Development of current Design Condition Data for use in Load Estimation & Analysis

Summary of project progress and industry consultation findings

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1. Purpose

The purpose of this paper is to document the progress to date related to efforts to develop current design condition data for use in load estimation and analysis, including a summary of comments, suggestions and proposed actions arising from industry consultation findings.

2. Background

Design condition data consists of extracts of climatic records selected so as to indicate the climatic extremes likely to be experienced in a given location. The data, primarily related to temperature and humidity (near) extremes, is often used in calculations to estimate peak thermal loads in buildings for the purposes of HVAC system design.

Requests from AIRAH have been made over recent years for Commonwealth Government assistance to update the design conditions published with AIRAH DA09 Application Manual. The AIRAH data was originally developed with heavy involvement of the Commonwealth during the 1970s and 1980s, but is now suspected to be out-of-date due to climate change and urban heat island effects.

A contract was established with a consortium of service providers to develop up-to-date design data to suit contemporary needs within the Australian context. The project is being treated as an opportunity to better understand a range of important issues in order to inform future work and to allow for expanded data extraction for the benefit of industry. It is not, therefore, simply intended to be *only* an update of the DA09 figures.

Key stakeholders were consulted in regards to the proposed project plan. This consultation proved useful in both refining a comprehensive set of objectives, and in producing a range of comments and suggestions aimed at improving the project process and outcomes. The remainder of this document summarizes the outcomes of the consultation.

3. Consultation outcomes: Objectives of research

After initial scoping and industry consultation, various potential benefits of the project have been identified. It has become evident that a broad range of objectives can be specified in regards to the project, and it is expected that these multiple objectives can be simultaneously achieved in a manner consistent with industry views and needs.

Following incorporation of feedback, the project objectives can now be more comprehensively stated as follows:

- Provide up to date data from the highest quality sources currently available with an aim to improve confidence in use of design condition data for system design and analysis, potentially reducing a perceived need to apply oversizing margins. The revised ACDB (NIWA, 2013) currently provides the best basis to initiate this process, allowing a thorough investigation of key issues whilst providing excellent population coverage.
- Provide design data extracts in a range of formats suitable for the variety of load estimation applications typically adopted in Australia.
- As far as possible within the project constraints, maximise the potential of the detailed hourly records in the ACDB to provide a range of data combinations at various ranges of criticality to enable designers to consider (if they wish) a range of climatic factors and risk levels appropriate to a specific context and thereby assist in system optimisation.
- Assess the extent of design condition change across time and space in order to inform decisions about
  (a) the need to provide updates of design data beyond the ACDB's 80 locations (up to a maximum 1200 regional and remote locations)
  (b) the need to provide updates on a more regular basis to more adequately account for trend change
  (c) the need to incorporate projected trends into HVAC design decisions
- Provide greater clarity around the appropriate use of various design conditions for various purposes, establish industry confidence in the robustness of the new data and improve industry awareness of the issues.
- Provide recommendations for further work including proposing possible approaches to extending the spatial coverage of recent design data so as enable accurate use of local 3pm and 8am climatic data records for locations where hourly records do not exist.

4. Consultation outcomes: Comments and suggestions regarding methodology

A number of key issues for consideration have been identified in consultation with industry stakeholders, and will be addressed during the course of the project. A summary of feedback and suggestions is provided below, grouped together into related issues.

- Due to the variety of possible approaches to extracting design conditions, and the manner in which such methodologies have been seen to change over time, there seems to be some uncertainty within industry as to merits of each approach and which is best for Australian applications.
- There seems to be no agreed or objective position on what exactly is meant by "design conditions" and "extreme design conditions", and various figures produced for the same location often differ with no clear guidance on suitability or equivalence
- The project description sent to stakeholders was somewhat unclear in terms of exactly what will be produced, and how exactly it will be produced.
- There will be a need to somehow validate any new figures and/or methodologies arising from the project so as to convince industry that the output can be relied upon for system selection, especially where the figures lead to lower predicted loads/system sizes.

- There should be appropriate analysis done to identify whether there has been significant change to design conditions over the recent period, and if there is any evidence of significant trend change. For example, extracting design conditions from 10-year blocks of data and then comparing to extracts from the entire set and comparing across methods (eg ASHRAE vs AIRAH methods)
- The need for further provision of design data for major population centres should be objectively evaluated and balanced against the need to update data for regional and remote locations.

5. Response to key issues

Following consideration of stakeholder suggestions in discussion with the Service Providers, it is proposed that the following actions and approaches be adopted in order to ensure that stakeholder needs can be met:

- **Provide a clearer description of exactly what will be produced and how it will be produced.** It is proposed that a document be prepared entitled "Project methodology and key issues" in which this clearer description is presented with specific calculation procedures and assumptions.
- **Address the issue of defining "design conditions".** It is proposed that a discussion piece be prepared that outlines a possible approach to defining and using design condition data, seeking industry consensus and/or agreement on relevant principles. This piece of work will also be included in the "methodology and key issues" document.
- **Describe approach to validate new data and enable industry confidence**. It is proposed that more work be done as part of the project to calculate and clearly demonstrate the practical implications of the new design data. Further suggestions will be sought with this issue in mind. It is noted, however, that most validation work will necessarily require the production of a substantial volume of design data beforehand to enable analysis to be conducted.
- **Conduct substantial analysis of design condition change over time** – It is proposed that change in extreme conditions be investigated using a variety of approaches, including analysing change in blocks of time, comparing urban with country locations over time, and scrutiny of PPD data trends.
- **Investigate options to extend up-to-date coverage to regional and remote areas.** It is proposed that the project should include initial scoping/development of daily range curves derived from analyses of Australian conditions at various locations. This work as seen as a precursor to allowing an improved, more accurate method of translating 3pm and 8am data (available at hundreds of sites) into daily climatic profiles required for common load estimation processes. Together with the proposed analysis of change over time, these pieces of work would provide a solid basis for future work to update design data throughout Australia (up to 1200 locations) in a manner that would produce optimum outcomes and industry confidence.

6. Next Steps

The Commonwealth Government and the Service Providers have issued this document for the information and consideration of project stakeholders. A separate document will also be prepared in an effort to address issues raised during consultation titled “Project methodology and key issues”.

Agreement is sought in relation to Item 5 in this document, namely “Response to key issues”. It is hoped that a reasonable level of support can be established promptly for the proposed project pathway in order that efforts can be channelled into producing actual data outcomes.

If you have any concerns about the proposed response to key issues, please provide relevant feedback to AIRAH as soon as possible.