

BEFORE THE INDEPENDENT HEARINGS PANEL

IN THE MATTER of the Resource Management Act 1991 (**RMA**)

AND

IN THE MATTER of Intensification Planning Instrument (**IPI**):
Proposed Plan Change (**PC**) 78: Intensification
(**PC78**) to the Auckland Unitary Plan Operative
in Part (**AUP**)

AND

IN THE MATTER of Hearing Topics 016A Business – City Centre
Zone Provisions, 020A Precincts – I201
Britomart Precinct, 020D Precincts – I207
Learning Precinct, 020E Precincts – I209 Quay
Park Precinct, 020G Precincts – I211 Viaduct
Harbour Precinct and 020I Precincts – I214
Wynyard Precinct

**PRIMARY STATEMENT OF EVIDENCE OF DANICA THERESE ABEAR
TORRES ON BEHALF OF AUCKLAND COUNCIL**

**Geospatial Modelling: Hearing Topics 016A, 020A, 020D, 020E, 020G,
020I**

Date: 16 November 2023

7 SUMMARY

- 7.1 This evidence on behalf of Auckland Council (**Council**) should be read together with the modelling evidence of Mr Warren Nicholson on behalf of the Council. My evidence briefly describes the GIS 3D models. I was involved in creating and developing and the various data sets and model layers provided to Architectus that Mr Warren Nicholson discusses in his evidence.
- 7.2 The GIS 3D models I developed are the base for the Architectus model developed by Mr Warren Nicholson. Mr Warren Nicholson's evidence gives more detail on how the model data sets and layers I provided were used in the Architectus modelling.
- 7.3 The different types of models I created were the: parcel-based 3D model, building footprint-based 3D model and non-extruded 3D layers. These models were converted to a drawing (.dwg) file before being provided to Mr Warren Nicholson for use in the model he developed. The data sets I provided to Mr Nicholson are listed in **Attachment A** to my evidence. The layers I created using the parcel-based 3D-model are listed in **Attachment B**. **Attachment C** contains the list of hosted feature class for the scene viewer, and **Attachment D** to my evidence contains a list of the modelling assumptions and limitations.

8 INTRODUCTION

- 8.1 My full name is Danica Therese Abear Torres. I am employed as a Senior Geospatial Specialist in Auckland-wide Unit at Auckland Council (**Council**).
- 8.2 I hold the qualification of a Bachelor of Science in Geology and a minor in Geography from Victoria University of Wellington. I have been in the geospatial industry for over 5 years and have worked in both central and local government.
- 8.3 Earlier in my professional career, I worked as a GIS Analyst creating web and static maps to visualise information. These were used for engagement with different stakeholders such as local iwi and government organisations. I have also created an app to show

publicly accessible areas across Aotearoa as well as a data collection app.

- 8.4 I am experienced in using several software applications including ArcGIS Pro, ArcGIS Portal, ArcGIS Online, and FME.
- 8.5 In 2022, I joined the GIS team in the Auckland-wide Unit at the Council. I took over the work related to 3D models of the city centre. The purpose of the 3D models is to visualise the height and other controls in the Unitary Plan. It is also to aid planners understand the scale and effects of future developments in the city centre zone and certain precincts within the city centre.
- 8.6 My involvement in PC78 to date has included creating PDF maps for the notified plan change related to Chapter H Zones – Business Zone, and Chapter I Precincts City Centre.
- 8.7 I was also involved in refining the boundaries of proposed walkable catchments to ensure there were no slivers on the boundary extent that could cause to it pick up a neighbouring property by mistake.
- 8.8 I have also done various analysis for planners across the department. This involved calculating statistic values and creating maps to show the difference in zoning pre and post notification of PC78. I also created 3D models of properties near ridgeline protection overlay areas (**RPO**) in Glen Eden.
- 8.9 Of particular relevance to these hearing topics, I have created 3D models and model layers of the city centre zone and particular precincts¹ that have been provided to Architectus for use in the Architectus 3D model created by Mr Nicholson.
- 8.10 I am authorised by Auckland Council to provide evidence in relation to city centre zone modelling for Hearing Topics 016A Business – City Centre Zone Provisions, 020A Precincts – I201 Britomart Precinct, 020D Precincts – I207 Learning Precinct, 020E Precincts – I209 Quay

¹ I201 Britomart Precinct, I207 Learning Precinct, I209 Quay Park Precinct, I211 Viaduct Harbour Precinct, and I214 Wynyard Precinct.

Park Precinct, 020G Precincts – I211 Viaduct Harbour Precinct and 020I Precincts – I214 Wynyard Precinct.

9 CODE OF CONDUCT

9.1 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 and that I agree to comply with it. I confirm that I have considered all the material facts of which I am aware that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

10 SCOPE OF EVIDENCE

10.1 My evidence on behalf of the Council for these Hearing Topics is structured as follows:

10.1.1 3D modelling of City Centre zone and certain precincts

10.1.2 Methodology

10.1.3 Outputs

10.2 My evidence should be read together with the modelling evidence of Mr Warren Nicholson on behalf of the Council. In my evidence, I outline the methodology, assumptions and outputs of the 3D models and model layers that I created for the City Centre zone and particular City Centre precincts that I provided to Mr Nicholson for use in the Architectus model.

11 3D MODELLING OF CITY CENTRE ZONE AND CERTAIN PRECINCTS

11.1 In his evidence, Mr Nicholson describes the purpose of the 3D modelling he has undertaken. He discusses that he received a number of data set files from the Council's geospatial team that were used in the Architectus model.

11.2 I was responsible for preparing those files and I provided them to Mr Nicholson for use and analysis in the Architectus model.

11.3 The files I prepared relate to the City Centre zone and the following precincts:

- Britomart Precinct
- City Centre Wharves Precinct
- Cook Street Depot Precinct
- Learning Precinct
- Port Precinct
- Viaduct Harbour Precinct
- Wynyard Precinct

11.4 A full list of all the data sets I provided to Architectus and the format in which they were provided is included as **Attachment A** to my evidence.

12 METHODOLOGY FOR MODELS AND MODEL LAYERS PROVIDED TO ARCHITECTUS

Parcel-based 3D model

- 12.1 I used the NZ Primary Parcel layer from Land Information New Zealand (**LINZ**) as the building footprint for each site since it is not possible to predict what building will be built on a particular site. The layer uses the NZTM 2000 coordinate system, which is the standard coordinate system for general mapping in New Zealand. The list of layers created using this method is listed in **Attachment B**.
- 12.2 The 2013 LiDAR DEM (Digital Elevation Model) was used to determine the ground surface height of each parcel. It uses the NZTM 2000 coordinate system, and the vertical datum is Auckland 1946. The DEM also has a vertical accuracy of +/- 0.1 and 68% confidence.
- 12.3 I used ArcGIS Pro, a GIS software to determine the average height of each building footprint at ground level. This allows the building footprint to be extruded to the correct height. The extruded building footprint is the sum of the average height at ground level and the applicable height control. Figure 1 below is an example of a parcel with a building height of 20m.

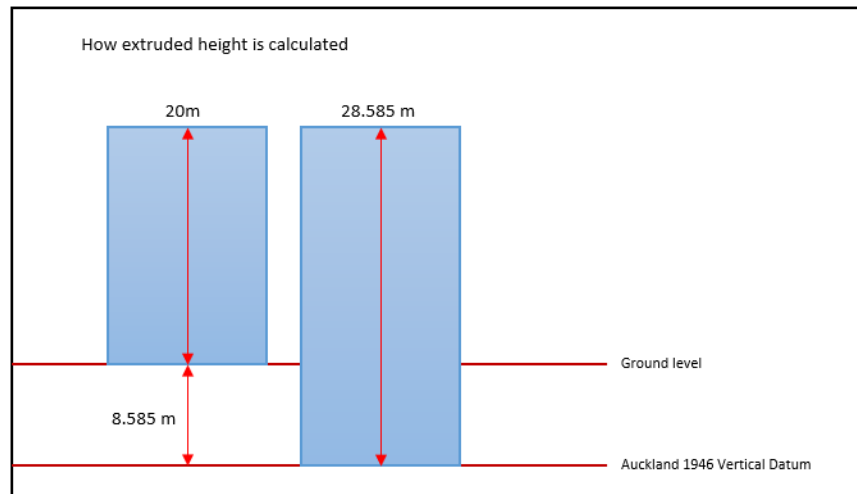


Figure 1: Shows how building height is extruded from ground level.

- 12.4 After extruding the parcel, I created a multipatch feature class type dataset. This serves as a standalone 3D layer for the extruded models. I then copied over the extruded parcels into this layer.

Building footprints-based 3D model

- 12.5 This 3D model was used to visualise existing buildings in the city centre. I used the building outlines dataset which was captured from aerial imagery available from LINZ Data Service.
- 12.6 The 2013 LiDAR DSM (Digital Surface Model) captures elevation above the ground such as buildings, vegetation, and other structures. It uses the NZTM 2000 coordinate system, and the vertical datum is Auckland 1946. It also has a vertical accuracy of +/- 0.1 and 68% confidence. **Figure 2** below shows the difference between DSM and the DEM data set discussed above.

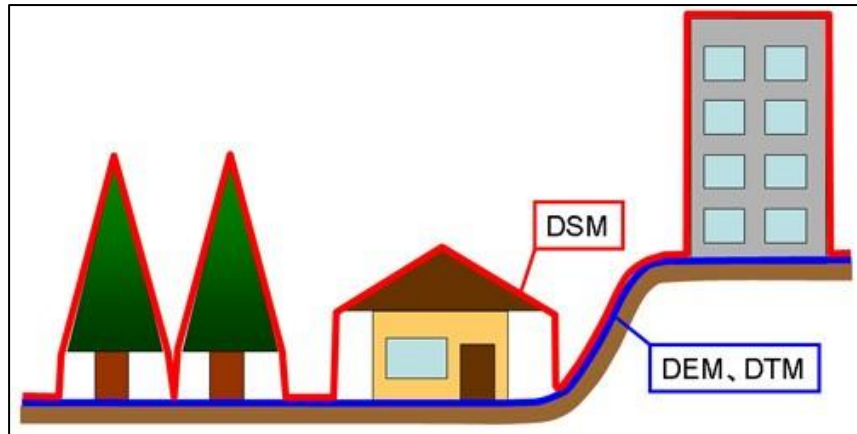


Figure 2: Shows the difference between a DEM and DSM.²

- 12.7 To create the existing building 3D model, I used ArcGIS Pro to determine the maximum height of the building outlines. I then extruded the outlines to their maximum height.
- 12.8 I created a multipatch feature class type dataset to serve as a standalone 3D layer and copied over the extruded building outlines into this layer.

Extruded 3D models to Drawing (.dwg) files

- 12.9 The 3D models sent to Architectus were in drawing (.dwg) format. To prepare the 3D models, they needed to be converted from a multipatch feature class to a dwg file. I used FME software to perform the conversion since it has the capability to do the process in batches.
- 12.10 The process was straightforward. I started by adding the individual multipatch 3D models as the input. I then created an output corresponding to each of the inputs and checked the parameters to ensure the coordinate system was maintained. Once the input and output were all linked, I ran the process to proceed with the conversion to dwg files.

² Diagram sourced online, (14 November 2015)
 <<https://m.blog.naver.com/PostView.naver?isHttpsRedirect=true&blogId=rsmilee&logNo=220480947493>>.

12.11 To check if the process was successful, I used Autodesk's DWG TrueView 2018 to view the results.

12.12 This confirmed that all the dwg converted layers have a coordinate system of NZTM2000.

Non-extruded 3D layers to dwg files

12.13 I also used FME software to convert 2D layers to 3D. To start with, I put the contour layer through a 3D Forcer tool within FME to add z coordinate values. The 3D contour layer was provided to Architectus and used to create the topography in the modelling Mr Nicholson discusses.

12.14 I then used the surface draper tool within FME to drape the following 2D layers over the converted contour layer to add elevation information:

From LINZ data service:

- Building outlines

From Auckland Council's database:

- Impervious surface
- Kerblines
- NZ Primary Land Parcel
- Open space areas
- Tree points

12.15 All the layers including the contour layer have a coordinate system of NZTM2000.

12.16 The models and model layers I developed were subject to a number of assumptions and limitations which are listed in **Attachment D** to my evidence.

13 Outputs

13.1 The following types of outputs were provided to Mr Nicholson in drawing (.dwg) format for use in the Architectus model. The layers have a coordinate system of NZTM2000. The list of individual layers of the following types are included in **Attachment A**:

- a. Extruded parcel-based 3D models,
- b. Non-extruded 3D models,
- c. Extruded building outlines model,
- d. Other layers from Auckland Council Database, and
- e. Victoria Park Files.

13.2 The multipatch feature class is the file format that sits within the GIS system and is used when the model is created and/or updated. It has a coordinate system of NZTM2000. The list of individual layers of the following types are included in **Attachment B**:

- a. Existing controls and heights,
- b. Notified heights, and
- c. Models from submissions.

13.3 Hosted feature layer for the scene viewer – Multipatch feature class are hosted as a layer for the scene viewer. This allows Mr Nicholson to access and view the 3D model before I convert the data set to dwg and confirm the extent of the model. It is also used to check the data set he received matches the GIS model. The hosted layers have a coordinate system of WGS-84. The list of individual layers of the following types is included in **Attachment C**:

- a. Existing controls and heights,
- b. Notified heights, and
- c. Models from submissions.

Danica Therese Abear Torres

16 November 2023

ATTACHMENT A

List of data sets provided to Architectus in drawing (.dwg) format with the coordinate system of NZTM2000.

1. Extruded parcel-based 3D models

Existing controls and heights:

- a. H0 – Unlimited height
- b. H1 – Special Height Controls
- c. H2 – General Height Controls
- d. H3 – Precinct Height Controls
- e. H4 – Wynyard Precinct Basic Height
- f. H5 – Wynyard Precinct Maximum Height
- g. Operative Enabled Height

Notified heights:

- a. General Height 16m
- b. General Height 20m
- c. General Height 30m
- d. General Height 35m
- e. General Height 72.5m
- f. Learning Precinct 72.5m
- g. Enabled Height
- h. Britomart Precinct
- i. City Wharves Precinct
- j. Cook Street Precinct
- k. Learning Precinct
- l. Port Precinct
- m. Viaduct Precinct

Models from submissions in the following precincts:

- a. Britomart Precinct
- b. Quay Park Precinct

- c. Viaduct Harbour Precinct
- d. Wynyard Precinct

Height Testing

- a. 72.5 Precincts
- b. 72.5m Special Height Area
- c. Special Height Area
- d. General Heights with Setbacks

2. Non-extruded 3D layers

- a. These layers were exported as drawing (dwg) files with a coordinate system of NZTM 2000. These were provided to Architectus. This includes:

- i. Building Outlines
- ii. Impervious Surface
- iii. Kerblines
- iv. NZ Primary Land Parcels
- v. Open space area
- vi. Tree points

3. Extruded building outlines model

- a. Existing buildings

4. Other layers from Auckland Council database

- a. Existing buildings
- b. Sky Tower
- c. Under Construction
- d. Mt Eden Viewshaft

5. Victoria Park files

- a. Buildings
- b. Garden Turf Extent
- c. Park Extent
- d. Sport Field Extent
- e. Sport Field Marking

- f. Structure Hard Surface
- g. Tree Register

ATTACHMENT B

List of multipatch feature class created with the coordinate system of NZTM2000.

1. Existing controls and heights:
 - a. H0 – Unlimited Height
 - b. H1 – Special Height Controls
 - c. H2 – General Height Controls
 - d. H3 – Precinct Height Controls
 - e. H4 – Wynyard Precinct Basic Height
 - f. H5 – Wynyard Precinct Maximum Height
 - g. Existing building

2. Notified heights:
 - a. General Height 16m
 - b. General Height 20m
 - c. General Height 30m
 - d. General Height 35m
 - e. General Height 72.5m
 - f. Learning Precinct 72.5m
 - g. Enabled Height
 - h. Britomart Precinct
 - i. City Wharves Precinct
 - j. Cook Street Precinct
 - k. Learning Precinct
 - l. Port Precinct
 - m. Viaduct Precinct

3. Models from submissions in the following precincts:
 - a. Britomart Precinct
 - b. Quay Park Precinct
 - c. Viaduct Harbour Precinct
 - d. Wynyard Precinct

4. Height Testing
 - a. 72.5 Precincts
 - b. 72.5m Special Height Area
 - c. Special Height Area
 - d. General Heights with Setbacks

ATTACHMENT C

List of hosted feature class for the scene viewer with a coordinate system of WGS-84.

1. Existing controls and heights:
 - a. H0 – Unlimited Height
 - b. H1 – Special Height Controls
 - c. H2 – General Height Controls
 - d. H3 – Precinct Height Controls
 - e. H4 – Wynyard Precinct Basic Height
 - f. H5 – Wynyard Precinct Maximum Height
 - g. Existing building

2. Notified heights:
 - a. General Height 16m
 - b. General Height 20m
 - c. General Height 30m
 - d. General Height 35m
 - e. General Height 72.5m
 - f. Learning Precinct 72.5m
 - g. Enabled Height
 - h. Britomart Precinct
 - i. City Wharves Precinct
 - j. Cook Street Precinct
 - k. Learning Precinct
 - l. Port Precinct
 - m. Viaduct Precinct

3. Models from submissions in the following precincts:
 - a. Britomart Precinct
 - b. Quay Park Precinct
 - c. Viaduct Harbour Precinct
 - d. Wynyard Precinct

4. Height Testing
 - a. 72.5 Precincts
 - b. 72.5m Special Height Area
 - c. Special Height Area
 - d. General Heights with Setbacks

ATTACHMENT D

Assumptions and limitations of the 3D models

1. H1 Special Height Controls

- a. The heights in this layer are affected by Mt Eden viewshaft, height control planes, view protection planes and sunlight admission control. This results in parcels being split in some areas, meaning they don't follow the building footprint. This means that a parcel displays more than one height, where part of it is extruded to a lower height. A noticeable example of this is where the parcels are cut by Mt Eden viewshaft at Wynyard Quarter.



Figure 3: Example of height split in Wynyard Quarter displaying more than one height in a parcel.

2. 2013 LiDAR DSM

- a. The DSM used to model the existing building outlines layer was captured between 17 July and 23 November 2013. This does not include heights of newer structures that were built past this date. It

may also include heights of structures that were in progress of being built. This can affect the calculated maximum height from ground level. The maximum height was used to extrude the building outlines.

- b. Although the official vertical datum for New Zealand is NZVD2016, the DSM uses Auckland 1946 vertical datum. This is to ensure consistency across all the other files held by the council.

3. 2013 LiDAR DEM

- a. The DEM used in this modelling was captured between 17 July and 23 November 2013. This does not capture any changes in the terrain past this date. This can affect the calculated average height of the ground level. The average ground level height was used to calculate the extruded height of the layers: operative controls and heights, heights in PC78 as notified, and heights requested in submissions.
- b. Although the official vertical datum for New Zealand is NZVD2016, the DEM uses Auckland 1946 vertical datum. This is to ensure consistency across all the other files held by the council.

4. Building outlines dataset

- a. The outlines in this dataset are captured from latest aerial imagery available on the LINZ Data Service. I downloaded the dataset on 25 February 2022. The aerial imagery in the Auckland region was last updated in 2017. Therefore, any new buildings past that date have not been captured and included in the modelling. An example of this is Commercial Bay shopping mall.

5. Notified enabled height layers

- a. This is the lower height when comparing between H1-Special Height Controls and Notified General Heights in the city centre zone. The building footprint between the two layers vary in some areas where it is affected by the Mt Eden viewshaft, height control planes, view protection planes and sunlight admission control. Where the Maximum Height is lower and therefore included in the Enabled Height layer, the 3D model is manually split to match the footprint of H1-Special Height Controls. This means the building footprint might not be fully identical.