

# Research/Interview Questions

# Augmented Reality Use in Construction

## Abstract

Overall Research Question: Should companies implement augmented reality into practice?

Preliminary Question: Can you list the augmented reality programs that you are using?

Sub Question 1: How developed is AR technology?

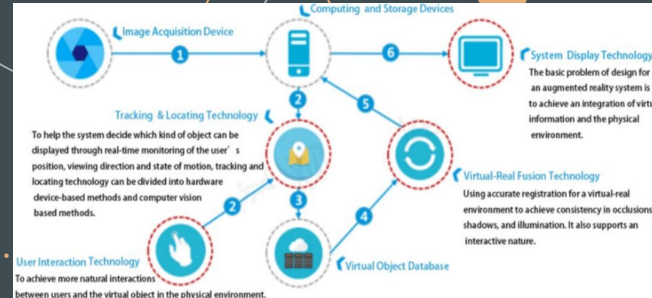
- 1) How reliable is it?
- 2) Can it replace current/traditional practices?
- 3) What needs to be fixed/addressed for AR technology to be viable?
- 4) What is the biggest hindrance with AR technology?

Sub Question 2: Is adopting AR worth the cost?

- 2.1) What upfront costs must be made before AR technology can be used?
- 2.2) What productivity values does it bring?
- 2.3) Does it decrease the time/increase efficiency for typical tasks?
- 2.4) Would you recommend/continue using this technology/software?

Sub Question 3: What is the future for AR?

- 3.1) What are the upsides if AR technology were polished to be utilized in the field?
- 3.2) What traditional practices will it replace?
- 3.3) What programs/technologies can AR be combined with?



Flowchart for an AR System



Virtual Objects as Seen Through AR



Microsoft HoloLens

The construction industry has been lagging in adopting technology applications, but has begun to integrate them in the past few years. Augmented reality (AR) is an innovative technology that allowed for the visualization of virtual objects in the real world. Presently, it can be used for various activities and tasks in construction but does not yet have the accuracy to be relied on. This case study interviewed industry personnel to determine if AR should be implemented into practice based on the experiences in the field. Based on the responses, the majority believed that it was a potential technological tool that had a high ceiling but was not at the level yet where it must be widely incorporated. However, they reported that there were many beneficial uses to AR, such as quality control/assurance, clash detection, visualization of the building, and double-checking work being performed. Many interviewees stated that technology is a revolutionary tool that has simplified and increased efficiency in construction. Ignoring technology advances will only hinder the growth of the company. Competition is constantly happening in the industry, so being ahead of competitors by adopting innovative technology is an advantage that must not be overlooked.

## Conclusion

The construction industry is going through a technology adoption phase where more resources and tools are being introduced and developed to increase productivity. The industry has been lagging in adopting technology but has begun to address this issue. AR is one of the innovative programs that have been introduced to increase productivity. The overall research question for this case study was to determine whether companies should implement AR into practice. Based on the interviews and research conducted, the key takeaway was that it had many benefits that could help with a company's productivity. The interviewees listed the benefits of AR, stating how it has helped with QA/QC, clash detection, visualization, and many more. While AR is a tool that cannot be depended on, it can be utilized with other resources to act as a safety net to double check the work being done. Companies should be adopting and implementing AR into practice to not only boost productivity, but to be familiar with the technology and not fall behind other competitors. It is a beneficial tool that has a high ceiling, so while AR is being developed to the point where it can be relied on, it will still be a useful tool that will benefit a company in the long run.

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## Results

AR technology is not very reliable, due to the inaccuracy of the models. There were many issues involving the calibration and reliability that made the margin of error too large. If the reliability, accuracy, better connectivity with Wi-Fi, and better user interface were fixed, it would make AR more viable. AR can be used for checking plans in real-time, quality assurance (QA) and quality control (QC), virtual mockups, and drilling into concrete for embeds. It has saved on many man hours that were spent on traveling between the office and the field, looking through 3D models and referencing the 2D plans, and time spent on QA/QC. It was reported to be extremely helpful in identifying the location of underground utilities and systems. Half the interviewees would recommend AR technology as it was still a developing technology that had certain flaws. It also depends on the company's projects, if more than 50% of the projects were designed in BIM, it would be very beneficial, especially for medical buildings as their systems were more complex. If AR technology were further developed, it would help with inspections, recording as-built conditions, QA/QC, clash detection, accurate representation for existing and hidden systems, increasing collaboration between architects and engineers, safety mitigation and precautions, and dependable real-time collaboration. It could also combine multiple aspects of construction into one centralized resource to boost performance. AR can replace the traditional practices with total stations for formwork, sleeves, embeds, studs, etc. It could also replace training for equipment and services, trade installation conflicts, subcontractor work with specialized interfaces, and the initial design phase with 3D augmented design. However, many of the interviewees stated that AR would not necessarily replace traditional practices but act as a complementary tool to help increase efficiency.