Re-define the way we collaborate visually using AR

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Bachelor of Arts in Architecture | Portland State University | Portland, OR Minor in Community Development

Master of Architecture | Portland State University | Portland, OR

Virtual Design & Construction Estimating Engineer | Skanska USA Building | Portland, OR

My Aspirations

## Objectives: What you will learn are

Explore various AR applications and implementations

Evaluate AR hardware and software for their applicability

Create an interactive experience for all stakeholders

Use AR to excite and engage internal and external clients



## Skanska's Innovation Journey Case Studies:

AR-Media | Inglobe Technologies:

**Banfield Pet Hospital** 

Hologram:

**PSU School of Business** 

Google Cardboard:

Confidential Project #1

Confidential Project #2

htc-VIVE:

PSU Neuberger Hall Pursuit

Hololens:

2ND & University

**Generation Park** 

Nanco Technology:

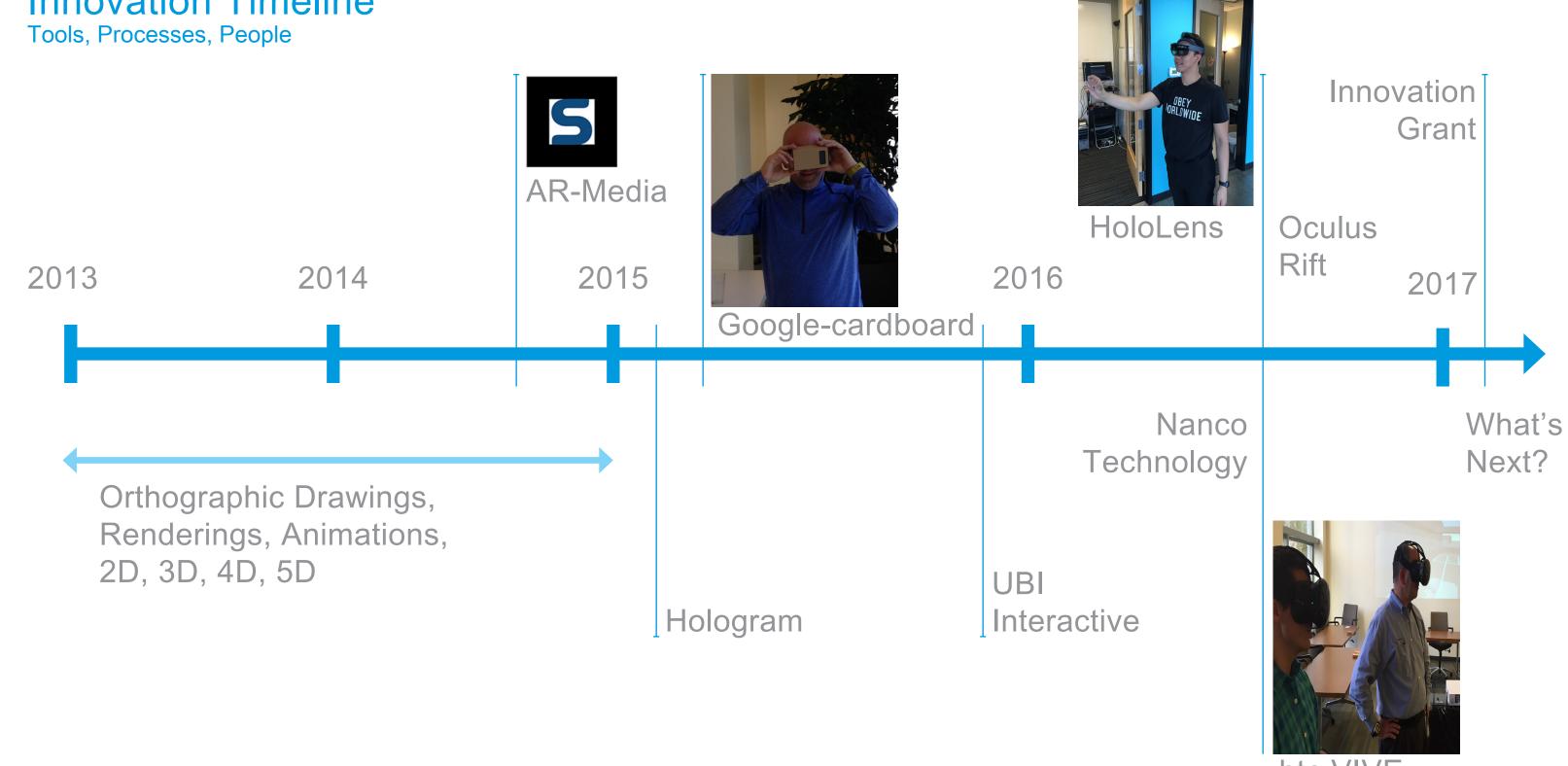
**Visualization Center** 

**Innovation Grant Research Project** 

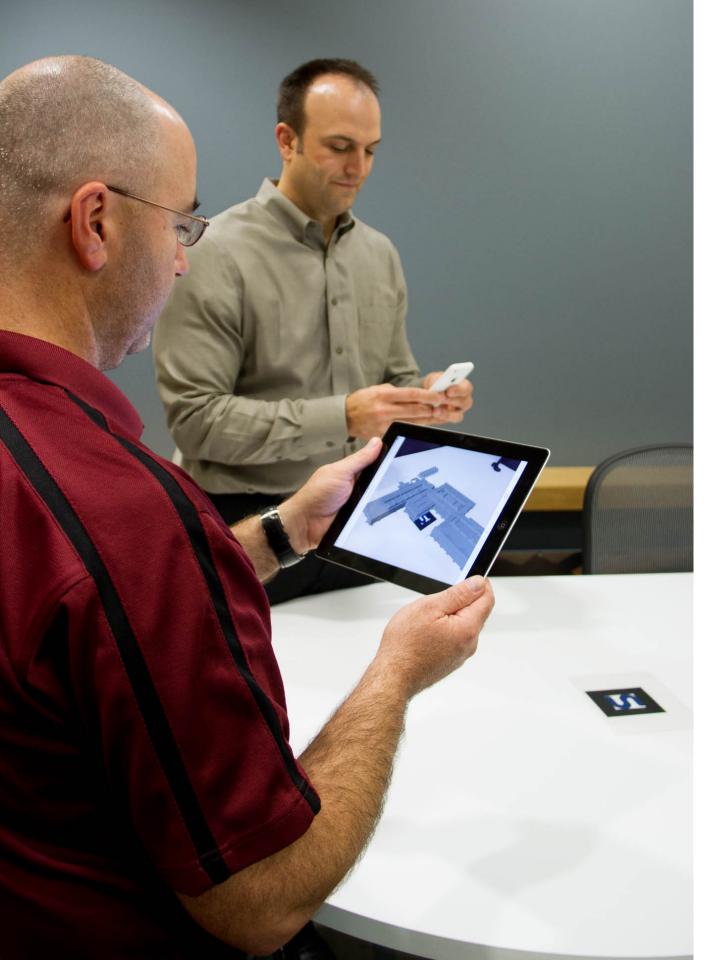
Where do we go from here?

What is your story?

#### **Innovation Timeline**



htc VIVE



## AR-Media Banfield Headquarters

Vancouver, WA

#### Lessons-Learned:

- "Demonstrated the creativity and outside the box thinking"
   David Standley, *Director of Preconstruction*
- 2. "Good wow factor and nice visualization of the project on a greenfield site"
- 3. "cumbersome to communicate to client" Steve Clem, *VP of Preconstruction*





## Google-cardboard Confidential Project #1

**CLIENT'S OFFICE** 

LEGEND:

View looking from Client's conference room on the 12<sup>th</sup> floor at adjacent building

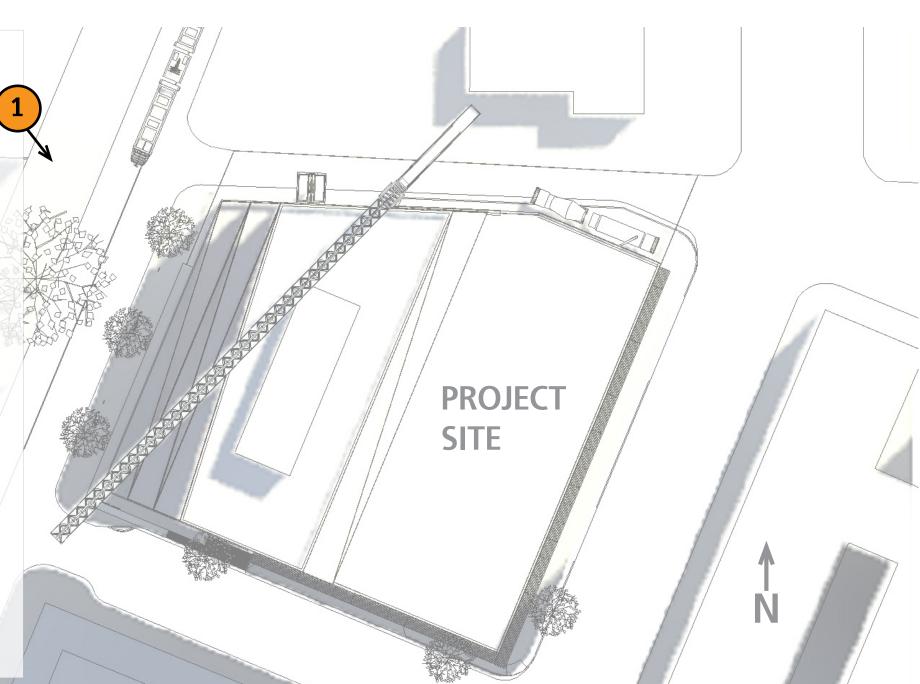
Top Right: QR code for Stereo Panorama of View 1

Below: Key Plan Not To Scale

"I think we impressed the owner and

GBD. It was good to have the device and content in the meeting and show them how to use it. If they were on their own, I'm not sure they would have explored it."

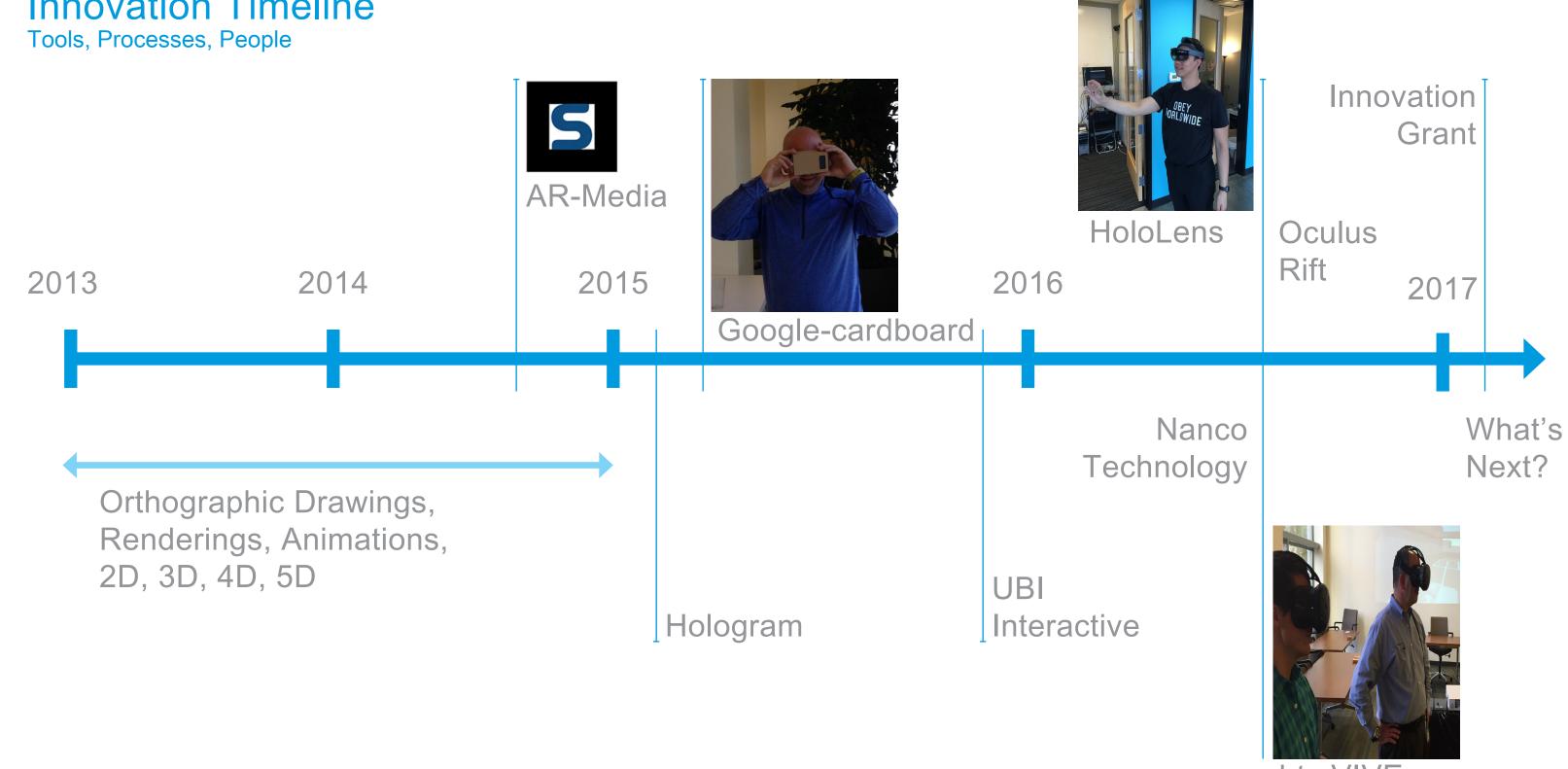
Steve Clem, VP of Preconstruction



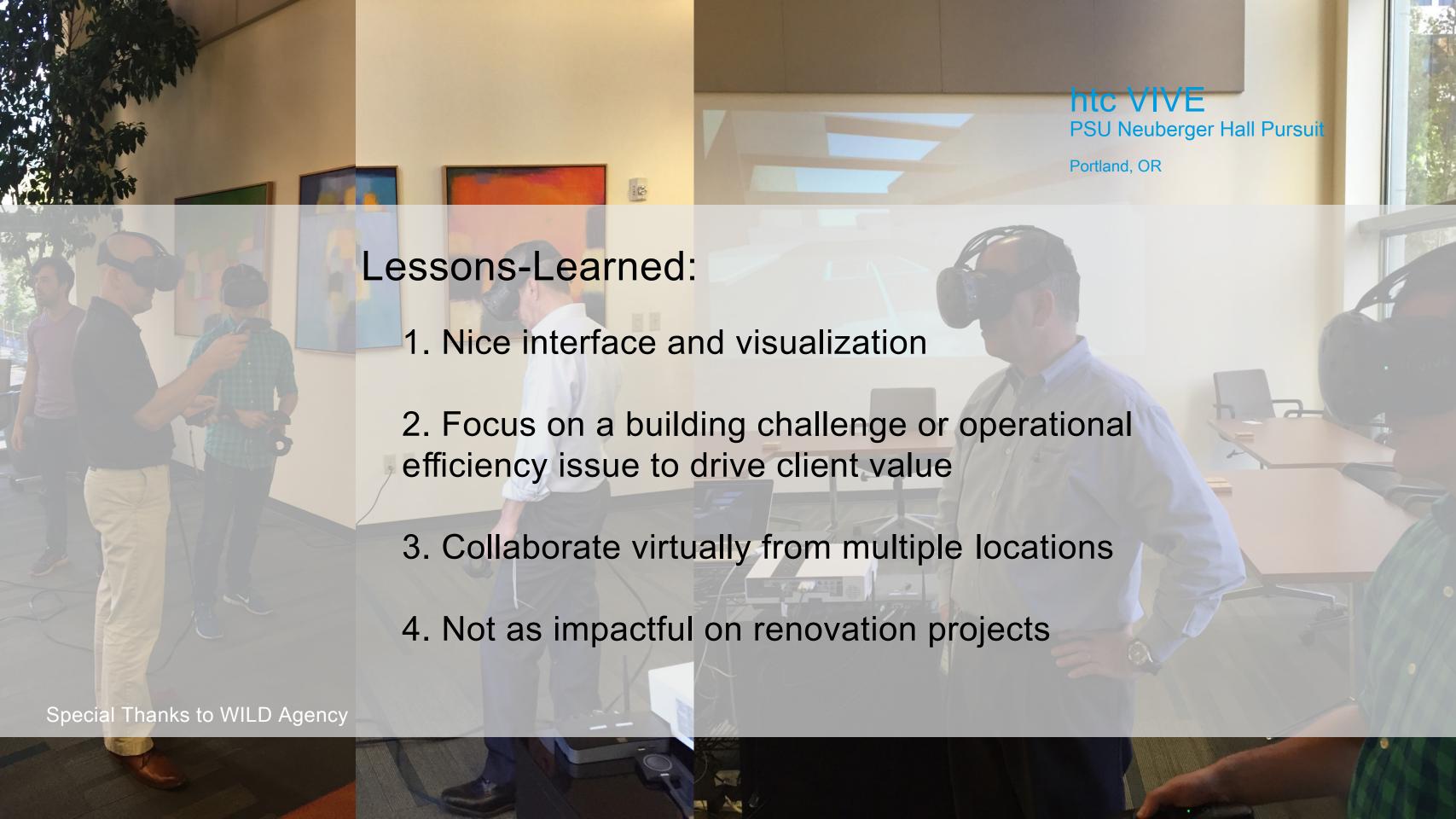
GBD

5

#### **Innovation Timeline**



htc VIVE





## HoloLens 2nd & University Office Tower Seattle, WA

#### Lessons-Learned:

- 1. Collaborated with great thinkers
- 2. Inspired the company's innovation culture
- 3. Initiated a conversation for the company across the globe and business-units to spark new ideas
- 4. Outsource v.s. In-House?

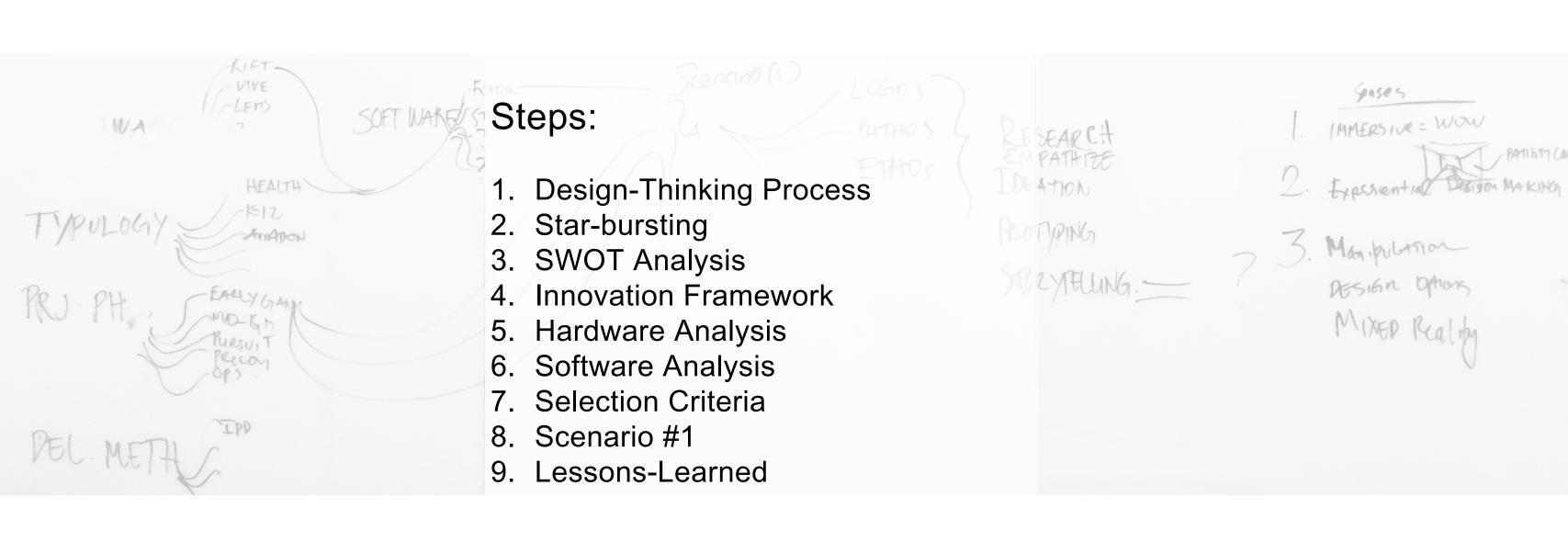


### **Innovation Timeline**

Tools, Processes, People Innovation 5 Grant AR-Media HoloLens Oculus Rift 2016 2013 2014 2015 2017 Google-cardboard Nanco What's Technology Next? Orthographic Drawings, Renderings, Animations, 2D, 3D, 4D, 5D **UBI** Hologram Interactive

htc VIVE

#### **Innovation Grant Research Process**



#### **Innovation Grant Research**

Re-think the way we think, create, and build through visual collaboration

Objectives: to create a platform (hardware and software) that local teams can leverage to develop immersive experiences to enhance business development efforts.

Continue to foster a culture of innovation

Engage all project stakeholders through visual collaboration Influence client's perception of Skanska

Attract and retain key employees

#### The Design-Thinking Process

Research	Empathize	Define	Ideate	Prototype	Test	Storytelling
Traditional Methods of Visualization v.s. Modern Techniques	Clients? Creators?	What are the Issues we are trying to Solve?				
Star- bursting	Innovation Frame- work	Selection Criteria	Develop Scenario #1	Set-up a Virtual Room in PDX	Scenario #1	Share our Story
Research Inventory  SWOT  Analysis	How are they going to use these tools? Who are the endusers?	Software & Hardware Analysis		Invite different users to test	Scenario #2	I = V/C  VALUE  OLD VALUE  INNOVATION
What's the ROI?  Potential Collaborators?		Measurement for Success/Failure			Test Hardware against Software and capture Lessons-Learned	COST

## Star-bursting Generating Questions

#### WHEN?

When should we consider AR? When is it applicable?

#### WHO?

Who are responsible for producing contents?
Who has ownership?
Who are our clients?

#### WHAT?

What's the ROI? What are the benefits? What are the risks?

#### WHERE?

Where are the contents coming from?
Where is it applicable?

Using AR for Visual Collaboration & Communication at Skanska

#### HOW?

How are we going to create a standard workflow that's applicable to different offices?
How are we going to sell?

#### WHY?

Why do we need AR?
Why should we invest?
Why don't we outsource?

- + A global company
- + People are our greatest asset
- + Different business-units, diverse mindsets
- + Financial synergies

- + Grow our business
- + Develop and motivate our people
- + Grow our innovation culture
- + Be a leader



- Business model constrains innovation
- No strategy for integrating innovation into our operational process.
- Competitors will surpass us
- Disconnect with customers, lose business
- Employees become stagnant
- Become complacent



Objective Metrics: be a thought leader in technology, innovation, and creative thinking by providing clients with more innovative solutions to grow our business

Subjective Metrics: Grow our innovation culture by connecting our people across the organization and business-units

How To: develop an efficient workflow that could be integrated across the country and business-units to create a visually collaborative workspace enhanced by AR technology.

Innovation		Mark	eting		Preconstru	ction		O	oeratio	ns	Strategy
Framework	Early Game	Mid- Game	RFP	Interview	Conceptual SD	DD	CD	Site Logistics	Safety		
	<del>←</del>										
Creative Process			research, i conceptua 2D - 3D, do compelling Inhouse vs Outsource	ize, evelop contents,	develop visual contents to communicate with internal and external clients, research, develop, and incorporate new technologies, differentiate from our competitors						people play an important role in the creative process, cross-pollinate ideas with people from different disciplines, empower people to speak and share ideas, introduce non-traditional brainstorming activities, design thinking process
Tools			Adobe, CA Rendering Googlecar AR-Media	.360, board,	Adobe, CAD, Revit, Googlecarboard, Assemble, Solibri, Navisworks, AR-Media	Revit, Ass OST, Grad Kanban		Revit, Nav	isworks		don't limit yourself to just one tool, technology is secondary
Deliverables			renderings animations walthrough analysis,	,	conceptual estimates, design options, VE options,	GMP, Lum	np Sum	PEP, 4D s logistics,	ite		focus on the goal and vision of your client, simplify the problem, added-value solution? what can I do differently?
ROI			provide proteam with a information the game to informed productions,	detailed n early in o make	allow internal and external to have a long-term vision of the project, promote effective communication to avoid unnecessary error						create value through more cost savings, early ADOPTER, stay in front of the trend
Vision	promote v to increase engageme communic create valu savings, a	t engagements is ual collaborate team dynamics and cation, plan or cross-polling generate n	oration amic, early, cost nation		continue client engagment effort to drive consistency and communicate to all partners, identify opportunites for time and cost savings and innovation, ability to be transparent,	include outhe designan interactory process, in our QAQC by present consisting information	process, tive mprove process ting and clear	incorporat technolog our jobsite boost effic consistent safety, bu	y into es to iency,		strive to be a leader in the industry, differentiate from our competitors by thinking, creating, and building differently,

#### The Design-Thinking Process

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	Ea		Fidelity	Cost	Applic	ability	Experiential	
Hardware	Creator	User			Context	Content	Quality	Evaluation
HOMiDO	N/A	yes	medium-high	TBD	initial client meetings	stereoscopic renderings	more immersive than googlecardboard	light to travel with, easy to use
Google- cardboard	N/A	yes	low-medium	TBD	initial client meetings	stereoscopic renderings	only visual - not smooth to experience	provides a cool factor, clunky to use, a fun and affordable tool to get project team excited and engaged
Hologram	set-up views in Revit for supplier to print	yes, doesn't require any manipulations	low-medium	TBD	marketing	project phases/ sequences	only visual	expensive for a print (holographic picture), no practical application outside of sales and marketing
HTC VIVE	requires coding	detached from the external world	medium-high	TBD	varies	varies	visual, tactile, and auditory, can interact remotely with others,	not mobile
Oculus Rift	requires coding	singular experiences	high	TBD	varies	varies	visual - provides a platform for group discussion each team member has control over the model using their device(s)	not mobile
Hololens	requires coding	not isolated from the external world	high	TBD	varies	varies	visual, tactile, auditory, and kinesthetic	not tethered
Leap Motion				TBD				

	Ea	se	Fidelity	Cost	Cost Applic		Experiential	
Software	Creator	User			Context	Content	Quality	Evaluation
AR-Media	Yes	cumbersome interface	low-medium	TBD	site analysis, conceptual - schematic design meetings	massing models, design options	visual - provides a platform for group discussion each team member has control over the model using their device(s)	when geolocate to site, it is not possible to geolocate exactly on the coordinates manual adjustments of the model can be jumpy and caused frustrations for users good for an early analysis tool, not immersive
Fuzor	set-up views in Revit and render in the cloud	yes	low-medium	TBD	initial client meetings	massing models	only visual - not smooth to experience	provides a cool factor, clunky to use, a fun and affordable tool to get project team excited and engaged
Unity	set-up views in Revit for supplier to print	yes, doesn't require any manipulations	low-medium	TBD	marketing	project phases/ sequences	only visual	expensive for a print (holographic picture), no practical application outside of sales and marketing
Stingray	required coding	detached from the external world	medium-high	TBD	varies	varies	visual, tactile, and auditory, can interact remotely with others,	not mobile
Rendering A360	required coding	singular experiences	high	TBD	varies	varies	visual - provides a platform for group discussion each team member has control over the model using their device(s)	not mobile
Worldviz	required coding	not isolated from the external world	high	TBD	varies	varies	visual, tactile, auditory, and kinesthetic	not tethered
Unreal	required coding	not isolated from the external world	high	TBD	varies	varies	visual, tactile, auditory, and kinesthetic	not tethered

Project Delivery Method		D-B-B (LS Bid)				CM/GC CMAR Negotiated GMP				MP	D-B LS or GMP				
Selection Criterion Project	Conceptual	Programming	SD	DD	CD	Conceptual	Programming	SD	DD	CD	Conceptual	Programming	SD	DD	CD
Innovation					0	5	4	3	1	0	5	4	3	1	0
Budget Control					0	2	2	2	1	0	3	3	2	1	0
Schedule		N	A		0	3	3	3	1	1	3	3	3	1	1
Collaboration					0	5	4	3	1	1	5	5	4	2	1
Early Client Engagement					0	5	4	3	1	0	5	5	4	1	0
Sub-Total					0	20	17	14	5	2	21	20	16	6	2
Total					0			58					65		

#### **Selection Criteria**

Objectives: develop a rating system to evaluate and identify a project delivery method that provides the most opportunity for using AR technology to collaborate

Results: Design-Build has highest score. Especially, in the Collaboration, Early Client Engagement, and Innovation category

Rating System:

1(Least) > 5(Most)

Project Type Short Type	Office	Healthcare	Retail	Hospitality	K-12	Higher Ed.	High-Tech	Aviation	Manufacturing	Commercial Development	Sports	Government	Mixed-Use	Warehouse	Cultural
Design & Execution Complexity	2	5	2	3	3	4	5	4	4	3	3	4	3	1	3
Design Impact on Opex	2	5	2	4	3	4	5	4	5	3	3	3	3	2	3
Clients open to Collaborative Project Delivery	2	5	2	3	3	5	3	4	1	4	4	4	3	1	3
Need to Communicate to Multiple Stakeholders	3	5	2	3	3	4	3	4	2	3	3	4	4	1	2
Sales & Marketing	5	2	3	3	2	3	1	2	1	5	2	1	4	1	3
Sub-Total	14	22	11	16	14	20	17	18	13	18	15	16	14	6	14
Total															

#### **Selection Criteria**

Objectives: develop a rating system to evaluate and identify a project type that provides the most opportunity for using AR technology to collaborate

Results: Healthcare,
Higher Education,
Aviation, and Commercial
Development have the
highest scores, especially
Healthcare

Rating System:



#### The Design-Thinking Process

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#### Scenario #1

Market Sector: Healthcare

Delivery Method: Design-Build

Project Phase: Programming

Issues: clients are unable to visualize the design can cause project delays and drive costs up

Objectives: speed up the decision making process, reduce cost and time of coordination, collaboration, and communication by leveraging AR technology

Challenges: where are the contents coming from? Architect or in-house production?

Opportunities: create a collaborative process and provide added-value solutions for our clients

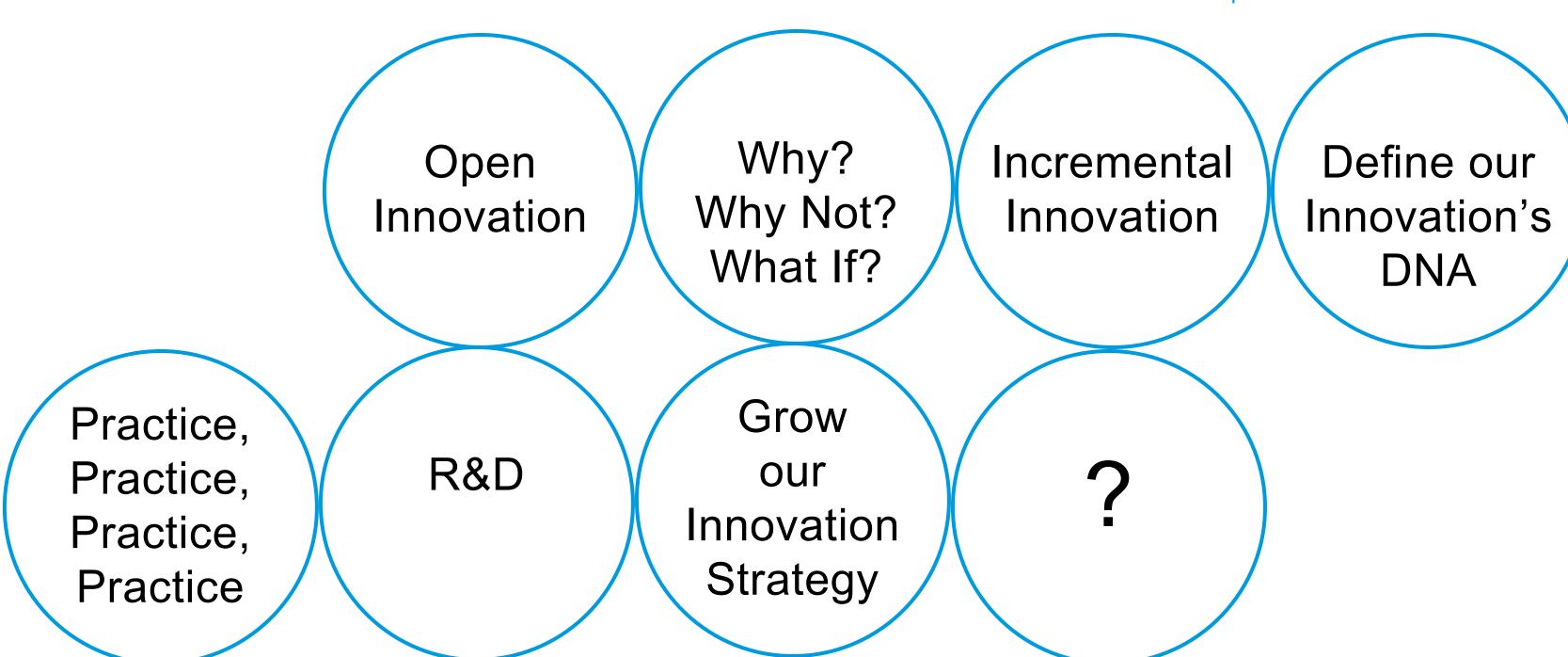
Desired Outcomes: reduce the cost of traveling, coordinating, and producing full-scale cardboard mock-ups. Collaborate efficiently with our design partners and enable our clients to make critical decisions easier and faster

#### Lessons-Learned:

- Develop a flexible workflow for your research
- Network with creative thinkers
- Understand your client's vision and goal
- Think about the end-users

## Takeaways We talked about

## What's Next Our Aspirations



# Thank you!

## What is your story? What is your scenario?



## How did I do?

- Your class feedback is critical. Fill out a class survey now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- •Your feedback results in better classes and a better AU experience.