Automated Checking of Regulations and Requirements Managment in Healthcare Design

Benefits design teams, professionals in charge design assessment, software developers, policy makers

"The challenges facing construction and the built environment will require greater collaboration between all parts of the industry and academia, particularly in the area of sustainability and improved whole life value. Community Health Partnerships are currently supporting HEI's in a number of areas which it is hoped will result in improved value in healthcare design and delivery."

Julian Humphreys, Community Health Partnerships
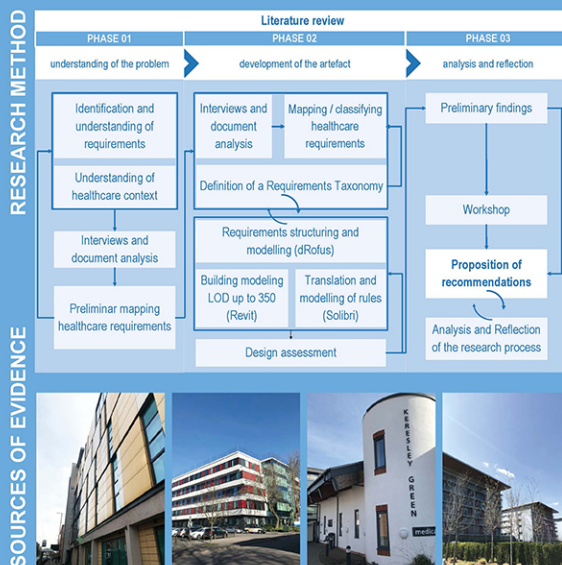
SUMMARY

BIM can support the automation of design assessment with regards to regulation compliance, and its use for modelling information contributes to the visualisation and organisation of requirements data. The practical adoption of automation can support transparency and consistency for designers and regulatory bodies. This research proposes recommendations for the adoption of automated checking of regulatory compliance in the design of healthcare facilities.

Main findings include an evaluation of the information content of existing healthcare regulations towards automation; and the need of a hybrid approach for assessment was identified. The hybrid approach should support the automation of objective requirements, but also address subjective requirements through human inputs.
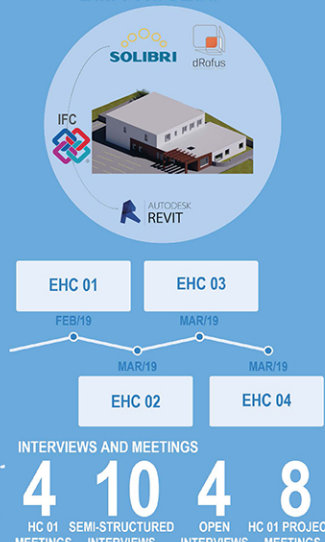
Acknowledgements: We are grateful to Community Health Partnerships, Solibri and Hospital das Clinicas de Porto Alegre for their collaboration. We also would like to thank all other stakeholders and companies which supported the research enabling site visits, interviews and meetings

- The UK has over 100 healthcare design regulations or guidance; requirements are often described through **complex and subjective expressions**, creating difficulties for automation

- The proposed taxonomy describes how regulations should be written to enable, in the future, an **easier automation of quantifiable requirements and a reduction of subjectivity**

- Existing regulatory requirements that can be translated into logic rules for automated checking have **low and medium logic complexity**, which is beneficial for automation

KEY FINDINGS

- Need to adopt automated checking at **different design stages** to avoid non-compliance and rework

- Subjectivity can be: **Natural** - requirements contents cannot be translated into an objective sentence e.g. design flexibility; or **Artificial** - created by humans and hence could be presented objectively e.g. accessibility

- Need for a **hybrid approach**: automation is suitable for objective requirements; subjective requirements needs to be addressed through semi-automated approaches
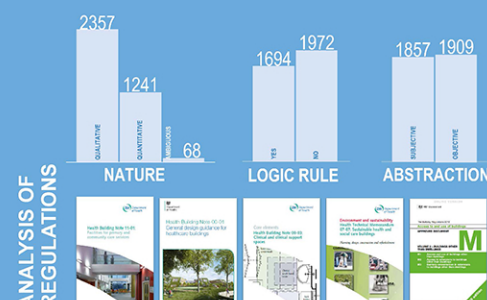
RESEARCH METHOD

BIM PROCESS

EHC 01 — FEB/19
EHC 02 — MAR/19
EHC 03 — MAR/19
EHC 04 — MAR/19

INTERVIEWS AND MEETINGS

4	10	4	8
HC 01 MEETINGS	SEMI-STRUCTURED INTERVIEWS	OPEN INTERVIEWS	HC 01 PROJECT MEETINGS

SOURCES OF EVIDENCE

APPLICATION OF SOLIBRI AND DROFUS

- Regulatory requirements were inserted in Solibri, modelled and checked against the building model.

- Solibri was successfully used to verify requirements related to areas, components, corridor dimensions.

- The spaces, equipment and furniture planned in dRofus were connected to the building model, making requirements explicit during the design process.

ANALYSIS OF REGULATIONS

NATURE: QUALITATIVE 2357, QUANTITATIVE 1241, ? 68
LOGIC RULE: 1694, 1972
ABSTRACTION: SUBJECTIVE 1857, OBJECTIVE 1909

IMPACT AND VALUE

- More structured, reliable, easier and faster compliance checking

- Better understanding of compliance needs and clarity about rules for automated checking

- Support the revision of regulations so automation can be more easily implemented in the future

LONG-TERM VISION

- Need to update healthcare regulations to enable automation of quantifiable requirements according to the proposed taxonomy

- A support system which automatically checks regulatory compliance during design development and supports decision making of subjective requirements

NEXT STEPS

- Analyse other regulations according to the proposed taxonomy for further validation

- Better understand links between regulatory and clients requirements, in terms of prioritisation and conflicts

- Explore design support systems and mistake-proofing using the regulatory framework as a basis

- Further explore the need for subjectivity in regulations

RECOMMENDATIONS
FOR AUTOMATED CHECKING OF REGULATIONS AND REQUIREMENTS IN HEALTHCARE DESIGN

- **Policy makers** should avoid artificial subjective elements in regulatory texts, ensuring objective and quantifiable sentences are included in the revision of regulations. There is a need to consider if any subjectivity should exist within the regulatory framework, as it can cause design errors and rework, and challenge attempts to automate the process.

- **All stakeholders** should manage the subjectivity embedded in the regulations by using a common language.

- **Designers** and policy makers should organise requirements in a common, structured and integrated database. Clients should provide constant support and inputs to this database.

- **Designers** and software developers should better consider the integration of regulatory and clients requirements and systems to enable such integration.

- **All stakeholders** should envisage the use of the regulatory framework as a support tool towards mistake-proofing rather than a mistake-finding mechanism.

Collaborate with us
engagement@cdbb.cam.ac.uk
www.cdbb.cam.ac.uk
@CambridgeCDBB

Contact: Prof Patricia Tzortzopoulos
Professor, School of Art, Design and Architecture,
University of Huddersfield, HD1 3DH, UK.
P.Tzortzopoulos@hud.ac.uk
https://research.hud.ac.uk/institutes-centres/idl/

UNIVERSITY OF CAMBRIDGE

University of HUDDERSFIELD — Inspiring tomorrow's professionals

Centre for Digital Built Britain