FRONTIER
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ARCHITECTURAL, STRUCTURAL & CIVIL

Detailed Seismic Assessment
Commercial Building

Location: 11b Allandale Road, Hawarden 7385
Client: Hurunui District Council

Job No: FC19037
Issue Date: 15 August 2019
Revision: 00

Document Quality Assurance Record

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Document Transmittal

Rev	**Date**	**Revision Details/Status**	**Author**	**Reviewer**
00	15 August 2019	Issue to Client	Peter Duncan	Alan Pearson

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1 INTRODUCTION

This report covers the investigation into the Multi-Use Community Building at 11b Allandale Road, Hawarden

The report covers three aspects of the building:

1. Condition Assessment and Earthquake damage assessment
2. Engineering seismic risk assessment
3. Recommendations for repair and maintenance

1.1 Site Details

Address	11b Allandale Road, Hawarden 7385
Owner	Hurunui District Council
Architect	N/A
Engineer	Frontier Consultants NZ Ltd
Geotechnical Report	N/A
Site Area	N/A
Council	Hurunui District Council

1.2 Building Description

The building structure is a single level community building built using various construction methods including timber frame, reinforced concrete masonry block, and precast concrete panel.

The building includes a bar/function (social) area, change rooms and showers, kitchen, two squash courts, and associated change room facilities. The main rugby change rooms open onto a concrete viewing deck which opens onto the playing field.

Building Element	**Description**
Foundation	Slab on grade.
Walls/External Cladding	Main area – Reinforced concrete masonry timber frame Squash court – Precast concrete panels, and reinforced concrete masonry Fibre Cement Sheet above concrete panel Fibre Cement board – change rooms (part)
Walls/Internal Lining	Main building – wall sheeting various types
Roof - Structure	Column and Truss (main function area) Portal frame with infill timber frame (Changerooms) Beam and column (Squash court and facilities)

The Building has been divided into three main areas and throughout the report some different room titles have been used.

The Original building is of unknown age and is described as the original building or the "rugby" rooms. For the purposes of analysis, the change rooms constructed with the squash court/social area have also been included in this area. The original building is concrete masonry walled structure with internal steel portals supporting the gable roof and braced with timber frame and masonry walls. Horizontal bracing loads are resisted by longitudinal and transverse bracing walls. We have assumed that the building is circa 1965, based on the size of the steel in the portal frames in the change room which indicates that it is before 1975.

The "social area" is also described as the main area and includes the open plan area, kitchen, storerooms and bar area. The toilets and showers jointly used by the squash players were constructed with this area; as indicated above these rooms are analysed with the original building because the form of construction is like the original building. The social area is open plan and is constructed from timber trusses on reinforced concrete masonry columns. Horizontal bracing loads are achieved by the connection to the original building, and transverse horizontal loads are reacted by the columns. The building permit information indicates that the building was constructed in 1982/1983.

The two squash courts and viewing area were constructed last. We have not been provided with information on the squash courts. The front wall is precast concrete panel. The middle wall may be precast panel. The external side walls are reinforced concrete masonry block forming the rebound surface and timber frame above supporting the roof. The drawings of the social room reference the proposed squash court, so we have assumed construction circa 1985.

1.3 Executive summary

We have reviewed the building for overall condition as well as conducting a seismic risk assessment on the building.

In a repaired state, the overall seismic risk assessment is 72%NBS. The summary and the detail in the report provide the reasoning for this assessment.

The key findings are:

- The building is in “fair to good” condition
- There is earthquake damage which should be repaired.

1.3.1 Condition Assessment and Earthquake related damage

There are three aspects to the condition assessment. These are discussed as Earthquake related defects, Historical (normal age and condition-related defects) and Design related defects.

Based on our visual inspection and non-invasive testing we suggest that, structurally, the building is on balance in “fair to good” condition. There is some earthquake related damage to the structure indicated in the table below.

There is also evidence age and wear related defects and damage caused by using the building. It is “lived in”. Age and wear defects are noted but are not significant.

The third aspect – design related defects – is related to how the building is used now compared to how it was envisaged to be used when constructed. There are no indications of design related defects.

There are 5 elements which are clearly damage caused by an earthquake. The most likely event is the Kaikoura earthquake of October 2016. Reasons for indicating that there is earthquake damage and discussion are given in the body of the report.

The Earthquake damage noted includes:

Damaged Item	**Reason**	**Repair**
Cracks in FC sheet above precast panel	Excessive racking in structure	Replace FC sheet
Crack in lower corner of precast	Earthquake shaking	Epoxy repair crack
Damaged connection in bock wall	Earthquake Shaking	Further investigation and strengthen connection
Damaged roof sheet – rugby change room above showers	Possible earthquake related damage	Replace roof sheet in short term – consider re-roof in long term
Cracks in concrete floor slab – exacerbated by shaking	Cracks in front deck (front of rugby rooms) are wider than expected from normal shrinkage	Repair step, replace deck slab

1.3.2 Seismic Assessment Risk Assessment

Seismic Risk assessment is used in commercial and public buildings to provide a guide to the risk of failure of a building which could cause harm. The seismic assessment is discussed in detail below and uses two related factors to assess seismic risk to the building under severe earthquake condition. The initial measure to describe structural capacity as a percentage of "New Building Standard" or % NBS and this related to a seismic grade measure marked from A to E

Our initial Seismic Risk Assessment is that the building lies between ***50%NBS and 67%NBS*** or Grade C. This would be increased to approximately ***72%*** **(Grade B)** when the key earthquake damage is repaired at the Squash Court back wall where the steel beam is fixed to the masonry block. Some additional strengthening may increase seismic grade to Grade A but it is doubtful whether it would extend beyond that grading.

Our analysis of the building structure indicates that it was designed to the building standards prior to 1985. After the Canterbury Earthquake Sequence (September 2010 to December 2011) the seismic loads used in design increased by approximately 30%. Effectively this means that in Canterbury most commercial buildings should return a seismic risk number of around 67%NBS.

1.3.3 Immediate Maintenance and Repair Recommendations

We have made immediate maintenance/repair recommendations for repair of the earthquake related damage.

These repairs are below in order of considered importance:

1. Repair and strengthen the damaged connection in the block wall between the squash court and the main function area
2. Repair the cracks between the block centre wall of the squash court and the pre-cast panels
3. Repair the external crack in the pre-cast panel with epoxy
4. Repair the cracks and settlement in the front deck (in front of the rugby change rooms)
5. Replace the external cladding above the concrete walls in the squash court – A painted plywood shadow clad may be considered where this is screwed in a bracing pattern to provide additional resistance to racking
6. Seal the wall joints between squash court and function area with a flexible sealant

1.3.4 Secondary Repairs and maintenance

There are further repairs and maintenance noted. These include items of minor earthquake/exacerbation and items of maintenance (not earthquake damage):

- Replace roof sheeting on the rugby change rooms with “long run” to repair the crushed sheet and ensure water proofing of the building
- Treat rust in box gutter – check on water proofing. Box Gutter is between the squash court roof and the main function area roof

There is also a small number of minor cracks in the foundation concrete – We recommend monitoring only because the cracks are minor and have no structural significance.

2 CONDITION ASSESSMENT

We have assessed the building as being in **“fair to good”** condition. Structurally, most of the critical elements are not showing signs of distress.

The following are a “plain English” range of descriptor definitions for condition grading:

- New – condition expected of a newly constructed building no defects.
- Good – “lived in” – but no obvious defects or damage (could require paint)
- Fair – “lived in” – some defects or damage readily repaired defects or damage most of the building is good condition
- Poor – has some defects that are more difficult to repair, or a lot of defects.
- Unsafe – The building has significant defects which cause it to be unsafe.

The Assessment for this building is as follows:

I. There is one item of earthquake damage which could be noted as a critical structural weakness – this is the connection of the roof beam in the squash court to the masonry blockwork column in the main area. The damage occurred because there is a point load on the blockwork – this is unlikely to have been considered in the original design.
The repair of this item is more complex than the other repairs, but the proposed repair and strengthening of the area will decrease the seismic risk of the building and improve the overall grade.
The solution is to ensure that the squash court walls resist the whole of the earthquake load. The complexity is how can that be done as a retrofit solution.
II. The deck area (in front of the rugby rooms) is damaged, cracked and out of level – this should be repaired, or partially replaced.
III. The other issues are minor damage which should be repaired.

I have included one maintenance issue in the report – specifically the treatment of rust in the box gutter. Other issues are relatively minor and can be readily included in the normal maintenance programme.

The Change rooms and toilets show signs of “wear and tear”. This is expected in a building that is used well (appropriately).

3 EXPLANATION OF EARTHQUAKE DAMAGE – MBIE GUIDANCE

Assessment of earthquake damaged buildings is carried out in accordance with MBIE Guidance on “Repairing and rebuilding houses affected by the Canterbury earthquakes” issued December 2012.

The document provides guidance on repair of earthquake damage to buildings and guidance on when to repair or replace damaged items. The document is mostly applicable to residential buildings. More complex commercial buildings can be assessed using the same guidance, but more complex analysis and engineering judgement may be required.

Public and commercial buildings are assessed for seismic risk. This assessment involves review of damage to the building and an assessment of the risk of future damage to a building from a seismic event. How the building has performed or was damaged in previous seismic events provides a guide to future performance.

Buildings can be damaged in one or both of two primary causes. The first cause is best described as shaking or racking damage. This is the observed movement of the superstructure. (The walls, floors and roof of the building above the ground).

The second cause is settlement of the foundations. This may have number of causes underlying the settlement, but the effect of the settlement is a change of foundation support which causes vertical stress load on the building walls and floors. When the stress in the building elements exceeds the capacity, failure occurs.

The Canterbury earthquakes in Christchurch caused a significant amount of settlement damage to buildings; particularly those on flat river silt areas. This resulted in emphasis on the settlement damage. It is also relatively easy to measure using simple techniques.

Floor levels are used to provide a guide to settlement which may have been directly caused by an earthquake event. Generally, buildings with differential floor level of less than 50mm and floor slopes of less than 0.5% or 1:200 are considered within suitable tolerances and do not require relevelling. Timber floors with differential floor levels between 50mm and 100mm would be recommended to be relevelled and floors that exceed 100mm in differential settlement may be recommended for foundation replacement.

These are broad guideline values and are subject to engineering advice and some discretion. It is noted that most buildings can be relevelled without the need to replace foundations.

The scope of work and repair methodologies are in accordance with the MBIE Guidance, and the NZ Building Code.

For this building we interpret the floor level data provided as indicating that the Floor levels are less than 20mm in total differential with no settlement indicated in the foundations.

The most significant damage to the building was racking of internal walls and evidence of damage between areas with differential stiffness.

Understanding the Building

The building is a complex structure. It has been built in three stages. The original building includes the rugby club and change rooms, the open plan bar and club area is a second structure and the squash courts are a third structure.

The original area is normal construction with block walls providing bracing in both longitudinal and transverse directions. The roof is supported on portal frames which are braced by the walls and limits the deflection of the portal frame.

The function area is constructed using reinforced masonry columns and truss roof structure. The structure is braced by the original building walls in the longitudinal direction. As a stand-alone building this load in the transverse direction would have been carried by the columns as a cantilever.

The construction of the squash court attached to the wall of the club area provided additional bracing capacity in the transverse direction.

The roof structures provide transfer of load to bracing walls.

The seismic assessment of buildings uses a factor for assessment of ductility. (m) In lay terms this is a measure of stiffness and flexibility as it relates to earthquake performance of a structure.

In terms of this structure the original building is the least flexible, the open function area is the most flexible and the squash court varies from very stiff to very flexible. This explains the location of type of earthquake damage evident in the building and shows that it is the interaction of elements with different stiffnesses which causes the damage.

The floor level measurements taken show the building has not settled to any significant amount. Settlement damage is therefore excluded from the assessment.

The building is located approximately 40km from the Kaikoura earthquake epicentre. There is a clear line approximately south-south-west of the epicentre to the site. The earthquake would have been clearly felt at this site. We have not investigated the extent of shaking at the site, but we have investigated other buildings in the valley and the damage is consistent with the earthquake event.

Critical Structural Weakness

The building has one clear critical structural weakness. This is found at the connection of the squash court roof support to the main building column and masonry wall. There is earthquake damage at this point.

It is unknown at the time of writing whether the masonry blockwork in the original structure is reinforced. As there is no evidence of damage, and it is well supported by other walls, it is therefore reasonable to assume that the masonry is reinforced. There is no damage to the elements which indicate unreinforced masonry.

It appears that the addition of the squash court to the main building has changed the structural action of the building. The addition should have improved the structural performance of the building, and where the load transfer is through transverse walls, there is no evidence of damage. The main evidence of damage is where the transfer of horizontal earthquake force is through a single point at the roof rafter. The most likely repair is to strengthen the area of load transfer.

There are four different structural types of construction in the building. These are described on the attached plan as

- The rugby team rooms
- The rugby and squash court change and shower areas
- The main function area (Social Room and kitchen)
- The Squash Courts

4 SEISMIC RISK ASSESSMENT

The assessment has been carried out in 2 parts. A visual inspection of the building including photographs of the building elements, followed by an engineering assessment. The objective is to provide two figures; an assessment of strength based on the current or "New Building Standard" this is shown as a percentage of New Building Standard; and a related Seismic Grade.

The engineering assessment is also carried out in stages. The first stage is the "Initial Engineering Procedure" (IEP). This stage reviews the existing information and uses a spreadsheet to determine an initial assessment of the %NBS. If the result of this assessment is satisfactory then the assessment may stop at this point.

If the IEP result is unsatisfactory, further assessment of either the IEP factors or a more detailed analysis is required.

At the time of the inspection there was evidence of defects caused by an earthquake probably the Kaikoura event.

The initial engineering procedure (IEP) estimates that the design %NBS is currently 50%NBS based on the assessment of the original rugby rooms. The newer social room and squash court indicate %NBS greater than 100%. This assumes that the building is in good repaired condition. Based on the damage to the masonry blocks in the squash court we have de-rated the building in its present (unrepaired) condition to be in the order of ***50%NBS to 67%NBS***.

The IEP result is often sensitive to the engineering factors selected, and a low result using the IEP in the first instance suggests that a better analysis should be carried out. We are confident, based on the type and extent of damage that the building in its current condition is greater than 50%NBS.

We have assessed that the building requires further analysis to confirm the seismic performance in the repaired state and to obtain information to assist with the design of the repair.

As indicated in the section of damage assessment the building has three distinct areas which react differently during earthquake shaking.

Our supporting reasoning is as follows:

- The rugby rooms and change rooms are constructed from concrete masonry block and provide bracing in both directions. The structure is normally ductile using a factor m of approximately 1.25.
- The Social room is a more flexible structure and is a column and truss construction. The columns act as cantilever moment supporting beams. A seismic ductility factor of 1.75 and 2.0 has been assumed.
- The Squash court for the most part is a stiff structure in the lower walls with a flexible structure in the upper part supporting the roof. This difference in ductility between floors is the reason for the damage noted in the structure. For the purpose

of analysis, a ductility factor of 1 is assumed for the lower portion of the walls and 2 for the upper flexible portion.

The results of the detailed analysis (explained below) including assumptions indicate that the building should have %NBS of approximately **72%** when repaired.

Further Explanation of the procedure:

The assessment of the % NBS based on the IEP (Initial Engineering Procedure) spreadsheet calculated to 50%NBS for the original building**.**

The additional analysis procedure proposed is as follows:

- Analyse the original building for earthquake loads and bracing – determine %NBS
- Analyse the Social area for earthquake loads and bracing – connected to original building
- Analyse the squash court – as a stand-alone structure and determine the point load placed on the function area

The summary of results is tabulated below:

Building Section	%NBS – pre-repair	%NBS – Post Repair - estimated
Original Building – Rugby club rooms and change area	70%	90% improved bracing in roof and repair of roof sheet
Social Area	97%	Not calculated
Squash court Stand alone	100%	Not Calculated
Combined Building – worst case assessment	Worst Case 47% (calculated) 57%-60% (based on design)	72% Post repair without improvement

The %NBS result indicates that the assessed building is <u>not</u> earthquake prone. The single figure %NBS quoted is the lowest estimated figure – in this case 72%NBS.

4.1 *Definitions of Seismic Risk Assessments*

4.1.1 Earthquake Prone Assessment

The legal requirements for building structures assessed under this methodology are based on structures required to meet the minimum standard of 34% NBS. A building rating less than the 34% is considered to be "Earthquake prone"

A building assessed as being below the 34% figure requires further investigation and may require further action to strengthen the building.

If the above is greater than 33% then the Building does not require further action in terms of the Building Act but may still be strengthened to meet requirements of insurance.

If the result above result is less than or equal to 33% then the building is potentially earthquake prone in terms of the Building Act. Further action will be required, and this should include a detailed assessment of the building in the first instance.

4.1.2 Earthquake Risk Assessment

The second level is called Earthquake Risk. Buildings that are calculated to be less than 67%NBS but greater than 33%NBS

If the result above is greater than or equal to 67%NBS then the building does not present an earthquake risk. Generally, no further assessment is required.

If the result is above 33% and less than 67% then the building is potentially an earthquake risk and further action such as a detailed assessment of the building may be recommended.

We have not recommended a detailed analysis for this building as there is very little accurate information available and extensive intrusive investigations would be required.

4.1.3 Detailed Assessment

For this building a detailed assessment will add some value. In particular, it will allow the calculation of loads on the area of failure which is considered the critical structural weakness. Without a detailed analysis we are guessing.

4.1.4 Seismic Grade

The following excerpt from the NZSEE guidelines

"The grading scheme shown in Table 2.1 (Section 2.8) is being promoted by the New Zealand Society for Earthquake Engineering to improve public awareness of earthquake risk and the relative risk between buildings.

It is not a requirement of the Building Act to provide a seismic grade, but it is strongly recommended that this be recorded so as to promote the concept of seismic grading.

Seismic grading determined from the results of the IEP should be considered provisional and subject to confirmation by detailed assessment."

Relationship of Seismic grade to %NBS

Grade:	A+	A	B	C	D	E
%NBS:	> 100	100 to 80	80 to 67	67 to 33	33 to 20	< 20

5 MAINTENANCE/REPAIR RECOMMENDATIONS

The following table represents my recommendations for maintenance and repair methodology.

Issue	Repair Method	Recommended Product/s	Cost/Value
Critical Connection	Repair masonry block wall and strengthen with steel plate	Further investigation of the repair method is required	
Critical Connection	Provide additional strengthening to steel rafter at roof ridge – review and improve bracing	Further investigation of the repair method is required	
Repair to front wall of squash court	Grind temporary repair flat and seal		
Repair hairline cracks in wall	Inspect and repair with liquid epoxy as required or rake out crack and fill with an epoxy putty grind flat		
External squash court wall joint between panels	Need further investigation		
External squash court wall – crack in bottom right corner of panel	Epoxy repair/ seal external concrete panel with waterproof seal	Possible to repair with AQURON	
Original rugby building roof sheet damage	Replace roof sheet with “long run” sheeting – inspect and improve bracing in roof		
Cracks in veranda stair	Epoxy fill stair and grind flat		
Cracks in concrete floors in change rooms	Ensure floors are safe Grind and paint with epoxy nonslip floor coating		
Box gutter rust	Treat rust with rust converter and paint		

APPENDIX 1 – Seismic Evaluation

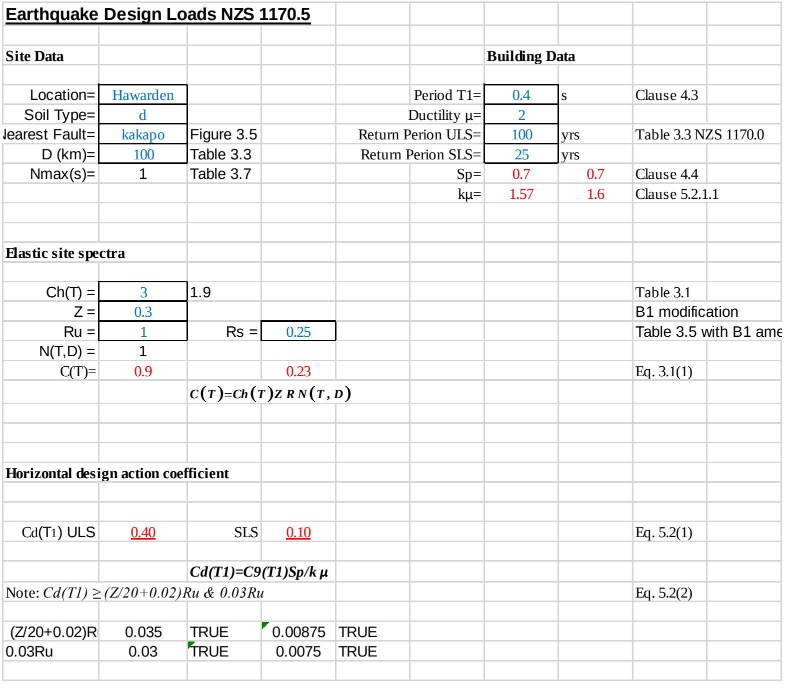
Detailed Evaluation

Peter D Duncan CPEng RPEQ			Job No	190801		
Address		**Hawarden Multi use**	**190801**			
Loads AS1170						
Dead Load	item	Roof load From Sheet	0.12	0.12	kn/m2	
		Roof Purlins	0.05 kn/m /purlin	0.15	kn/m2	
		Roof Beams		0.064	kn/m	
Live Load	item	Load on beam from DL roof	0.25 x w	1.29	Kn/m	
		roof point load		1.4	kN	
Wind Load		location	Hawarden			
		wind region	Region	A7	Fig 3.1	
		Determine Structural Importance		1	BCA B1.2	
					AS1170	
		Wind speed		45		
		Wind Speed servicability LS		37		
		Wind directional multiplier	Wind actions major ele.	0.9		
		Wind directional multiplier	Cladding	1		
		Structure Height		7		
		terrain category		2		
		terrain height multiplier	M (z,cat)	0.91		
		sheilding multiplier	Ms	1	Table 4.3	
		topoographic multiplier	Mh	1	4.4.2	
		Lee multiplier (NZ	Mlee	1.1		
		site wind speed servicability		33.67		
		Site Wind Speed Vu		**36.855**		
		design wind pressure, sls		0.680201	kPa	2.4.1
		design wind pressure, uls		0.814975	kPa	2.4.1
		Wind Zone	Medium		<37m/s	

The following table has been used to calculate the seismic loads on the structures.

Seismic weights Eq. 4.2(1)

	Item	G kPa	Q kPa	Length m	Height/ Width m	Area m2	Quantity #	ψa -	ψE -	G kN	ψaψEQ kN
Roof	Roof 1	0.9	0.25	14.000	14.800	207.200	1	0.5	1.0	186.48	26.34
	Roof 2	0.9		22.300	13.500	301.050	1			270.95	0.00
	Roof 3	0.7		21.200	10.000	212.000	1			148.40	0.00
						0.000	0			0.00	0.00
						0.000	0			0.00	0.00
									Wi =	**605.83**	**kN**
Floor 3			0	0.000	0.000	0.000	0	1.0	0.3	0.00	0.00
		0.0		0.000	0.000	0.000	0			0.00	0.00
		0.0		0.000	0.000	0.000	0			0.00	0.00
						0.000				0.00	0.00
						0.000				0.00	0.00
						0.000				0.00	0.00
						0.000				0.00	0.00
									Wi =	**0.00**	**kN**
Floor 2	Walls Squash light	0.70		37.400	2.000	74.800	1	0.6	1.0	52.36	0.00
	Walls Squash	4.5		0.000		0.000				0.00	0.00
	Walls Social	1.5		42.700	1.400	59.780	1			89.67	0.00
	Walls OB light	0.7		58.900	1.400	82.460	1			57.72	0.00
	Walls OB 1	4.5		54.600	1.400	76.440	1			343.98	0.00
	Floor - includes 0.5 kPa SDL					0.000		1	0.3	0.00	0.00
									Wi =	**543.73**	**kN**
Floor 1	Walls Squash light					0.000		0.5	0.3	0.00	0.00
	Walls Squash	4.5		37.400	2.400	89.760	1			403.92	0.00
	Walls Social	1.5		42.700	1.400	59.780	1			89.67	0.00
	Walls OB light	0.60		58.900	1.400	82.460	1			49.48	0.00
	Walls OB 1	4.5	1.5	54.600	1.400	76.440	1	1	0.3	343.98	34.40
	Floor - includes 0.5 kPa SDL	5.0		46.060	15.000	690.900	1			3454.50	0.00
									Wi =	**4375.94**	**kN**
Ground	Walls B					0.000	0			0.00	0.00
	Floor - includes 0.5 kPa SDL	0.0		16.800	10.000	168.000	0	1	0.3	0.00	0.00
				0.000	0.000	0.000	0			0.00	0.00
									Wi =	**0.00**	**kN**



Earthquake Design Loads NZS 1170.5									
Site Data						**Building Data**			
Location=	Hawarden				Period T1=	0.4	s	Clause 4.3	
Soil Type=	d				Ductility μ=	2			
earest Fault=	kakapo	Figure 3.5			Return Perion ULS=	100	yrs	Table 3.3 NZS 1170.0	
D (km)=	100	Table 3.3			Return Perion SLS=	25	yrs		
Nmax(s)=	1	Table 3.7			Sp=	0.7	0.7	Clause 4.4	
					kμ=	1.57	1.6	Clause 5.2.1.1	
Elastic site spectra									
Ch(T) =	3	1.9						Table 3.1	
Z =	0.3							B1 modification	
Ru =	1	Rs =	0.25					Table 3.5 with B1 ame	
N(T,D) =	1								
C(T)=	0.9		0.23					Eq. 3.1(1)	
		C(T)=Ch(T)Z R N(T, D)							
Horizontal design action coefficient									
Cd(T1) ULS	0.40	SLS	0.10					Eq. 5.2(1)	
		Cd(T1)=C9(T1)Sp/k μ							
Note: *Cd(T1) ≥ (Z/20+0.02)Ru & 0.03Ru*								Eq. 5.2(2)	
(Z/20+0.02)R	0.035	TRUE	0.00875	TRUE					
0.03Ru	0.03	TRUE	0.0075	TRUE					

We then made the following assumptions:

1. The original building has enough bracing to satisfy the earthquake loads but is unlikely to achieve 100%NBS. There is minimal evidence of earthquake damage in the original building and the building is a standard (straight-forward) structure. There is significant structural redundancy in the building (eg: bracing walls). We did not carry out a detailed analysis of the original building but focussed on the critical structural weakness evident in the squash court.

2. The social building extension can be tested as a "stand alone" structure. Wall and roof loads are applied at the top of the concrete masonry columns.

2a. The social building columns are assumed to be reinforced with 4- D16 bars (one in each "pot") in the 400 square column

3. The critical load point from the squash court beam can then be determined and applied to the masonry column. The load is assumed to be placed at the top of the column in the first case and at approximately 1m away from the column as second design case.

Taking the critical grid line where the middle wall of the squash court will apply the load, the load on the column from seismic shaking can be applied m=2 for the social room.
CdT (ULS) = 0.4

Part wall and part roof load
3x2.6x4.5 = 35.1kN
35.1 x 0.4 = 14.04kN
Roof = 3x6.7x0.9= 18.09
18.09x0.4 = 7.2

14.04+7.2= 21.27kN

Moment at base of column = 55.31kNm (estimated New Building Standard)
Design Capacity of column = 53.69kNm
97% NBS

Add Point load from Squash court middle wall and column and recalculate.

Mid Wall of squash court –

10x2.4x4.5=108kN
108x0.4= 43.2kN

Assume 1/3 of load is applied. Most of the load will be taken in the wall and less than 1/3 will be transferred through the steel frame

43.2/3= 14.4kN

14.4 +21.27=35.67kN

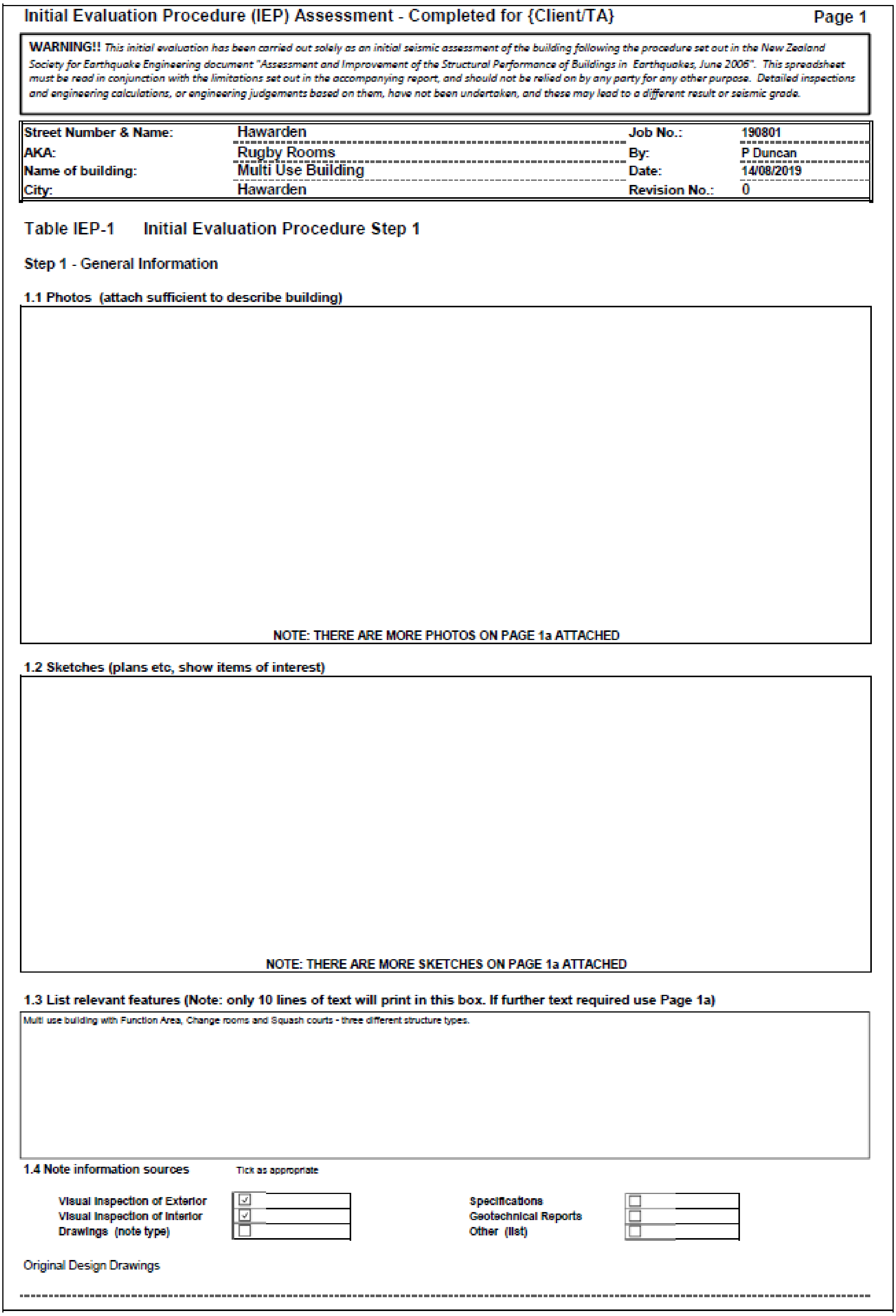
Moment = 92.74kNm

Capacity is therefore 53.69/92.67= 57%

It is possible that the original design did not allow for any horizontal force to be transferred from seismic loading to the block wall.

Making this assumption, the load applied to the masonry wall would be
7.2kN and the moment at the base would be 21.27+7.4=28.67
Moment = 28.67 x2.6= 74.54kNm

53.69/74.54= 72%NBS



Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Page 1

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Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Rugby Rooms	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

1.2 Sketches (plans etc, show items of interest)

NOTE: THERE ARE MORE SKETCHES ON PAGE 1a ATTACHED

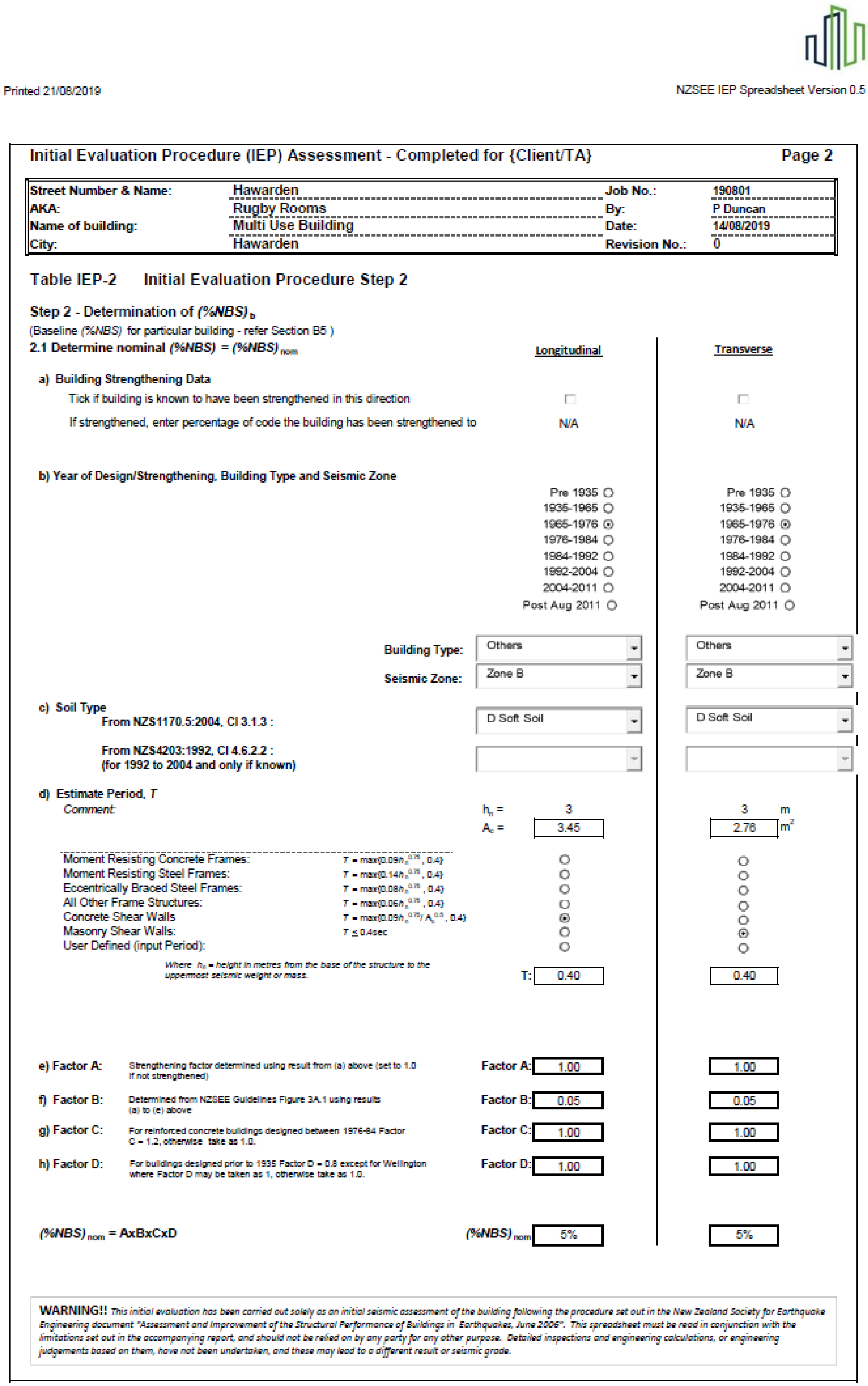
1.3 List relevant features (Note: only 10 lines of text will print in this box. If further text required use Page 1a)

Multi use building with Function Area, Change rooms and Squash courts - three different structure types.

1.4 Note information sources Tick as appropriate

Visual Inspection of Exterior	☑	Specifications	☐
Visual Inspection of Interior	☑	Geotechnical Reports	☐
Drawings (note type)	☐	Other (list)	☐

Original Design Drawings



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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Page 2

Street Number & Name:	Hawarden	**Job No.:**	190801
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Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-2 Initial Evaluation Procedure Step 2

Step 2 - Determination of $(\%NBS)_b$

(Baseline *(%NBS)* for particular building - refer Section B5)

2.1 Determine nominal *(%NBS)* = $(\%NBS)_{nom}$

	Longitudinal	**Transverse**
a) Building Strengthening Data		
Tick if building is known to have been strengthened in this direction	☐	☐
If strengthened, enter percentage of code the building has been strengthened to	N/A	N/A
b) Year of Design/Strengthening, Building Type and Seismic Zone		
	Pre 1935 ○	Pre 1935 ○
	1935-1965 ○	1935-1965 ○
	1965-1976 ●	1965-1976 ●
	1976-1984 ○	1976-1984 ○
	1984-1992 ○	1984-1992 ○
	1992-2004 ○	1992-2004 ○
	2004-2011 ○	2004-2011 ○
	Post Aug 2011 ○	Post Aug 2011 ○
Building Type:	Others	Others
Seismic Zone:	Zone B	Zone B
c) Soil Type **From NZS1170.5:2004, Cl 3.1.3 :**	D Soft Soil	D Soft Soil
From NZS4203:1992, Cl 4.6.2.2 : **(for 1992 to 2004 and only if known)**		

d) Estimate Period, *T*

Comment:

	Longitudinal	Transverse
h_n =	3	3 m
A_c =	3.45	2.76 m^2

		Longitudinal	Transverse
Moment Resisting Concrete Frames:	$T = \max\{0.09h_n^{0.75}, 0.4\}$	○	○
Moment Resisting Steel Frames:	$T = \max\{0.14h_n^{0.75}, 0.4\}$	○	○
Eccentrically Braced Steel Frames:	$T = \max\{0.08h_n^{0.75}, 0.4\}$	○	○
All Other Frame Structures:	$T = \max\{0.06h_n^{0.75}, 0.4\}$	○	○
Concrete Shear Walls	$T = \max\{0.09h_n^{0.75}/A_c^{0.5}, 0.4\}$	●	○
Masonry Shear Walls:	$T \leq 0.4sec$	○	●
User Defined (input Period):		○	○

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

T: 0.40 | 0.40

			Longitudinal	Transverse
e) Factor A:	Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened)	**Factor A:**	1.00	1.00
f) Factor B:	Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	**Factor B:**	0.05	0.05
g) Factor C:	For reinforced concrete buildings designed between 1976-84 Factor C = 1.2, otherwise take as 1.0.	**Factor C:**	1.00	1.00
h) Factor D:	For buildings designed prior to 1935 Factor D = 0.8 except for Wellington where Factor D may be taken as 1, otherwise take as 1.0.	**Factor D:**	1.00	1.00
$(\%NBS)_{nom}$ = AxBxCxD		$(\%NBS)_{nom}$	5%	5%

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Street Number & Name:	Hawarden	**Job No.:**	190801
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Name of building:	Multi Use Building	**Date:**	14/08/2019
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Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \leq 1.5$sec, Factor E = 1

		Longitudinal	Transverse
a) Near Fault Factor, *N(T,D)* (from NZS1170.5:2004, Cl 3.1.6)	N(T,D):	1	1
b) Factor E = 1/N(T,D)	Factor E:	1.00	1.00

2.3 Hazard Scaling Factor, Factor F

a) Hazard Factor, *Z*, for site

Location: Cheviot

Z = 0.4 (from NZS1170.5:2004, Table 3.3)
Z_{1992} = 1.2 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))
Z_{2004} = 0.4 (from NZS1170.5:2004, Table 3.3)

b) Factor F
For pre 1992 = $1/Z$
For 1992-2011 = Z_{1992}/Z
For post 2011 = Z_{2004}/Z

	Longitudinal	Transverse
Factor F:	2.50	2.50

2.4 Return Period Scaling Factor, Factor G

a) Design Importance Level, I
(Set to 1 if not known. For buildings designed prior to 1965 and known to be designed as a public building set to 1.25. For buildings designed 1965-1976 and known to be designed as a public building set to 1.33 for Zone A or 1.2 for Zone B. For 1976-1984 set I value.)

b) Design Risk Factor, R_o
(set to 1.0 if other than 1976-2004, or not known)

c) Return Period Factor, R
(from NZS1170.0:2004 Building Importance Level)

Choose Importance Level

d) Factor G = IR_o/R

	Longitudinal	Transverse
I =	1	1
R_o =	1	1
Importance Level	○ 1 ● 2 ○ 3 ○ 4	○ 1 ● 2 ○ 3 ○ 4
R =	1.0	1.0
Factor G:	1.00	1.00

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure
Comment:

b) Factor H
For pre 1976 (maximum of 2)
For 1976 onwards

	Longitudinal	Transverse
μ =	1.25	1.25
	k_{μ}	k_{μ}
For pre 1976 (maximum of 2) =	1.14	1.14
For 1976 onwards =	1	1
Factor H:	1.14	1.14

(where k_{μ} is NZS1170.5:2004 Inelastic Spectrum Scaling Factor, from accompanying Table 3.3)

2.6 Structural Performance Scaling Factor, Factor I

a) Structural Performance Factor, S_p
(from accompanying Figure 3.4)
Tick if light timber-framed construction in this direction

b) Structural Performance Scaling Factor = $1/S_p$
Note Factor B values for 1992 to 2004 have been multiplied by 0.67 to account for Sp in this period

	Longitudinal	Transverse
Tick if light timber-framed construction	☐	☐
S_p =	0.93	0.93
Factor I:	1.08	1.08

2.7 Baseline %NBS for Building, *(%NBS)*$_b$
(equals $(\%NBS)_{nom}$ x E x F x G x H x I)

	Longitudinal	Transverse
$(\%NBS)_b$	15%	15%

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 4

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Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

a) Longitudinal Direction

Critical Structural Weakness | **Effect on Structural Performance** (Choose a value - Do not interpolate) | **Factors**

3.1 Plan Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor A** 1.0

Comment

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor B** 1.0

Comment

3.3 Short Columns

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor C** 1.0

Comment

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

> *Note:*
> *Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.*

Factor D1 For Longitudinal Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Longitudinal Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	○ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	● 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor E** 1.0

Comment

3.6 Other Factors - *for allowance of all other relevant characterstics of the building*

For ≤ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 2.5

Record rationale for choice of Factor F:

Comment

PAR

3.7 Performance Achievement Ratio (PAR)
(equals **A x B x C x D x E x F**)

Longitudinal 2.50

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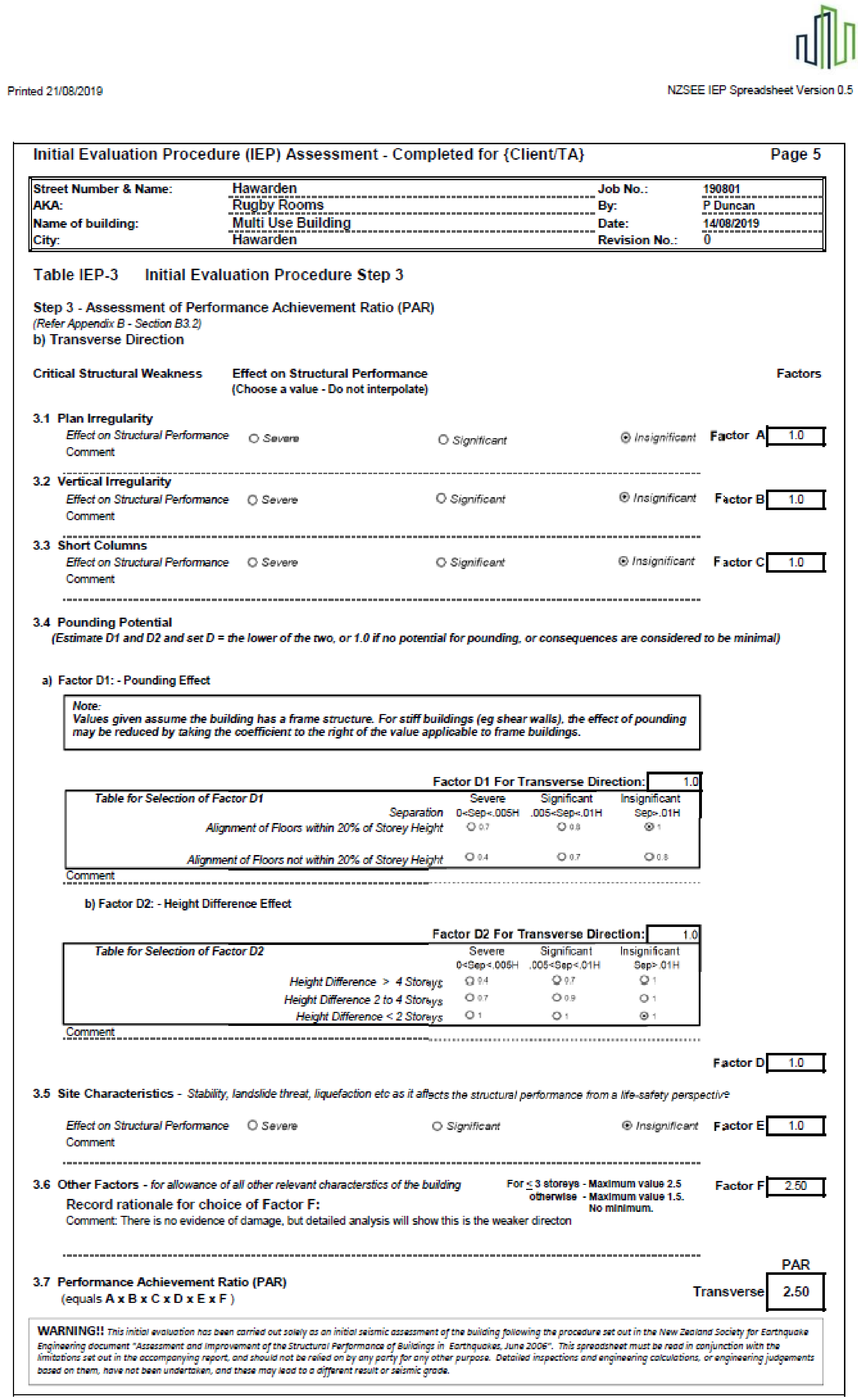

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} **Page 5**

Street Number & Name:	Hawarden	**Job No.:**	190801
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Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

b) Transverse Direction

Critical Structural Weakness **Effect on Structural Performance** **Factors**
(Choose a value - Do not interpolate)

3.1 Plan Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor A** 1.0

Comment

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor B** 1.0

Comment

3.3 Short Columns

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor C** 1.0

Comment

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

> ***Note:***
> ***Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.***

Factor D1 For Transverse Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Transverse Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	○ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	● 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor E** 1.0

Comment

3.6 Other Factors - *for allowance of all other relevant characterstics of the building*

For ≤ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 2.50

Record rationale for choice of Factor F:

Comment: There is no evidence of damage, but detailed analysis will show this is the weaker directon

3.7 Performance Achievement Ratio (PAR)
(equals **A x B x C x D x E x F**)

PAR
Transverse 2.50

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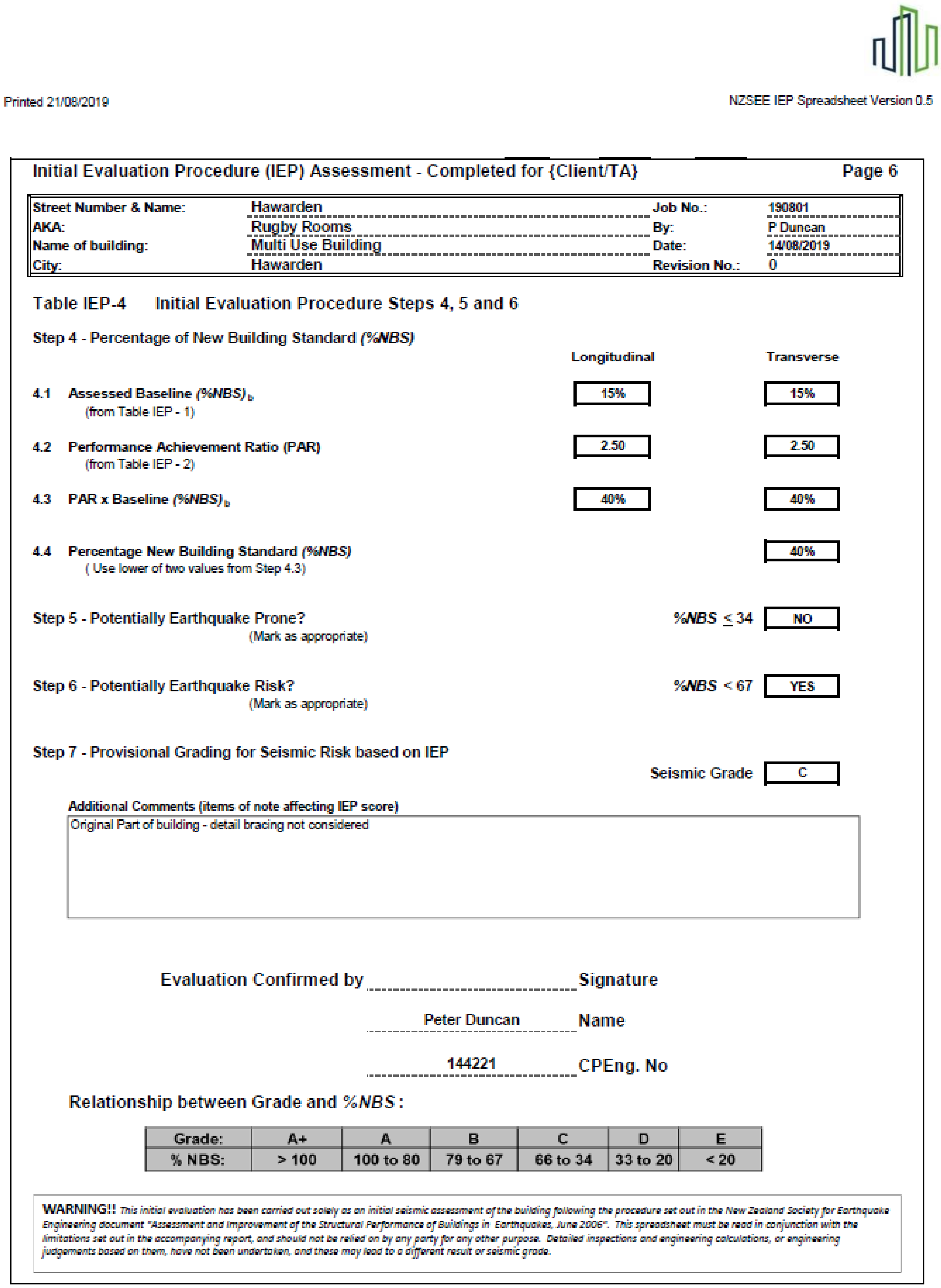

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

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Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Rugby Rooms	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-4 Initial Evaluation Procedure Steps 4, 5 and 6

Step 4 - Percentage of New Building Standard *(%NBS)*

		Longitudinal	Transverse
4.1	**Assessed Baseline *(%NBS)*$_b$** (from Table IEP - 1)	15%	15%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	2.50	2.50
4.3	**PAR x Baseline *(%NBS)*$_b$**	40%	40%
4.4	**Percentage New Building Standard *(%NBS)*** (Use lower of two values from Step 4.3)		40%

Step 5 - Potentially Earthquake Prone? *%NBS* $\leq$ 34 NO

(Mark as appropriate)

Step 6 - Potentially Earthquake Risk? *%NBS* < 67 YES

(Mark as appropriate)

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade C

Additional Comments (items of note affecting IEP score)

Original Part of building - detail bracing not considered

Evaluation Confirmed by ______________________ Signature

Peter Duncan Name

144221 CPEng. No

Relationship between Grade and *%NBS* :

Grade:	A+	A	B	C	D	E
% NBS:	> 100	100 to 80	79 to 67	66 to 34	33 to 20	< 20

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Page 1a

Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Rugby Rooms	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately

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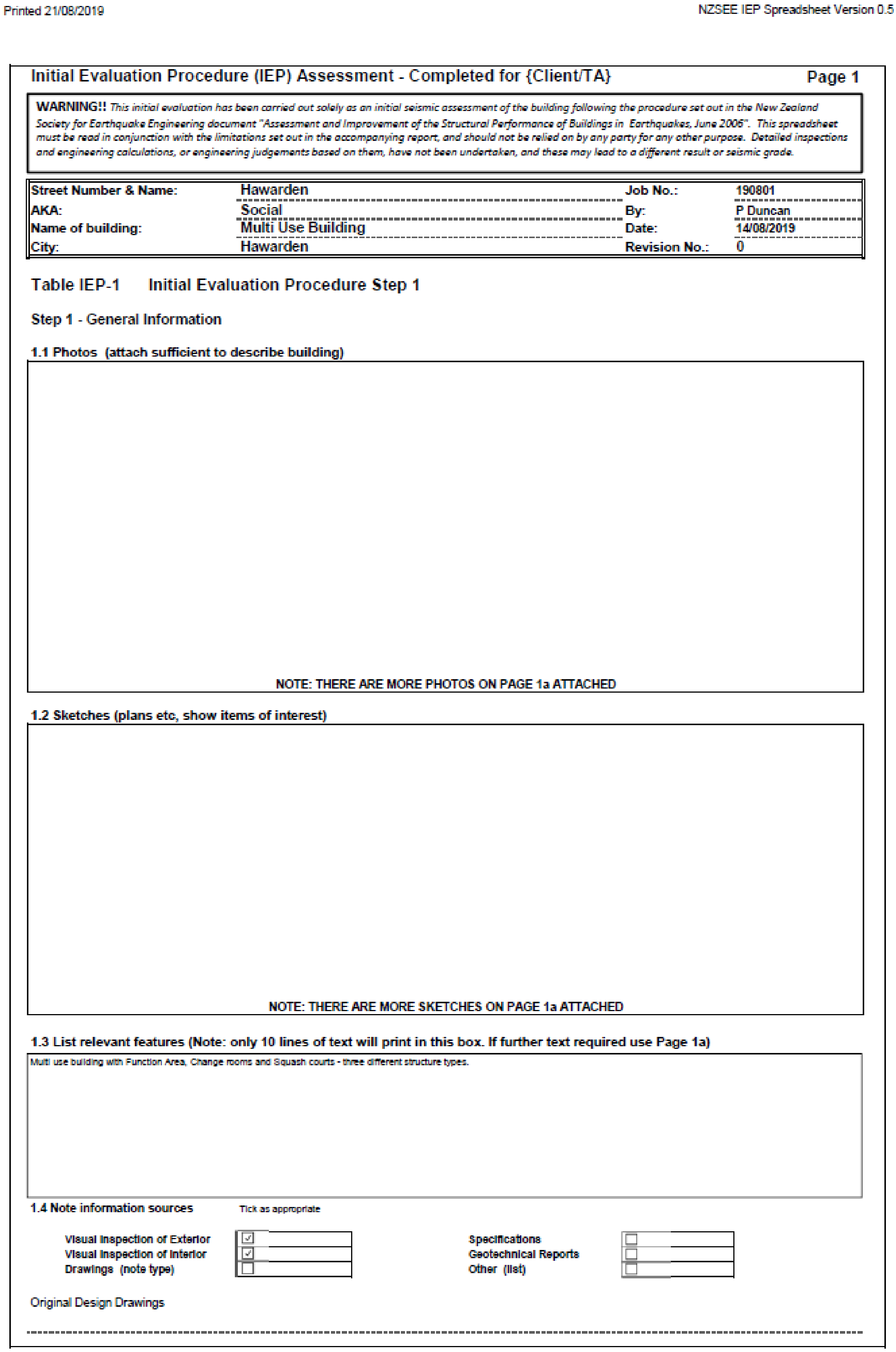

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Page 1

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Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Social	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

1.2 Sketches (plans etc, show items of interest)

NOTE: THERE ARE MORE SKETCHES ON PAGE 1a ATTACHED

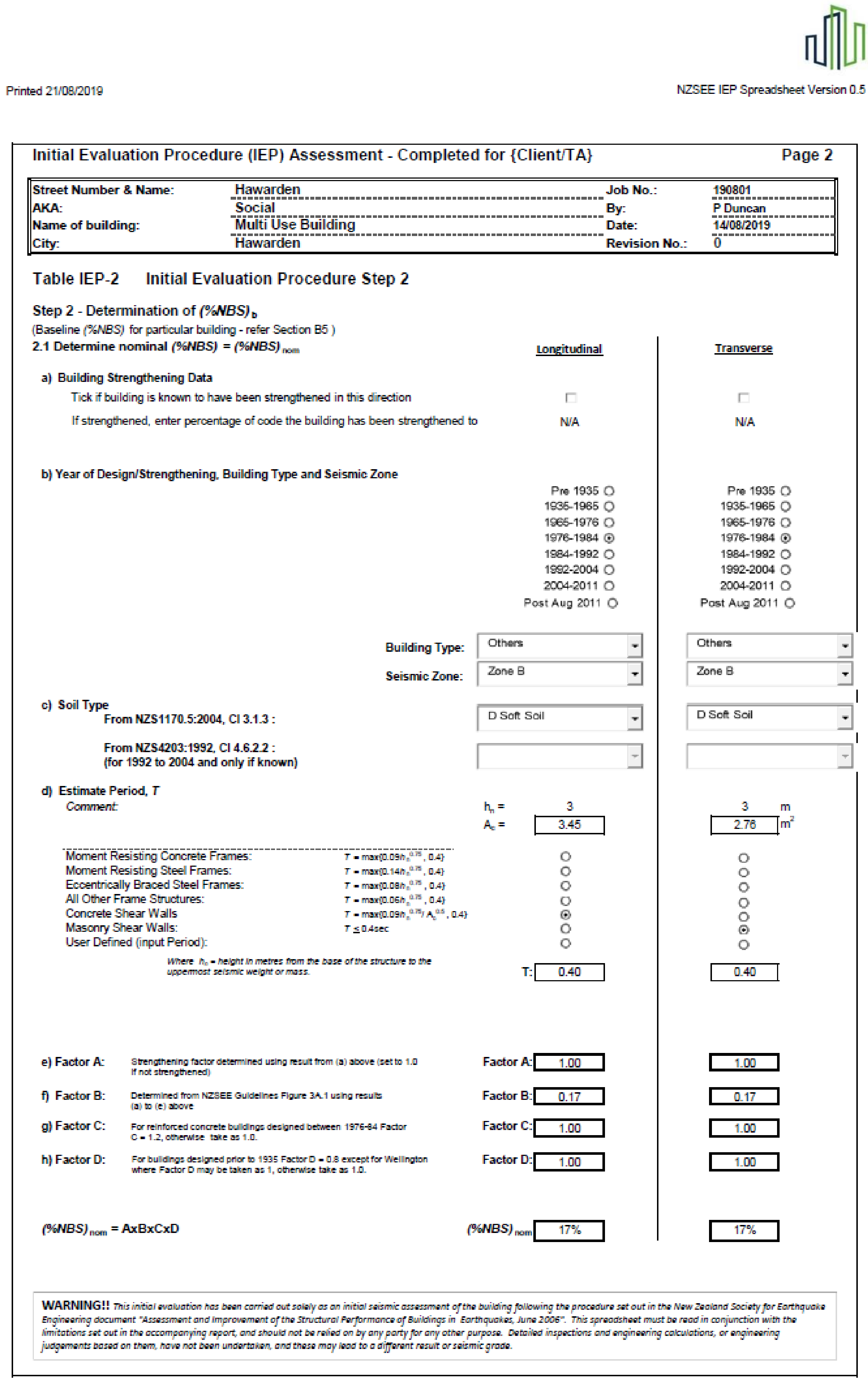
1.3 List relevant features (Note: only 10 lines of text will print in this box. If further text required use Page 1a)

Multi use building with Function Area, Change rooms and Squash courts - three different structure types.

1.4 Note information sources Tick as appropriate

Visual Inspection of Exterior	☑	Specifications	☐
Visual Inspection of Interior	☑	Geotechnical Reports	☐
Drawings (note type)	☐	Other (list)	☐

Original Design Drawings



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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} **Page 2**

Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Social	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-2 Initial Evaluation Procedure Step 2

Step 2 - Determination of *(%NBS)*$_b$

(Baseline *(%NBS)* for particular building - refer Section B5)

2.1 Determine nominal *(%NBS)* = *(%NBS)*$_{nom}$

a) Building Strengthening Data

	Longitudinal	**Transverse**
Tick if building is known to have been strengthened in this direction	☐	☐
If strengthened, enter percentage of code the building has been strengthened to	N/A	N/A

b) Year of Design/Strengthening, Building Type and Seismic Zone

	Longitudinal	Transverse
Pre 1935	○	○
1935-1965	○	○
1965-1976	○	○
1976-1984	●	●
1984-1992	○	○
1992-2004	○	○
2004-2011	○	○
Post Aug 2011	○	○
Building Type:	Others	Others
Seismic Zone:	Zone B	Zone B

c) Soil Type

	Longitudinal	Transverse
From NZS1170.5:2004, Cl 3.1.3 :	D Soft Soil	D Soft Soil
From NZS4203:1992, Cl 4.6.2.2 : **(for 1992 to 2004 and only if known)**		

d) Estimate Period, *T*

Comment:

		Longitudinal	Transverse	
h_n =		3	3	m
A_c =		3.45	2.76	m^2
Moment Resisting Concrete Frames:	$T = \max(0.09h_n^{0.75}, 0.4)$	○	○	
Moment Resisting Steel Frames:	$T = \max(0.14h_n^{0.75}, 0.4)$	○	○	
Eccentrically Braced Steel Frames:	$T = \max(0.08h_n^{0.75}, 0.4)$	○	○	
All Other Frame Structures:	$T = \max(0.06h_n^{0.75}, 0.4)$	○	○	
Concrete Shear Walls	$T = \max(0.09h_n^{0.75}/A_c^{0.5}, 0.4)$	●	○	
Masonry Shear Walls:	$T \leq 0.4\text{sec}$	○	●	
User Defined (input Period):		○	○	
	T:	0.40	0.40	

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

			Longitudinal	Transverse
e) Factor A:	Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened)	**Factor A:**	1.00	1.00
f) Factor B:	Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	**Factor B:**	0.17	0.17
g) Factor C:	For reinforced concrete buildings designed between 1976-84 Factor C = 1.2, otherwise take as 1.0.	**Factor C:**	1.00	1.00
h) Factor D:	For buildings designed prior to 1935 Factor D = 0.8 except for Wellington where Factor D may be taken as 1, otherwise take as 1.0.	**Factor D:**	1.00	1.00
***(%NBS)*$_{nom}$ = AxBxCxD**		***(%NBS)*$_{nom}$**	17%	17%

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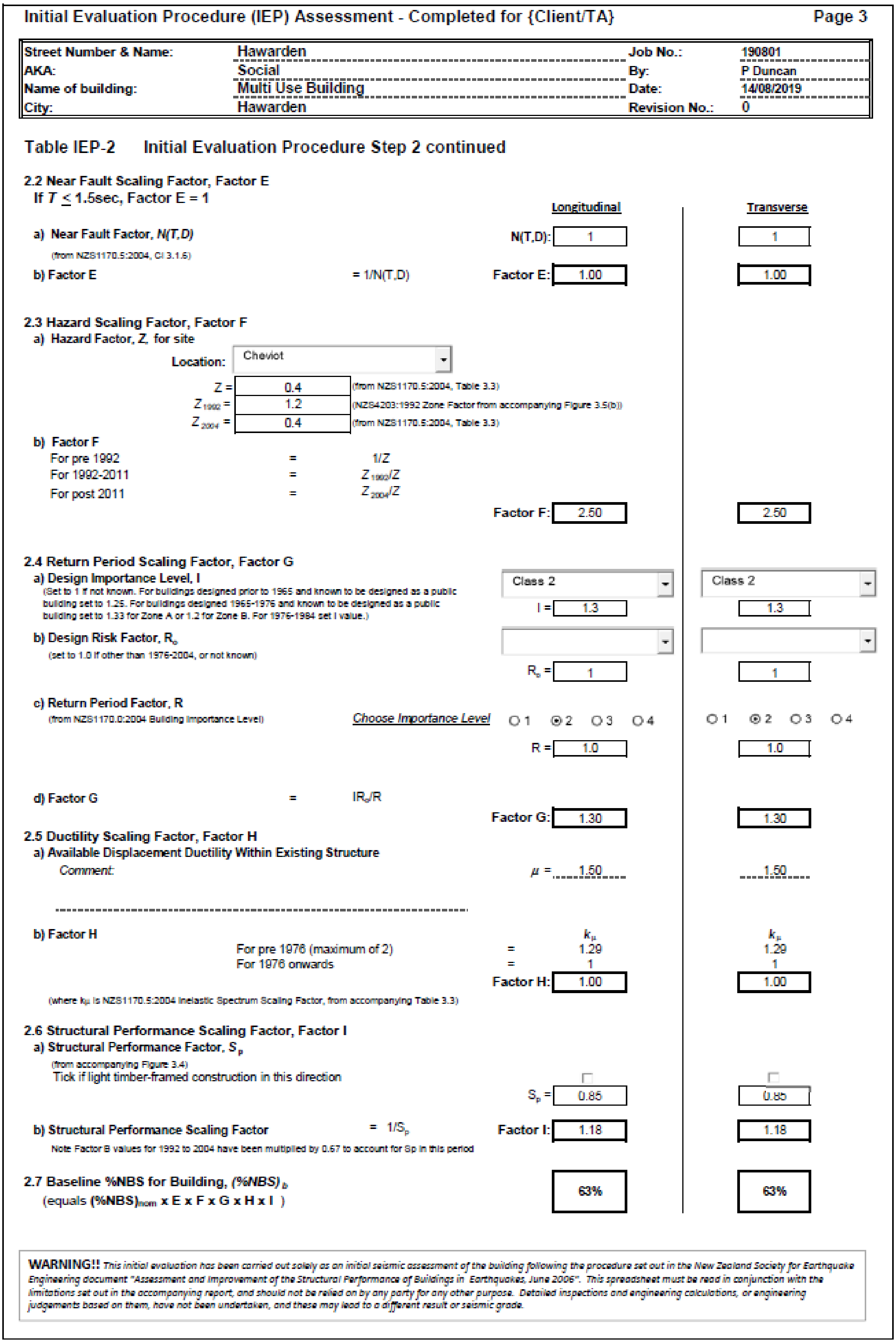

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

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City:	Hawarden	**Revision No.:**	0

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \leq 1.5$sec, Factor E = 1

			Longitudinal	**Transverse**
a) Near Fault Factor, *N(T,D)* (from NZS1170.5:2004, Cl 3.1.6)		N(T,D):	1	1
b) Factor E	= 1/N(T,D)	Factor E:	1.00	1.00

2.3 Hazard Scaling Factor, Factor F

a) Hazard Factor, *Z*, for site

Location: Cheviot

Z = 0.4 (from NZS1170.5:2004, Table 3.3)

Z_{1992} = 1.2 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

Z_{2004} = 0.4 (from NZS1170.5:2004, Table 3.3)

b) Factor F

For pre 1992 = $1/Z$

For 1992-2011 = Z_{1992}/Z

For post 2011 = Z_{2004}/Z

		Longitudinal	Transverse
	Factor F:	2.50	2.50

2.4 Return Period Scaling Factor, Factor G

		Longitudinal	Transverse
a) Design Importance Level, I (Set to 1 if not known. For buildings designed prior to 1965 and known to be designed as a public building set to 1.25. For buildings designed 1965-1976 and known to be designed as a public building set to 1.33 for Zone A or 1.2 for Zone B. For 1976-1984 set I value.)		Class 2	Class 2
	I =	1.3	1.3
b) Design Risk Factor, R_o (set to 1.0 if other than 1976-2004, or not known)			
	R_o =	1	1
c) Return Period Factor, R (from NZS1170.0:2004 Building Importance Level)	*Choose Importance Level*	○ 1 ● 2 ○ 3 ○ 4	○ 1 ● 2 ○ 3 ○ 4
	R =	1.0	1.0
d) Factor G = IR_o/R	**Factor G:**	1.30	1.30

2.5 Ductility Scaling Factor, Factor H

		Longitudinal	Transverse
a) Available Displacement Ductility Within Existing Structure *Comment:*	μ =	1.50	1.50
b) Factor H		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.29	1.29
For 1976 onwards	=	1	1
	Factor H:	1.00	1.00

(where k_μ is NZS1170.5:2004 Inelastic Spectrum Scaling Factor, from accompanying Table 3.3)

2.6 Structural Performance Scaling Factor, Factor I

		Longitudinal	Transverse
a) Structural Performance Factor, S_p (from accompanying Figure 3.4) Tick if light timber-framed construction in this direction		☐	☐
	S_p =	0.85	0.85
b) Structural Performance Scaling Factor = $1/S_p$	**Factor I:**	1.18	1.18

Note Factor B values for 1992 to 2004 have been multiplied by 0.67 to account for Sp in this period

	Longitudinal	Transverse
2.7 Baseline %NBS for Building, *(%NBS)$_b$* (equals **$(\%NBS)_{nom}$ x E x F x G x H x I**)	63%	63%

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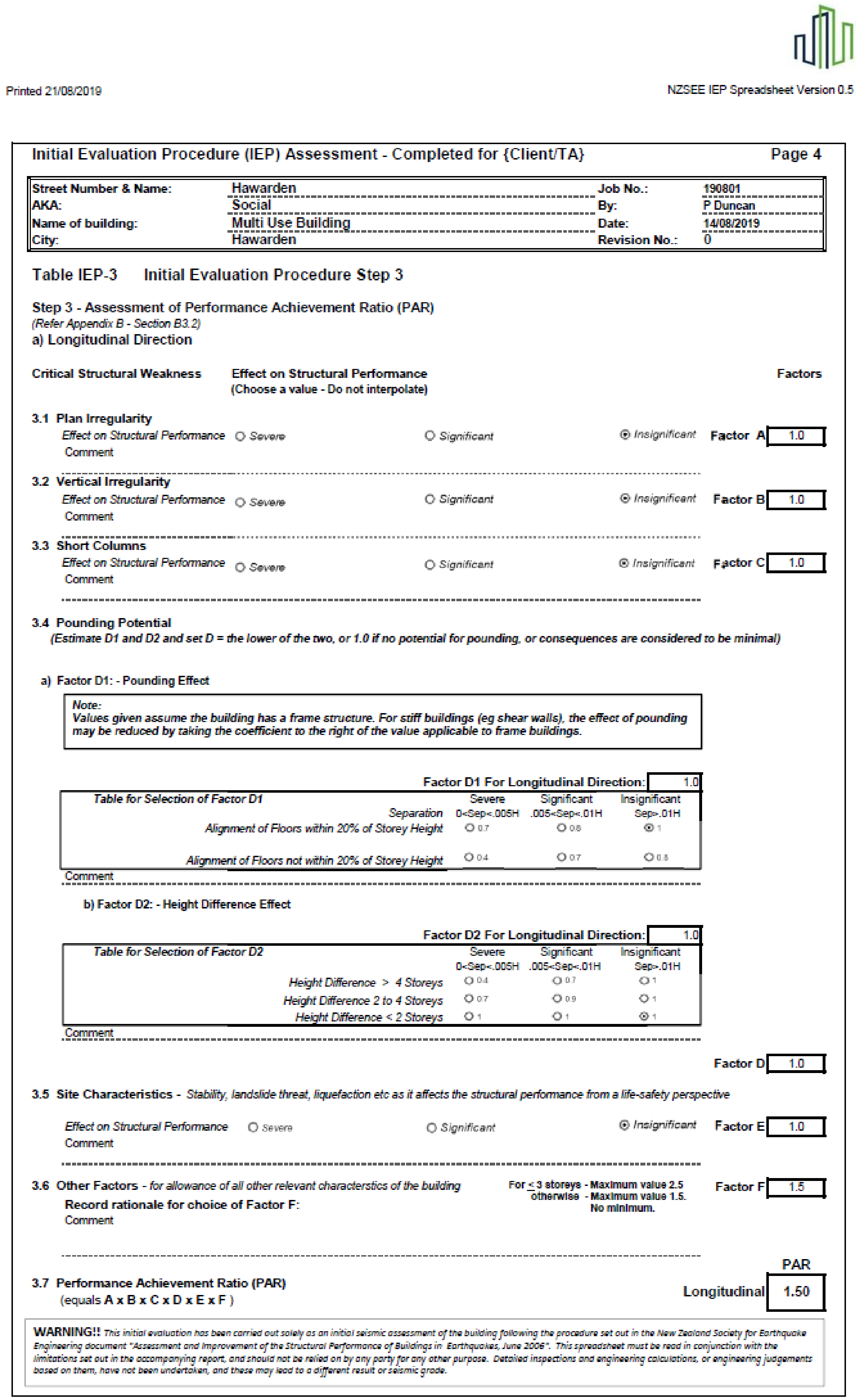

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} **Page 4**

Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Social	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

a) Longitudinal Direction

Critical Structural Weakness **Effect on Structural Performance** **Factors**
(Choose a value - Do not interpolate)

3.1 Plan Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor A** 1.0

Comment

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor B** 1.0

Comment

3.3 Short Columns

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor C** 1.0

Comment

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

Note:
Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.

Factor D1 For Longitudinal Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Longitudinal Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	○ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	● 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor E** 1.0

Comment

3.6 Other Factors - *for allowance of all other relevant characteristics of the building*

For ≤ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 1.5

Record rationale for choice of Factor F:

Comment

3.7 Performance Achievement Ratio (PAR)
(equals **A x B x C x D x E x F**)

PAR
Longitudinal 1.50

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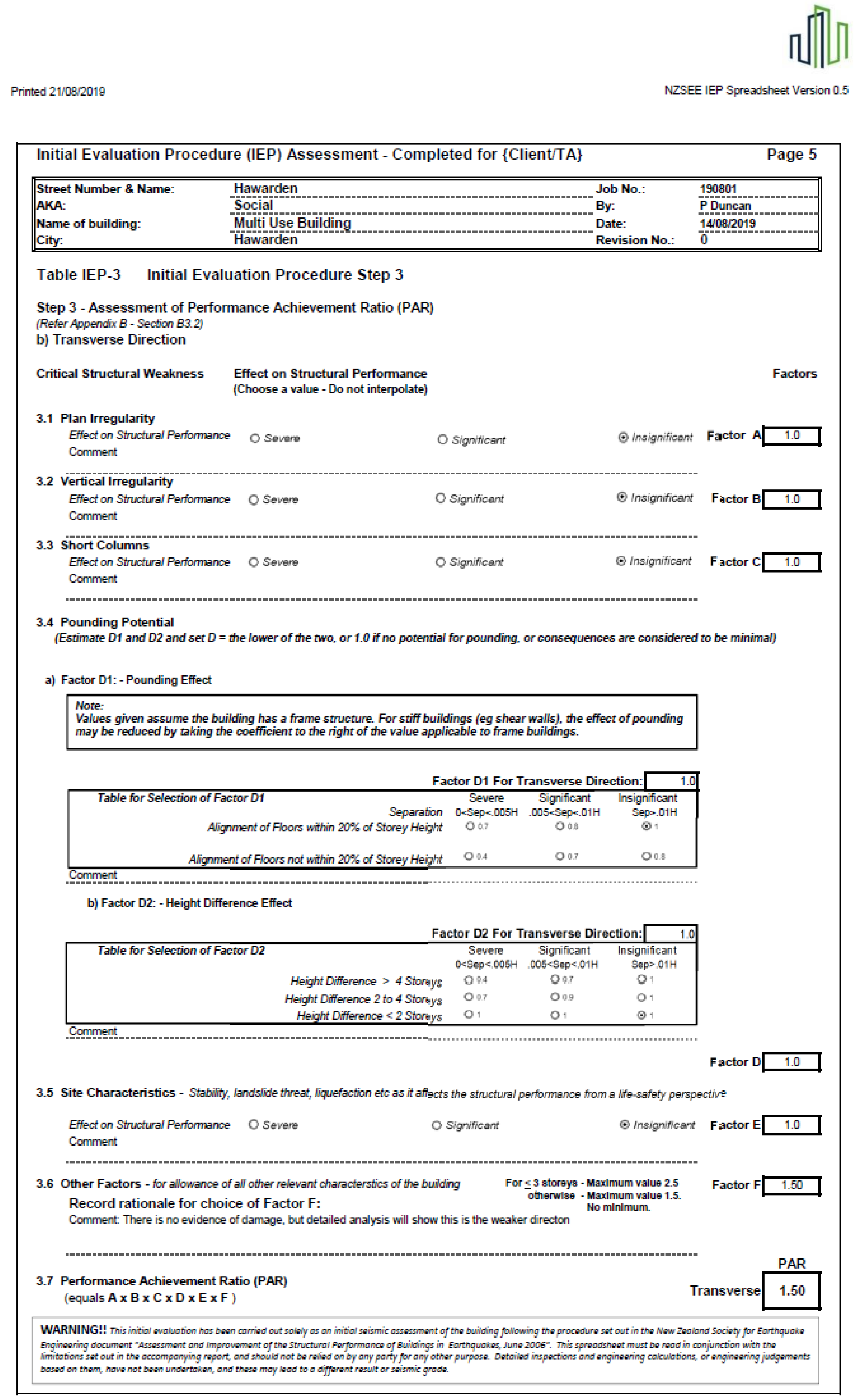

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} **Page 5**

Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Social	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

b) Transverse Direction

Critical Structural Weakness **Effect on Structural Performance** **Factors**

(Choose a value - Do not interpolate)

3.1 Plan Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor A** 1.0

Comment

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor B** 1.0

Comment

3.3 Short Columns

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor C** 1.0

Comment

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

Note:
Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.

Factor D1 For Transverse Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Transverse Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	○ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	● 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ○ *Severe* ○ *Significant* ● *Insignificant* **Factor E** 1.0

Comment

3.6 Other Factors - *for allowance of all other relevant characteristics of the building*

For ≤ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 1.50

Record rationale for choice of Factor F:

Comment: There is no evidence of damage, but detailed analysis will show this is the weaker directon

3.7 Performance Achievement Ratio (PAR)

(equals **A x B x C x D x E x F**)

PAR

Transverse 1.50

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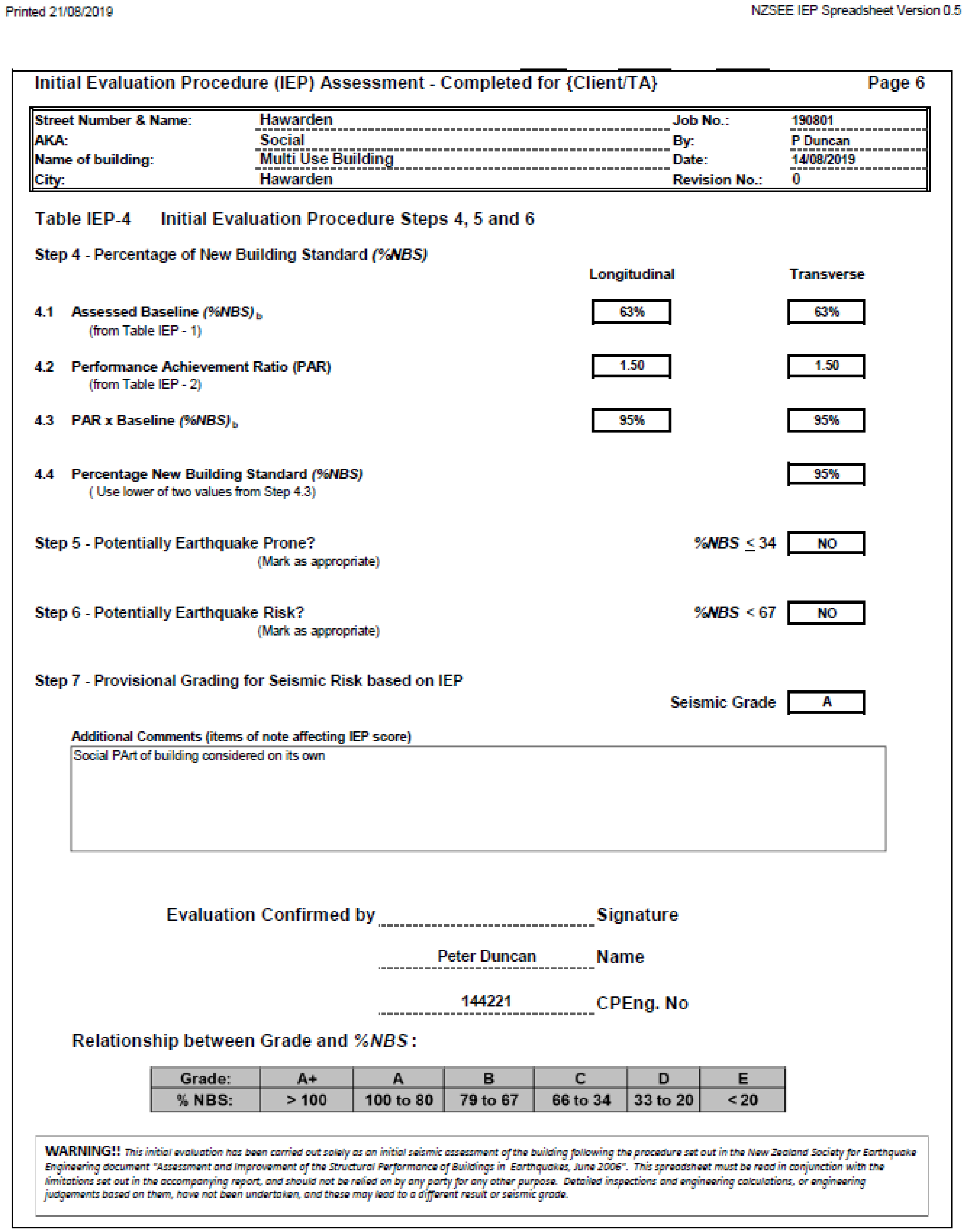

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

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Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Social	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-4 Initial Evaluation Procedure Steps 4, 5 and 6

Step 4 - Percentage of New Building Standard *(%NBS)*

	Longitudinal	Transverse
4.1 Assessed Baseline *(%NBS)*$_b$ (from Table IEP - 1)	63%	63%
4.2 Performance Achievement Ratio (PAR) (from Table IEP - 2)	1.50	1.50
4.3 PAR x Baseline *(%NBS)*$_b$	95%	95%
4.4 Percentage New Building Standard *(%NBS)* (Use lower of two values from Step 4.3)		95%

Step 5 - Potentially Earthquake Prone? (Mark as appropriate) *%NBS* $\leq$ 34 **NO**

Step 6 - Potentially Earthquake Risk? (Mark as appropriate) *%NBS* < 67 **NO**

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade **A**

Additional Comments (items of note affecting IEP score)

Social PArt of building considered on its own

Evaluation Confirmed by ______________________ Signature

Peter Duncan Name

144221 CPEng. No

Relationship between Grade and *%NBS* :

Grade:	A+	A	B	C	D	E
% NBS:	> 100	100 to 80	79 to 67	66 to 34	33 to 20	< 20

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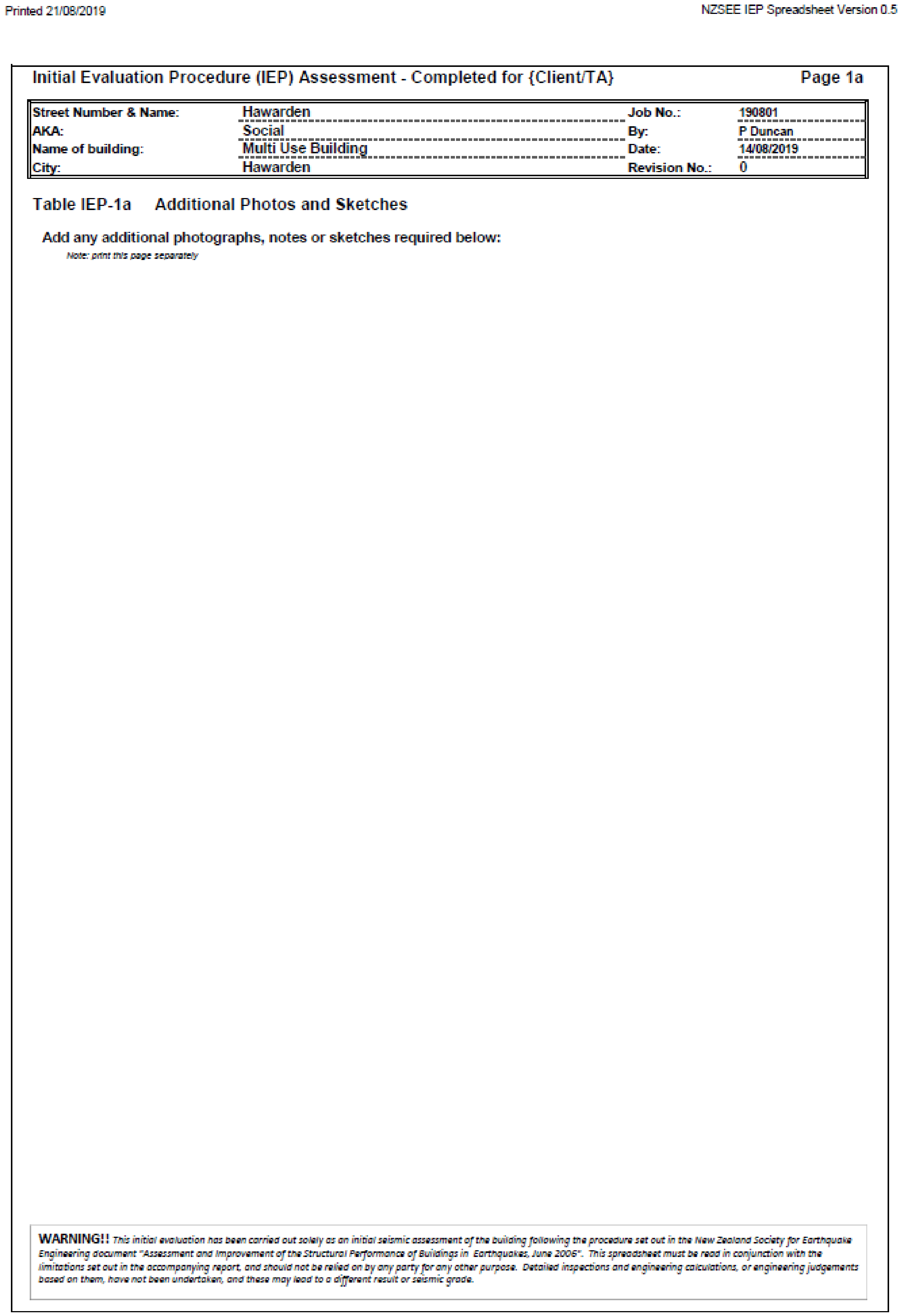

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} **Page 1a**

Street Number & Name:	Hawarden	**Job No.:**	190801
AKA:	Social	**By:**	P Duncan
Name of building:	Multi Use Building	**Date:**	14/08/2019
City:	Hawarden	**Revision No.:**	0

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately

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APPENDIX 2 – Photographs

Social Room

Earthquake Damage Critical Structure weakness – squash court


Crack through step at veranda


Rust on roof at box gutter


Crack through pf sheet at squash court – timber frame above concrete wall

ATTACHMENT A – Drawings

FRONTIER
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Free Call: 0508 FRONTIER (0508 376 684)
Email: admin@fcnzltd.nz

Client
Hurunui District Council

Project Address
11b Allandale Road, , Hawarden

Project Description
Detailed Engineering Evaluation

Drawing Title
Ground Floor Plan

Drawn by RJK
Design by
QA by ####

Scale at A3 1:150
Issue Date 26/08/2019
Project Status: Issued for Report

Project # FC19037
Sheet A1.1
Revision A

R:\1. FC Draughting Files\Archicad Templates\FC Template V22.tpl Rev Date ##/##/####