

## Modelling Method

### Methodology description in respect of SATURN/SIDRA modelling undertaken by Council in 2015/16 regarding Airport GFA (traffic related) thresholds for strategic assessment (District Plan) purposes

#### 1 Purpose

##### 1.1 To describe:

- i) Overall modelling methodology used
- ii) Airport SIDRA network pm peak models 2017, 2021 and 2031.
- ii) Interpretation of modelling results.

#### 2 Context

- 2.1 The issue of the appropriateness or otherwise of Council transport modelling has been raised at the PDP Hearings with respect to the use of SIDRA to model the potential effects of Airport traffic assessment thresholds for the Chapter 6 Working Environment Hearing.
- 2.2 The modelling method used by Council and an Airport SIDRA model was developed to test whether Integrated Transport Assessments (ITAs) should be undertaken at specified stages of Airport Development. The aim of the work, was to test a range of GFA scenarios for different years using level of service (LOS) criteria to determine whether or not identified stages of Airport development were likely to have a material effect on operational conditions on the local road network. Furthermore, whether or not any change in LOS was likely to require ITAs being undertaken at specified stages of development.
- 2.3 Given this context, the issues to be addressed include: what is an appropriate methodology? and is the method adopted by Council an appropriate approach? Different views on these issues have been expressed at the recent PDP Hearings. This paper aims to provide a factual statement on the modelling method applied to date.

### **3 Overall modelling methodology**

#### SATURN

- 3.1 There is no specific requirement for traffic modelling to be undertaken for the purposes of preparing a District Plan. However, if an authority (such as Council) decides to undertake modelling for this purpose, the NZTA Model Development Guidelines (2014) suggest that Type C models, namely wide area assignment models, are most appropriate for planning and development strategies. Council has primarily relied on SATURN modelling for the purposes of the District Plan review and Proposed District Plan assessment purposes.
- 3.2 With reference to the NZTA Guidelines, Type E models, are said in the Guidelines to be more suitable for more localised purposes such a traffic management.
- 3.3 The reason that Type E modelling (SIDRA) relating to the Airport was undertaken was the nature of the Operative District Plan requirements (carried over initially into the Proposed District Plan).
- 3.4 Some parties have questioned the appropriateness of SATURN/SIDRA modelling for District Planning purposes, and consider that, alternative modelling, particularly micro-simulation (VISSIM) would have been more appropriate.
- 3.5 The Kāpiti SATURN model was developed originally by Council as KTM1 up to 2010, NZTA took ownership in 2010 (Kāpiti Traffic Modelling Databook, November 2014, section 2.5) of KTM2 in the period up to 2014. The KTM2 model was used at the Board of Inquiries (BoI) for the Mackays to Peka Peka (M2PP) and the Peka Peka to Otaki (PP2O) Roads of National Significance (RoNS) projects. Post-2014 Council re-assumed ownership of the model and undertook further changes to create the current KTM3 model.
- 3.6 The KTM3 SATURN model is validated against a base year of 2015. A more detailed local revalidation of demand for the SIDRA model, has not been undertaken, although more detailed network information has been included in developing the SIDRA models.
- 3.7 The modelling methodology, to adjust the SATURN model to reflect the current Airport access network, zone loadings and to export demands for more detailed modelling, is the same as the 2016 specification for the VISSIM model extension work, with the obvious exception that VISSIM was substituted for SIDRA.
- 3.8 The overall modelling methodology, but including the use of SIDRA, is also the same as used in 2015 also for network assessment and planning purposes. This took SATURN model demand flows as inputs to a Town Centre SIDRA network model. In this case, the purpose was to undertake the preliminary evaluation of the proposed Kāpiti Road Relief Route (Ihakara Street to Arawhata Road), for funding application purposes.
- 3.9 The District Plan (DP) was reviewed from 2008-12 and the Proposed District Plan (PDP) was notified in 2012, with the Western Link Road being initially included in the PDP as the main future road improvement. Following the outcome of the M2PP and PP2O BoI processes, the PDP was amended to reflect these changes, together with the removal of requirements to link Airport development thresholds with specific infrastructure improvements. These were replaced with requirements to undertake Integrated Transport Assessments at the same thresholds. This operative DP and the PDP were developed in the context of SATURN modelling,

incorporating demographic projections, employment forecasts and major planning proposals, for example, Airport Plan Change (PC73), the Ngarara Zone (PC79) and the Waikanae North (PC80).

- 3.10 Since 2012 the PDP has been checked and refined mainly on the basis of SATURN. Other more detailed models (including SIDRA, VISSIM, PARAMICS, TRANSYT and LINSIG) have been used within Kāpiti for a range of different purposes over the period 2008-2016. It is in this context that the Airport SIDRA network model was developed in 2015/16, i.e. in order to check (and if necessary to inform changes to) PDP requirements.
- 3.11 The 2015 Airport SIDRA modelling took turning demands from the KTM3 SATURN model. The key to this work was the relative change in operational conditions between different levels of development to assist in deciding (especially) whether or not the three lower GFA thresholds in the PDP were appropriate for ITA purposes. The focus was not to obtain precise results for design purposes.
- 3.12 It should be noted that as a convention, the GFA thresholds have been taken to be equivalent to particular traffic generation rates. The trip generation estimates from PC73 were used in the SATURN /SIDRA modelling work by Council, based on key stages of development, as follows:

Development Threshold (m <sup>2</sup> , GFA)	Generated Vehicle Trips (vehicle movements/hour, weekday PM peak)
43,050	670
62,500	1,130
102,900	1,600

**Table 1: Modelled Traffic Volumes Associated with Development Thresholds**

- 3.13 The years selected for the original SIDRA modelling were 2017 (i.e. immediately post expressway) and 2031 (potential long term effects). 2021 was not selected because of the uncertainty over the timing of the KRRR. 2021 was used in the later SIDRA modelling as it was included in the SATURN / VISSIM modelling. A total of 11 scenarios were tested in the SATURN/SIDRA modelling for PDP purposes.
- 3.14 Three scenarios were also run for 2017 using SIDRA on the basis of traffic volumes potentially associated with the Airport Proposed Private Plan Change.
- 3.15 PM peak modelling was undertaken to represent the most critical period for local road network operational assessment purposes.
- 3.16 The basis of the overall SATURN composite growth forecasting is discussed in the M2PP Traffic Modelling Report, Technical Report 34, Appendix 34.G. However, a different approach is taken by Council to consider localised impacts of major developments on the basis of the full traffic generation testing of affected zones.

#### SIDRA

- 3.17 A validated/calibrated base year SIDRA model was not constructed as part of the Airport SIDRA modelling, for example by including detailed on-site surveys, this was because
- The requirement was to test the relativity of future impacts on local road network LOS (with the Expressway in place) of large scale changes in Airport GFA.

- The work was focussed on assessment for District Plan purposes, rather than for the consideration of a design proposal or a resource consent application. Consequently, no detailed mitigation measures or infrastructure options were tested.

3.18 Submitters have contended that further testing should have been undertaken, in terms of infrastructure requirements and sensitivity testing.

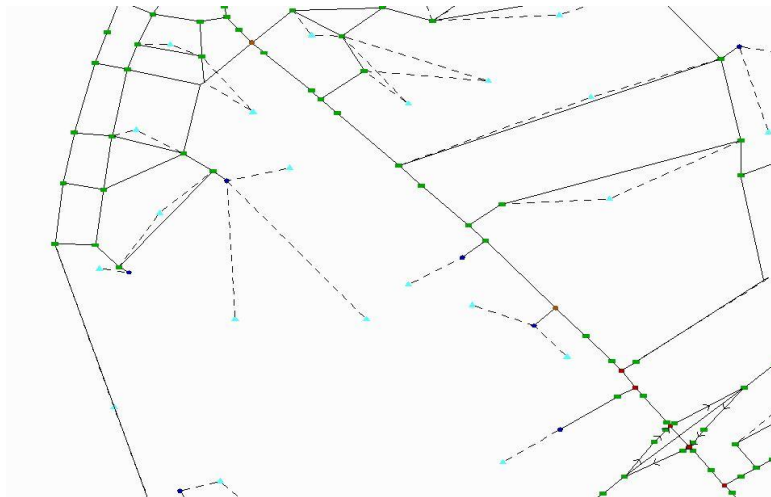
#### Micro-simulation

3.19 Council has developed micro-simulation models (including PARAMICS in Waikanae and VISSIM in Paraparaumu) for the purpose of SH1 revocation design, the Town Centres and Connectors Transformation Project and for the detailed evaluation of KRRR. It was thought (in 2016 prior to the PDP Hearings) that additional information from extending the Paraparaumu VISSIM model may have been useful for Airport assessment purposes. However, problems occurred in the latest dynamic assignment VISSIM modelling undertaken, including issues in respect of base year representation (see 4.7 below) and a lack of convergence in the 2031 future year model.

## **4 Airport SIDRA models**

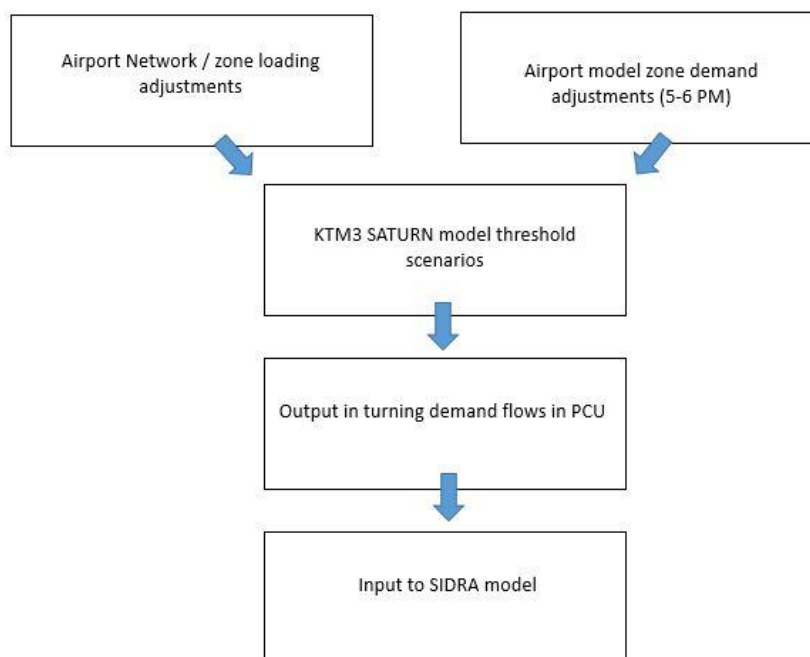
### SIDRA demand inputs

4.1 The KTM3 SATURN model had limitations in terms of network representation in the vicinity of the Airport, including limited recognition of present access realities and also included an uncommitted project (the Ihakara Extension). SATURN networks were therefore altered to reflect current and committed network representation, as illustrated below:



4.2 In detail the KTM2/KTM3 SATURN models use composite growth for forecasting purposes. This means that zones within the model are only allowed to grow to a maximum of 50% of their potential total generation. To test the effect of Airport development, the six Airport SATURN zones were factored to reflect different levels of development using traffic generation ratios (not GFA ratios). The modelling process is illustrated below:

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- 4.3 SATURN demand turning volumes (in PCU) for each scenario were derived for each intersection for direct input to SIDRA.
- 4.4 Demand outputs from the SATURN network in the vicinity of Blue Gum Road were problematic and a revalidation of the SATURN model in that area was made. Although this did occur (at a later date) when the Airport SIDRA models were being constructed, demand flows in the localised area of Blue Gum Road were manually adjusted to make them more realistic. SIDRA inputs were, as far as possible consistent, with SATURN model outputs.

### SIDRA assumptions

- 4.5 The model extent was determined by the current Airport accesses and the likely primary impact of Airport traffic on the adjacent network. The time period was taken to 5-6 PM. The model was built in SIDRA 6.1 in 2015. Network details were checked using scheme drawings and aerial photos.
- 4.6 SIDRA Saturation flows were applied based on Austroads (GTM, Part 3)

Table 6.4: Base saturation flows in through car units per hour by environment class and lane type

Environment class	Basic saturation flow in tcu/h		
	Lane type 1	Lane type 2	Lane type 3
A	1850	1810	1700
B	1700	1670	1570
C	1580	1550	1270

Source: Akcelik (1998) Table 5.1.

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- 4.7 A limited comparison of SATURN outputs for 2015 and count data on Kāpiti Road was undertaken, as follows:

<b>Kāpiti Road east of Milne Drive</b>				
	2015 SATURN (vehicles)	2015 VISSIM (vehicles)	Difference	2015 Count (vehicles)
Eastbound	641	576	11.2%	777
Westbound	790	703	12.3%	938
<b>Total</b>	<b>1,430</b>	<b>1,279</b>	<b>11.8%</b>	<b>1,715</b>

- 4.8 Other aspects of demand should be noted as follows: The additional demand generation to/from SATURN zones does not include all turning movements at intersections with Kāpiti Road. The true peak hour on the local network is earlier than 5-6pm. The SIDRA modelling has taken traffic generation from the lower thresholds (23k, 43k and 62k GFA) to be in PCU rather than in vehicles.
- 4.9 The desired network speed adopted for SIDRA network analysis purposes was 55 km/hr.
- 4.10 Pedestrian demand / crossing facilities were included at all signalised intersections in the Airport SIDRA model.
- 4.11 The current signal phasing/timing settings at Milne Drive and Te Roto Drive are not represented in the model. This is because current signal settings will change as post-Expressway traffic patterns and demands change, and also because there was no known operational plan for future signal timings, offsets and co-ordination. Therefore, the Airport SIDRA network modelling has attempted to optimise and co-ordinate settings as far as possible, and to seek to minimise future delays to achieve the best LOS possible.
- 4.12 Council selected a range of potential future thresholds and years for testing in order to represent a range of possible future scenarios. These were essentially the currently consented and built development, future scenarios set by the PC73 decision and subsequently incorporated in the operational DP with an additional scenario (at 203k GFA) originally suggested by the Airport. SIDRA was used in order to provide a consistent basis (i.e. using as far as possible the same settings and capacities for each run) to determine whether or not different levels of Airport development:
- i) were likely to have an effect on operational conditions on the local road network, and
  - ii) if so, whether ITAs should be undertaken at these thresholds
- 4.13 Airport SIDRA modelling was undertaken (in July 2016) using SIDRA 7 taking direct SATURN outputs from the modelling undertaken in preparation for the VISSIM model, even though this SATURN modelling had adopted a slightly different network adjustment and zonal demand approach, compared to the 2015 SATURN /SIDRA modelling, the later SIDRA network tests were undertaken for comparison purposes and because these were seen as 'plausible scenarios'.

## 5 Interpretation of SIDRA results

- 5.1 Council interpretation of results is contained in the PDP Chapter 6 Memo on Transport, Section 2, Annex 1 and Annex 2. This and other references are listed below.
- 5.2 Alternative views on the modelling process have been presented to the Chapter 6 PDP Hearings (in particular the evidence of T Kelly and M G Georgeson). <http://www.kapiticoast.govt.nz/Your-Council/Planning/District-Plan-Review/proposed-district-plan-hearings-2016/chapter-6-working-environment/>
- 5.3 Other comments on the modelling process have been made by in the evidence of A W Brennand and J D Parlane) on the Council modelling process are available from the Chapter 6 web link listed above.

### References (electronic copies to be provided)

PDP Ch11 Memo on Modelling

PDP Ch6 Memo on Transport – Section 2, Annex 1 and Annex 2

PDP Ch 6 Opening Statement on Transport

2014 KTM3 Kāpiti Model Data Book

2014 NZTA model guidelines

2012 KTM3 Technical Report 34 (Appendix 34.G only)

11 PDP Airport SIDRA models

3 APPPC Airport SIDRA models

Summary Background Material

Integrated Transport Assessments <https://www.nzta.govt.nz/assets/resources/integrated-transport-assessments/docs/integrated-transport-assessments.pdf>