

Building Permit Digitisation in Saudi Arabia

Eyad Jalal^a, Claire Ellul^a, Ben Clifford^b

^aDepartment of Civil, Environmental and Geomatic Engineering, University College London / UK

^bBartlett School of Planning, University College London / UK

General Statement

In recent years, efforts to digitise the building permit processes and regulations have increased at different levels. Countries and municipalities have put strategies in place to use and adopt the benefit of technology to manage data and design cities sustainably [1], [2], [3].

A building permit is an official document the responsible authority must grant before the construction phase begins [4]. Designing a new building should consider several aspects: the design quality and the geographical relationship of the new building to its context. For a permit to be issued, the proposed building must comply with the related building regulations. Currently, they are written in the form of (text), read, and interpreted by people [5].

However, studies [2], [6], [7], [8] found that issuing a building permit encounters issues including:

- 1) The processes are time-consuming and costly.
- 2) Regulations are open to interpretation.
- 3) Assessment is subject to human error.
- 4) Lack of transparency in the application assessment.
- 5) Lack of use of technology in the assessment processes.

Problem Statement

Digitally enabled (semi-automated) building permit application processing could help overcome these issues [9], [10], [11] and investigations have been carried out in various countries [7], [12], [13], [14], [15], [16]. However, to date, very little work has been done in the context of Saudi Arabia.

Context – Saudi Arabia

Saudi Arabia is the biggest nation in the Middle East and the fourteenth largest globally. Saudi cities are witnessing dramatic urban growth due to growing populations [17], [18]. [19] Saudi Arabia is one of the most urbanised countries worldwide, with an approximate population of 30 million, with 84% residing in cities in 2021 [19], predicted to rise to [20]39.1 million by 2025 [20]. Consequently, this will result in increases in housing demand [21], restrictions on green infrastructure, carbon emissions, and traffic restrictions and congestion [22].

Research Questions

The Saudi planning system provides an opportunity to extend and further validate approaches to digital building permits, both in terms of the rapid urbanisation of the country and in terms of the challenges that may be presented by the use of the Arabic language (and hence character set/alphabet) to encode regulations. The desert climate also means that the regulations may have a different focus than those traditionally encountered in existing case studies (which are mostly based in Northern Europe).

This paper takes preliminary steps towards exploring these issues, providing initial answers to two questions:

- To what extent does Saudi Arabia adopt similar approaches and face similar challenges to other countries in the context of digital building permits?
- What is the potential to apply existing approaches towards the digitisation of building permit regulations in Saudi Arabia?

Methods

A two-step approach was taken to answer these questions.

Step 1: A literature review (of both academic literature and grey literature as well as official government publications in English and Arabic) was conducted to identify and document the processes used in obtaining building permits in Saudi Arabia and any existing research on this topic. The resulting planning and permits workflows and issues are then compared to those already documented for other countries.

Step 2: Digitally encoded and parse-able building permits are a pre-requisite of any digital permit system to automate or semi-automate regulations checks. However, to date, most countries create their regulations in PDF format (although digital processes may be used to create the PDFs initially). To frame further research, a review of existing approaches to planning regulations encoding from PDF to digital format was conducted to identify any specific challenges that will be faced if these are applied in a different cultural/linguistic context.

Preliminary Results

Step 1a: The Saudi Building Permit Process

Saudi municipalities use a basic e-system (Baldy) for issuing building permits [23]. Issuing the building permit starts when the applicant assignees and discusses the design preferences with a certified engineering office. Then, the engineering office starts preparing the drawings following the applicant's requirements and building regulations and uploads the required documents to Baldy in PDF format. Next, the municipality conducts an administrative review to ensure the application includes the required documents and a manual content review to ensure the proposed design complies with building and planning regulations. Lastly, the municipality makes the decision, and the applicant is notified in Baldy [17], [23]. As shown in Figure 1, the process of obtaining a building permit in Saudi Arabia is closely similar to that of other countries.

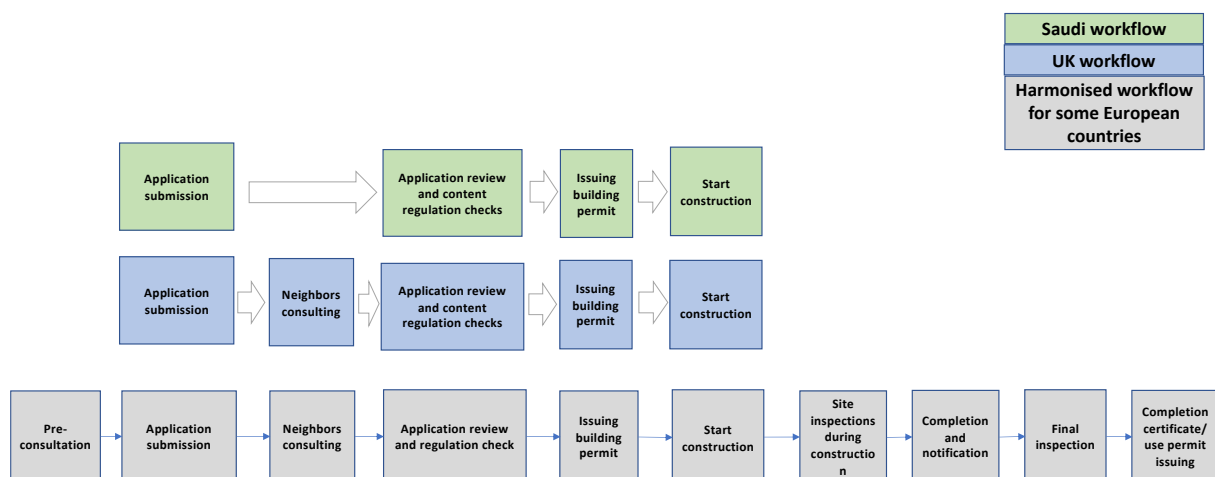


Fig. 1: Comparison of building permit workflow. Adopted from [8]

Step 1b: Existing Challenges for Saudi Building Permits

[17] Saudi cities face issues associated with the regulations and policies in the building permit cycle and among decision-makers and notifying the applicant of the states of the building permit, which is lengthy and fragmented [17]. Moreover, the study found that Saudi municipalities need to adopt new technology for issuing permits and enhancing city management performance. Further, the study found that many engineering offices have improved their capabilities and use of digital models to ensure that proposals comply with the municipalities' regulations, such as the building height, prior to submitting a building permit application. However, checking processes are taking significant time and effort and results can be inaccurate (ibid). A study by [24] found that the time required to issue a building permit for an apartment building is one to six months, and for a villa is about four months. This is due to the fact that:

- The submitted drawings often do not comply with the regulations.
- The regulations are subject to interpretation by officials.
- The processes are not transparent for both officials and consultant construction firms.

These issues were confirmed by the Ministry of Municipal and Rural Affairs (MOMRA) report, which revealed that about 75% of public construction projects are delayed and need to meet the planned time [25].

Step 2: Applying Existing Approaches to Digitising the Saudi Planning Regulations

To develop an automated compliance checking system, it is essential to digitise the building regulations, where the regulation must be translated from natural human language into computer language [14], [26]. Digitising the related building regulations is one of the most challenging tasks in digitising the building permit process [14], [27], [28]. In this context, [29], [30] developed a mark-up method, namely Requirement, Applicability, Selection and Exception (RASE), which aims to transform the regulations text into a computable form. This method has been used in different contexts. For example, [15] modified the RASE method to interpret the Turkish zoning regulations in the English language. Another project is the CHEK project, which applies the RASE method in four municipalities in Italy, Portugal, and Czechia [14].

Saudi planning regulations are provided in Arabic as text in PDF format. Some regulation documents include images and tables to illustrate specific cases, such as building height and percentage, as shown in Figure 2. In some cases – e.g. Jeddah City – all the regulations are conveniently contained in one document [31].

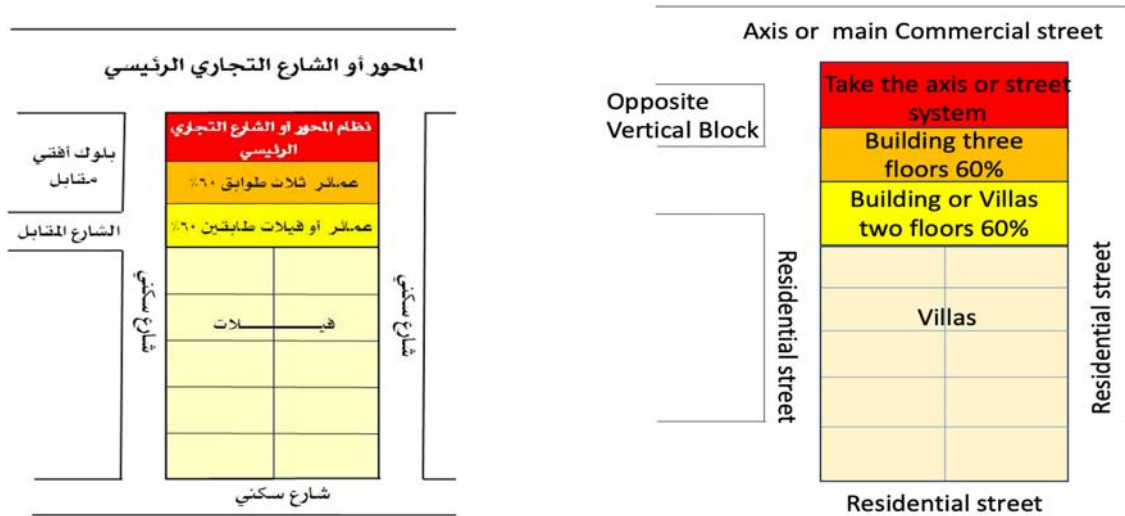


Fig. 2: Rear parcel building percentage and building height rule. Adapted from [31]

The RASE method was applied to a selected planning rule (building percentage and building height) of Jeddah's municipality. Preliminary results show the general applicability of the RASE method in the Arabic language. However, careful consideration of sentence structure and vocabulary is needed, as certain words can alter the meaning of the rule, resulting in different interpretations. Considering the following sentence from [31]:

“القطع الخلفية: تأخذ نظام المنطقة الخلفية في الاستخدام أما الارتفاع فيكون كما يلي.”

Once applying the RASE method, this sentence can be interpreted as a Requirement (Rear Parcel: take the rear area system in use, **and** the height is as follows), or as an Exception (Rear Parcel: take the rear area system in use, **but** the height is as follows). Here, the word “أما” can be translated into English as (AND) or (BUT).

Conclusion and Future Work

Our review shows that the construction sector in Saudi Arabia is performing poorly in terms of service provision (time and cost) [32], and the planning and permits sector faces similar challenges to those encountered elsewhere. Additionally, planning and permit workflows are, in fact, relatively similar to those adopted in other countries. Regulations are – as in many other countries – provided in PDF documents, however, in Arabic. This means that existing approaches, such as RASE, are applicable in the Saudi context.

More broadly, implementing new practices and advancements in the construction industry is important but requires altering the regulations and reducing or eliminating obstacles. In addition, digitising the building permit process in the Saudi Arabian context is rarely discussed. Further work will involve a more in-depth review of benefits, processes, and regulations, including a more in-depth study of the applicability of RASE to the planning regulations and an investigation of the impacts of GeoBIM-based automated compliance checking on the building permit process.

References

- [1] F. Noardo et al., “Unveiling the actual progress of Digital Building Permit: Getting awareness through a critical state of the art review,” *Build Environ*, vol. 213, p. 108854, Apr. 2022, doi: 10.1016/J.BUILDENV.2022.108854.
- [2] F. Rehmann, F. Cudok, R. Streblow, J. Fauth, G. Malacarne, and C. Marcher, “Digitalisation of the

- building permit process - a case study in Italy,” IOP Conf Ser Earth Environ Sci, vol. 1101, no. 5, p. 052008, Nov. 2022, doi: 10.1088/1755-1315/1101/5/052008.
- [3] EuroSDR, “Workshop Report European Spatial Data Research I EUnet4DBP International workshop on Digital Building Permit DIGITAL BUILDING PERMIT: A STATE OF PLAY,” 2021.
- [4] K. Ullah, E. Witt, and I. Lill, “The BIM-Based Building Permit Process: Factors Affecting Adoption,” Buildings, vol. 12, no. 1, 2022, doi: 10.3390/buildings12010045.
- [5] D. M. Brito, D. B. Costa, and E. A. M. Ferreira, “Code Checking using BIM for Digital Building Permit: a case study in a Brazilian municipality,” IOP Conf Ser Earth Environ Sci, vol. 1101, no. 2, p. 022049, Nov. 2022, doi: 10.1088/1755-1315/1101/2/022049.
- [6] F. Noardo, T. Wu, K. Arroyo Otori, T. Krijnen, and J. Stoter, “IFC models for semi-automating common planning checks for building permits,” Autom Constr, vol. 134, p. 104097, Feb. 2022, doi: 10.1016/J.AUTCON.2021.104097.
- [7] N. Hobeika et al., “Geobim Information to Check Digital Building Permit Regulations,” ISPAr, vol. 43B4, no. B4-2022, pp. 529–535, May 2022, doi: 10.5194/ISPRS-ARCHIVES-XLIII-B4-2022-529-2022.
- [8] F. Noardo et al., “Opportunities and challenges for GeoBIM in Europe: developing a building permits use-case to raise awareness and examine technical interoperability challenges,” <https://doi.org/10.1080/14498596.2019.1627253>, vol. 65, no. 2, pp. 209–233, May 2019, doi: 10.1080/14498596.2019.1627253.
- [9] C. Ellul, F. Noardo, L. Harrie, and J. Stoter, “THE EUROSDBR GEOBIM PROJECT-DEVELOPING CASE STUDIES FOR THE USE OF GEOBIM IN PRACTICE,” 2020, doi: 10.5194/isprs-archives-XLIV-4-W1-2020-33-2020.
- [10] K. Ullah, E. Witt, I. Lill, N. Banaitienė, and M. Statulevičius, “Readiness assessment for BIM-based building permit processes using Fuzzy-COPRAS,” *jest.vgtu.lt*, 2022, doi: 10.3846/jcem.2022.17274.
- [11] H. Lee, J. K. Lee, S. Park, and I. Kim, “Translating building legislation into a computer-executable format for evaluating building permit requirements,” Autom Constr, vol. 71, pp. 49–61, Nov. 2016, doi: 10.1016/J.AUTCON.2016.04.008.
- [12] T. Beach, “D-COM: Digital COMpliance : Digitisation of Requirements, Regulations and Compliance Checking Processes in the Built Environment - Final Report,” 2019, doi: 10.17863/CAM.40451.
- [13] I. Kim, J. Choi, E. Teo, H. S.-J. of C. Engineering, and undefined 2020, “Development of K-BIM e-Submission prototypical system for the openBIM-based building permit framework,” *journals.vilniustech.lt*, 2020, doi: 10.3846/jcem.2020.13756.
- [14] S. Mastrolembro Ventura et al., “Change toolkit for digital building permit Deliverable number D2.1 Deliverable name Regulations interpretation and needs identification for CHEK DBP Authors and contributors Author Organisation E-mail Quality control Author Organisation Role Date Document history Release Description Date Author,” 2023.
- [15] Y. Demir Altıntaş and M. E. Ilal, “Loose coupling of GIS and BIM data models for automated compliance checking against zoning codes,” Autom Constr, vol. 128, p. 103743, Aug. 2021, doi: 10.1016/J.AUTCON.2021.103743.
- [16] P. O. Olsson, J. Axelsson, M. Hooper, and L. Harrie, “Automation of Building Permission by Integration of BIM and Geospatial Data,” ISPRS International Journal of Geo-Information 2018, Vol. 7, Page 307, vol. 7, no. 8, p. 307, Jul. 2018, doi: 10.3390/IJGI7080307.
- [17] O. Aljobaly, M. Maatouk, and E. Qurnfulah, “Developing Buildings Permits Systems Platforms (BPSP) for driving change to introduce GeoBIM potentials, challenges, and opportunities,” Journal of Applied Geospatial Information, vol. 6, no. 2, pp. 711–721, Dec. 2022, doi: 10.30871/JAGI.V6I2.4698.
- [18] A. Alqahtany, “Affordable housing in Saudi Arabia’s vision 2030: new developments and new challenges,” International Journal of Housing Markets and Analysis, vol. 14, no. 1, pp. 243–256, Feb.

- 2021, doi: 10.1108/IJHMA-04-2020-0035/FULL/PDF.
- [19] The World Bank, “Population, total - Saudi Arabia | Data.” Accessed: May 02, 2023. [Online]. Available: https://data.worldbank.org/indicator/SP.POP.TOTL?end=2021&locations=SA&most_recent_value_desc=false&start=1960
- [20] General Authority for Statistics, “General Authority for Statistics, Population and Vital Statistics,” General Authority for Statistics. Accessed: May 05, 2023. [Online]. Available: <https://www.stats.gov.sa/en/indicators/1>
- [21] R. M. Doheim, A. A. Farag, and S. Badawi, “Smart city vision and practices across the Kingdom of Saudi Arabia—a review,” *Smart Cities: Issues and Challenges Mapping Political, Social and Economic Risks and Threats*, pp. 309–332, Jan. 2019, doi: 10.1016/B978-0-12-816639-0.00017-X.
- [22] M. Aljoufie and A. Tiwari, “Exploring Housing and Transportation Affordability in Jeddah,” <https://doi.org/10.1080/10511482.2020.1815070>, 2020, doi: 10.1080/10511482.2020.1815070.
- [23] Ministry of Municipal and Rural Affairs, “Building Permit.” Accessed: Jun. 04, 2023. [Online]. Available: https://www.my.gov.sa/wps/portal/snp/servicesDirectory/servicedetails/s9057!/ut/p/z0/04_Sj9CPykssy0xPLMnMz0vMAfljo8zivQIsTAWdDQz9LQwNzQwCnS0tXPwMvYwN3A30g1Pz9L30o_ArAppiVOTr7JuuH1WQWJKhm5mXlq8fUWxpYGquX5DtHg4AUafoaw!!/
- [24] M. Helmi, “The ability of the local planning authority to implement zoning regulations: a case study of Jeddah, Saudi Arabia,” 2015, Accessed: May 04, 2023. [Online]. Available: <http://theses.ncl.ac.uk/jspui/handle/10443/2872>
- [25] M. A. Al-Hammadi and W. Tian, “Challenges and Barriers of Building Information Modeling Adoption in the Saudi Arabian Construction Industry,” *The Open Construction & Building Technology Journal*, vol. 14, no. 1, pp. 98–110, Jul. 2020, doi: 10.2174/1874836802014010098.
- [26] R. J. G. Mateus et al., “Improving Regulations for Automated Design Checking Through Decision Analysis Good Practices: A Conceptual Application to the Construction Sector,” pp. 160–169, 2024, doi: 10.1007/978-3-031-38241-3_19.
- [27] K.-Y. Kim, “Improving Regulations for Automated Design Checking Through Decision Analysis Good Practices: A Conceptual Application to the Construction Sector,” *Flexible Automation and Intelligent Manufacturing: The Human-Data-Technology Nexus Proceedings of FAIM 2022*, June 19–23, 2022, Detroit, Michigan, USA /, pp. 160–169, 2024, doi: 10.1007/978-3-031-38241-3_19.
- [28] Y. S. Huang, S. G. Shih, and K. H. Yen, “An integrated GIS, BIM and facilities infrastructure information platform designed for city management,” <https://doi.org/10.1080/02533839.2021.1897481>, vol. 44, no. 4, pp. 293–304, 2021, doi: 10.1080/02533839.2021.1897481.
- [29] N. Nisbet, L. Ma, and G. Aksenova., “Presentations of rase knowledge mark-up,” Jul. 2022. doi: 10.35490/EC3.2022.162.
- [30] E. Hjelseth and N. Nisbet, “CAPTURING NORMATIVE CONSTRAINTS BY USE OF THE SEMANTIC MARK-UP RASE METHODOLOGY,” pp. 26–28, 2011.
- [31] Jeddah Municipality, “المخطط المحلي لمحافظة جدة أنظمة وضوابط البناء.”
- [32] S. Alhumayn, E. Chinyio, I. N.-W. T. on T. Built, and undefined 2017, “The barriers and strategies of implementing BIM in Saudi Arabia,” *witpress.com*, 2017, doi: 10.2495/BIM170061.