Visual Impact Photomontage Methodology for Barangaroo Commercial Building C3 Planning Application

BACKGROUND

This document was prepared by Virtual Ideas to describe the processes used to create the visual impact photomontages and illustrate the accuracy of the results, and show media to allow assesment of visual impact..

Virtual Ideas is a highly experienced 3D visualisation company which commonly prepares material for both application and court use, and is familiar with requirements to provide 3D visualisation media that will communicate the visual impact of proposed developments. Our methodologies and results have been inspected by various court appointed experts in a variety of cases and have always been found to be accurate and acceptable.

OVERVIEW

The process of creating accurate photomontage renderings begins with the creation of an accurate, real world scale digital 3D model. We then take site photographs from known locations and place cameras in the digital 3D model that match the real world position of the site photography.

By matching the lens properties of the cameras in the digital 3D software, to that of the real world photography, and rotating the cameras in the software so that surveyed points in 3D space align with the corresponding points on the photograph, we can create a rendering that is correct in terms of position, scale, rotation, and perspective. Time and data information is also recorded during the site photography so that accurate lighting conditions can be reproduced in the 3D rendering.

A digital image is then rendered from the camera in the 3D software application that is then superimposed into the real world photo to generate an image that represents accurate form and visual impact.

DESCRIPTION OF COLLECTED DATA

To create the 3D model and establish accurate reference points for alignment to the photography, a variety of information was collected. This includes the following:

1) 3D model of the Approved Concept plan (Mod 4)
   - Supplied by: RSHP Architects
   - Format: DWG
   - Content: 3D model of the Approved Concept plan

2) Ortho-corrected aerial photography of the city of Sydney and surrounds
   - Created by: Department of Lands
   - Supplied by: Department of Lands
   - Format: ecw
   - Content: Ortho-corrected aerial photography

3) Digital terrain model of the city of Sydney and surrounding suburbs
   - Created by: Department of Lands
   - Supplied by: Department of Lands
   - Format: DWG
   - Content: 3D contours of the ground plane only (no buildings)

4) Surveyed 3D model of the city of Sydney buildings and ground plane
   - Created by: AAM Hatch
   - Supplied by: Lend Lease
   - Format: DWG
   - Content: 3D model of the city of Sydney buildings and ground plane

5) 3D model of the Barangaroo Commercial Building C4
   - Created by: RSHP Architects
   - Supplied by: Lend Lease
   - Format: DWG
   - Content: 3D model of the Barangaroo buildings

6) Site photography
   - Created by: Luke Kolln of Virtual Ideas (VI Photos)
   - Format: JPEG file
   - Content: High resolution photo

CREATION OF THE DIGITAL 3D MODEL

Creating the surrounding terrain model

Using our software application (3D Studio Max) we imported the Lands 3D topographical CAD data and created a three dimensional terrain model at real world scale. This model was referenced back to MGA co-ordinates using a common reference point that all project drawings are being referenced to. The ortho-corrected aerial photography was then mapped to this model giving us a relatively accurate source for referencing camera positions in both position and height.

Creating the Sydney city buildings 3D model

To have sufficient survey data that would allow us to accurately align the 3D model to the photography, a surveyed 3D model was purchased from AAM hatch and positioned into the 3D scene using the common MGA reference point as the origin. In addition a surveyed ground plane from AAM Hatch was also purchased and positioned under the buildings.

The building survey was created by AAM Hatch using photogrammetric mapping equipment and techniques.

Creating the Barangaroo Commercial Buildings C3 3D model

The Barangaroo C3 building model was supplied by RHSP and Lend Lease. The building was supplied in its correct MGA referenced position and was correct in height and scale.

SITE PHOTOGRAPHY

Site photography was taken from the positions agreed with Lend Lease. The positions were selected to fulfil the Director General Requirements provided by the department of planning. The DGR requirements did not specify a lens size for the photographs.

Additional locations for photomontages were requested by the city of Sydney, and subsequently photographed.

The lens selection for each shot was based on the following criteria:

- The on-site location for the photograph should be as close as possible to the instructed location.
- The entirety of the proposed buildings, including the approved concept plan envelope should be in view in each photo where possible.
- Surrounding existing buildings should also be visible in each photomontage to allow for fair and accurate comparison to existing built form.

The lens size selected for each shot ranges from 17-40mm. For further explanation of digital photography and the human eye refer to Appendix A.

In most cases we consider that a 17-24mm lens is a fair representation of the focal length of the human eye. It is difficult to define the exact focal length of the eye as we have to consider the distance to the subject and peripheral vision. There are many studies to support that 17mm is acceptable. Also many scientists consider 20-24mm acceptable when looking at a specific item in the distance. - Please see appendix A.

CREATION OF PHOTOMONTAGES

The positions of the real world photography were located in the 3D scene using the lands and AAM Hatch 3D models, and the orthocorrected photography.

Cameras were then created in the 3D scene to match the locations and height of where the photographs were taken from and the lens data stored in the metadata of the photograph. The cameras was then aligned in rotation so that the points of the 3D model aligned with their corresponding objects that are visible in the photograph.

A realistic sun & skylight light system was then created in the 3D scene and matched to the precise time and date of when each photograph was taken.

3D renderings of the new built form was then created from the selected cameras, at the exact pixel dimensions and aspect ration of the original digital photograph. (4368 x 2912 pixels)

The 3D renderings were then place into the digital photography, and masked out where existing form appeared in front of the buildings.

In conclusion, it is my opinion as an experienced 3D architectural visualisation professional that the images provided accurately portray the level of visibility and impact of the built form with respect to the surrounds.

Yours sincerely

Grant Kolln,
Director Virtual Ideas

MAP SHOWING CAMERA LOCATIONS

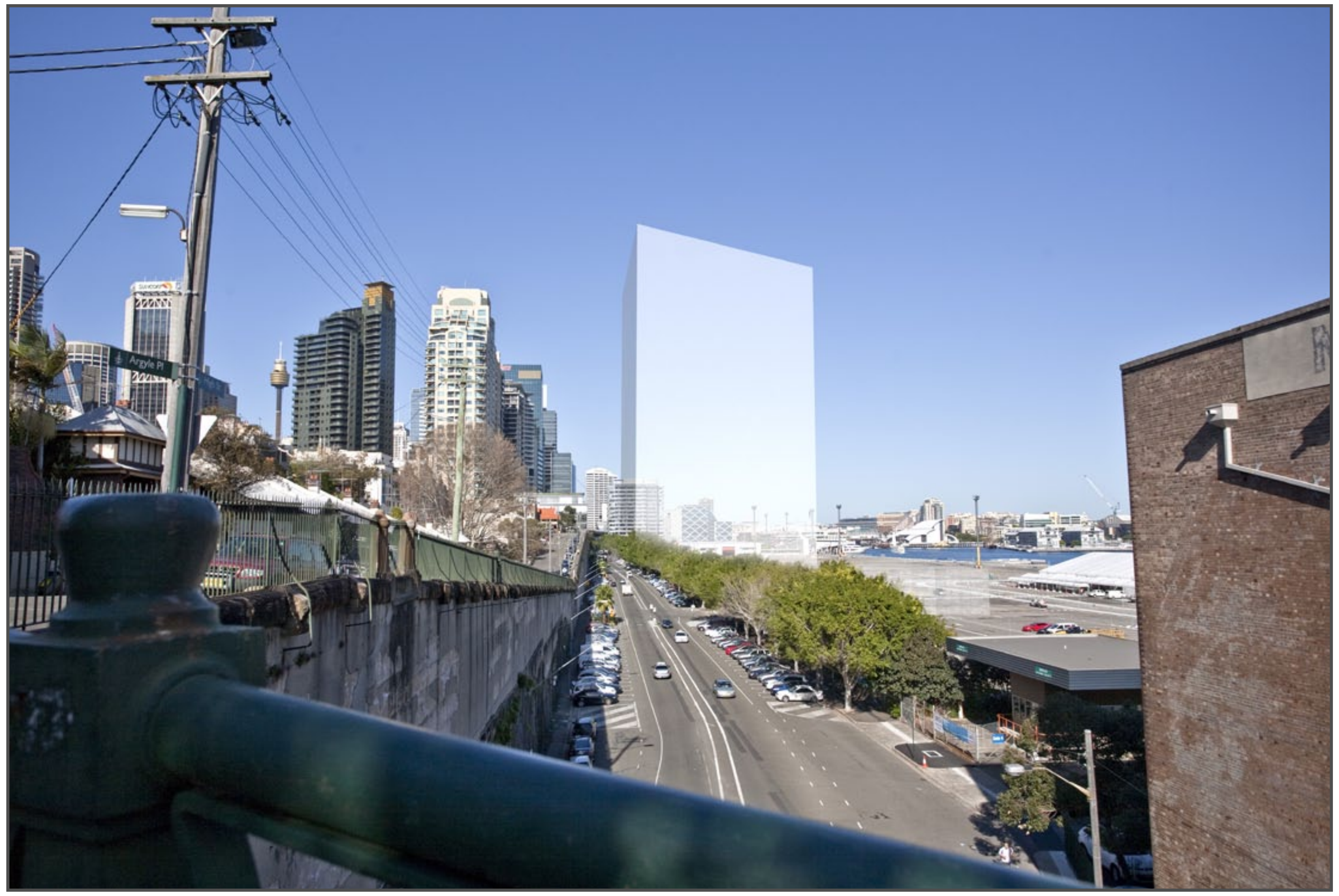

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	HICKSON ROAD
Camera R.L.	17.5m
MGA coords:	X: 333734.347, Y: 6252097.407
Lens:	24mm
Dimensions:	4368 x 2912
Date:	18/06/2010 12:30 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 24mm lens was to capture the heights of several existing city buildings to the left of the image, and also show the building immediately to the right of the viewer. Including the handrail in this image also visually desribes that the viewer is standing on the bridge.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph.

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	MILLERS POINT (OBSERVATORY HILL)
Camera R.L.	43.2m
MGA coords:	X: 333894.874, Y: 6252001.792
Lens:	40mm
Dimensions:	4368 x 2912
Date:	2/06/2010 2:57 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 40mm lens was that from this specific location the wider lens only captured more of the underside of the canopy and did not see any additional built form. Therfore we selected a 40mm lens as this balanced the amount of built form vs the surrounding nature in the image.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph.

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	KENT ST (CNR MARGARET ST)
Camera R.L.	17.9m
MGA coords:	X: 333899.463, Y: 6251329.789
Lens:	20mm
Dimensions:	4368 x 2912
Date:	2/06/2010 2:19 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 20mm lens was to capture the heights of the Westpac building, while also providing enough room to see the extent of the future Barangaroo buildings and the approved concept plan.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

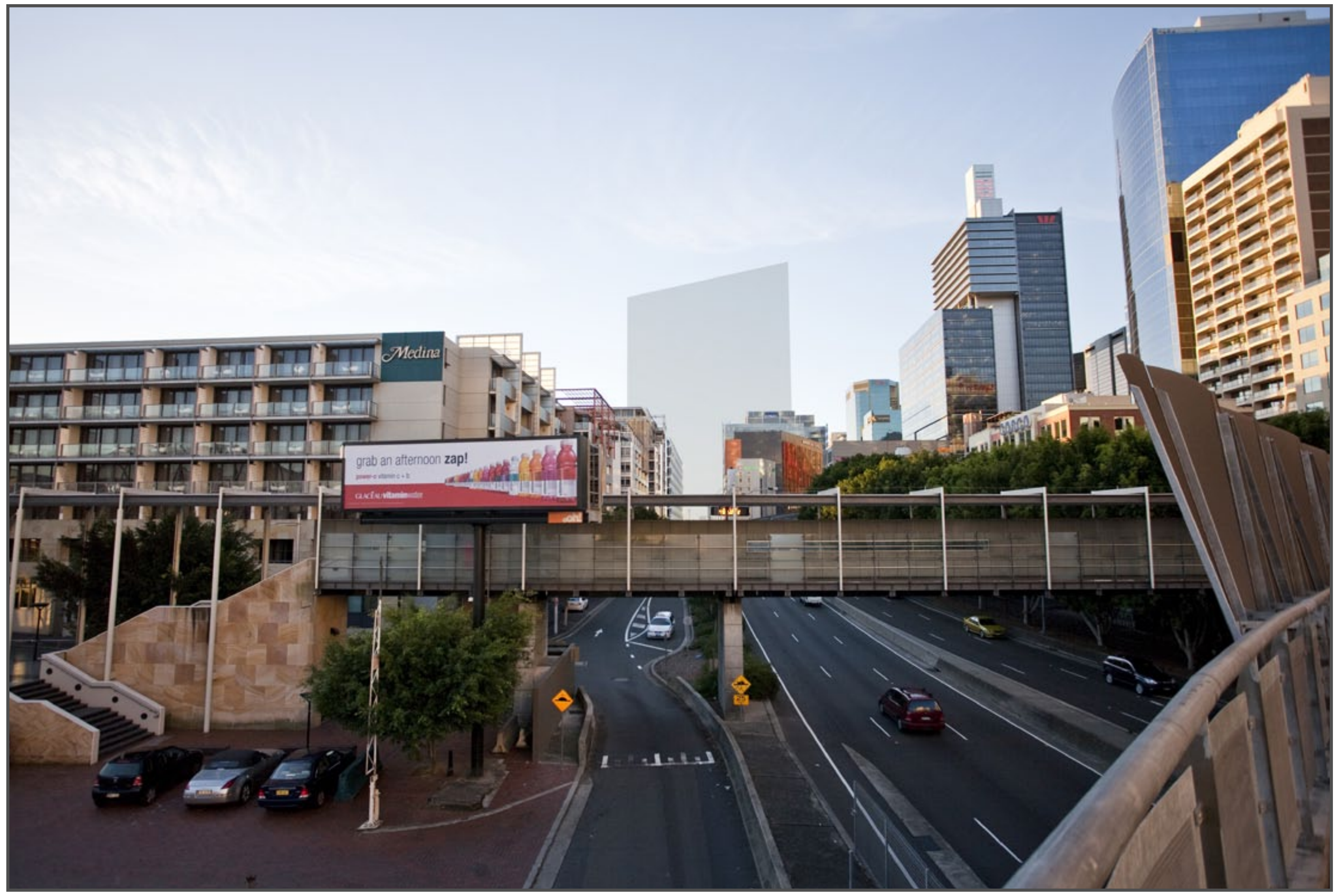

Image showing block 3 from the approved concept plan (Mod 4)

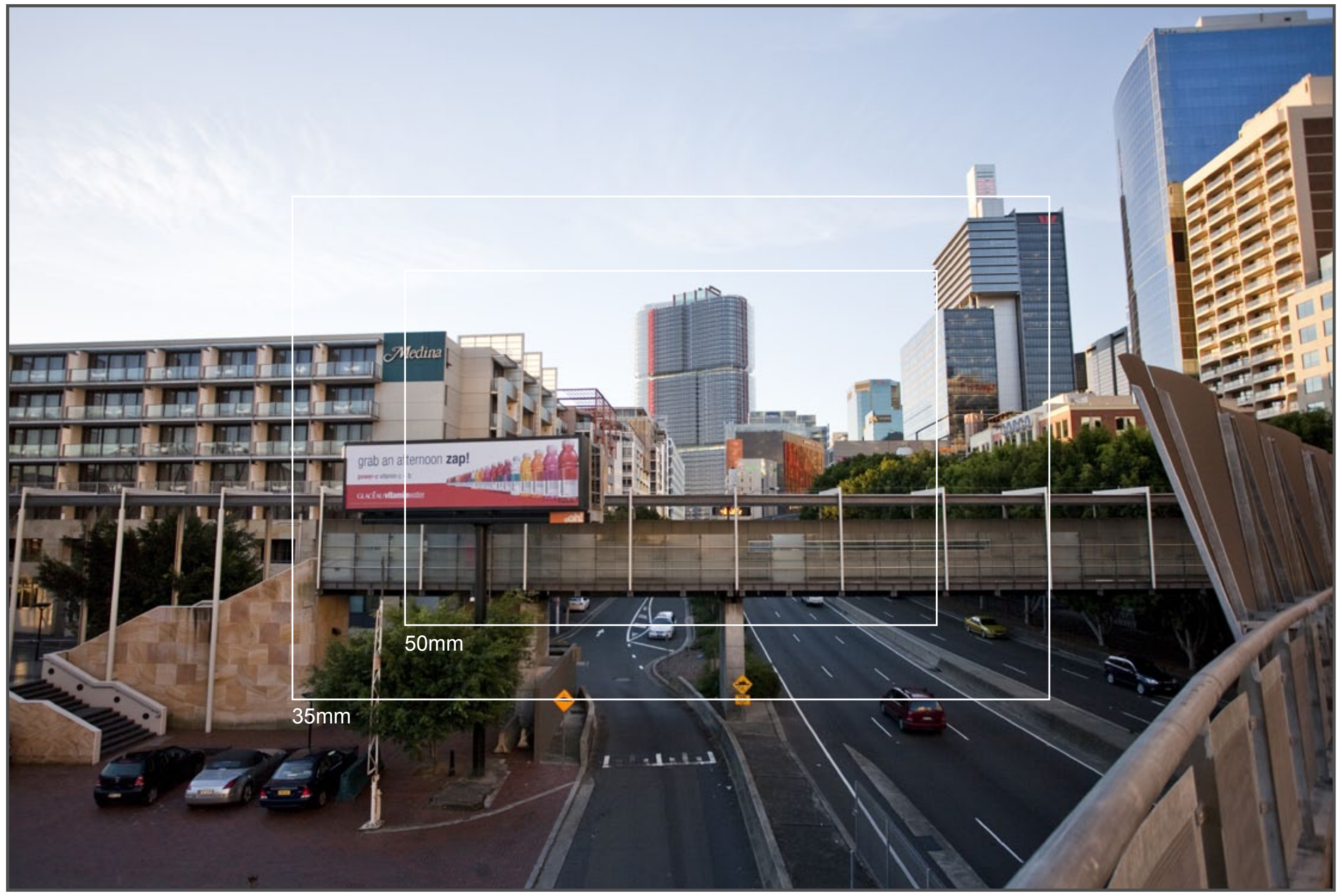

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	SHELLEY ST FROM KING ST BRIDGE
Camera R.L.	11.8m
MGA coords:	X: 333775.939, Y: 6250899.372
Lens:	20mm
Dimensions:	4368 x 2912
Date:	8/06/2010 5:41 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 20mm lens was to capture the heights of several existing city buildings to the right of the image, and also show some of the built form to the left of the viewer. Including the handrail in this image also visually desribes that the viewer is standing on the bridge.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	LIME STREET
Camera R.L.	6.7m
MGA coords:	X: 333693.502, Y: 6250920.272
Lens:	22mm
Dimensions:	4368 x 2912
Date:	8/06/2010 5:47 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 22mm lens was that to show the width of the street in front of the viewer, as well as to capture the height of the lime st buildings.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	DARLING HARBOUR
Camera R.L.	13.6m
MGA coords:	X: 333547.744, Y: 6250747.816
Lens:	22mm
Dimensions:	4368 x 2912
Date:	8/06/2010 5:15 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 22mm lens was to capture the surrounding city buildings, while capturing some of the foreground elements so that the viewer could feel like they were standing on the bridge.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image. (See apendix B)

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

Image showing block 3 from the approved concept plan (Mod 4)

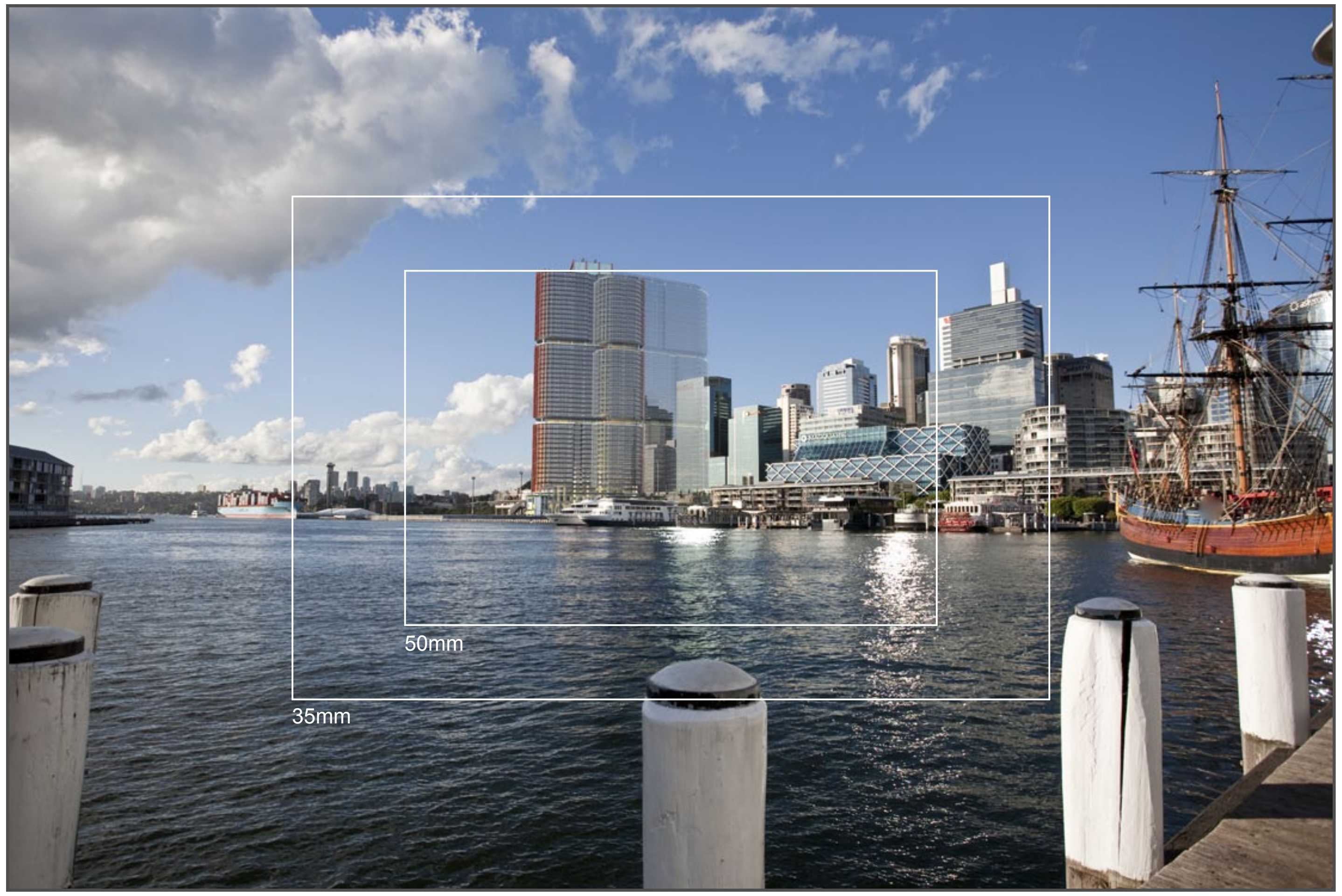

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	PYRMONT
Camera R.L.	4.9m
MGA coords:	X: 333401.942, Y: 6250969.394
Lens:	20mm
Dimensions:	4368 x 2912
Date:	8/06/2010 4:43 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 20mm lens was to capture the surrounding city buildings, while capturing some of the foreground elements so that the viewer could feel like they were standing at the waters edge. We also wanted to ensure that the edge of Sydney wharf was included in the photo so that the distance between the Barangaroo site and Sydney wharf was clearly visible.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

Image showing block 3 from the approved concept plan (Mod 4)

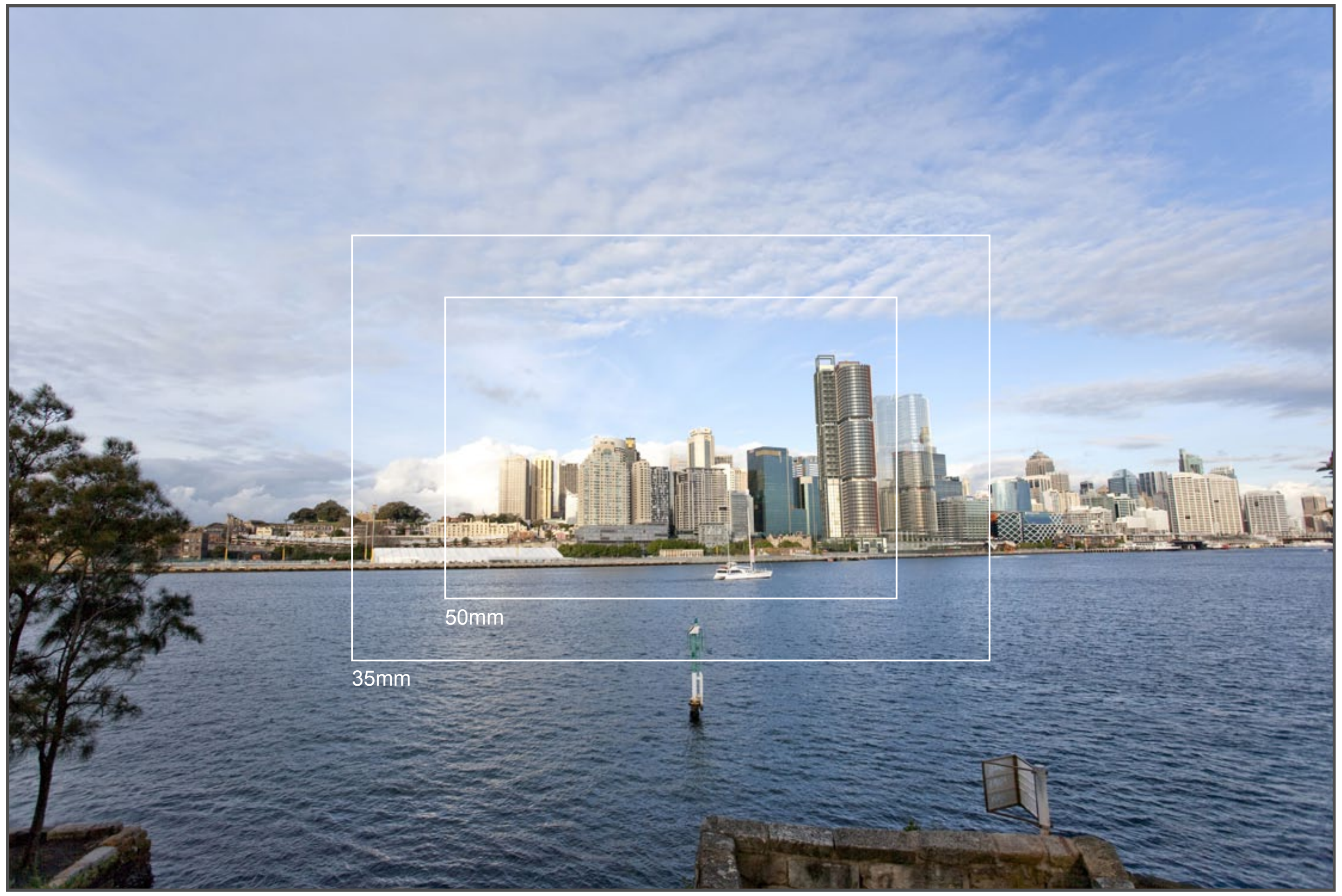

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	BALMAIN EAST
Camera R.L.	11.6m
MGA coords:	X: 333142.111, Y: 6251923.256
Lens:	17mm
Dimensions:	4368 x 2912
Date:	2/06/2010 4:55 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 17mm lens was to capture as much of the city buildings as possible from the selected position. We also wanted to show some of the foreground element so the viewer knows where they are standing.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	EAST BALMAIN (POSITION 2)
Camera R.L.	6.5m
MGA coords:	X: 333168.223, Y: 6251983.911
Lens:	21mm
Dimensions:	4368 x 2912
Date:	2/06/2010 5:05 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 21mm lens was to capture the extent of the city skyline and also provide some foreground information so that the viewer knows that they are at the waters edge.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	BALLS HEAD
Camera R.L.	32m
MGA coords:	X: 332869.201, Y: 6253291.613
Lens:	40mm
Dimensions:	4368 x 2912
Date:	2/06/2010 4:17 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 40mm lens was that the location was quite far away and zooming to this extent captured the city and the Barangaroo site as a whole. We also included some of the forgound foliage for reference.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

Image showing block 3 from the approved concept plan (Mod 4)

Image showing proposed building montaged into existing photograph & crop marks for longer lenses sizes.

Photographic data

Location:	BLUES POINT
Camera R.L.	14.6m
MGA coords:	X: 333783.957, Y: 6253021.351
Lens:	21mm
Dimensions:	4368 x 2912
Date:	2/06/2010 3:58 PM
Camera:	Canon EOS 5D

Rationale for lens selection

The rationale for using a 21mm lens was to capture as much of the city buildings as possible from the selected position. We also wanted to show some of the foreground elementS so the viewer knows where they are standing.

Overlays showing longer lenses have been included to illustrate the effect of a longer lens. Note that using a longer lens from the same location will have the same effect as cropping the wider image.

Image showing proposed C3 building montaged into existing photograph (for context, C4 S75W shown as transparent).

APPENDIX A - DIGITAL CAMERA LENSES FOR PHOTOMONTAGES AND VISUAL IMPACT ASSESSMENTS

The intention of a photomontage rendering is to visually communicate how proposed built form sits in respect to its surroundings. To achieve this, a digitally rendered image from a digital 3D model is accurately superimposed into a digital photograph to provide an accurate representation in terms of light, material, scale, and form.
Camera lens selection also plays an important part in creating a photomontage that communicates visual impact. There are several things to consider with respect to lens selection.

Field of View of the Human Eye

This is a topic that varies depending on the source of information. In many cases the field of view of the eye is stated to be 17mm. Other sources of information on the web say that it is more like 22-24mm. Whichever the case it is clear that the human eye has quite a wide field of view and when we stand close to a subject (say a building) we have quite allot of vision towards the top, sides and bottom. In addition to this the human eye can change focus and target direction extremely quickly allowing us to view a large structure in a very short period of time, effectively making our perceived field of view even larger.

The Perspective of the human eye

It is difficult to accurately reproduce what the human eye sees by the means of a printed image. As the back of the human eye is curved and the sensors on cameras are flat the perspective of a photograph can look quite different to how we see things in the real world, especially with a larger field of view, or wider lens.
In digital photography circles it is commonly stated that using a longer lens (approx 50mm) reduces the amount of perspective in an image and therefore looks more like the human eye would see reality, but this is talking about perspective only, and does not consider the field of view of the eye. If you take a photo using a 50mm lens, print the photo, and hold the print out against the actual view in the same location the photo was taken from, it becomes very clear that the human eye can see much more of the surrounding information than what is shown on the print out.

Changing the FOV on a digital camera

The main difference in using a longer lens vs. a wider lens is the amount of information that is displayed at the edges of the subject. Changing the lens to a smaller FOV produces the same result as cropping in on the wide angle image, providing that the position and the angle of the camera remains constant while taking the photographs. In short, a lens with a wider FOV does not create an image that has incorrect perspective it simply means that the perspective is extended at the edges of the image showing more of the surrounds in the images.

What all of this means for visual assessment is that there is no one fits all solution for lens selection. If we follow the opinion that a longer lens produces images that are closer to the perspective of the human eye, we will inevitably be in the situation where we cannot show the entirety of our subject and enough of the surrounds that it resides in. Also if we strictly stick to a 17mm lens we will have situations where the subject is far away and looks very small in the image, again making it difficult to assess visual impact. For these reasons we have taken the view that we can never totally represent what the human eye will see on a piece of paper, and for visual impact photomontages we should select lenses that strike a balance between the two and can accurately display the built for in its surroundings.

The most effective way to accurately gauge visual impact and get a real world feeling for scale would be to take prints of the photomontages to the exact site photography locations and compare the prints with the scale of the existing built form.

Extract from the web site - The Physics Factbook - Concerning the Focal Length of a Human Eye

http://hypertextbook.com/facts/2002/JuliaKhutoretskaya.shtml

The human eye is the organ which gives us the sense of sight, allowing us to learn more about the surrounding world than we do with any of the other four senses. We use our eyes in almost every activity we perform, whether reading, working, watching television, and driving a car, among countless other ways.

And how exactly does the eye work? The eyeball is a spherical structure approximately 2.5 cm (about 1 in) in diameter with a pronounced bulge on its forward surface, the cornea. Just behind the cornea is the iris, a coloured area with a hole in the centre called the pupil. Circular muscle tissue in the iris allows it to open and close the pupil to regulate the amount of light that gets inside the eyeball. Just behind the iris and pupil is the lens. The cornea and the lens work together to focus images on the retina, which is the light-sensitive layer that lines the inside of the eyeball.

Light moves in straight lines. Whenever a light ray encounters a surface of a different transparent medium, however, it refracts. The amount of refraction depends on the refractive index of the substance, the angle at which the light hits it, and the colour of the light. On a curved surface such as a lens, parallel rays of light will hit the surface at different angles and will be refracted in different directions.
The eye focuses on an object by bending all of the light rays from a single point on the observed object toward a single point on the retina. In the eyeball, light rays passing through the cornea are bent by its curvature toward the pupil. The lens flexes to change its curvature and finish the focusing process. When an object is located at infinity, the focal length, or the distance from the cornea to the retina, of a normal relaxed eye is about 1.7 cm (17 mm).

Bibliographic Entry	Result (w/surrounding text)	Standardized Result
Serway, Raymond & Beichner, Robert. *Physics for Scientists and Engineers with Modern Physics, Fifth Edition.* Saunders College Publishing. 2000.	"For an object distance of infinity, the focal length of the eye is equal to the fixed distance between the lens and the retina, about 1.7 cm"	17 mm
Cameron, John R.; James G. Skofronick & Roderick M. Grant. *Physics of the Body. Second Edition.* Madison, WI: Medical Physics Publishing, 1999.	"The diameter of the central bright spot at the retina is the product of the effective aperture to retina distance (17 mm) ….."	17 mm
Alexander, David. Light and Color (PHYS 1230) Lecture 21. University of Colorado. 1997.	"The normal relaxed eye focuses rays from infinity onto the retina, with a focal length of about 1.7 cm or power of about +60 diopters."	17 mm
The Eye: The Wonder of Accommodation. The Physics Classroom and Mathsoft Education and Engineering, Inc. 2002.	"The distance from the cornea (where the light undergoes most of its refraction) to the central portion of the fovea on the retina is approximately 1.7 cm."	17 mm