	200	0	3380	0	0
28)=	31	322	3	1	5	2	0	0	0	0	0	320	0	3550	0	0
29)=	31	342	3	3	5	2	0	0	0	0	0	200	0	3440	0	0
30)=	31	343	3	3	5	1	0	0	0	0	0	200	0	1340	0	0
31)=	31	412	4	1	5	2	0	0	0	0	0	410	0	3750	0	0
32)=	31	432	4	1	5	2	0	0	0	0	0	200	0	3200	0	0
33)=	31	443	4	2	5	1	0	0	0	0	0	200	0	3100	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	ENTRY 1 FLOW	ENTRY 1 CRUISE SPEED	ENTRY 2 LINK NO.	ENTRY 2 FLOW	ENTRY 2 CRUISE SPEED	ENTRY 3 LINK NO.	ENTRY 3 FLOW	ENTRY 3 CRUISE SPEED	ENTRY 4 LINK NO.	ENTRY 4 FLOW	ENTRY 4 CRUISE SPEED
34)=	32	111	300	0	0	0	50	0	0	0	0	0	0	0	0	0
35)=	32	112	200	0	0	0	50	0	0	0	0	0	0	0	0	0
36)=	32	113	50	0	0	0	50	0	0	0	0	0	0	0	0	0
37)=	32	121	100	0	0	0	55	0	0	0	0	0	0	0	0	0
38)=	32	122	650	0	0	0	50	0	0	0	0	0	0	0	0	0
39)=	32	123	50	0	0	0	50	0	0	0	0	0	0	0	0	0
40)=	32	131	550	0	432	200	50	443	350	50	0	0	0	0	0	0
41)=	32	132	800	0	432	400	50	443	400	45	0	0	0	0	0	0
42)=	32	133	450	0	432	200	50	443	250	45	0	0	0	0	0	0
43)=	32	141	300	0	242	300	50	0	0	0	0	0	0	0	0	0
44)=	32	142	900	0	242	900	50	0	0	0	0	0	0	0	0	0
45)=	32	143	200	0	242	200	50	0	0	0	0	0	0	0	0	0
46)=	32	221	485	0	111	180	50	122	100	50	133	200	60	0	0	0
47)=	32	222	850	0	111	100	50	122	600	50	133	150	60	0	0	0
48)=	32	242	1550	0	342	650	50	313	900	50	0	0	0	0	0	0
49)=	32	243	550	0	342	580	50	0	0	0	0	0	0	0	0	0
50)=	32	311	100	0	0	0	50	0	0	0	0	0	0	0	0	0
51)=	32	313	900	0	0	0	50	0	0	0	0	0	0	0	0	0
52)=	32	321	450	0	222	450	45	0	0	0	0	0	0	0	0	0
53)=	32	322	400	0	222	400	45	0	0	0	0	0	0	0	0	0
54)=	32	342	1350	0	0	0	45	0	0	0	0	0	0	0	0	0
55)=	32	343	150	0	0	0	45	0	0	0	0	0	0	0	0	0
56)=	32	412	600	0	112	250	50	123	50	50	141	300	50	0	0	0
57)=	32	432	900	0	0	0	50	0	0	0	0	0	0	0	0	0
58)=	32	441	150	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	443	1300	0	0	0	50	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT*****

120 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
1	4	0	38	69	98			
2	1	0						
3	3	0	41	92				
4	2	0	49					

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES CRUISE (SEC)	PER PCU DELAY (SEC)	DELAY: UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY: RANDOM+ OVERSAT	DELAY: COST OF DELAY ($/H)	STOPS: MEAN STOPS /PCU (%)	STOPS: COST OF STOPS ($/H)	QUEUE: MEAN MAX. (PCU)	QUEUE: AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	GREEN TIMES END 1ST	GREEN TIMES START 2ND	GREEN TIMES END 2ND
111	300	800	54	14	10	0.2 +	0.6	(12.4)	29	(3.3)	3		15.7					
112	200	3600	28	14	44	2.3 +	0.2	(38.0)	85	(6.4)	6		44.4	1	75	98		
113	50	1700	13	14	42	0.5 +	0.1	(9.1)	81	(1.5)	1		10.7	1	43	69		
121	100	800	16	13	6	0.1 +	0.1	(2.7)	24	(1.1)	1		3.8					
122	650	3600	66	14	44	7.0 +	1.0	(122.5)	89	(22.0)	20		144.5	1	6	38		
123	50	1650	21	14	55	0.6 +	0.1	(11.9)	93	(1.8)	2		13.7	1	104	0		
131	551	800	93	30	43	1.2 +	5.3	(101.6)	76	(15.8)	15		117.4					
132	800	3600	107	32	192	11.3 +	31.4	(662.0)	182	(55.3)	58		717.3	1	74	98		
133	449	2200	102	32	150	5.4 +	13.2	(289.1)	167	(28.5)	28		317.6	1	46	69		
141	301	800	40	4	4	0.0 +	0.3	(5.7)	11	(1.2)	2		6.9					
142	899	3470	94	14	65	9.6 +	6.6	(252.0)	115	(39.1)	36		291.1	1	6	38		
143	202	1900	75	14	67	2.3 +	1.4	(57.9)	111	(8.4)	8		66.3	1	104	0		
221	481	800	60	7	8	0.3 +	0.8	(16.9)	38	(7.1)	9	+	23.9					
222	848	3400	25	10	1	0.0 +	0.2	(2.6)	1	(0.2)	0		2.8					
242	1551	3700	42	22	1	0.0 +	0.4	(5.6)	1	(0.4)	0		6.0					
243	551	800	90	22	55	4.5 +	3.9	(130.1)	105	(21.9)	21		152.0					
311	100	800	14	14	3	0.0 +	0.1	(1.5)	9	(0.4)	0		1.8					
313	900	3380	73	14	38	8.2 +	1.3	(147.5)	87	(29.7)	27		177.1	3	49	92		
321	449	800	59	25	11	0.7 +	0.7	(21.4)	64	(8.8)	12		30.2					
322	398	3550	36	26	60	6.3 +	0.3	(102.7)	92	(11.3)	12		114.0	3	5	41		
342	1350	3440	72	16	24	7.8 +	1.3	(140.8)	74	(30.5)	35		171.4	3	97	41		
343	150	1340	56	16	58	1.8 +	0.6	(37.7)	99	(4.6)	5		42.2	3	97	0		
412	601	3750	43	30	23	3.5 +	0.4	(60.2)	84	(19.0)	17		79.2	4	5	49		
432	900	3200	75	14	39	8.1 +	1.5	(149.3)	88	(30.0)	27		179.3	4	5	49		
441	150	800	22	14	5	0.1 +	0.1	(3.1)	16	(0.9)	1		3.9					
443	1300	3100	75	14	24	7.3 +	1.5	(136.1)	75	(36.7)	34		172.8	4	54	0		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	235.6	15.1	89.3	73.3	(2520.3)	+	(386.0)	+	(0.0)	=	2906.3	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	191.3	+	187.0	+	161.6	=	539.9

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 26

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18
- (SECONDS)

1	4	84	2	33	62
2	1	0			
3	3	0	41	92	
4	2	102	31		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	232.2	15.3	85.9	73.3	(2468.3)	+	(383.9)	+	(0.0)	=	2852.2	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 215

```
    120 SECOND CYCLE  60 STEPS

 INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48
  - (SECONDS)

     1        4       84        2        33        62
     2        1        0
     3        3        0       41        92
     4        2       54      103

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME       JOURNEY       UNIFORM  RANDOM+    COST          COST            FOR        PERFORMANCE
 TRAVELLED        SPENT       SPEED         DELAY   OVERSAT     OF            OF            EXCESS         INDEX
                                                     DELAY     DELAY         STOPS          QUEUES
 (PCU-KM/H)     (PCU-H/H)     (KM/H)      (PCU-H/H) (PCU-H/H)  ($/H)         ($/H)           ($/H)          ($/H)

   3563.0         232.2        15.3          86.0     73.3    (2469.0) + (  381.6)  +  (    0.0)   =    2850.5      TOTALS

 NO. OF ENTRIES TO SUBPT  =   10
 NO. OF LINKS RECALCULATED=  174


    120 SECOND CYCLE  60 STEPS

 INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48  -1
  - (SECONDS)

     1        4       84        2        31        62
     2        1        0
     3        3      119       43        93
     4        2       52      103

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME       JOURNEY       UNIFORM  RANDOM+    COST          COST            FOR        PERFORMANCE
 TRAVELLED        SPENT       SPEED         DELAY   OVERSAT     OF            OF            EXCESS         INDEX
                                                     DELAY     DELAY         STOPS          QUEUES
 (PCU-KM/H)     (PCU-H/H)     (KM/H)      (PCU-H/H) (PCU-H/H)  ($/H)         ($/H)           ($/H)          ($/H)

   3563.0         225.9        15.8          85.3     67.6    (2370.5) + (  372.1)  +  (    0.0)   =    2742.6      TOTALS

 NO. OF ENTRIES TO SUBPT  =   29
 NO. OF LINKS RECALCULATED=  454


    120 SECOND CYCLE  60 STEPS

 INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48  -1  18
  - (SECONDS)

     1        4       84        2        31        62
     2        1        0
     3        3      119       43        93
     4        2       70        1

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME       JOURNEY       UNIFORM  RANDOM+    COST          COST            FOR        PERFORMANCE
 TRAVELLED        SPENT       SPEED         DELAY   OVERSAT     OF            OF            EXCESS         INDEX
                                                     DELAY     DELAY         STOPS          QUEUES
 (PCU-KM/H)     (PCU-H/H)     (KM/H)      (PCU-H/H) (PCU-H/H)  ($/H)         ($/H)           ($/H)          ($/H)

   3563.0         225.0        15.8          84.5     67.6    (2357.4) + (  370.2)  +  (    0.0)   =    2727.6      TOTALS

 NO. OF ENTRIES TO SUBPT  =    9
 NO. OF LINKS RECALCULATED=  167


    120 SECOND CYCLE  60 STEPS

 INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48  -1  18  48
  - (SECONDS)

     1        4       84        2        31        62
     2        1        0
     3        3      119       43        93
     4        2       70        1

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME       JOURNEY       UNIFORM  RANDOM+    COST          COST            FOR        PERFORMANCE
 TRAVELLED        SPENT       SPEED         DELAY   OVERSAT     OF            OF            EXCESS         INDEX
                                                     DELAY     DELAY         STOPS          QUEUES
 (PCU-KM/H)     (PCU-H/H)     (KM/H)      (PCU-H/H) (PCU-H/H)  ($/H)         ($/H)           ($/H)          ($/H)

   3563.0         225.0        15.8          84.5     67.6    (2357.4) + (  370.2)  +  (    0.0)   =    2727.6      TOTALS

 NO. OF ENTRIES TO SUBPT  =    9
 NO. OF LINKS RECALCULATED=  167
```

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1
- (SECONDS)

1	4	81	119	28	59
2	1	0			
3	3	0	44	94	
4	2	70	1		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	224.5	15.9	83.9	67.7	(2349.7)	+	(372.6)	+	(0.0)	=	2722.2	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 227

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1 -1
- (SECONDS)

1	4	81	119	28	59
2	1	0			
3	3	2	44	94	
4	2	72	1		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	224.3	15.9	83.8	67.6	(2346.0)	+	(368.8)	+	(0.0)	=	2714.8	TOTALS

NO. OF ENTRIES TO SUBPT = 29
NO. OF LINKS RECALCULATED= 480

120 SECOND CYCLE 60 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 18 48 -1 18 48 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
1	4	81	119	28	59			
2	1	0						
3	3	2	44	94				
4	2	76	5					

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY: UNIFORM (PCU-H/H)	DELAY: RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	DELAY: COST OF DELAY ($/H)	STOPS: MEAN STOPS /PCU (%)	STOPS: COST OF STOPS ($/H)	QUEUE: MEAN MAX. (PCU)	QUEUE: AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES 1ST START (SECONDS)	GREEN TIMES 1ST END (SECONDS)	GREEN TIMES 2ND START (SECONDS)	GREEN TIMES 2ND END (SECONDS)
111	300	800	53	14	9	0.2 +	0.6	(11.8)	28	(3.2)	3		14.9					
112	200	3600	26	14	42	2.2 +	0.2	(36.3)	82	(6.2)	6		42.5	1	34	59		
113	50	1700	14	14	45	0.5 +	0.1	(9.6)	84	(1.6)	1		11.2	1	4	28		
121	100	800	16	13	7	0.1 +	0.1	(2.9)	24	(1.1)	1		4.0					
122	650	3600	66	14	44	6.9 +	1.0	(122.4)	89	(22.0)	20		144.4	1	87	119		
123	50	1650	21	14	55	0.6 +	0.1	(11.9)	94	(1.8)	2		13.7	1	65	81		
131	551	800	93	30	43	1.2 +	5.4	(101.4)	74	(15.4)	14		116.7					
132	800	3600	99	32	101	10.6 +	11.9	(347.6)	136	(41.2)	38		388.8	1	33	59		
133	449	2200	111	32	273	6.8 +	27.2	(526.8)	209	(35.6)	42		562.4	1	7	28		
141	301	800	40	4	4	0.0 +	0.3	(5.5)	7	(0.8)	1		6.3					
142	899	3470	94	14	61	8.6 +	6.6	(236.5)	108	(37.0)	35		273.5	1	87	119		
143	202	1900	75	14	86	3.4 +	1.4	(74.9)	119	(9.0)	8		83.9	1	65	81		
221	465<	800	58	7	7	0.3 +	0.7	(15.0)	34	(6.2)	8	+	21.2					
222	836<	3400	25	10	1	0.0 +	0.2	(2.5)	1	(0.2)	0		2.7					
242	1551	3700	42	22	1	0.0 +	0.4	(5.6)	1	(0.4)	0		6.0					
243	551	800	89	22	42	2.7 +	3.8	(99.6)	108	(22.6)	22		122.2					
311	100	800	14	14	3	0.0 +	0.1	(1.3)	5	(0.2)	0		1.5					
313	900	3380	74	14	39	8.4 +	1.4	(152.7)	88	(30.1)	27		182.8	3	52	94		
321	443	800	58	25	11	0.7 +	0.7	(21.0)	64	(8.8)	13		29.8					
322	393	3550	35	26	18	1.7 +	0.3	(29.9)	46	(5.7)	8		35.6	3	7	44		
342	1350	3440	71	16	23	7.5 +	1.2	(135.4)	72	(29.9)	34		165.3	3	99	44		
343	150	1340	56	16	58	1.8 +	0.6	(37.7)	99	(4.6)	5		42.2	3	99	2		
412	601	3750	43	30	26	4.0 +	0.4	(67.4)	79	(18.0)	16		85.4	4	81	5		
432	900	3200	75	14	39	8.1 +	1.5	(149.3)	88	(30.0)	27		179.3	4	81	5		
441	150	800	22	14	5	0.0 +	0.1	(2.9)	15	(0.8)	1		3.8					
443	1300	3100	75	14	24	7.3 +	1.5	(136.1)	75	(36.7)	34		172.8	4	10	76		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	224.2	15.9	83.7	67.6	(2344.2)	+	(368.9)	+	(0.0)	=	2713.1	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	191.3	+	173.9	+	154.4	=	519.6

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 191

PROGRAM TRANSYT FINISHED

== end of file ==

[Printed at 12:03:50 on 08/05/2003]

T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible, running under Microsoft Windows 95

Program TRANSYT 11, Analysis Program Version 1.1

Run with file:- "MODTFBAMAPR01.DAT" at 09:31 on 09/04/01

Transfund : Signal Integration - Network B am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

```
NUMBER OF NODES                      =   3
NUMBER OF LINKS                      =  27
NUMBER OF OPTIMISED NODES            =   4
MAXIMUM NUMBER OF GRAPHIC PLOTS      =   0
NUMBER OF STEPS IN CYCLE             =  60
MAXIMUM NUMBER OF SHARED STOPLINES   =   0
MAXIMUM NUMBER OF TIMING POINTS      =   4
MAXIMUM LINKS AT ANY NODE            =   9

CORE REQUESTED =   6702 WORDS
CORE AVAILABLE =  72000 WORDS
```

DATA INPUT :-

CARD NO. CARD TYPE
(1)= TITLE:- Transfund : Signal Integration - Network B am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	EFFECTIVE-GREEN DISPLACEMENTS END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	120	60	60	2	3	1	1	0	0	1	2	0	0	1550	283

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	22	23	24	22	0	0	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	14	22	0	17	0	36	0	21	0	19	0	0	0	0	0	0
5)=	23	23	0	34	0	16	0	10	0	0	0	0	0	0	0	0
6)=	14	24	0	50	0	13	0	17	0	11	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	PRIORITY LINKS LINK2 NO.	LINK1 GIVEWAY ONLY % FLOW	COEFFS. A1 X100	COEFFS. A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
7)=	30	2211	2222	2233	0	25	0	0	0	0	0	200	0	800	0	0
8)=	30	2231	2242	2213	0	25	0	0	0	0	0	50	0	800	0	0
9)=	30	2241	2212	2223	0	25	0	0	0	0	0	50	0	800	0	0
10)=	30	2321	2332	0	100	0	0	0	0	0	0	200	0	800	0	0
11)=	30	2331	2313	0	100	0	0	0	0	0	0	100	0	800	0	0
12)=	30	2421	2432	2444	0	22	0	0	0	0	0	200	0	800	0	0
13)=	30	2431	2444	2413	0	22	0	0	0	0	0	50	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	FIRST GREEN START LAG	FIRST GREEN END STAGE	FIRST GREEN END LAG	SECOND GREEN START STAGE	SECOND GREEN START LAG	SECOND GREEN END STAGE	SECOND GREEN END LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
14)=	31	2212	22	1	5	2	0	0	0	0	0	999	0	3700	0	0
15)=	31	2213	22	4	5	1	0	0	0	0	0	200	0	1550	0	0
16)=	31	2221	22	3	5	4	0	0	0	0	0	999	0	1550	0	0
17)=	31	2222	22	3	5	4	0	0	0	0	0	999	0	1800	0	0
18)=	31	2223	22	3	5	4	0	0	0	0	0	999	0	1530	0	0
19)=	31	2232	22	1	5	2	0	0	0	0	0	680	0	3500	0	0
20)=	31	2233	22	4	5	1	0	0	0	0	0	680	0	2800	0	0
21)=	31	2242	22	2	5	3	0	0	0	0	0	999	0	1800	0	0
22)=	31	2243	22	2	5	3	0	0	0	0	0	999	0	1700	0	0
23)=	31	2312	23	1	5	3	0	0	0	0	0	685	0	3500	0	0
24)=	31	2313	23	2	5	3	0	0	0	0	0	100	0	1700	0	0
25)=	31	2323	23	3	5	1	0	0	0	0	0	999	0	3200	0	0
26)=	31	2332	23	1	5	2	0	0	0	0	0	330	0	3300	0	0
27)=	31	2412	24	1	5	2	0	0	0	0	0	330	0	4200	0	0
28)=	31	2413	24	4	5	1	0	0	0	0	0	50	0	1720	0	0
29)=	31	2422	24	3	5	4	0	0	0	0	0	999	0	1800	0	0
30)=	31	2423	24	3	5	4	0	0	0	0	0	999	0	1800	0	0
31)=	31	2432	24	1	5	2	0	0	0	0	0	999	0	3900	0	0
32)=	31	2433	24	4	5	1	0	0	0	0	0	999	0	1800	0	0
33)=	31	2444	24	2	5	3	0	0	0	0	0	200	0	1800	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	ENTRY 1 FLOW	ENTRY 1 CRUISE SPEED	ENTRY 2 LINK NO.	ENTRY 2 FLOW	ENTRY 2 CRUISE SPEED	ENTRY 3 LINK NO.	ENTRY 3 FLOW	ENTRY 3 CRUISE SPEED	ENTRY 4 LINK NO.	ENTRY 4 FLOW	ENTRY 4 CRUISE SPEED
34)=	32	2211	220	0	0	0	50	0	0	0	0	0	0	0	0	0
35)=	32	2212	240	0	0	0	50	0	0	0	0	0	0	0	0	0
36)=	32	2213	160	0	0	0	50	0	0	0	0	0	0	0	0	0
37)=	32	2221	220	0	0	0	50	0	0	0	0	0	0	0	0	0
38)=	32	2222	430	0	0	0	50	0	0	0	0	0	0	0	0	0
39)=	32	2223	70	0	0	0	50	0	0	0	0	0	0	0	0	0
40)=	32	2231	120	0	2332	120	50	0	0	0	0	0	0	0	0	0
41)=	32	2232	370	0	2321	70	50	2332	300	50	0	0	0	0	0	0
42)=	32	2233	340	0	2332	340	50	0	0	0	0	0	0	0	0	0
43)=	32	2241	420	0	0	0	50	0	0	0	0	0	0	0	0	0
44)=	32	2242	590	0	0	0	50	0	0	0	0	0	0	0	0	0
45)=	32	2243	140	0	0	0	50	0	0	0	0	0	0	0	0	0
46)=	32	2312	480	0	2241	280	50	2212	160	50	2223	40	50	0	0	0
47)=	32	2313	200	0	2241	120	50	2212	80	50	2223	30	50	0	0	0
48)=	32	2321	70	0	0	0	50	0	0	0	0	0	0	0	0	0
49)=	32	2323	90	0	0	0	50	0	0	0	0	0	0	0	0	0
50)=	32	2331	210	0	2421	40	50	2432	170	50	0	0	0	0	0	0
51)=	32	2332	820	0	2421	40	50	2432	770	50	2444	10	50	0	0	0
52)=	32	2412	440	0	2312	330	50	2323	90	50	0	0	0	0	0	0
53)=	32	2413	90	0	2312	90	50	0	0	0	0	0	0	0	0	0
54)=	32	2421	80	0	0	0	50	0	0	0	0	0	0	0	0	0
55)=	32	2422	90	0	0	0	50	0	0	0	0	0	0	0	0	0
56)=	32	2423	90	0	0	0	50	0	0	0	0	0	0	0	0	0
57)=	32	2431	170	0	0	0	50	0	0	0	0	0	0	0	0	0
58)=	32	2432	860	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	2433	10	0	0	0	50	0	0	0	0	0	0	0	0	0
60)=	32	2444	50	0	0	0	50	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT*****

120 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
22	4	0	18	65	100			
23	3	0	34	50	60	94	110	
24	4	0	68	81	100			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (PCU-H/H)	DELAY RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	GREEN TIMES END 1ST	GREEN TIMES START 2ND	GREEN TIMES END 2ND
2211	220	800	32	14	4	0.0 +	0.2	(3.6)	0	(0.0)	0		3.6					
2212	240	3700	56	72	59	3.3 +	0.6	(61.3)	99	(9.0)	8		70.4	22	5	18		
2213	160	1550	77	14	86	2.2 +	1.6	(59.5)	122	(7.4)	7		66.9	22	105	0		
2221	220	1550	55	72	48	2.4 +	0.6	(45.8)	91	(7.6)	7		53.5	22	70	100		
2222	430	1800	92	72	84	5.2 +	4.8	(155.0)	124	(20.3)	19		175.2	22	70	100		
2223	70	1530	18	72	40	0.7 +	0.1	(12.1)	80	(2.1)	2		14.2	22	70	100		
2231	120	800	18	4	3	0.0 +	0.1	(1.7)	0	(0.0)	0		1.7					
2232	370	3500	91	49	77	3.9 +	4.0	(123.0)	122	(17.1)	16		140.1	22	5	18		
2233	340	2800	91	49	102	5.5 +	4.1	(149.0)	121	(15.6)	15		164.5	22	105	0		
2241	420	800	56	4	6	0.0 +	0.6	(10.6)	12	(1.9)	2		12.5					
2242	590	1800	91	72	65	6.0 +	4.6	(164.6)	113	(25.3)	23		189.9	22	23	65		
2243	140	1700	23	72	31	1.0 +	0.1	(18.5)	69	(3.7)	3		22.2	22	23	65		
2312	480	3500	18	49	4	0.4 +	0.1	(8.3)	34	(6.2)	4		14.4	23	5	50	65	110
2313	200	1700	59	7	35	1.3 +	0.7	(30.4)	111	(8.4)	5		38.8	23	39	50	99	110
2321	70	800	9	14	2	0.0 +	0.0	(0.7)	0	(0.0)	0		0.7					
2323	90	3200	28	72	33	0.6 +	0.2	(12.7)	100	(3.4)	2		16.1	23	55	60	115	0
2331	210	800	26	7	3	0.0 +	0.2	(2.8)	0	(0.0)	0		2.8					
2332	821	3300	50	24	18	3.7 +	0.5	(65.1)	75	(23.2)	19		88.3	23	5	34	65	94
2412	440	4200	20	24	21	2.4 +	0.1	(39.3)	59	(9.9)	9		49.2	24	5	68		
2413	90	1720	39	4	61	1.2 +	0.3	(23.8)	106	(3.6)	3		27.4	24	105	0		
2421	80	800	13	14	4	0.0 +	0.1	(1.5)	14	(0.4)	0		1.9					
2422	90	1800	40	72	62	1.2 +	0.3	(23.9)	100	(3.4)	3		27.3	24	86	100		
2423	90	1800	40	72	62	1.2 +	0.3	(23.9)	100	(3.4)	3		27.3	24	86	100		
2431	170	800	22	4	3	0.0 +	0.1	(2.1)	0	(0.0)	0		2.1					
2432	860	3900	41	72	18	4.0 +	0.4	(67.5)	58	(18.8)	17		86.3	24	5	68		
2433	10	1800	4	72	53	0.1 +	0.0	(2.3)	90	(0.3)	0		2.6	24	105	0		
2444	50	1800	37	14	74	0.7 +	0.3	(15.9)	109	(2.1)	2		17.9	24	73	81		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	157.6	27.0	47.3	25.3	(1124.9)	+	(193.1)	+	(0.0)	=	1318.0	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	228.5	+	83.5	+	80.9	=	392.8

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 27

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18
- (SECONDS)

22	4	36	54	101	16		
23	3	18	52	68	78	112	8
24	4	0	68	81	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	153.9	27.6	43.6	25.3	(1067.9)	+	(178.9)	+	(0.0)	=	1246.9	TOTALS

NO. OF ENTRIES TO SUBPT = 9
NO. OF LINKS RECALCULATED= 165

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48
- (SECONDS)

22	4	36	54	101	16		
23	3	18	52	68	78	112	8
24	4	0	68	81	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	153.9	27.6	43.6	25.3	(1067.9)	+	(178.9)	+	(0.0)	=	1246.9	TOTALS

NO. OF ENTRIES TO SUBPT = 9
NO. OF LINKS RECALCULATED= 165

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1
- (SECONDS)

22	4	37	55	101	16		
23	3	18	52	68	78	112	8
24	4	116	69	82	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	153.2	27.7	43.2	25.0	(1057.3)	+	(176.1)	+	(0.0)	=	1233.4	TOTALS

NO. OF ENTRIES TO SUBPT = 33
NO. OF LINKS RECALCULATED= 520

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18
- (SECONDS)

22	4	19	37	83	118		
23	3	18	52	68	78	112	8
24	4	116	69	82	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.9	27.8	42.8	25.0	(1051.7)	+	(180.1)	+	(0.0)	=	1231.9	TOTALS

NO. OF ENTRIES TO SUBPT = 10
NO. OF LINKS RECALCULATED= 185

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48
- (SECONDS)

22	4	91	109	35	70		
23	3	18	52	68	78	112	8
24	4	116	69	82	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.7	27.8	42.6	25.0	(1048.9)	+	(175.2)	+	(0.0)	=	1224.0	TOTALS

NO. OF ENTRIES TO SUBPT = 10
NO. OF LINKS RECALCULATED= 185

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1
- (SECONDS)

22	4	94	112	38	73		
23	3	19	53	69	79	113	9
24	4	115	68	81	99		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.5	27.9	42.4	25.0	(1045.0)	+	(175.4)	+	(0.0)	=	1220.4	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 217

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1 -1
- (SECONDS)

22	4	94	112	38	73		
23	3	19	53	69	79	113	9
24	4	115	68	81	99		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.5	27.9	42.4	25.0	(1045.0)	+	(175.4)	+	(0.0)	=	1220.4	TOTALS

NO. OF ENTRIES TO SUBPT = 29
NO. OF LINKS RECALCULATED= 503

120 SECOND CYCLE 60 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 18 48 -1 18 48 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
22	4	94	112	38	73			
23	3	18	52	68	78	112	8	
24	4	114	67	80	98			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	GREEN TIMES END 1ST	GREEN TIMES START 2ND	GREEN TIMES END 2ND
2211	220	800	32	14	4	0.0 +	0.2	(3.6)	0	(0.0)	0		3.6					
2212	240	3700	56	72	59	3.3 +	0.6	(61.3)	99	(9.0)	8		70.4	22	99	112		
2213	160	1550	73	14	78	2.2 +	1.3	(53.9)	115	(7.0)	6		60.9	22	78	94		
2221	220	1550	55	72	48	2.3 +	0.6	(45.8)	91	(7.6)	7		53.4	22	43	73		
2222	430	1800	92	72	84	5.2 +	4.8	(154.9)	125	(20.3)	19		175.3	22	43	73		
2223	70	1530	18	72	40	0.7 +	0.1	(12.1)	79	(2.1)	2		14.2	22	43	73		
2231	120	800	18	4	3	0.0 +	0.1	(1.8)	5	(0.2)	0		2.0					
2232	370	3500	91	49	88	5.0 +	4.0	(139.6)	127	(17.8)	16		157.5	22	99	112		
2233	340	2800	86	49	71	4.0 +	2.7	(104.2)	111	(14.3)	13		118.6	22	78	94		
2241	420	800	56	4	6	0.0 +	0.6	(10.6)	12	(1.9)	2		12.5					
2242	590	1800	94	72	73	6.2 +	5.7	(184.6)	120	(26.8)	25		211.4	22	117	38		
2243	140	1700	24	72	32	1.1 +	0.2	(19.0)	70	(3.7)	3		22.7	22	117	38		
2312	480	3500	18	49	2	0.2 +	0.1	(4.3)	17	(3.1)	2		7.4	23	23	68	83	8
2313	200	1700	59	7	29	0.9 +	0.7	(24.7)	106	(8.0)	5		32.8	23	57	68	117	8
2321	70	800	9	14	2	0.0 +	0.0	(0.7)	0	(0.0)	0		0.7					
2323	90	3200	28	72	33	0.6 +	0.2	(12.7)	100	(3.4)	2		16.1	23	73	78	13	18
2331	210	800	26	7	3	0.0 +	0.2	(2.8)	0	(0.0)	0		2.8					
2332	821	3300	50	24	8	1.3 +	0.5	(28.1)	40	(12.5)	9		40.5	23	23	52	83	112
2412	440	4200	18	24	12	1.3 +	0.1	(22.6)	42	(7.1)	6		29.7	24	119	67		
2413	90	1720	52	4	74	1.3 +	0.5	(28.8)	111	(3.8)	3		32.5	24	103	114		
2421	80	800	13	14	4	0.0 +	0.1	(1.5)	12	(0.4)	0		1.8					
2422	90	1800	43	72	64	1.2 +	0.4	(24.9)	102	(3.5)	3		28.4	24	85	98		
2423	90	1800	43	72	64	1.2 +	0.4	(24.9)	102	(3.5)	3		28.4	24	85	98		
2431	170	800	22	4	3	0.0 +	0.1	(2.1)	0	(0.0)	0		2.1					
2432	860	3900	38	72	15	3.3 +	0.3	(56.3)	52	(16.9)	16		73.2	24	119	67		
2433	10	1800	6	72	59	0.1 +	0.0	(2.5)	96	(0.4)	0		2.9	24	103	114		
2444	50	1800	37	14	74	0.7 +	0.3	(15.9)	109	(2.1)	2		18.0	24	72	80		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.4	27.9	42.4	25.0	(1044.4)	+	(175.4)	+	(0.0)	=	1219.8	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	228.5	+	77.5	+	73.4	=	379.4

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 194

PROGRAM TRANSYT FINISHED

== end of file ==

[Printed at 12:05:11 on 08/05/2003]

T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible

Program TRANSYT 11, Analysis Program Version 1.3

Run with file:- "C12APR02.DAT" at 16:37 on 12/04/02

Transfund : Signal Integration - Network C am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

NUMBER OF NODES	=	5
NUMBER OF LINKS	=	35
NUMBER OF OPTIMISED NODES	=	5
MAXIMUM NUMBER OF GRAPHIC PLOTS	=	0
NUMBER OF STEPS IN CYCLE	=	60
MAXIMUM NUMBER OF SHARED STOPLINES	=	0
MAXIMUM NUMBER OF TIMING POINTS	=	4
MAXIMUM LINKS AT ANY NODE	=	10

CORE REQUESTED = 7951 WORDS
CORE AVAILABLE = 72000 WORDS

DATA INPUT :-

CARD NO.	CARD TYPE	
(1)=	TITLE:-	Transfund : Signal Integration - Network C am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	EFFECTIVE-GREEN DISPLACEMENTS END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CRUISE-SPEEDS CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	90	60	60	2	3	1	0	0	0	1	2	0	0	1550	283

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	17	18	19	20	21	0	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	13	19	0	22	26	20	72	14	0	0	0	0	0	0	0	0
5)=	13	17	0	15	23	10	55	15	0	0	0	0	0	0	0	0
6)=	13	18	0	10	46	10	57	10	0	0	0	0	0	0	0	0
7)=	13	20	0	28	47	10	57	30	0	0	0	0	0	0	0	0
8)=	14	21	0	20	33	15	55	15	75	11	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	PRIORITY LINKS LINK2 NO.	LINK1 GIVEWAY ONLY % FLOW	COEFFS. A1 X100	COEFFS. A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
9)=	30	1921	1932	0	0	22	0	0	0	0	0	200	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	FIRST GREEN START LAG	FIRST GREEN END STAGE	FIRST GREEN END LAG	SECOND GREEN START STAGE	SECOND GREEN START LAG	SECOND GREEN END STAGE	SECOND GREEN END LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
10)=	31	1711	17	1	5	3	0	0	0	0	0	160	0	1338	0	0
11)=	31	1712	17	1	5	2	0	0	0	0	0	200	0	3400	0	0
12)=	31	1732	17	3	5	2	0	0	0	0	0	110	0	1600	0	0
13)=	31	1733	17	3	5	1	0	0	0	0	0	110	0	1600	0	0
14)=	31	1741	17	2	5	1	0	0	0	0	0	200	0	2800	0	0
15)=	31	1743	17	2	5	3	0	0	0	0	0	200	0	1925	0	0
16)=	31	1812	18	3	5	2	0	0	0	0	0	105	0	1300	0	0
17)=	31	1813	18	3	5	1	0	0	0	0	0	110	0	1430	0	0
18)=	31	1821	18	2	5	3	0	0	0	0	0	200	0	1430	0	0
19)=	31	1823	18	2	5	3	0	0	0	0	0	200	0	1530	0	0
20)=	31	1831	18	1	5	3	0	0	0	0	0	195	0	1700	0	0
21)=	31	1832	18	1	5	2	0	0	0	0	0	195	0	1700	0	0
22)=	31	1912	19	3	5	2	0	0	0	0	0	200	0	3803	0	0
23)=	31	1913	19	3	5	1	0	0	0	0	0	200	0	1700	0	0
24)=	31	1923	19	2	5	3	0	0	0	0	0	200	0	1700	0	0
25)=	31	1931	19	1	0	3	0	0	0	0	0	100	0	800	0	0
26)=	31	1932	19	1	5	2	0	0	0	0	0	160	0	1700	0	0
27)=	31	2012	20	3	5	2	0	0	0	0	0	200	0	1600	0	0
28)=	31	2013	20	3	5	1	0	0	0	0	0	200	0	500	0	0
29)=	31	2021	20	2	5	1	0	0	0	0	0	200	0	1600	0	0
30)=	31	2023	20	2	5	3	0	0	0	0	0	200	0	1700	0	0
31)=	31	2031	20	1	0	3	0	0	0	0	0	100	0	500	0	0
32)=	31	2032	20	1	5	2	0	0	0	0	0	385	0	1600	0	0
33)=	31	2111	21	1	0	3	0	0	0	0	0	385	0	1520	0	0
34)=	31	2112	21	1	6	2	0	0	0	0	0	385	0	2000	0	0
35)=	31	2113	21	4	6	1	0	0	0	0	0	385	0	1520	0	0
36)=	31	2121	21	3	6	1	0	0	0	0	0	200	0	1520	0	0
37)=	31	2122	21	3	6	4	0	0	0	0	0	200	0	1800	0	0
38)=	31	2131	21	1	6	2	0	3	6	4	0	200	0	1800	0	0
39)=	31	2132	21	1	6	2	0	0	0	0	0	200	0	1300	0	0
40)=	31	2133	21	4	8	1	0	0	0	0	0	200	0	1880	0	0
41)=	31	2141	21	2	6	3	0	0	0	0	0	200	0	1800	0	0
42)=	31	2142	21	2	6	3	0	0	0	0	0	200	0	1800	0	0
43)=	31	2143	20	2	5	3	0	0	0	0	0	200	0	1800	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	ENTRY 1 FLOW	ENTRY 1 CRUISE SPEED	ENTRY 2 LINK NO.	ENTRY 2 FLOW	ENTRY 2 CRUISE SPEED	ENTRY 3 LINK NO.	ENTRY 3 FLOW	ENTRY 3 CRUISE SPEED	ENTRY 4 LINK NO.	ENTRY 4 FLOW	ENTRY 4 CRUISE SPEED
44)=	32	1711	290	0	1912	140	50	1923	150	50	0	0	0	0	0	0
45)=	32	1712	310	0	1912	160	50	1923	150	50	0	0	0	0	0	0
46)=	32	1732	480	0	1821	210	50	1832	270	50	0	0	0	0	0	0
47)=	32	1733	250	0	1821	100	50	1832	150	50	0	0	0	0	0	0
48)=	32	1741	90	0	0	0	50	0	0	0	0	0	0	0	0	0
49)=	32	1743	300	0	0	0	50	0	0	0	0	0	0	0	0	0
50)=	32	1812	230	0	1712	170	50	1741	60	50	0	0	0	0	0	0
51)=	32	1813	160	0	1712	130	50	1741	30	50	0	0	0	0	0	0
52)=	32	1821	310	0	0	0	50	0	0	0	0	0	0	0	0	0
53)=	32	1823	40	0	0	0	50	0	0	0	0	0	0	0	0	0
54)=	32	1831	10	0	2032	10	50	0	0	0	0	0	0	0	0	0
55)=	32	1832	390	0	2032	350	50	2021	40	50	0	0	0	0	0	0
56)=	32	1912	330	0	0	0	50	0	0	0	0	0	0	0	0	0
57)=	32	1913	250	0	0	0	50	0	0	0	0	0	0	0	0	0
58)=	32	1921	340	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	1923	300	0	0	0	50	0	0	0	0	0	0	0	0	0
60)=	32	1931	420	0	1732	220	50	1743	200	50	0	0	0	0	0	0
61)=	32	1932	350	0	1732	250	50	1743	100	50	0	0	0	0	0	0
62)=	32	2012	280	0	1812	230	50	1823	40	50	0	0	0	0	0	0
63)=	32	2013	140	0	1812	140	50	0	0	0	0	0	0	0	0	0
64)=	32	2021	40	0	0	0	50	0	0	0	0	0	0	0	0	0
65)=	32	2023	30	0	0	0	50	0	0	0	0	0	0	0	0	0
66)=	32	2031	20	0	2131	10	50	2121	10	50	0	0	0	0	0	0
67)=	32	2032	530	0	2121	150	50	2132	60	50	2143	20	50	0	0	0

68)=	32	2111	80	0	2012	80	50	0	0	0	0	0	0	0	0	0
69)=	32	2112	300	0	2012	280	50	2023	15	50	0	0	0	0	0	0
70)=	32	2113	120	0	2012	100	50	2023	15	50	0	0	0	0	0	0
71)=	32	2121	160	0	0	0	50	0	0	0	0	0	0	0	0	0
72)=	32	2122	260	0	0	0	50	0	0	0	0	0	0	0	0	0
73)=	32	2131	80	0	0	0	50	0	0	0	0	0	0	0	0	0
74)=	32	2132	350	0	0	0	50	0	0	0	0	0	0	0	0	0
75)=	32	2133	140	0	0	0	50	0	0	0	0	0	0	0	0	0
76)=	32	2141	120	0	0	0	50	0	0	0	0	0	0	0	0	0
77)=	32	2142	290	0	0	0	50	0	0	0	0	0	0	0	0	0
78)=	32	2143	20	0	0	0	50	0	0	0	0	0	0	0	0	0

FUEL CARD

		CRUISE CONSTANTS A	B	C	DELAY CONST.	STOP CONST.									
(79)=	37	145	-375	405	115	635	0	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT****

90 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
17	3	0	23	55				
18	3	0	36	70				
19	3	0	36	67				
20	3	0	43	53				
21	4	0	33	55	75			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	DELAY UNIFORM RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	END 1ST	START 2ND	END 2ND
1711	290	1338	38	12	23	1.5 + 0.3	(28.6)	75	(8.2)	6		36.8	17	5	55		
1712	310	3400	43	14	33	2.5 + 0.4	(44.6)	95	(11.2)	8		55.8	17	5	23		
1732	480	1600	50	8	19	2.0 + 0.5	(39.4)	77	(14.0)	9		53.4	17	60	23		
1733	249	1600	45	8	33	1.9 + 0.4	(35.2)	101	(9.6)	6		44.7	17	60	0		
1741	90	2800	5	14	5	0.1 + 0.0	(2.0)	28	(1.0)	1		3.0	17	28	0		
1743	300	1925	50	14	31	2.1 + 0.5	(40.5)	84	(9.5)	7		50.0	17	28	55		
1812	230	1300	31	8	7	0.2 + 0.2	(6.8)	25	(2.2)	3		9.0	18	75	36		
1813	160	1430	63	8	75	2.5 + 0.8	(51.8)	118	(7.2)	5		59.0	18	75	0		
1821	310	1430	65	14	36	2.2 + 0.9	(48.3)	92	(10.8)	7		59.1	18	41	70		
1823	40	1530	8	14	24	0.2 + 0.0	(4.2)	69	(1.0)	1		5.2	18	41	70		
1831	10	1700	1	14	1	0.0 + 0.0	(0.1)	2	(0.0)	0		0.1	18	5	70		
1832	390	1700	64	14	30	2.3 + 0.9	(49.7)	55	(8.1)	5		57.8	18	5	36		
1912	330	3803	14	14	8	0.7 + 0.1	(11.9)	40	(5.0)	4		16.8	19	72	36		
1913	250	1700	70	14	49	2.3 + 1.1	(52.8)	105	(10.0)	7		62.8	19	72	0		
1921	340	800	47	14	5	0.0 + 0.4	(6.9)	0	(0.0)	0		6.9					
1923	300	1700	59	14	35	2.2 + 0.7	(45.6)	90	(10.2)	7		55.8	19	41	67		
1931	420	800	69	7	18	1.0 + 1.1	(32.5)	67	(10.6)	5		43.1	19	0	67		
1932	350	1700	58	12	34	2.7 + 0.7	(51.7)	91	(12.1)	8		63.7	19	5	36		
2012	280	1600	21	14	3	0.1 + 0.1	(3.5)	15	(1.6)	1		5.2	20	58	43		
2013	140	500	76	14	73	1.3 + 1.5	(44.1)	128	(6.8)	5		50.9	20	58	0		
2021	40	1600	5	14	15	0.1 + 0.0	(2.6)	53	(0.8)	1		3.4	20	48	0		
2023	30	1700	26	14	61	0.3 + 0.2	(7.9)	114	(1.3)	1		9.2	20	48	53		
2031	20	500	7	7	18	0.1 + 0.0	(1.6)	74	(0.6)	0		2.1	20	0	53		
2032	530	1600	76	28	36	3.8 + 1.6	(82.8)	83	(16.7)	11		99.6	20	5	43		
2111	80	1520	8	28	14	0.3 + 0.0	(4.7)	54	(1.6)	1		6.3	21	0	55		
2112	300	2000	48	28	36	2.6 + 0.5	(46.8)	94	(10.6)	7		57.4	21	6	33		
2113	120	1520	71	28	63	0.9 + 1.2	(32.6)	126	(5.7)	4		38.3	21	81	0		
2121	160	1520	32	14	28	1.0 + 0.2	(19.0)	76	(4.6)	3		23.6	21	61	0		
2122	260	1800	87	14	76	2.6 + 2.8	(85.0)	133	(13.1)	9		98.1	21	61	75		
2131	80	1800	9	14	9	0.1 + 0.1	(3.1)	51	(1.5)	1		4.6	21	6	33	61	75
2132	350	1300	87	14	59	2.8 + 2.9	(89.1)	120	(15.9)	11		105.0	21	6	33		
2133	140	1880	84	14	97	1.6 + 2.2	(58.7)	149	(7.9)	6		66.6	21	83	0		
2141	120	1800	35	14	40	1.1 + 0.3	(20.6)	92	(4.2)	3		24.8	21	39	55		
2142	290	1800	85	14	68	2.8 + 2.6	(84.7)	125	(13.8)	10		98.5	21	39	55		
2143	20	1800	17	14	57	0.2 + 0.1	(4.9)	109	(0.8)	1		5.8	20	48	53		

90 SECOND CYCLE 60 STEPS

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	105.4	15.0	48.2	25.6	(1144.2)	+	(238.2)	+	(0.0)	=	1382.5	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	92.8	+	84.9	+	99.7	=	277.4

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 35

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13
- (SECONDS)

17	3	13	36	68	
18	3	0	36	70	
19	3	0	36	67	
20	3	13	56	66	
21	4	0	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
1579.0	103.4	15.3	46.3	25.6	(1113.9) +	(228.6) +	(0.0) =	1342.4	TOTALS

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 198

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36
- (SECONDS)

17	3	49	72	14	
18	3	72	18	52	
19	3	0	36	67	
20	3	13	56	66	
21	4	0	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
1579.0	98.4	16.1	41.2	25.6	(1035.2) +	(214.0) +	(0.0) =	1249.2	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 213

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	0	39	67	
20	3	13	56	66	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
1579.0	97.1	16.3	39.9	25.6	(1015.5) +	(209.7) +	(0.0) =	1225.2	TOTALS

NO. OF ENTRIES TO SUBPT = 44
NO. OF LINKS RECALCULATED= 558

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	0	39	67	
20	3	13	56	66	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
1579.0	97.1	16.3	39.9	25.6	(1015.5) +	(209.7) +	(0.0) =	1225.2	TOTALS

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 207

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13 36
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	0	39	67	
20	3	13	56	66	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	97.1	16.3	39.9	25.6	(1015.5)	+	(209.7)	+	(0.0)	=	1225.2	TOTALS

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 216

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13 36 1
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	89	38	66	
20	3	17	60	70	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	96.6	16.3	39.4	25.6	(1008.0)	+	(211.1)	+	(0.0)	=	1219.0	TOTALS

NO. OF ENTRIES TO SUBPT = 15
NO. OF LINKS RECALCULATED= 257

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13 36 1 -1
- (SECONDS)

17	3	48	72	9	
18	3	75	18	53	
19	3	89	38	66	
20	3	17	60	70	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	96.6	16.4	39.4	25.6	(1007.3)	+	(211.2)	+	(0.0)	=	1218.5	TOTALS

NO. OF ENTRIES TO SUBPT = 31
NO. OF LINKS RECALCULATED= 460

90 SECOND CYCLE 60 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 13 36 -1 13 36 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
17	3	48	72	9				
18	3	75	18	53				
19	3	89	38	66				
20	3	17	60	70				
21	4	1	33	55	75			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES 1ST START (SECONDS)	GREEN TIMES 1ST END	GREEN TIMES 2ND START	GREEN TIMES 2ND END
1711	290	1338	41	12	10	0.5 +	0.4	(12.8)	36	(3.9)	3		16.7	17	53	9		
1712	310	3400	41	14	30	2.2 +	0.3	(40.1)	65	(7.7)	5		47.8	17	53	72		
1732	480	1600	46	8	11	1.0 +	0.4	(21.8)	58	(10.5)	7		32.2	17	14	72		
1733	249	1600	40	8	15	0.7 +	0.3	(15.7)	66	(6.2)	4		21.9	17	14	48		
1741	90	2800	5	14	5	0.1 +	0.0	(2.1)	30	(1.0)	1		3.1	17	77	48		
1743	300	1925	61	14	39	2.5 +	0.8	(50.2)	94	(10.7)	7		60.8	17	77	9		
1812	230	1300	31	8	6	0.2 +	0.2	(5.9)	18	(1.6)	2		7.5	18	58	18		
1813	160	1430	56	8	28	0.6 +	0.6	(19.2)	46	(2.8)	2		22.0	18	58	75		
1821	310	1430	63	14	34	2.1 +	0.8	(46.0)	90	(10.5)	7		56.5	18	23	53		
1823	40	1530	8	14	24	0.2 +	0.0	(4.1)	67	(1.0)	1		5.1	18	23	53		
1831	10	1700	1	14	8	0.0 +	0.0	(0.4)	43	(0.2)	0		0.5	18	80	53		
1832	390	1700	71	14	46	3.8 +	1.2	(77.0)	111	(16.4)	11		93.4	18	80	18		
1912	330	3803	13	14	7	0.6 +	0.1	(10.1)	36	(4.5)	3		14.5	19	71	38		
1913	250	1700	70	14	49	2.3 +	1.1	(52.8)	105	(10.0)	7		62.7	19	71	89		
1921	340	800	47	14	5	0.0 +	0.4	(6.9)	0	(0.0)	0		6.9					
1923	300	1700	66	14	41	2.5 +	1.0	(52.9)	97	(11.1)	8		64.0	19	43	66		
1931	420	800	69	7	14	0.5 +	1.1	(24.7)	54	(8.5)	7		33.2	19	89	66		
1932	350	1700	53	12	25	1.9 +	0.6	(37.7)	66	(8.7)	6		46.4	19	4	38		
2012	280	1600	21	14	3	0.1 +	0.1	(3.9)	32	(3.4)	3		7.3	20	75	60		
2013	140	500	76	14	47	0.3 +	1.5	(28.2)	114	(6.1)	5		34.3	20	75	17		
2021	40	1600	5	14	15	0.1 +	0.0	(2.6)	53	(0.8)	1		3.4	20	65	17		
2023	30	1700	26	14	61	0.3 +	0.2	(7.9)	114	(1.3)	1		9.2	20	65	70		
2031	20	500	7	7	21	0.1 +	0.0	(1.8)	63	(0.5)	0		2.3	20	17	70		
2032	530	1600	76	28	22	1.6 +	1.6	(49.5)	54	(10.8)	8		60.3	20	22	60		
2111	80	1520	9	28	6	0.1 +	0.0	(2.0)	18	(0.5)	0		2.5	21	1	55		
2112	300	2000	50	28	20	1.2 +	0.5	(26.1)	46	(5.3)	4		31.4	21	7	33		
2113	120	1520	64	28	78	1.7 +	0.9	(40.5)	121	(5.5)	4		46.0	21	81	1		
2121	160	1520	31	14	27	1.0 +	0.2	(18.3)	75	(4.5)	3		22.8	21	61	1		
2122	260	1800	87	14	76	2.6 +	2.8	(85.0)	133	(13.1)	9		98.1	21	61	75		
2131	80	1800	10	14	9	0.2 +	0.1	(3.2)	53	(1.6)	1		4.8	21	7	33	61	75
2132	350	1300	90	14	68	2.9 +	3.7	(102.7)	129	(17.1)	12		119.8	21	7	33		
2133	140	1880	74	14	75	1.5 +	1.4	(45.1)	129	(6.8)	5		51.9	21	83	1		
2141	120	1800	35	14	40	1.1 +	0.3	(20.6)	92	(4.2)	3		24.8	21	39	55		
2142	290	1800	85	14	68	2.8 +	2.6	(84.7)	125	(13.8)	10		98.5	21	39	55		
2143	20	1800	17	14	58	0.2 +	0.1	(5.0)	110	(0.8)	1		5.8	20	65	70		

90 SECOND CYCLE 60 STEPS

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	96.6	16.4	39.4	25.6	(1007.3)	+	(211.2)	+	(0.0)	=	1218.5	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	92.8	+	74.7	+	88.4	=	255.9

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 206

PROGRAM TRANSYT FINISHED
=== end of file ===

[Printed at 12:11:25 on 08/05/2003]

T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible

Program TRANSYT 11, Analysis Program Version 1.3

Run with file:- "D16APR02.DAT" at 17:10 on 16/04/02

Transfund NZ : Traffic Signal Integration - Network D am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

NUMBER OF NODES	=	6
NUMBER OF LINKS	=	48
NUMBER OF OPTIMISED NODES	=	6
MAXIMUM NUMBER OF GRAPHIC PLOTS	=	0
NUMBER OF STEPS IN CYCLE	=	35
MAXIMUM NUMBER OF SHARED STOPLINES	=	0
MAXIMUM NUMBER OF TIMING POINTS	=	4
MAXIMUM LINKS AT ANY NODE	=	9

CORE REQUESTED = 8417 WORDS
CORE AVAILABLE = 72000 WORDS

DATA INPUT :-

CARD NO.	CARD TYPE
(1)=	TITLE:- Transfund NZ : Traffic Signal Integration - Network D am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	EFFECTIVE-GREEN DISPLACEMENTS END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CRUISE-SPEEDS CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	140	35	60	2	3	1	0	0	0	1	2	0	0	1550	283

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	10	12	13	14	15	16	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	14	10	0	40	54	40	79	12	94	12	0	0	0	0	0	0
5)=	14	12	0	20	62	40	104	30	116	10	0	0	0	0	0	0
6)=	14	13	0	10	65	20	88	20	128	12	0	0	0	0	0	0
7)=	14	14	0	10	47	24	71	20	124	12	0	0	0	0	0	0
8)=	13	15	0	40	44	40	75	25	0	0	0	0	0	0	0	0
9)=	14	16	0	25	51	12	66	12	108	40	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	PRIORITY LINKS LINK2 NO.	LINK1 ONLY % FLOW	GIVEWAY COEFFS. A1 X100	GIVEWAY COEFFS. A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
10)=	30	1021	1032	1042	0	25	0	0	0	0	0	200	0	800	0	0
11)=	30	1031	1042	1013	0	25	0	0	0	0	0	280	0	800	0	0
12)=	30	1041	1012	1023	0	22	0	0	0	0	0	200	0	800	0	0
13)=	30	1321	1332	1342	0	33	0	0	0	0	0	200	0	800	0	0
14)=	30	1331	1342	1313	0	25	0	0	0	0	0	150	0	800	0	0
15)=	30	1411	1433	0	100	25	0	0	0	0	0	150	0	800	0	0
16)=	30	1521	1532	0	0	22	0	0	0	0	0	200	0	800	0	0
17)=	30	1531	1513	0	100	25	0	0	0	0	0	230	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	FIRST GREEN START LAG	FIRST GREEN END STAGE	FIRST GREEN END LAG	SECOND GREEN START STAGE	SECOND GREEN START LAG	SECOND GREEN END STAGE	SECOND GREEN END LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
18)=	31	1012	10	1	5	2	0	0	0	0	0	200	0	5200	0	0
19)=	31	1013	10	4	5	1	0	0	0	0	0	200	0	1700	0	0
20)=	31	1022	10	3	5	4	0	0	0	0	0	200	0	1900	0	0
21)=	31	1023	10	3	6	4	0	0	0	0	0	200	0	1570	0	0
22)=	31	1032	10	1	5	2	0	0	0	0	0	280	0	3800	0	0
23)=	31	1033	10	4	6	1	0	0	0	0	0	280	0	1400	0	0
24)=	31	1042	10	2	6	3	0	0	0	0	0	200	0	2000	0	0
25)=	31	1212	12	4	5	2	0	0	0	0	0	280	0	5200	0	0
26)=	31	1213	12	4	6	1	0	0	0	0	0	280	0	1600	0	0
27)=	31	1221	12	3	5	1	0	0	0	0	0	200	0	1650	0	0
28)=	31	1223	12	3	5	4	0	0	0	0	0	200	0	1650	0	0
29)=	31	1231	12	1	5	4	0	0	0	0	0	200	0	1450	0	0
30)=	31	1232	12	1	5	2	0	0	0	0	0	200	0	3900	0	0
31)=	31	1253	12	2	5	3	0	0	0	0	0	200	0	1500	0	0
32)=	31	1312	13	1	5	2	0	0	0	0	0	200	0	4400	0	0
33)=	31	1313	13	4	4	1	0	0	0	0	0	200	0	1700	0	0
34)=	31	1322	13	3	4	4	0	0	0	0	0	200	0	1800	0	0
35)=	31	1323	13	3	4	4	0	0	0	0	0	200	0	1650	0	0
36)=	31	1332	13	1	5	2	0	0	0	0	0	150	0	4400	0	0
37)=	31	1333	13	4	4	1	0	0	0	0	0	150	0	1500	0	0
38)=	31	1341	13	2	4	3	0	0	0	0	0	200	0	1400	0	0
39)=	31	1342	13	2	4	3	0	0	0	0	0	200	0	1600	0	0
40)=	31	1412	14	4	6	2	0	0	0	0	0	150	0	4300	0	0
41)=	31	1421	14	3	6	1	0	0	0	0	0	200	0	3000	0	0
42)=	31	1423	14	3	6	4	0	0	0	0	0	200	0	3100	0	0
43)=	31	1432	14	1	5	3	0	0	0	0	0	180	0	3200	0	0
44)=	31	1433	14	2	4	3	0	0	0	0	0	180	0	1700	0	0
45)=	31	1512	15	3	6	2	0	0	0	0	0	180	0	3600	0	0
46)=	31	1513	15	3	6	1	0	0	0	0	0	180	0	1700	0	0
47)=	31	1523	15	2	6	3	0	0	0	0	0	200	0	1700	0	0
48)=	31	1532	15	1	5	2	0	0	0	0	0	230	0	3600	0	0
49)=	31	1611	16	1	5	2	0	3	5	4	0	230	0	1600	0	0
50)=	31	1612	16	1	5	2	0	0	0	0	0	230	0	1990	0	0
51)=	31	1613	16	4	5	1	0	0	0	0	0	230	0	1900	0	0
52)=	31	1621	16	2	5	3	0	4	5	1	0	200	0	1500	0	0
53)=	31	1622	16	2	5	3	0	0	0	0	0	200	0	1990	0	0
54)=	31	1632	16	1	5	2	0	0	0	0	0	200	0	3600	0	0
55)=	31	1633	16	4	5	1	0	0	0	0	0	200	0	1200	0	0
56)=	31	1642	16	3	5	4	0	0	0	0	0	200	0	1800	0	0
57)=	31	1643	16	3	5	4	0	0	0	0	0	200	0	1990	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	ENTRY 1 FLOW	ENTRY 1 CRUISE SPEED	ENTRY 2 LINK NO.	ENTRY 2 FLOW	ENTRY 2 CRUISE SPEED	ENTRY 3 LINK NO.	ENTRY 3 FLOW	ENTRY 3 CRUISE SPEED	ENTRY 4 LINK NO.	ENTRY 4 FLOW	ENTRY 4 CRUISE SPEED
58)=	32	1012	1020	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	1013	450	0	0	0	50	0	0	0	0	0	0	0	0	0
60)=	32	1021	500	0	0	0	50	0	0	0	0	0	0	0	0	0
61)=	32	1022	130	0	0	0	50	0	0	0	0	0	0	0	0	0
62)=	32	1023	30	0	0	0	50	0	0	0	0	0	0	0	0	0
63)=	32	1031	100	0	1232	100	50	0	0	0	0	0	0	0	0	0
64)=	32	1032	1200	0	1221	20	50	1232	1180	50	0	0	0	0	0	0
65)=	32	1033	70	0	1232	70	50	0	0	0	0	0	0	0	0	0
66)=	32	1041	70	0	0	0	50	0	0	0	0	0	0	0	0	0
67)=	32	1042	230	0	0	0	50	0	0	0	0	0	0	0	0	0

68)=	32	1212	1050	20	1012	950	50	1023	30	50	1041	70	50	0	0	0
69)=	32	1213	30	0	1012	30	50	0	0	0	0	0	0	0	0	0
70)=	32	1221	20	0	0	0	50	0	0	0	0	0	0	0	0	0
71)=	32	1223	20	0	0	0	50	0	0	0	0	0	0	0	0	0
72)=	32	1231	60	0	1332	60	50	0	0	0	0	0	0	0	0	0
73)=	32	1232	1480	0	1332	1430	50	1321	40	50	1342	10	50	0	0	0
74)=	32	1253	20	0	0	0	50	0	0	0	0	0	0	0	0	0
75)=	32	1312	1090	0	1212	1050	50	1253	20	50	1223	20	50	0	0	0
76)=	32	1313	100	0	1212	100	50	0	0	0	0	0	0	0	0	0
77)=	32	1321	50	0	0	0	50	0	0	0	0	0	0	0	0	0
78)=	32	1322	10	0	0	0	45	0	0	0	0	0	0	0	0	0
79)=	32	1323	150	0	0	0	50	0	0	0	0	0	0	0	0	0
80)=	32	1331	380	0	1432	150	50	1421	230	50	0	0	0	0	0	0
81)=	32	1332	1470	0	1432	690	50	1421	520	50	0	0	0	0	0	0
82)=	32	1333	10	0	1432	10	50	0	0	0	0	0	0	0	0	0
83)=	32	1341	20	0	0	0	30	0	0	0	0	0	0	0	0	0
84)=	32	1342	10	0	0	0	30	0	0	0	0	0	0	0	0	0
85)=	32	1411	220	0	1341	10	50	1323	50	50	1312	160	50	0	0	0
86)=	32	1412	1000	0	1341	10	50	1323	100	50	1312	890	50	0	0	0
87)=	32	1421	750	0	0	0	55	0	0	0	0	0	0	0	0	0
88)=	32	1423	600	0	0	0	50	0	0	0	0	0	0	0	0	0
89)=	32	1432	840	0	1521	380	50	1532	460	50	0	0	0	0	0	0
90)=	32	1433	140	0	1532	140	50	0	0	0	0	0	0	0	0	0
91)=	32	1512	990	0	1423	600	50	1412	390	50	0	0	0	0	0	0
92)=	32	1513	480	0	1412	480	50	0	0	0	0	0	0	0	0	0
93)=	32	1521	380	0	0	0	50	0	0	0	0	0	0	0	0	0
94)=	32	1523	210	0	0	0	50	0	0	0	0	0	0	0	0	0
95)=	32	1531	490	0	1621	30	50	1643	290	50	1632	170	50	0	0	0
96)=	32	1532	680	0	1621	70	50	1643	280	50	1632	330	50	0	0	0
97)=	32	1611	290	0	1512	290	50	0	0	0	0	0	0	0	0	0
98)=	32	1612	390	0	1523	210	50	1512	180	50	0	0	0	0	0	0
99)=	32	1613	370	0	1512	370	50	0	0	0	0	0	0	0	0	0
100)=	32	1621	100	0	0	0	50	0	0	0	0	0	0	0	0	0
101)=	32	1622	150	0	0	0	50	0	0	0	0	0	0	0	0	0
102)=	32	1632	660	0	0	0	50	0	0	0	0	0	0	0	0	0
103)=	32	1633	100	0	0	0	50	0	0	0	0	0	0	0	0	0
104)=	32	1642	130	0	0	0	45	0	0	0	0	0	0	0	0	0
105)=	32	1643	490	0	0	0	50	0	0	0	0	0	0	0	0	0

FUEL CARD

		CRUISE CONSTANTS A	B	C	DELAY CONST.	STOP CONST.										
(106)=	37	145	-375	405	115	635	0	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT****

140 SECOND CYCLE 35 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
10	4	0	46	86	100			
12	4	0	60	100	130			
13	4	0	79	99	123			
14	4	0	47	71	124			
15	3	0	41	81				
16	4	0	37	54	100			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	GREEN TIMES END 1ST (SECONDS)	GREEN TIMES START 2ND (SECONDS)	GREEN TIMES END 2ND (SECONDS)
1012	1020	5200	65	14	46	12.1 +	0.9	(202.0)	86	(33.2)	35		235.2	10	5	46		
1013	450	1700	103	14	171	7.1 +	14.3	(331.0)	163	(27.8)	32		358.9	10	105	0		
1021	500	800	89	14	43	2.2 +	3.7	(91.9)	89	(16.9)	18	+	108.8					
1022	130	1900	96	14	188	2.3 +	4.4	(105.2)	168	(8.3)	9		113.5	10	91	100		
1023	30	1570	30	14	87	0.5 +	0.2	(11.3)	111	(1.3)	1		12.5	10	92	100		
1031	101	800	14	20	3	0.0 +	0.1	(1.2)	0	(0.0)	0		1.2					
1032	1200	3800	105	20	178	21.5 +	37.9	(919.9)	154	(70.0)	90		989.9	10	5	46		
1033	71	1400	20	20	63	1.1 +	0.1	(19.1)	106	(2.8)	3		21.9	10	106	0		
1041	70	800	11	14	6	0.0 +	0.1	(1.7)	18	(0.5)	0		2.2					
1042	230	2000	46	14	51	2.8 +	0.4	(50.6)	86	(7.5)	8		58.0	10	52	86		
1212	1050	5200	43	20	8	2.0 +	0.4	(37.1)	15	(5.9)	6		43.0	12	135	60		
1213	31	1600	54	20	159	0.8 +	0.6	(21.2)	144	(1.6)	2		22.8	12	136	0		
1221	20	1650	5	14	43	0.2 +	0.0	(3.7)	77	(0.6)	1		4.3	12	105	0		
1223	20	1650	7	14	53	0.3 +	0.0	(4.5)	85	(0.6)	1		5.2	12	105	130		
1231	59	1450	5	14	1	0.0 +	0.0	(0.4)	1	(0.0)	0		0.4	12	5	130		
1232	1479	3900	95	14	38	8.2 +	7.6	(245.0)	45	(25.3)	34		270.3	12	5	60		
1253	20	1500	5	14	44	0.2 +	0.0	(3.8)	77	(0.6)	1		4.3	12	65	100		
1312	1090	4400	46	14	4	0.6 +	0.4	(16.6)	6	(2.4)	2		19.0	13	5	79		
1313	101	1700	59	14	107	2.3 +	0.7	(46.7)	118	(4.5)	5		51.2	13	127	0		
1321	50	800	11	14	11	0.1 +	0.1	(2.3)	34	(0.6)	1		2.9					
1322	10	1800	4	16	58	0.1 +	0.0	(2.5)	88	(0.3)	0		2.8	13	103	123		
1323	150	1650	61	14	74	2.3 +	0.8	(47.7)	104	(5.9)	6		53.6	13	103	123		
1331	379	800	48	11	5	0.0 +	0.5	(7.5)	9	(1.2)	4		8.7					
1332	1470	4400	62	11	24	9.1 +	0.8	(153.2)	63	(35.1)	38		188.3	13	5	79		
1333	10	1500	7	11	99	0.2 +	0.0	(4.3)	110	(0.4)	0		4.7	13	127	0		
1341	20	1400	12	24	67	0.3 +	0.1	(5.8)	94	(0.3)	1		6.0	13	83	99		
1342	10	1600	5	24	65	0.2 +	0.0	(2.8)	93	(0.1)	0		2.9	13	83	99		
1411	219	800	27	11	3	0.0 +	0.2	(2.9)	0	(0.0)	0		2.9					
1412	1000	4300	56	11	56	15.0 +	0.6	(242.4)	81	(30.8)	32		273.2	14	130	47		
1421	750	3000	55	13	30	5.7 +	0.6	(98.1)	70	(24.2)	22		122.3	14	77	0		
1423	600	3100	56	14	41	6.2 +	0.6	(106.9)	81	(18.5)	19		125.4	14	77	124		
1432	840	3200	55	13	13	2.4 +	0.6	(46.8)	28	(9.0)	10		55.8	14	5	71		
1433	140	1700	55	13	37	0.8 +	0.6	(22.1)	107	(5.7)	6		27.8	14	51	71		
1512	990	3600	41	13	3	0.4 +	0.3	(11.4)	5	(1.9)	2		13.3	15	87	41		
1513	480	1700	73	13	92	11.0 +	1.3	(191.1)	107	(19.5)	20		210.6	15	87	0		
1521	380	800	58	14	10	0.4 +	0.7	(16.7)	33	(4.8)	5		21.5					
1523	210	1700	49	14	53	2.6 +	0.5	(48.1)	87	(7.0)	7		55.1	15	47	81		
1531	490	800	61	17	9	0.4 +	0.8	(18.4)	45	(8.3)	11		26.7					
1532	680	3600	72	17	47	7.6 +	1.2	(137.5)	68	(17.5)	19		155.0	15	5	41		
1611	289	1600	34	17	24	1.6 +	0.3	(29.3)	81	(8.9)	7		38.2	16	5	37	59	100
1612	390	1990	83	17	86	6.9 +	2.3	(143.8)	110	(16.2)	17		160.0	16	5	37		
1613	370	1900	76	17	53	3.9 +	1.5	(84.4)	89	(12.4)	14		96.8	16	105	0		

140 SECOND CYCLE 35 STEPS

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	GREEN TIMES END 1ST (SECONDS)	GREEN TIMES START 2ND (SECONDS)	GREEN TIMES END 2ND (SECONDS)
1621	100	1500	19	14	20	0.5 +	0.1	(8.8)	69	(2.6)	2		11.4	16	42	54	105	0
1622	150	1990	81	14	109	2.6 +	1.9	(70.4)	126	(7.2)	8		77.6	16	42	54		
1632	660	3600	78	14	59	9.2 +	1.7	(168.9)	97	(24.2)	25		193.1	16	5	37		
1633	100	1200	32	14	51	1.2 +	0.2	(21.8)	85	(3.2)	3		25.0	16	105	0		
1642	130	1800	24	16	41	1.3 +	0.2	(23.1)	76	(3.1)	4		26.2	16	59	100		
1643	490	1990	82	14	62	6.2 +	2.2	(130.1)	101	(18.7)	20		148.8	16	59	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	333.6	11.7	162.7	92.9	(3961.9)	+	(497.3)	+	(0.0)	=	4459.2	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	229.9	+	293.9	+	208.2	=	732.0

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 48

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21
- (SECONDS)

10	4	21	67	107	121
12	4	0	60	100	130
13	4	0	79	99	123
14	4	0	47	71	124
15	3	0	41	81	
16	4	0	37	54	100

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	323.0	12.1	152.1	92.9	(3797.9)	+	(502.8)	+	(0.0)	=	4300.7	TOTALS

NO. OF ENTRIES TO SUBPT = 13
NO. OF LINKS RECALCULATED= 274

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56
- (SECONDS)

10	4	21	67	107	121
12	4	0	60	100	130
13	4	0	79	99	123
14	4	0	47	71	124
15	3	0	41	81	
16	4	0	37	54	100

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	323.0	12.1	152.1	92.9	(3797.9)	+	(502.8)	+	(0.0)	=	4300.7	TOTALS

NO. OF ENTRIES TO SUBPT = 15
NO. OF LINKS RECALCULATED= 329

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1
- (SECONDS)

10	4	18	68	108	121
12	4	0	60	100	130
13	4	139	77	97	121
14	4	7	45	71	109
15	3	0	41	81	
16	4	138	37	54	98

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	305.3	12.8	143.2	84.1	(3524.1)	+	(468.1)	+	(0.0)	=	3992.2	TOTALS

NO. OF ENTRIES TO SUBPT = 71
NO. OF LINKS RECALCULATED= 913

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21
- (SECONDS)

10	4	18	68	108	121
12	4	0	60	100	130
13	4	139	77	97	121
14	4	7	45	71	109
15	3	0	41	81	
16	4	138	37	54	98

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	305.3	12.8	143.2	84.1	(3524.1)	+	(468.1)	+	(0.0)	=	3992.2	TOTALS

NO. OF ENTRIES TO SUBPT = 13
NO. OF LINKS RECALCULATED= 316

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21 56
- (SECONDS)

10	4	18	68	108	121
12	4	0	60	100	130
13	4	139	77	97	121
14	4	7	45	71	109
15	3	0	41	81	
16	4	54	93	110	14

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	303.1	12.9	141.0	84.1	(3489.7)	+	(473.2)	+	(0.0)	=	3962.9	TOTALS

NO. OF ENTRIES TO SUBPT = 13
NO. OF LINKS RECALCULATED= 328

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21 56 1
- (SECONDS)

10	4	20	70	110	123
12	4	0	60	100	130
13	4	139	77	97	121
14	4	4	42	68	106
15	3	0	41	81	
16	4	54	93	110	14

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	302.1	12.9	140.1	84.1	(3474.4)	+	(476.9)	+	(0.0)	=	3951.3	TOTALS

NO. OF ENTRIES TO SUBPT = 17
NO. OF LINKS RECALCULATED= 398

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21 56 1 -1
- (SECONDS)

10	4	21	70	110	123
12	4	0	60	100	130
13	4	139	78	98	122
14	4	6	41	66	105
15	3	139	41	81	
16	4	54	93	110	14

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	300.3	13.0	140.1	82.2	(3445.7)	+	(482.8)	+	(0.0)	=	3928.6	TOTALS

NO. OF ENTRIES TO SUBPT = 52
NO. OF LINKS RECALCULATED= 1053

140 SECOND CYCLE 35 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 21 56 -1 21 56 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
10	4	22	71	111	124			
12	4	2	62	102	132			
13	4	0	79	99	123			
14	4	6	41	66	105			
15	3	139	41	81				
16	4	54	93	110	14			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	--------DELAY-------- UNIFORM RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	COST OF DELAY ($/H)	----STOPS---- MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	----QUEUE---- MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	END 1ST	START 2ND	END 2ND
1012	1020	5200	61	14	43	11.4 + 0.8	(188.1)	82	(31.9)	34		219.9	10	27	71		
1013	450	1700	109	14	251	8.0 + 23.4	(486.5)	189	(32.3)	41	+	518.8	10	129	22		
1021	500	800	92	14	52	2.6 + 4.7	(112.1)	99	(18.8)	21	+	130.9					
1022	130	1900	106	14	288	2.4 + 8.0	(161.2)	203	(10.0)	13		171.2	10	116	124		
1023	30	1570	33	14	93	0.5 + 0.2	(12.1)	114	(1.3)	1		13.4	10	117	124		
1031	101	800	14	20	3	0.0 + 0.1	(1.2)	0	(0.0)	0		1.2					
1032	1200	3800	98	20	59	7.0 + 12.7	(305.3)	88	(40.1)	54		345.4	10	27	71		
1033	71	1400	22	20	85	1.5 + 0.1	(25.9)	106	(2.8)	3		28.7	10	130	22		
1041	70	800	11	14	5	0.0 + 0.1	(1.5)	15	(0.4)	0		1.9					
1042	230	2000	46	14	51	2.8 + 0.4	(50.6)	87	(7.6)	8		58.2	10	77	111		
1212	1050	5200	43	20	32	9.0 + 0.4	(145.7)	50	(19.9)	21		165.6	12	137	62		
1213	31	1600	54	20	140	0.6 + 0.6	(18.6)	144	(1.6)	2		20.3	12	138	2		
1221	20	1650	5	14	44	0.2 + 0.0	(3.8)	75	(0.6)	1		4.3	12	107	2		
1223	20	1650	7	14	54	0.3 + 0.0	(4.6)	84	(0.6)	1		5.2	12	107	132		
1231	59	1450	5	14	1	0.0 + 0.0	(0.4)	1	(0.0)	0		0.4	12	7	132		
1232	1479	3900	95	14	36	7.3 + 7.6	(231.9)	42	(23.5)	30		255.4	12	7	62		
1253	20	1500	5	14	44	0.2 + 0.0	(3.8)	76	(0.6)	1		4.4	12	67	102		
1312	1090	4400	46	14	6	1.4 + 0.4	(27.7)	10	(4.1)	6		31.8	13	5	79		
1313	101	1700	59	14	111	2.4 + 0.7	(48.5)	118	(4.5)	5		53.0	13	127	0		
1321	50	800	11	14	13	0.1 + 0.1	(2.9)	39	(0.7)	1		3.6					
1322	10	1800	4	16	58	0.1 + 0.0	(2.5)	88	(0.3)	0		2.8	13	103	123		
1323	150	1650	61	14	74	2.3 + 0.8	(47.7)	104	(5.9)	6		53.6	13	103	123		
1331	379	800	48	11	4	0.0 + 0.5	(7.3)	6	(0.9)	2		8.2					
1332	1470	4400	62	11	22	8.3 + 0.8	(141.9)	51	(28.3)	33		170.2	13	5	79		
1333	10	1500	7	11	99	0.2 + 0.0	(4.3)	110	(0.4)	0		4.7	13	127	0		
1341	20	1400	12	24	67	0.3 + 0.1	(5.8)	94	(0.3)	1		6.0	13	83	99		
1342	10	1600	5	24	65	0.2 + 0.0	(2.8)	93	(0.1)	0		2.9	13	83	99		
1411	219	800	27	11	3	0.0 + 0.2	(2.9)	0	(0.0)	0		2.9					
1412	1000	4300	46	11	21	5.3 + 0.4	(88.8)	52	(19.8)	21		108.6	14	111	41		
1421	750	3000	47	13	22	4.2 + 0.4	(71.6)	59	(20.4)	18		92.0	14	72	6		
1423	600	3100	80	14	61	8.3 + 1.9	(158.1)	98	(22.3)	23		180.4	14	72	105		
1432	840	3200	66	13	19	3.4 + 0.9	(67.3)	43	(13.6)	18		80.9	14	11	66		
1433	140	1700	52	13	32	0.7 + 0.5	(19.2)	105	(5.6)	6		24.7	14	45	66		
1512	990	3600	41	13	6	1.3 + 0.3	(25.7)	26	(9.9)	20		35.5	15	87	41		
1513	480	1700	75	13	51	5.4 + 1.4	(106.1)	70	(12.8)	13		118.9	15	87	139		
1521	380	800	58	14	10	0.4 + 0.7	(17.1)	32	(4.7)	5		21.8					
1523	210	1700	49	14	53	2.6 + 0.5	(48.1)	87	(7.0)	7		55.1	15	47	81		
1531	490	800	61	17	9	0.4 + 0.8	(18.6)	45	(8.4)	11		27.0					
1532	680	3600	70	17	47	7.8 + 1.1	(138.1)	96	(24.9)	26		162.9	15	4	41		
1611	289	1600	34	17	12	0.7 + 0.3	(14.7)	69	(7.6)	7		22.3	16	59	93	115	14
1612	390	1990	78	17	57	4.4 + 1.8	(95.2)	99	(14.6)	16		109.8	16	59	93		
1613	370	1900	76	17	60	4.6 + 1.5	(95.1)	104	(14.7)	15		109.8	16	19	54		

140 SECOND CYCLE 35 STEPS

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START END 1ST (SECONDS)	GREEN TIMES START END 2ND (SECONDS)
1621	100	1500	19	14	20	0.4 +	0.1	(8.7)	70	(2.6)	2		11.3	16	98 110	19 54
1622	150	1990	81	14	109	2.6 +	1.9	(70.4)	126	(7.2)	8		77.6	16	98 110	
1632	660	3600	73	14	56	8.8 +	1.4	(158.0)	94	(23.5)	25		181.5	16	59 93	
1633	100	1200	32	14	51	1.2 +	0.2	(21.9)	84	(3.2)	3		25.1	16	19 54	
1642	130	1800	25	16	43	1.4 +	0.2	(24.2)	78	(3.1)	4		27.3	16	115 14	
1643	490	1990	86	14	69	6.5 +	2.9	(145.0)	106	(19.7)	21		164.7	16	115 14	

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	299.9	13.0	139.7	82.2	(3439.4)	+	(482.9)	+	(0.0)	=	3922.2	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	229.9	+	255.2	+	202.1	=	687.2

NO. OF ENTRIES TO SUBPT = 14
NO. OF LINKS RECALCULATED= 360

PROGRAM TRANSYT FINISHED

==================== end of file ====================

[Printed at 12:11:50 on 08/05/2003]

Appendix C

AIMSUN2 – Network Simulation Results

STREAM Notes:

1. Network 'loops' as per network plan supplied on 16/04/02 via facsimile
2. Both directions (i.e., x1 = clockwise and x2 = anti-clockwise)

Loop A:	Nodes 1, 22, 7, 5 and back to 1
Loop B:	Nodes 22, 21, 16, 10, 9, 7 and back to 22
Loop C:	Nodes 21, 17, 16 and back to 21
Loop AB:	Nodes 1, 21, 16, 10, 9, 7, 5 and back to 1
Loop BC:	Nodes 22, 17, 10, 9, 7 and back to 22
Loop ABC	Nodes 1, 17, 10, 9, 7, 5 and back to 1
Loop M/Way East:	Nodes 2, 15, 10, 9, 7, 5 and back to 2
Loop M/Way West B:	Nodes 2, 15, 16, 21, 1 and back to 2
Loop M/Way West B:	Nodes 2, 15, 17, 1 and back to 2

Comparison of Existing and Proposed System

Stream Comparison

stream	mean travel time difference (s)	mean travel time difference (min:s)	comments
10-22	26	00:00:26	time saved
14-15	-8	00:00:08	
17-21	-12	00:00:12	
21-17	3	00:00:03	time saved
7-10	-1	00:00:01	
Loop A1	-13	00:00:13	
Loop A2	0	00:00:00	
Loop AB1	7	00:00:07	time saved
Loop AB2	189	00:03:09	Maximum Time SAVED
Loop ABC1	18	00:00:18	time saved
Loop ABC2	51	00:00:51	time saved
Loop B1	19	00:00:19	time saved
Loop B2	189	00:03:09	Maximum Time SAVED
Loop BC1	30	00:00:30	time saved
Loop BC2	51	00:00:51	time saved
Loop C1	131	00:02:11	time saved
Loop C2	-48	00:00:48	Maximum Time LOST
M/Way East 1	14	00:00:14	time saved
M/Way East 2	3	00:00:03	time saved
M/Way West B1	9	00:00:09	time saved
M/Way West B2	165	00:02:45	time saved
M/Way West BC1	20	00:00:20	time saved
M/Way West BC2	27	00:00:27	time saved

Notes

1. Each value is average of five replications ("existing" - "proposed")
2. Red = (-)ve
3. Therefore (+)ve travel time is GOOD
4. Maximum Time SAVED was 189 seconds
5. Maximum Time LOST was 48 seconds

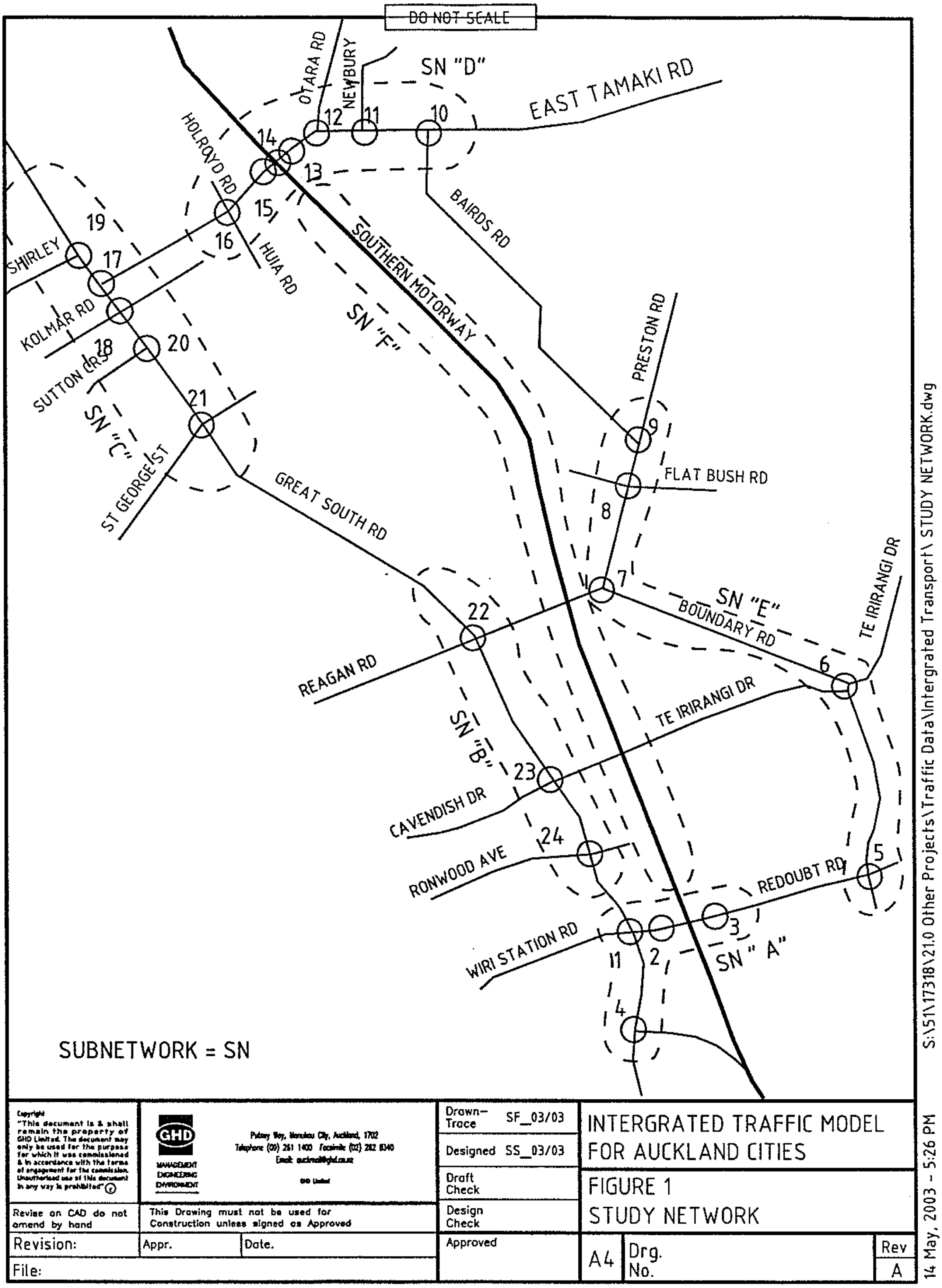
Comparison of Existing and Proposed System						
System Comparison						

replication Number	from	to	flow difference (pcu/h)	density difference (veh/km)	speed difference (km/h)	travel time difference (s)
1	25200	26100	400	-0.4999	0.562161	-8
1	26100	27000	-372	-0.34836	0.849129	-6
1	27000	27900	-88	0.503827	-0.11964	2
1	27900	28800	-100	0.375366	-0.09586	-1
1	28800	29700	-408	0.848233	0.141865	2
1	29700	30600	-92	1.155399	0.24562	2
1	30600	31500	80	1.133427	-0.1193	8
1	31500	32400	108	1.076977	-0.83336	10
1	**25200**	**32400**	**-59**	**0.383404**	**0.086513**	**1**
2	25200	26100	-152	-0.00781	0.49213	-4
2	26100	27000	-148	0.754603	-0.24043	3
2	27000	27900	244	0.960129	-0.48298	2
2	27900	28800	-160	1.203914	-0.08278	0
2	28800	29700	-160	1.179726	-0.19866	6
2	29700	30600	92	1.995808	-0.62951	9
2	30600	31500	116	1.30877	-0.63424	9
2	31500	32400	120	1.000847	-0.19387	9
2	**25200**	**32400**	**-6**	**0.898455**	**-0.24889**	**4**
3	25200	26100	308	0.000639	-0.69247	1
3	26100	27000	108	0.288704	-0.0414	-6
3	27000	27900	232	0.529644	-0.45763	2
3	27900	28800	76	1.248916	0.372029	-4
3	28800	29700	8	1.285877	-0.99818	5
3	29700	30600	-84	1.137989	-0.09766	-1
3	30600	31500	-212	0.924305	-0.18579	2
3	31500	32400	-188	1.443332	-0.64917	1
3	**25200**	**32400**	**31**	**0.735027**	**-0.34226**	**0**
4	25200	26100	-128	-0.142	0.217346	-4
4	26100	27000	176	-0.1012	0.200256	-6
4	27000	27900	20	-0.14164	0.084511	-1
4	27900	28800	-64	-0.46711	0.941746	-7
4	28800	29700	-328	-0.31839	1.547192	-4
4	29700	30600	-120	-0.17216	0.842514	-2
4	30600	31500	-472	0.1851	1.542405	-4
4	31500	32400	-16	0.811687	1.354427	-1
4	**25200**	**32400**	**-116**	**-0.05733**	**0.842518**	**-4**
5	25200	26100	-164	0.173797	0.0961	2
5	26100	27000	268	0.38543	-0.30481	-1
5	27000	27900	-144	0.639553	0.080101	0
5	27900	28800	176	1.575718	-0.94968	2
5	28800	29700	-156	1.613339	-0.24062	6
5	29700	30600	-216	1.006016	-0.5606	6
5	30600	31500	352	1.340721	-0.87448	3
5	31500	32400	464	1.198497	-0.78322	3
5	**25200**	**32400**	**72**	**0.874799**	**-0.4406**	**2**
Average of five replications			-15.6	0.56687	-0.02054	0.6

Notes
1 Five replications
2 (+)ve travel time difference is good

Figure 2.1 The study network showing the 6 Subnetworks A – F.

(The Subnetworks straddle Manukau City Council and Transit New Zealand jurisdictions.)



T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible, running under Microsoft Windows 95

Program TRANSYT 11, Analysis Program Version 1.1

Run with file:- "MODTFAAMAPR01.DAT" at 09:22 on 09/04/01

Transfund NZ : Traffic Signal Integration - Network A am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

NUMBER OF NODES	=	4
NUMBER OF LINKS	=	26
NUMBER OF OPTIMISED NODES	=	4
MAXIMUM NUMBER OF GRAPHIC PLOTS	=	0
NUMBER OF STEPS IN CYCLE	=	60
MAXIMUM NUMBER OF SHARED STOPLINES	=	0
MAXIMUM NUMBER OF TIMING POINTS	=	4
MAXIMUM LINKS AT ANY NODE	=	8

CORE REQUESTED = 6642 WORDS
CORE AVAILABLE = 72000 WORDS

DATA INPUT :-

CARD NO. CARD TYPE
(1)= TITLE:- Transfund NZ : Traffic Signal Integration - Network A am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	EFFECTIVE-GREEN DISPLACEMENTS END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	120	60	60	2	3	1	1	0	0	1	2	0	0	1550	283

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	4	1	3	1	0	0	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	14	1	0	38	40	25	71	23	98	22	0	0	0	0	0	0
5)=	11	2	0	100	0	0	0	0	0	0	0	0	0	0	0	0
6)=	13	3	0	41	41	48	92	24	0	0	0	0	0	0	0	0
7)=	12	4	0	30	49	27	0	0	0	0	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	PRIORITY LINKS LINK2 NO.	LINK1 ONLY % FLOW	GIVEWAY COEFFS. A1 X100	A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
8)=	30	111	122	133	0	22	22	0	0	0	0	200	0	800	0	0
9)=	30	121	132	143	0	25	0	0	0	0	0	200	0	800	0	0
10)=	30	131	142	113	0	25	0	0	0	0	0	420	0	800	0	0
11)=	30	141	112	123	0	22	22	0	0	0	0	50	0	800	0	0
12)=	30	221	243	0	100	22	0	0	0	0	0	100	0	800	0	0
13)=	30	243	222	0	0	22	0	0	0	0	0	310	0	800	0	0
14)=	30	311	322	0	0	22	0	0	0	0	0	200	0	800	0	0
15)=	30	321	343	0	0	22	0	0	0	0	0	310	0	800	0	0
16)=	30	441	412	0	0	22	0	0	0	0	0	200	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	FIRST GREEN START LAG	FIRST GREEN END STAGE	FIRST GREEN END LAG	SECOND GREEN START STAGE	SECOND GREEN START LAG	SECOND GREEN END STAGE	SECOND GREEN END LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
17)=	31	112	1	3	6	4	0	0	0	0	0	200	0	3600	0	0
18)=	31	113	1	2	5	3	0	0	0	0	0	200	0	1700	0	0
19)=	31	122	1	1	6	2	0	0	0	0	0	200	0	3600	0	0
20)=	31	123	1	4	6	1	0	0	0	0	0	200	0	1650	0	0
21)=	31	132	1	3	5	4	0	0	0	0	0	420	0	3600	0	0
22)=	31	133	1	2	8	3	0	0	0	0	0	420	0	2200	0	0
23)=	31	142	1	1	6	2	0	0	0	0	0	200	0	3470	0	0
24)=	31	143	1	4	6	1	0	0	0	0	0	200	0	1900	0	0
25)=	31	222	0	0	0	0	0	0	0	0	0	140	0	3400	0	0
26)=	31	242	0	0	0	0	0	0	0	0	0	310	0	3700	0	0
27)=	31	313	3	2	8	3	0	0	0	0	0	200	0	3380	0	0
28)=	31	322	3	1	5	2	0	0	0	0	0	320	0	3550	0	0
29)=	31	342	3	3	5	2	0	0	0	0	0	200	0	3440	0	0
30)=	31	343	3	3	5	1	0	0	0	0	0	200	0	1340	0	0
31)=	31	412	4	1	5	2	0	0	0	0	0	410	0	3750	0	0
32)=	31	432	4	1	5	2	0	0	0	0	0	200	0	3200	0	0
33)=	31	443	4	2	5	1	0	0	0	0	0	200	0	3100	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	ENTRY 1 FLOW	ENTRY 1 CRUISE SPEED	ENTRY 2 LINK NO.	ENTRY 2 FLOW	ENTRY 2 CRUISE SPEED	ENTRY 3 LINK NO.	ENTRY 3 FLOW	ENTRY 3 CRUISE SPEED	ENTRY 4 LINK NO.	ENTRY 4 FLOW	ENTRY 4 CRUISE SPEED
34)=	32	111	300	0	0	0	50	0	0	0	0	0	0	0	0	0
35)=	32	112	200	0	0	0	50	0	0	0	0	0	0	0	0	0
36)=	32	113	50	0	0	0	50	0	0	0	0	0	0	0	0	0
37)=	32	121	100	0	0	0	55	0	0	0	0	0	0	0	0	0
38)=	32	122	650	0	0	0	50	0	0	0	0	0	0	0	0	0
39)=	32	123	50	0	0	0	50	0	0	0	0	0	0	0	0	0
40)=	32	131	550	0	432	200	50	443	350	50	0	0	0	0	0	0
41)=	32	132	800	0	432	400	50	443	400	45	0	0	0	0	0	0
42)=	32	133	450	0	432	200	50	443	250	45	0	0	0	0	0	0
43)=	32	141	300	0	242	300	50	0	0	0	0	0	0	0	0	0
44)=	32	142	900	0	242	900	50	0	0	0	0	0	0	0	0	0
45)=	32	143	200	0	242	200	50	0	0	0	0	0	0	0	0	0
46)=	32	221	485	0	111	180	50	122	100	50	133	200	60	0	0	0
47)=	32	222	850	0	111	100	50	122	600	50	133	150	60	0	0	0
48)=	32	242	1550	0	342	650	50	313	900	50	0	0	0	0	0	0
49)=	32	243	550	0	342	580	50	0	0	0	0	0	0	0	0	0
50)=	32	311	100	0	0	0	50	0	0	0	0	0	0	0	0	0
51)=	32	313	900	0	0	0	50	0	0	0	0	0	0	0	0	0
52)=	32	321	450	0	222	450	45	0	0	0	0	0	0	0	0	0
53)=	32	322	400	0	222	400	45	0	0	0	0	0	0	0	0	0
54)=	32	342	1350	0	0	0	45	0	0	0	0	0	0	0	0	0
55)=	32	343	150	0	0	0	45	0	0	0	0	0	0	0	0	0
56)=	32	412	600	0	112	250	50	123	50	50	141	300	50	0	0	0
57)=	32	432	900	0	0	0	50	0	0	0	0	0	0	0	0	0
58)=	32	441	150	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	443	1300	0	0	0	50	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT*****

120 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
1	4	0	38	69	98			
2	1	0						
3	3	0	41	92				
4	2	0	49					

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	DELAY UNIFORM RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	END 1ST	START 2ND	END 2ND
111	300	800	54	14	10	0.2 + 0.6	(12.4)	29	(3.3)	3		15.7					
112	200	3600	28	14	44	2.3 + 0.2	(38.0)	85	(6.4)	6		44.4	1	75	98		
113	50	1700	13	14	42	0.5 + 0.1	(9.1)	81	(1.5)	1		10.7	1	43	69		
121	100	800	16	13	6	0.1 + 0.1	(2.7)	24	(1.1)	1		3.8					
122	650	3600	66	14	44	7.0 + 1.0	(122.5)	89	(22.0)	20		144.5	1	6	38		
123	50	1650	21	14	55	0.6 + 0.1	(11.9)	93	(1.8)	2		13.7	1	104	0		
131	551	800	93	30	43	1.2 + 5.3	(101.6)	76	(15.8)	15		117.4					
132	800	3600	107	32	192	11.3 + 31.4	(662.0)	182	(55.3)	58		717.3	1	74	98		
133	449	2200	102	32	150	5.4 + 13.2	(289.1)	167	(28.5)	28		317.6	1	46	69		
141	301	800	40	4	4	0.0 + 0.3	(5.7)	11	(1.2)	2		6.9					
142	899	3470	94	14	65	9.6 + 6.6	(252.0)	115	(39.1)	36		291.1	1	6	38		
143	202	1900	75	14	67	2.3 + 1.4	(57.9)	111	(8.4)	8		66.3	1	104	0		
221	481	800	60	7	8	0.3 + 0.8	(16.9)	38	(7.1)	9	+	23.9					
222	848	3400	25	10	1	0.0 + 0.2	(2.6)	1	(0.2)	0		2.8					
242	1551	3700	42	22	1	0.0 + 0.4	(5.6)	1	(0.4)	0		6.0					
243	551	800	90	22	55	4.5 + 3.9	(130.1)	105	(21.9)	21		152.0					
311	100	800	14	14	3	0.0 + 0.1	(1.5)	9	(0.4)	0		1.8					
313	900	3380	73	14	38	8.2 + 1.3	(147.5)	87	(29.7)	27		177.1	3	49	92		
321	449	800	59	25	11	0.7 + 0.7	(21.4)	64	(8.8)	12		30.2					
322	398	3550	36	26	60	6.3 + 0.3	(102.7)	92	(11.3)	12		114.0	3	5	41		
342	1350	3440	72	16	24	7.8 + 1.3	(140.8)	74	(30.5)	35		171.4	3	97	41		
343	150	1340	56	16	58	1.8 + 0.6	(37.7)	99	(4.6)	5		42.2	3	97	0		
412	601	3750	43	30	23	3.5 + 0.4	(60.2)	84	(19.0)	17		79.2	4	5	49		
432	900	3200	75	14	39	8.1 + 1.5	(149.3)	88	(30.0)	27		179.3	4	5	49		
441	150	800	22	14	5	0.1 + 0.1	(3.1)	16	(0.9)	1		3.9					
443	1300	3100	75	14	24	7.3 + 1.5	(136.1)	75	(36.7)	34		172.8	4	54	0		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	235.6	15.1	89.3	73.3	(2520.3)	+	(386.0)	+	(0.0)	=	2906.3	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	191.3	+	187.0	+	161.6	=	539.9

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 26

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18
- (SECONDS)

1	4	84	2	33	62
2	1	0			
3	3	0	41	92	
4	2	102	31		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	232.2	15.3	85.9	73.3	(2468.3)	+	(383.9)	+	(0.0)	=	2852.2	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 215

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48
- (SECONDS)

1	4	84	2	33	62
2	1	0			
3	3	0	41	92	
4	2	54	103		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	232.2	15.3	86.0	73.3	(2469.0)	+	(381.6)	+	(0.0)	=	2850.5	TOTALS

NO. OF ENTRIES TO SUBPT = 10
NO. OF LINKS RECALCULATED= 174

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1
- (SECONDS)

1	4	84	2	31	62
2	1	0			
3	3	119	43	93	
4	2	52	103		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	225.9	15.8	85.3	67.6	(2370.5)	+	(372.1)	+	(0.0)	=	2742.6	TOTALS

NO. OF ENTRIES TO SUBPT = 29
NO. OF LINKS RECALCULATED= 454

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18
- (SECONDS)

1	4	84	2	31	62
2	1	0			
3	3	119	43	93	
4	2	70	1		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	225.0	15.8	84.5	67.6	(2357.4)	+	(370.2)	+	(0.0)	=	2727.6	TOTALS

NO. OF ENTRIES TO SUBPT = 9
NO. OF LINKS RECALCULATED= 167

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48
- (SECONDS)

1	4	84	2	31	62
2	1	0			
3	3	119	43	93	
4	2	70	1		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	225.0	15.8	84.5	67.6	(2357.4)	+	(370.2)	+	(0.0)	=	2727.6	TOTALS

NO. OF ENTRIES TO SUBPT = 9
NO. OF LINKS RECALCULATED= 167

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1
- (SECONDS)

1	4	81	119	28	59
2	1	0			
3	3	0	44	94	
4	2	70	1		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	224.5	15.9	83.9	67.7	(2349.7)	+ (	372.6)	+ (	0.0)	=	2722.2	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 227

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1 -1
- (SECONDS)

1	4	81	119	28	59
2	1	0			
3	3	2	44	94	
4	2	72	1		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	224.3	15.9	83.8	67.6	(2346.0)	+ (	368.8)	+ (	0.0)	=	2714.8	TOTALS

NO. OF ENTRIES TO SUBPT = 29
NO. OF LINKS RECALCULATED= 480

120 SECOND CYCLE 60 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 18 48 -1 18 48 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
1	4	81	119	28	59			
2	1	0						
3	3	2	44	94				
4	2	76	5					

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	END 1ST	START 2ND	END 2ND (SECONDS)
111	300	800	53	14	9	0.2 +	0.6	(11.8)	28	(3.2)	3		14.9					
112	200	3600	26	14	42	2.2 +	0.2	(36.3)	82	(6.2)	6		42.5	1	34	59		
113	50	1700	14	14	45	0.5 +	0.1	(9.6)	84	(1.6)	1		11.2	1	4	28		
121	100	800	16	13	7	0.1 +	0.1	(2.9)	24	(1.1)	1		4.0					
122	650	3600	66	14	44	6.9 +	1.0	(122.4)	89	(22.0)	20		144.4	1	87	119		
123	50	1650	21	14	55	0.6 +	0.1	(11.9)	94	(1.8)	2		13.7	1	65	81		
131	551	800	93	30	43	1.2 +	5.4	(101.4)	74	(15.4)	14		116.7					
132	800	3600	99	32	101	10.6 +	11.9	(347.6)	136	(41.2)	38		388.8	1	33	59		
133	449	2200	111	32	273	6.8 +	27.2	(526.8)	209	(35.6)	42		562.4	1	7	28		
141	301	800	40	4	4	0.0 +	0.3	(5.5)	7	(0.8)	1		6.3					
142	899	3470	94	14	61	8.6 +	6.6	(236.5)	108	(37.0)	35		273.5	1	87	119		
143	202	1900	75	14	86	3.4 +	1.4	(74.9)	119	(9.0)	8		83.9	1	65	81		
221	465<	800	58	7	7	0.3 +	0.7	(15.0)	34	(6.2)	8	+	21.2					
222	836<	3400	25	10	1	0.0 +	0.2	(2.5)	1	(0.2)	0		2.7					
242	1551	3700	42	22	1	0.0 +	0.4	(5.6)	1	(0.4)	0		6.0					
243	551	800	89	22	42	2.7 +	3.8	(99.6)	108	(22.6)	22		122.2					
311	100	800	14	14	3	0.0 +	0.1	(1.3)	5	(0.2)	0		1.5					
313	900	3380	74	14	39	8.4 +	1.4	(152.7)	88	(30.1)	27		182.8	3	52	94		
321	443	800	58	25	11	0.7 +	0.7	(21.0)	64	(8.8)	13		29.8					
322	393	3550	35	26	18	1.7 +	0.3	(29.9)	46	(5.7)	8		35.6	3	7	44		
342	1350	3440	71	16	23	7.5 +	1.2	(135.4)	72	(29.9)	34		165.3	3	99	44		
343	150	1340	56	16	58	1.8 +	0.6	(37.7)	99	(4.6)	5		42.2	3	99	2		
412	601	3750	43	30	26	4.0 +	0.4	(67.4)	79	(18.0)	16		85.4	4	81	5		
432	900	3200	75	14	39	8.1 +	1.5	(149.3)	88	(30.0)	27		179.3	4	81	5		
441	150	800	22	14	5	0.0 +	0.1	(2.9)	15	(0.8)	1		3.8					
443	1300	3100	75	14	24	7.3 +	1.5	(136.1)	75	(36.7)	34		172.8	4	10	76		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3563.0	224.2	15.9	83.7	67.6	(2344.2)	+	(368.9)	+	(0.0)	=	2713.1	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	191.3	+	173.9	+	154.4	=	519.6

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 191

PROGRAM TRANSYT FINISHED

== end of file ==

[Printed at 12:03:50 on 08/05/2003]

T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible, running under Microsoft Windows 95

Program TRANSYT 11, Analysis Program Version 1.1

Run with file:- "MODTFBAMAPR01.DAT" at 09:31 on 09/04/01

Transfund : Signal Integration - Network B am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

```
NUMBER OF NODES                    =   3
NUMBER OF LINKS                    =  27
NUMBER OF OPTIMISED NODES          =   4
MAXIMUM NUMBER OF GRAPHIC PLOTS    =   0
NUMBER OF STEPS IN CYCLE           =  60
MAXIMUM NUMBER OF SHARED STOPLINES =   0
MAXIMUM NUMBER OF TIMING POINTS    =   4
MAXIMUM LINKS AT ANY NODE          =   9

CORE REQUESTED =   6702 WORDS
CORE AVAILABLE =  72000 WORDS
```

DATA INPUT :-

CARD NO.	CARD TYPE
(1)=	TITLE:- Transfund : Signal Integration - Network B am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	EFFECTIVE-GREEN DISPLACEMENTS END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	120	60	60	2	3	1	1	0	0	1	2	0	0	1550	283

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	22	23	24	22	0	0	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	14	22	0	17	0	36	0	21	0	19	0	0	0	0	0	0
5)=	23	23	0	34	0	16	0	10	0	0	0	0	0	0	0	0
6)=	14	24	0	50	0	13	0	17	0	11	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	PRIORITY LINKS LINK2 NO.	LINK1 ONLY % FLOW	GIVEWAY COEFFS. A1 X100	A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
7)=	30	2211	2222	2233	0	25	0	0	0	0	0	200	0	800	0	0
8)=	30	2231	2242	2213	0	25	0	0	0	0	0	50	0	800	0	0
9)=	30	2241	2212	2223	0	25	0	0	0	0	0	50	0	800	0	0
10)=	30	2321	2332	0	100	0	0	0	0	0	0	200	0	800	0	0
11)=	30	2331	2313	0	100	0	0	0	0	0	0	100	0	800	0	0
12)=	30	2421	2432	2444	0	22	0	0	0	0	0	200	0	800	0	0
13)=	30	2431	2444	2413	0	22	0	0	0	0	0	50	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	FIRST GREEN START LAG	FIRST GREEN END STAGE	FIRST GREEN END LAG	SECOND GREEN START STAGE	SECOND GREEN START LAG	SECOND GREEN END STAGE	SECOND GREEN END LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
14)=	31	2212	22	1	5	2	0	0	0	0	0	999	0	3700	0	0
15)=	31	2213	22	4	5	1	0	0	0	0	0	200	0	1550	0	0
16)=	31	2221	22	3	5	4	0	0	0	0	0	999	0	1550	0	0
17)=	31	2222	22	3	5	4	0	0	0	0	0	999	0	1800	0	0
18)=	31	2223	22	3	5	4	0	0	0	0	0	999	0	1530	0	0
19)=	31	2232	22	1	5	2	0	0	0	0	0	680	0	3500	0	0
20)=	31	2233	22	4	5	1	0	0	0	0	0	680	0	2800	0	0
21)=	31	2242	22	2	5	3	0	0	0	0	0	999	0	1800	0	0
22)=	31	2243	22	2	5	3	0	0	0	0	0	999	0	1700	0	0
23)=	31	2312	23	1	5	3	0	0	0	0	0	685	0	3500	0	0
24)=	31	2313	23	2	5	3	0	0	0	0	0	100	0	1700	0	0
25)=	31	2323	23	3	5	1	0	0	0	0	0	999	0	3200	0	0
26)=	31	2332	23	1	5	2	0	0	0	0	0	330	0	3300	0	0
27)=	31	2412	24	1	5	2	0	0	0	0	0	330	0	4200	0	0
28)=	31	2413	24	4	5	1	0	0	0	0	0	50	0	1720	0	0
29)=	31	2422	24	3	5	4	0	0	0	0	0	999	0	1800	0	0
30)=	31	2423	24	3	5	4	0	0	0	0	0	999	0	1800	0	0
31)=	31	2432	24	1	5	2	0	0	0	0	0	999	0	3900	0	0
32)=	31	2433	24	4	5	1	0	0	0	0	0	999	0	1800	0	0
33)=	31	2444	24	2	5	3	0	0	0	0	0	200	0	1800	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	ENTRY 1 FLOW	ENTRY 1 CRUISE SPEED	ENTRY 2 LINK NO.	ENTRY 2 FLOW	ENTRY 2 CRUISE SPEED	ENTRY 3 LINK NO.	ENTRY 3 FLOW	ENTRY 3 CRUISE SPEED	ENTRY 4 LINK NO.	ENTRY 4 FLOW	ENTRY 4 CRUISE SPEED
34)=	32	2211	220	0	0	0	50	0	0	0	0	0	0	0	0	0
35)=	32	2212	240	0	0	0	50	0	0	0	0	0	0	0	0	0
36)=	32	2213	160	0	0	0	50	0	0	0	0	0	0	0	0	0
37)=	32	2221	220	0	0	0	50	0	0	0	0	0	0	0	0	0
38)=	32	2222	430	0	0	0	50	0	0	0	0	0	0	0	0	0
39)=	32	2223	70	0	0	0	50	0	0	0	0	0	0	0	0	0
40)=	32	2231	120	0	2332	120	50	0	0	0	0	0	0	0	0	0
41)=	32	2232	370	0	2321	70	50	2332	300	50	0	0	0	0	0	0
42)=	32	2233	340	0	2332	340	50	0	0	0	0	0	0	0	0	0
43)=	32	2241	420	0	0	0	50	0	0	0	0	0	0	0	0	0
44)=	32	2242	590	0	0	0	50	0	0	0	0	0	0	0	0	0
45)=	32	2243	140	0	0	0	50	0	0	0	0	0	0	0	0	0
46)=	32	2312	480	0	2241	280	50	2212	160	50	2223	40	50	0	0	0
47)=	32	2313	200	0	2241	120	50	2212	80	50	2223	30	50	0	0	0
48)=	32	2321	70	0	0	0	50	0	0	0	0	0	0	0	0	0
49)=	32	2323	90	0	0	0	50	0	0	0	0	0	0	0	0	0
50)=	32	2331	210	0	2421	40	50	2432	170	50	0	0	0	0	0	0
51)=	32	2332	820	0	2421	40	50	2432	770	50	2444	10	50	0	0	0
52)=	32	2412	440	0	2312	330	50	2323	90	50	0	0	0	0	0	0
53)=	32	2413	90	0	2312	90	50	0	0	0	0	0	0	0	0	0
54)=	32	2421	80	0	0	0	50	0	0	0	0	0	0	0	0	0
55)=	32	2422	90	0	0	0	50	0	0	0	0	0	0	0	0	0
56)=	32	2423	90	0	0	0	50	0	0	0	0	0	0	0	0	0
57)=	32	2431	170	0	0	0	50	0	0	0	0	0	0	0	0	0
58)=	32	2432	860	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	2433	10	0	0	0	50	0	0	0	0	0	0	0	0	0
60)=	32	2444	50	0	0	0	50	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT*****

120 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
22	4	0	18	65	100			
23	3	0	34	50	60	94	110	
24	4	0	68	81	100			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	END 1ST	START 2ND	END 2ND (SECONDS)
2211	220	800	32	14	4	0.0 +	0.2	(3.6)	0	(0.0)	0		3.6					
2212	240	3700	56	72	59	3.3 +	0.6	(61.3)	99	(9.0)	8		70.4	22	5	18		
2213	160	1550	77	14	86	2.2 +	1.6	(59.5)	122	(7.4)	7		66.9	22	105	0		
2221	220	1550	55	72	48	2.4 +	0.6	(45.8)	91	(7.6)	7		53.5	22	70	100		
2222	430	1800	92	72	84	5.2 +	4.8	(155.0)	124	(20.3)	19		175.2	22	70	100		
2223	70	1530	18	72	40	0.7 +	0.1	(12.1)	80	(2.1)	2		14.2	22	70	100		
2231	120	800	18	4	3	0.0 +	0.1	(1.7)	0	(0.0)	0		1.7					
2232	370	3500	91	49	77	3.9 +	4.0	(123.0)	122	(17.1)	16		140.1	22	5	18		
2233	340	2800	91	49	102	5.5 +	4.1	(149.0)	121	(15.6)	15		164.5	22	105	0		
2241	420	800	56	4	6	0.0 +	0.6	(10.6)	12	(1.9)	2		12.5					
2242	590	1800	91	72	65	6.0 +	4.6	(164.6)	113	(25.3)	23		189.9	22	23	65		
2243	140	1700	23	72	31	1.0 +	0.1	(18.5)	69	(3.7)	3		22.2	22	23	65		
2312	480	3500	18	49	4	0.4 +	0.1	(8.3)	34	(6.2)	4		14.4	23	5	50	65	110
2313	200	1700	59	7	35	1.3 +	0.7	(30.4)	111	(8.4)	5		38.8	23	39	50	99	110
2321	70	800	9	14	2	0.0 +	0.0	(0.7)	0	(0.0)	0		0.7					
2323	90	3200	28	72	33	0.6 +	0.2	(12.7)	100	(3.4)	2		16.1	23	55	60	115	0
2331	210	800	26	7	3	0.0 +	0.2	(2.8)	0	(0.0)	0		2.8					
2332	821	3300	50	24	18	3.7 +	0.5	(65.1)	75	(23.2)	19		88.3	23	5	34	65	94
2412	440	4200	20	24	21	2.4 +	0.1	(39.3)	59	(9.9)	9		49.2	24	5	68		
2413	90	1720	39	4	61	1.2 +	0.3	(23.8)	106	(3.6)	3		27.4	24	105	0		
2421	80	800	13	14	4	0.0 +	0.1	(1.5)	14	(0.4)	0		1.9					
2422	90	1800	40	72	62	1.2 +	0.3	(23.9)	100	(3.4)	3		27.3	24	86	100		
2423	90	1800	40	72	62	1.2 +	0.3	(23.9)	100	(3.4)	3		27.3	24	86	100		
2431	170	800	22	4	3	0.0 +	0.1	(2.1)	0	(0.0)	0		2.1					
2432	860	3900	41	72	18	4.0 +	0.4	(67.5)	58	(18.8)	17		86.3	24	5	68		
2433	10	1800	4	72	53	0.1 +	0.0	(2.3)	90	(0.3)	0		2.6	24	105	0		
2444	50	1800	37	14	74	0.7 +	0.3	(15.9)	109	(2.1)	2		17.9	24	73	81		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
4251.6	157.6	27.0	47.3	25.3	(1124.9) +	(193.1) +	(0.0) =	1318.0	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	228.5	+	83.5	+	80.9	=	392.8

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 27

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18
- (SECONDS)

22	4	36	54	101	16		
23	3	18	52	68	78	112	8
24	4	0	68	81	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
4251.6	153.9	27.6	43.6	25.3	(1067.9) +	(178.9) +	(0.0) =	1246.9	TOTALS

NO. OF ENTRIES TO SUBPT = 9
NO. OF LINKS RECALCULATED= 165

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48
- (SECONDS)

22	4	36	54	101	16		
23	3	18	52	68	78	112	8
24	4	0	68	81	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	153.9	27.6	43.6	25.3	(1067.9)	+	(178.9)	+	(0.0)	=	1246.9	TOTALS

NO. OF ENTRIES TO SUBPT = 9
NO. OF LINKS RECALCULATED= 165

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1
- (SECONDS)

22	4	37	55	101	16		
23	3	18	52	68	78	112	8
24	4	116	69	82	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	153.2	27.7	43.2	25.0	(1057.3)	+	(176.1)	+	(0.0)	=	1233.4	TOTALS

NO. OF ENTRIES TO SUBPT = 33
NO. OF LINKS RECALCULATED= 520

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18
- (SECONDS)

22	4	19	37	83	118		
23	3	18	52	68	78	112	8
24	4	116	69	82	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.9	27.8	42.8	25.0	(1051.7)	+	(180.1)	+	(0.0)	=	1231.9	TOTALS

NO. OF ENTRIES TO SUBPT = 10
NO. OF LINKS RECALCULATED= 185

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48
- (SECONDS)

22	4	91	109	35	70		
23	3	18	52	68	78	112	8
24	4	116	69	82	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.7	27.8	42.6	25.0	(1048.9)	+	(175.2)	+	(0.0)	=	1224.0	TOTALS

NO. OF ENTRIES TO SUBPT = 10
NO. OF LINKS RECALCULATED= 185

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1
- (SECONDS)

22	4	94	112	38	73		
23	3	19	53	69	79	113	9
24	4	115	68	81	99		

TOTAL DISTANCE TRAVELLED	TOTAL TIME SPENT	MEAN JOURNEY SPEED	TOTAL UNIFORM DELAY	TOTAL RANDOM+ OVERSAT DELAY	TOTAL COST OF DELAY		TOTAL COST OF STOPS		PENALTY FOR EXCESS QUEUES		TOTAL PERFORMANCE INDEX	
(PCU-KM/H)	(PCU-H/H)	(KM/H)	(PCU-H/H)	(PCU-H/H)	($/H)		($/H)		($/H)		($/H)	
4251.6	152.5	27.9	42.4	25.0	(1045.0)	+	(175.4)	+	(0.0)	=	1220.4	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 217

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1 18 48 1 -1
- (SECONDS)

22	4	94	112	38	73		
23	3	19	53	69	79	113	9
24	4	115	68	81	99		

TOTAL DISTANCE TRAVELLED	TOTAL TIME SPENT	MEAN JOURNEY SPEED	TOTAL UNIFORM DELAY	TOTAL RANDOM+ OVERSAT DELAY	TOTAL COST OF DELAY		TOTAL COST OF STOPS		PENALTY FOR EXCESS QUEUES		TOTAL PERFORMANCE INDEX	
(PCU-KM/H)	(PCU-H/H)	(KM/H)	(PCU-H/H)	(PCU-H/H)	($/H)		($/H)		($/H)		($/H)	
4251.6	152.5	27.9	42.4	25.0	(1045.0)	+	(175.4)	+	(0.0)	=	1220.4	TOTALS

NO. OF ENTRIES TO SUBPT = 29
NO. OF LINKS RECALCULATED= 503

120 SECOND CYCLE 60 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 18 48 -1 18 48 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
22	4	94	112	38	73			
23	3	18	52	68	78	112	8	
24	4	114	67	80	98			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	DELAY RANDOM+ OVERSAT (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES 1ST START (SECONDS)	GREEN TIMES 1ST END (SECONDS)	GREEN TIMES 2ND START (SECONDS)	GREEN TIMES 2ND END (SECONDS)
2211	220	800	32	14	4	0.0 +	0.2	3.6	0	0.0	0		3.6					
2212	240	3700	56	72	59	3.3 +	0.6	61.3	99	9.0	8		70.4	22	99	112		
2213	160	1550	73	14	78	2.2 +	1.3	53.9	115	7.0	6		60.9	22	78	94		
2221	220	1550	55	72	48	2.3 +	0.6	45.8	91	7.6	7		53.4	22	43	73		
2222	430	1800	92	72	84	5.2 +	4.8	154.9	125	20.3	19		175.3	22	43	73		
2223	70	1530	18	72	40	0.7 +	0.1	12.1	79	2.1	2		14.2	22	43	73		
2231	120	800	18	4	3	0.0 +	0.1	1.8	5	0.2	0		2.0					
2232	370	3500	91	49	88	5.0 +	4.0	139.6	127	17.8	16		157.5	22	99	112		
2233	340	2800	86	49	71	4.0 +	2.7	104.2	111	14.3	13		118.6	22	78	94		
2241	420	800	56	4	6	0.0 +	0.6	10.6	12	1.9	2		12.5					
2242	590	1800	94	72	73	6.2 +	5.7	184.6	120	26.8	25		211.4	22	117	38		
2243	140	1700	24	72	32	1.1 +	0.2	19.0	70	3.7	3		22.7	22	117	38		
2312	480	3500	18	49	2	0.2 +	0.1	4.3	17	3.1	2		7.4	23	23	68	83	8
2313	200	1700	59	7	29	0.9 +	0.7	24.7	106	8.0	5		32.8	23	57	68	117	8
2321	70	800	9	14	2	0.0 +	0.0	0.7	0	0.0	0		0.7					
2323	90	3200	28	72	33	0.6 +	0.2	12.7	100	3.4	2		16.1	23	73	78	13	18
2331	210	800	26	7	3	0.0 +	0.2	2.8	0	0.0	0		2.8					
2332	821	3300	50	24	8	1.3 +	0.5	28.1	40	12.5	9		40.5	23	23	52	83	112
2412	440	4200	18	24	12	1.3 +	0.1	22.6	42	7.1	6		29.7	24	119	67		
2413	90	1720	52	4	74	1.3 +	0.5	28.8	111	3.8	3		32.5	24	103	114		
2421	80	800	13	14	4	0.0 +	0.1	1.5	12	0.4	0		1.8					
2422	90	1800	43	72	64	1.2 +	0.4	24.9	102	3.5	3		28.4	24	85	98		
2423	90	1800	43	72	64	1.2 +	0.4	24.9	102	3.5	3		28.4	24	85	98		
2431	170	800	22	4	3	0.0 +	0.1	2.1	0	0.0	0		2.1					
2432	860	3900	38	72	15	3.3 +	0.3	56.3	52	16.9	16		73.2	24	119	67		
2433	10	1800	6	72	59	0.1 +	0.0	2.5	96	0.4	0		2.9	24	103	114		
2444	50	1800	37	14	74	0.7 +	0.3	15.9	109	2.1	2		18.0	24	72	80		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
4251.6	152.4	27.9	42.4	25.0	(1044.4)	+	(175.4)	+	(0.0)	=	1219.8	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	228.5	+	77.5	+	73.4	=	379.4

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 194

PROGRAM TRANSYT FINISHED

== end of file ==

[Printed at 12:05:11 on 08/05/2003]

T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible

Program TRANSYT 11, Analysis Program Version 1.3

Run with file:- "C12APR02.DAT" at 16:37 on 12/04/02

Transfund : Signal Integration - Network C am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

NUMBER OF NODES	=	5
NUMBER OF LINKS	=	35
NUMBER OF OPTIMISED NODES	=	5
MAXIMUM NUMBER OF GRAPHIC PLOTS	=	0
NUMBER OF STEPS IN CYCLE	=	60
MAXIMUM NUMBER OF SHARED STOPLINES	=	0
MAXIMUM NUMBER OF TIMING POINTS	=	4
MAXIMUM LINKS AT ANY NODE	=	10

CORE REQUESTED = 7951 WORDS
CORE AVAILABLE = 72000 WORDS

DATA INPUT :-

CARD NO.	CARD TYPE
(1)=	TITLE:- Transfund : Signal Integration - Network C am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	90	60	60	2	3	1	0	0	0	1	2	0	0	1550	283

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	17	18	19	20	21	0	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	13	19	0	22	26	20	72	14	0	0	0	0	0	0	0	0
5)=	13	17	0	15	23	10	55	15	0	0	0	0	0	0	0	0
6)=	13	18	0	10	46	10	57	10	0	0	0	0	0	0	0	0
7)=	13	20	0	28	47	10	57	30	0	0	0	0	0	0	0	0
8)=	14	21	0	20	33	15	55	15	75	11	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	LINK2 NO.	LINK1 GIVEWAY ONLY % FLOW	COEFFS. A1 X100	A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
9)=	30	1921	1932	0	0	22	0	0	0	0	0	200	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	LAG	END STAGE	LAG	SECOND GREEN START STAGE	LAG	END STAGE	LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
10)=	31	1711	17	1	5	3	0	0	0	0	0	160	0	1338	0	0
11)=	31	1712	17	1	5	2	0	0	0	0	0	200	0	3400	0	0
12)=	31	1732	17	3	5	2	0	0	0	0	0	110	0	1600	0	0
13)=	31	1733	17	3	5	1	0	0	0	0	0	110	0	1600	0	0
14)=	31	1741	17	2	5	1	0	0	0	0	0	200	0	2800	0	0
15)=	31	1743	17	2	5	3	0	0	0	0	0	200	0	1925	0	0
16)=	31	1812	18	3	5	2	0	0	0	0	0	105	0	1300	0	0
17)=	31	1813	18	3	5	1	0	0	0	0	0	110	0	1430	0	0
18)=	31	1821	18	2	5	3	0	0	0	0	0	200	0	1430	0	0
19)=	31	1823	18	2	5	3	0	0	0	0	0	200	0	1530	0	0
20)=	31	1831	18	1	5	3	0	0	0	0	0	195	0	1700	0	0
21)=	31	1832	18	1	5	2	0	0	0	0	0	195	0	1700	0	0
22)=	31	1912	19	3	5	2	0	0	0	0	0	200	0	3803	0	0
23)=	31	1913	19	3	5	1	0	0	0	0	0	200	0	1700	0	0
24)=	31	1923	19	2	5	3	0	0	0	0	0	200	0	1700	0	0
25)=	31	1931	19	1	0	3	0	0	0	0	0	100	0	800	0	0
26)=	31	1932	19	1	5	2	0	0	0	0	0	160	0	1700	0	0
27)=	31	2012	20	3	5	2	0	0	0	0	0	200	0	1600	0	0
28)=	31	2013	20	3	5	1	0	0	0	0	0	200	0	500	0	0
29)=	31	2021	20	2	5	1	0	0	0	0	0	200	0	1600	0	0
30)=	31	2023	20	2	5	3	0	0	0	0	0	200	0	1700	0	0
31)=	31	2031	20	1	0	3	0	0	0	0	0	100	0	500	0	0
32)=	31	2032	20	1	5	2	0	0	0	0	0	385	0	1600	0	0
33)=	31	2111	21	1	0	3	0	0	0	0	0	385	0	1520	0	0
34)=	31	2112	21	1	6	2	0	0	0	0	0	385	0	2000	0	0
35)=	31	2113	21	4	6	1	0	0	0	0	0	385	0	1520	0	0
36)=	31	2121	21	3	6	1	0	0	0	0	0	200	0	1520	0	0
37)=	31	2122	21	3	6	4	0	0	0	0	0	200	0	1800	0	0
38)=	31	2131	21	1	6	2	0	3	6	4	0	200	0	1800	0	0
39)=	31	2132	21	1	6	2	0	0	0	0	0	200	0	1300	0	0
40)=	31	2133	21	4	8	1	0	0	0	0	0	200	0	1880	0	0
41)=	31	2141	21	2	6	3	0	0	0	0	0	200	0	1800	0	0
42)=	31	2142	21	2	6	3	0	0	0	0	0	200	0	1800	0	0
43)=	31	2143	20	2	5	3	0	0	0	0	0	200	0	1800	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	FLOW	CRUISE SPEED	ENTRY 2 LINK NO.	FLOW	CRUISE SPEED	ENTRY 3 LINK NO.	FLOW	CRUISE SPEED	ENTRY 4 LINK NO.	FLOW	CRUISE SPEED
44)=	32	1711	290	0	1912	140	50	1923	150	50	0	0	0	0	0	0
45)=	32	1712	310	0	1912	160	50	1923	150	50	0	0	0	0	0	0
46)=	32	1732	480	0	1821	210	50	1832	270	50	0	0	0	0	0	0
47)=	32	1733	250	0	1821	100	50	1832	150	50	0	0	0	0	0	0
48)=	32	1741	90	0	0	0	50	0	0	0	0	0	0	0	0	0
49)=	32	1743	300	0	0	0	50	0	0	0	0	0	0	0	0	0
50)=	32	1812	230	0	1712	170	50	1741	60	50	0	0	0	0	0	0
51)=	32	1813	160	0	1712	130	50	1741	30	50	0	0	0	0	0	0
52)=	32	1821	310	0	0	0	50	0	0	0	0	0	0	0	0	0
53)=	32	1823	40	0	0	0	50	0	0	0	0	0	0	0	0	0
54)=	32	1831	10	0	2032	10	50	0	0	0	0	0	0	0	0	0
55)=	32	1832	390	0	2032	350	50	2021	40	50	0	0	0	0	0	0
56)=	32	1912	330	0	0	0	50	0	0	0	0	0	0	0	0	0
57)=	32	1913	250	0	0	0	50	0	0	0	0	0	0	0	0	0
58)=	32	1921	340	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	1923	300	0	0	0	50	0	0	0	0	0	0	0	0	0
60)=	32	1931	420	0	1732	220	50	1743	200	50	0	0	0	0	0	0
61)=	32	1932	350	0	1732	250	50	1743	100	50	0	0	0	0	0	0
62)=	32	2012	280	0	1812	230	50	1823	40	50	0	0	0	0	0	0
63)=	32	2013	140	0	1812	140	50	0	0	0	0	0	0	0	0	0
64)=	32	2021	40	0	0	0	50	0	0	0	0	0	0	0	0	0
65)=	32	2023	30	0	0	0	50	0	0	0	0	0	0	0	0	0
66)=	32	2031	20	0	2131	10	50	2121	10	50	0	0	0	0	0	0
67)=	32	2032	530	0	2121	150	50	2132	60	50	2143	20	50	0	0	0

68)=	32	2111	80	0	2012	80	50	0	0	0	0	0	0	0	0	0
69)=	32	2112	300	0	2012	280	50	2023	15	50	0	0	0	0	0	0
70)=	32	2113	120	0	2012	100	50	2023	15	50	0	0	0	0	0	0
71)=	32	2121	160	0	0	0	50	0	0	0	0	0	0	0	0	0
72)=	32	2122	260	0	0	0	50	0	0	0	0	0	0	0	0	0
73)=	32	2131	80	0	0	0	50	0	0	0	0	0	0	0	0	0
74)=	32	2132	350	0	0	0	50	0	0	0	0	0	0	0	0	0
75)=	32	2133	140	0	0	0	50	0	0	0	0	0	0	0	0	0
76)=	32	2141	120	0	0	0	50	0	0	0	0	0	0	0	0	0
77)=	32	2142	290	0	0	0	50	0	0	0	0	0	0	0	0	0
78)=	32	2143	20	0	0	0	50	0	0	0	0	0	0	0	0	0

FUEL CARD

		CRUISE CONSTANTS A	B	C	DELAY CONST.	STOP CONST.										
(79)=	37	145	-375	405	115	635	0	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT****

90 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
17	3	0	23	55				
18	3	0	36	70				
19	3	0	36	67				
20	3	0	43	53				
21	4	0	33	55	75			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	RANDOM+ OVERSAT	COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	END 1ST	START 2ND	END 2ND
1711	290	1338	38	12	23	1.5 +	0.3	(28.6)	75	(8.2)	6		36.8	17	5	55		
1712	310	3400	43	14	33	2.5 +	0.4	(44.6)	95	(11.2)	8		55.8	17	5	23		
1732	480	1600	50	8	19	2.0 +	0.5	(39.4)	77	(14.0)	9		53.4	17	60	23		
1733	249	1600	45	8	33	1.9 +	0.4	(35.2)	101	(9.6)	6		44.7	17	60	0		
1741	.90	2800	5	14	5	0.1 +	0.0	(2.0)	28	(1.0)	1		3.0	17	28	0		
1743	300	1925	50	14	31	2.1 +	0.5	(40.5)	84	(9.5)	7		50.0	17	28	55		
1812	230	1300	31	8	7	0.2 +	0.2	(6.8)	25	(2.2)	3		9.0	18	75	36		
1813	160	1430	63	8	75	2.5 +	0.8	(51.8)	118	(7.2)	5		59.0	18	75	0		
1821	310	1430	65	14	36	2.2 +	0.9	(48.3)	92	(10.8)	7		59.1	18	41	70		
1823	40	1530	8	14	24	0.2 +	0.0	(4.2)	69	(1.0)	1		5.2	18	41	70		
1831	10	1700	1	14	1	0.0 +	0.0	(0.1)	2	(0.0)	0		0.1	18	5	70		
1832	390	1700	64	14	30	2.3 +	0.9	(49.7)	55	(8.1)	5		57.8	18	5	36		
1912	330	3803	14	14	8	0.7 +	0.1	(11.9)	40	(5.0)	4		16.8	19	72	36		
1913	250	1700	70	14	49	2.3 +	1.1	(52.8)	105	(10.0)	7		62.8	19	72	0		
1921	340	800	47	14	5	0.0 +	0.4	(6.9)	0	(0.0)	0		6.9					
1923	300	1700	59	14	35	2.2 +	0.7	(45.6)	90	(10.2)	7		55.8	19	41	67		
1931	420	800	69	7	18	1.0 +	1.1	(32.5)	67	(10.6)	5		43.1	19	0	67		
1932	350	1700	58	12	34	2.7 +	0.7	(51.7)	91	(12.1)	8		63.7	19	5	36		
2012	280	1600	21	14	3	0.1 +	0.1	(3.5)	15	(1.6)	1		5.2	20	58	43		
2013	140	500	76	14	73	1.3 +	1.5	(44.1)	128	(6.8)	5		50.9	20	58	0		
2021	40	1600	5	14	15	0.1 +	0.0	(2.6)	53	(0.8)	1		3.4	20	48	0		
2023	30	1700	26	14	61	0.3 +	0.2	(7.9)	114	(1.3)	1		9.2	20	48	53		
2031	20	500	7	7	18	0.1 +	0.0	(1.6)	74	(0.6)	0		2.1	20	0	53		
2032	530	1600	76	28	36	3.8 +	1.6	(82.8)	83	(16.7)	11		99.6	20	5	43		
2111	80	1520	8	28	14	0.3 +	0.0	(4.7)	54	(1.6)	1		6.3	21	0	55		
2112	300	2000	48	28	36	2.6 +	0.5	(46.8)	94	(10.6)	7		57.4	21	6	33		
2113	120	1520	71	28	63	0.9 +	1.2	(32.6)	126	(5.7)	4		38.3	21	81	0		
2121	160	1520	32	14	28	1.0 +	0.2	(19.0)	76	(4.6)	3		23.6	21	61	0		
2122	260	1800	87	14	76	2.6 +	2.8	(85.0)	133	(13.1)	9		98.1	21	61	75		
2131	80	1800	9	14	9	0.1 +	0.1	(3.1)	51	(1.5)	1		4.6	21	6	33	61	75
2132	350	1300	87	14	59	2.8 +	2.9	(89.1)	120	(15.9)	11		105.0	21	6	33		
2133	140	1880	84	14	97	1.6 +	2.2	(58.7)	149	(7.9)	6		66.6	21	83	0		
2141	120	1800	35	14	40	1.1 +	0.3	(20.6)	92	(4.2)	3		24.8	21	39	55		
2142	290	1800	85	14	68	2.8 +	2.6	(84.7)	125	(13.8)	10		98.5	21	39	55		
2143	20	1800	17	14	57	0.2 +	0.1	(4.9)	109	(0.8)	1		5.8	20	48	53		

90 SECOND CYCLE 60 STEPS

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	105.4	15.0	48.2	25.6	(1144.2)	+	(238.2)	+	(0.0)	=	1382.5	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	92.8	+	84.9	+	99.7	=	277.4

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 35

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13
- (SECONDS)

17	3	13	36	68	
18	3	0	36	70	
19	3	0	36	67	
20	3	13	56	66	
21	4	0	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	103.4	15.3	46.3	25.6	(1113.9)	+	(228.6)	+	(0.0)	=	1342.4	TOTALS

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 198

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36
- (SECONDS)

17	3	49	72	14	
18	3	72	18	52	
19	3	0	36	67	
20	3	13	56	66	
21	4	0	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	98.4	16.1	41.2	25.6	(1035.2)	+	(214.0)	+	(0.0)	=	1249.2	TOTALS

NO. OF ENTRIES TO SUBPT = 12
NO. OF LINKS RECALCULATED= 213

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	0	39	67	
20	3	13	56	66	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	97.1	16.3	39.9	25.6	(1015.5)	+	(209.7)	+	(0.0)	=	1225.2	TOTALS

NO. OF ENTRIES TO SUBPT = 44
NO. OF LINKS RECALCULATED= 558

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	0	39	67	
20	3	13	56	66	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	97.1	16.3	39.9	25.6	(1015.5)	+	(209.7)	+	(0.0)	=	1225.2	TOTALS

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 207

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13 36
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	0	39	67	
20	3	13	56	66	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	97.1	16.3	39.9	25.6	(1015.5)	+	(209.7)	+	(0.0)	=	1225.2	TOTALS

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 216

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13 36 1
- (SECONDS)

17	3	48	73	9	
18	3	75	18	53	
19	3	89	38	66	
20	3	17	60	70	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	96.6	16.3	39.4	25.6	(1008.0)	+	(211.1)	+	(0.0)	=	1219.0	TOTALS

NO. OF ENTRIES TO SUBPT = 15
NO. OF LINKS RECALCULATED= 257

90 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 13 36 -1 13 36 1 -1
- (SECONDS)

17	3	48	72	9	
18	3	75	18	53	
19	3	89	38	66	
20	3	17	60	70	
21	4	1	33	55	75

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	96.6	16.4	39.4	25.6	(1007.3)	+	(211.2)	+	(0.0)	=	1218.5	TOTALS

NO. OF ENTRIES TO SUBPT = 31
NO. OF LINKS RECALCULATED= 460

90 SECOND CYCLE 60 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 13 36 -1 13 36 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
17	3	48	72	9				
18	3	75	18	53				
19	3	89	38	66				
20	3	17	60	70				
21	4	1	33	55	75			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	--------DELAY-------- UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	RANDOM+ OVERSAT	COST OF DELAY ($/H)	----STOPS---- MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	----QUEUE---- MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	END 1ST	START 2ND	END 2ND
1711	290	1338	41	12	10	0.5 +	0.4	(12.8)	36	(3.9)	3		16.7	17	53	9		
1712	310	3400	41	14	30	2.2 +	0.3	(40.1)	65	(7.7)	5		47.8	17	53	72		
1732	480	1600	46	8	11	1.0 +	0.4	(21.8)	58	(10.5)	7		32.2	17	14	72		
1733	249	1600	40	8	15	0.7 +	0.3	(15.7)	66	(6.2)	4		21.9	17	14	48		
1741	90	2800	5	14	5	0.1 +	0.0	(2.1)	30	(1.0)	1		3.1	17	77	48		
1743	300	1925	61	14	39	2.5 +	0.8	(50.2)	94	(10.7)	7		60.8	17	77	9		
1812	230	1300	31	8	6	0.2 +	0.2	(5.9)	18	(1.6)	2		7.5	18	58	18		
1813	160	1430	56	8	28	0.6 +	0.6	(19.2)	46	(2.8)	2		22.0	18	58	75		
1821	310	1430	63	14	34	2.1 +	0.8	(46.0)	90	(10.5)	7		56.5	18	23	53		
1823	40	1530	8	14	24	0.2 +	0.0	(4.1)	67	(1.0)	1		5.1	18	23	53		
1831	10	1700	1	14	8	0.0 +	0.0	(0.4)	43	(0.2)	0		0.5	18	80	53		
1832	390	1700	71	14	46	3.8 +	1.2	(77.0)	111	(16.4)	11		93.4	18	80	18		
1912	330	3803	13	14	7	0.6 +	0.1	(10.1)	36	(4.5)	3		14.5	19	71	38		
1913	250	1700	70	14	49	2.3 +	1.1	(52.8)	105	(10.0)	7		62.7	19	71	89		
1921	340	800	47	14	5	0.0 +	0.4	(6.9)	0	(0.0)	0		6.9					
1923	300	1700	66	14	41	2.5 +	1.0	(52.9)	97	(11.1)	8		64.0	19	43	66		
1931	420	800	69	7	14	0.5 +	1.1	(24.7)	54	(8.5)	7		33.2	19	89	66		
1932	350	1700	53	12	25	1.9 +	0.6	(37.7)	66	(8.7)	6		46.4	19	4	38		
2012	280	1600	21	14	3	0.1 +	0.1	(3.9)	32	(3.4)	3		7.3	20	75	60		
2013	140	500	76	14	47	0.3 +	1.5	(28.2)	114	(6.1)	5		34.3	20	75	17		
2021	40	1600	5	14	15	0.1 +	0.0	(2.6)	53	(0.8)	1		3.4	20	65	17		
2023	30	1700	26	14	61	0.3 +	0.2	(7.9)	114	(1.3)	1		9.2	20	65	70		
2031	20	500	7	7	21	0.1 +	0.0	(1.8)	63	(0.5)	0		2.3	20	17	70		
2032	530	1600	76	28	22	1.6 +	1.6	(49.5)	54	(10.8)	8		60.3	20	22	60		
2111	80	1520	9	28	6	0.1 +	0.0	(2.0)	18	(0.5)	0		2.5	21	1	55		
2112	300	2000	50	28	20	1.2 +	0.5	(26.1)	46	(5.3)	4		31.4	21	7	33		
2113	120	1520	64	28	78	1.7 +	0.9	(40.5)	121	(5.5)	4		46.0	21	81	1		
2121	160	1520	31	14	27	1.0 +	0.2	(18.3)	75	(4.5)	3		22.8	21	61	1		
2122	260	1800	87	14	76	2.6 +	2.8	(85.0)	133	(13.1)	9		98.1	21	61	75		
2131	80	1800	10	14	9	0.2 +	0.1	(3.2)	53	(1.6)	1		4.8	21	7	33	61	75
2132	350	1300	90	14	68	2.9 +	3.7	(102.7)	129	(17.1)	12		119.8	21	7	33		
2133	140	1880	74	14	75	1.5 +	1.4	(45.1)	129	(6.8)	5		51.9	21	83	1		
2141	120	1800	35	14	40	1.1 +	0.3	(20.6)	92	(4.2)	3		24.8	21	39	55		
2142	290	1800	85	14	68	2.8 +	2.6	(84.7)	125	(13.8)	10		98.5	21	39	55		
2143	20	1800	17	14	58	0.2 +	0.1	(5.0)	110	(0.8)	1		5.8	20	65	70		

90 SECOND CYCLE 60 STEPS

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
1579.0	96.6	16.4	39.4	25.6	(1007.3)	+	(211.2)	+	(0.0)	=	1218.5	TOTALS

****

	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	92.8	+	74.7	+	88.4	=	255.9

NO. OF ENTRIES TO SUBPT = 11
NO. OF LINKS RECALCULATED= 206

PROGRAM TRANSYT FINISHED

== end of file ==

[Printed at 12:11:25 on 08/05/2003]

T R A N S Y T

TRAffic Network StudY Tool

Implementation for IBM-PC or compatible

Program TRANSYT 11, Analysis Program Version 1.3

Run with file:- "D16APR02.DAT" at 17:10 on 16/04/02

Transfund NZ : Traffic Signal Integration - Network D am

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

```
NUMBER OF NODES                    =    6
NUMBER OF LINKS                    =   48
NUMBER OF OPTIMISED NODES          =    6
MAXIMUM NUMBER OF GRAPHIC PLOTS    =    0
NUMBER OF STEPS IN CYCLE           =   35
MAXIMUM NUMBER OF SHARED STOPLINES =    0
MAXIMUM NUMBER OF TIMING POINTS    =    4
MAXIMUM LINKS AT ANY NODE          =    9

CORE REQUESTED =   8417 WORDS
CORE AVAILABLE =  72000 WORDS
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DATA INPUT :-
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CARD NO.	CARD TYPE
(1)=	TITLE:- Transfund NZ : Traffic Signal Integration - Network D am

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	140	35	60	2	3	1	0	0	0	1	2	0	0	1550	283

CARD NO.	CARD TYPE	LIST OF NODES TO BE OPTIMISED														
3)=	2	10	12	13	14	15	16	0	0	0	0	0	0	0	0	0

NODE CARDS: STAGE CHANGE TIMES AND MINIMUM STAGE TIMES

CARD NO.	CARD TYPE	NODE NO.	STAGE 1 CHANGE	STAGE 1 MIN	STAGE 2 CHANGE	STAGE 2 MIN	STAGE 3 CHANGE	STAGE 3 MIN	STAGE 4 CHANGE	STAGE 4 MIN	STAGE 5 CHANGE	STAGE 5 MIN	STAGE 6 CHANGE	STAGE 6 MIN	STAGE 7 CHANGE	STAGE 7 MIN
4)=	14	10	0	40	54	40	79	12	94	12	0	0	0	0	0	0
5)=	14	12	0	20	62	40	104	30	116	10	0	0	0	0	0	0
6)=	14	13	0	10	65	20	88	20	128	12	0	0	0	0	0	0
7)=	14	14	0	10	47	24	71	20	124	12	0	0	0	0	0	0
8)=	13	15	0	40	44	40	75	25	0	0	0	0	0	0	0	0
9)=	14	16	0	25	51	12	66	12	108	40	0	0	0	0	0	0

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	PRIORITY LINKS LINK2 NO.	LINK1 ONLY % FLOW	GIVEWAY COEFFS. A1 X100	A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
10)=	30	1021	1032	1042	0	25	0	0	0	0	0	200	0	800	0	0
11)=	30	1031	1042	1013	0	25	0	0	0	0	0	280	0	800	0	0
12)=	30	1041	1012	1023	0	22	0	0	0	0	0	200	0	800	0	0
13)=	30	1321	1332	1342	0	33	0	0	0	0	0	200	0	800	0	0
14)=	30	1331	1342	1313	0	25	0	0	0	0	0	150	0	800	0	0
15)=	30	1411	1433	0	100	25	0	0	0	0	0	150	0	800	0	0
16)=	30	1521	1532	0	0	22	0	0	0	0	0	200	0	800	0	0
17)=	30	1531	1513	0	100	25	0	0	0	0	0	230	0	800	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	START LAG	END STAGE	END LAG	SECOND GREEN START STAGE	START LAG	END STAGE	END LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
18)=	31	1012	10	1	5	2	0	0	0	0	0	200	0	5200	0	0
19)=	31	1013	10	4	5	1	0	0	0	0	0	200	0	1700	0	0
20)=	31	1022	10	3	5	4	0	0	0	0	0	200	0	1900	0	0
21)=	31	1023	10	3	6	4	0	0	0	0	0	200	0	1570	0	0
22)=	31	1032	10	1	5	2	0	0	0	0	0	280	0	3800	0	0
23)=	31	1033	10	4	6	1	0	0	0	0	0	280	0	1400	0	0
24)=	31	1042	10	2	6	3	0	0	0	0	0	200	0	2000	0	0
25)=	31	1212	12	4	5	2	0	0	0	0	0	280	0	5200	0	0
26)=	31	1213	12	4	6	1	0	0	0	0	0	280	0	1600	0	0
27)=	31	1221	12	3	5	1	0	0	0	0	0	200	0	1650	0	0
28)=	31	1223	12	3	5	4	0	0	0	0	0	200	0	1650	0	0
29)=	31	1231	12	1	5	4	0	0	0	0	0	200	0	1450	0	0
30)=	31	1232	12	1	5	2	0	0	0	0	0	200	0	3900	0	0
31)=	31	1253	12	2	5	3	0	0	0	0	0	200	0	1500	0	0
32)=	31	1312	13	1	5	2	0	0	0	0	0	200	0	4400	0	0
33)=	31	1313	13	4	4	1	0	0	0	0	0	200	0	1700	0	0
34)=	31	1322	13	3	4	4	0	0	0	0	0	200	0	1800	0	0
35)=	31	1323	13	3	4	4	0	0	0	0	0	200	0	1650	0	0
36)=	31	1332	13	1	5	2	0	0	0	0	0	150	0	4400	0	0
37)=	31	1333	13	4	4	1	0	0	0	0	0	150	0	1500	0	0
38)=	31	1341	13	2	4	3	0	0	0	0	0	200	0	1400	0	0
39)=	31	1342	13	2	4	3	0	0	0	0	0	200	0	1600	0	0
40)=	31	1412	14	4	6	2	0	0	0	0	0	150	0	4300	0	0
41)=	31	1421	14	3	6	1	0	0	0	0	0	200	0	3000	0	0
42)=	31	1423	14	3	6	4	0	0	0	0	0	200	0	3100	0	0
43)=	31	1432	14	1	5	3	0	0	0	0	0	180	0	3200	0	0
44)=	31	1433	14	2	4	3	0	0	0	0	0	180	0	1700	0	0
45)=	31	1512	15	3	6	2	0	0	0	0	0	180	0	3600	0	0
46)=	31	1513	15	3	6	1	0	0	0	0	0	180	0	1700	0	0
47)=	31	1523	15	2	6	3	0	0	0	0	0	200	0	1700	0	0
48)=	31	1532	15	1	5	2	0	0	0	0	0	230	0	3600	0	0
49)=	31	1611	16	1	5	2	0	3	5	4	0	230	0	1600	0	0
50)=	31	1612	16	1	5	2	0	0	0	0	0	230	0	1990	0	0
51)=	31	1613	16	4	5	1	0	0	0	0	0	230	0	1900	0	0
52)=	31	1621	16	2	5	3	0	4	5	1	0	200	0	1500	0	0
53)=	31	1622	16	2	5	3	0	0	0	0	0	200	0	1990	0	0
54)=	31	1632	16	1	5	2	0	0	0	0	0	200	0	3600	0	0
55)=	31	1633	16	4	5	1	0	0	0	0	0	200	0	1200	0	0
56)=	31	1642	16	3	5	4	0	0	0	0	0	200	0	1800	0	0
57)=	31	1643	16	3	5	4	0	0	0	0	0	200	0	1990	0	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 LINK NO.	ENTRY 1 FLOW	ENTRY 1 CRUISE SPEED	ENTRY 2 LINK NO.	ENTRY 2 FLOW	ENTRY 2 CRUISE SPEED	ENTRY 3 LINK NO.	ENTRY 3 FLOW	ENTRY 3 CRUISE SPEED	ENTRY 4 LINK NO.	ENTRY 4 FLOW	ENTRY 4 CRUISE SPEED
58)=	32	1012	1020	0	0	0	50	0	0	0	0	0	0	0	0	0
59)=	32	1013	450	0	0	0	50	0	0	0	0	0	0	0	0	0
60)=	32	1021	500	0	0	0	50	0	0	0	0	0	0	0	0	0
61)=	32	1022	130	0	0	0	50	0	0	0	0	0	0	0	0	0
62)=	32	1023	30	0	0	0	50	0	0	0	0	0	0	0	0	0
63)=	32	1031	100	0	1232	100	50	0	0	0	0	0	0	0	0	0
64)=	32	1032	1200	0	1221	20	50	1232	1180	50	0	0	0	0	0	0
65)=	32	1033	70	0	1232	70	50	0	0	0	0	0	0	0	0	0
66)=	32	1041	70	0	0	0	50	0	0	0	0	0	0	0	0	0
67)=	32	1042	230	0	0	0	50	0	0	0	0	0	0	0	0	0
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68)=	32	1212	1050	20	1012	950	50	1023	30	50	1041	70	50	0	0	0
69)=	32	1213	30	0	1012	30	50	0	0	0	0	0	0	0	0	0
70)=	32	1221	20	0	0	0	50	0	0	0	0	0	0	0	0	0
71)=	32	1223	20	0	0	0	50	0	0	0	0	0	0	0	0	0
72)=	32	1231	60	0	1332	60	50	0	0	0	0	0	0	0	0	0
73)=	32	1232	1480	0	1332	1430	50	1321	40	50	1342	10	50	0	0	0
74)=	32	1253	20	0	0	0	50	0	0	0	0	0	0	0	0	0
75)=	32	1312	1090	0	1212	1050	50	1253	20	50	1223	20	50	0	0	0
76)=	32	1313	100	0	1212	100	50	0	0	0	0	0	0	0	0	0
77)=	32	1321	50	0	0	0	50	0	0	0	0	0	0	0	0	0
78)=	32	1322	10	0	0	0	45	0	0	0	0	0	0	0	0	0
79)=	32	1323	150	0	0	0	50	0	0	0	0	0	0	0	0	0
80)=	32	1331	380	0	1432	150	50	1421	230	50	0	0	0	0	0	0
81)=	32	1332	1470	0	1432	690	50	1421	520	50	0	0	0	0	0	0
82)=	32	1333	10	0	1432	10	50	0	0	0	0	0	0	0	0	0
83)=	32	1341	20	0	0	0	30	0	0	0	0	0	0	0	0	0
84)=	32	1342	10	0	0	0	30	0	0	0	0	0	0	0	0	0
85)=	32	1411	220	0	1341	10	50	1323	50	50	1312	160	50	0	0	0
86)=	32	1412	1000	0	1341	10	50	1323	100	50	1312	890	50	0	0	0
87)=	32	1421	750	0	0	0	55	0	0	0	0	0	0	0	0	0
88)=	32	1423	600	0	0	0	50	0	0	0	0	0	0	0	0	0
89)=	32	1432	840	0	1521	380	50	1532	460	50	0	0	0	0	0	0
90)=	32	1433	140	0	1532	140	50	0	0	0	0	0	0	0	0	0
91)=	32	1512	990	0	1423	600	50	1412	390	50	0	0	0	0	0	0
92)=	32	1513	480	0	1412	480	50	0	0	0	0	0	0	0	0	0
93)=	32	1521	380	0	0	0	50	0	0	0	0	0	0	0	0	0
94)=	32	1523	210	0	0	0	50	0	0	0	0	0	0	0	0	0
95)=	32	1531	490	0	1621	30	50	1643	290	50	1632	170	50	0	0	0
96)=	32	1532	680	0	1621	70	50	1643	280	50	1632	330	50	0	0	0
97)=	32	1611	290	0	1512	290	50	0	0	0	0	0	0	0	0	0
98)=	32	1612	390	0	1523	210	50	1512	180	50	0	0	0	0	0	0
99)=	32	1613	370	0	1512	370	50	0	0	0	0	0	0	0	0	0
100)=	32	1621	100	0	0	0	50	0	0	0	0	0	0	0	0	0
101)=	32	1622	150	0	0	0	50	0	0	0	0	0	0	0	0	0
102)=	32	1632	660	0	0	0	50	0	0	0	0	0	0	0	0	0
103)=	32	1633	100	0	0	0	50	0	0	0	0	0	0	0	0	0
104)=	32	1642	130	0	0	0	45	0	0	0	0	0	0	0	0	0
105)=	32	1643	490	0	0	0	50	0	0	0	0	0	0	0	0	0

FUEL CARD

		CRUISE CONSTANTS A	B	C	DELAY CONST.	STOP CONST.										
(106)=	37	145	-375	405	115	635	0	0	0	0	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT****

140 SECOND CYCLE 35 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
10	4	0	46	86	100			
12	4	0	60	100	130			
13	4	0	79	99	123			
14	4	0	47	71	124			
15	3	0	41	81				
16	4	0	37	54	100			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	DELAY: UNIFORM RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	DELAY: COST OF DELAY ($/H)	STOPS: MEAN STOPS /PCU (%)	STOPS: COST OF STOPS ($/H)	QUEUE: MEAN MAX. (PCU)	QUEUE: AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	END 1ST	START 2ND	END 2ND
1012	1020	5200	65	14	46	12.1 + 0.9	(202.0)	86	(33.2)	35		235.2	10	5	46		
1013	450	1700	103	14	171	7.1 + 14.3	(331.0)	163	(27.8)	32		358.9	10	105	0		
1021	500	800	89	14	43	2.2 + 3.7	(91.9)	89	(16.9)	18	+	108.8					
1022	130	1900	96	14	188	2.3 + 4.4	(105.2)	168	(8.3)	9		113.5	10	91	100		
1023	30	1570	30	14	87	0.5 + 0.2	(11.3)	111	(1.3)	1		12.5	10	92	100		
1031	101	800	14	20	3	0.0 + 0.1	(1.2)	0	(0.0)	0		1.2					
1032	1200	3800	105	20	178	21.5 + 37.9	(919.9)	154	(70.0)	90		989.9	10	5	46		
1033	71	1400	20	20	63	1.1 + 0.1	(19.1)	106	(2.8)	3		21.9	10	106	0		
1041	70	800	11	14	6	0.0 + 0.1	(1.7)	18	(0.5)	0		2.2					
1042	230	2000	46	14	51	2.8 + 0.4	(50.6)	86	(7.5)	8		58.0	10	52	86		
1212	1050	5200	43	20	8	2.0 + 0.4	(37.1)	15	(5.9)	6		43.0	12	135	60		
1213	31	1600	54	20	159	0.8 + 0.6	(21.2)	144	(1.6)	2		22.8	12	136	0		
1221	20	1650	5	14	43	0.2 + 0.0	(3.7)	77	(0.6)	1		4.3	12	105	0		
1223	20	1650	7	14	53	0.3 + 0.0	(4.5)	85	(0.6)	1		5.2	12	105	130		
1231	59	1450	5	14	1	0.0 + 0.0	(0.4)	1	(0.0)	0		0.4	12	5	130		
1232	1479	3900	95	14	38	8.2 + 7.6	(245.0)	45	(25.3)	34		270.3	12	5	60		
1253	20	1500	5	14	44	0.2 + 0.0	(3.8)	77	(0.6)	1		4.3	12	65	100		
1312	1090	4400	46	14	4	0.6 + 0.4	(16.6)	6	(2.4)	2		19.0	13	5	79		
1313	101	1700	59	14	107	2.3 + 0.7	(46.7)	118	(4.5)	5		51.2	13	127	0		
1321	50	800	11	14	11	0.1 + 0.1	(2.3)	34	(0.6)	1		2.9					
1322	10	1800	4	16	58	0.1 + 0.0	(2.5)	88	(0.3)	0		2.8	13	103	123		
1323	150	1650	61	14	74	2.3 + 0.8	(47.7)	104	(5.9)	6		53.6	13	103	123		
1331	379	800	48	11	5	0.0 + 0.5	(7.5)	9	(1.2)	4		8.7					
1332	1470	4400	62	11	24	9.1 + 0.8	(153.2)	63	(35.1)	38		188.3	13	5	79		
1333	10	1500	7	11	99	0.2 + 0.0	(4.3)	110	(0.4)	0		4.7	13	127	0		
1341	20	1400	12	24	67	0.3 + 0.1	(5.8)	94	(0.3)	1		6.0	13	83	99		
1342	10	1600	5	24	65	0.2 + 0.0	(2.8)	93	(0.1)	0		2.9	13	83	99		
1411	219	800	27	11	3	0.0 + 0.2	(2.9)	0	(0.0)	0		2.9					
1412	1000	4300	56	11	56	15.0 + 0.6	(242.4)	81	(30.8)	32		273.2	14	130	47		
1421	750	3000	55	13	30	5.7 + 0.6	(98.1)	70	(24.2)	22		122.3	14	77	0		
1423	600	3100	56	14	41	6.2 + 0.6	(106.9)	81	(18.5)	19		125.4	14	77	124		
1432	840	3200	55	13	13	2.4 + 0.6	(46.8)	28	(9.0)	10		55.8	14	5	71		
1433	140	1700	55	13	37	0.8 + 0.6	(22.1)	107	(5.7)	6		27.8	14	51	71		
1512	990	3600	41	13	3	0.4 + 0.3	(11.4)	5	(1.9)	2		13.3	15	87	41		
1513	480	1700	73	13	92	11.0 + 1.3	(191.1)	107	(19.5)	20		210.6	15	87	0		
1521	380	800	58	14	10	0.4 + 0.7	(16.7)	33	(4.8)	5		21.5					
1523	210	1700	49	14	53	2.6 + 0.5	(48.1)	87	(7.0)	7		55.1	15	47	81		
1531	490	800	61	17	9	0.4 + 0.8	(18.4)	45	(8.3)	11		26.7					
1532	680	3600	72	17	47	7.6 + 1.2	(137.5)	68	(17.5)	19		155.0	15	5	41		
1611	289	1600	34	17	24	1.6 + 0.3	(29.3)	81	(8.9)	7		38.2	16	5	37	59	100
1612	390	1990	83	17	86	6.9 + 2.3	(143.8)	110	(16.2)	17		160.0	16	5	37		
1613	370	1900	76	17	53	3.9 + 1.5	(84.4)	89	(12.4)	14		96.8	16	105	0		

140 SECOND CYCLE 35 STEPS

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM	DELAY RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	DELAY COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	STOPS COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	END 1ST	START 2ND	END 2ND (SECONDS)
1621	100	1500	19	14	20	0.5 +	0.1	(8.8)	69	(2.6)	2		11.4	16	42	54	105	0
1622	150	1990	81	14	109	2.6 +	1.9	(70.4)	126	(7.2)	8		77.6	16	42	54		
1632	660	3600	78	14	59	9.2 +	1.7	(168.9)	97	(24.2)	25		193.1	16	5	37		
1633	100	1200	32	14	51	1.2 +	0.2	(21.8)	85	(3.2)	3		25.0	16	105	0		
1642	130	1800	24	16	41	1.3 +	0.2	(23.1)	76	(3.1)	4		26.2	16	59	100		
1643	490	1990	82	14	62	6.2 +	2.2	(130.1)	101	(18.7)	20		148.8	16	59	100		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	333.6	11.7	162.7	92.9	(3961.9)	+	(497.3)	+	(0.0)	=	4459.2	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	229.9	+	293.9	+	208.2	=	732.0

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 48

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21
- (SECONDS)

10	4	21	67	107	121
12	4	0	60	100	130
13	4	0	79	99	123
14	4	0	47	71	124
15	3	0	41	81	
16	4	0	37	54	100

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	323.0	12.1	152.1	92.9	(3797.9)	+	(502.8)	+	(0.0)	=	4300.7	TOTALS

NO. OF ENTRIES TO SUBPT = 13
NO. OF LINKS RECALCULATED= 274

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56
- (SECONDS)

10	4	21	67	107	121
12	4	0	60	100	130
13	4	0	79	99	123
14	4	0	47	71	124
15	3	0	41	81	
16	4	0	37	54	100

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	323.0	12.1	152.1	92.9	(3797.9)	+	(502.8)	+	(0.0)	=	4300.7	TOTALS

NO. OF ENTRIES TO SUBPT = 15
NO. OF LINKS RECALCULATED= 329

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1
- (SECONDS)

10	4	18	68	108	121
12	4	0	60	100	130
13	4	139	77	97	121
14	4	7	45	71	109
15	3	0	41	81	
16	4	138	37	54	98

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	305.3	12.8	143.2	84.1	(3524.1)	+	(468.1)	+	(0.0)	=	3992.2	TOTALS

NO. OF ENTRIES TO SUBPT = 71
NO. OF LINKS RECALCULATED= 913

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21
- (SECONDS)

10	4	18	68	108	121
12	4	0	60	100	130
13	4	139	77	97	121
14	4	7	45	71	109
15	3	0	41	81	
16	4	138	37	54	98

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	305.3	12.8	143.2	84.1	(3524.1)	+	(468.1)	+	(0.0)	=	3992.2	TOTALS

NO. OF ENTRIES TO SUBPT = 13
NO. OF LINKS RECALCULATED= 316

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21 56
- (SECONDS)

10	4	18	68	108	121
12	4	0	60	100	130
13	4	139	77	97	121
14	4	7	45	71	109
15	3	0	41	81	
16	4	54	93	110	14

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	303.1	12.9	141.0	84.1	(3489.7)	+	(473.2)	+	(0.0)	=	3962.9	TOTALS

NO. OF ENTRIES TO SUBPT = 13
NO. OF LINKS RECALCULATED= 328

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21 56 1
- (SECONDS)

10	4	20	70	110	123
12	4	0	60	100	130
13	4	139	77	97	121
14	4	4	42	68	106
15	3	0	41	81	
16	4	54	93	110	14

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	302.1	12.9	140.1	84.1	(3474.4)	+	(476.9)	+	(0.0)	=	3951.3	TOTALS

NO. OF ENTRIES TO SUBPT = 17
NO. OF LINKS RECALCULATED= 398

140 SECOND CYCLE 35 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 21 56 -1 21 56 1 -1
- (SECONDS)

10	4	21	70	110	123
12	4	0	60	100	130
13	4	139	78	98	122
14	4	6	41	66	105
15	3	139	41	81	
16	4	54	93	110	14

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	300.3	13.0	140.1	82.2	(3445.7)	+	(482.8)	+	(0.0)	=	3928.6	TOTALS

NO. OF ENTRIES TO SUBPT = 52
NO. OF LINKS RECALCULATED= 1053

140 SECOND CYCLE 35 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :- 21 56 -1 21 56 1 -1 1
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
10	4	22	71	111	124			
12	4	2	62	102	132			
13	4	0	79	99	123			
14	4	6	41	66	105			
15	3	139	41	81				
16	4	54	93	110	14			

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	DELAY UNIFORM RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES 1ST START	1ST END	2ND START	2ND END (SECONDS)
1012	1020	5200	61	14	43	11.4 + 0.8	(188.1)	82	(31.9)	34		219.9	10	27	71		
1013	450	1700	109	14	251	8.0 + 23.4	(486.5)	189	(32.3)	41	+	518.8	10	129	22		
1021	500	800	92	14	52	2.6 + 4.7	(112.1)	99	(18.8)	21	+	130.9					
1022	130	1900	106	14	288	2.4 + 8.0	(161.2)	203	(10.0)	13		171.2	10	116	124		
1023	30	1570	33	14	93	0.5 + 0.2	(12.1)	114	(1.3)	1		13.4	10	117	124		
1031	101	800	14	20	3	0.0 + 0.1	(1.2)	0	(0.0)	0		1.2					
1032	1200	3800	98	20	59	7.0 + 12.7	(305.3)	88	(40.1)	54		345.4	10	27	71		
1033	71	1400	22	20	85	1.5 + 0.1	(25.9)	106	(2.8)	3		28.7	10	130	22		
1041	70	800	11	14	5	0.0 + 0.1	(1.5)	15	(0.4)	0		1.9					
1042	230	2000	46	14	51	2.8 + 0.4	(50.6)	87	(7.6)	8		58.2	10	77	111		
1212	1050	5200	43	20	32	9.0 + 0.4	(145.7)	50	(19.9)	21		165.6	12	137	62		
1213	31	1600	54	20	140	0.6 + 0.6	(18.6)	144	(1.6)	2		20.3	12	138	2		
1221	20	1650	5	14	44	0.2 + 0.0	(3.8)	75	(0.6)	1		4.3	12	107	2		
1223	20	1650	7	14	54	0.3 + 0.0	(4.6)	84	(0.6)	1		5.2	12	107	132		
1231	59	1450	5	14	1	0.0 + 0.0	(0.4)	1	(0.0)	0		0.4	12	7	132		
1232	1479	3900	95	14	36	7.3 + 7.6	(231.9)	42	(23.5)	30		255.4	12	7	62		
1253	20	1500	5	14	44	0.2 + 0.0	(3.8)	76	(0.6)	1		4.4	12	67	102		
1312	1090	4400	46	14	6	1.4 + 0.4	(27.7)	10	(4.1)	6		31.8	13	5	79		
1313	101	1700	59	14	111	2.4 + 0.7	(48.5)	118	(4.5)	5		53.0	13	127	0		
1321	50	800	11	14	13	0.1 + 0.1	(2.9)	39	(0.7)	1		3.6					
1322	10	1800	4	16	58	0.1 + 0.0	(2.5)	88	(0.3)	0		2.8	13	103	123		
1323	150	1650	61	14	74	2.3 + 0.8	(47.7)	104	(5.9)	6		53.6	13	103	123		
1331	379	800	48	11	4	0.0 + 0.5	(7.3)	6	(0.9)	2		8.2					
1332	1470	4400	62	11	22	8.3 + 0.8	(141.9)	51	(28.3)	33		170.2	13	5	79		
1333	10	1500	7	11	99	0.2 + 0.0	(4.3)	110	(0.4)	0		4.7	13	127	0		
1341	20	1400	12	24	67	0.3 + 0.1	(5.8)	94	(0.3)	1		6.0	13	83	99		
1342	10	1600	5	24	65	0.2 + 0.0	(2.8)	93	(0.1)	0		2.9	13	83	99		
1411	219	800	27	11	3	0.0 + 0.2	(2.9)	0	(0.0)	0		2.9					
1412	1000	4300	46	11	21	5.3 + 0.4	(88.8)	52	(19.8)	21		108.6	14	111	41		
1421	750	3000	47	13	22	4.2 + 0.4	(71.6)	59	(20.4)	18		92.0	14	72	6		
1423	600	3100	80	14	61	8.3 + 1.9	(158.1)	98	(22.3)	23		180.4	14	72	105		
1432	840	3200	66	13	19	3.4 + 0.9	(67.3)	43	(13.6)	18		80.9	14	11	66		
1433	140	1700	52	13	32	0.7 + 0.5	(19.2)	105	(5.6)	6		24.7	14	45	66		
1512	990	3600	41	13	6	1.3 + 0.3	(25.7)	26	(9.9)	20		35.5	15	87	41		
1513	480	1700	75	13	51	5.4 + 1.4	(106.1)	70	(12.8)	13		118.9	15	87	139		
1521	380	800	58	14	10	0.4 + 0.7	(17.1)	32	(4.7)	5		21.8					
1523	210	1700	49	14	53	2.6 + 0.5	(48.1)	87	(7.0)	7		55.1	15	47	81		
1531	490	800	61	17	9	0.4 + 0.8	(18.6)	45	(8.4)	11		27.0					
1532	680	3600	70	17	47	7.8 + 1.1	(138.1)	96	(24.9)	26		162.9	15	4	41		
1611	289	1600	34	17	12	0.7 + 0.3	(14.7)	69	(7.6)	7		22.3	16	59	93	115	14
1612	390	1990	78	17	57	4.4 + 1.8	(95.2)	99	(14.6)	16		109.8	16	59	93		
1613	370	1900	76	17	60	4.6 + 1.5	(95.1)	104	(14.7)	15		109.8	16	19	54		

140 SECOND CYCLE 35 STEPS

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	RANDOM+ OVERSAT	COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES 1ST START	1ST END	2ND START	2ND END (SECONDS)
1621	100	1500	19	14	20	0.4 +	0.1	(8.7)	70	(2.6)	2		11.3	16	98	110	19	54
1622	150	1990	81	14	109	2.6 +	1.9	(70.4)	126	(7.2)	8		77.6	16	98	110		
1632	660	3600	73	14	56	8.8 +	1.4	(158.0)	94	(23.5)	25		181.5	16	59	93		
1633	100	1200	32	14	51	1.2 +	0.2	(21.9)	84	(3.2)	3		25.1	16	19	54		
1642	130	1800	25	16	43	1.4 +	0.2	(24.2)	78	(3.1)	4		27.3	16	115	14		
1643	490	1990	86	14	69	6.5 +	2.9	(145.0)	106	(19.7)	21		164.7	16	115	14		

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3905.6	299.9	13.0	139.7	82.2	(3439.4)	+	(482.9)	+	(0.0)	=	3922.2	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	229.9	+	255.2	+	202.1	=	687.2

NO. OF ENTRIES TO SUBPT = 14
NO. OF LINKS RECALCULATED= 360

PROGRAM TRANSYT FINISHED

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