Acronem Consulting Australia Pty Ltd

Solutions Engineered

NCC, BCA, NZBC, Codes & Standards

- New Building Product Development
- Testing, Appraisal & Regulatory Compliance
- Energy Efficiency & Insulation Expertise

Marketing

- Product Manuals, Installation/Construction
- Technical Literature & Datasheets

Structural Engineering

- Design
- Research
- Reporting

Acronem Consulting Australia Pty Ltd ACN:148 929 944
Web: www.acronem.com.au Phone: 0437 407 176
Email: cameron@acronem.com.au

REPORT NO: ACA – 170112

LOAD SPAN TABLES OF A SUSPENDED CEILING SYSTEM -

COMPONENTS AS PER MELBOURNE TESTING SERVICES REPORT MT-16-798

CLIENT: **MELBOURNE TESTING SERVICES / STUDWORKS**
UNIT 1, 15 PICKERING ROAD,
MULGRAVE, VIC. 3170
AUSTRALIA

DATE: JANUARY 12TH 2017

CONTENTS

1 Overview

Acronem Consulting has been approached by Melbourne Testing Services to perform an analysis of the results of testing on Studworks Top-Cross-Rail, Furring-Channel, Brackets and Clips as described in Report MT-16-798 16th December 2016. The analysis included the determination of load span tables for the Furring-Channel member and for the Top-Cross-Rail member supported by the brackets, clips and hangers as described in MT-16-798.

The results reported as part of this work shall not be interpreted as being applicable for any other componentry or assembly other than that tested and reported in Melbourne Testing Services Report MT-16-798

2 Testing Program

Bending tests were performed to determine the load deflection behaviour (flexural rigidity) and the ultimate bending strength (of the cross-section with unrestrained flanges in compression) of the Furring-Channel and Top-Cross-Rail members. A total number of 10 repeats were performed for each member to provide input data for a statistical analysis for determining the design bending strengths in accordance with AS/NZS 1170.1 Appendix B. The ultimate strength of the hanging system for two different clips and two different brackets was determined from a series of tensile tests performed on the bracket-hanger assembly and the hanger-clip-top-cross-rail-clip-furring channel assembly. The results of these test series provided input to a statistical analysis for determining the design tensile strength of the assembly in accordance with AS/NZS 1170.1 Appendix B.

3 Analysis and Design

3.1 Furring Channel

The analysis was based on engineering first principles and the following assumptions:

- Linear elastic deflections for serviceability loading, (confirmed on the basis of the ultimate bending strength testing performed).
- Single-span and continuous span Furring-Channel members as noted.
- Internal Wind Loads to Ceilings to AS 4055 where:
  N2: V_{hu}=40m/s, V_{hs}=26m/s, C_{pi}=-0.3, and ULS Internal Pressure =-0.29kPa, SLS Internal Pressure =-0.12kPa
- Dead Loads for Australian Conditions in accordance with AS/NZS 1170 and AS 4055
  G = Ceiling Lining + UDL Service Load (0.03kPa) + Self-Weight
- Load Combinations for Australian Conditions in accordance with AS/NZS 1170 and AS 4055
  Ultimate Limit State: 1.4G + 1.2U + W_u
- Serviceability Limit State: G (limited to Span/600 in accordance with AS 3623)
- Serviceability Limit State: G + W_s (limited to Span/200 in accordance with AS/NZS 1170)
- Connections to supporting structures must be independently verified.
- Non-Trafficable Ceiling Systems only.
- Strength check of cross-section with unrestrained flange in compression.

3.2 Top Cross Rail

The analysis was based on engineering first principles and the following assumptions:

- Linear elastic deflections for serviceability loading, (confirmed on the basis of the ultimate bending strength testing performed).
- Continuous (minimum 2-span) Top-Cross-Rail members,
- Dead Loads for Australian Conditions in accordance with AS 2785 shall include
  G = Ceiling Lining + UDL Service Load (0.03kPa) + Self-Weight.
- Critical Load Combinations for Serviceability Limit States and Ultimate Limit States for Australian Conditions in accordance with AS 2785 Clauses 3.3.5 and 3.4.3.
- Serviceability Limit State: Load Combinations limited to Span/360 or 3mm.
- Connections to supporting structures must be independently verified.
- Non-Trafficable Ceiling Systems only.
- Strength check is of cross-section with unrestrained flange in compression.

4 Load Span Tables

The loads used for the following Furring Channel Tables are:

- 1 x 10mm Plasterboard = 7.7kg/m2,
- 1 x 13mm Plasterboard = 10kg/m2,
- 1 x 16mm Plasterboard = 13kg/m2,
- 2 x 13mm Plasterboard = 20kg/m2, and
- 2 x 16mm Plasterboard = 26kg/m2.

4.1 Furring Channel N2 Internal Wind Load

Table 1: Maximum Furring Channel Span: Wind Loads N2 (0.29 kPa Ult.)

Ceiling Lining	Furring Channel (38x28x0.53bmt) Spacing			
	Single Span		Continuous Span	
	450	600	450	600
1 x 10mm Plasterboard	1512	1374	2027	1842
1 x 13mm Plasterboard	1400	1272	1877	1706
1 x 16mm Plasterboard	1293	1175	1734	1576
2 x 13mm Plasterboard	1131	1028	1517	1378
2 x 16mm Plasterboard	1041	946	1396	1268

Notes:

1. Internal Wind Loads to Ceilings to AS 4055 where:
   N2: V_{hu}=40m/s, V_{hs}=26m/s, C_{pi}=-0.3, and ULS Internal Pressure =-0.29kPa, SLS Internal Pressure =-0.12kPa
2. Dead Loads for Australian Conditions in accordance with AS/NZS 1170 and AS 4055
   G = Ceiling Lining + UDL Service Load (0.03kPa) + Self-Weight
3. Load Combinations for Australian Conditions in accordance with AS/NZS 1170 and AS 4055
   Ultimate Limit State: 1.4G + 1.2U + Wu
   Serviceability Limit State: G (limited to Span/600 in accordance with AS 3623)
   Serviceability Limit State: G + Ws (limited to Span/200 in accordance with AS/NZS 1170)
4. Connections to supporting structures must be independently verified.
5. Non-Trafficable Ceiling Systems only.
6. Strength check of cross-section with unrestrained flange in compression.

4.2 Furring Channel N3 Internal Wind Load

Table 2: Maximum Furring Channel Span: Wind Loads N3 (0.45 kPa Ult.)				
Ceiling Lining	Furring Channel (38x28x0.53bmt) Spacing			
	Single Span		Continuous Span	
	450	600	450	600
1 x 10mm Plasterboard	1500	1363	2011	1827
1 x 13mm Plasterboard	1400	1272	1877	1706
1 x 16mm Plasterboard	1293	1175	1734	1576
2 x 13mm Plasterboard	1131	1028	1517	1378
2 x 16mm Plasterboard	1041	946	1396	1268

Notes:

1. Internal Wind Loads to Ceilings to AS 4055 where:
   N3: V_{hu}=50m/s, V_{hs}=32m/s, C_{pi}=-0.3, and ULS Internal Pressure =-0.45kPa, SLS Internal Pressure =-0.18kPa
2. Dead Loads for Australian Conditions in accordance with AS/NZS 1170 and AS 4055
   G = Ceiling Lining + UDL Service Load (0.03kPa) + Self-Weight
3. Load Combinations for Australian Conditions in accordance with AS/NZS 1170 and AS 4055
   Ultimate Limit State: 1.4G + 1.2U + Wu
   Serviceability Limit State: G (limited to Span/600 in accordance with AS 2785 Level 5 finish.)
   Serviceability Limit State: G + Ws (limited to Span/200 in accordance with AS/NZS 1170)
4. Suitability of connections to supporting structures must be independently verified.
5. Non-Trafficable Ceiling Systems only.
6. Strength check of cross-section with unrestrained flange in compression.

4.3 Top Cross Rail 900mm Span

Table 3: Maximum Design Ceiling Load – 900mm Span of Top Cross Rail (25x21x0.7mm)		
TCR Spacing	Furring Channel (38x28x0.53bmt) Spacing (mm)	
	450	600
900	55.5	55.5
1200	41.7	31.0
1500	21.0	16.0
1800	12.0	9.3

Notes:

1. Maximum Ceiling Loads are total factored design ceiling loads incorporating limitations for each of the components and assemblies as tested in MT-16-798.
2. Dead Loads for Australian Conditions in accordance with AS 2785 shall include
   G = Ceiling Lining + UDL Service Load (0.03kPa) + Self-Weight.
3. Critical Load Combinations for Serviceability Limit States and Ultimate Limit States for Australian Conditions in accordance with AS 2785
4. Serviceability Limit State: Load Combinations limited to Span/360 or 3mm.
5. Connections to supporting structures must be independently verified.
6. Non-Trafficable Ceiling Systems only.
7. Strength check of cross-section with unrestrained flange in compression.

4.4 Top Cross Rail 1200mm Span

Table 4: Maximum Design Ceiling Load - 1200mm Span of Top Cross Rail (25x21x0.7mm)		
TCR Spacing	**Furring Channel (38x28x0.53bmt) Spacing (mm)**	
	450	**600**
900	30.4	30.4
1200	22.8	25.3
1500	18.3	16.0
1800	12.0	9.3

Notes:
1. Maximum Ceiling Loads are total factored design ceiling loads incorporating limitations for each of the components and assemblies as tested in MT-16-798.
2. Dead Loads for Australian Conditions in accordance with AS 2785 shall include
G = Ceiling Lining + UDL Service Load (0.03kPa) + Self-Weight.
3. Critical Load Combinations for Serviceability Limit States and Ultimate Limit States for Australian Conditions in accordance with AS 2785
4. Serviceability Limit State: Load Combinations limited to Span/360 or 3mm.
5. Connections to supporting structures must be independently verified.
6. Non-Trafficable Ceiling Systems only.
7. Strength check of cross-section with unrestrained flange in compression.

4.5 Top Cross Rail 1500mm Span

Table 5: Maximum Design Ceiling Load - 1500mm Span of Top Cross Rail (25x21x0.7mm)		
TCR Spacing	**Furring Channel (38x28x0.53bmt) Spacing (mm)**	
	450	**600**
900	12.4	12.4
1200	9.3	9.3
1500	7.4	7.4
1800	6.2	6.2

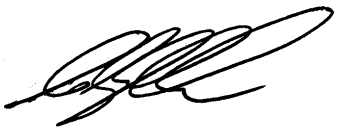
Notes:
1. Maximum Ceiling Loads are total factored design ceiling loads incorporating limitations for each of the components and assemblies as tested in MT-16-798.
2. Dead Loads for Australian Conditions in accordance with AS 2785 shall include
G = Ceiling Lining + UDL Service Load (0.03kPa) + Self-Weight.
3. Critical Load Combinations for Serviceability Limit States and Ultimate Limit States for Australian Conditions in accordance with AS 2785
4. Serviceability Limit State: Load Combinations limited to Span/360 or 3mm.
5. Connections to supporting structures must be independently verified.
6. Non-Trafficable Ceiling Systems only.
7. Strength check of cross-section with unrestrained flange in compression.

5 Summary

An analysis of the results of testing described in Melbourne Testing Services Report MT-16-798 of 16th December 2016 has been performed to determine, from first principles, load-span capacity tables for the Furring-Channel member and for the Top-Cross-Rail member supported by the brackets, clips and hangers, within those Serviceability and Ultimate Limit State design conditions as described.

This work incorporated a statistical analysis for determination of design bending and tensile strengths of the members and assemblies in accordance with AS/NZS 1170.1 Appendix B.

Notes:
1. Acronem Consulting Australia Pty Ltd (Acronem) shall not be liable for loss, cost, damages or expenses incurred by the client or any other person or company, resulting from the use of any information or interpretation given in this report.
2. In no case shall Acronem be liable for consequential damages including, but not limited to, lost profit, damages for failure to meet deadlines or other losses arising from this report.
3. This document shall not be reproduced except in full and relates only to the testing as detailed.
4. It remains the responsibility of the client to verify that the information provided is applicable for their intended purpose.
5. Acronem shall take no responsibility for the interpretation or misinterpretation of this report.



12TH JANUARY 2017

CAMERON CHICK BE(HONS), PH.D, G.C.(COM (MKTG.), M.AIRAH, RPEQ
ACRONEM CONSULTING AUSTRALIA PTY LTD
Registration No: EC 39441

REGISTERED Building Practitioner