NSAI Approved Thermal Modellers Scheme

Guidance for applicant to NSAI Approved Thermal Modellers Scheme

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Part 1 - Assessment for competency - Explanatory Notes

1 Application Process

Candidates must demonstrate that they have acquired the appropriate levels of skills and knowledge to assess the effects of thermal bridging at junctions and around openings in the external elements of buildings as described in clause 1.3.3.2 (iii) of part L 2011 of the Technical Guidance Documents to the Irish Building Regulations.

1.1 Application Form

The application form must be completed in full and signed by the applicant. The application form includes a declaration to confirm that the information contained in your submission is correct and that all relevant matters have been disclosed.

1.2 Application Fee

Your application must be accompanied by the appropriate assessment fee. The Assessment Fee covers the cost of processing and evaluating your submission. Current assessment fees are listed on the Thermal Modellers scheme page on the NSAI's website - www.nsai.ie

1.3 Curriculum Vitae

Provide up-to-date Curriculum Vitae as described in section 3.

1.4 Summary of relevant Projects

Provide a brief summary of projects for which you have carried out thermal modelling as described in section 4.

1.5 Portfolio

Your Portfolio submission must contain 5 construction details similar to those described in section 5.

1.6 Thermal modeller assessment exam

Candidates wishing to register as an NSAI approved thermal modeller shall sit a thermal modeller exam as described in section 9 of this document.

Graduates of the DIT Bolton Street CPD certification in thermal Bridge Assessment are exempt from this exam.

2 Evidence of Identity

Please enclose a copy of suitable photographic identification such as a Passport or drivers licence.

3 Curriculum Vitae

Your Curriculum Vitae should include in summary form all relevant education, qualifications and experience.

Your Curriculum Vitae, in reverse date order, should giving full details of relevant employment history and experience. This should include evidence of educational qualifications.

'Education' includes any full or part-time courses attended, anywhere, whether followed by award of a qualification or not, and can include conferences, relevant training and any other educational activities.

For inclusion on the scheme candidates must have acquired a Level 8 qualification in Engineering, Architecture, Physics or equivalent together with specific training and experience. A Level 7 qualification may also be acceptable if it is specifically focused on building performance and coupled with appropriate practical experience.

"Specific training and experience" relates to training and the use of appropriate software in the calculation of thermal performance of building junctions.

'Practical experience' should be chronologically listed and cover each period of employment/practice, identifying the employer/practice and stating your title/position in each case.

4 Summary of relevant Projects

Provide a brief summary of relevant projects or elements of projects for which you were responsible for the thermal modelling aspects (these may include building junctions covered by your Portfolio submission described in section 5):

- name and contact details of person whom can verify your involvement,
- building type and description,
- the elements of the projects in which you were involved,
- statement of your specific role and responsibilities, in particular those relating to the assessment of thermal performance,
- Include a number sample building junctions at A4 size in support of each relevant project.

5 Portfolio

Your Portfolio submission can contain the following 5 construction details or similar which you have thermal modelled:-

a) Timber Suspended Ground Floor (ACD 1.03)
b) Eaves – Unventilated cavity and ventilated loft (R=0.2W/m.K) - Insulated at ceiling (ACD 1.09)
c) Concrete Forward Sill (ACD 1.26)
d) Masonry Party/Partition Wall – plan (ACD 3.06)
e) Ground Floor - Insulation above slab (ACD 1.01a)

Your submissions must be presented as per section 12 - 14 of this document and any other factor(s) which you deem relevant should be identified in your submission.

6 Educational Documentary Submission

Copies of valuable certificates, diplomas, etc. are acceptable in your Educational Documentary Submission but the original documents may be sought.

7 Supporting Documentary Evidence

The NSAI must determine whether or not, the work submitted had been realised by the applicant, and if the applicant was not totally responsible, what level of responsibility the applicant had for the works submitted.

So you will need to be capable of submitting supporting documentary evidence for all statements made in your 'Curriculum Vitae', 'summary of relevant projects', your 'Portfolio', 'Educational Documentation' or 'Self-Assessment' (if applicable) as requested.

The Documentary Evidence may include:

- Certificates, Diplomas or Degrees awarded (with relevant academic transcripts).
- Relevant courses attended (with academic transcripts[2] where available, or curricula and course descriptions).
- Job specifications and company organization charts.
- Records of Continuing Professional Development or Training.
- Staff training and assessment records.
- References, endorsements, testimonials, references from clients, current or past employers, supervisors and/or colleagues in a professional category equal to or higher than a Chartered Engineer, Registered Architect etc.
- Publications or other academic papers.
- Membership of other organizations (criteria for membership must be supplied).
- Other material that you consider relevant.

The quality of documentary evidence in support of your thermal modelling experience is more important than its quantity and you should omit anything that does not have direct relevance to your application and/or the criteria to be met.

8 Self-Assessment/Demonstration of Competences in Qualifications Directive

This allows the applicant the opportunity to demonstrate competency and skills required to carry out the function of thermal modelling. Along with technical considerations, expression should be given as to how the thermal modeller overlaps and interacts with other construction professionals. Discussion on the overall thermal performance of the building envelope and the place of specific junction analysis within that should be presented along with direct experience.

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9 Thermal modeller assessment exam

Candidates wishing to register as an NSAI approved thermal modeller shall sit a thermal modeller exam as described below.

Graduates of the DIT Bolton Street CPD certification in thermal Bridge Assessment are exempt from this exam.

The exam consists of three questions. All analyses should be carried out in accordance with BR497 and ISO 10211. You have three hours to complete the exam.

Questions 1 & 2 shall be 2D junctions and you may be typically be asked to calculate the elemental U-values (and modelling U-value if applicable), Psi-values (Ψ) and Frsi values for both of these junctions. Your results should be submitted in the form of pdf report for both Ψ-values and Frsi.

Question 3 will typically be a 3D junction and you will be required to calculate elemental U-values, modelling U-value, Ψ-values, Chi-values (χ) and Frsi values as requested. Again your results should be submitted in the form of pdf report.

The exam questions may be accompanied by AutoCAD files which provide information on junction geometry. Candidates should have the ability to open AutoCAD LT 2010 files at a minimum. You must also have software capable of taking dimensions from drawings provided.

You should have with you a computer with min. 8GB RAM installed and processor running at min. 2.33GHz. You should already have installed thermal modelling software capable of carrying out 2D & 3D calculations. This software must be validated against EN ISO 10211 (2007).

You should bring a mouse and scientific calculator. The exam is open-book; it is your responsibility to bring with you anything which you feel you may need in order to carry out thermal modelling calculations. The exam will start at 10am sharp and finish at 1pm sharp. Please be in attendance from 9.40am. You will have 15 minutes prior to commencement to read the paper and ask any questions related directly and only to clarifying what is being asked on the paper.

Your answers must be submitted in the form of a PDF report. The report must show visual images of the models, including IR, isotherms, non-hatched model,

boundary conditions and element mesh. It must also list the boundary conditions used, as well as list the materials used and their thermal conductivities. Please ensure when carrying out the models that a distinct colour is used for each material.

The overall required pass grade is 65%, with the 3D question also requiring a pass of 65% in its own right.

Marks are awarded for calculating the correct elemental U-values, modelling U-values, Ψ-values, χ-values, Frsi values, assigning correct thermal conductivities to materials, assigning correct boundary conditions as required by BR 497, applying the junction assessment approach as described in BR 497.

Part 2 -Thermal Modellers Scheme Guidance notes.

10 Approved Thermal Modellers scheme - Scope

The purpose of this document is give applicants guidance on how to register as an approved Thermal Modeller, for the purpose of compliance with Clause 1.3.3.2(iii) of Technical Guidance Document Part L Conservation of Fuel and Energy - Dwellings.

Successful candidates will be listed on the NSAI's website as an Approved Thermal Modeller.

Registered candidates can be deemed competent to carry out thermal modelling of complex building junction in compliance with the requirements of Appendix D of Technical Guidance Document to Part L of the 2011 Irish Building Regulations.

Registered candidates will be subject to an annual audit by the approval body.

11 Specific requirements for an Approved Thermal Modeller.

The specification requirements for the Modeller, Training and NSAI Agrément are outlined in this section.

11.1 Qualifications required to be recognized as a modeller.

a) Applicants should have an appropriate construction related qualification.
b) The modeller should attend a 3 dimensional and 2 dimensional software modelling course that provides training to **I.S. EN ISO 10211** and **BR 497** - Conventions for calculating linear thermal transmittance and temperature factors. At the end of the course the trainee should be able to produce the validation calculations provided in I.S. EN ISO 10211, I.S. EN ISO 10077-2 and BR 497. The trainee should also be able to produce calculations for typical thermal bridging details for different construction types e.g. Masonry, Timber frame, Steel frame. Examples of typical details for different construction types can be found in Acceptable Construction Details.
c) The modeller should be able to produce 2D and 3D calculations using suitable 2D and 3D software packages as listed in ASIEPI P198 - Software and atlases for evaluating thermal bridges.
d) The thermal modelling software used must be validated to I.S. EN ISO 10211. Modellers may be asked to produce all validation examples form that standard.
e) Whilst a modeller will not necessarily have all the skills necessary to assess a detail against all Parts of the Irish Building Regulations it is expected that the modeller will coordinate with the client or other design professionals to assess the detail against other parts of the regulations. For a detail to be acceptable for use on site it should be assessed by a suitably qualified construction professional against all parts of the building regulations and further consideration should be given to both partiality and constructability of the detail. E.g. Part B Fire and Part C Resistance to moisture and Part L Air permeability. The detail should be issued in the format of an Acceptable Construction Detail as outlined in section 14, for use on site with any recommendations with regards to construction identified on the drawing.

11.2 NSAI Agrément approval process

a) NSAI Agrément will assess the applicants competency based on the documents submitted as outlined in sections 1-8 above and the thermal modelling exam as outlined in section 9.
b) NSAI Agrément will assess the ability of modeller to perform 3D and 2D modelling calculations as described in section 5 and 9 above.
c) NSAI Agrément will check qualifications and training of the applicant.
d) NSAI Agrément will perform annual assurance audits of all successfully registered Thermal Modellers.
e) Approval body will maintain and update a web based register of Thermal Modellers.

11.3 Process for modelling and certification of detail

a) The registered Thermal Modeller will perform thermal modelling calculations at the request of client/design team.
b) Registered Thermal Modeller will produce a report for each building junction assessed as described in sections 12-14.
c) The Registered Thermal Modeller prior to final issue of certified details will sign off on his work and must reference their NSAI registration number on all certified details.
d) Clients/ builders /developers and overseeing professional will be required to confirm that 'as built' junctions are in substantial compliance with the certified construction details prior to entering a calculated or improved 'Y-value' in the final Building Energy Rating Certificate (**BER Certificate**).
e) Detailed calculation and drawings must be available on request for inspection by Building Control or NSAI Agrément scheme operator.
f) Summary calculation of Psi value should be available for the use of BER assessors for energy ratings as required.

Part 3 – Modelling Reports

12 Detailed Input and Output from a numerical model

This Clause gives the detailed input and output required from the model, in a case of dispute, in order to facilitate any adjudication on the correct values of Ψ and f. The input and output listed below is the minimum that should be kept for each model that provides values of Ψ and f. The input data file should also be kept, together with the name and version of the software that produced the modelling results.

12.1 Input Data

1. Image(s) of the model showing the geometry.
2. A list of the boundary conditions – temperature and surface conductance/ resistance used.
3. A list of the materials and thermal conductivities used.
4. A list of airspaces, their dimensions and their thermal resistance (or equivalent thermal conductivity) used.
5. Give either the total number of cells or the total number of nodes in the model.
6. Image(s) giving an indication of the meshing used for the model, especially in the vicinity of any thermal bridges.
7. The dimension of the flanking elements in each model, i.e. the distance from the junction to the adiabatic of the flanking element.

12.2 Output Data

1. Total heat flow into and out of the model.
2. U-values of the flanking elements. If any of these are separate one dimensional calculations, then give the detail of the calculation. If instead it is determined from the heat flow or surface temperature at the adiabatic edge of the flanking element, that heat flow or temperature should be given.
3. Image(s) showing internal surface temperatures.
4. For 2-D models, an image showing heat flow lines through the model and the heat flow value represented by each line.
5. The detailed calculation of the Ψ-value, using the total heat flow through the model less the one-dimensional flow through the flanking elements as determined from the product of Area (or length) of the flanking elements. For each flanking element, give the U-value and Area (or length) involved in the overall calculation of Ψ.

For adjudication all Ψ-values and minimum temperature factors should be available to three decimals. Similarly, where U-values are used as input data for the model or in the determination of Ψ, these should be provided to three decimals and the construction in the model should reflect this (modelling) U-value. All flanking dimensions should be given in metres (m) and should be given to three decimals.

13 Drawings

2D AutoCAD drawing (or similar) of all modelled junctions must be provided for inclusion in the 'detailed' modelling reports. Further to the information required

for the 'A4 summary' report, namely, critical dimensions, thermal conductivities and material types to enable replication on site, the illustrations for the full 'detailed' report must identify all boundary conditions used, all dimensions and/or areas of flanking elements, temperature gradients across the junction, isothermal line (i.e. contours of similar temperature).

2D AutoCAD drawing (or similar) of all modelled junctions must be provided for inclusion in both 'detailed' and 'A4 summary' reports (See section 14). This must record all dimensions and material types to ensure that the junction as modelled can be replicated on site.

14 Final Report

An electronic copy of all 'detailed' Input and Output from a numerical model/ construction detail must be retained. These records will be assessed during an annual audit of the registered Thermal modeller. All report documents should reference the Thermal Modellers registration number.

In addition to 'detailed' modelling report, a single 'A4 summary' report should be produced for each construction detail. This summary report should contain the following information at a minimum

1) Thermal Modellers registration number (Blank if at application stage).
2) Thermal Modellers details i.e. Name
3) Date report completed
4) 2D illustration of construction at bridged junction. The illustration must identify critical dimensions, thermal conductivities and material types to enable replication on site. (3D junctions may require several 2D images).
5) Report reference number. Report number should be prefixed with the NSAI Agrément Thermal Modellers registration number.
6) Provides values for the linear thermal transmittance Ψ-value (or the point thermal transmittance χ for 3D junctions) and frsi.
7) U-Value of all flanking elements.
8) The number of nodes used in the model.

Any recommendations or special requirements with respect to the construction of the building detail must be identified on the summary report i.e. minimum R-values or minimum thickness of insulation at reveals etc.

Part 4 – References

15 Normative references

Classification standards and reference documentation

i) **I.S. EN ISO 10211:2011** "Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations"
ii) **I.S. EN ISO 10077-1** "Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General"
iii) **I.S. EN ISO 10077-2:2003** "Thermal performance of windows, doors and shutters Calculation of thermal transmittance – Part 2: Numerical method for frames"
iv) **I.S. EN ISO 13370** "Thermal performance of buildings – Heat transfer via the ground - Calculation methods "
v) **I.S. EN ISO 14683** "Thermal performance of windows, doors and shutters Calculation of thermal transmittance – Part 2: Numerical method for frames"
vi) **BRE IP 1/06, 2006,** "Assessing the effects of thermal bridging at junctions and around openings" by Ward.
vii) **BRE 497, 2007** "Conventions for calculating linear thermal transmittance and temperature factors" by Ward & sanders.
viii) **ASIEPI P198** - Software and atlases for evaluating thermal bridges.
ix) **I.S. EN ISO 10456:2007** Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)
x) **I.S. EN ISO 6946:2007** Building components and building elements – Thermal resistance and thermal transmittance - Calculation method (ISO 6946:2007)
xi) **I.S. EN 673** (November 1997). Glass in building – Determination of thermal transmittance (U value) – Calculation method.
xii) **I.S. EN ISO 13789:2007** Thermal performance of buildings -Transmission and ventilation heat transfer coefficients – Calculation method
xiii) **BR 443** - Conventions for U-value calculations. 2006 edition by Brian Anderson
xiv) **I.S. EN ISO 13788**, Hygrothermal performance of building components and building elements — Internal surface temperature to avoid critical surface humidity and interstitial condensation — Calculation methods
xv) **I.S. EN ISO 7345** , Thermal insulation — Physical quantities and definitions