Appendix C –

Oatlands Gaol Structural Report

Peter Spratt 2005.

PETER SPRATT

CONSULTING CHARTERED ENGINEER

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19th. January 2005

Ref No 7580

Mr. Brad Williams
Heritage Project Officer
Southern Midlands Council
71 High Street
Oatlands
TAs 7120

Dear Sir,

Oatlands Gaoler's Residence
Structural Report

Thank you for your request to provide a fee proposal for the above.
I have read the Gaol Remedial Works Report by B and E Bjorksten which you sent to me and I advise that:-

- The report has, I believe, correctly identified the structural problems as being due to roof movements.
- The roof defects will be inclusive of inadequately sized members and the adequacy of their connections and most importantly correction will need an overall examination of how and why the roof and its elements move under wind load. This has not yet been done and there is need for a site inspection to determine and catalogue the roof defects which have led to the observed movement effects and to then work out the best means of correction.
- There is need to additionally address the wall construction and its weaknesses made evident by the roof loading.
- The problems described are common but construction details and site specifics require site specific solutions.

I suggest that I inspect the building in your company and that of the Bjorkstens and provide an integrated Structural Report listing all of the observable defects of both roof and walls and their interactions and including recommended remedial works and cost estimates.

My fee for the Report as above including travelling would be $700.

Yours faithfully

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21st. March 2005

Ref No 7580

Mr. Brad Williams
Heritage Project Officer
Southern Midlands Council
71 High Street
Oatlands
TAS 7120

Dear Sir,

Gaol Yard Wall to North Side on Mason Street

I have, to your request inspected this wall and I advise that :-

1. Wall Dampness.

The wall retains fill and is subject to water drainage from:-

- The old convict drainage system as shown in the Bjorksten Report.
- Lawn watering from swimming pool area.
- Possible leakage from pool.
- General ground water flow into fill behind wall.

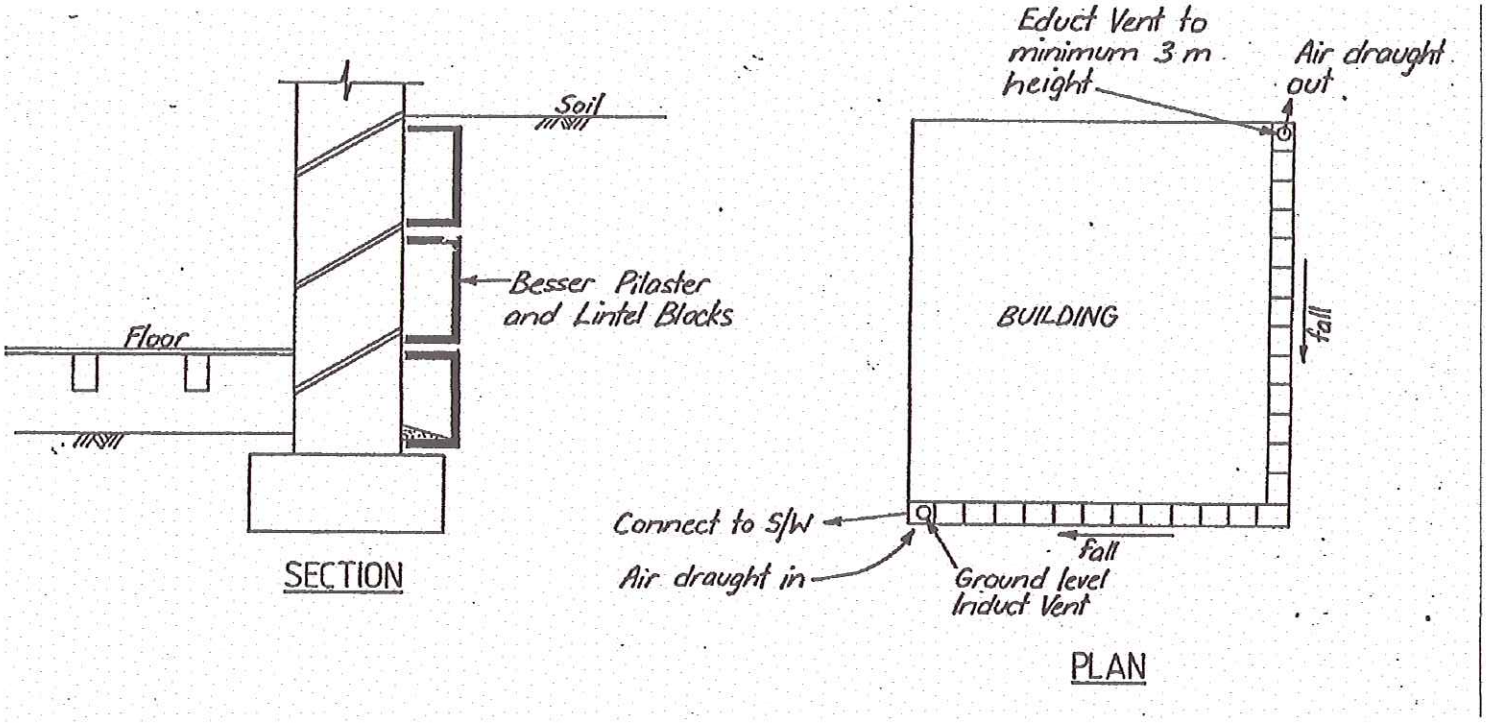
The face of the retaining wall above Mason Street road level is subject to rising dampness and major stone fretting and there is no doubt it is due to water entry from the above sources.

2. Assessment and Recommendation.

Removal of the swimming pool as has been suggested is unlikely to remove the problem.
Best effective course of action is to prevent, as far as is practicable, water entry into the wall.
I have developed an air vent drain technique as the attached description and recommend that it be constructed to Mason Street road level on the top side of the affected wall.

Yours faithfully

PETER SPRATT



AIR VENT DRAIN

AIR VENT DRAIN PRINCIPLE

The air vent drains

- remove wet soil from against the exterior building walls.
- by being laid open jointed they pick up surface and subsurface waters and lead them away from the building.
- provide an air cavity below ground level against the building walls.
- by containing an induct vent grate at their lower end and an educt vent pipe at their upper, provide a drying air current against the wall and ventilate the air vent in the same manner as sewer pipe ventilation.
- Use concrete pilaster or lintel blocks with open face against the wall so as to allow the air draught to dry out the wall below ground level.

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17th. March 2005

Ref No 7580

Mr. Brad Williams
Heritage Project Officer
Southern Midlands Council
71 High Street
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TAS 7120

Dear Sir,

Oatlands Gaol
Structural Report

I have, to your request, carried out an inspection and I now report on the above.
I visited the site and inspected the building in your company and that of Mr. Barry Bjorksten on the 24th. February last.
My inspection was visual externally and internally and included the roof space.

This Report follows on and is an addendum to the Remedial Works Report 2004 on the Oatlands Gaol by Barry and Eleanor Bjorksten.

This Report is based upon my site observations.
I have drawn upon the very detailed and comprehensive Bjorksten Report as needed.
You will appreciate that I neither designed nor constructed this building and whilst I can observe defects and deduce causes there will be unknowns which are covered up and which may affect the structure now or in the future.
Defects found during uncovery or remedial works will require a new assessment.

I advise that :-

1. **The Building**

The building is of two story ashlar sandstone construction with galvanised iron hipped roof.
Ground floor is a mix of sandstone flags and timber and first floor is timber. The building is on the Tasmanian Heritage Register No.R5067 and any work requires the approval of the Tasmanian Heritage Council but is eligible for a Heritage Grant by virtue of the registration.

Photo 1.East front and north side walls.

2. Site Observations

The following comments are illustrated by the wall movements and roof framing description and plans as attached from the Bjorksten Report and photographs 2 – 8.

- The building is ashlar faced with few headers bonding the facing to the main wall behind.
- The stones are bedded in site soil with little or no quicklime with the result that the bedding has little bond strength and is readily washed out with water entry.
- The ashlar stones are of variable thickness and it is indicated that some stones provide little vertical support area to the stones above.
- The roof load is on the ashlar facing and any roof vibration or movement is transferred into the ashlar.
- The roof ridges are not adequately supported and the ceiling joists do not tie the roof rafter landing plates in either direction between the outside walls. As a consequence the roofs have spread as the roof ridges have dropped.
- The roof framing timbers have excessive slenderness ratios and readily buckle under compressive wind forces.
- There is major water entry into the walls from faulty gutters, downpipes and flashings.
- The water entry has caused major rot of critical supporting timbers in the roof.
- Structural alteration with the removal of essential load bearing walls on the first floor west side has resulted in overload and adverse deflection of members tying the roof structure together and imposing additional laminating stress on the ashlar at the wall plates on the east and west sides.
- The combination of roof ridge drop, member buckling, poor ashlar bonding of roof loads on the ashlar, likely bedding washout and rot of critical roof timbers has led to extensive ashlar delamination and cracking of the ashlar and cracking of bonding internal cross walls at their junction with the external walls.
- I can account for all of the external wall cracking and movements through these defects.
- There is no arching of any of the cracks in the external walls and hence no present evidence of foundation settlement.
- There may be some secondary wall cracking through wet/ dry clay ground heave but , excepting for the SW corner , the wall cracks on the outside of the external walls are not reflected inside suggesting that foundation movements are not occurring excepting perhaps at this corner. The question of reflective wall cracks is, however, masked by the ashlar delamination so that a definitive statement is not possible. The solution is to correct the primary roof movement and to monitor the result to ascertain if minor foundation work is warranted.
- The site is subject to high wind loads which are of the order of 2 to 3 times the wind loads in England where the building design originated.

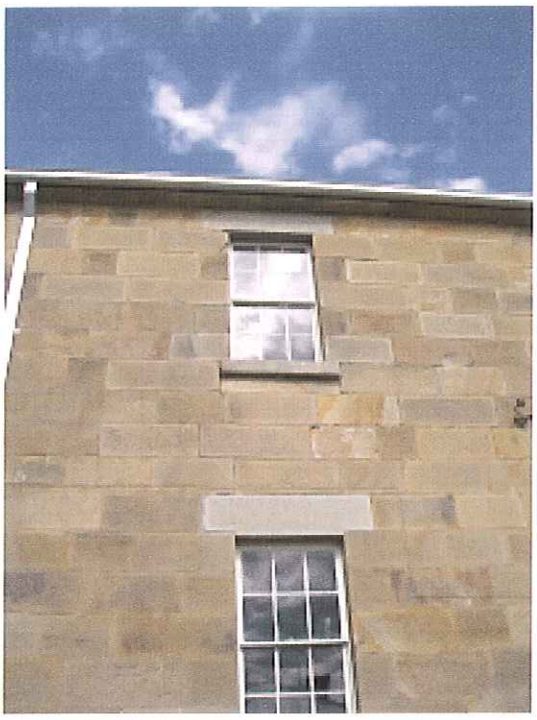


Photo 2. Note lack of headers and vertical stone cracking between windows indicating ashlar movement and delamination

Photo 3. Site soil bedding and variable thickness.

Photo 4.
The roof lands on the outside ashlar.
Note the joists on the right are parallel to the wall plate and there is no connection between the roof and the joists.

Photo 5.
Note the very slender roof members which readily deflect or buckle in compression.
Compression member span divided by member minimum thickness should not exceed 50.

Photo 6.
Rot of ceiling tie beams with water entry.
A supporting wall has been removed increasing beam span and deflection.

Photo 7.
As photo 6 from above.
The beam deflections have dropped the ends of the joists which the beams support.

Photo 8.
Typical roof construction with inadequate ridge support, readily buckled struts and braces and with all roof timbers undersized.

3. Assessment.
The problems with the building structure are due to :-

1. The wind being able to move to move a poorly constructed roof of light timbers and with the roof load landing on an inadequately bonded ashlar facing causing differential ashlar movement and delamination..

2. Water entry into site soil bonded ashlar stonework with an inadequate number of headers and with a variable ashlar stone thickness where thin section or sharp edged ashlar gives little vertical support to stones above.

3. The specific construction details of lack of ties across the building between the roof rafter landing wall plates.

4. The specific construction details of inadequately supported roof ridges and the use of undersized roof framing members which readily buckle under wind load.

5. The specific later removal of critical supporting walls exacerbating the effects of the problems.

6. Water entry from gutters and flashings particularly from the central east to west defective valley gutter causing rot of critical support beams to the roof and the first floor under.

7. Numerous minor local effects of the above as detailed in the Bjorksten report.

4. Recommended Works and Cost Estimates.
The works are simple and consist of stiffening the roof, making good the ashlar delaminations and of replacing the removed wall and making good the defective gutter and associated rotted timbers.

The roof is best practice stiffened by constructing timber trusses along the roof ridge lines and as truss underpurlin support to the roof rafter centres with truss bottom chords simultaneously stiffening the ceiling joists under. The trusses will additionally tie the roof structure to all the building walls.
I have effectively used this technique on a large number of historic buildings with the same roof problem.
Figure 1 attached shows the concept.

The ashlar delamination is simply and effectively corrected by grouting and spiking the delaminated sections to solid.

First works are to rebuild the removed walls and to make good the rotted roof timbers and floor timbers caused by the defective valley gutter.

Minor finishing works are the making good of wall cracks and of local effects as noted in the Bjorksten Report.

My cost estimates are inclusive of all of the above structural items but are exclusive of finishes.
Costs are based upon the current contract rates of similar works elsewhere.

Peter Spratt
ABN 55 120 015 973

The works and estimates are :-

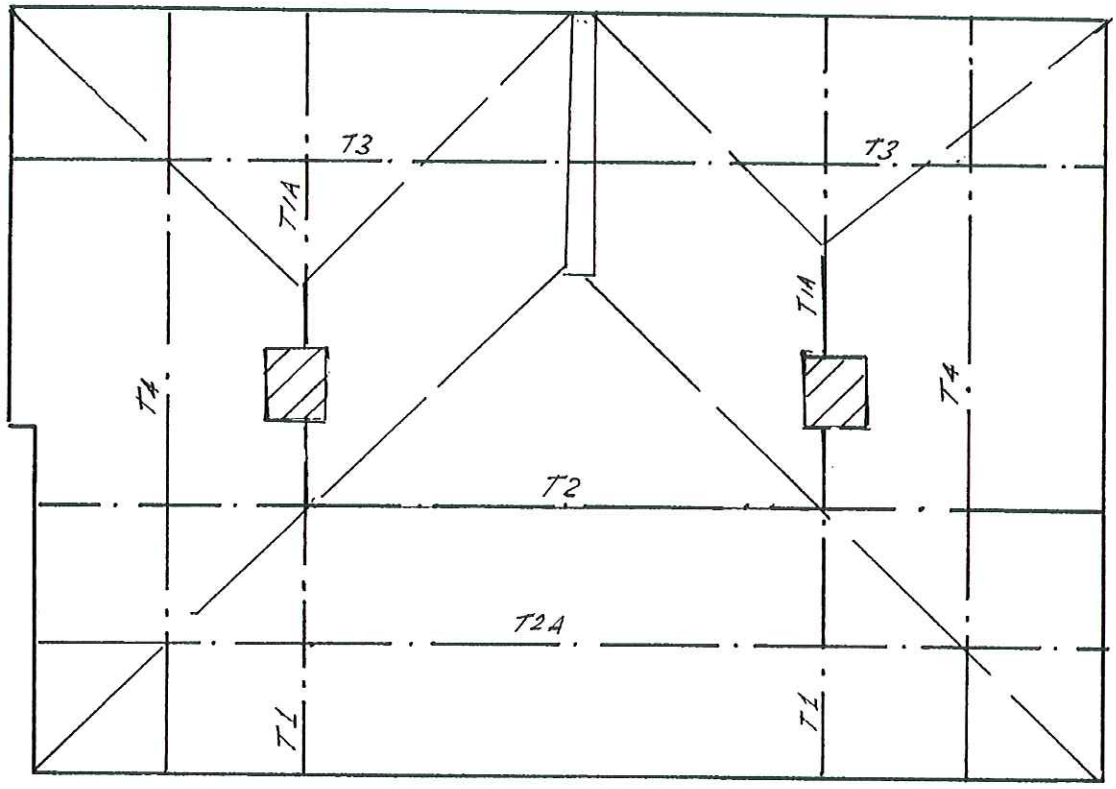
- Rebuild the removed walls.
- Make good rotted timber beams and joists in roof and first floor under valley gutter.
- Stiffen the roof. Construct trusses along roof ridges and connect to ceiling joists and wall plates. Construct trusses along roof rafter centres and connect to ceiling joists and wall plates.
- Spike and grout delaminated ashlar to solid.
- Make good defective valley gutter.
- Make good wall cracks and carry out minor local defect repairs.

	$48,000
Contingency	$5000
Fees	$5000
GST	$5800
TOTAL	**$63,800**

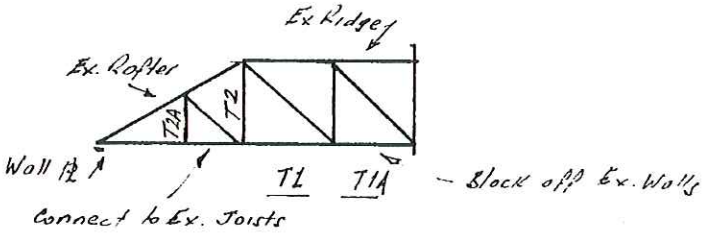
Yours faithfully,

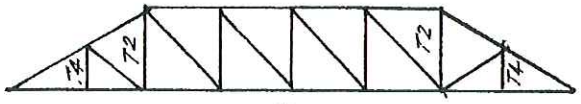
PETER SPRATT

Peter Spratt
ABN 55 120 015 973



ROOF PLAN
Trusses T





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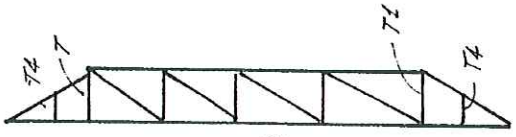

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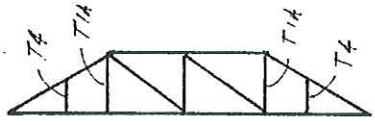

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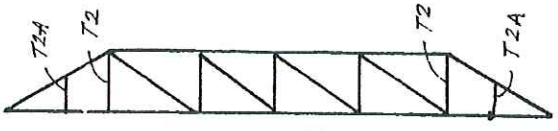

T4

OATLANDS GAOL
ROOF STIFFENING

FIGURE 1