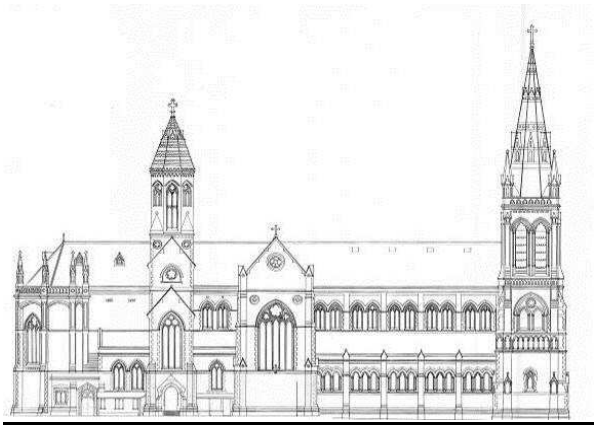
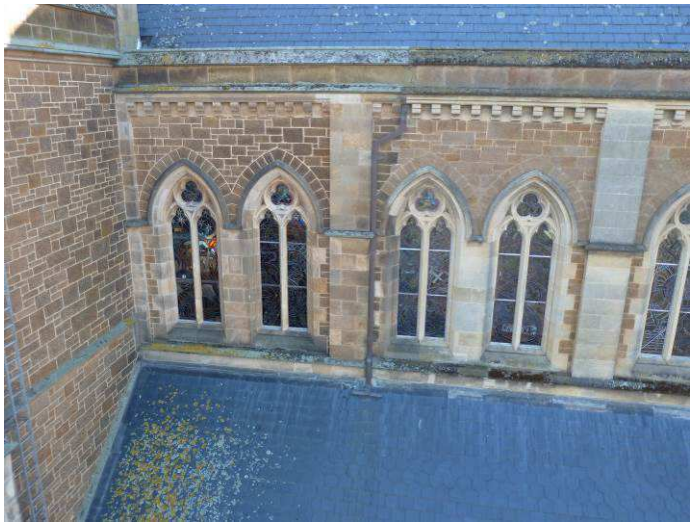
4.2.5 South Elevation



Analysis	Recommendations
The south elevation was constructed in stages. Stage One during 1869-1878 included the Sanctuary, the Choir, the Transepts and one bay only of the Nave. Between 1890-91 the remaining sections of the Nave were constructed, followed by the tower and spires in 1902. Finally the Lady Chapel was erected in 1902-1904. The use of the same materials and detailing makes the stages indistinguishable. Early photographs show the gradual staged building of this façade and the Cathedral as a whole. The walls are constructed in Tea Tree Gully Sandstone on a Glen Osmond Bluestone plinth. Dressings are in dressed sandstone and fossiliferous limestone. Generally the façade has been maintained well over time. A key issue for the south elevation is the lack of access to sunlight, and the associated dampness of the base of the walls. This is exacerbated near the transept where the water is not well taken away, and the associated ground is covered in moss and lichen. In addition the established Plane Trees prevent summer western sun striking this elevation to dry out the base of the walls. In September 2013 a storm dislodged a cross to this elevation, and damage was caused when this fell through the organ roof. The repairs works are being undertaken under insurance separately and are not included in this report. *Note that the towers and spires are covered under the east elevation.* *Refer Section 4.2 4 Lady Chapel for discussion of north, west and south elevations of the Lady Chapel.*	• General cleaning of the stone facade is required. • This elevation shows typical soiling and accumulation of lichen to the projecting sandstone and limestone dressings. Areas of accumulated moss and lichen on horizontal surfaces and buttress cappings should be removed using low pressure water, nonmetallic scrapers and brushes followed by the application of a biocide. • Remove all cement pointing mortar to bluestone plinth and repoint in lime mortar. • Cut out ground level adjacent to the Cathedral and install gravel along whole side to prevent build up of moss and lichen. Install new gravel to existing paths. • Reconfigure the drain at the western end. This will include taking stormwater from Bays E19 – E24 away underground to connect to existing stormwater system. Downpipes from Bays E28 can continue to discharge via surface open drains. Additional downpipe needs to be installed to take away the water from the porch roof. • Box gutter behind stone parapet – refer roofing section. Internal leaks correspond to box gutter sections. • Leakage through base of leadlight windows – shown internally (there is evidence internally of soiling and water ingress). • General soiling and build up of dirt and some lichen accumulation. The bluestone plinth has damaged stone particularly at the base of the South Tower, and requires total repointing, with some selective stone replacement. • There was a storm in September 2013 and one of the crosses fell off the end of the gable of the lantern tower and fell into the roof over the organ loft. This was separately repaired during the course of this report preparation. Work undertaken by Harrold and Kite, engineer Jim Wilson.

Eastern Bay of South Elevation



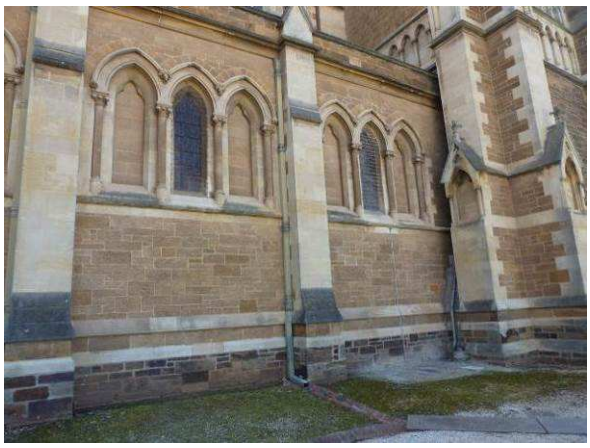
South Elevation, E28, E29

Base of South Elevation

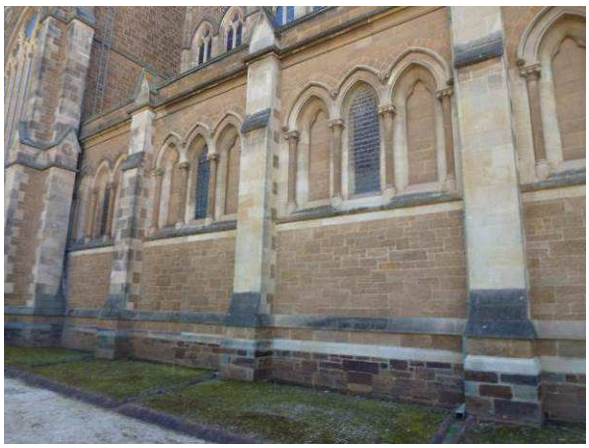
Details of base of South Elevation showing downpipes discharging water on the ground, causing damp ground

View down on South Elevation (arrow where cross fell down)

South Elevation E28 – E30

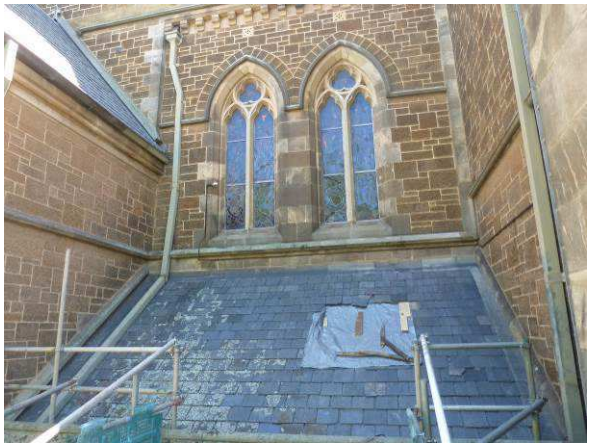


Base of South Elevation - steps to porch (left) and downpipes discharging water into brick drains



Base of South Elevation - downpipes discharging water into brick drains

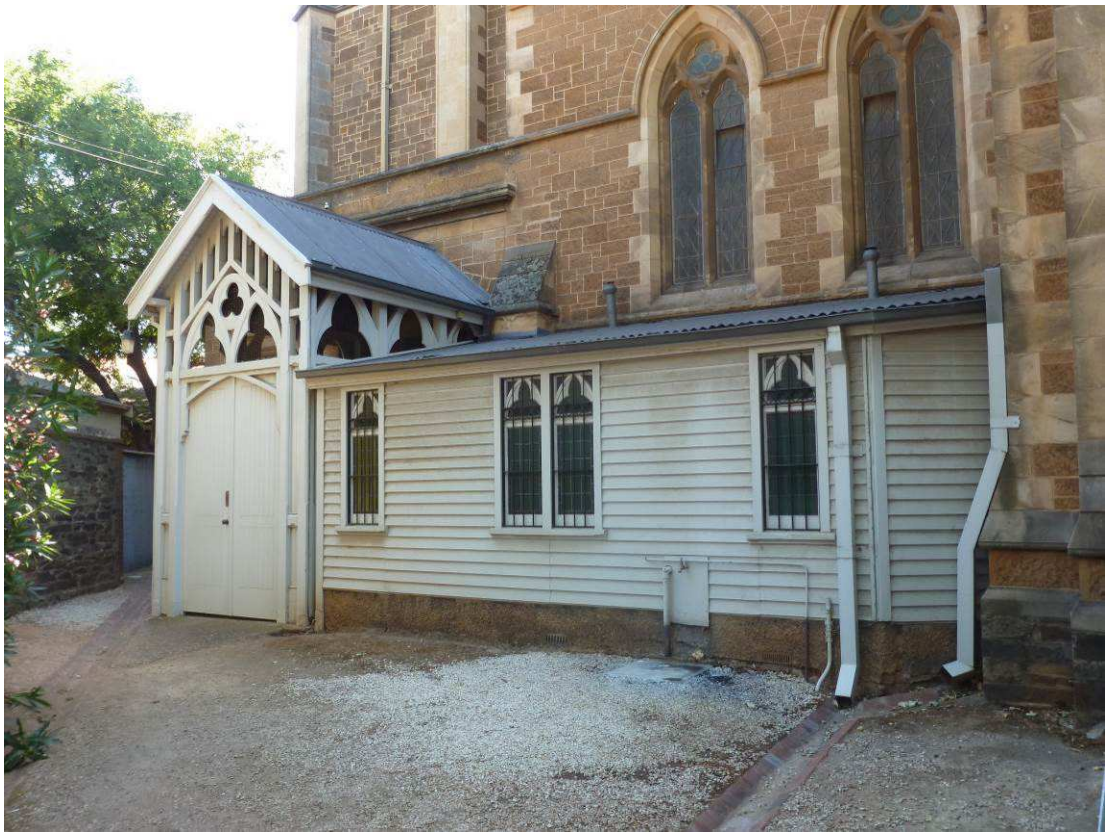
‘Walter Hervey Bagot LFRAIK FRIBA Architect of this Cathedral from 1907 to 1945’ – on the South Elevation



Damage to roof due to storm

Damage to roof due to storm

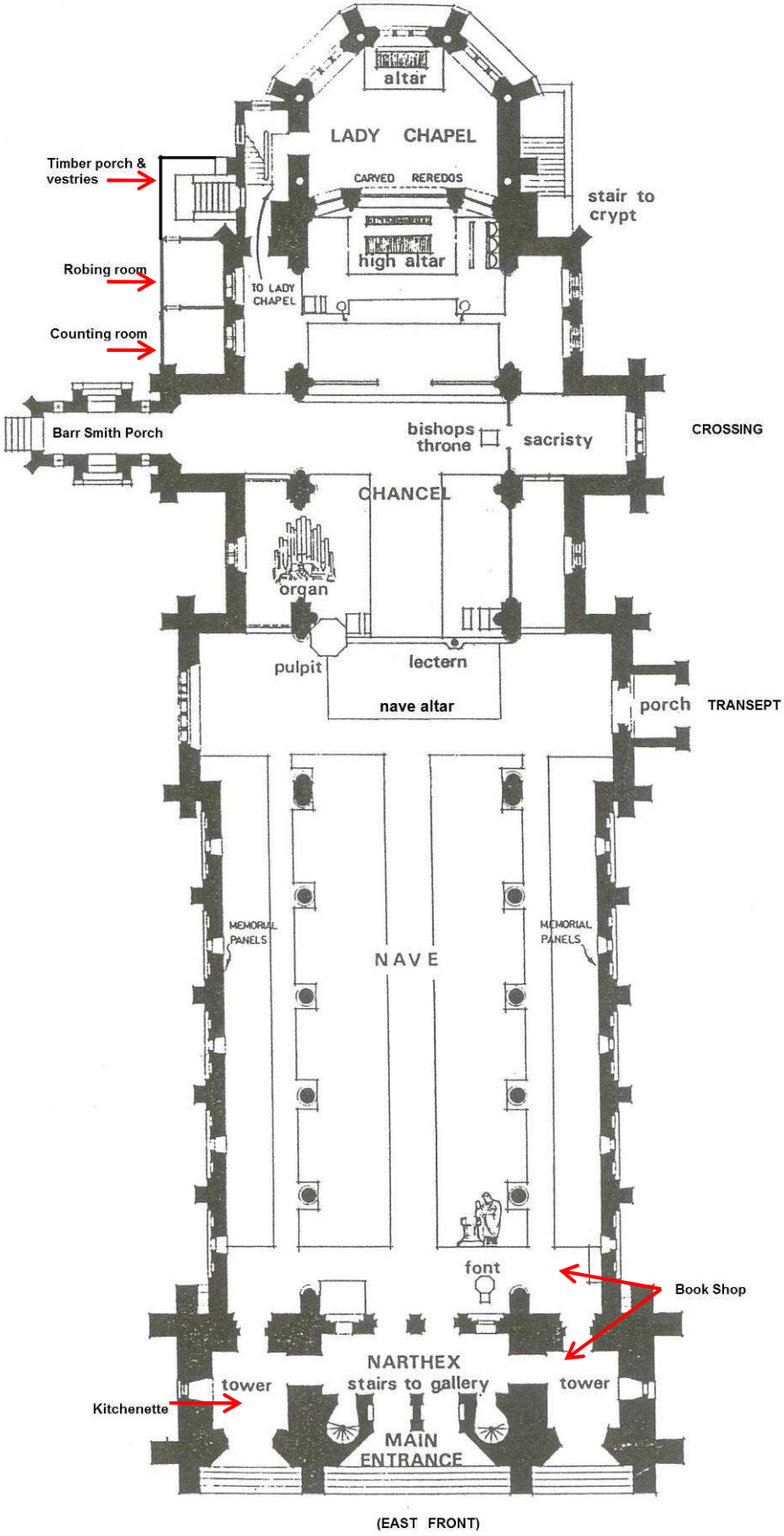
Damaged cross from storm damage



Timber porch on south elevation, contains the vestries and robing rooms

4.3 Internal Analysis and Recommendations

4.3.1 Floor Plan

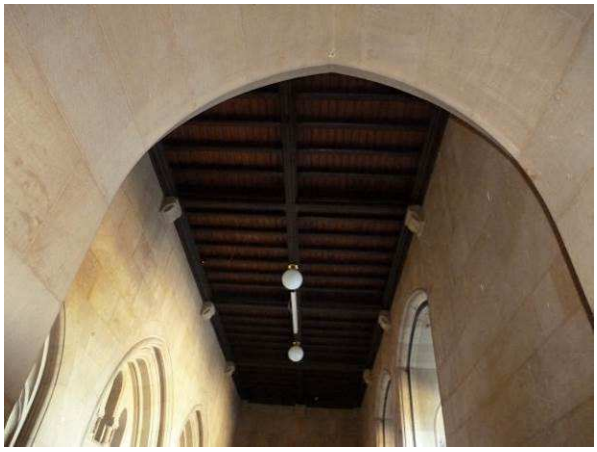


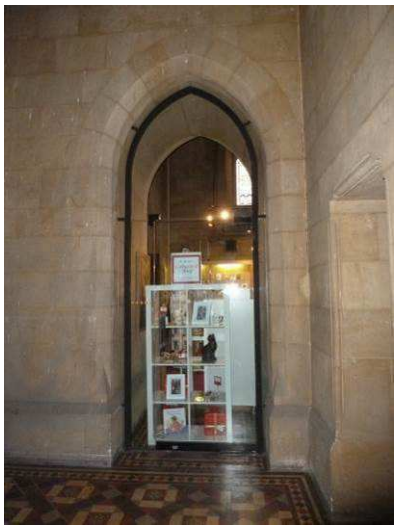
FLOOR PLAN
(Not to scale – North for report purposes only)

N

4.3.2 Narthex and Entrance

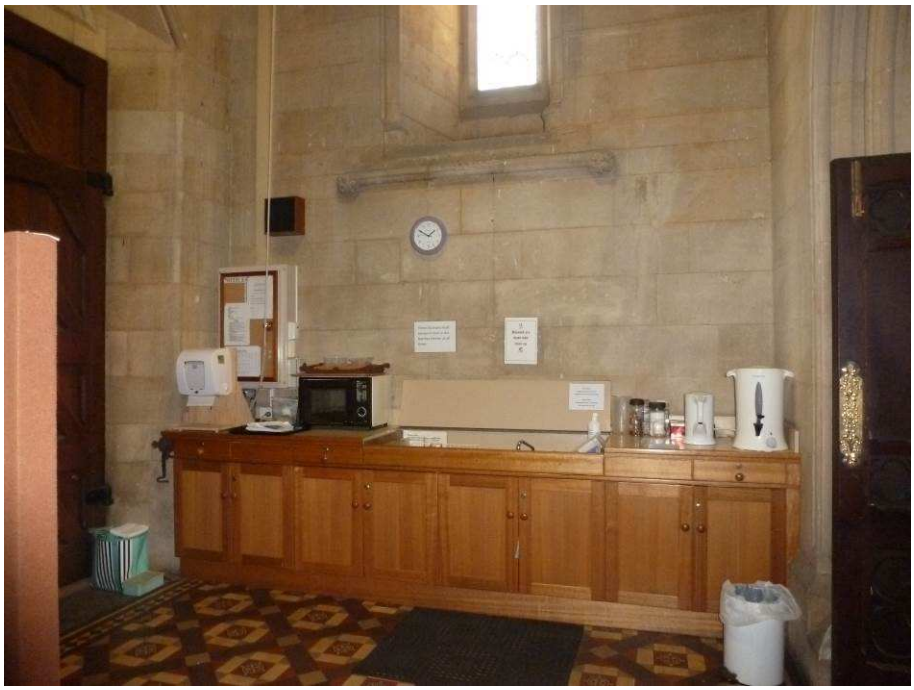
Analysis	Recommendations
This area was constructed as part of Stage 4 of the Cathedral, when the towers and spires were added to the nave. On the eastern side of the narthex, glass doors were installed to provide weatherproofing adjacent to the handsome cast metal entrance gates. There were also glass doors inserted on the northern side of the narthex at the time of the installation of the Cathedral shop in 1990. Dressed stone forms the walls of this area, and generally the stone is dirty. Handsome joinery is incorporated, particularly the main cedar entrance doors with elaborate brass door pulls and push plates. The tiled flooring continues the terracotta, black, brown and cream tiles used throughout the Cathedral. Entry thresholds are in slate, showing some signs of delamination and wear. There is a timber ceiling with surface mounted lights (ball globes and fluorescent lights). Access to the tower and upper gallery/balcony is via the narthex.	• Continue to maintain and monitor the condition of this area. • Retain and maintain the timber entry doors. • Undertake cleaning to the internal stone walls.  



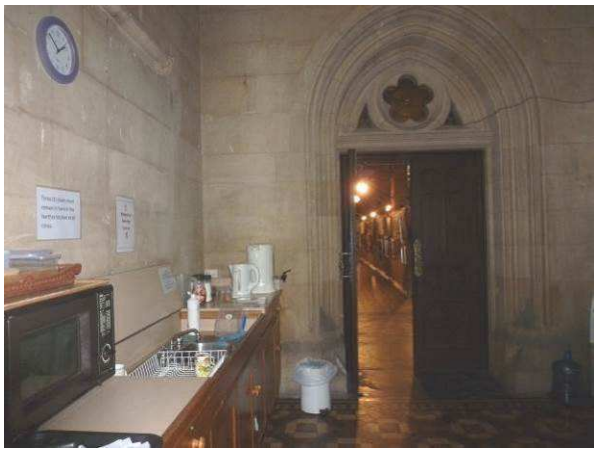


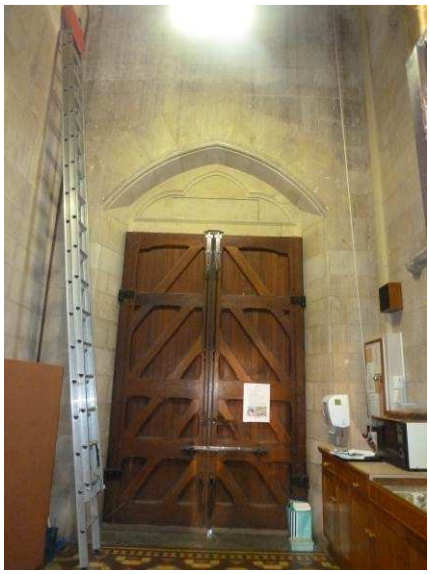
Detail to Narthex and Entrance

4.3.3 Kitchenette



Analysis	Recommendations
A kitchenette was installed in the 1990s in the ground level of the southern tower to provide the necessary facilities for Cathedral use. This area has timber ceiling, face stone walls and large paired timber doors to the exterior.	• Continue to maintain. This appears to be a logical place for this facility and in due course joinery etc will require upgrading.



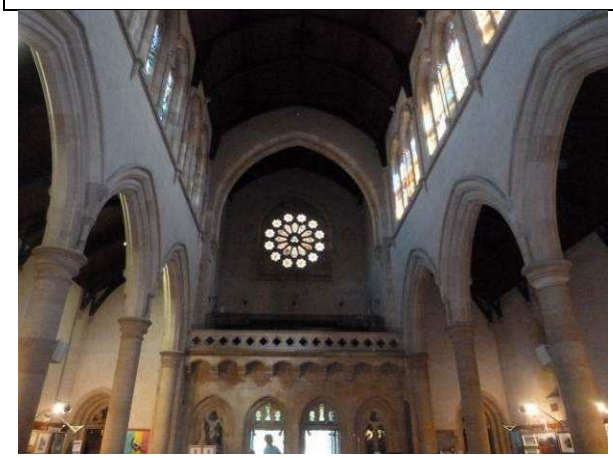


Detail to Kitchenette

4.3.4 Nave and Aisles

Analysis	Recommendations
The nave is of early English Gothic style and was constructed in two stages. The first bay of the nave adjacent to the transept formed Stage One of the Cathedral (1869-1877) and the subsequent four bays to the east were constructed as Stage Two and Three of the Cathedral (the lower section of the walls were built in Stage Two 1890-1894, and the upper section was built in 1899-1901). The interior detailing continues the original 1869-1877 finishes and design elements, and the two different construction periods are not visible. The wall construction is of stone, with a render finish and with dressed sandstone surrounds to the stained glass windows. The upper level continues this rendered finish above the Gothic dressed stone arcade. The top section of the wall above the clerestory windows are also with rendered finish above the stone sections of the window arcades. There is evidence of water entry throughout the nave from the roof above, either corresponding to box gutter leakages, or entry to the interior via the leadlight windows (visible via water lines). Refer following page for photos of deterioration. The nave columns appear straight and true, without any structural issues, and the detailing of these columns and associated dressed stone Gothic arches and foliage bosses is simple and elegant. Originally the Cathedral was lit by standard gas lamps located under the apex of each arch in the nave colonnade, but in 1925 these were replaced with new electrical lighting. The lighting has subsequently been upgraded, being located on	• After completion of roof works, (to ensure there are no future) leaks, clean and repair the sections of render where there has been damage due to leaks.  Water damage on the southern wall of the nave/ aisle  Water damage on the southern wall of the nave/ aisle - eastern end

Analysis	Recommendations
the aisle ceiling. In 1960 new pews were installed and by the 1980s repairs to the floor tiling was required. In 1992 major works were undertaken to the floor under the pews, when the tiles were taken up, and a new concrete slab installed which incorporated in floor electric heating. There are reputedly no current leaks in the nave, and the water damage evident from external box gutters is old, and those gutters have now been repaired/ unblocked. These areas of damage are identified in the dilapidation drawings. In the central tiled aisle are metal grilles which connect to external vents. This was to provide a system of 'air re-freshening' to accommodate gas lighting. There is some soiling below the upper level clerestory windows, but there has been no experience of dripping water associated with these upper level windows. These windows were installed in 1993 and are to the design of Cedar Prest, with a financial contribution from Santos. According to the facilities manager, there are issues of falling dust from efflorescing render, and this constantly needs cleaning up on the floor. This dust falling is associated with previous leaks where the water entry has now been rectified.	 Water damage on the northern wall of the nave/ aisle - adjacent to transcept 

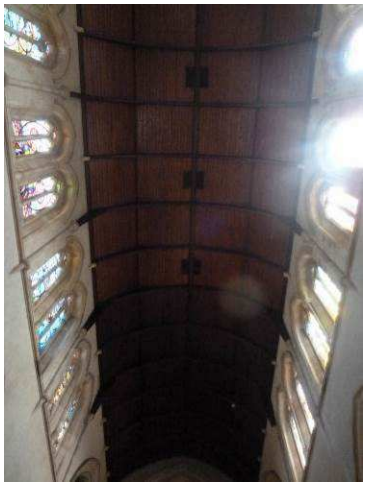

View towards the east along the nave


View of north aisle and clerestory




Interior of southern porch


Views of ceiling – at eastern end underneath lantern crossing



View of timber boarding ceiling in nave, ceiling above organ, adjacent to organ

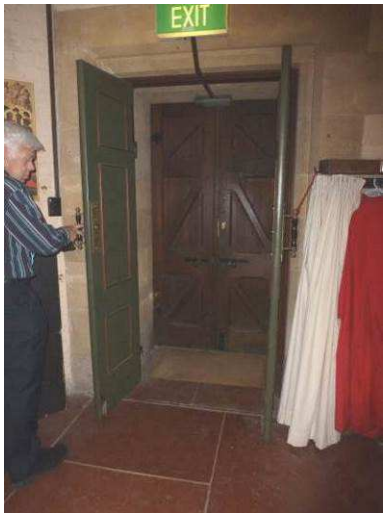
View of ceiling above the choir


General views of interior of the nave – floor and heraldry

4.3.5 Crypt


Analysis	Recommendations
The crypt is used for robing. There do currently not appear to be any structural issues requiring attention.	• Continue to monitor this area. Generally maintain existing finishes.



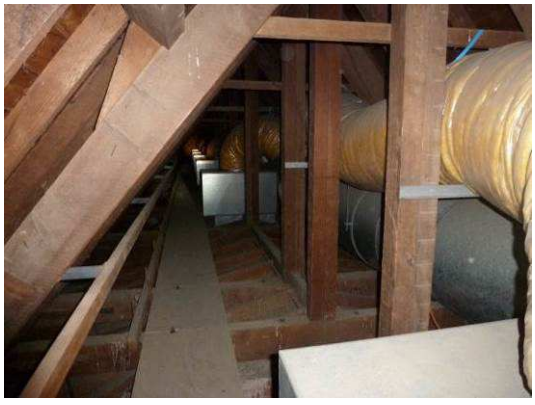

Photos of the crypt

4.3.6 Vestries/Robing Room

Analysis	Recommendations
This are is adjacent to the Barr Smith Porch and is a timber extension to the Cathedral.	• Continue to monitor this area. Generally maintain existing finishes.

4.3.7 Roof Space

Analysis	Recommendations
The main roof space above the nave and gallery is accessed via the north tower through a roof hatch. The timber roof trusses are constructed of Oregon and generally appear to be in sound condition. However, there is some minor splitting in some of the trusses and king posts (refer to separate engineer's report). The upper side of the ceiling is viewed through the roof space, being tongue & groove boarding. There were previously galvanised iron vents as part of the roof, but these were removed in 1989 when the roof works were undertaken, and the current electrical mechanical venting system was installed. This was undertaken by Butterfields, and was designed by Lincoln Scott with a master switch at ground level. The roof space above the Choir, High Altar and Lady Chapel is not accessible. The walkway to the roof space is not safe and the platform is constructed in ply and under-designed. At the time of inspection, one of these platforms nearly broke with two people on it. This access platform was installed in 1992 but is not adequate and a new access platform system needs to be installed.	• Install new access walkway platform system, designed specifically for this area, to provide save access to the internal roof area. • Undertake strengthening in accordance with Engineers recommendations. • Continue to maintain.



Looking west

West end of roof space

Typical detail

Walkway showing long span

Apex junction with later plate

Walkway

Junction with transept

4.4 Condition Assessment by Engineer

The following advice was provided from Jim Wilson Engineer - Refer Appendix 5 for full report

4.4.1 Load Bearing Stone Walls

The load bearing stone walls are generally in good condition, with little sign of cracking due to load bearing stresses, except for the arches supporting the lantern tower. These arches have cracking in the eastern vertical faces, probably caused by structural stresses.

There is some cracking in individual stones in the external wall, probably caused by minor irregularities in the stone and local stresses around windows. Areas of stone have surface degradation requiring repair, and the extent is documented in the separate Dilapidation Survey of the Cathedral.

4.4.2 Gable Walls

The gable walls on the north and south elevations are in good structural condition. The roof structure is built into the gable walls, however, the soundness of the connection of the roof to the wall could not be determined visually. A robust connection is required for earthquake loads.

4.4.3 Crosses

One of the stone crosses at the top of a southern gable broke and fell onto the adjacent roof during a particularly strong wind in September 2013. The cross appeared to be fixed in place on the wall with a dowel, and the cross broke by fracturing through the stone at the base of the cross.

Other crosses that were accessible from the crane were tested by hand and appeared firm. However, there is still a risk of failure of other crosses in extreme winds, as the stone in the cross is weathered hence reducing the strength, and there are some instances of cracking near the base of the crosses.

4.4.4 Roof

Externally the roof appeared sound, with no visible deflections or deformations that would indicate structural defects.

The roof was also inspected from within the ceiling space for the accessible portion of the roof between the eastern spires and the lantern tower. The roof timbers are generally in very good condition apart from some defects:

- Splitting in the central vertical timber of the truss, also some opening of the top connection joint of the central vertical
- Some minor splits in other timbers
- The walkway in the roof space is structurally unsound and must be replaced

DISCUSSION

The structural implications of the site observations are discussed below, for "normal conditions" which exclude unusual loads from high winds and earthquakes, and for "extreme conditions" which include the forces from high winds and earthquake.

4.4.5 Structure Under Normal Conditions (excludes high winds, earthquake loads)

The condition of the structure of St Peter's Cathedral is considered to be generally very good for "normal conditions". The stone load bearing walls are in sound condition, with some repairs required for individual stones that are cracked, and repairs required for the weathered surface of areas of stone. The cracks in the arches under the lantern tower do not extend into the lower arch portion and hence are not considered to compromise the structural capacity for "normal condition loads".

The crosses felt firm for "normal conditions", however they could be vulnerable in extreme conditions, or in years to come with further weathering.

The splits in the central vertical member of the roof trusses are not structurally significant. The forces in the central vertical are carried by a steel tie rod. The top joint of the central vertical timber has opened, and a restraint timber gusset is required to hold the timber in place.

Some other roof timbers have splits and should be repaired with plywood splice plates glued and nailed along the length of the split.

The central walkway is defective and should be replaced, as well as the roof access platform to the central walkway.

In summary, the repairs recommended for "normal conditions" are:

- Provide plywood gusset plates to restrain the top of the central timber vertical in the roof trusses
- Replace the ceiling walkway and roof access platform
- Provide plywood strengthening plates along split roof timbers
- Review the condition of the roof crosses regularly (maximum biannually) for deterioration and repair as necessary, or alternatively carry out restorative work to all roof crosses now.

4.4.6 Structure Under Normal Extreme Conditions (high winds, earthquake)

The crosses are considered to be vulnerable under high wind or earthquake loading, and removal and reinstatement with a reliable method of fixing is recommended.

The arches supporting the lantern tower have cracks in the vertical faces of the eastern and western arches. The cracks appear to be due to structural stresses. The cause of the cracking is currently unclear, but could possibly be due to horizontal loads on the lantern tower (wind or earthquake) which would give out of plane forces on the arches on the eastern and western sides of the lantern tower. Closer examination (from a scaffolding tower) is warranted to check whether the cracking extends into the masonry as anticipated, or whether the cracking is superficial.

The structure of St Peter's Cathedral is vulnerable for earthquake loads. Masonry and stone structures perform poorly under earthquake loads, and church structures are particularly vulnerable, due to the height of the walls and the large internal open spaces with few dividing walls which would provide bracing. St Peter's Cathedral has large open spaces with stone walls above the spaces in the Nave and Chancel.

The Engineer has carried out an approximate structural design check using the earthquake loads recommended in the Australian Standard AS 1170.4 Structural design actions – Earthquake actions in Australia for parts of the structure. If the Cathedral was subjected to these forces it is likely that parts at least would collapse. The Standard uses an annual probability of exceedance of 1/500.

The structure could be retrofitted to increase the resistance to earthquake loads, but it would be costly and difficult to achieve full compliance with AS 1170.4 and at the same time avoid having reinforcing structure that was obtrusive.

There is another Australian Standard AS 3826 for strengthening existing buildings for earthquakes. The standard has reduced earthquake requirements, based on accepting a greater degree of risk in existing buildings for infrequent events such as damaging earthquakes, and acceptance of some structural damage.

The Engineer's recommendations would be to seek to retrofit the structure to increase the earthquake resistance to at least AS 3826 levels, and preferably closer to AS 1170.4 levels.

The type of retrofit work that would be required is listed below. Detailed structural measurements, analysis and design would be required to document the precise details and extent.

- Secure appendages such as crosses and pinnacles
- Tie gable walls to the roof structure
- Reinforce the lower roof levels so that the roof structure can act as a diaphragm spanning between end walls, and tie the roof to the walls.

- Reinforce the upper roof structure above the ceiling level to act as a diaphragm and possibly strengthen the trusses
- Check the supporting arches of the lantern tower, possibly strengthen for lateral loads
- Check the eastern towers, steel internal framing probably required to strengthen above roof level.
- Check the piers and buttresses of the Chancel and Transept for lateral loads, probably reinforce.

5.0 CONSERVATION POLICIES AND APPROACH TO CONSERVATION

5.1 General Approach

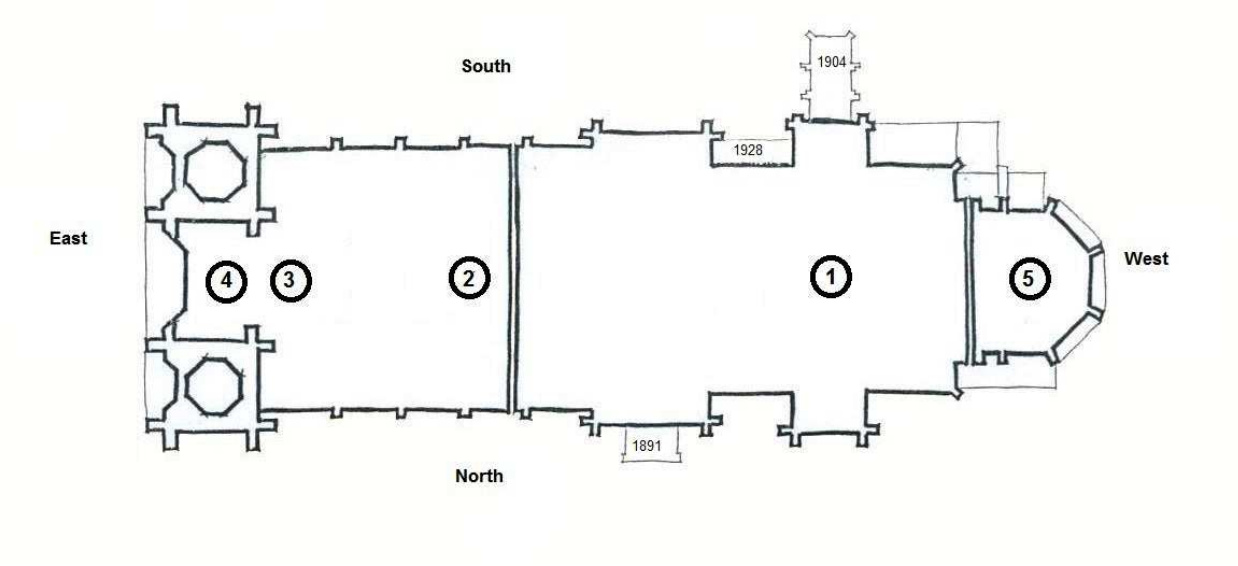
The Statement of Cultural Significance for St Peters Cathedral outlines that the primary value of the place derives from its architectural significance as well as its long history and ongoing use as a religious institution. The approach to the conservation of the complex should be that of revealing the 5 major stages of construction and the following:

- The statement of cultural heritage significance (refer to Section 3) for the place should be accepted as the basis for future planning.
- All future conservation and adaptation works which affect elements of significance should be carried out having regard for the principles of the Australia ICOMOS (Burra Charter) 2013.
- Any conservation planning, works or maintenance to the complex should be undertaken to the direction of a skilled Conservation Architect.
- A systematic program of maintenance should be followed.

5.2 Site Policies

- Maintain the landmark qualities of the Cathedral through appropriate development which will enhance and not detract from the heritage values of the place.
- Ensure that any future development directly adjacent to and/or surrounding the Cathedral does not visually dominate the former residence/monastery and is complementary in building form, materials, scale, colours and proportions.
- Ensure that all stormwater is taken well away from the base of the building.
- Ensure that the ground level is not built up adjacent to the Cathedral. Monitor the bitumen car park and in the long term, remove bitumen adjacent to the cathedral on the north side, to prevent resultant rising damp.

5.3 Summary of General Construction Materials of the Cathedral



STAGES OF CONSTRUCTION
(not to scale)

N

A report was prepared by Jim Mann Stone Consultant *(see Appendix 8)* which outlined that nine stone types have been used in the Cathedral. Details of the each of the stone characteristics and possible sources are outlined in this report. This is summarised as follows:

5.3.1 Stage One – 1869-1878 (Sanctuary, Choir, Transepts and One Bay of the Nave)

Walls - Tea Tree Gully sandstone (hammer dressed rubble sandstone) likely sourced from Bundey's quarry. Replacement stone not currently quarried, and would need to be salvage stone if required.

Dressings and Quoins - Tea Tree Gully sandstone (sawn ashlar) most likely sourced from the Brown & Thompson quarry (which also supplied stone for the Adelaide Town Hall and General Post Office). Some of this stone was also likely sourced from St Peters Quarry (ie, similar but not the same sandstone).

This stone type is no longer available. A similar material suitable for replacement is considered to be Basket Range sandstone, quartzite variety or Helidon sandstone, or Gosford Quarries.

Plinth - Glen Osmond Bluestone - likely quarried in the foothills at Glen Osmond. Some later material may also have been quarried from near Tapley's Hill adjacent to Main South Road. Suitable replacement material is Kanmantoo Bluestone or Callington Bluestone.

Roof – Willunga slate

Gutters and down pipes– copper, galvanised at lower level due to theft of copper when used at lower level

Roof flashings - *lead*

5.3.2 Stage Two – 1890-1894 Lower Section of Three Bays of the Nave

Walls - Tea Tree Gully sandstone (as per Stage 1)

Pilasters String courses, dressings and quoins - Murray Bridge Limestone sourced from an un-named quarry at Murray Bridge which has now been rehabilitated into the Sturt Reserve. Murray Bridge limestone is still available from the Sunnyside quarry although the material extracted is generally more porous and coarser grained and usually a darker colour. The most suitable replacement is considered to be Waikerie Limestone.

Plinth - Glen Osmond Bluestone (as per Stage 1)

5.3.3 Stage Three – 1899-1901 Front East Elevation, Upper Section of Three Bays of the Nave and Roof

Walls - Tea Tree Gully sandstone (as per Stage 1)

Pilasters String courses, dressings and quoins –Murray Bridge Limestone *(as per Stage 2).* The most suitable replacement is considered to be Waikerie Limestone.

Decorative elements to the main facade: Waurn Ponds (Victoria) limestone - used on decorative elements associated with the eastern elevation (main facade) such as the 'rosette window panels' and finials and possibly the crosses installed at the terminus of the roof ridge at each end of the Cathedral. Waurn Ponds limestone near Geelong, Victoria has a similar appearance to Murray Bridge limestone but was available in a more consistent finer grain and would be considered easier to work and has a history of use in other ecclesiastical structures notably St Paul's Cathedral in Melbourne. Given the intricate nature of these elements it may possible that the items were carved interstate and imported for the project. Waurn Ponds limestone is no longer available. The most suitable replacement material is considered to be Waikerie Limestone (source: Heritage Stone Restorations). This material has a similar durability, strength, water absorption and decay mode to the original stone.

Roof – Cornish slate

Gutters and down pipes– copper

Roof flashings - *lead*

5.3.4 Stage Four – Towers & Spires (1901 – 1902)

Walls - Tea Tree Gully sandstone (as per Stage 1)

Spires, parapets and balustrades - Murray Bridge limestone from Sunnyside quarry (opposite the Mypolonga landing) which was specifically opened to provide stone for the Cathedral. (Both the Sunnyside limestone quarry and the St Peter's Tea Tree Gully sandstone quarry were both operated by Mr Torode.) Murray Bridge limestone is still available from the Sunnyside quarry with similar properties although the stone tends to be lighter in colour. Supply of Murray Bridge limestone can be sporadic and other sources may be required. Suitable replacement materials are Murray Bridge Limestone (source: D L Scott & Son), Waikerie Limestone (source: Heritage Stone Restorations)

Spire Stone bands – Pyrmont sandstone - sandstone is exclusively used as an 'accent course' within the tower producing a polychromatic effect with the lighter colour Murray Bridge limestone. The stone is commonly known as a yellow block 'Sydney Sandstone' sourced from Pyrmont. (Note predominant stone used in St Mary's Cathedral in Sydney). The most suitable replacement material is Piles Creek Guinea Gold sandstone from Gosford Quarries, which has a very similar durability, strength, water absorption and decay mode to the Pyrmont stone.

5.3.5 Stage Five – 1902-1904 Lady Chapel

Walls – lower levels - Tea Tree Gully sandstone (as per Stage 1)

Pinnacles, parapets and balustrades - Murray Bridge limestone from Sunnyside quarry (opposite the Mypolonga landing) which was specifically opened to provide stone for the Cathedral. (Both the Sunnyside limestone quarry and the St Peter's Tea Tree Gully sandstone quarry were both operated by Mr Torode.) Murray Bridge limestone is still available from the Sunnyside quarry with similar properties although the stone tends to be lighter in colour. Supply of Murray Bridge limestone can be sporadic and other sources may be required. Suitable replacement materials are Murray Bridge Limestone (D L Scott & Son), Waikerie Limestone (source: Heritage Stone Restorations).

Window surrounds – sandstone and/or fine-grained fossiliferous limestone. (sandstone reused from original east wall)

Plinth – Glen Osmond Bluestone (as per Stage 1)

Stone retaining wall – some Tapleys Hill Bluestone

Roof – Cornish slate

5.4 External Conservation Policies and Recommendations

5.4.1 Roof and Stormwater

***Background**:* The roof throughout is finished in slate (apart from the roof to the timber porch on the south elevation which is sheeted in corrugated iron). The original section of roofing on the transept and crossing still remains in Willunga slate.

In 1991-92 the nave roof was re-roofed (including the Lady Chapel) in Bugle Cornish Slate. (according to Woods Bagot specification) During these works:

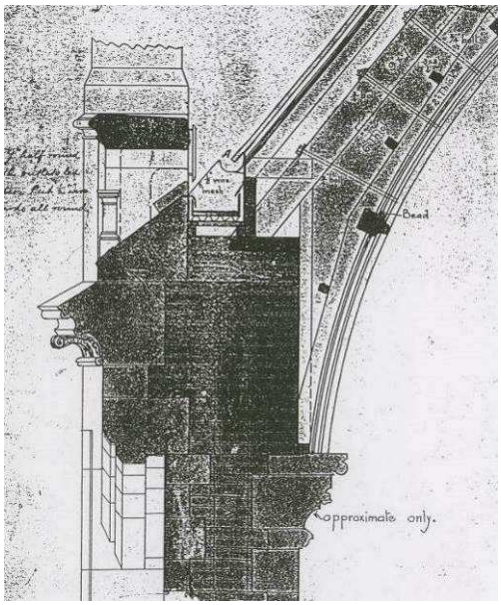
- It appears that the vents on the nave roof were removed, although they still survive to the Lady Chapel roof.
- The gutters were replaced in copper and copper downpipes were also installed. However, at the lower levels there are galvanized downpipes (as there have been problems with theft of copper at the lower levels).
- Bolts were installed into the box gutters to allow for fixing of scaffolding. These are now redundant.

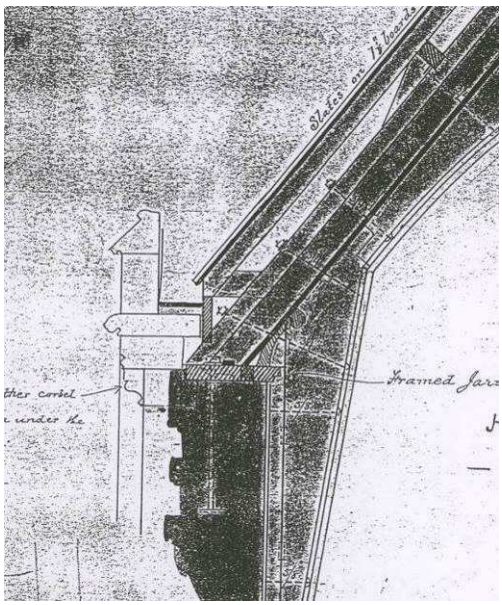
Access to the roof for cleaning is problematic and via egress through the front towers, and also via vertical ladders elsewhere. This is not in accordance with current safety standards. These required safety standards have changed since the roof work was undertaken in the 1990s. It is not safe for the current mode of cleaning of gutters via walking along the roof not attached to a safety line. This cannot continue, in relation to the liability issues for the Cathedral.

The roof does not currently leak (information provided by Office and Facilities Manager) although there is evidence of previous leakage and in particular, there is evidence internally in the roof space that there is some water leakage into this space, (but not through to the interior). This has been due to blocking of gutters and downpipes. However, the Cathedral currently appears to be keeping these in good condition and cleaned out on a regular basis.

Gutters were originally zinc, but these have been replaced in copper in 1991-1992 – in quad profile, not ogee, which is surprising. Downpipes are also in copper or galvanized. All gutters are generally concealed behind the stone parapets with some surface mounted gutters (eg, to the Crossing Roof and to the lower level porch roofs). There are no overflow points to the gutters, such that if the down pipe is blocked, the roof will overflow inside.

Valley gutters do appear to be leaking in the location of the transept and the crossing tower, but this leakage is contained within the roof space. This leaking is due to split lead. In addition, there are also no overflows in the box gutters and at the time of heavy downpours, these box gutters are likely to leak.





DETAIL OF LADY CHAPEL BOX GUTTER ***DETAIL OF NAVE BOX GUTTER***

(Details extracted from original drawings – showing the box gutters at top of walls)

***Policy**:* Original roofing material and elements which have been altered over time should be reinstated in a manner which matches the original design intent of the building. Any roof leaks should be rectified.

***Recommendations**:*

Undertake roofing works as follows: (Refer also to separate Dilapidation Survey for extent of works.)

Roof Safety Upgrade

- Improve safety conditions of roof access - Install anchor points in the roof to allow for safe harnessing for gutter cleaning and roof maintenance.
- Install upgraded internal roof walk way and maintenance system in accordance with current safety standards.
- Install fall arrest systems and external roof access systems as outlined in Appendix 6 i

Roof Conservation Works

- All ridge capping to be re-leaded in 25kg lead in maximum 1.5 metre lengths (replacing current 3 metre lengths which are cracking). Reuse short lengths where possible in short run repairs.
- Remove previously installed scaffold bolts to the box gutters along top of upper nave clerestory walls. Install lead capping in this location to the tops of nave clerestory walls.
- Install expansion joints in existing copper gutters.
- All current slates which are oxide stained should be replaced – estimate approximately 40 slates over roof.
- Install lead capping to top of parapets/ box gutters to the nave and aisle roofs, and install 75mm copper overflow pipes with bird's beak traditional end.
- Install lead capping to the nave and aisle parapets/ box gutters, to properly flash the gutters in this area.
- Install overflows to gutters, via coring of stone and inserting copper over flow pipes with "birds beak" ends.
- Any galvanised downpipes or spreaders should be changed to copper
- Replace internal tower gutters (inside north and south towers) now rusted out, and renew associated down pipe to ensure discharge of tower roof water.
- Install upgraded storm water discharge adjacent to the south elevation. This should discharge to the south via the existing underground storm water.

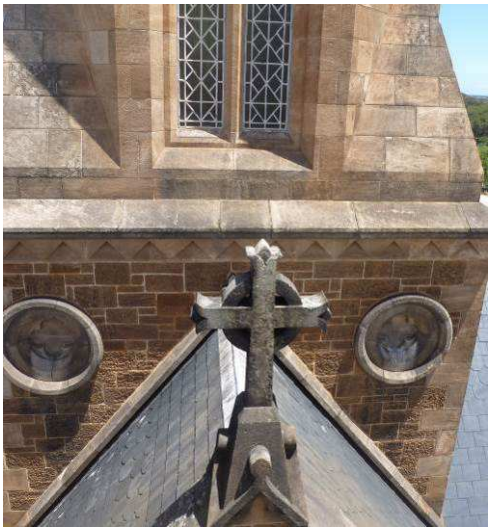
5.4.2 Stonework

Background: Six different types of stone have been used in the construction of the Cathedral. This includes Tea Tree Gully sandstone (from three different quarries), Murray Bridge Limestone (from two different quarries), Pyrmont Sandstone, Glen Osmond Bluestone and Waurn Ponds limestone. Generally the surviving original stone work is in good condition apart from the deteriorated limestone on the spires, towers, and the Lady Chapel.

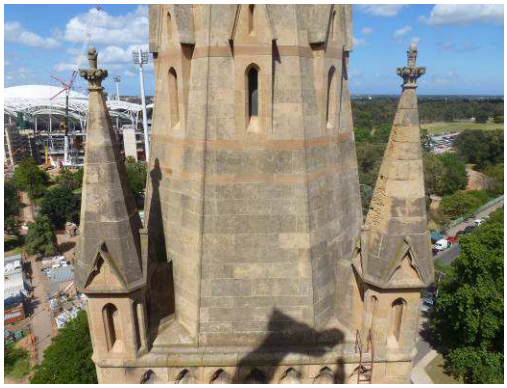
***Policy**:* Removal of later cement pointing is required to ensure that the sandstone walling and bluestone plinth will not deteriorate. All stone should be cleaned, consolidated where required, and reinstated where damaged or missing, using stone which matches the original in colour and finish and a lime mortar which matches the colour and texture of the original mortar and will decay preferentially to the stone.

***Recommendations**:* Continue to maintain and clean stone. Undertake all stone conservation works as identified in the dilapidation survey accompanying this report, and to the method statements outlined in Section 6 of this report.

Glen Osmond Bluestone Plinth, with limestone banding (North Elevation, Bay E2 – note deterioration)



Sandstone to the crossing tower, with sandstone dressings (early 1869 section of Cathedral), note stone cross



Spire, showing deteriorated limestone (arrowed) and banding of Pyrmont Stone

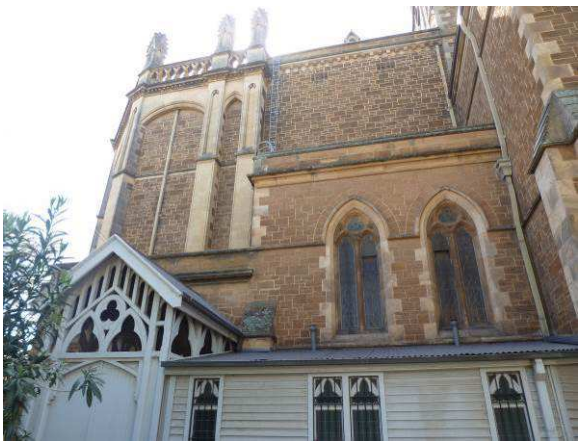
Sandstone to the nave walls, with limestone dressings (extension of nave undertaken in 1890 – 94)

5.4.3 External Joinery and Timber

Background: External joinery includes the doors which are generally in good condition, and the south porch.

Policy: All timber should be retained and conserved.

Recommendations: Regularly re-paint external timber joinery using an appropriate colour scheme as required to prevent deterioration.



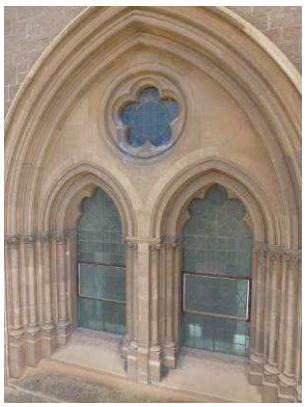
Examples of external joinery

5.4.4 Leadlight Windows (window numbers are as outlined on Dilapidation Drawings)

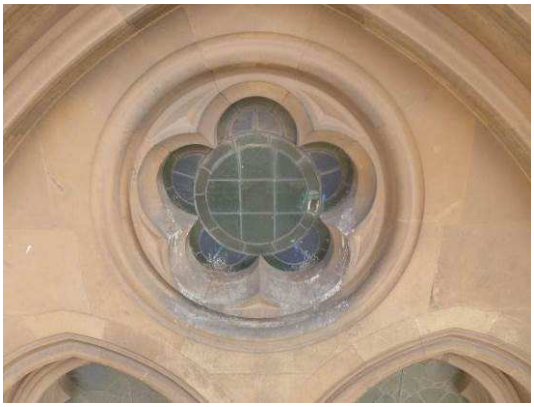
***Background**:* The Cathedral contains many excellent stained glass windows. An assessment of the Cathedral windows has been undertaken by Ernie Tinesz of The Glass Foundry dated November 2013 – see Appendix 9. This Firm has previously undertaken glass work at the Cathedral, including the installation of the Cedar Prest windows. The survey showed evidence of oxidization to lead cames, cracks to windows, putty caulking erosion, and deteriorating paint on windows. There are also many examples of broken cames throughout the windows. Window protection is also required and this report recommends a Conservation Grade UV stable polycarbonate screen system, eg Bayer Marcolon UV2 of Lexan 9034.

***Policy**:* Maintain stained glass windows in good condition. Any repairs required should be undertaken by an experienced glass worker.

***Recommendations**:* Continue to monitor condition of windows and clean as required with appropriate cleaning agents which will not damage the decorative surface of the glass. Leaking windows should be repaired. Undertake a detailed survey of the windows to establish clear priorities for conservation and window protection. *Note that window repairs should be undertaken at the time of stone conservation due to access being available via the scaffold.*



East front elevation – windows W201 East Bay 34



W326 East Bay 1

North elevation - nave windows, design, fabricated and installed by Cedar Prest in 1992

5.4.5 Maintenance Access Ladders

***Background**:* The Cathedral gutters are regularly maintained and cleaned via access from the north and south towers. However, the current access arrangements are not safe and do not comply with current standards. Traditionally access to the areas of roof not accessed by the towers has been undertaken by vertical ladders fixed across the Cathedral. These are not fitted with vertical fall arrests next to the ladders and also provide an access method which is not safe.

***Policy**:* Ensure safe access to roof for maintenance.

***Recommendations**:* Upgrade all of the maintenance access system to the Cathedral. Refer separate report prepared for this (Appendix 6). Install system of anchor points (every 4 to 5 metres) in line with roof trusses, with a continuous static line along the nave roof to provide points of securing harnesses when the roof is being maintained. See 5.4.1 above

5.5 Internal Conservation Policies and Recommendations

The interior of the Cathedral has evolved over time. The following policies should guide conservation and adaptation work to the interior of the building.

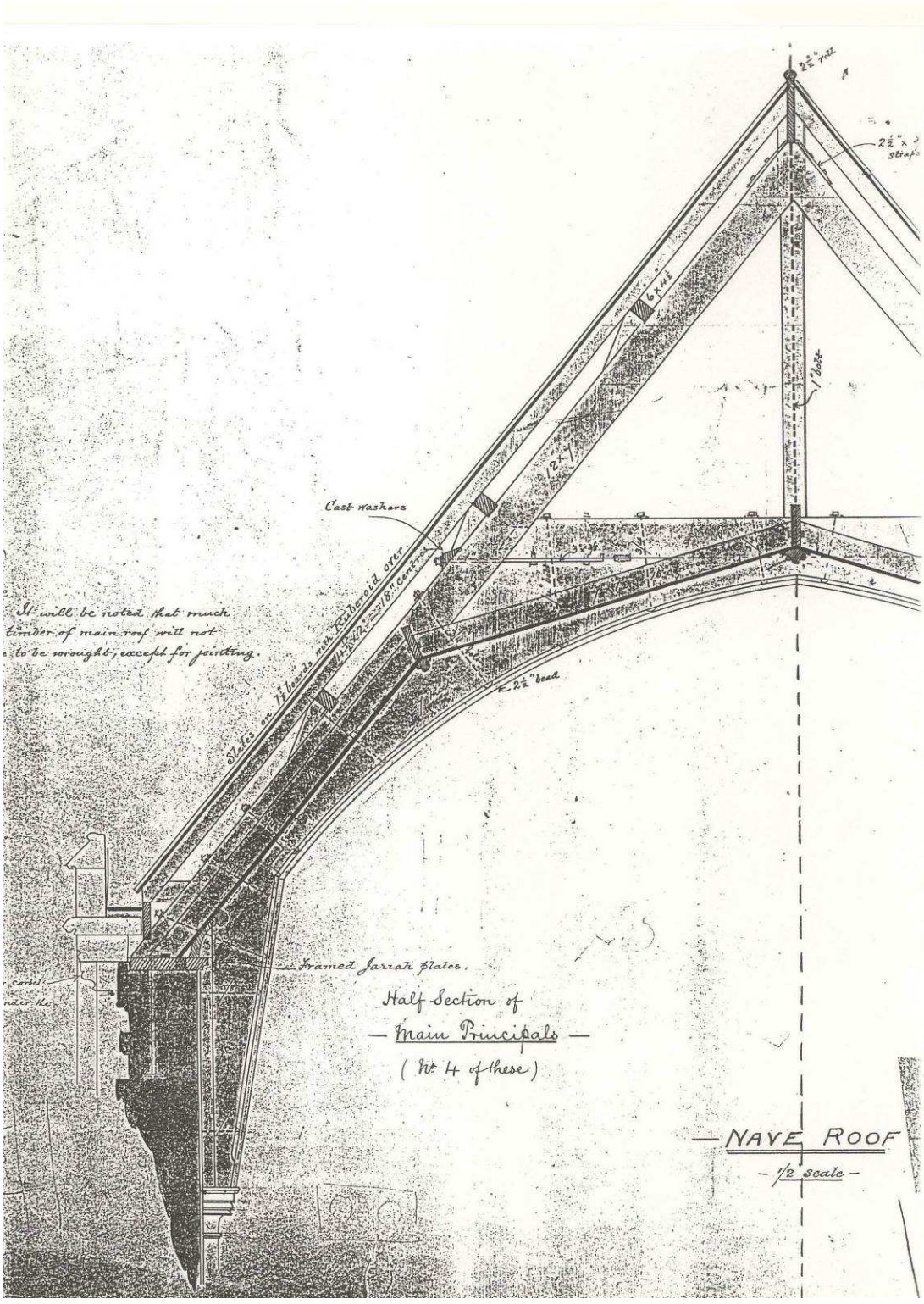
5.5.1 Main Roof Space

***Background**:* The main roof space above the nave and gallery is accessed via the north tower through a roof hatch. The timber roof trusses are constructed of Oregon and generally appear to be in sound condition. However, there is some minor splitting in some of the trusses and king posts (refer to separate engineer's report). The upper side of the ceiling is viewed through the roof space, being tongue & groove boarding. There were previously galvanised iron vents as part of the roof, but these were removed in 1993 when the roof works were undertaken, and the current venting system was installed. The roof space above the Choir, High Altar and Lady Chapel is not accessible.

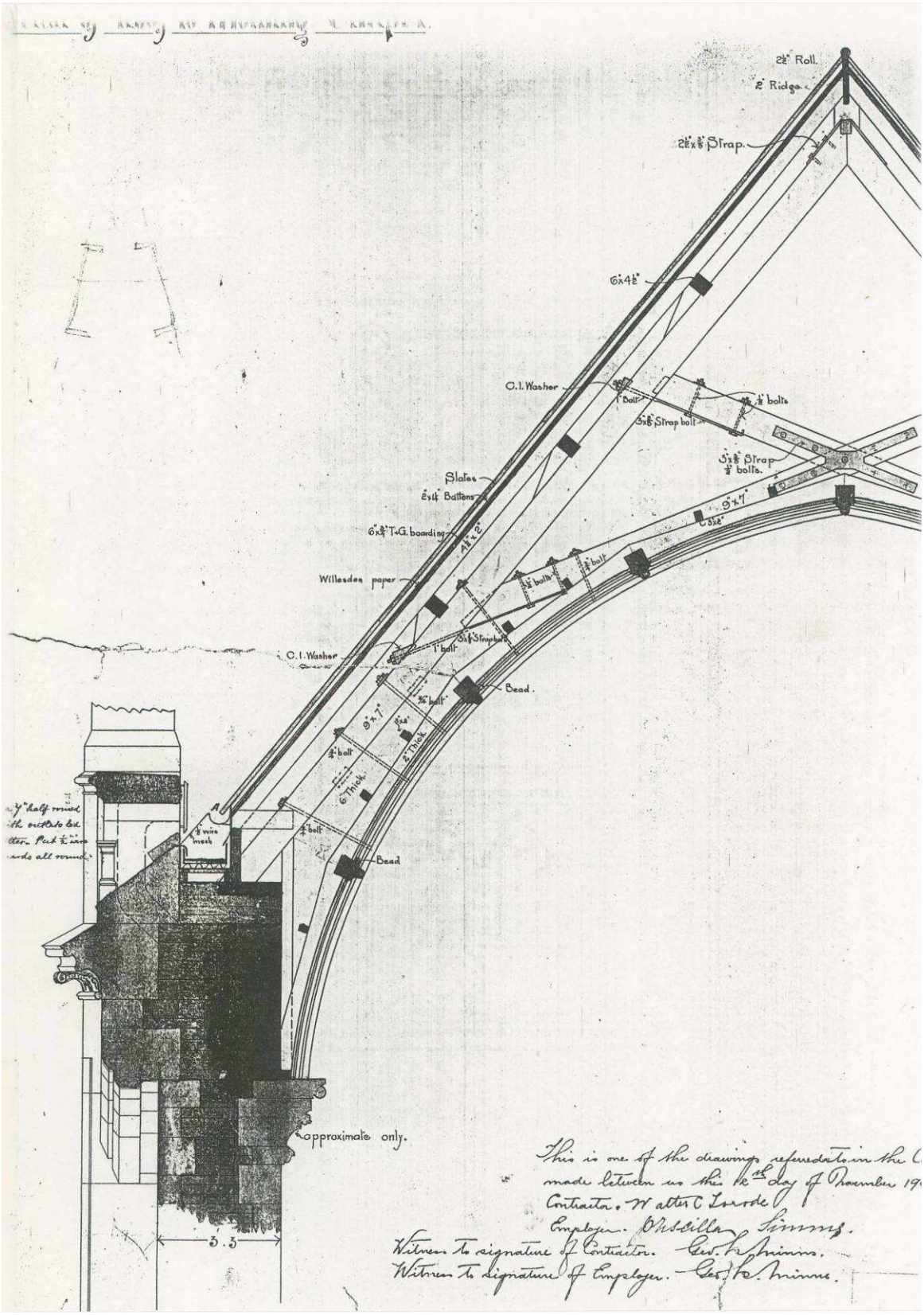
The walkway to the roof space is not safe and the platform is constructed in ply and under-designed. At the time of inspection, one of these platforms nearly broke with two people on it. This access platform was installed in 1992 but is not adequate and a new access platform system needs to be installed.

***Policy**:* The interior roof space should be regularly inspected and any repair works undertaken in accordance with engineer's recommendations. Ensure that roof walkway is upgraded to safe design.

***Recommendations**:* Continue to regularly inspect and maintain the roof space. Install safe roof walkway system. Undertake strengthening to internal timbers in accordance with engineer's recommendations.



NAVE ROOF DETAIL
(Woods Bagot Archives)



DETAIL TO HIGH ALTAR OF THE LADY CHAPEL ROOF
(Woods Bagot Archives)

5.5.2 Main Ceiling

***Background**:* The ceiling in the Gallery Nave and Choir is constructed of 150mm Baltic Pine matchboard fixed to the underside of the roof trusses. The matchboard is stained a medium brown colour, probably a shellac finish. The ceiling is divided up into bays and panels, with a clear colour difference between the 1869-77 sections and the later 1890-1901 section. The former is a slightly darker colour, with the latter incorporates five ventilation grilles. Four tension rods are located just below the ceiling in the 1890-1901 sections. These appear to be in sound condition.

The ceiling to the Lady Chapel and High Altar is a hard plaster vaulted ceiling, set out from the line of the roof truss. This is divided into panels by timber cross members. The plaster work is generally extensively cracked.

***Policy**:* Retain all original timber work to the main ceiling. Repair cracks to Lady Chapel ceiling

***Recommendations**:* Continue to maintain timber and repair any damaged sections to match original where required. Monitor cracks to the Lady Chapel ceiling

5.5.3 Internal Walls

***Background**:* The walls are generally constructed of rendered masonry, with dressed stonework used for the major architectural elements, eg window quoins, tracery, arches, columns, capitals, string courses, pilasters etc, and rendered stonework or brickwork used on the general walling. Timber panelling is used in the Nave aisles up to a height of about 2.3 metres.

There is little evidence of cracking in the Nave side walls, but there is significant cracking in the east wall of the Nave, ie, the eastern wall of the major transept. There is cracking associated with the Lantern Tower, and cracking on the side walls of the High Altar. Refer engineer's report.

Previous water entry is evident at the top of both the Nave aisle walls below the box gutter. This would now be the location of drummy render and there are also sections of drummy render in the Nave walls, likely also adjacent to the Lantern Tower cracking. Later patching is evident in the Lantern Tower adjacent to where the point of the rood is fixed.

There is considerable build up of dust and dirt on the walls and ledges and some water staining associated with water entry.

***Policy**:* Retain all original finishes of internal walls.

***Recommendations**:* Once external conservation works have been undertaken, repair all drummy render internally associated with external leaks. Ensure that new render matches colour and consistency of the existing render, undertaking trial samples for checking prior to undertaking full works.

5.5.4 Floor Surfaces

***Background**:* The floor surfaces are generally in sound condition. The main floor in the Cathedral is constructed of unglazed ceramic tiles. In 1993 considerable work was undertaken to the main floor with the relaying of the tiles (associated also with the installation of sub-floor heating).

***Policy**:* The floor tiling should be retained and conserved. All damaged tiles should be repaired or replaced with matching tiles.

***Recommendations**:* Continue to maintain tiled floors.

5.5.5 Internal Joinery

***Background**:* Timber wall panelling is located along the base of the walls in the nave and choir area. Additional panels were installed in 1993 to conceal electrical cables and other services.

Other joinery (architraves, skirtings, and internal doors) in the ancillary spaces are generally in good condition, but require ongoing re-painting/staining as part of overall internal maintenance.

***Policy**:* Retain all original joinery and maintain all timber finishes. A clear stain finish is recommended for all original joinery, with a paint finish appropriate for other surfaces.

***Recommendations**:* Continue to maintain timber and regularly finish as required to prevent deterioration. Repair any damaged sections to match original. Note that clear stained timber should not be painted.

5.5.6 Internal Lighting

***Background**:* The original lighting of the Cathedral was by gas lighting and in the nave this was achieved by large floor mounted lights fixed on cast iron stands approximately 2.5 metres tall (information from 1995 Conservation Plan). These were located under each colonnade arch and were removed in 1925. Current lighting consists of spotlights, and the lighting was upgraded in the 1992 works.

***Policy and Recommendations**:* continue to maintain appropriate levels of lighting, ensuring that associated wiring is unobtrusive.

Lighting

Speakers

5.5.7 Services and Electrical including Air-Conditioning and Heating

***Background**:* Electrical services were not part of the original building and were installed after the Cathedral was completed. Consequently there was wiring and cabling fixed to walls and ledges on top of door mouldings and on top of timber panelling. The incremental nature of this wiring did not enhance the presentation of the interior. In 1993, the wall panelling was extended to allow for concealing of services in this area.

Currently the interior of the complex has a variety of fittings and services. In other places electrical conduits are generally surface mounted, and in some cases bundled into cable runs concealed within pvc larger conduits. There is currently no air-conditioning.

***Policy**:* continue to maintain appropriate electrical, lighting and heating, ensuring that associated wiring is unobtrusive

***Recommendations**:* Future upgrading and installation of electrical services should adhere to the following:

- consolidation of conduits into a single cable and careful consideration of the location of supply conduits.
- Careful visual concealment of cable against the walls or installation under floor where possible.

Any future computer fibre optic cable should be combined with electrical supply.

5.6 Fittings

- **Reredos -** the reredos to the High Altar was installed in 1907 as part of that work carried out during the main building period of the Cathedral. The reredos in the Lady Chapel is the first reredos in the Cathedral, being located in its present position when the Lady Chapel was built. The main reredos is constructed of timber and incorporates poly chromed figures which appear to have faded. A number of cracks are evident, and some joints have opened up.
- **High Altar –** this appears to be in sound condition. The glass top on the narrow table behind the high altar was cracked right through.
- **Organ** – a separate Conservation Plan was prepared by the Organ Curator, Roger Lewis in 1990. A Restoration Project is currently planned for the Organ.
- **Choir Stalls –** these were installed in 1927 and appear to be in good condition for their age, although some minor previous white ant attack was evident. Access for white ant treatment has been cut into the floor of the second row of stalls, in both the northern and southern stalls.
- **Pews –** the pews appear to be in sound condition,
- **Other** – the Sedilia, Commission Rails, Sacristy Office Screens, Pulpit and Eagle Lecture all appear to be in sound condition.

***Policy and Recommendations**:* continue to maintain furniture and fittings, regularly checking for white ant evidence.

6.0 CONSERVATION ACTIONS – WORK METHOD STATEMENTS AND PRELIMINARY SCHEDULE

The following method statements provide a basis for any future Specification which is to be prepared for conservation works to be undertaken to the Cathedral. This report does not comprise a full Specification of Works, but has been prepared as a guiding document for the Cathedral, which has allowed for the required Scope of Works to be ascertained, and also an indicative budget to be prepared. The following Work Method Statements will require further detailing to become sufficient for inclusion in a full Specification of Works.

6.1 Scaffolding

Scaffolding will be required for conservation works, allowing for all working levels to be fully decked out, complete with ladders to all working decks. All scaffolds will be fully clad with shade cloth. The scaffolding and any associated temporary works should be constructed without requiring major intervention into the historic building fabric. No penetrations or fixings should occur without discussion and approval. **The main entrances should be kept accessible at all times.**

6.2 Roofing

Any roofing slate replacement to match in colour and size existing slate. All slate should be hard dense sound rock machine punched for two nails each. No broken or cracked slate shall be used. Slate shall be of thickness to match existing smooth texture.

Protect the roofing material system and building interior from damage throughout the work. Keep the roof surface clear of debris and loose material. Slate to be fastened with two large head slaters solid copper or aluminium clouts. Prevent any direct contact between incompatible metals. Use only a qualified and experienced slater or roof slating company for re-slating and repairs to existing roof.

Inspect all roof sections scheduled for repair and replace all decayed, cracked, delaminated and otherwise unsound slates. Repair in accordance with BS 5534 Code of Practice for Slating and Tiling. Use salvaged slates from elsewhere in the Cathedral roof wherever possible, otherwise use new slates or other approved salvaged slates. Ensure the roof is left sound and weather-tight.

Carefully remove existing slates and salvage wherever possible. Remove existing battens and sarking carefully where necessary to minimize any damage to boarding below. Repair any damaged boarding, and ensure that a smooth and even roof base is provided. Install new sarking, and new Oregon or other approved battens to match the existing size and spacing. Cut new slates as needed for rounded diamond slates. Ensure the roof is left sound and weathertight.

Access to the Internal Roof Space and Internal Walkway in Roof

External Access to the internal nave roof space is via the North & South Towers

Upgrade existing external landing to North Tower including new platform decking handrails to platform edge and ladder down to gutter level. Install new access platform similar to North Tower outside the South Tower. Note the external ladder up the outside of the North and South Tower are non-compliant and not required for general maintenance access. These should be either removed or sign posted that they are non-compliant and not to be used.

Internal - Construct new designed walkway system as current system is unsafe and incapable of carrying required weight of workmen plus equipment. Install stiffening to trusses as per engineer's recommendations.

6.3 Site Drainage and Discharge of Stormwater

Undertake site drainage work to the southern elevation to discharge stormwater away from base of the building – connect storm water to existing storm water system adjacent to the Deanery.

6.4 Glossary of Stone Conservation Terms

The following glossary explains the terms used on the Dilapidation Drawings and as outlined in the conservation works in sections 6.5 and onwards below.

Biocide Treatment	A treatment which inhibits further organic growth on the face of stone or brick by killing the spores which cause regrowth of moss or lichen. A non- damaging proprietary system of low toxicity formulated specifically for mosses and lichens and appropriate for the stone substrate should be employed, following manufacturer's instructions for strength and application.
Cement pointing	Inappropriate cement pointing/mortar joints of stone or brick - this is proposed for removal.
Consolidation	Consolidation aims to restore the physical integrity and mechanical properties of decayed stone to an acceptable level by re-establishing the bonds between adjacent grains. A consolidant can perform this function through the deposition of a new and durable binding agent within the pores of stone. Limewater can be used as a consolidant for limestone. The currently recommended consolidant for non-calcareous sandstone is ethyl silicate.
Lime mortar	Mortar without the addition of cement, which comprises a mix of sand and slaked lime or lime putty. [Lime shall conform to AS 1672] Lime mortar includes sharp washed sand of the appropriate colour. Do not use a sand with clay content. [Sand shall comply with AS 1465 and shall be well graded washed sand matching the texture and range of sizes found in the mortar to be matched.] Lime mortar can be achieved using 9 parts sand: 2 or 3 parts slaked lime or lime putty. Mix the mortar gauging every mix with the same measure of materials, to ensure the colour, texture and consistency will remain the same. Specific issues to be considered include mixing, wetting down, curing period, temperature & humidity.
Pinning	A method of stone repair by drilling and inserting stainless steel dowel of required thickness to re-secure the stone.
Plastic repairs **[Mortar repairs]**	A method of stone repair which can be carried out without the stone being disturbed in the wall. This is done with colour and texture matched lime mortars (or resin based mortars in sheltered locations), using crushed base wall material if possible. Mix the materials into a thick paste and then push into the crack or hole to be repaired. Allow the mortar to set and when it is hard enough use a straight edge to scrape the surface so the repair blends into the original material. The repair can be stippled or raked if a rougher finish is required. When the plastic repair has set, the new look can often be reduced by brushing a small amount of local soil over it. Use a fine haired paint brush to do this.

Poultice	A method of drawing salts from stone or brickwork using a coating of absorbent material applied upon plaster, stone or brick surfaces in order to dry and to remove, by physical action only, all the mineral salts contained in the base material. The poulticing paste should be applied to a clean surface and kept damp for the required period of time.
Sacrificial render	A very weak render consisting of 10 Sand, 2 Lime. An applied render used to draw the salts from the stone before falling from the wall surface - used in situations where brick or stone is in an early stage of decay through salt ingress. Once the render has fallen to the ground this is collected and disposed of. After a sacrificial render has been applied, it must be left in its natural state for 12 months or more, in some cases several years. It is important that the correct mix is used to obtain a good colour match as it must not be painted. Sacrificial renders are reapplied once they have decayed and are a very effective and practical method of minimising further decay from salts or other external agents.
Removal of Cement pointing and render	Cement render holds in moisture as it stops the wall 'breathing' which can cause the wall behind to deteriorate and disintegrate. Remove cement render gently with hand tools: hammer and chisel. No power tools, such as jackhammers, should be used. Where hard render covers a large area, cuts are to be made into the surface of the render using a small angle grinder, controlling the amount of render which is pulled or chiselled off at one time. Repoint wall with lime mortar which is more vapour permeable (breathable).
Replacement of stone	Replacement stone should match original or if not procurable, a stone similar in colour, texture and character. A small area of stone only should be replaced at one time, with stone replacement matching original course lines wherever possible.
Re-pointing of stone with lime mortar	As a general rule, the joint should be raked out to a depth twice that of its width, or a minimum depth of 25mm. Seriously deteriorated joints are defined as having loose or missing mortar; excessively soft mortar; powdery or crumbling mortar; cracks that weaken the bond between stones. Immediately before repointing all areas should be washed to remove all dust and to wet the surface well until suction is controlled and the surface stays wet. Re-point using a small tool, small trowel or window tool, all depending on the size of the joints. Push the mortar into the joint so the joint is full, then before it goes off, sponge off to a smooth finish and then iron in (or mark) the lines if required. The “ironing” tool is generally made by each mason to suit each job. New repointing can be aged with the use of diluted black tea over the pointing area to dirty up the pointing colour. An alternative is soot and water.
Shelter coat	Lime shelter coat is a slurry of slaked lime, fine sand and stone dust in water and is applied to masonry that has otherwise been fully cleaned, desalinated and repaired. Its purpose is to fill small crevices and depressions caused by decay processes and then, by thinly coating the rest of the surface, to act as a barrier or sacrificial layer against future attack.
Stone Cleaning	First remove lichen and moss and general grime with water with soft brush, and plastic or wooden tools. Lightly scrub with water only to remove dirt and dust. Any industrial grime may require

	alternative cleaning methods. Apply biocide treatment after cleaning process. This treatment prevents further organic growth on the face of the stone and brick. Sound stone and render work may be cleaned using a suitable micro abrasive cleaning system (eg JOS or suitable recommended equivalent).
Stone fracture repair – resin inject and fill	A method used for stitching of fine fractures by means of drilling small holes approx 3mm in diameter along the length of the fracture. Inject a two part epoxy resin into holes, fracture to be filled with a stone dust mortar repair.
Stone indent repair	Careful insertion of a piece of matching stone. The indent should be secured with stainless steel pins in non-visible locations.

Note on longevity of shelter coat and approach to conservation:

For the lime mortar repointing using Hydraulic limes (NHL) one would expect in our current weather conditions and atmospheric pollution between 50>100 years, if not prone to salt damp issues. For the lime consolidation the composition of a surface treatment should be close to that of the stone to be conserved. In practice, it is seldom possible to achieve this, but the use of lime water, and lime shelter coating in the conservation of limestone seems, in principle, to be the ideal approach. This system has been used, with most impressive success, in the conservation of limestone. There appear to be three mechanisms involved, namely, consolidation of the friable limestone near the surface by lime water in multiple layers forming part of the matrix of the fabric and sacrificial protection of the limestone by the lime shelter coating, in turn this giving the limestone longevity. Although these conservation practices have only been practiced since the late 1980s in Europe, today there is no evidence that show any signs of failure.

6.5 Stone Conservation – Preparatory Processes

6.5.1 Dry Cleaning Limestone and Sandstone

Undertake careful hand-washing of friable limestone. Total facade of sound stone is to be cleaned with Jos machine. Biocide clean (see below) accumulated moss and lichen to all horizontal surfaces and buttress cappings.

Remove all loose dirt and crumbling stone from the vertical and horizontal surfaces. The stone should be dry brushed and then vacuumed to remove loose particles, and any salts which have precipitated to the surface of the stone. Wooden and plastic scrapers should be used with great care to remove biological growths and also any accumulation of dirt or bird droppings. This should be undertaken on the copings, cornices and mouldings, and no damage should occur to the stonework itself. Note that much of the limestone is soft and easily damaged and extreme care must be taken when cleaning. All material removed from the face of the stonework must be collected by vacuuming, transferred to drums and removed from site by a waste management firm. All later and unused metal fixings and conduits should be carefully removed at this point.

6.5.2 Redressing of Decayed Stone

Re-dress decayed sandstone where required with suitable chisels, to remove the deteriorated layer. The width of re-dressing will be back to sound stone along the face of the stonework, the final extent to be decided on site. The edge of this re-dressed area will need to be bevelled back over a short distance as a weathered edge to the exposed face. The material removed during redressing must be collected and removed from site. (Stone to be repointed).

6.5.3 Flashings

Cut and remove existing lead flashings (ridge and valley flashings) where proposed to be removed. Co-ordinate this work with other roofing works.

6.5.4 Biocide Cleaning - Desalination by Washing, Poulticing, and Biocide Treatment

Carefully wash limestone copings and sandstone faces, to remove near surface salts. These include limestone copings, cornices and mouldings, and sandstone surfaces immediately beneath the limestone. Use clean water at low pressure to wash down the facades, combined with soft nylon brushes for any additional hand cleaning. Do not use wire brushes. All waste water is to be collected and removed from site in an approved manner.

Poultice affected areas to remove salts from sandstone. Areas requiring poulticing will show delamination and deterioration. The extent of stone requiring poulticing will need to be confirmed on site. Use the *Cocoon* or equivalent method of poulticing. Two to three cycles of damp poulticing will be required to remove the salts in evidence. Maintain optimum damp conditions during poulticing process, according to product requirements. The pH level and salt content of the poultice will be tested at the end of the process to determine composition of salts and reaction between sandstone and limestone.

Wash clean the remaining vertical areas of sandstone walling with low pressure water to remove discolouration if possible. Any serious soiling could also be removed from sound stone with the **micro-abrasive system. Treat all horizontal surfaces with a biocide wash to prevent further biological growth.**

6.5.5 Removal of Black Crust to Stone and Beneath Mouldings

Remove depositions of black crust, mostly beneath mouldings. Cleaning may require a series of methods, depending on the resistance of the crust to removal. Crusted areas should be thoroughly dampened before cleaning. Initial testing with the JOS system of micro abrasive cleaning can be trialled. Areas resistant to this method can be poulticed with the Mora (EDTA) system to soften the crust material. Careful testing should be undertaken on any limestone mouldings, as potential for damage to the stone will limit the use of any abrasive system. Removal of areas of damp crust on fragile stone may be possible with hand tools – timber or plastic. All removed material must be collected and removed from site.

6.5.6 Removal of Cement Based Mortar Joints and Repairs

Carefully remove all cement based mortars to the bluestone plinth and cement patches to stonework, as part of the initial works. Stones should not be damaged and sharp arises must be retained. Remove cement render gently with hand tools: hammer and chisel. No power tools, such as jackhammers, should be used. Where hard render covers a large area, cuts are to be made into the surface of the render using a small angle grinder, controlling the amount of render which is pulled or chiseled off at one time.

6.6 Stone Conservation – Review of Masonry Condition

After the above preparatory works have been undertaken a review of the “cleaned” appearance will be undertaken. Inspection of all masonry after these preparatory treatments will indicate the extent of remedial works required. The condition of the masonry will be assessed beyond scope outlined in dilapidation survey. Analysis and testing of decay and salts to determine required composition of shelter coats will be undertaken. Analysis of lime mortar to sandstone and limestone walling may need to be undertaken to determine composition. Gable copings will be checked for water absorption and repellency. Extent of areas for consolidation of the friable sandstone will be confirmed and delineated. All damaged stones which will require replacement will be confirmed.

6.7 Stone Conservation Works: Stone Replacement, Stone Repairs, and Mortar Re-pointing

6.7.1 Repair and Replacement of Damaged Sandstone and Limestone

Stone Indent– replace damaged stone to match (either bluestone or limestone)

Replace identified damaged stones. All replacement stones must match, as far as is discernible, the original stones in colour, texture, grade, size and finish. Possible sources of stone will need to be investigated. Waikerie Limestone is considered suitable for the limestone replacement, subject to careful colour and texture selection.

Damaged and friable stones should be re-dressed to sound surface and edges bevelled to create water shedding angles. This will include the chasing line of the removed flashing. All mortar repairs and repointing should be undertaken in a mix to match original, to be determined by testing. Remove any excess mortar immediately from adjacent surfaces.

6.7.2 Repair of Cracks to Stonework

Repair the cracks in the joints of the stonework – as identified in the dilapidation survey. Repoint joints in lime mortar to match original pointing.

6.7.3 Repointing of Mortar Joints

Re-point **deteriorated and open joints in lime mortar – allow for the % of the elevation as shown on the dilapidation drawings (excluding plinth which is shown as 100%).**

All open, deteriorated joints and jointing in hard cement will have been raked out to a depth of at least 25mm (or to a depth of at least twice the width of the joint). Repoint with lime mortars, composition of mix to be determined by testing, using jointing irons that fit within the joints.

Deep repointing should be undertaken in stages and thorough pre-wetting and damp curing will be required.

Undertake trial samples of repointing work on all elevations and stone types for approval by conservation architect.

6.7.4 Shelter Coats to Limestone

All horizontal surfaces to parapets where identified to be shelter coat finished

A shelter coat treatment of a slurry of slaked lime, fine sand and stone dust in water (colour to match the base stone) rubbed into the surface of the limestone will be applied and allowed to cure. (Probable required application of one to two coats) Damp cure the slurry/shelter coat properly, allowing at least three to four weeks in total. Work should not be undertaken on days of above 25 C. Composition and preparation of shelter coat. Slurry of slaked lime, fine sand with stone dust in water, or pigmented to match Murray Bridge limestone colour. (Typical mix: 3 parts St Astier NHL 2 (feeble): 1 part pigmented fine sand or stone dust: 6 parts clean potable water.) To be prepared off-site and brought to the site in drums.

6.7.5 Repair of Stone Fractures to Limestone

A method used for stitching of fine fractures by means of drilling small holes approx 3mm in diameter along the length of the fracture. Inject a two part epoxy resin into holes, fracture to be filled with a stone dust mortar repair.

6.7.6 Consolidation of Sandstone with Ethyl Silicate

Sandstone consolidation to cappings and stringcourses at both levels– brush off friable areas, and consolidate the sandstone with ethyl silicate consolidant.

Consolidation of sandstone with ethyl silicate (Wacker OH 100 brand most often used) is considered the most effective process to use on damaged and deteriorated wall areas that have been cleaned and poulticed. Apply a number of coats (3 or more) of liquid chemical to manufacturer's specification and dilution until stone section is saturated appropriately. Note that this material will be applied after all stone repairs and repointing has been completed.

6.7.7 Lead Dressings/Weatherings

Install lead dressings to base of spires and to top of box gutters to the nave and aisles. Install lead capping on the parapet wall tops of the nave and aisle (ie the outer edge of the box gutter). The application of lead capping is required as a shelter coat will not provide long term water repellency for this high level element. This approach will be necessary to prevent continued deterioration of the limestone in the future, as monitoring of the shelter coat and new works will not be easily undertaken at this high level.

Lead ridge capping to be renewed at the top of all ridges.

An experienced roof plumber and lead worker should be sub-contracted to design and install lead dressings in these locations. Finishing should be neat and watertight.

6.8 Stone Replacement - Finials to Lady Chapel

Carve and install 8 finials to match the original on the Lady Chapel – note that there are six nearly complete existing finials located at the base of the Lady Chapel.

Use high quality Waikerie limestone for finials or alternative sources of similar coloured stone may be located. Reuse sections of the original finials where possible if recommended by stone contractor. Carving of the finials to be undertaken by specialist banker masons. Mason to propose work schedule for the reuse of the existing finials.

6.9 Stained Glass Windows - Refer separate leadlight window assessment (Appendix 9) and general notes as follows:

6.9.1 On Site Window Inspection

All windows are to be inspected by a specialist glazing conservator and discussed with the Architect before commencing works. All windows are to be photographed externally before being repaired as a whole and on a section by section basis.

6.9.2 Stained and Coloured Glass

Only glass of a quality equivalent or better than that used in the existing window should be used.

Replace missing coloured glass with new glass that matches the existing in all visual qualities. Broken glass is to be retained and reused wherever possible.

6.9.3 Lead Cames

New lead cames shall match the existing in shape, seize, depth, heart thickness and cross section, unless greater structural support is needed. Any glazing requiring such support is to approved before reconstruction of windows commences.

6.9.4 Reinforcing Bars

Existing reinforcing bars shall be retained and reused where sound and structurally appropriate to the need. New reinforcing bars where required shall match the existing in shape, size, material and finish.

6.9.5 Off Site Restoration (Glazing Removed To Studio)

Where necessary, remove individual window sections requiring restoration work. Leave window frame intact wherever possible. Disassemble only those window sections requiring restoration work.

6.9.6 Reassemble Windows with New Lead Cames

Waterproofing cement shall be thoroughly forced into all leads, both sides. All excess shall be removed so that none remains on the glass surface nor around the edges of leads.

6.10 Metal Work

Repair and repaint all metal work in black as required undertaking rust treatment where required.

6.11 Timber

Repair and repaint all timber elements including porch on south side, and clear finish to east and north access doors. Cut out and repair any damaged timber, ensure watertight finish. Ensure protection of stone surfaces when painting.

6.12 Bird Proofing

Install bird proofing via stranded wire system to the following areas:

- North and South tower window openings – bird proofing to lower two lovures, on all faces of the towers, ie 8 faces
- Horizontal ledges at the base of both spires – ie at junction with towers.
- Base of window sills on windows to the upper levels of the nave

6.13 Internal Render Repairs

Repair all drummy render to the nave walls associated with external leaks. Cut out drummy render, and allow to re-render in render which matches the original composition in colour texture and composition. Undertaken sampling of render to determine original composition and apply render with finish to match existing. Undertake render repair sample for checking by architect prior to undertaking all repairs, to ensure of colour and texture match. The most appropriate method of repair needs to be determined once extent is clarified.

7.0 MANAGEMENT ISSUES – KEY RECOMMENDATIONS

7.1 Constraints Arising from Statement of Cultural Significance

Section 3.0 outlines the conservation significance of the building and any future conservation of the building should be undertaken in a manner which does not compromise or remove any of the cultural significance.

7.2 State Heritage Place Implications and Approvals for Works

Reference should be made to this report when undertaking any conservation or maintenance, to ensure that any proposed works accord to the general recommendations and spirit of this report.

Any major works undertaken at the building should be undertaken to the direction of an experienced Conservation Architect. This is important to ensure that the significant fabric of the building, both (the exterior and the interior) is appropriately handled, and no future works diminish the significance of the building. In addition any new development on the site should not detract from the significance of these buildings. Any new landscaping should be carefully considered to provide an appropriate setting for this building.

The *Development Act, 1993* established a legal structure for controlling the use and development of land throughout South Australia. As part of this legal structure, any proposed works (small works may be exempt) to the cathedral will require development approval from the Local Government Authority, in this case, Adelaide City Council. As the cathedral is also listed as a State Heritage Place, the DEWNR and the South Australian Heritage Council are responsible for protecting and conserving non-Aboriginal cultural heritage of state significance, and the South Australian Heritage Unit will be involved in the development assessment process. The Development Act 1993 requires all development applications affecting state heritage places to be referred to the Minister responsible for the Heritage Places Act 1993. DEWNR conservation architects advise the Minister, and in some instances, act as the Minister's delegate regarding commenting on and approving applications for development of heritage places.

7.3 Organ Restoration

At the time of this report preparation, a separate initiative is underway to restore the Cathedral organ. This report does not cover this matter, or include any costings for this separate project.

7.4 Potential Funding Sources

The funding for conservation works can be assisted by grants or loans from Government agencies. These include:

- **Heritage SA Grant Funding** – The DEWNR administers grants for heritage projects through the State Heritage Grants Program which operates on a July to June financial year basis. DEWNR administers the South Australian Heritage Fund allocating funds for projects across the state to repair and restore significant state heritage places. $150,000 has been allocated for projects all across South Australia to be completed before June 2014. This indicates that there is not much assistance available through this avenue. Applications for grants are called annually, by notices in The Advertiser newspaper and the Heritage South Australia Newsletter.
- **2014-15 SA Heritage Fund Grant program -** The SA Heritage Fund Grants program for 2014-15 is yet to be announced. Further information will be posted on this DEWNR website when details are available.
- **National Heritage Funding Initiatives** – This Australian Government has previously provided assistance to restore and conserve Australia's most important historic heritage places. However there is no current funding opportunities via the Federal Government

A special federal government allocation for funds should be requested through the Minister for Heritage, as there is a history of this occurring at other cathedrals who have received special one off grants for major conservation projects.

- **St. Peters Cathedral Restoration Fund**

  The Cathedral currently has a tax deductible Restoration Fund via the National Trust of South Australia.

- **Adelaide City Council Heritage Incentives Scheme**
  This source of funding is only applicable if the State Heritage Fund has refused funding for the project. A special allocation could then be made. Applications can be submitted for funding of

7.5 Security, Services and Building Protection

There is currently a security system installed in the cathedral and monitored by Chubb. The Cathedral should constantly review the protective arrangements to ensure that these are satisfactory. If not, the relevant Cathedral Committee should develop an upgraded building protection strategy.

7.6 Interpretation

There are currently several informative brochures that provide information about the cathedral. In addition there is a section of the Cathedral devoted to the display of early photographs and historical information which is well presented.

Although current interpretive media is satisfactory, the Cathedral may consider establishing an interpretation program comprising of guided tours such that users and visitors have a greater understanding the cultural value of the place.

Views of interpretative material in the Cathedral including the model

7.7 Maintenance and Archival Recording of Works Undertaken

A systematic program of maintenance is required for the Cathedral to ensure that no elements deteriorate further. It is recommended that a record of maintenance be undertaken and an example of an external maintenance schedule is included on the following page

A systematic archival system needs to be established for the Cathedral, holding the early drawings, reports and early photographs. This needs to be managed, so that items are not borrowed or lost. All the reports compiled as part of this report preparation should be included in this collection. An archivist should be allocated the task of managing this collection.

7.8 Conservation Project Implementation

The method statements prepared in this report provide a basis for any future Specification which is to be prepared for conservation works to be undertaken to the Cathedral.

This report does not comprise a full Specification of Works, but has been prepared as a guiding document for the Cathedral, which has allowed for the required Scope of Works to be ascertained, and also an indicative budget to be prepared.

Once the priorities have been agreed and some funds have been raised, Stages of Work will need to be documented either as trade packages for implementation as funds allow. This will require the engagement of a conservation architect to undertake this documentation based on this report and Dilapidation Survey. The Cathedral will also need to establish relevant committees to ensure the implementation of the recommendations of this report. Fund raising and marketing of the project will be required including the preparation of pamphlets extracting relevant information from this report.

EXTERNAL MAINTENANCE SCHEDULE

Area of Building	Recommended Assessment	Date of Works and Extent	Contractor for Works	Cost of Works	Source of Funding
Drainage Stormwater pipes Groundwater drainage sump	Every 6 months				
Roof Cladding Flashings Fixing and cappings Gutters and brackets Rainwater heads Downpipes Eaves *Are stormwater pipes blocked?* *Do gutters need cleaning?*	Every 12 months - clean gutters				
External walls Stone walls (bluestone , sandstone and limestone) Slate thresholds Windows – check glazing & leadlight Timber doors & hinges *Is there any dampness? Is there any build up of the ground level.*	Check every 5 years				
Internal Elements Rendered elements Timber ceiling Tiled floor *Is there any dampness?*					

8.0 PRIORITIES – KEY RECOMMENDATIONS

8.1 Structural Condition

The engineer's assessment (refer report Appendix 5) has confirmed that there are no immediate structural issues for the Cathedral and the building is in sound condition. Fortunately one loose finial on the front East elevation was located during the site inspection for this report – this could easily have fallen off in a high wind. The finial has been removed for safe keeping and has been documented as needing reinstatement as part of the Conservation Works.

Following from the analysis and recommendations provided in Section 4, the following priorities are recommended:

8.2 Urgent Works

- **Current access arrangements for roof maintenance** - these are considered a high risk for both the Cathedral and the roofing contractor. A roof safety access audit inspection has been undertaken by Joe Tindal of Hallweld Bennett Pty Ltd. This report provides recommendations for making the maintenance and regular cleaning of gutters accord with current access standards. Currently these are not in accordance with current safety requirements, and therefore it is considered that the Cathedral is at risk should there be an accident (refer report Appendix 6). Refer also section 4.4 which outlines that the internal roof access passage flooring is not safe. Annual cleaning of gutters is required, but until upgrade works are undertaken, these should not be accessed via the roof.
- **Roofing Works** – re-leading of ridges and flashing of clerestory and aisle gutters, and associated storm-water works. This would prevent any future leaks to the roof.

Priorities of remaining Conservation Work – given that an overall and comprehensive conservation project for the Cathedral is the ideal, it is also acknowledged that staging of works will be required as funds are made available.

Therefore this Conservation Strategy recommends priorities which are as follows:

8.3 High Priority Works

- **Front (East) Façade and Towers** – these are major works and would have the most visual impact, and therefore are seen as a high priority. Given the deteriorated condition of the limestone on the towers, there is some urgency in undertaking this work. Works would include all stone conservation and repairs, in addition to façade cleaning. Restoration of the leadlight windows in the tower room would be undertaken when the scaffolding was in place.
- **Removal of bitumen paving at base of north wall -** This recent sealing of the ground adjacent to the base of the wall will likely cause rising damp and will need to be rectified by cutting away the bitumen and creating an area which 'breathes' adjacent to the Cathedral.

8.4 Medium Priority Works

- **Stage Three**: North façade Conservation Works (excluding Lady Chapel section and including leadlight repair work and installation of window protection system).
- **Stage Four:** South façade Conservation Works (excluding Lady Chapel section and including leadlight repair work and installation of window protection system).
- **Stage Five**: Internal repairs associated with previous leaks

8.5 Long Term Works

- **Stage Six**: Lady Chapel Works including leadlight repair work and installation of window protection system.
- **Stage Seven:** Conservation Works to limestone wall separating Cathedral and Cathedral Office Complex.

9.0 COSTINGS

A Quantity Surveyor has been engaged to assess this report and the dilapidation survey and has provided the following preliminary estimate costings for the future planning and management of this building.

9.1 Urgent Works

- **Current access arrangements for roof maintenance -** price provided by Joe Tindal of Hallweld Bennett Pty Ltd. (refer report Appendix 6)

- **Roofing Works** – re-leading of ridges and flashing of clerestory and aisle gutters, and associated storm-water works. This would prevent any future leaks to the roof. – price provided by James Henry Roofing (refer report Appendix 7)

  Total Budget Amount for all urgent works including above, professional fees and scaffolding: $1,290,000

Priorities of remaining Conservation Work – given that an overall and comprehensive conservation project for the Cathedral is the ideal, it is also acknowledged that staging of works will be required as funds are made available.

Therefore this Conservation Strategy recommends priorities which are as follows:

9.2 High Priority Works

- **Front (East) Façade and Towers** including leadlight repair work and installation of window protection system – refer Dilapidation Survey for extent

  Budget Amount including professional fees and scaffolding: $1,500,000

9.3 Medium Term Works

- **Stage Three**: North façade Conservation Works (excluding Lady Chapel section and including leadlight repair work and installation of window protection system).

  Budget Amount including professional fees and scaffolding: $776,000

- **Stage Four:** South façade Conservation Works (excluding Lady Chapel section and including leadlight repair work and installation of window protection system).

  Budget Amount including professional fees and scaffolding: $675,000

- **Stage Five**: Internal repairs associated with previous leaks

  Budget Amount including professional fees and scaffold/scissor lift access: $121,000

9.4 Long Term Works

- **Stage Six**: Lady Chapel Works including leadlight repair work and installation of window protection system.

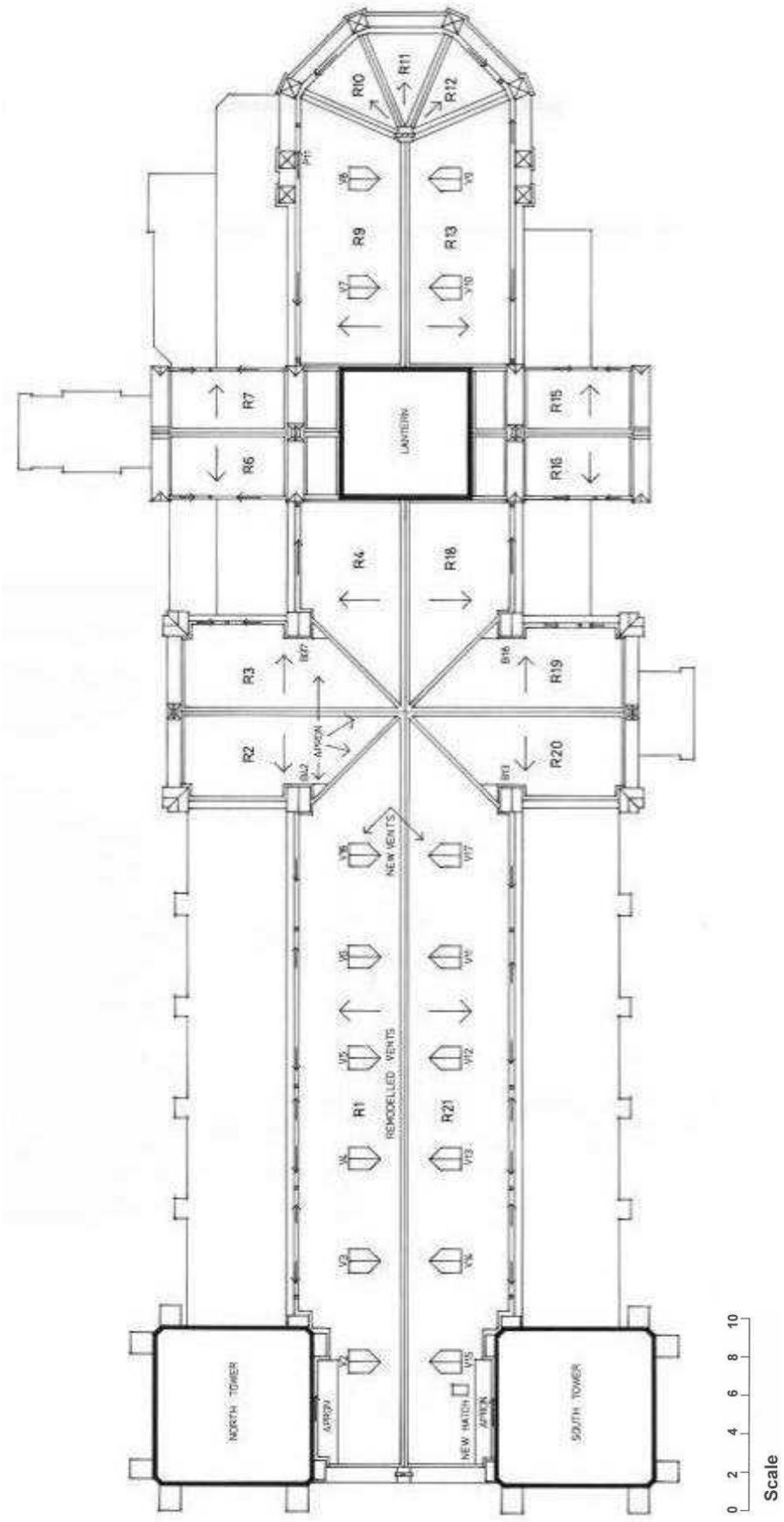
  Budget Amount including professional fees and scaffolding: $640,000

- **Stage Seven:** Conservation Works to limestone wall separating Cathedral and Cathedral Office Complex.

  Budget Amount including professional fees and scaffolding: $13,000

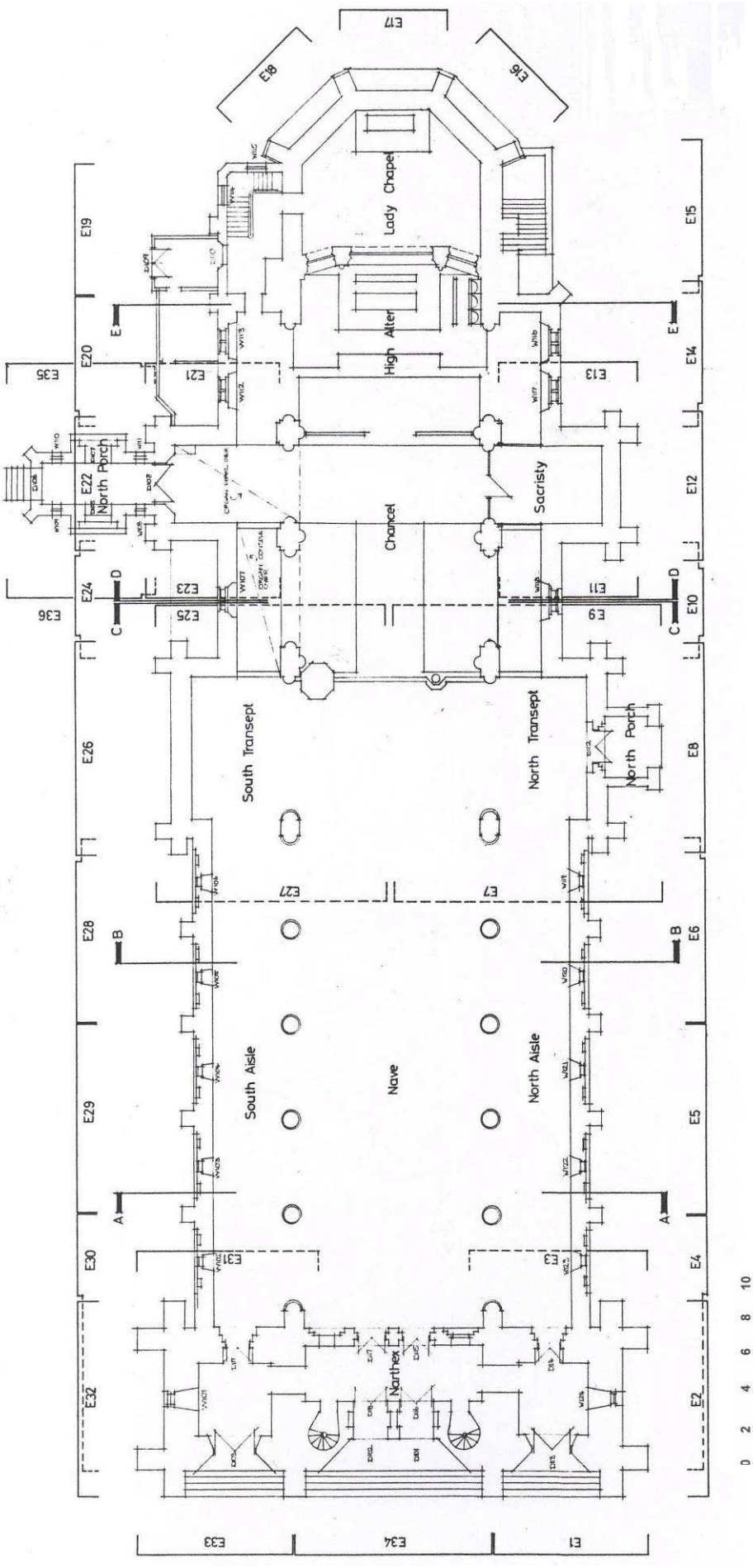
  Total estimate at January 2014 - $5,015,000
  Excludes – Structural works for extreme conditions, any work to the organ, upgrade of security system, GST and escalation.

10.0 EXISTING DRAWINGS OF THE CATHEDRAL



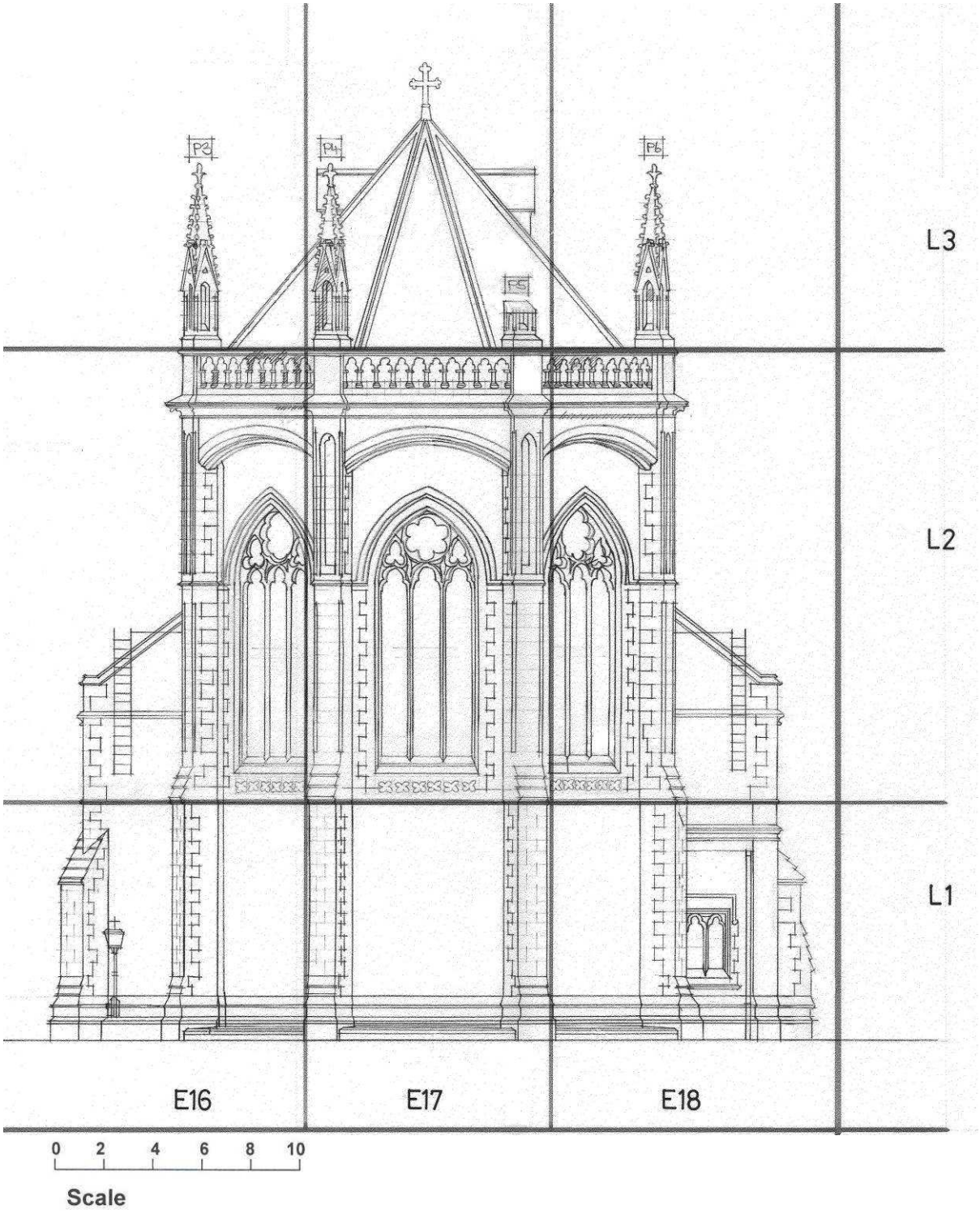
ROOF PLAN **N** **(report purposes only)**

(Woods Bagot, 1990 – note that this drawing includes roof vents along the nave, but these have been removed in the 1990 reroofing works)

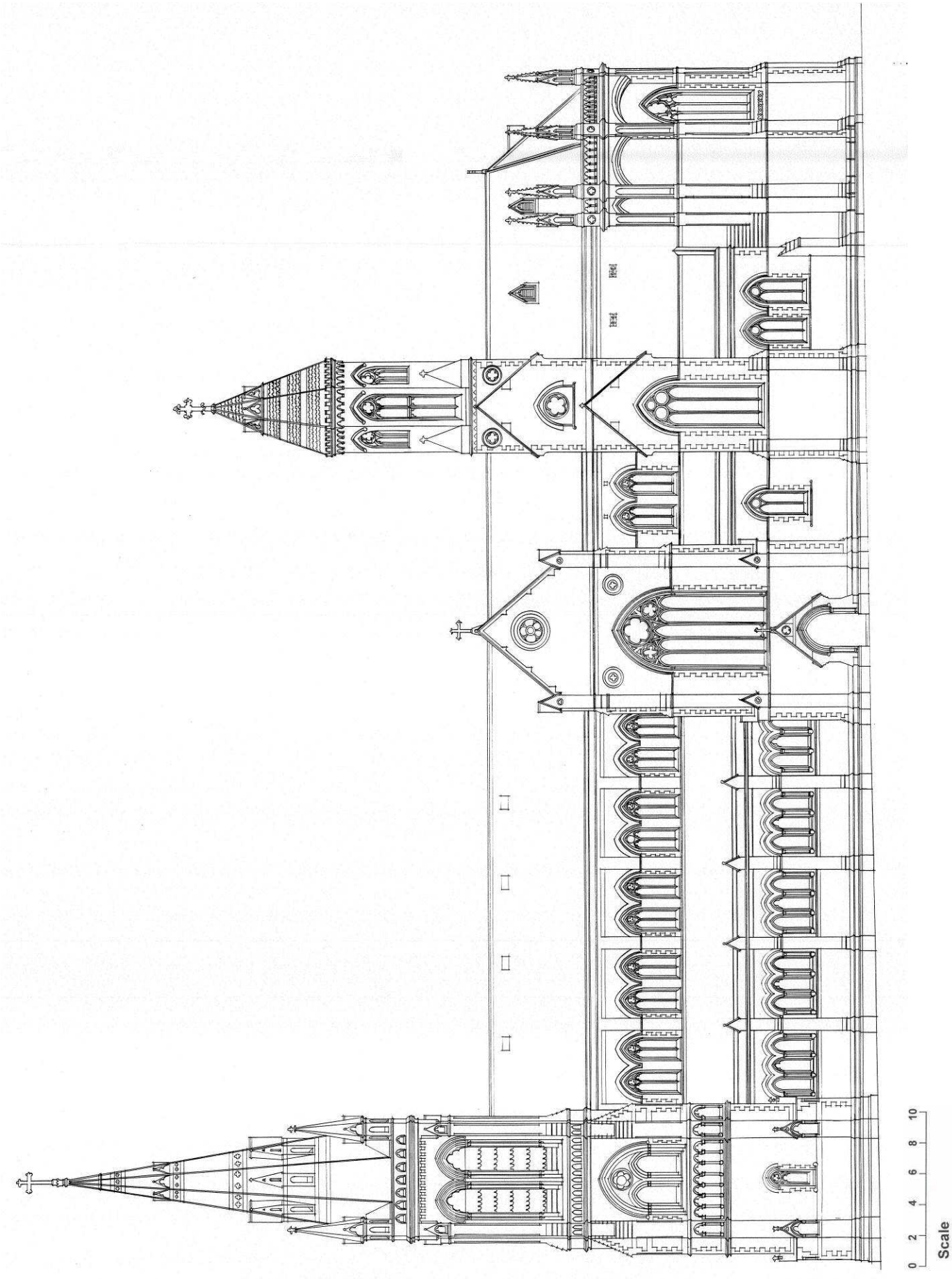


FLOOR PLAN **N** → **(report purposes only)**

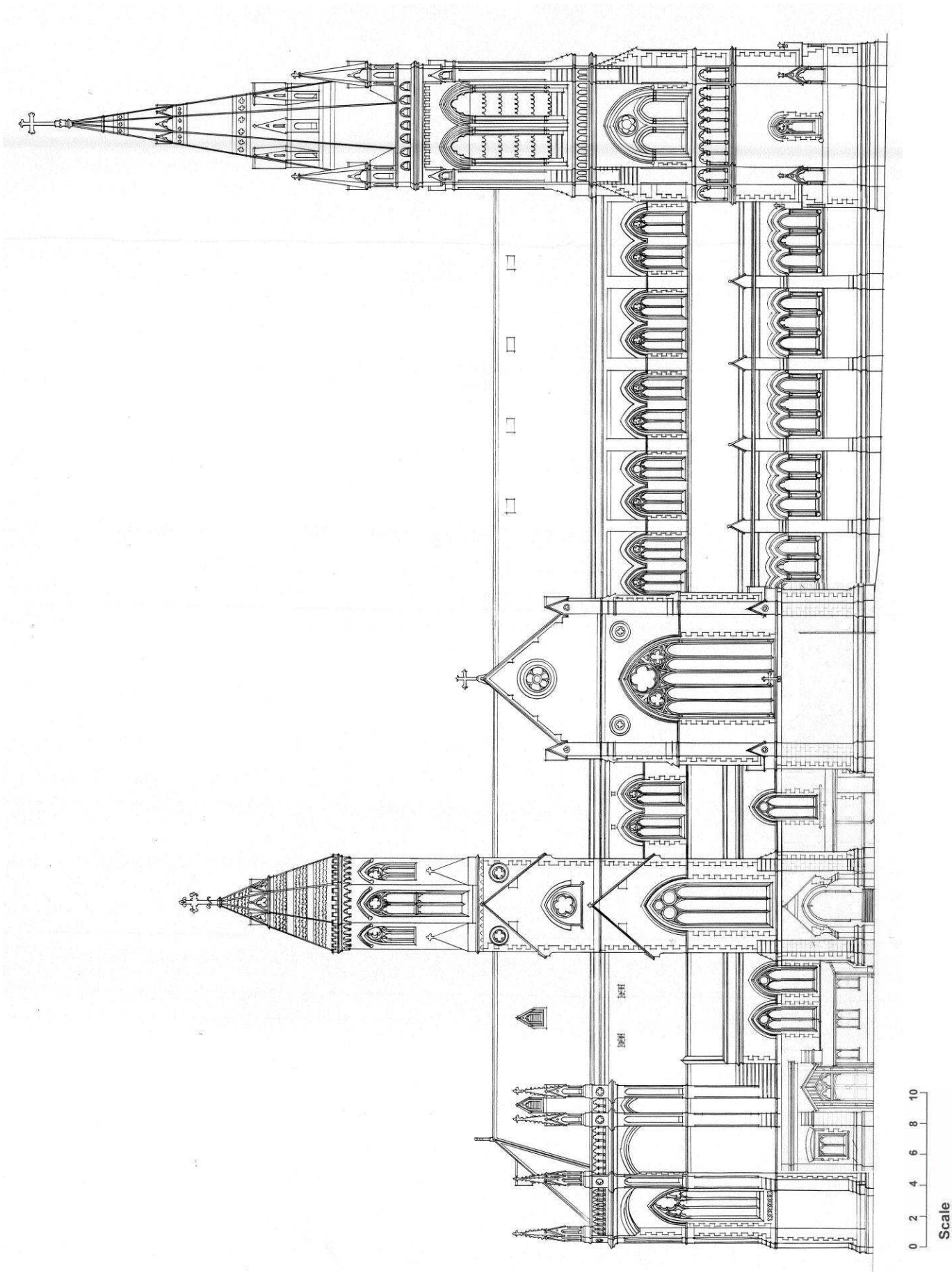
(Source of plan is Woods Bagot, 1990)



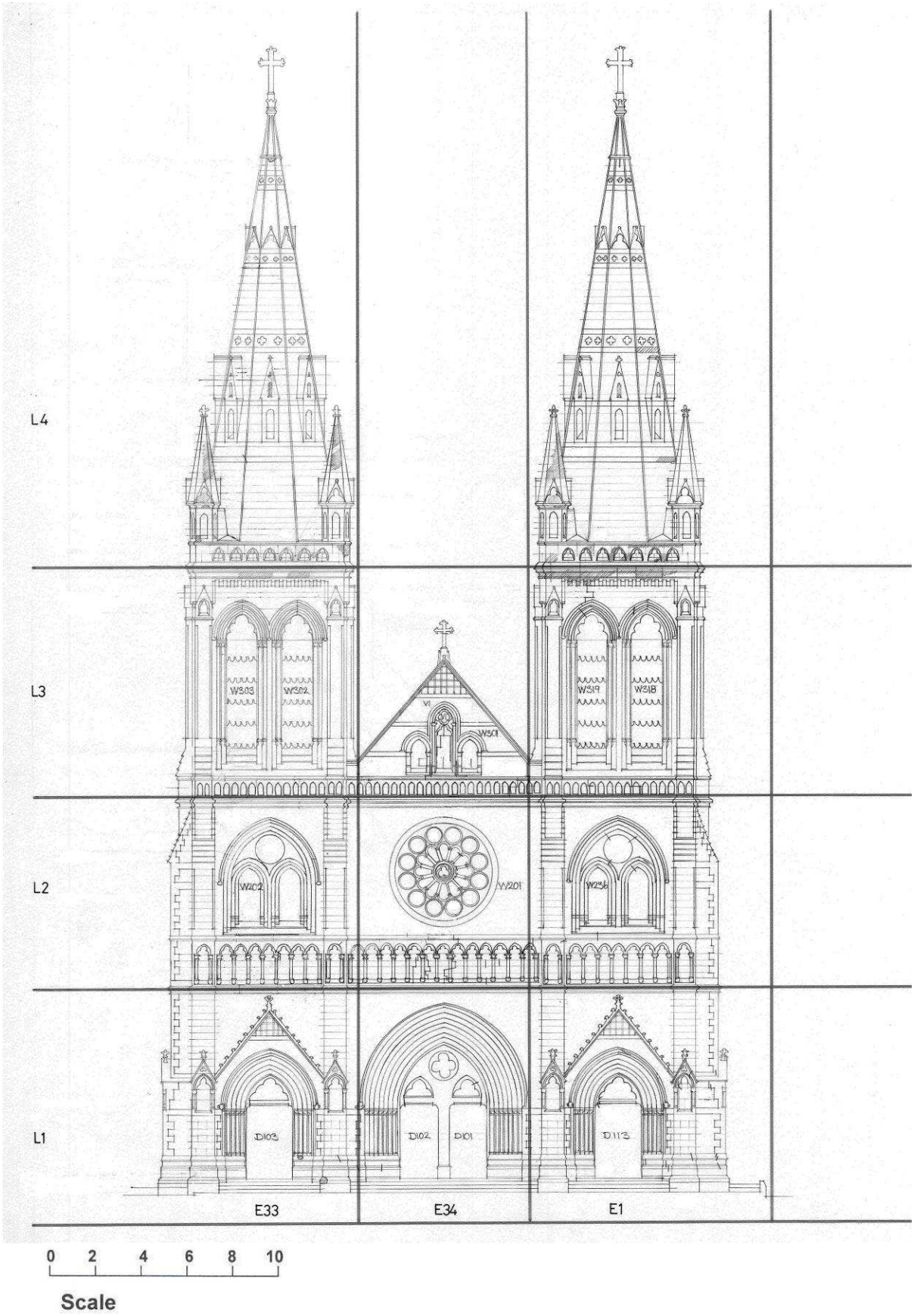
WEST ELEVATION
(Woods Bagot, 1990)



NORTH ELEVATION
(Woods Bagot, 1990)



SOUTH ELEVATION
(Woods Bagot, 1990)



EAST (LITURGICAL WEST) ELEVATION
(Woods Bagot, 1990)

APPENDICES