



Mid-rise Case Study:

Oxford Apartments, Williams Landing

Contents

1. Preface
2. Introduction
3. The Project Team
4. Architecture
5. Structure
6. Building Code Considerations
7. Construction Considerations
8. Environmental & Sustainability Impacts
9. Conclusion
10. Mid-rise Advisory Program – Partners & Assistance
11. Project Credits and Information

Cover Images

Project: Oxford Apartments
Architect: DKO Architects
Engineer: Wood & Grieve Engineers
Builder: Figurehead Constructions
Location: Williams Landing, Vic

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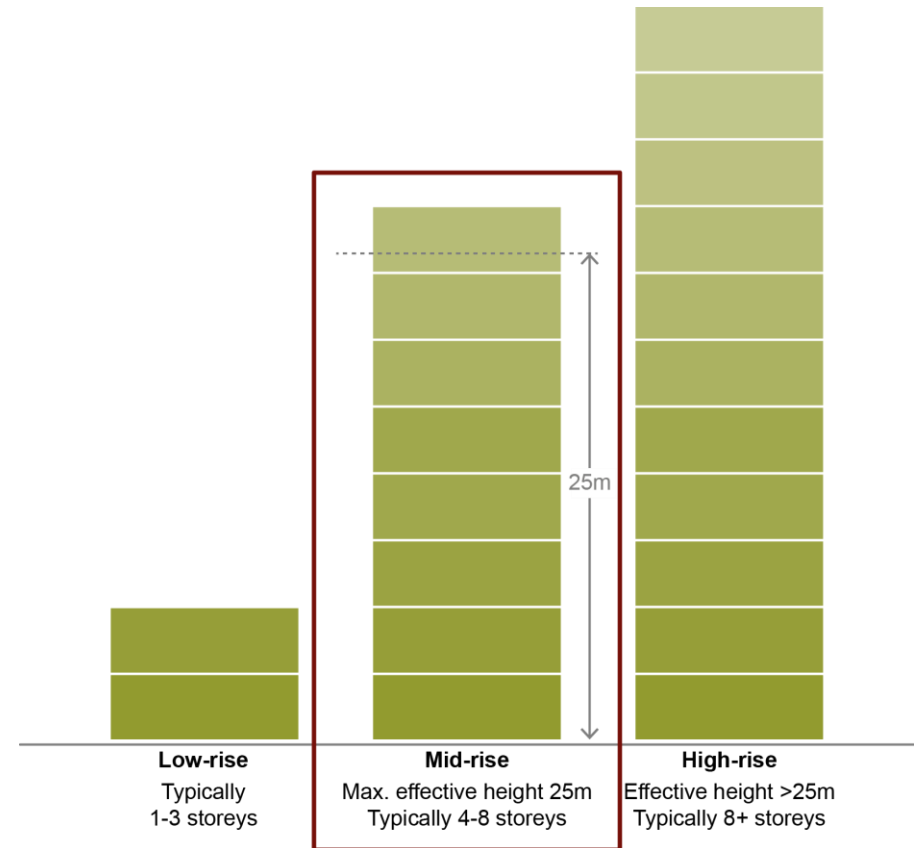
1. Preface

In 2016, the National Construction Code, Volume One (NCC), Building Code of Australia (BCA), was amended to allow the use of timber construction systems, under the Deemed-to-Satisfy (DtS) provisions, for Building Classes 2 (apartments), 3 (hotel type buildings) and 5 (offices), up to 25 metres in effective height; the 2019 version of the NCC expanded these provisions to all Building Classes. This means that timber buildings which were limited previously to three storeys, can now potentially be built up to eight storeys under the DtS provisions. This landmark DtS change makes it much simpler and cheaper for developers and building professionals to have these projects designed and certified; timber buildings of greater height can be built, but under the 'Performance' provisions of the NCC.

Under this NCC change, both lightweight timber framing and massive timber systems, such as Cross Laminated Timber (CLT), Laminated Veneer Lumber (LVL), or Glulam, can be used with the appropriate layers of encapsulating fire-protective grade linings and compliant automatic sprinkler systems.

Mid-rise timber construction systems have been introduced extensively in Europe, America and Canada over the past decade, as these countries have amended their building codes. Clear demonstration has been provided over this time of the cost effectiveness and quality of these timber construction systems compared to alternative materials; this has also been shown to be the case for the mid-rise timber buildings constructed in Australia. The interest from the Australian building community in these new cost-effective, rapidly constructed and environmentally friendly timber building systems continues to grow, and more and more Australian companies today are looking at what is possible under the simple DTS, and the broader NCC Performance provisions.

Innovative Australian-focussed solutions are now being developed to meet the opportunities and needs of off-site timber system prefabrication, quick and safe on-site construction, building fire-protection, acoustic performance and services integration. WoodSolutions case study No 1 provides an overview of mid-rise timber construction in Australia and introductory information on these topics. The aim of this series of WoodSolutions case studies is to provide useful examples of how Australian developers, building professionals and timber systems suppliers are adopting and adapting these new timber system construction opportunities into their projects and businesses.



Mid-rise timber construction can provide significant efficiency, speed and cost benefits compared to alternative materials and methods.

2. Introduction

Williams Landing – Cedar Woods’ winning formula

Just 20km west of Melbourne’s CBD, Cedar Woods’ Williams Landing is a 225-hectare master planned community of 2,400 dwellings, alongside a town centre and other amenities.

ASX-listed property developer Cedar Woods has been creating dynamic residential communities for over 30 years, with many successful projects in Queensland, South Australia, Victoria and Western Australia.

Cedar Woods’ Williams Landing has already become a popular place to live and work. The development offers architecturally designed homes and infrastructure surrounded by parkland, close to amenities and public transport, including its own railway station. Williams Landing has attracted, for instance, retail giant Target’s new national head office. The Williams Landing Shopping Centre features a Woolworths supermarket, 106-place childcare centre, medical centre, 25 speciality stores and over 1,800 square metres of office space.

Oxford Apartments, Williams Landing

The Oxford Apartments combine with the Newton and Lancaster Apartments in a new medium density residential precinct, incorporating 199 apartments, three townhouses and several retail tenancies.

Over five levels the Oxford Apartments construction utilises a slab on ground, two suspended slabs providing car parking and three additional levels of timber framing providing 98 apartments, with wrap around cantilevered balconies on the corners with views to the city. The façade incorporates a mix of selected face brick and rendered walls and painted fibre cement weatherboard cladding.

The apartment complex offers a variety of configurations of one, two, and three bedroom apartments featuring stylish contemporary interiors with both soft and hard flooring finishes and quality laminated joinery. Three retail tenancies are also provided at the ground floor, complementing the now established Williams Landing shopping precinct located just a short walk away.



Project: Oxford Apartments
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“This is our fourth light timber framed mid-rise project. We have a formula that works for the developer, designer, and builder.”

Maurice Leone, DKO Architects

3. The Project Team

DKO Architects, Figurehead Constructions and their sub-consulting teams have worked together on four mid-rise projects for Cedar Woods, all of which utilised three residential floors of lightweight timber framing over concrete podiums, an approach which has proven to provide a fast, efficiently-constructed and highly cost-effective build with superior acoustic amenity and fire safety.

Cedar Woods' commitment to quality, affordability and sustainability have been key drivers in their major timber projects to date, with Figurehead Constructions, DKO Architects and the project's prefabricated timber solution supplier Timbertruss all sharing a passion for delivering innovative construction solutions.

Figurehead is a boutique Melbourne based construction company delivering projects across all markets. It prides itself on its innovation and delivery of high-quality outcomes with a proactive customer-focussed approach, and DKO, a dynamic architectural design practice that emphasises innovative design and effective project delivery.

The contemporary default materials for mid-rise buildings in the past has been concrete, and to a lesser extent steel. These are environmentally significant generators of carbon dioxide (CO₂) during manufacture and comparatively slow to build due to curing and back-propping time requirements. Using timber construction systems by comparison provides a high quality, economical, and environmentally friendly alternative. Combine this with the significant savings in construction time, truck visits to site, and reduced use of cranes and you can see why Figurehead is happy to work with the economic and sustainably advantageous construction formula it has developed with DKO, to deliver high quality apartment buildings for Cedar Woods.



FIGUREHEAD



WOOD & GRIEVE ENGINEERS

4. Architecture

Design Objectives

Building on an established model proven to deliver high quality medium density housing, the Oxford Apartments design and delivery teams were driven to achieve their most successful project yet. Located within the medium density centre of Williams Landing estate, the Oxford Apartments project was required to provide high quality internal environments for a variety of one, two, and three bedroom apartments and substantial car park while maintaining an amenable and aesthetically appealing street frontage. With this in mind, it was also important that the project was structurally efficient, avoiding overdesign and ultimately waste.

Organisation

The Oxford Apartment plan is organised with the ground and first floor apartments surrounding the internal car parking area. Levels two to five have the apartment floor layout utilising an innovative U-shaped configuration, maximising the penetration of

natural light into living spaces and providing views for all apartments (see section below).

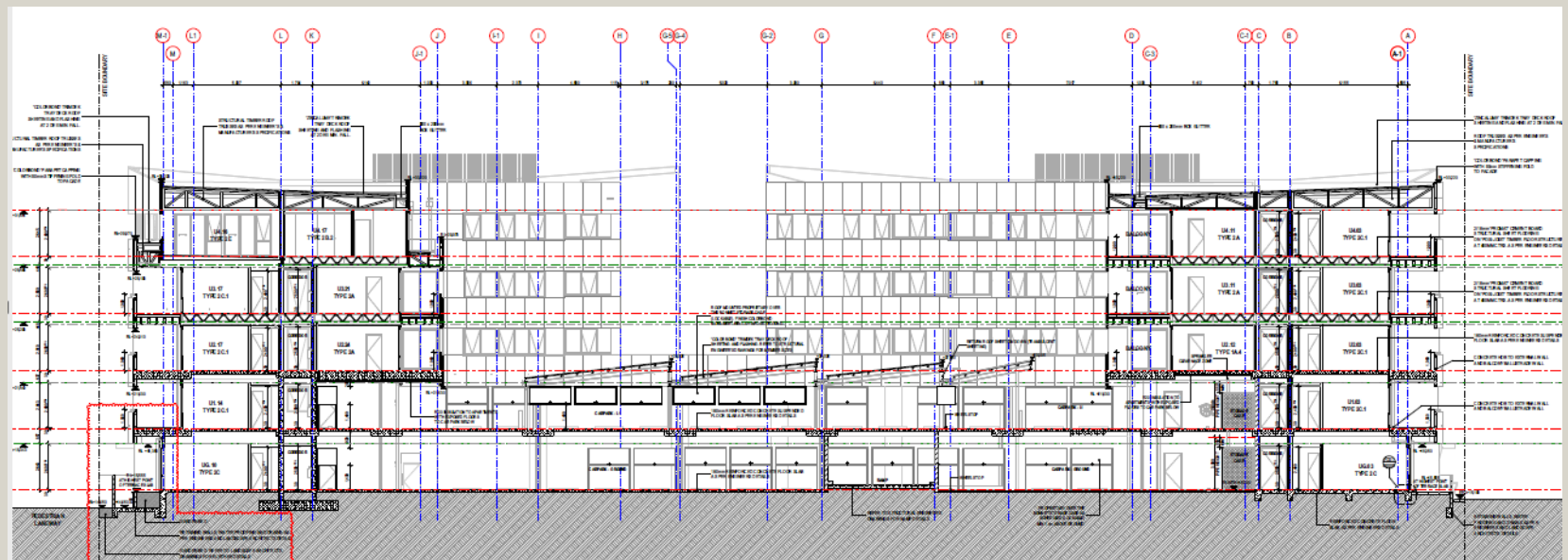
The project incorporates four internal stair cores, two lift cores, and a series of common corridors to provide access to the apartments.

Material Choices

When considering which structural system to utilise for this project the project team elected for a first floor concrete podium topped with the tried and tested, high performance system of prefabricated timber stud framing. This decision was made early in the design process, maximising the positive impacts of the system on the project outcome. While it is now possible and common to build lateral stability components out of massive timber, all cores at the Oxford Apartments were completed in reinforced concrete.

The design for the Oxford Apartments follows the 'Texas doughnut' concept popular in North America, featuring a central car park bordered by multi-level apartments.

This design improves the street front environment, lending a friendly, walkable feel to the precinct without sacrificing the development's car parking amenity.



5. Structure

The Oxford Apartments utilises two levels of reinforced concrete car parking/apartments (ground & first floor) and above this, three storeys of lightweight timber framed apartments extending from level 2 through 4.

With a site subject to poor soil conditions (as is common throughout the West of Victoria) the design team elected to build the entire project above grade, saving significant amounts of time and cost of basement excavation, estimated to have potentially added an additional \$300/m² to build costs.

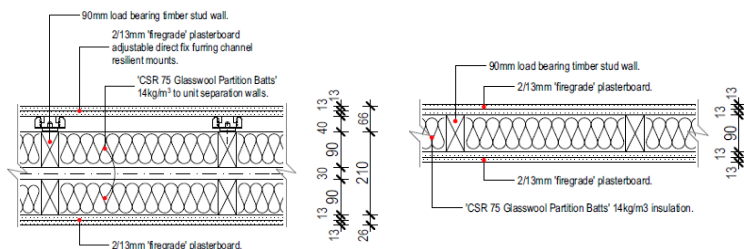
Floor System

Figurehead chose to use timber floor cassette systems throughout the job because of previous positive experiences with these rapidly installed systems. The cassettes were prefabricated off-site by Timbertruss, a major lightweight timber frame and truss manufacturer based in Western Victoria. The cassette floors were constructed using 412mm deep Posi-joist steel webbed floor trusses spaced at 450mm centres. The floor trusses were designed especially for greater strength and spanning capacity, utilising SUPA17 hardwood timber for both the top and bottom chords where required. Rather than the traditional yellow tongue or plywood flooring membrane the design team utilised Promat floor panels as a means to add mass to the element, improving acoustic performance. A platform approach was used throughout the majority of the job, with floor cassettes bearing directly on top of the walls, and floor trusses aligning directly over wall studs (see image to the right). Where floor cassettes abutted continuous vertical elements such as the lift shaft, floor trusses were mounted through the use of a timber ledger beam.

Wall System

A range of different lightweight wall types were used throughout levels 2-4, with internal and external loadbearing timber walls using 90x45mm Machine Graded Pine studs at 450cs with double top-plates and single bottom plates; at level two double studs were used. A range of non-loadbearing stud sizes were also used dependant on stud height. Both single leaf and double leaf (discontinuous) walls were utilised, the latter for improved acoustic performance.

Load bearing wall systems feature two layers of 13mm fire rated plasterboard.



A unique feature of prefabricated timber systems, floor elements require no propping once installed resulting in early services rough in an expedited completion schedule.



Where required, light weight floor cassettes featured high strength top and bottom chords proving larger spanning capacity and stiffer floors.

6. Building Code Considerations

Fire Protection

The National Construction Code sets out four requirements for mid-rise timber buildings in order to achieve a 'Deemed to Satisfy' solution. These include:

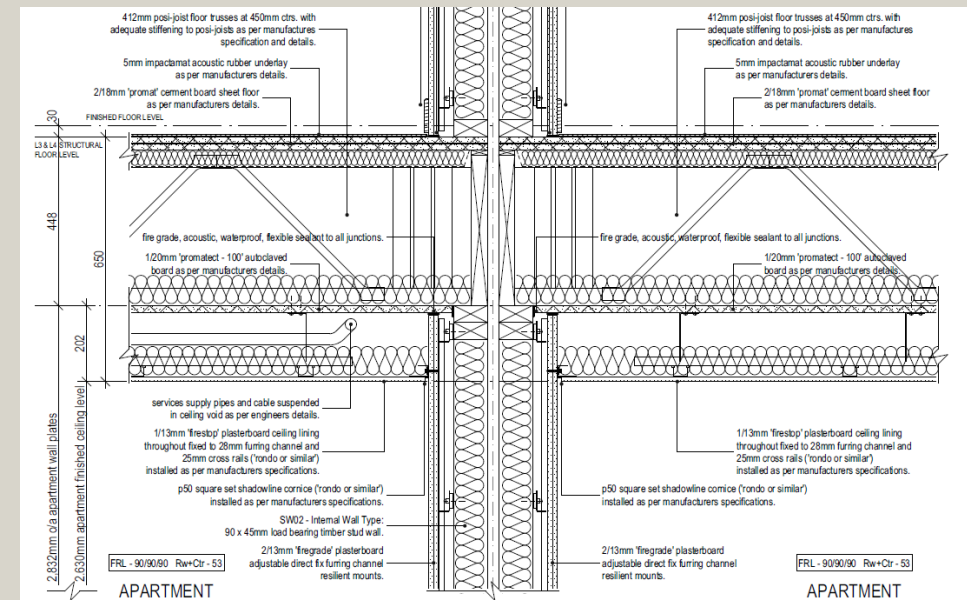
- any structural 'lightweight timber framing' or 'massive timber systems' used needs to be 'fire protected' by total encapsulation with appropriate fire rated linings to achieve the required fire resistance level (FRL),
- cavity barriers must be installed at specific locations to prevent the spread of flame or smoke,
- any insulation used in a structural cavity must be non-combustible, and
- the building needs to utilise an automatic fire sprinkler system; a requirement of all mid-rise building regardless of their structural materials or systems.

The fire encapsulation solution used at the Oxford Apartments used a number of fire-resisting lining products including:

- Where a floor element separates two Sole Occupancy Units (SOUs) the ceilings are lined with one layer of Promatect-100 autoclaved board installed on-site. Joints between these boards were concealed through the application of a supplementary Promatect-100 covering strip. Under this finish a false ceiling is installed, comprising a single layer of 13mm fire rated plasterboard, delivering superior fire and acoustic performance, and providing a smooth surface for finishing.
- For walls, 2 layers of 13mm fire-grade plasterboard were installed on-site to achieve the 90/90/90 FRL required of loadbearing walls in a Deemed to Satisfy Class 2 building.

Single layer of Promatect-100 plus patching strip covering all joints.

A suspended ceiling was also added after this photo was taken.



Tested and certified wall and floor systems were utilized to provide suitable acoustic and fire separation between Sole Occupancy Units. Details for these systems are readily available from all major plasterboard manufacturers.

6. Building Code Considerations

Acoustic Design

With lightweight timber framed buildings, designing, specifying and installing to meet the required acoustic performance levels is one of the most important and critical steps. With acoustic performance the system used needs to address airborne noise, impact noise and flanking noise which is the transfer of vibration through the physical structure.

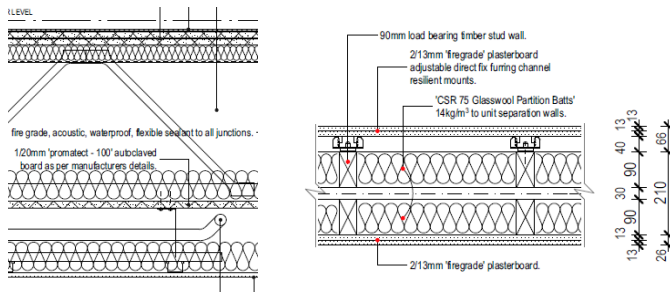
For walls, sound isolation can be accomplished in two ways. One is to use partitions with a high mass or to use low mass systems separated by air space, that is using a double leaf (discontinuous) wall. The advantage of the double leaf wall is twofold. The greater the separation between the gypsum wallboard on each face of the wall, the more the noise is reduced and the greater the acoustic rating becomes. The second advantage is that building utilities can be isolated from the stud system for the unit they serve. For the Oxford Apartments double leaf discontinuous walls were used to separate individual apartments and on apartment / passageway walls. Fixing the plasterboard on furring channels with resilient mounts also improved the acoustic performance

Floors require an acoustic rating for both airborne and impact noise. Airborne noise can be best attenuated through the addition of mass, while impact noise is best treated through the use of a damping product such as resilient mounts and/or acoustic matting. At the Oxford Apartments, mass was added to the floor system through the use of two layers of 18mm Promat cement board sheet on the top of the floor, and a single layer of Promatect-100 underneath the floor. This system was favoured because of the ability to pre-install one layer of the 18mm Promat offsite during the floor cassette prefabrication process, with the second layer applied onsite. Damping was achieved through the use of a resilient underlay under the flooring finish. Using this system noise transfer between apartments is virtually eliminated, *"You can walk through, even during construction, and notice how quiet they are compared to things like plywood flooring or chipboard,"* says Maurice Leone of DKO Architects.



High performance wall and floor acoustic systems prior to concealment with finishing boards. Resilient-mounted furring channel can be seen installed directly to the loadbearing studs, while a form of cement sheet product has already been installed on the floor (black lines indicate where joints have been waterproofed).

Inter-residency floor (left) and wall (right) acoustic systems



7. Construction Considerations

Timber construction systems typically offer benefits throughout all stages of a project, but perhaps none more-so than the construction stage. Prefabricated timber elements are not only light weight, but their tight tolerances, consistently high quality, and simple connection methods result in many positive impacts on a site. Several of these were experienced and the Oxford Apartments, including:

Fast construction on site

Completed in two stages, the Oxford Apartments utilised an optimised design and experienced installation team to deliver the project in an impressive 12 month program. Featuring lightweight floor truss based cassettes limited in size only by transport, floor cycles were able to hit 10 days, compared to 18 days if in concrete. With no propping or curing times required, services rough in and fit out works could commence immediately upon completion of the above floor, drastically reducing delivery times. Similarly to the floors, wall frames could be delivered to site on mass, and in the reverse order of installation (minimising double handling).

On-site safety

With all structural elements arriving on site in their final form, the structure stage of site works move from active construction processes to assembly processes. Not only does this require a smaller workforce on site, but it allows for the elimination of much high risk work, and a significant reduction in the amount of on-site waste generated. As experienced at the Oxford Apartments, these factors collectively result in reduced exposure to OH&S risks, making for a much safer site.

Tolerances

With all structural elements fabricated to a high level of precision, wall and floor elements can be expected to fit snugly together. While this level of tolerance is beneficial where timber bears on timber, intersections of timber and less precise materials may require more on-site attention.

Cranage

The combination of a greenfield site and the light weight of structural timber elements allowed the construction team to avoid the need for a tower crane at the Oxford Apartments. Instead, the structure was completed through the utilisation of both mobile cranes, and the cranes mounted on board the delivery trucks. This not only saved cost, but also reduced the amount of sacrificial structure and rectification works typically associated with the install and removal of a tower crane.



The Oxford Apartments utilized an insitu reinforced concrete structure for the ground and first floor, with timber structure for all floors above this. Here concrete was utilized to provide effective separation between the main Class 2 structure and the Class 7a car park.

8. Environmental & Sustainability Impacts

Our buildings are becoming increasingly operationally efficient from our improving electricity grids, cost reductions in renewable energy and the improved construction code standards for building performance. As operational energy impacts reduce, the proportion of environmental impacts that come from embodied energy is increasing. Therefore the spotlight is shifting towards materials with a growing understanding that there is a need for renewable sources, as there is for our consumption of energy.

Solar and wind are the cost competitive and renewable solution for energy, sustainably managed wood is a cost competitive and renewable solution for materials.

A product obtained from a natural resource which through the process of photosynthesis and using the solar energy of the sun converts CO₂ to the oxygen that we breathe and to carbon which is stored in the woody mass of the trees.

Around half the dry weight of wood is carbon – so a hardwood product of a density of 1,000kg/m³ stores around 500kg/m³ of carbon, multiply this by 3.66 and that is how much CO₂ is stored in the wood. The carbon sequestered will remain stored for the life of the wood product.

At the end of the products first-life, timber products have a great opportunity to be directly reused (doors, windows, floors, etc) or and recycled/reprocessed into other wood-based products. When a wood product can no longer be reused or recycled it can be utilised as a co-generation fuel in biomass energy plants, reducing the reliance on non-renewable fossil fuels such as coal, - the CO₂ released from the burning of the timber goes back to the atmosphere where ultimately it may be absorbed by other growing trees. It provides a very positive cradle-to-cradle lifecycle or carbon cycle story for wood products.

Applying the approximate timber volume per m² rates supplied in WoodSolutions Technical Design Guide #51 we can estimate the total volume of structural timber used at the Oxford Apartments to equal 2,225m³. Applying an average density of Radiata Pine (which makes up the majority of the structure) – 550kg/m³ – we can calculate that the structure comprises approximately 1,224t of wood, or roughly 610t of CO₂. This is equivalent to:



*Running 130
passenger vehicles
non-stop for a year*

or



*73 homes' energy
use for a year*

or



*106 homes'
electricity use for
one year*



*1,412 barrels of oil
consumed*

or



*Running a coal
fired power plant
for ~1.5 hours*

or



*Charging
77,782,514 smart
phones*

9. Conclusion

The Oxford Apartments now joins the Newton and Lancaster apartments Williams Landing's established medium density residential precinct. Broadly lauded as a great success, the project outcome is a direct outcome of the team involved, and the use of a practical, safe, and sustainable structural solution.

Now experienced in the field of mid-rise timber construction, Figurehead constructions continues to propose a timber structural solution for all suitable projects. Their enduring relationship with major panelisation prefabricators Timbertruss affords both security and certainty of the product to be supplied, ensuring a fast structural program every time.

DKO Architects have now designed many mid-rise multi-residential buildings in timber, and understand what it takes to deliver an efficient yet successful form. As demonstrated at the Oxford Apartments, the lightweight timber structural solution can provide the best of both worlds, with high quality, large span internal spaces achieved faster and more efficiently than ever before.

Cedar Woods are one of Australia's prime greenfield developers, with land estates located around Australia (notably in Melbourne's growth suburbs and Perth). The Oxford Apartments falls within the heart of Cedar Woods' Williams Landing Estate, just a short walk from retail, recreation facilities, and the train station. Largely populated by young professionals, the commute to Melbourne's CBD is just 25km.

The Oxford Apartments successfully utilised a 'Deemed to Satisfy' pathway to code compliance, meeting the requirements identified in the National Construction Code. Through smart detailing the project has been shown to achieve compliant acoustic and fire design, as well as an aesthetically appealing and durable façade system. Perhaps the most important message from this project is that the timber was not used for its aesthetic value (as has occurred in the past). Here, timber was selected for the many other benefits explored in this case study, not limited to improved quality, increased speed, heightened safety, reduced waste, and of course great sustainability credentials.

The Oxford Apartments confirms the value proposition of timber framing for mid-rise multi-residential projects. Quieter, safer, faster, and higher quality than traditional systems, the future for timber buildings is looking up!



The jewel in the crown of Williams Landing, the Oxford Apartments sets a new standard on the delivery of mid-rise multi-residential greenfield projects.

10. WoodSolutions Mid-rise Advisory Program

Expert advice from WoodSolutions Mid-rise Advisers

Accessible through woodsolutions.com.au

Contact our Program Development team about your next project

With extensive experience in property development, construction, timber engineering and architecture, the WoodSolutions team of Program Development Managers are ideally placed to liaise with development, design and construction professionals, providing generic information and advice on making the most of the cost, time, environmental and other advice.

Download free WoodSolutions Technical Design Guides

A wide range of technical design guides with detailed, state-of-the-art technical information on working with mid-rise timber buildings are available to download in PDF format from woodsolutions.com.au

Access a Full-scale Mid-rise Timber Construction Demonstration Model

As visiting active construction sites can often be difficult and restricted a full-scale mid-rise demonstration model has been constructed. This three-storey structure represents a seven-storey timber apartment building and allows building professionals to see first-hand the different structural, fire, and acoustic systems available for mid-rise timber construction. Contact the mid-rise advisers to visit the structure at Holmesglen Institute or take an e-tour on the woodsolutions.com.au website.

Partners of the Mid-rise Advisory Program include:



The WoodSolutions full scale, Mid-rise Demonstration at Holmesglen Institute, Melbourne. The structure is available for guided tours by appointment.

11. Project Credits and Information

Project	Oxford Apartments Overton Rd, Williams Landing Vic
Building Class	2, 6, and 7
Developer	Cedar Woods
Architect	DKO Architects
Engineer	Wood & Grieve Engineers
Builder	Figurehead Constructions
Supplier	Timbertruss

