Before a Board of Inquiry
Ruakura Development Plan Change

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of a Board of Inquiry appointed under section 149J of the Resource Management Act 1991 to consider a Plan Change requested by Tainui Group Holdings Limited and Chedworth Properties Limited

Statement of Summary Evidence of Fraser James Colegrave on behalf of Tainui Group Holdings Ltd and Chedworth Properties Ltd

19 May 2014

Introduction

1. My full name is Fraser James Colegrave.

2. My qualifications and experience are set out in my rebuttal evidence, dated 11 April 2014.

3. I reaffirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Consolidated Practice Note 2011 and agree to comply with it. In that regard, I confirm that this evidence is written within my area of expertise, except where otherwise stated, and that that I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

4. My rebuttal evidence is given in relation to the Plan Change requested by Tainui Group Holdings Limited and Chedworth Properties Limited (**the Plan Change**).

5. I was not required to attend any expert witness conferencing.

6. I confirm the content of my rebuttal evidence.

Scope of Evidence

7. My evidence .introduces the retail gravity model that I recently built for TGH and that was relied on in the evidence of Mr McDermott.

8. My evidence covers the following:

   (a) Rationale for, and theoretical basis of, retail gravity models

   (b) Using retail gravity models to estimate trade impacts

   (c) My approach to measuring distance and attractiveness

   (d) Supply- and demand-side coverage in the Hamilton city model

   (e) Data used to populate and calibrate the model

   (f) Calibration results

   (g) Scaling up to reach total city turnover

(h) Running scenarios

(i) Its application to the Plan Change

Retail Gravity Model

Rationale for using a gravity model

9. Retail impact assessments are an integral part of planning for new retail developments. They provide important initial insights into likely trade impacts, from which any potential flow-on effects can be assessed.

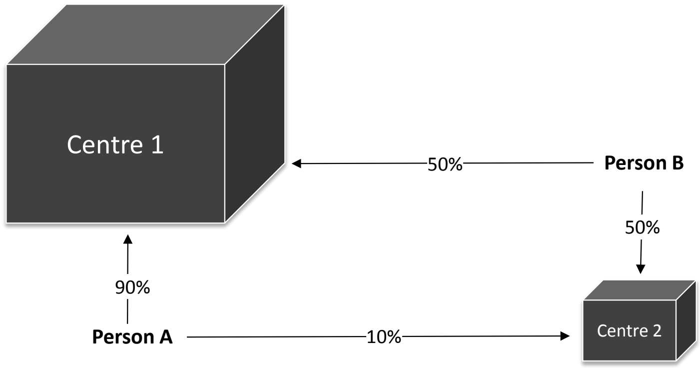
10. However, despite their importance, retail impact assessments are often hampered by a lack of timely data, making it difficult to reliably predict trade impacts *ex ante*. One way to address this is by constructing a retail gravity model (RGM) using real world data. These can be very accurate and provide an objective way to estimate trade impacts.

Theoretical basis of retail gravity models

11. As their name suggest, RGMs are derived from principles that are analogous to Newton's law of gravity. These state that, all other things being equal, objects are attracted to other objects that are large or nearby. In the retail context, RGMs capture the well-documented fact that shoppers are attracted to centres that are large or nearby.

12. Consider the diagram below, which shows two centres (1 and 2) and two consumers (A and B). In this example, person A lives closer to centre 1 and centre 1 is much larger, so person A does 90% of their shopping there. They only visit centre 2 infrequently, perhaps to meet friends or to visit a specific store. The situation for person B is different. Although they live closer to centre 2, centre 1 is bigger, so the two forces of attraction (size and distance) cancel out. As a result, person B visits both centres with similar frequency.

Figure 1: Illustration of the Gravity Model Concept



13. Our model applies these principles to calculate market shares for each centre across each possible combination of customer origins and store types.

14. Specifically, each centre is assigned a market share for each origin-store type combination using a two-step process. In the first step, each centre is assigned a score based on its distance and attractiveness. In the second step, each centre's score is divided by the sum of all scores for that origin-store type combination to derive its market share. In addition, an out-of-centre total is also calculated (again, by origin and store type) to ensure the analysis includes the full network of retail stores.

15. Once calculated, these market shares are overlaid with a matrix of total expenditure by origin and store type to estimate each centre's turnover (plus the aggregate turnover of out of centre stores).

My approach to measuring distance and attractiveness

16. As noted above, centre distance/location and attractiveness are key inputs to retail gravity models. While both can be complex (particularly the latter), I take a pragmatic approach to measuring them. For instance, while centre location should ideally be described in terms of travel times to each customer origin, such information is seldom available. Accordingly, I use straight line distances instead.

17. Further, while centre attractiveness is a broad concept that reflects a number of factors (such as centre size, parking, quality and so on) I measure it by only two factors – employment and a catch-all variable named "amenity" (whose values are set internally by the model).

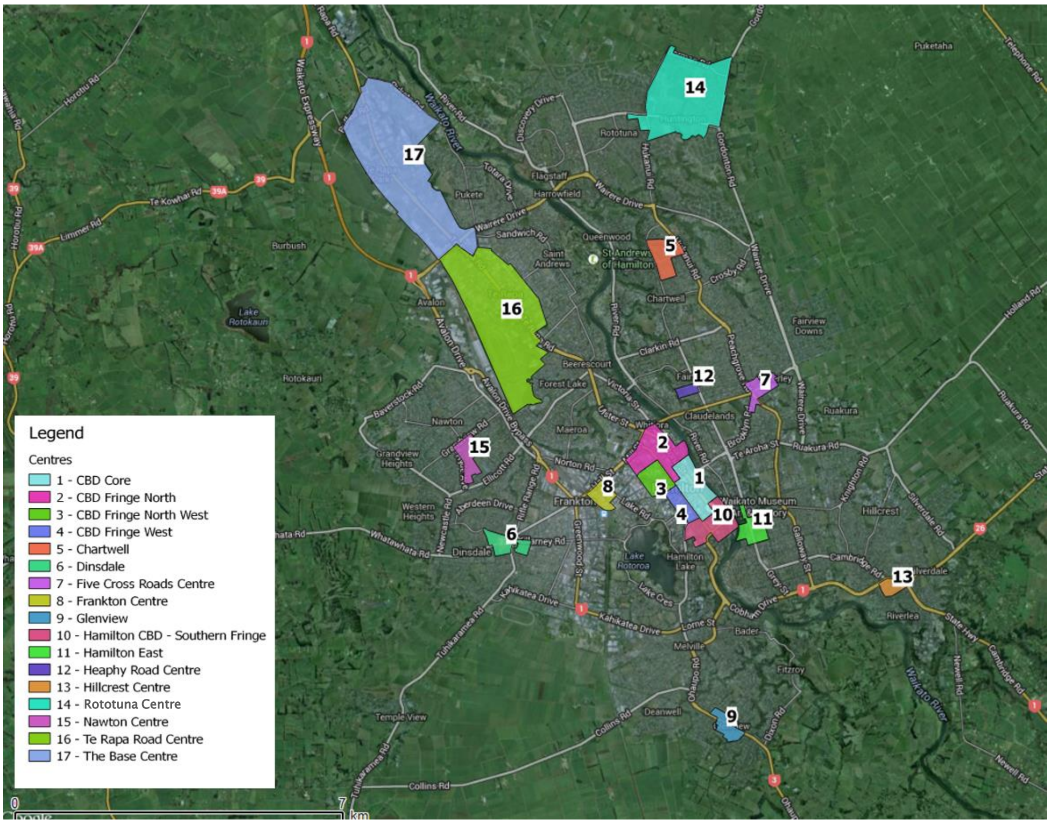
Using the model to estimate trade impacts

18. Once built, the model can be used to estimate the trade impacts of proposed new centres by running it twice and analysing the differences. First, the model is run without the new centre so that the baseline turnovers of existing centres can be estimated. Then, it is rerun including the new centre. By holding total expenditure (and hence turnover) constant between model runs, every dollar turned over at the new centre represents a dollar lost from other centres, thus providing direct estimates of trade impacts.

Hamilton model coverage

19. The model that I developed for Hamilton City covers 17 centres, as shown in the map below. These centres were already hard-coded into the data that we purchased from BNZ marketview, and cover all the main centres included in previous retail studies for the city. In addition, the model groups all other city retailers into a catch-all category called out-of-centre.

Figure 2: Map of Centres Included in the Model



20. Not only does the model disaggregate retailers by location, but it also separates them into nine store types. These cover all the “core retail” types listed in Statistics New Zealand’s Retail Trade Survey, except for accommodation

21. On the demand side, the model breaks the city down into 45 census area units, and also explicitly includes the two neighbouring districts (Waikato and Waipa). In addition, it groups all other territorial authorities in New Zealand into a catch-all group to ensure nationwide coverage.

Data used to populate and calibrate the model

22. As noted earlier, the advantages of RGMs stem not only from their solid theoretical foundations, but also their extensive use of real world data.

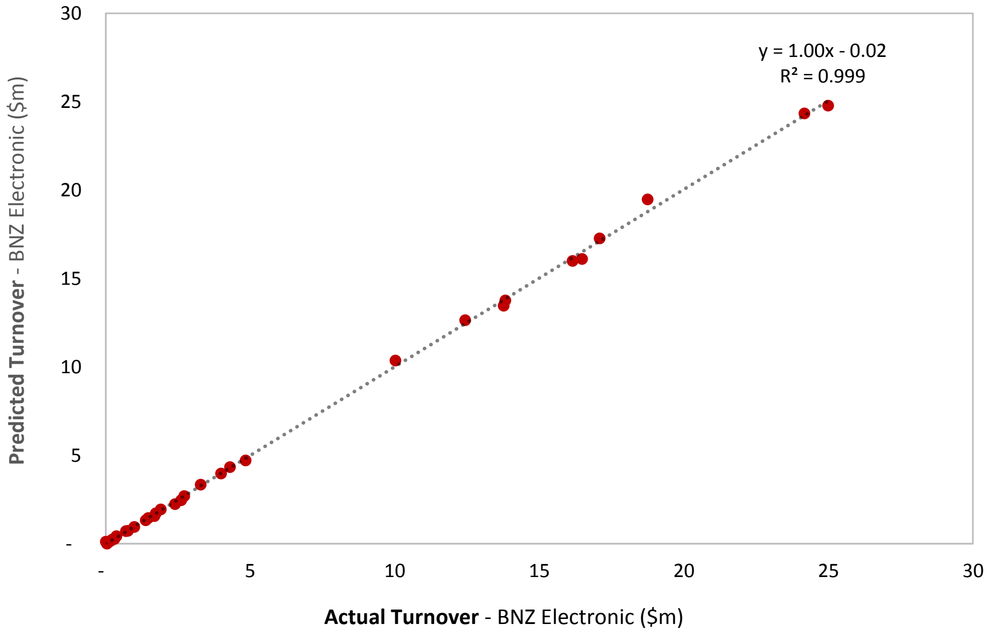
23. To populate and calibrate my model for Hamilton City, I obtained a dataset that summarised every electronic transaction by BNZ customers in Hamilton city in 2013.The data included over 4.6 million transactions with a total value of more than $253 million.

24. I used these data to solve for the optimal value of each parameter via an iterative process called calibration. This is simply where the model’s parameters are continually adjusted until the resulting estimates of centre turnover align as closely as possible with the actual values.

Calibration results

25. Although the model takes a fairly simple and pragmatic approach to the measurement of distance and attractiveness, it still produces remarkably accurate results. For instance, the graph below plots actual versus predicted BNZ electronic expenditure for each centre. Clearly, the model fits the data well. In fact, the R^2 value attached to the trendline suggests that the model has successfully explained 99.9% of the variation in turnover from one centre to the next. Moreover, the slope value of 1.00 suggests that there is a direct one-for-one relationship between actual and predicted spend. These are good results, indeed.

Figure 3: Predicted vs Actual BNZ Electronic Expenditure by Centre



Scaling up to reach estimated total turnover

26. By definition, and as noted in the evidence of Stephen Bridle for the Council, the *Marketview* data that I used to calibrate the model covered only electronic transactions by BNZ customers. To scale these up to reach total retail transactions, I applied a two-step adjustment process.

27. In the first step, I scaled up BNZ electronic transactions to include all other electronic transactions. In the second step, I scaled up total electronic transactions to include non-electronic transactions.

28. Applying this method to the BNZ data causes city wide turnover to increase from $253 million (as per the Marketview data) to $2.54 billion in 2013. To verify this, I took total employment by retail category, overlaid national estimates of turnover per employee, and made small adjustments based on the Waikato regional results in the Retail Trade Survey. This produced an independent estimate of $2.47 billion for 2013, which is within 3% of my scaled up estimate. As a result, I am confident that my scaling-up process is robust and produces reliable estimates of total city turnover.

Running scenarios

29. As noted above, the model can be used to test the impacts of proposed new centres by estimating the likely impact on rival centre turnovers. Running a scenario is quite straightforward. The user simply has to identify the location of the new store or centre, and then define the likely levels of employment by retail store type.

30. To determine retail employment by category when only centre GFA is known, I calculated ratios of floorspace per employee type so that GFA could be readily converted to employment.

31. These densities were derived by coding each centre in the Property Council's Shopping Centre Database to a meshblock, overlaying meshblock retail employment and solving for a set of densities that aligned with reported centre GFAs.

32. Users can also choose to run scenarios at future points in time to incorporate projected changes in population. This is done using Statistics New Zealand's official population projections.

Application to the Plan Change

33. During the course of writing this evidence, I received a copy of Dr McDermott's rebuttal evidence. Amongst other things, this analyses the potential trade impacts of a proposed 15,000m^2 suburban centre relative to the permitted baseline (of a 5,000m^2 neighbourhood centre).

34. Having reviewed Dr McDermott's rebuttal evidence, I confirm that the modelling results have been presented and interpreted correctly. In addition, based on the results of my gravity model I confirm my agreement with Dr McDermott's overall conclusion – that the estimated trade impacts are minor and certainly will not give rise to significant retail distribution effects under the RMA.

Conclusion

35. This short brief of evidence has introduced the retail gravity model that I recently built for TGH and compared its results to a very large sample of electronic expenditure. It has established that the model does indeed

have excellent predictive power and therefore provides a reliable basis for estimating trade impacts.

36. In addition, this evidence has briefly reviewed Dr McDermott's use of the model for the Plan Change. It has confirmed that Dr McDermott's interpretation of the model's outputs are correct, and that the inferences he draws from them are also sensible and appropriate.

Fraser James Colegrave

19 May 2014