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Fire assessment report

Best practice guideline for A1 COREX board applications

Sponsor: Trafalgar Group

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Quality management

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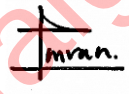
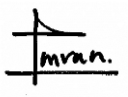
		Signature			

Executive summary

This report documents the recommended guidelines for best practice in protecting structural steel members with A1 COREX boards – in accordance with AS 4100:2020 and AS 1530.4:2014.

This report includes determining the expected period of structural adequacy (PSA) of structural steel members protected with A1 COREX boards and most conservative construction practices to be adhered to under varying applications to protect the construction scenarios listed below:

- interface between A1 COREX boards and another structural steel fire protection system
- steel beams at slab edges
- steel beams supporting composite steel deck floors
- junctions between primary and secondary steel members
- junction between structural steel column and discontinued separating wall

The A1 COREX boards have been tested and assessed as a structural steel fire protection system – in accordance with AS 4100:2020. As per referenced fire assessment report FAS200445 R1.2, A1 COREX boards are capable of providing a PSA of up to 180 minutes for open and closed section beams and columns.

Based on the discussions in section 5 to 9 of this report, the proposed construction applications of A1 COREX boards protecting structural steel members – if applied in accordance with the manufacturers' instructions following the guidelines stipulated in corresponding fire assessment reports – would not be detrimental to the overall fire resistance performance, if tested in accordance with AS 1530.4:2014. The overall PSA of the construction will be governed by the minimum PSA of A1 COREX board and / or spray / intumescent paint protected structural steel member.

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 3 and 10 of this report.

Contents

1. Introduction 5
2. Framework for the assessment 5
2.1 Assessment approach 5
2.2 Declaration 6
3. Limitations of this assessment 6
4. Description of the specimen and variations 7
4.1 System description 7
4.2 Referenced assessment report 7
4.3 Variations to the tested systems 7
4.4 Construction details 8
5. Assessment of the interface between A1 COREX board and fire protection spray or intumescent paint 25
5.1 Description of variation 25
5.2 Methodology 25
5.3 Assessment 25
5.4 Conclusion 27
6. Assessment of steel beams protected with A1 COREX board installed on slab edge 28
6.1 Description of variation 28
6.2 Methodology 28
6.3 Assessment 28
6.4 Conclusion 28
7. Assessment of steel beams protected with A1 COREX board supporting composite steel deck floors 29
7.1 Description of variation 29
7.2 Methodology 29
7.3 Assessment 29
7.4 Conclusion 31
8. Assessment of unprotected secondary beams fixed to protected primary beam/column 32
8.1 Description of variation 32
8.2 Methodology 32
8.3 Assessment 32
8.4 Conclusion 33
9. Assessment of column and wall interface protected with A1 COREX board 34
9.1 Description of variation 34
9.2 Methodology 34
9.3 Assessment 34
9.4 Conclusion 34
10. Validity 36
Appendix A Drawings and additional information 37
Appendix B Summary of supporting test data 38

1. Introduction

This report documents the recommended guidelines for best practice in protecting structural steel members with A1 COREX boards – in accordance with AS 4100:2020[1] and AS 1530.4:2014[2].

This report includes determining the expected period of structural adequacy (PSA) of structural steel members protected with A1 COREX boards and most conservative construction practices to be adhered to under varying applications to protect the construction scenarios listed below:

- interface between A1 COREX boards and another structural steel fire protection system
- steel beams at slab edges
- steel beams supporting composite steel deck floors
- junctions between primary and secondary steel members
- junction between structural steel column and discontinued separating wall

This assessment was carried out at the request of Trafalgar Group. The sponsor details are included in Table 1.

Table 1 Sponsor details

Sponsor	Address
Trafalgar Group	26a Ferndell Street South Granville NSW 2142 Australia

2. Framework for the assessment

2.1 Assessment approach

An assessment is an opinion about the expected performance of a component or element of structure if it was subject to a fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. We have therefore followed the 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2021[3].

This guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction which has already been tested
- The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

This assessment uses established empirical methods and our experience of fire testing similar products to extend the scope of application by determining the limits for the design based on the

1 Standards Australia, 2020, Steel structures, AS 4100:2020, Standards Australia, NSW.
2 Standards Australia, 2014, Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests for elements of construction, AS 1530.4:2014, Standards Australia, NSW.
3 Passive Fire Protection Forum (PFPF), 2019, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance if the elements were to be tested in accordance with AS 1530.4:2014.

This assessment has been written using appropriate test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been deemed appropriate to support the manufacturer's stated design.

2.2 Declaration

The 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal on 27 April 2021, Trafalgar Group confirmed that:

- To their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.

3. Limitations of this assessment

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.3.
- This report details the methods of construction, test conditions and assessed results that are expected if the system was tested and assessed in accordance with AS 1530.4:2014 and AS 4100:2020, respectively.
- The assessment is applicable for structural steel open and closed section beams and columns.
- All protection systems must adhere with construction details as shown in Figure 1 to Figure 16.
- The overall PSA of the construction will be governed by the minimum PSA of A1 COREX board and spray / intumescent paint protected structural steel member.
- For the construction details shown in Figure 15 and Figure 16, the overall fire resistance performance of the construction will be governed by the maximum required thickness of A1 COREX board for structural adequacy, integrity and insulation – as shown in Table 9. The required A1 COREX board thickness for structural adequacy must be obtained from the FAS200445 assessment report.
- The spray or intumescent paint that is expected to be used along with A1 COREX boards at interfaces must have been tested and assessed as a structural steel protection system in accordance with AS 4100:2020 – for their use by an Accredited Testing Laboratory (ATL).
- The Trafalgar FyreBATT sealing system and FyreFLEX sealant must have an established fire performance as required for the application, tested or assessed by an accredited testing laboratory and must not compromise the period of structural adequacy achievable using the A1 COREX boards.
- This report is only valid for the assessed systems and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of this assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL).

- The documentation that forms the basis for this report is listed in Appendix A and Appendix B.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.
- This assessment is based on the proposed systems being constructed under comprehensive quality control practices and following appropriate industry regulations and Australian Standards on quality of materials and maintenance, guidance on workmanship and the expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.

4. Description of the specimen and variations

4.1 System description

This assessment report addresses varying applications of A1 COREX boards protecting structural steel beams and columns and the best practices to be followed.

The A1 COREX boards have been tested and assessed as a structural steel fire protection system – in accordance with AS 4100:2020. As per referenced fire assessment report FAS200445 R1.2, A1 COREX boards are capable of providing a PSA of up to 180 minutes for open and closed section beams and columns.

Applications considered in this report include:

- interface between A1 COREX boards and another structural steel fire protection system
- steel beams at slab edges
- steel beams supporting composite steel deck floors
- junctions between primary and secondary steel members
- junction between structural steel column and discontinued separating wall

4.2 Referenced assessment report

The assessment of the variations to the tested system and the determination of the expected performance is based on the results of the fire assessment documented in the reports summarised in Table 2. Further details are included in Appendix B.

Table 2 Referenced assessment report

Report number	Report sponsor	Issue date	Issuing authority
FAS200445 R1.2	Trafalgar Group	5 May 2021	Warringtonfire
FAS210132 R1.1	Trafalgar Group	23 November 2021	Warringtonfire

4.3 Variations to the tested systems

An identical system has not been subject to a standard fire test. We have therefore assessed the system using baseline assessment information for similar systems. The variations to the assessed systems – together with the referenced assessment reports – are described in Table 3.

Table 3 Variations to tested systems

Item	Reference assessment report	Description	Variations
Fire protection of structural steel	FAS200445 R1.2	The referenced assessment report permits to protect structural steel members using A1 COREX boards for a PSA up to 180 minutes. Refer the referenced	It is proposed to: • Protect structural steel beam and column joint by a combination of the A1 COREX board and spray

Item	Reference assessment report	Description	Variations
		assessment report for specific limitations and outcomes.	or intumescent paint fire protection systems. • Protect structural steel beams located at the edge of a concrete slab with A1 COREX boards • Protect structural steel beams supporting composite steel deck floor slabs installed perpendicular or parallel to the voids with A1 COREX boards • Protect structural steel beam / beam or beam / column junctions with A1 COREX boards • Protect structural steel column and separating wall junction with A1 COREX boards
Shaft wall system	FAS210132 R1.1	The referenced assessment report documents the findings of the assessment undertaken to determine the expected fire resistance level of A1 COREX shaft wall systems for up to -/120/120 in accordance with AS 1530.4:2014.	

4.4 Construction details

Figure 1 to Figure 7 show the construction and treatment at the interface between the two structural steel protection systems. Figure 8 shows the construction details of steel beam located at the edge of a slab. Figure 9 to Figure 13 show the construction details of steel beams supporting composite steel deck floors and Figure 14 shows the construction details at the junction between primary and secondary steel members. Figure 15 and Figure 16 shows the construction details when A1 COREX board protected steel column is installed between a discontinued separating wall element which requires integrity and insulation performance.

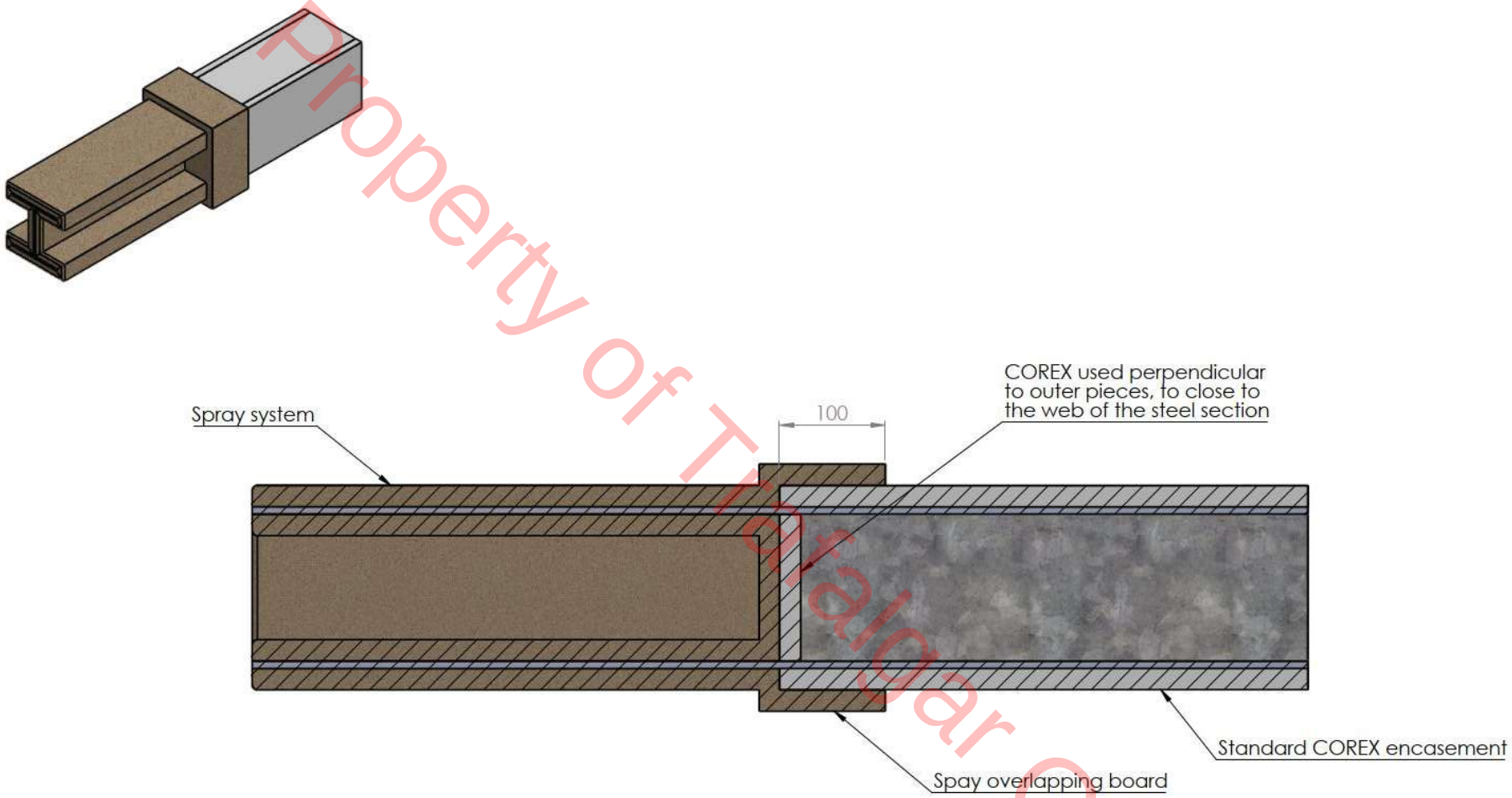


Figure 1 The construction detail when the spray protection system is added next to the existing board protection system – Option 1

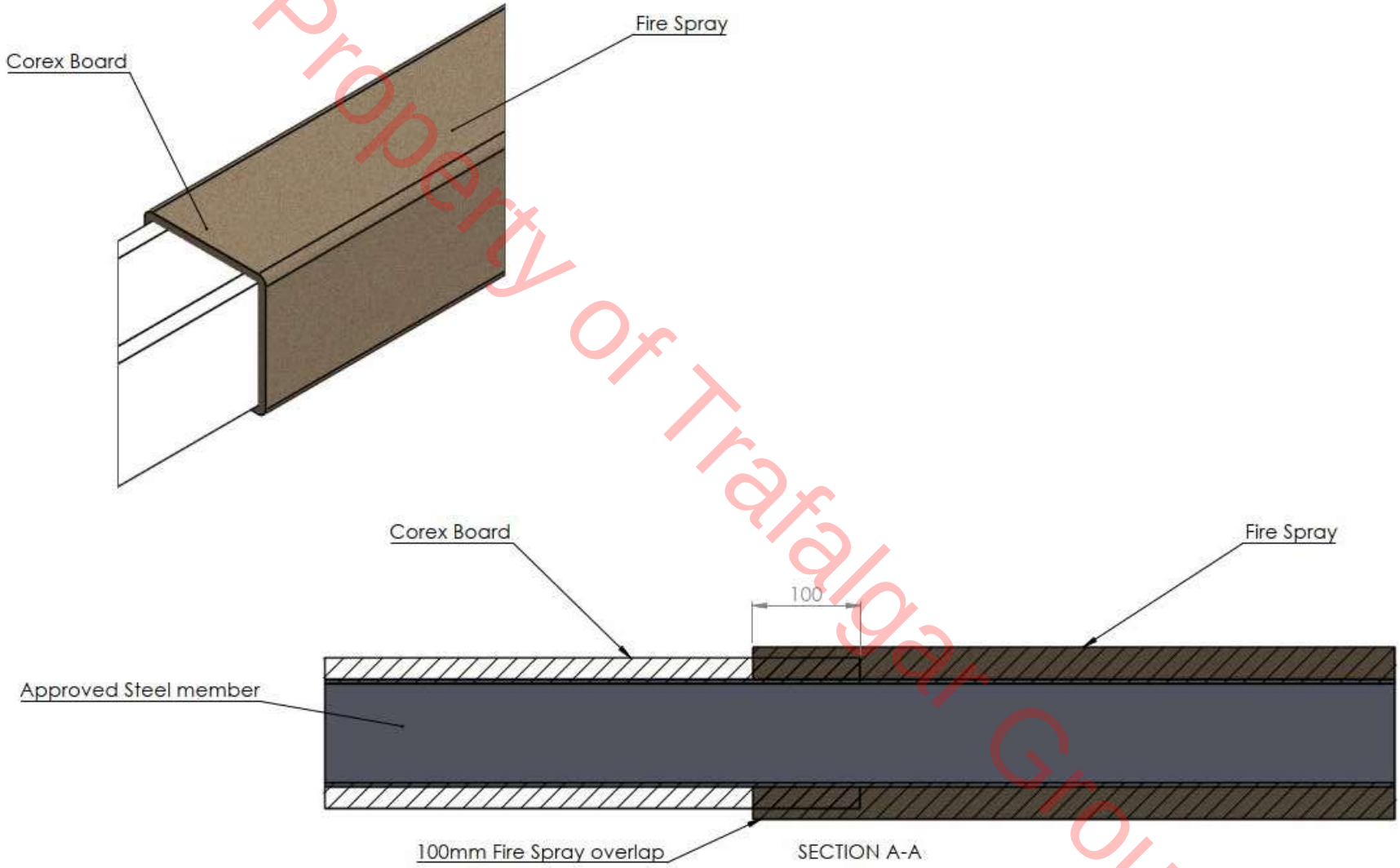


Figure 2 The construction detail when the spray protection system is added next to the existing board protection system – Option 2

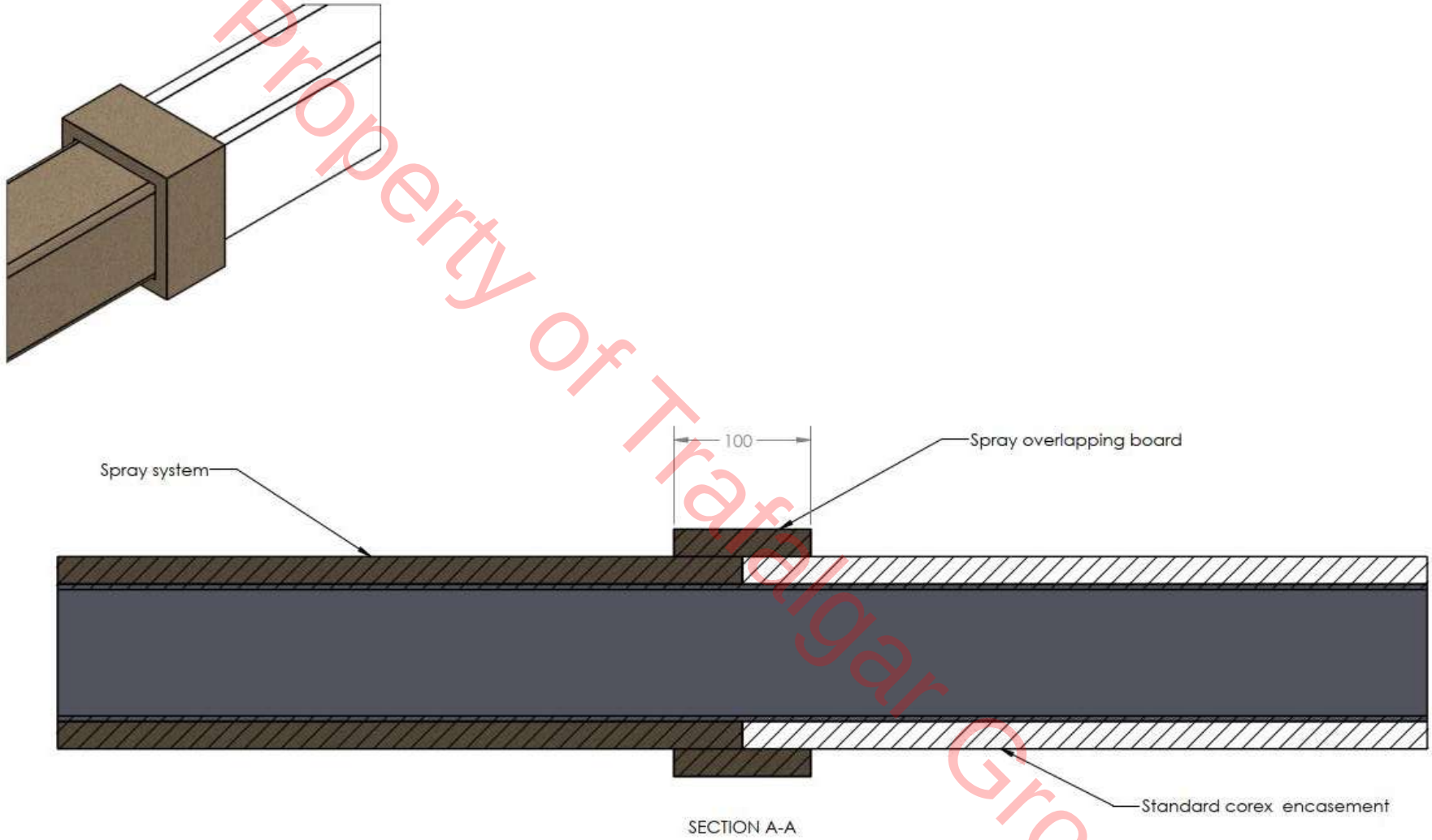


Figure 3 The construction detail when the spray protection system is added next to the existing board protection system – Option 3

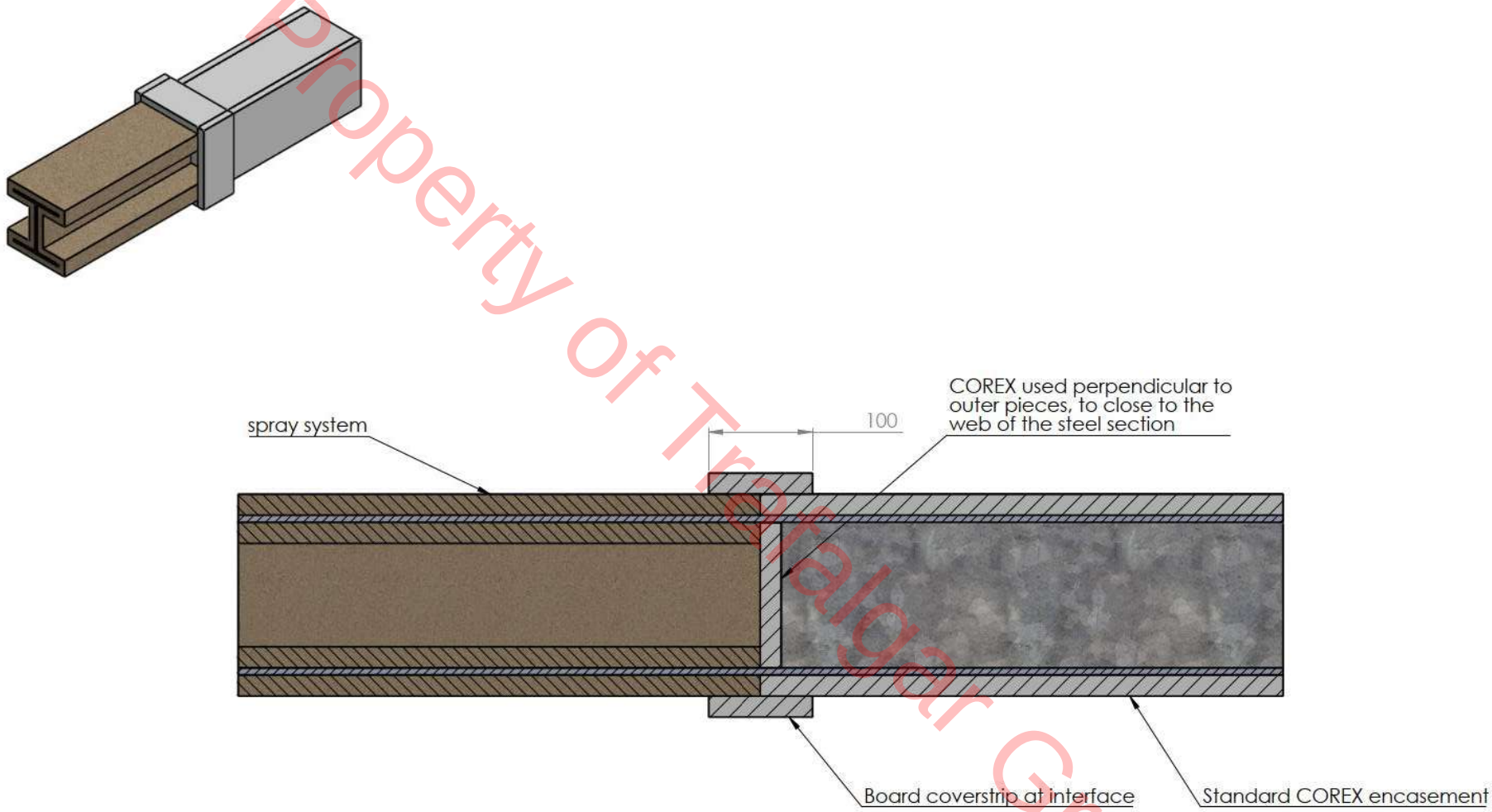


Figure 4 The construction detail when the board protection system is added next to the existing spray protection system – Option 1

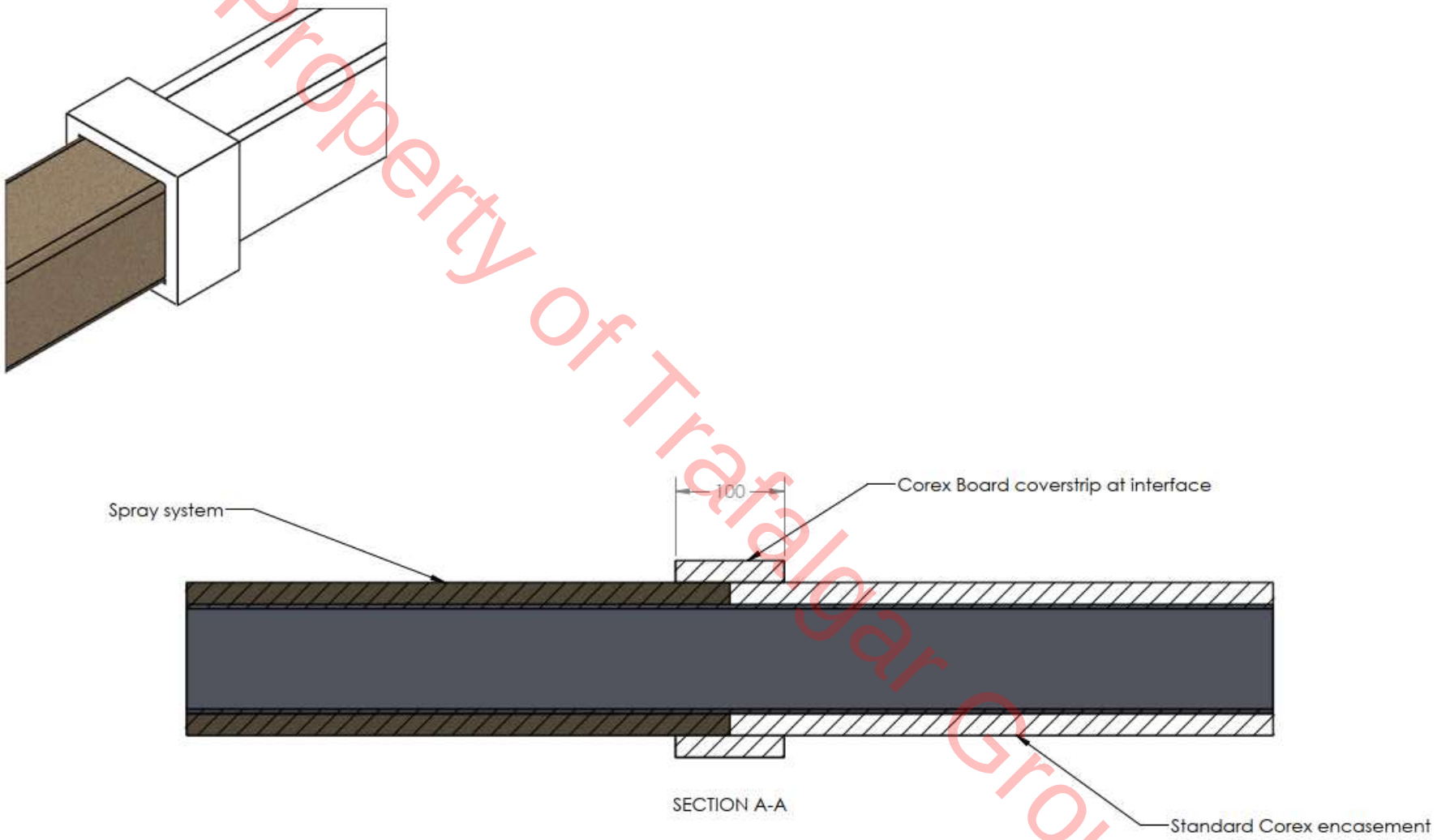


Figure 5 The construction detail when the board protection system is added next to the existing spray protection system – Option 2

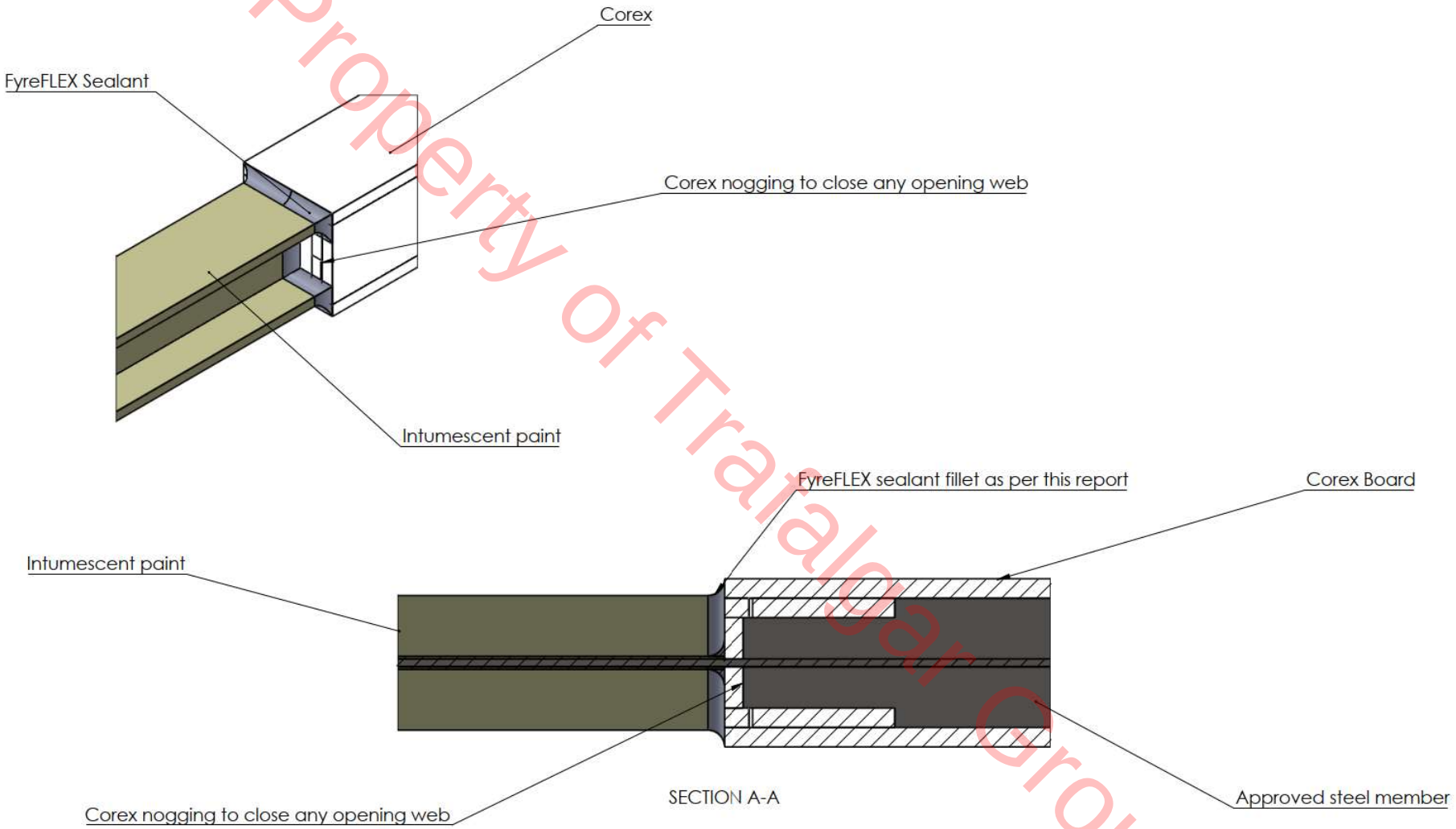


Figure 6 The construction detail when the board protection system is added next to the existing intumescent paint protection system

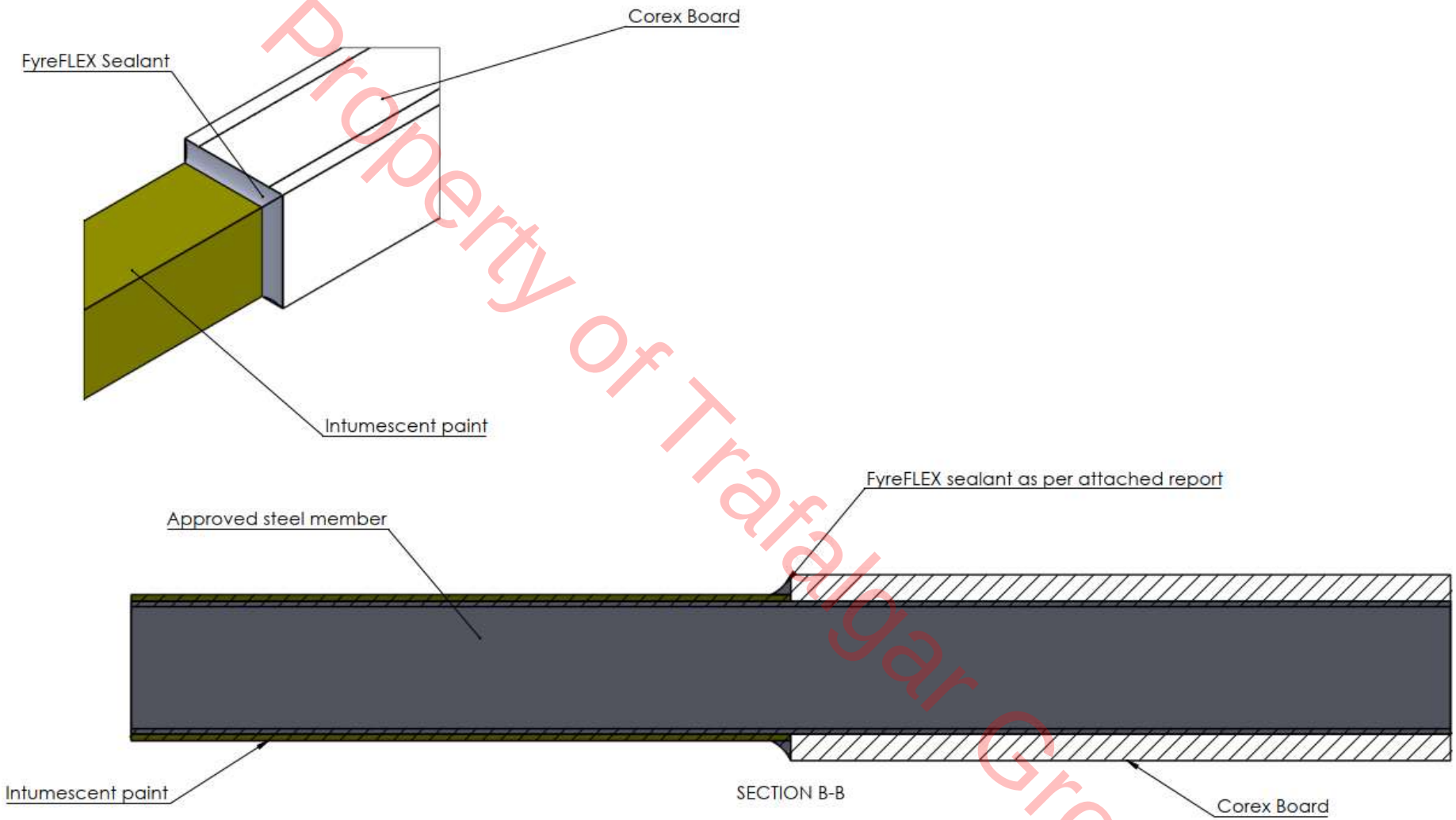


Figure 7 **The construction detail when the board protection system is added next to the existing intumescent paint protection system – Option 2**

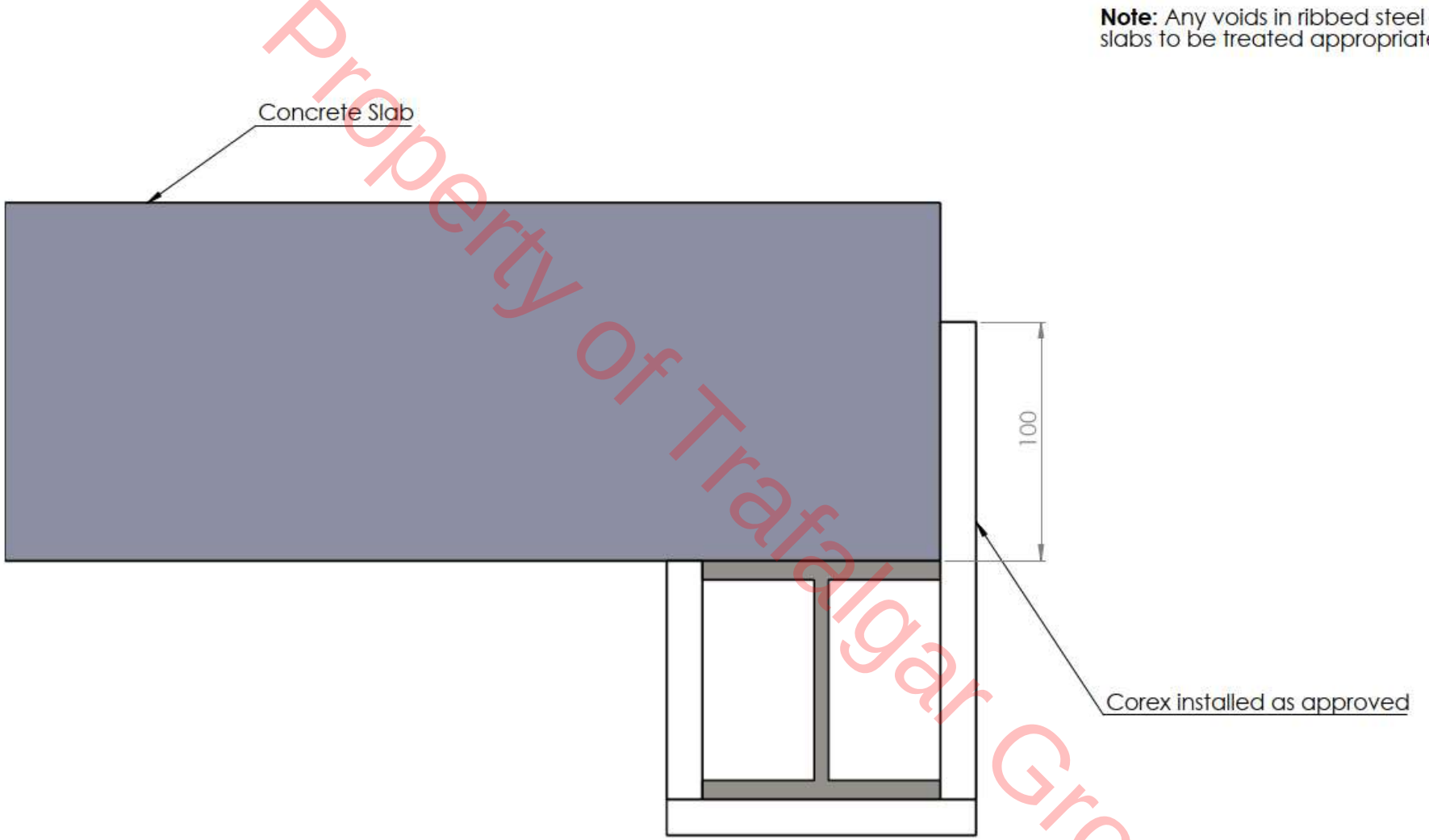


Figure 8 **The construction detail when a steel beam is located at the edge of a slab and is protected with A1 Corex boards**

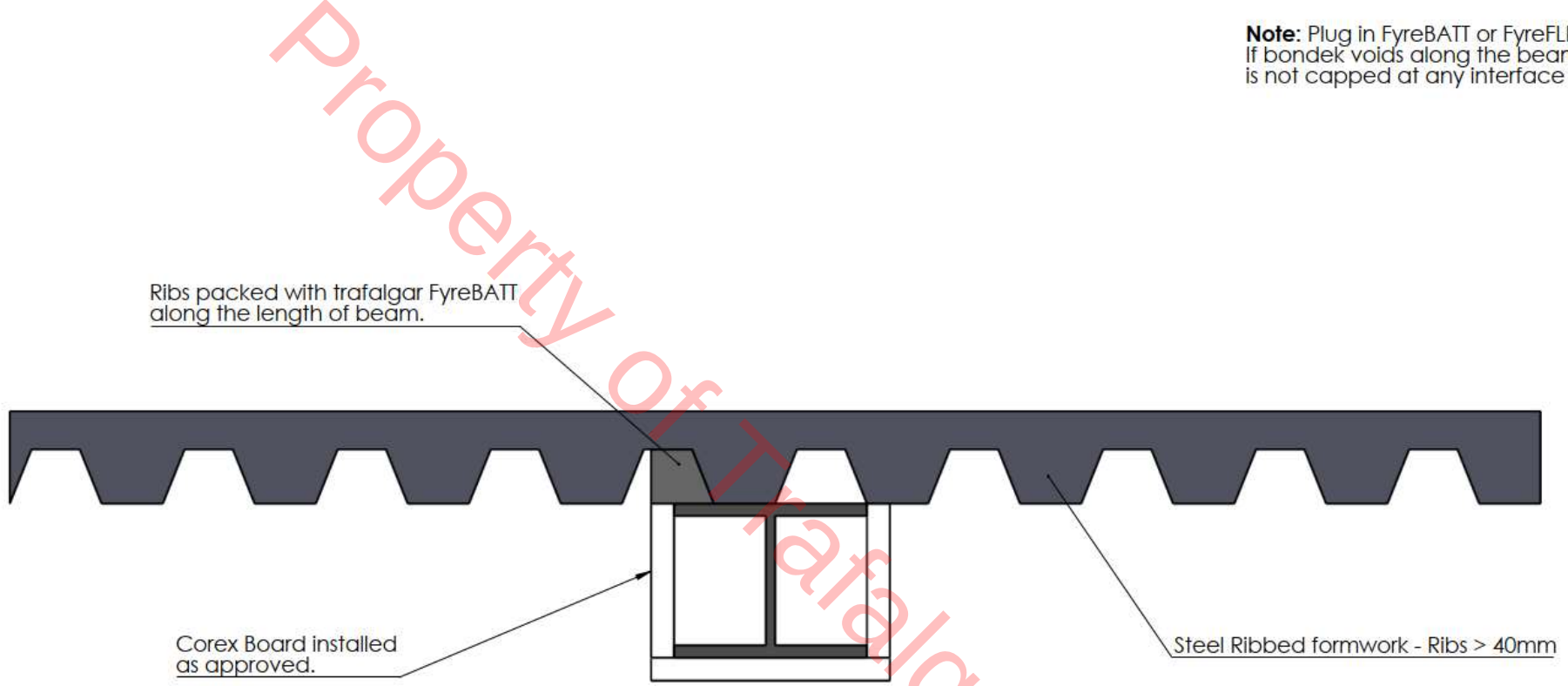


Figure 9 **The construction detail of protected beam parallel to the voids of a composite floor slab with ribs (> 40 mm) packed with Trafalgar FyreBATT along the length of the beam**

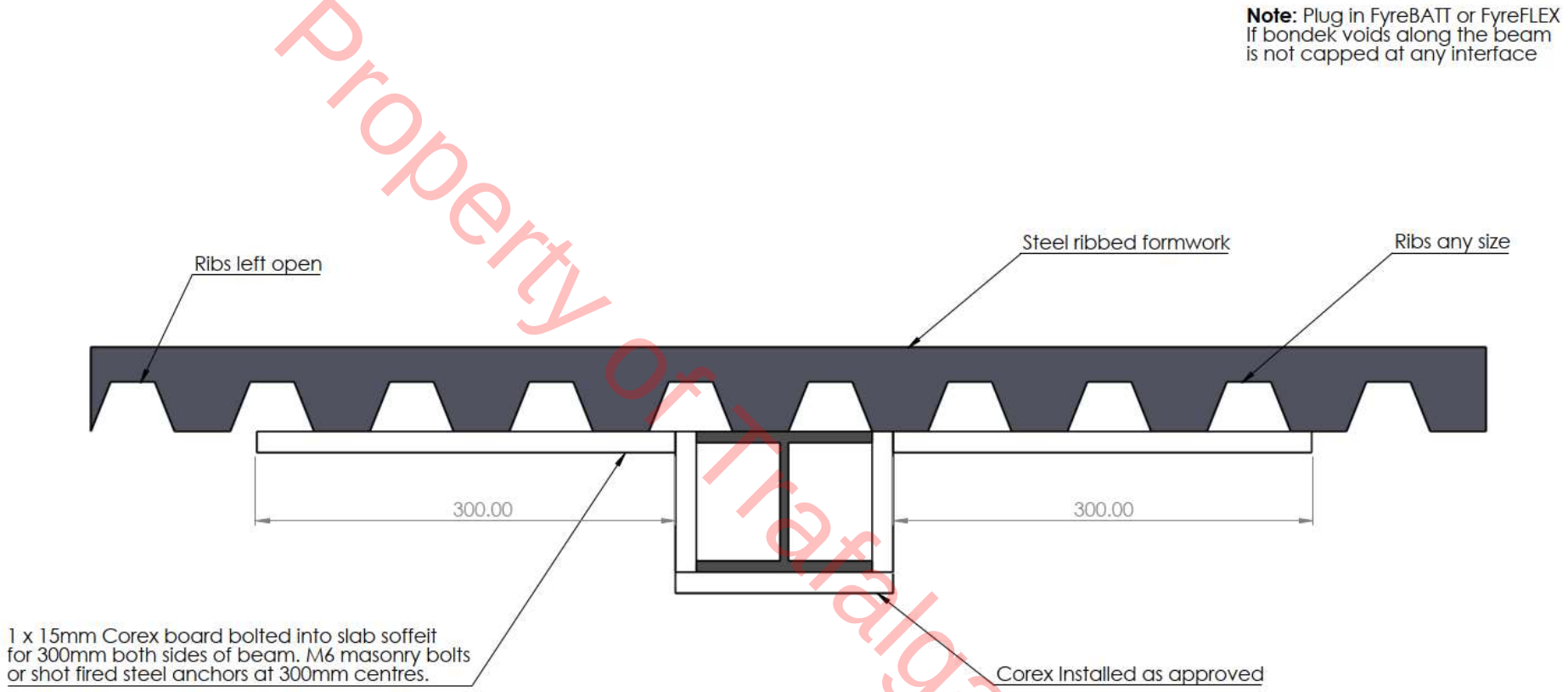


Figure 10 The construction detail of protected beam parallel to the voids of a composite floor slab with ribs of any size, with board protection extended for 300 mm on both sides

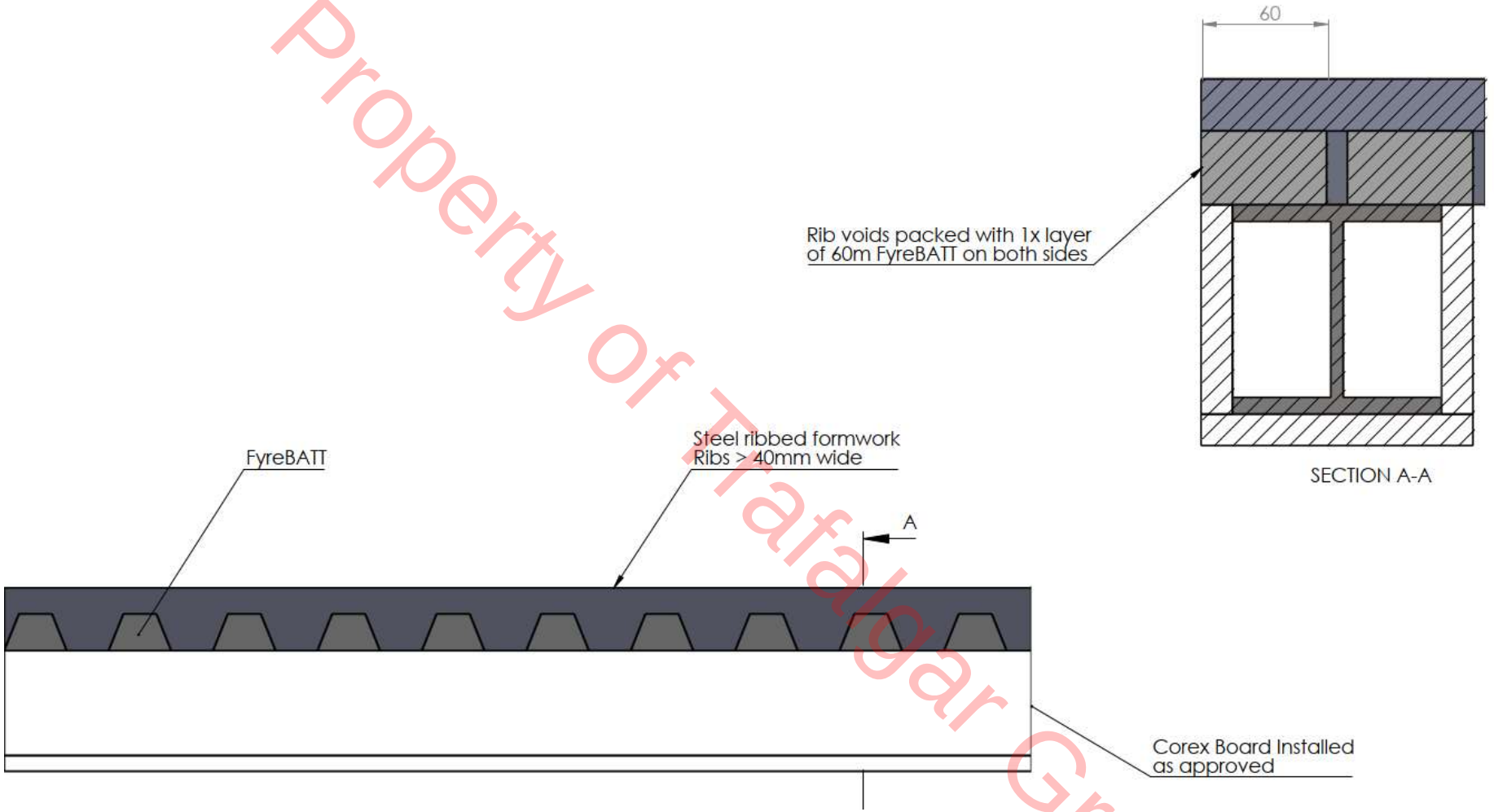


Figure 11 **The construction detail of protected beam perpendicular to the voids of a composite floor slab with ribs (> 40 mm) packed with Trafalgar FyreBATT along the length of the beam**

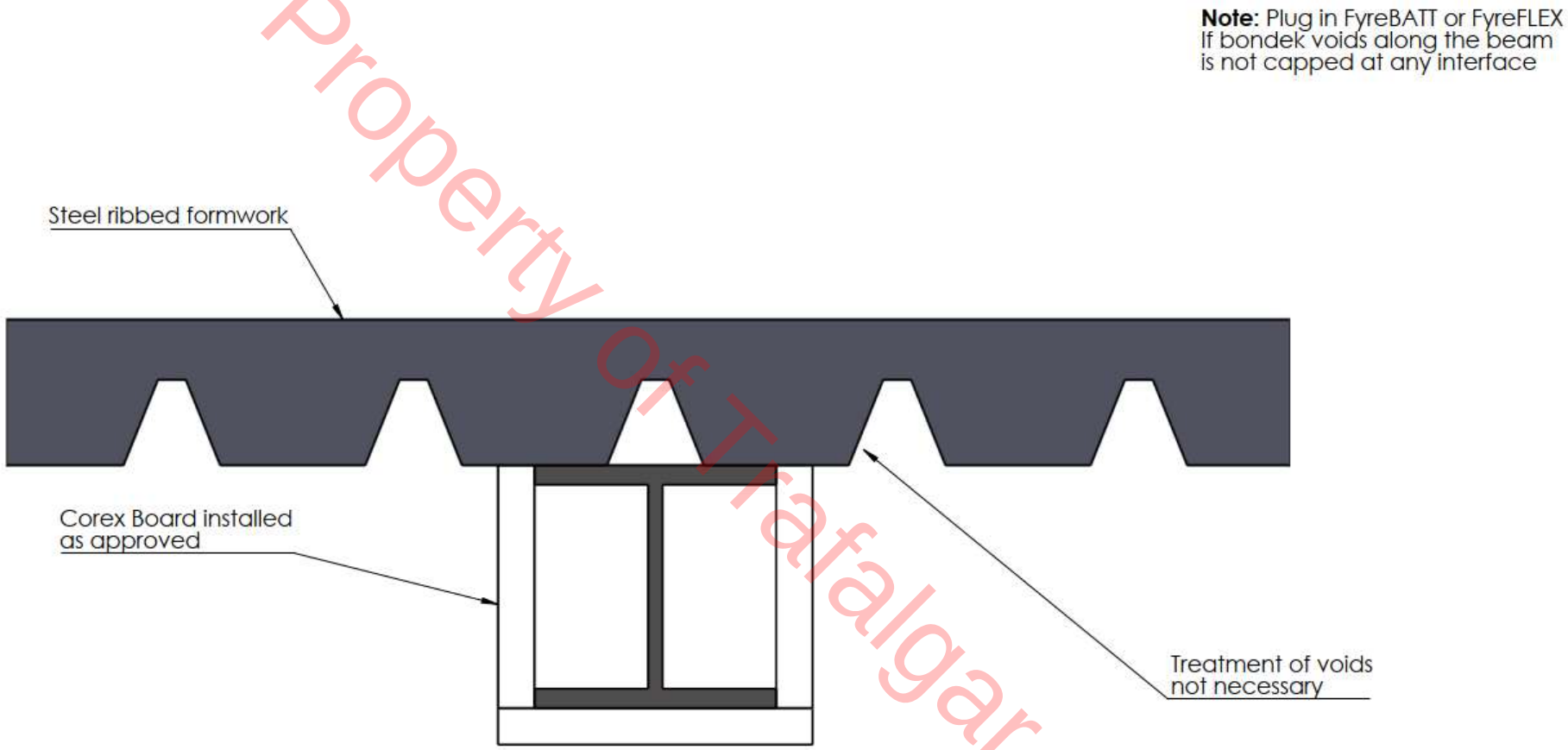


Figure 12 The construction detail of protected beam parallel to the voids of a composite floor slab with ribs (< 40 mm)

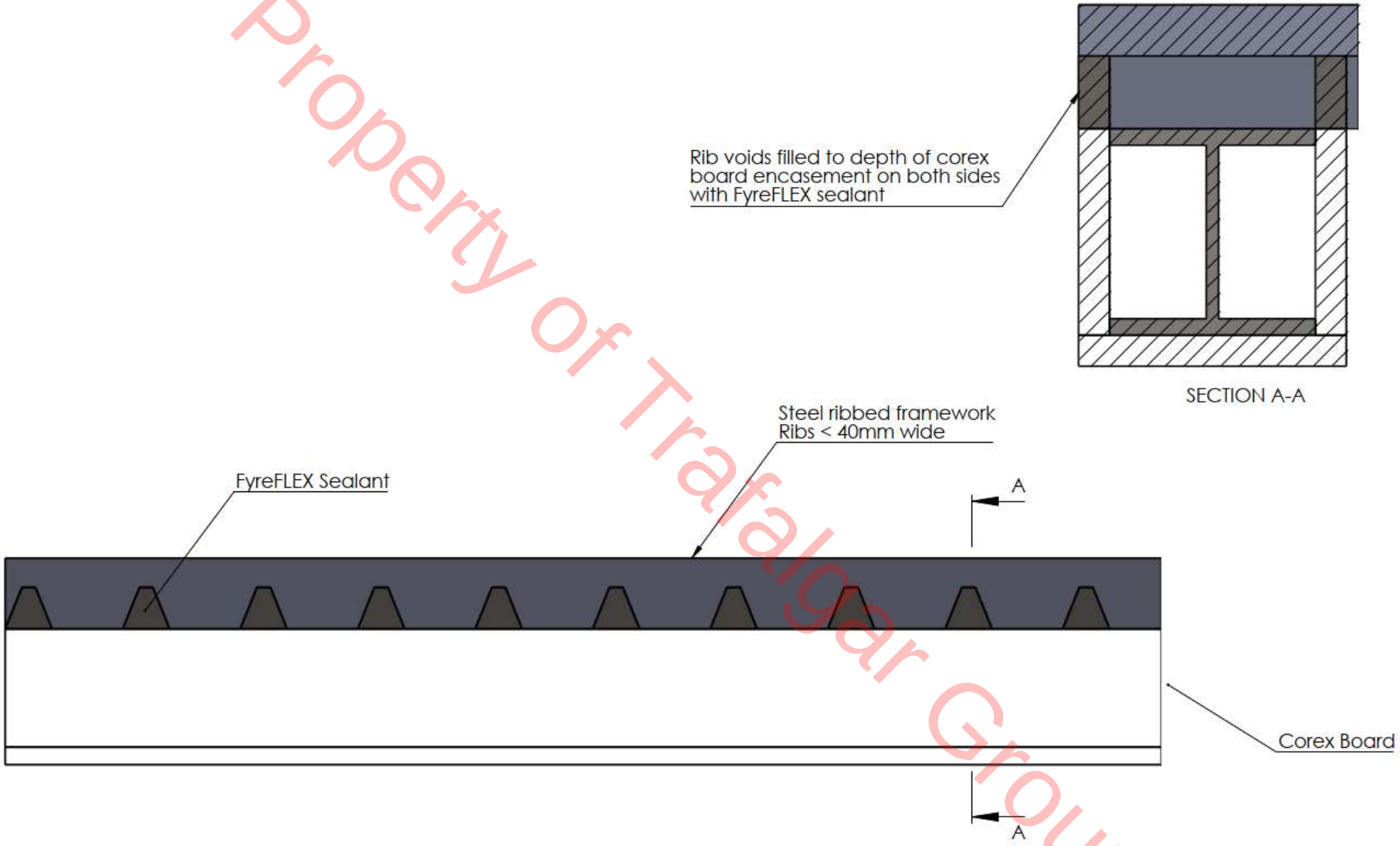


Figure 13 **The construction detail of protected beam perpendicular to the voids of a composite floor slab with ribs (< 40 mm) filled with Trafalgar FyreFLEX sealant along the length of the beam**

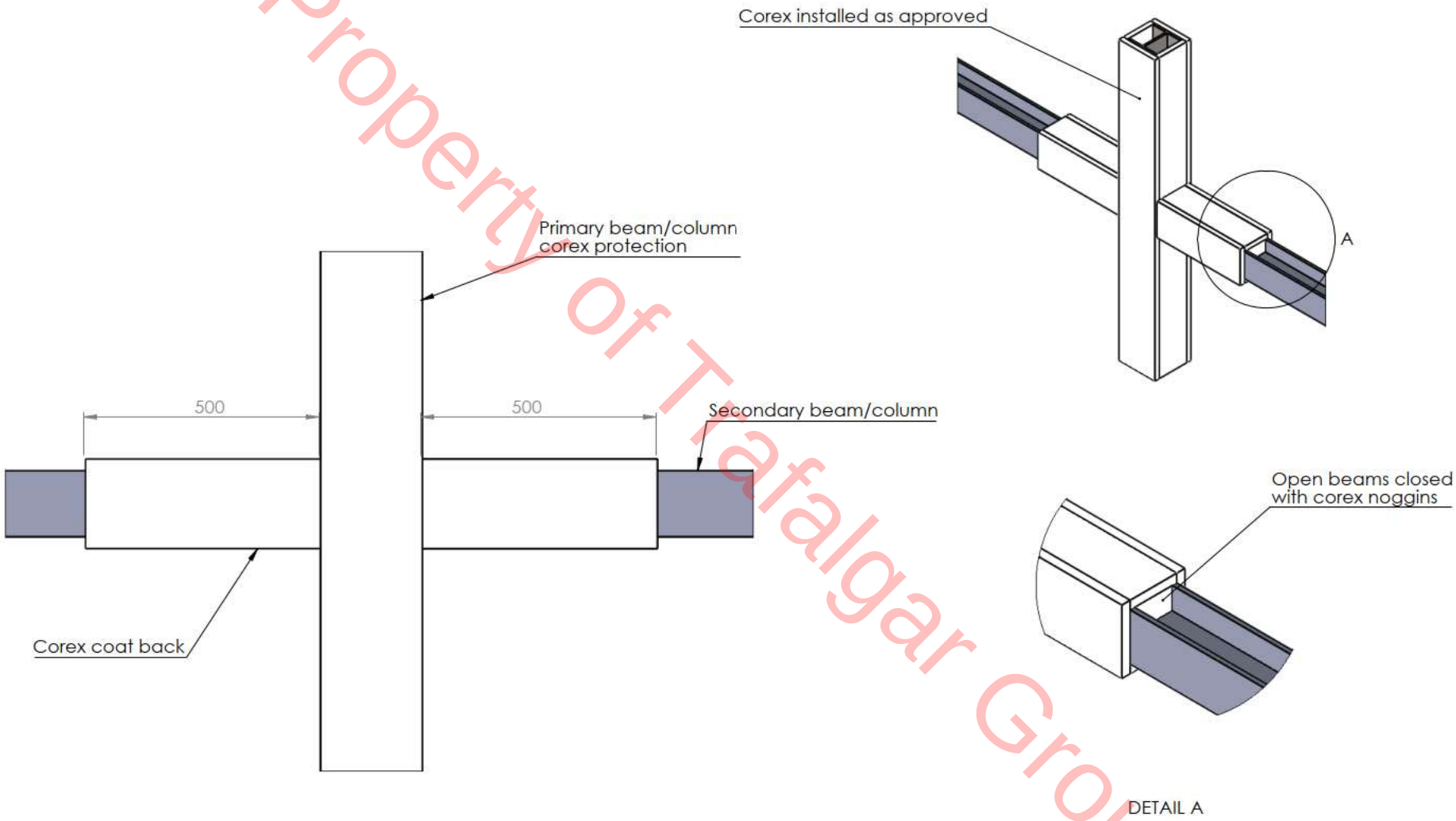


Figure 14 The construction detail of board protection on primary columns and secondary beams for a distance of 500 mm on both sides of the column

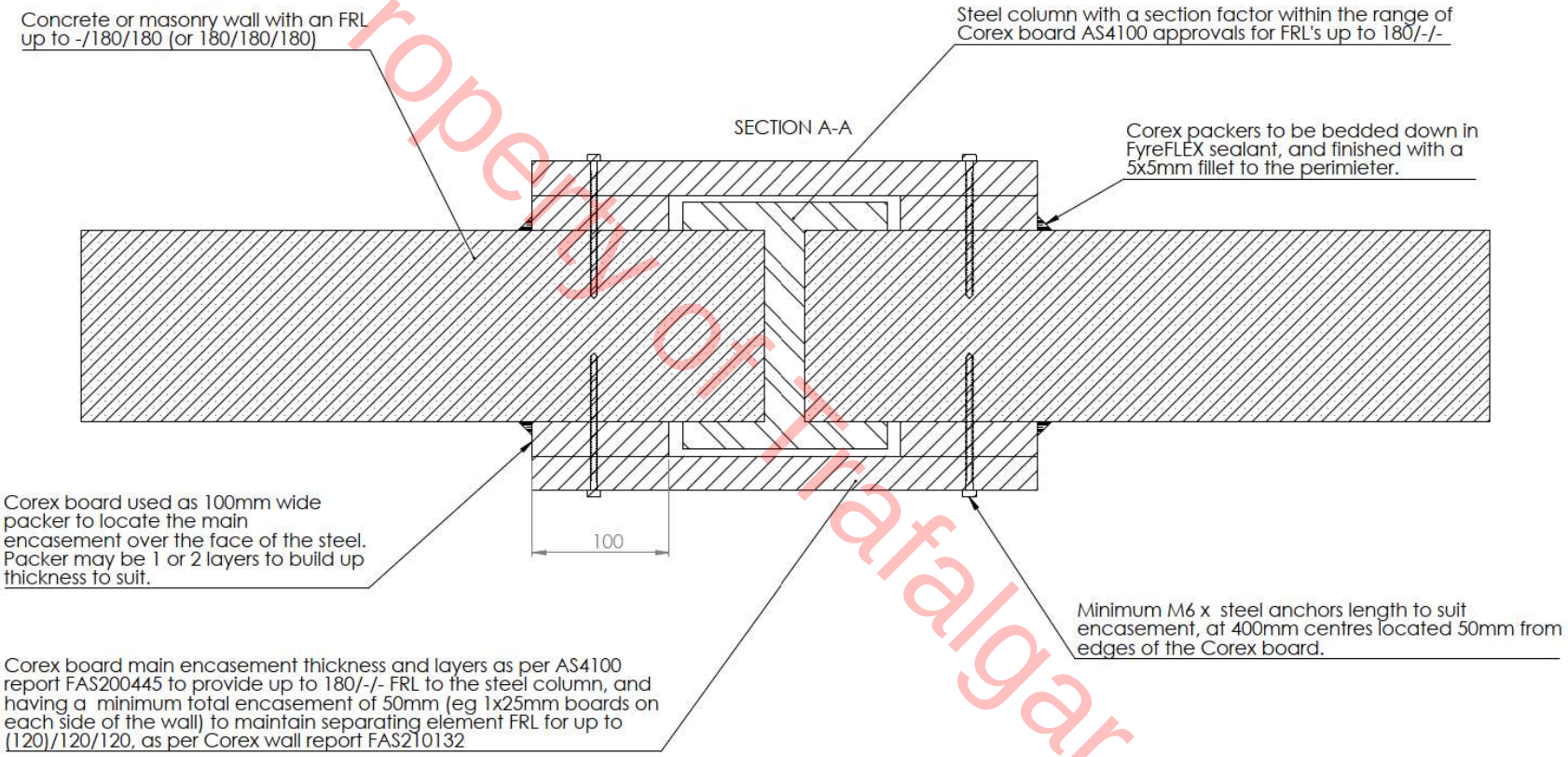


Figure 15 The construction detail of block wall and steel interface protected with A1 COREX board – section view 1

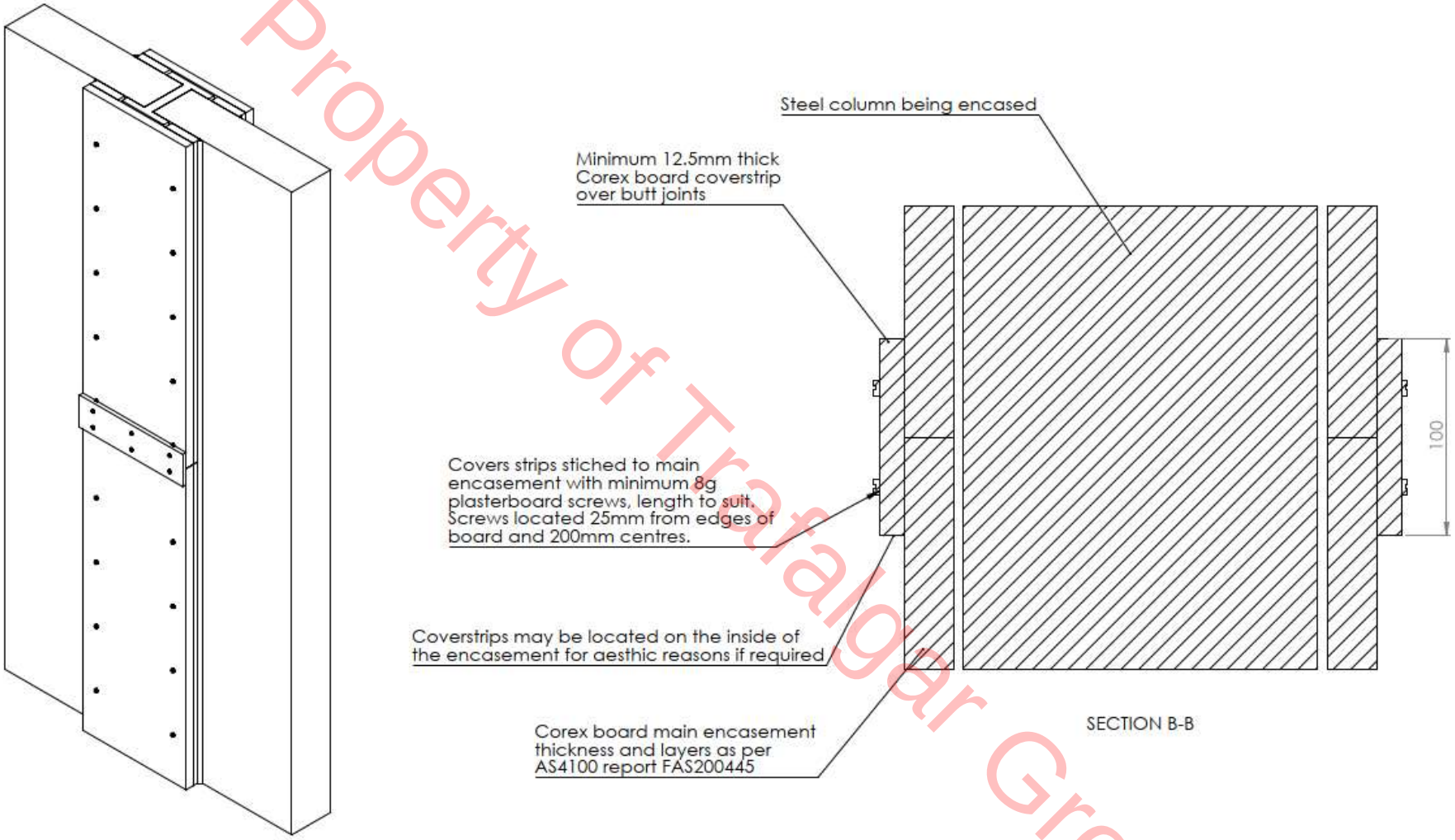


Figure 16 The construction detail of block wall and steel interface protected with A1 COREX board – section view 2

5. Assessment of the interface between A1 COREX board and fire protection spray or intumescent paint

5.1 Description of variation

The A1 COREX boards have been tested and assessed as a structural steel fire protection system –in accordance with AS 4100:2020. As per referenced fire assessment report FAS200445 R1.2, A1 COREX boards are capable of providing a PSA of up to 180 minutes for open section beams and columns, and hollow section columns. Similarly, the spray or intumescent paint that is expected to be used along with A1 COREX boards at interfaces must have been tested and assessed as a structural steel protection system in accordance with AS 4100:2020.

It is proposed to protect structural steel beam and column by a combination of the A1 COREX boards and structural steel protection spray or intumescent paint. The specific construction details are shown Figure 1 to Figure 7.

This assessment was done to determine the likely performance of the combined structural steel protection system in accordance with the requirements of AS 4100:2020 and AS 1530.4:2014.

5.2 Methodology

The method of assessment used is summarised in Table 4.

Table 4 Method of assessment

Assessment method	
Level of complexity	Simple assessment
Type of assessment	Qualitative

5.3 Assessment

The A1 COREX boards have been assessed and approved for PSAs up to 180 minutes – when applied in accordance with the manufacturer's instructions and guidance. The A1 COREX boards have been permitted by the referenced assessment report summarised in Table 2 for open section beams and columns, and hollow section columns.

The spray or intumescent paint that is expected to be used along with A1 COREX boards must also have been tested and approved for fire protection of steel elements – in accordance with AS 4100:2020 and applied in accordance with the manufacturer's instructions.

5.3.1 The spray protection system is added next to the existing A1 COREX board protection system

Figure 1 to Figure 3 show the construction detail when the spray protection system is added next to the existing board protection system. In the proposed construction, one of the steel members is protected using A1 COREX boards and the other is protected using an approved structural steel spray fire protection system.

As the spray is applied after the application of A1 COREX boards, it is proposed to overlap the board protection using the spray for a distance not less than 100 mm (see Figure 1 to Figure 3). This is expected to eliminate any gaps or inconsistencies of fire protection at the interface.

The fixing methods / mechanism of the spray are different from those of the boards. While the boards are usually fastened mechanically to the underlying steel member, the spray is retained in place due to its adhesion to the steel substrate or by using a steel mesh. It is important that the fixity of the board and spray systems at the interface is detailed appropriately – to be in line with the fixing system used in the referenced tests – to ensure that stickability is maintained for the required period of structural adequacy (in line with their own assessment).

The spray protection, which once hardened remains in place, is likely to provide additional protection at the 100 mm interface. As a result, overlapping the two protection systems by 100 mm is expected to provide a safety margin. This allows for increased confidence in the proposed detailing.

As a complete system, the PSA of the overall system will be governed by the minimum PSA of A1 COREX board and spray protected structural steel member. Reference should be made to the relevant fire assessment report to determine the required thickness of spray and board protection. As such, this report must be used in conjunction with FAS200445 and the fire assessment report of the spray protection system.

Based on the discussion above, the interface details between A1 COREX boards and spray protection system as shown in Figure 1 to Figure 3 are not considered to be detrimental to the fire resistance performance of structural steel members.

5.3.2 The A1 COREX board protection system is added next to the existing spray protection system

Figure 4 and Figure 5 show the construction detail when the board protection system is added next to the existing spray protection system. In the proposed construction, one of the steel members is protected using A1 COREX boards and the other is protected using an approved structural steel spray fire protection system.

As the A1 COREX boards is applied after the application of spray in this instance, it is proposed to cut back the spray protection to provide a flat edge. Then the A1 COREX boards are extended to the flat edge of the spray. The interface where the board meets the spray is protected using a 100 mm wide A1 COREX board strip as shown in Figure 4 and Figure 5. This is expected to eliminate any gaps or anomalies of fire protection at the interface.

As discussed in 5.3.1, the specific fixing methods / mechanism of the spray and A1 COREX board protection systems must be adhered to be in line with the fixing system used in the referenced tests – to ensure that stickability is maintained for the required period of structural adequacy.

As a complete system, the PSA of the overall system will be governed by the minimum PSA of A1 COREX board and spray protected structural steel member. Reference should be made to the relevant fire assessment report to determine the required thickness of spray and board protection. As such, this report must be used in conjunction with FAS200445 and the fire assessment report of the spray protection system.

Based on the discussion above, the interface details between A1 COREX boards and spray protection system as shown in Figure 4 and Figure 5 are not considered to be detrimental to the fire resistance performance of structural steel members.

5.3.3 The A1 COREX board protection system is added next to the existing intumescent paint protection system

Figure 6 and Figure 7 show the construction detail when the board protection system is added next to the existing intumescent paint protection system. In the proposed construction, one of the steel members is protected using A1 COREX boards and the other is protected using an approved structural steel intumescent paint fire protection system.

As the A1 COREX boards are applied after the application of intumescent paint, it is proposed to extend the boards up to the intumescent paint protection and protect the interface using Trafalgar FyreFLEX sealant as shown in Figure 6 and Figure 7. The FyreFLEX fillet size must be same size as the A1 COREX board thickness. The inclusion of the sealant at the interface is expected to eliminate any gaps or anomalies of fire protection at the interface.

The specific fixing methods of the boards and surface preparation before the application of intumescent paint must be adhered to be in line with the referenced tests – to ensure that stickability is maintained for the required period of structural adequacy.

As a complete system, the PSA of the overall system will be governed by the minimum PSA of A1 COREX board and intumescent paint protected structural steel member. Reference should be made to the relevant fire assessment report to determine the required thickness of intumescent paint and board protection. As such, this report must be used in conjunction with FAS200445 and the fire assessment report of the intumescent paint protection system.

Based on the discussion above, the interface details between A1 COREX boards and intumescent paint protection system as shown in Figure 6 and Figure 7 are not considered to be detrimental to the fire resistance performance of structural steel members.

5.4 Conclusion

It is expected that the interface construction details between the A1 COREX boards and the structural steel fire protection spray or intumescent paint – as shown in Figure 1 to Figure 7, if applied in accordance with the manufacturers' instructions following the guidelines stipulated in corresponding fire assessment reports – would not be detrimental to the overall fire resistance performance if tested in accordance with AS 1530.4:2014. The overall PSA of the construction will be governed by the minimum PSA of A1 COREX board and spray / intumescent paint protected structural steel member.

Relevant fire assessment reports must be referred to determine the required board, spray and intumescent paint protection thicknesses. As such, this report must be used in conjunction with FAS200445, and the fire assessment reports of the spray or intumescent paint protection systems.

6. Assessment of steel beams protected with A1 COREX board installed on slab edge

6.1 Description of variation

The A1 COREX boards have been tested and assessed as a structural steel fire protection system –in accordance with AS 4100:2020. As per referenced fire assessment report FAS200445 R1.2, A1 COREX boards are capable of providing a PSA of up to 180 minutes for open section beams and columns, and hollow section columns.

It is proposed to protect the interface between the edge of a concrete slab and the top flange of a structural steel beam installed along the edge of the slab with A1 COREX boards. The specific construction details are shown in Figure 8.

This assessment was done to determine the likely performance of the protection system in accordance with the requirements of AS 4100:2020 and AS 1530.4:2014.

6.2 Methodology

The method of assessment used is summarised in Table 5.

Table 5 Method of assessment

Assessment method	
Level of complexity	Simple assessment
Type of assessment	Qualitative

6.3 Assessment

Figure 8 shows the construction detail of a structural steel beam supporting a concrete slab, installed along the edge of the slab. The steel beam is exposed on three sides. In the proposed construction, the steel beam is protected on three sides using A1 COREX boards with the board extending up a further 100 mm along the slab edge. The 100 mm board extension must be anchored to the concrete slab.

The period of structural adequacy of a steel beam protected with A1 COREX boards for three-sided exposure can be determined from the referenced fire assessment report FAS200445. This has been assessed for when a steel beam is installed in the field of a concrete slab. However, when the steel beam is installed at the edge of a concrete slab, there is a possibility of localised heat transfer at the interface between the slab edge and the corner of the top flange of the steel beam due to fire exposure adjacent to the slab edge.

Extending the A1 COREX board protecting the steel beam to cover this junction with an overlap of 100 mm with the slab is expected to minimise localised heat transfer and to provide additional protection. A1 COREX boards must need to be fixed to the concrete using concrete anchors that are deemed suitable for fire exposure conditions.

As a complete system, the PSA of the overall system will be governed by the minimum PSA of A1 COREX board protected structural member. Reference should be made to the relevant fire assessment report to determine the required thickness of board protection. As such, this report must be used in conjunction with FAS200445. The specific fixing methods of the boards must be adhered to be in line with the referenced tests – to ensure that stickability is maintained for the required period of structural adequacy.

6.4 Conclusion

Based on the discussion above, the proposed protection system with the A1 COREX board protecting the steel beam on three sides and extending up a further 100 mm along the slab edge as shown in Figure 8 is not considered to be detrimental to the structural adequacy of the steel beam.

7. Assessment of steel beams protected with A1 COREX board supporting composite steel deck floors

7.1 Description of variation

The A1 COREX boards have been tested and assessed as a structural steel fire protection system –in accordance with AS 4100:2020. As per referenced fire assessment report FAS200445 R1.2, A1 COREX boards are capable of providing a PSA of up to 180 minutes for open section beams and columns, and hollow section columns.

It is proposed to protect structural steel beams supporting ribbed composite steel deck floors, installed either parallel or perpendicular to the voids. The specific construction details are shown in Figure 9 to Figure 12. Guidelines from the 5th edition of the Fire protection for structural steel in buildings – ASFP Yellow Book[4] was used in this assessment.

Composite steel deck floors comprise reinforced concrete cast on top of profiled steel decking. The decking may either be re-entrant or trapezoidal.

This assessment was done to determine the likely performance of the protection systems in accordance with the requirements of AS 4100:2020 and AS 1530.4:2014.

7.2 Methodology

The method of assessment used is summarised in Table 6.

Table 6 Method of assessment

Assessment method	
Level of complexity	Simple assessment
Type of assessment	Qualitative

7.3 Assessment

The A1 COREX boards have been assessed and approved for PSAs up to 180 minutes – when applied in accordance with the manufacturer's instructions and guidance. The A1 COREX boards have been permitted by the referenced assessment report summarised in Table 2 for open section beams and columns, and hollow section columns.

7.3.1 Steel beams supporting composite steel deck floors with ribs > 40 mm

Beams installed parallel to voids

Figure 9 and Figure 10 show the construction details of protected structural steel beams supporting a composite steel deck floor slab with ribs greater than 40 mm in width. The beams are installed such that the length of beam is parallel to the voids in the composite floor system.

The period of structural adequacy of a steel beam protected with A1 COREX boards for three-sided exposure can be determined from the referenced fire assessment report FAS200445. This has been assessed for when a steel beam is installed supporting a flat slab and the top side of the top flange is protected from direct fire exposure.

However, as seen in the proposed construction in Figure 9 and Figure 10, when supporting a ribbed composite floor slab, there will be air-filled voids on the top flange of the beam along the length of the beam. As these voids in the slab soffit are directly exposed to fire, there is a likelihood of localised heat transfer between the air in the void and top flange of the steel beam exposed to the void. This means that the heated perimeter of the steel beam cross-section is increased, and so the section factor, and correspondingly the rate of heating is also increased.

To prevent hot gases from filling into the voids, two possible sealing systems are proposed. As shown in Figure 9, it is proposed that the voids surrounding the steel beam are packed with Trafalgar

[4] Association for Specialist Fire Protection (ASFP), 2014, Fire protection for structural steel in buildings – Yellow book, 5th Edition, Hampshire UK.

FyreBATT along the length of the beam. Alternatively, as shown in Figure 10, the ribs are left open but 15 mm thick A1 COREX boards are bolted into the slab soffit extending 300 mm on both sides of the beam. M6 masonry bolts or shot fire steel anchors are used to anchor the board onto the slab at 300 mm centres. In both cases, A1 COREX boards are used to protect the beam from the three exposed sides as assessed in FAS200445.

Both construction details would ensure that the voids are not directly exposed to fire conditions and prevent a localised heat transfer from the void to the exposed top flange of the steel beam through radiation or convection. Furthermore, the steel beam will only be subjected to three-sided exposure, resulting in a lower section factor and slower rate of heating.

Therefore, the proposed construction is not considered to be detrimental to the structural adequacy of the steel beam.

Beams installed perpendicular to voids

Figure 11 show the construction details of protected structural steel beams supporting a composite steel deck floor slab with ribs greater than 40 mm in width. The beams are installed such that the length of beam is perpendicular to the voids in the composite floor system.

The period of structural adequacy of a steel beam protected with A1 COREX boards for three-sided exposure can be determined from the referenced fire assessment report FAS200445. This has been assessed for when a steel beam is installed supporting a flat slab and the top side of the top flange is protected from direct fire exposure.

However, as seen in the proposed construction in Figure 11, when supporting a ribbed composite floor slab, there are a series of air-filled voids along the top flange of the beam. As these voids in the slab soffit are directly exposed to fire, there is a likelihood of localised heat transfer between the air in the void and top flange of the steel beam exposed to the void.

To prevent hot gases from filling into the voids, it is proposed that the voids along the length of steel beam are packed with Trafalgar FyreBATT along the length of the beam. This would ensure that the voids are not directly exposed to fire conditions and prevent a localised heat transfer from the void to the exposed top flange of the steel beam through radiation or convection. Furthermore, the steel beam will only be subjected to three-sided exposure, resulting in a lower section factor and slower rate of heating.

Therefore, the proposed construction is not considered to be detrimental to structural adequacy of the steel beam.

7.3.2 Steel beams supporting composite steel deck floors with ribs < 40 mm

Beams installed parallel to voids

Figure 12 shows the construction details of protected structural steel beams supporting a composite steel deck floor slab with ribs less than 40 mm in width. The beams are installed such that the length of beam is parallel to the voids in the composite floor system.

The proposed construction shows that when the steel beam is installed supporting the ribbed composite floor slab, due to the relatively small width of the ribs, they are completely covered by the width of the beam. This means that the voids on top of the flange of the beam are protected from fire exposure by the beam itself and there is no heat transfer from above the steel beam.

Therefore, treatment of voids is not necessary and the period of structural adequacy of the steel beam protected with A1 COREX boards can be determined for three-sided exposure from the referenced fire assessment report FAS200445.

Beams installed perpendicular to voids

Figure 13 shows the construction details of protected structural steel beams supporting a composite steel deck floor slab with ribs less than 40 mm in width. The beams are installed such that the length of beam is perpendicular to the voids in the composite floor system.

The period of structural adequacy of a steel beam protected with A1 COREX boards for three-sided exposure can be determined from the referenced fire assessment report FAS200445. This has been

assessed for when a steel beam is installed supporting a flat slab and the top side of the top flange is protected from direct fire exposure.

However, as seen in the proposed construction in Figure 13, when supporting a ribbed composite floor slab, there are a series of air-filled voids along the top flange of the beam. As these voids in the slab soffit are directly exposed to fire, there is a likelihood of localised heat transfer between the air in the void and top flange of the steel beam exposed to the void.

To prevent hot gases from filling into the voids, it is proposed that the voids along the length of steel beam are filled with Trafalgar FyreFLEX sealant along the length of the beam. This would ensure that the voids are not directly exposed to fire conditions and prevent a localised heat transfer from the void to the exposed top flange of the steel beam through radiation or convection. Furthermore, the steel beam will only be subjected to three-sided exposure, resulting in a lower section factor and slower rate of heating.

Therefore, the proposed construction is not considered to be detrimental to the structural adequacy of the steel beam.

7.4 Conclusion

Based on the discussions above, the proposed protection systems for steel beams protected with A1 COREX board supporting ribbed composite concrete deck slabs as shown in in Figure 9 to Figure 12 are not considered to be detrimental to the structural adequacy of the steel beam.

As a complete system, the PSA of the overall system will be governed by the minimum PSA of A1 COREX board protected steel members. Reference should be made to the relevant fire assessment report and test evidence to determine the required thickness of board protection and installation of sealing systems.

As such, this report must be used in conjunction with FAS200445. The specific fixing methods of the boards must be adhered to be in line with the referenced tests – to ensure that stickability is maintained for the required period of structural adequacy. The Trafalgar FyreBATT sealing system and FyreFLEX sealant must have an established fire performance as required for the application, tested or assessed by an accredited testing laboratory and must not compromise the period of structural adequacy achievable using the A1 COREX boards.

8. Assessment of unprotected secondary beams fixed to protected primary beam/column

8.1 Description of variation

The A1 COREX boards have been tested and assessed as a structural steel fire protection system – in accordance with AS 4100:2020. As per referenced fire assessment report FAS200445 R1.2, A1 COREX boards are capable of providing a PSA of up to 180 minutes for open section beams and columns, and hollow section columns.

It is proposed to protect secondary structural steel beams fixed to protected primary beams/columns with a coat back of 500 mm of A1 COREX boards from the beam-beam or beam-column junction. The specific construction details are shown in Figure 14.

This assessment was done to determine the likely performance of the protection system in accordance with the requirements of AS 4100:2020 and AS 1530.4:2014.

8.2 Methodology

The method of assessment used is summarised in Table 7.

Table 7 Method of assessment

Assessment method	
Level of complexity	Simple assessment
Type of assessment	Qualitative

8.3 Assessment

Figure 14 shows the construction detail of the connection between a secondary steel beam fixed onto a primary beam / column. In the proposed construction, the primary beam / column is protected as required by building regulations for fire. Furthermore, secondary beams are protected with a coat back of 500 mm extending on either side from the beam-column junction.

While it is common practice to only protect primary loadbearing members, they may be made vulnerable by heat transfer occurring at the junction between protected primary members and unprotected secondary members.

Unprotected secondary members are fully exposed to fire conditions and are subjected to very high temperatures causing rapid loss in strength and stiffness. With a 500 mm coat back, the temperature at the interface between the primary and secondary members is expected to remain sufficiently low so as to prevent critical strength degradation, as heat from the fire exposed sections of the secondary member is not transferred to the protected section. This will ensure that there is no loss of strength or stiffness at the connection or in the primary member.

Additionally, the ASFP Technical Guidance Document 8 (TGD 8), Advisory Note 21[5] states that “if there is no evidence to support the omission of coat back then a figure of 500 mm as stated in ASFP TGD 8 ‘Code of practice for junctions between different fire protection systems’ when applied to load bearing structural steel elements should be assumed as a conservative solution.’

Furthermore, open beams must be closed with A1 COREX noggins. The boards must be fixed to the noggins using staples. The stapling requirements such as length and spacing must be similar to the tested specimens of referenced tests.

As a complete system, the PSA of the overall system will be governed by the minimum PSA of A1 COREX board protected structural steel members. Reference should be made to the relevant fire assessment report to determine the required thickness of board protection. As such, this report must be used in conjunction with FAS200445. The specific fixing methods of the boards must be adhered to

[5] Association for Specialist Fire Protection, 2010, TGD 8- Code of practice for junctions between different fire protection systems when applied to load bearing structural steel elements., Association for Specialist Fire Protection, UK.

be in line with the referenced tests – to ensure that stickability is maintained for the required period of structural adequacy.

8.4 Conclusion

Based on the discussion above, the proposed protection system with the A1 COREX board protecting primary steel beams / columns and secondary steel beams with a coat back of 500 mm as shown in Figure 14 is not considered to be detrimental to the structural adequacy of the structural steel system.

9. Assessment of column and wall interface protected with A1 COREX board

9.1 Description of variation

The A1 COREX boards have been tested and assessed as a structural steel fire protection system – in accordance with AS 4100:2020. In addition, the A1 COREX board was assessed as a shaft wall system up to 120 minutes – in accordance with AS 1530.4:2014.

It is proposed to protect the structural steel column fitted in between a discontinued separate element with A1 COREX boards while maintaining the insulation performance of the separating elements. The specific construction details are shown in Figure 15 and Figure 16.

This assessment was done to determine the likely performance of the protected system in accordance with AS 4100:2020 and AS 1530.4:2014.

9.2 Methodology

The method of assessment used is summarised in Table 8.

Table 8 Method of assessment

Assessment method	
Level of complexity	Simple assessment
Type of assessment	Qualitative

9.3 Assessment

Figure 15 and Figure 16 show the construction details of A1 COREX board protected structural steel column fitted in between the separating rigid walls. In the proposed construction, the rigid wall is discontinued due to the location of the structural steel column. The structural steel column requires a specific FRL for the structural adequacy performance, whereas the discontinued separating wall requires a specific FRL for the integrity and insulation performance.

It is understood that the criteria for structural adequacy and insulation performance are different. For structural adequacy, it is required to prevent the steel element from reaching its limiting steel temperature, which could be range between 350 °C to 750 °C, depending on the structural design. For insulation performance, AS 1530.4:2014 requires the unexposed side temperature of the separating element to not exceed an average temperature increase of 140 °C or a maximum temperature increase of 180 °C. To ensure both the structural steel column and the separating wall are meeting the fire resistance requirement, it is proposed to protect the construction details shown in Figure 15 and Figure 16 with the maximum A1 COREX board thickness required for the structural adequacy and insulation. The required thickness is shown in Table 9 in section 9.4.

To prevent gaps forming between the separating wall and the A1 COREX boards which could potentially lead to integrity failure, a 5 mm × 5 mm FyreFLEX sealant fillet must be applied to the perimeter of the interface – as shown in Figure 15. In case where a horizontal board joint is required, a 100 mm long A1 COREX cover strip of the same thickness must be installed over the joint extended onto the top and bottom boards for 50 mm – as shown in Figure 16. This cover strip is expected to provide additional protection to the board joints and prevent heat ingress to the structural steel column or the unexposed side of the wall, thus allow the system to maintain the integrity and insulation performance.

9.4 Conclusion

Based on the discussion above, the proposed steel column and wall interface protected with A1 COREX boards as shown in Figure 15 and Figure 16 is expected to achieve the FRL shown in Table 9 with the required board thickness.

Table 9 Assessment outcome

Required board thickness for structural steel column to maintain structural adequacy	Required board thickness for integrity and insulation	Required thickness for the system	FRL
Refer to FAS200445 R1.2 for appropriate protection thickness of A1 COREX board.	1 × 15 mm thick A1 COREX board on either side of the wall	The required thickness for the construction details shown in Figure 15 and Figure 16 must be the maximum of the required board thickness for structural adequacy and the required board thickness for integrity and insulation.	60/60/60
	1 × 20 mm thick A1 COREX board on either side of the wall		90/90/90
	1 × 25 mm thick A1 COREX board on either side of the wall		120/120/120
	2 × 25 mm thick A1 COREX board on either side of the wall		180/180/180

10. Validity

Warringtonfire does not endorse the tested or assessed product in any way. The conclusions of this assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

Due to the nature of fire testing and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. It is therefore recommended that this report be reviewed on, or before, the stated expiry date.

This assessment represents our opinion about the performance of the proposed systems expected to be demonstrated on a test in accordance with AS 1530.4:2014 based on the evidence referred to in this report.

This assessment is provided to Trafalgar Group for their own specific purposes. This report may be used as Evidence of Suitability in accordance the requirements of the relevant National Construction Code. Building certifiers and other third parties must determine the suitability of the systems described in this report for a specific installation.

Appendix A Drawings and additional information

Table 10 Details of drawings

Drawing title	Dwg no	Date	Drawn by
Board over spray	1	11 May 2021	Supplied by Trafalgar Group
Spray over board	2	11 May 2021	
Corex & Intumescent	1	7 May 2021	
SHS – Corex Board over spray	1	27 May 2021	
SHS – Corex & Spray	1	27 May 2021	
SHS – Spray over board	1	27 May 2021	
SHS – Corex & Intumescent	1	27 May 2021	
Steel beam located edge of slab	1	2 August 2021	
FyreBATT cut out packed in void	1	29 July 2021	
Beam parallel to void	1	5 August 2021	
Rib voids packed with FyreBATT	1	29 July 2021	
Beam parallel to void	1	5 August 2021	
Voids filled with FyreFLEX	1	29 July 2021	
Corex secondary beam coat back	1	5 August 2021	
Column and wall interface	1	21 April 2023	
Coverstrip	2	21 April 2023	

Appendix B Summary of supporting test data

B.1 Assessment report – FAS200445 R1.2

Table 11 Information about assessment report FAS200445 R1.2

Item	Information about test report
Report sponsor	Trafalgar Group
Issuing laboratory	Warringtonfire Unit 2, 409-411 Hammond Road, Dandenong South VIC 3175, Australia.
Issue date	The fire assessment report was issued on 5 May 2021.
Assessment standards	The assessment was done in accordance with AS 4100:2020 .
General description of the assessment	The report consists of an assessment of fire resistance performance of A1 COREX boards protected open section beams and columns, and hollow section columns. The assessment covers period of structural adequacies of 30, 45, 60, 90, 120 and 180 minutes. It considers a range of critical steel temperatures between 350℃ and 750℃ and section factors between 50 m^{-1} and 385 m^{-1}.

B.2 Assessment report – FAS210132 R1.1

Table 12 Information about assessment report FAS210132 R1.1

Item	Information about test report
Report sponsor	Trafalgar Group
Issuing laboratory	Warringtonfire Unit 2, 409-411 Hammond Road, Dandenong South VIC 3175, Australia.
Issue date	The fire assessment report was issued on 23 November 2021.
Assessment standards	The assessment was done in accordance with AS 1530.4:2014
General description of the assessment	The report consists of an assessment of fire resistance performance of A1 COREX shaft wall system.

warringtonfire

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