Author

Stephen Witherden
Technical Director, Software Engineering
Beca Ltd

Abstract

Conveying alternate engineering options to stakeholders is a complex undertaking, especially when stakeholders include the general public. In this paper, we explore the use of the latest augmented reality technologies to enable stakeholders to visualise, immerse themselves in, and actively interact with various corridor configurations for New North Road in Auckland. We assert that this approach results in higher engagement and better consultation outcomes with all stakeholders, including the public.

Immersing in the Future: Practice Paper

Background

Beca were recently engaged in preparing the corridor management plan for the New North Road (NNR) corridor. The NNR corridor extends from Newton to Avondale. It is approximately 6.5km long and passes through the centres of Kingsland, Morningside and Mt Albert. The corridor has a strong place role and function. The Auckland Plan sets a clear vision to create "the world's most liveable city". The Proposed Auckland Unitary Plan (PAUP) seeks to achieve this vision through appropriate zoning, with localised intensification proposed on the northern side of the rail corridor at Morningside and on both sides of NNR at Mt Albert and on the edge of Avondale Town Centre.

As a part of this plan, Beca were engaged to arrive at a new corridor management plan for this key corridor. This paper proposes a number of possible approaches for engaging stakeholders in the process of evaluating the corridor management plan.

The challenge of Stakeholder Engagement

Stakeholder engagement is a key activity required to gain feedback from stakeholders about (in this case) the options for the New North Road Corridor Management Plan.

According to the International Association for Public Participation (IAP2), the core values of stakeholder engagement are:

1. Stakeholders should have a say in decisions about actions that could affect their lives or essential environment for life.
2. Stakeholder participation includes the promise that the stakeholder's contribution will influence the decision.
3. Stakeholder participation promotes sustainable decisions by recognising and communicating the needs and interests of all participants, including decision-makers.
4. Stakeholder participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision.
5. Stakeholder participation seeks input from participants in designing how they participate.
6. Stakeholder participation provides participants with the information they need to participate in a meaningful way.
7. Stakeholder participation communicates to participants how their input affected the decision.

In this paper, we explore approaches to achieve the outcomes of these 7 core values through the use of technology. According to the Cranfield School of Management (Jeffery, 2009), there are 7 stages of stakeholder engagement:

1. Plan
2. Understanding Stakeholders and their Wants and Needs
3. Internal Preparedness and Alignment with Stakeholders
4. Building Trust
5. Consultation
6. Respond and Implement
7. Monitoring, Evaluating and Documenting

In our case, we are focusing on step 5: consultation. Consultation is usually conducted in meetings, workshops, panels or through more asynchronous channels such as surveys.

Evaluation Criteria

In order to identify technologies that could support the consultation process, we established the following evaluation criteria. A successful consultation technology must have the ability to:

- Present multiple options
- Collect feedback from multiple stakeholders
- Present the feedback dynamically on the options
- Provide a high level of engagement with the various planned options

Enabling technologies

Pen & Paper

The traditional approach to stakeholder engagement, this may include the use of a whiteboard with post-it notes, where stakeholders are able to engage with the proposed changes and provide their feedback. Feedback can be made directly onto the paper itself, available for all other participants to see.

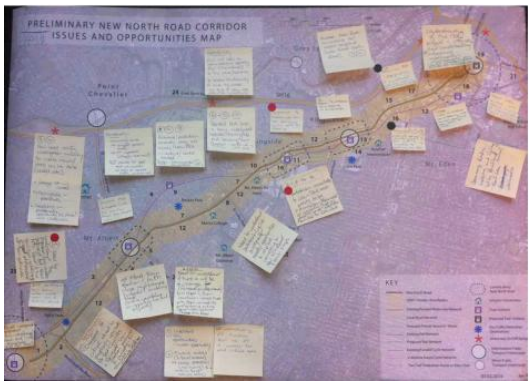

Figure 1 - Paper based engagement tools were used for the initial stakeholder consultation for this project. Paper is cheap and has a low barrier to entry for participants.

Advantages:

- Low barrier to entry, all stakeholders immediately understand how to work with a paper. representation of the plan and are generally able to write their feedback.
- Paper is a relatively cheap approach to engage with stakeholders.

Disadvantages:

- Paper is physically limited to a smaller number of participants.
- Paper is not interactive and does not allow the stakeholders to explore different options dynamically.
- Without a skilled facilitator, the level of engagement with paper is generally low.

Survey

Surveys can be conducted online, via the phone or in person. They can be used to collect quantitative and qualitative subjective feedback from stakeholders chosen either as a random representative sample or self-selecting by opting in.

Advantages:

- Surveys are relatively easy to construct as a representative sample.

Disadvantages:

- Feedback is limited to the questions asked in a survey.
- Responses can be biased based on questions asked.
- Surveys can be relatively expensive to conduct.
- Surveys are not much more interactive than paper as a medium for interacting with the options.

Geospatial Information Systems (GIS)

With the advent of Google Maps, the general public are now comfortable interacting with online maps. A geospatial information system allows users to view information overlaid on a map. This information can include top-down schematics of plans, illustrating the various options proposed.

Advantages:

- Most people have an intuitive understanding of maps.
- Studies show that people are more likely to believe information presented to them on a map.

Disadvantages:

- Even though they are interactive, maps don't typically allow people to explore multiple options.
- Geospatial systems typically do not show 3D representations of planned work.
- Geospatial systems typically do not show animations.

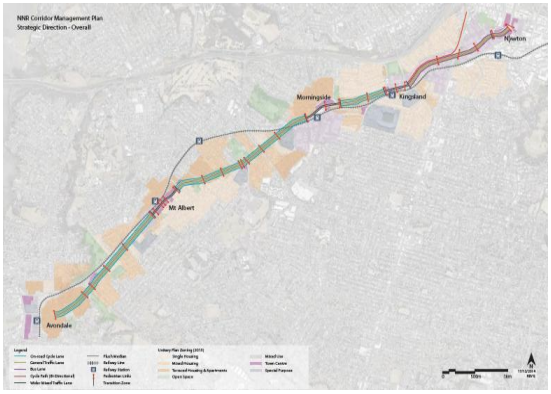

Figure 2 - Geospatial Information Systems were used to produce maps for consultation. Stakeholders have an intuitive understanding of maps but they lack the immersion of other approaches.

Virtual reality

Virtual reality is typically a 3D representation of a plan using computer graphics. Virtual Reality displays could be a fixed display (such as in a show room) available online or even using an immersive headset. "Immersion" refers to the degree to which the participant feels "physically present" in the virtual world.

Advantages:

- It is very easy for even laypeople to understand a 3D representation of a plan
- With some work, it's possible for more than one participant to interact with the virtual world
- Multiple options can easily be presented in the same display
- Using technologies such as the Occulus rift, the stakeholder can have a highly immersive experience

Disadvantages:

- Many people (especially older people) find interacting with a virtual world to be confusing and unnatural.

Figure 3 – VR headsets provide a high level of immersion in virtual reality worlds, but users find interacting with the virtual world confusing and unnatural. Samsung VR Headset, photographed by Nan Palmero © 2015.

Table-top Augmented Reality

Augmented reality is intended to be a blend of the real world and a virtual representation. In a "table-top" AR display, the "real world" consists of a table, the stakeholder participants, and specially designed AR markers. A camera system is able to recognise the markers and overlay the plans in an interactive way.

Advantages:

- Interacting with real-world objects such as markers is immediately more intuitive and engaging than a virtual world.
- As with Virtual Reality, various options can be presented, including animations.
- The system naturally supports multiple stakeholders interacting with the markers simultaneously

Disadvantages:

- Although highly engaging, such as setup is not as immersive as it would be to truly see the proposed developments "in person".

Figure 4 – Table top AR offers a higher level of interactivity due to being able to manipulate the virtual world inside the real world.

Outdoor Augmented Reality

In an "outdoor" AR Display, plans for a new corridor could be overlaid on top of the real world. At its best, such a system would allow stakeholders to see what the new development would look like outside their bedroom window. AugView is a New Zealand company with a compelling product. In our view, the technology is still not yet mature enough for mainstream use in consultation.

Advantages:

- The ability to see what the plans would look like from the stakeholder's own bedroom window would be priceless.
- Being able to walk in the actual space is a highly effective way to convey the vision of the design to stakeholders.

Disadvantages:

- Typically tends to rely on GPS fix and a compass bearing while outdoors and computer vision indoors. Computer vision technology required for a smooth outdoors AR experience when there is no GPS fix (i.e. looking out of your bedroom window) does not yet exist.

"Blended" Reality

Microsoft's Hololens technology promises to offer a "blend" of the virtual and real, Microsoft assert that the Hololens is not Augmented Reality but rather a "blended reality" platform. The Hololens is a headset which you wear, much like a more conventional Virtual Reality headset. It appears to use structured light to detect objects in the real world and can then overlay virtual constructs on the real world.

Advantages:

- Is able to understand the world around you and so can therefore project virtual reality onto any surface
- Promises to offer a fully immersive experience that AR and VR have traditionally not been able to match.

Disadvantages:

- Requires an expensive headset which only one subject can use at any given time.
- This technology is most certainly "bleeding edge", with only a few technology companies having had the opportunity to test its capabilities, its full potential is not yet well understood.

Figure 5 - Microsoft's Hololens offers an unprecedented blend between the virtual and physical. Image courtesy Microsoft Sweden © 2015.

Implementation

In our case, we implemented a 3D representation of the various New North Road corridor options using the table top AR approach described above. We then explored different approaches whereby stakeholders could interact with this table top model. Interactions included:

- Allowing the stakeholder to interactively switch between options themselves by manipulating the model
- Tagging options with stakeholders' feedback, as audio clips
- Replaying feedback tagged to elements of the solution
- Playing an animation representing how the option may play out visually in 3D

Conclusion and Future work

There are a broad spectrum of tools for eliciting feedback from stakeholders for a corridor management plan. In our view, technologies for augmented reality have the opportunity to transform the way in which we perform public consultations for large projects, and the promise of soon to be released technologies such as the Microsoft Hololens offers an unprecedented level of immersion for stakeholders in future consultations. In the future, we propose to expand the solution beyond the table top AR solution to allow for visualisation and interaction using Microsoft's Hololens technology as well.

References

Jeffery, Neil (2009). "Stakeholder Engagement: A Road Map to Meaningful Engagement". The Doughty Centre for Corporate Responsibility, Cranfield School of Management. Retrieved 23 April 2015.

IAP2 Core Values, Viewed 23 April 2015 <http://www.iap2.org/?page=A4>