The Business Value of Computational and Generative Design for Executives

Emily Bisaga Dunne

Industry Outcomes Lead, Building Design | @DunneDesignTech

AUTODESK.

Emily Bisaga Dunne

About

- Industry Outcomes Lead, Building Design at Autodesk
- Previously Architecture Technical Evangelist
- Specializing in AEC Industry Strategy, Technology and Design
  - 10+ years experience, based in the Boston

@DunneDesignTech

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Special Thanks

To the following all-stars:

- Kyle Bernhardt – Director, Building Design Strategy
- Michael Gustafson - Senior Industry Strategy Manager, Structural Engineering & Fabrication
- Zach Kron – Senior Product Manager, Generative Design
- Lilli Smith – Senior Product Manager, Generative Design
- Jacob Small – Designated Support Specialist, Computational / Generative Design
- Dieter Vermeulen – Technical Sales Specialist, AEC
- Phil Bernstein – Associate Dean at Yale School of Architecture,
  Architecture Design Data Author

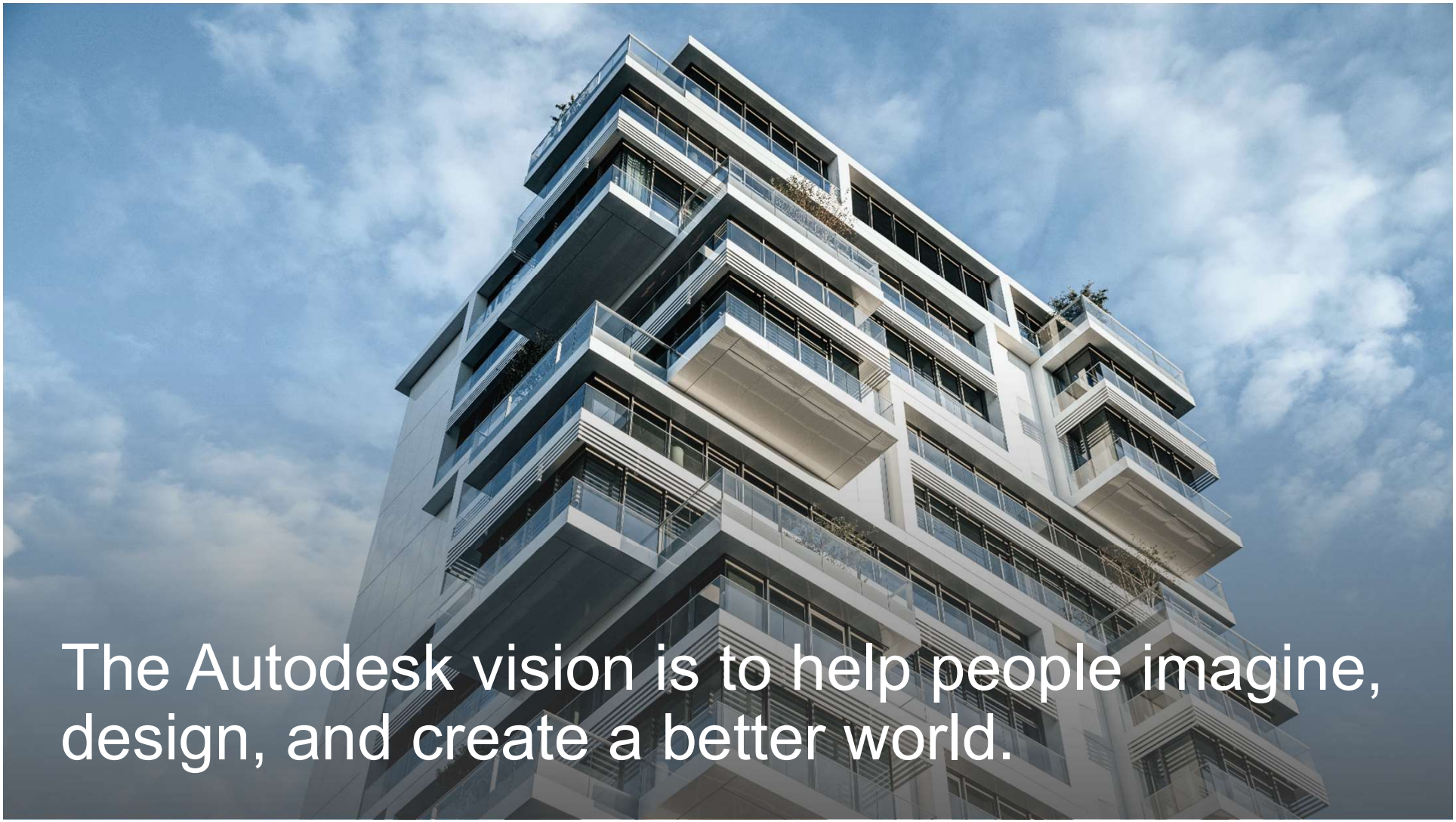
About This Course

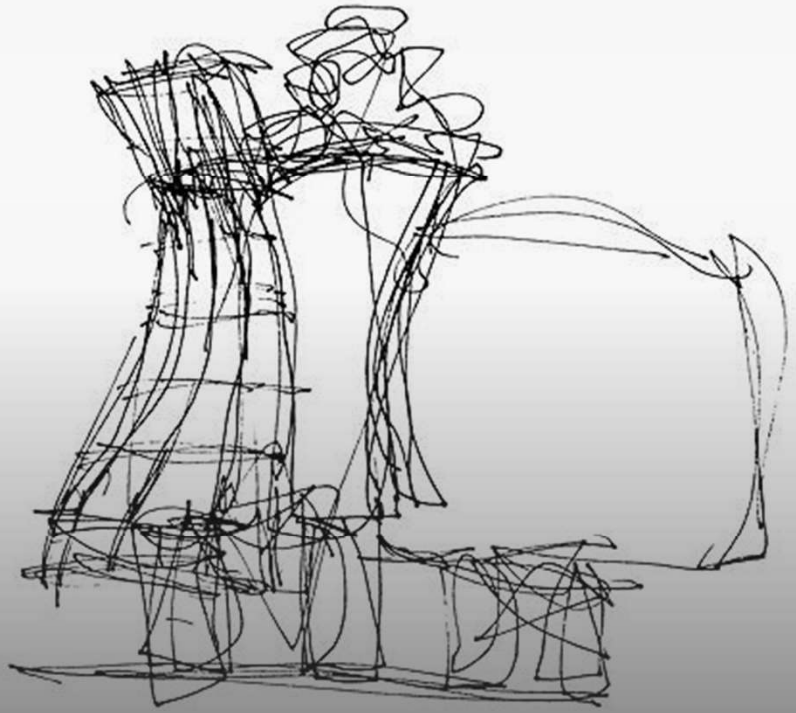
The Business Value of Computational and Generative Design for Executives

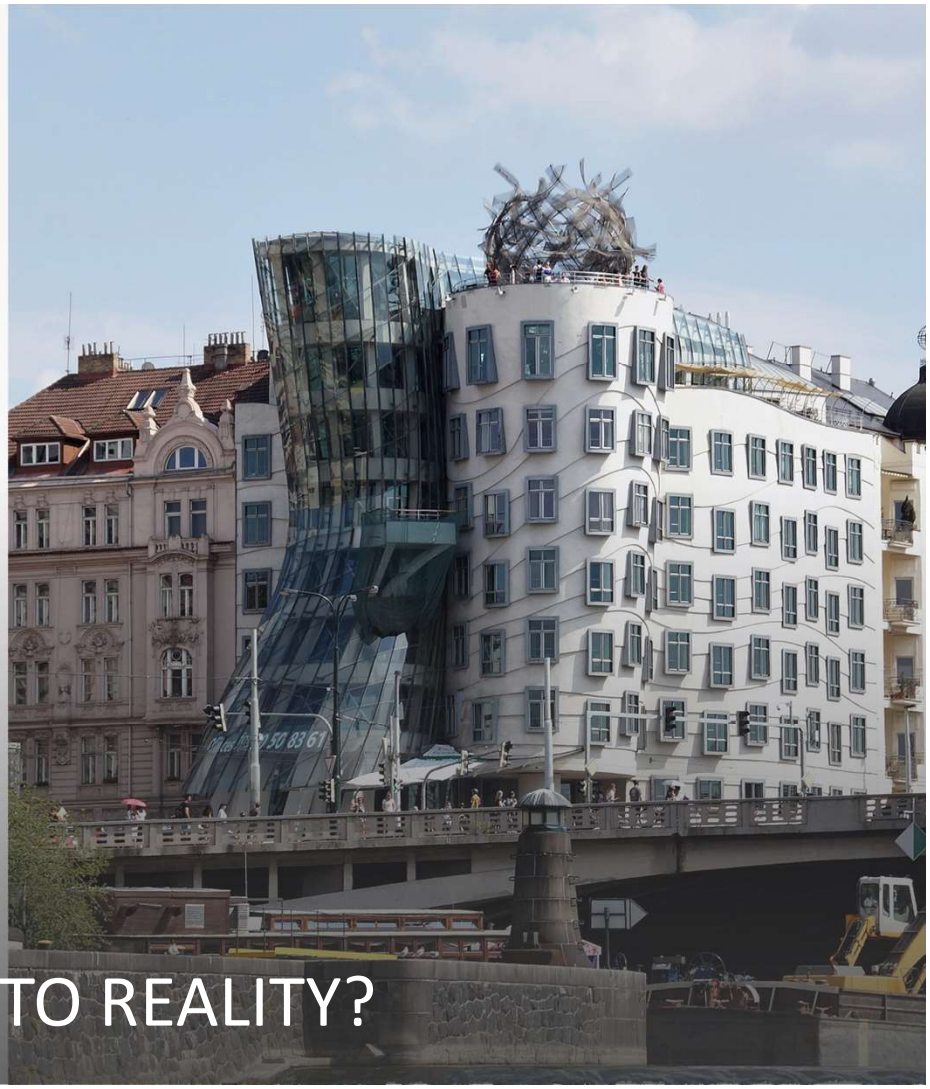
In this presentation, we'll examine the business value of computational and generative design for your company by reviewing a comparative analysis of design processes, including covering Dynamo, Refinery, and Revit software.

Learning Objectives:

- Gain complete understanding of computational and generative design
- Review a comparative value analysis of business processes
- Learn how to compellingly sell clients on BIM + solution for value add in future projects
- Learn about the implementation process in a project


The Autodesk vision is to help people imagine, design, and create a better world.





HOW DO WE GET FROM IDEA TO REALITY?

Image Courtesy of Telegraph.Co.Uk.

The Evolution of Ideation in Architecture

Found Materials

- On-site Ideation

Manual Drawing

Manual Modeling

(Drawing and modeling do not happen at the same time)

The Evolution of Ideation in Architecture

Found Materials

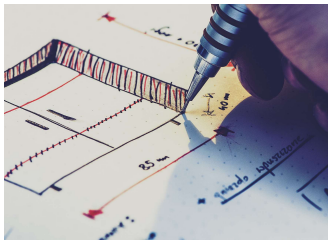
- On-site Ideation

Manual Drawing → Manual Drawing

Manual Modeling → Manual Modeling

Paper Innovation

- Previous +
- Mobile Ideation
- Offsite Ideation



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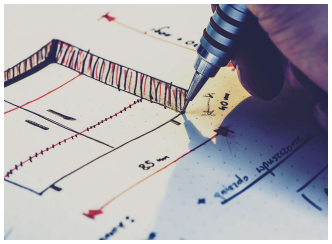
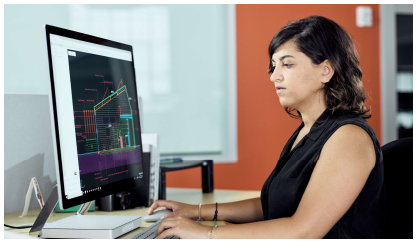


Manual Drawing → Manual Modeling

Computing Innovation

- Previous +
- Extended Drawing & Modeling Capabilities



Digital Drawing → Digital Modeling

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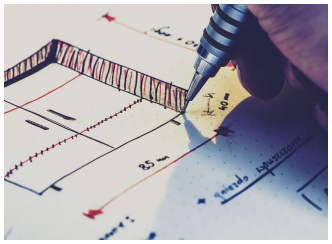

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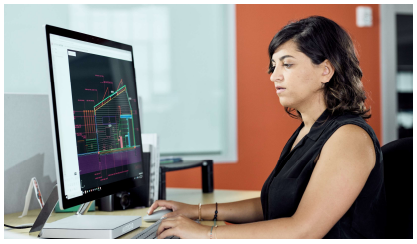
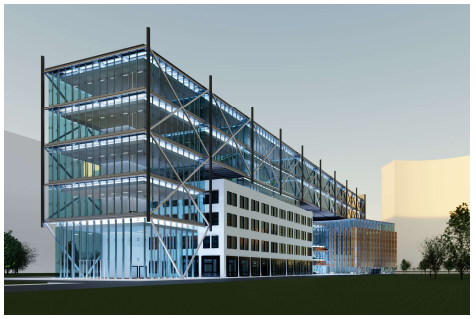


Digital Drawing → Digital Modeling

Hardware and Software Innovation

- Previous +
- Integrated Modeling, Drawing, Enhanced Visualization & Calculated Insights

Building Information Modeling With Parametric Design



BIM
Single Source of Truth for Ideas

(Drawing and modeling do not happen at the same time)

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Next Gen Ideation Evolution

Hardware and Software Innovation

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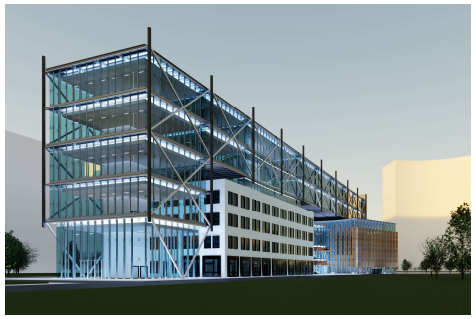

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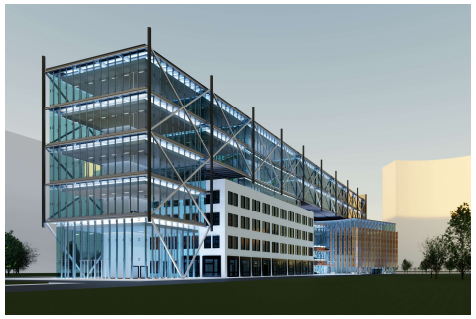

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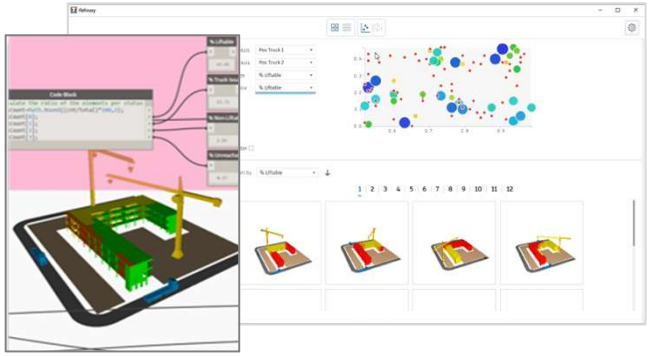
- Optimization of designs through option generation and selection with **Generative Design**



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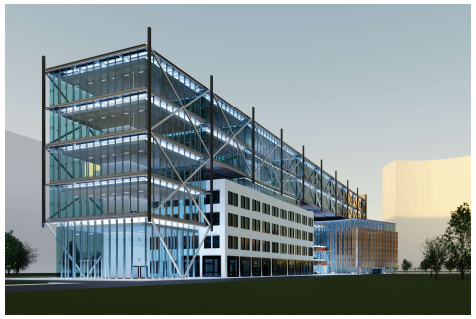

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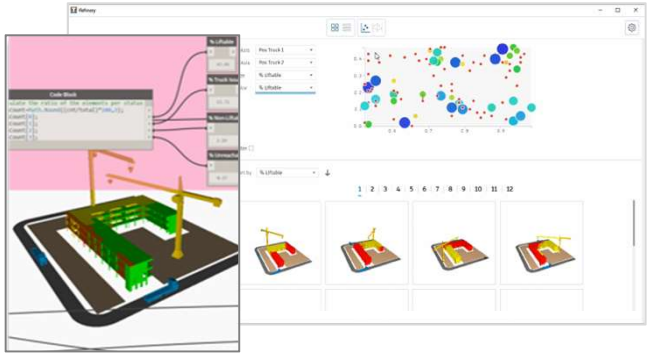
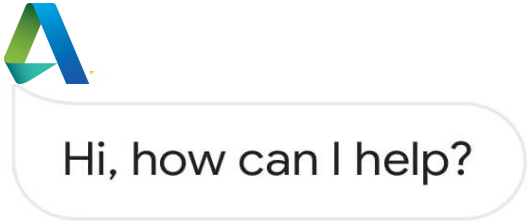


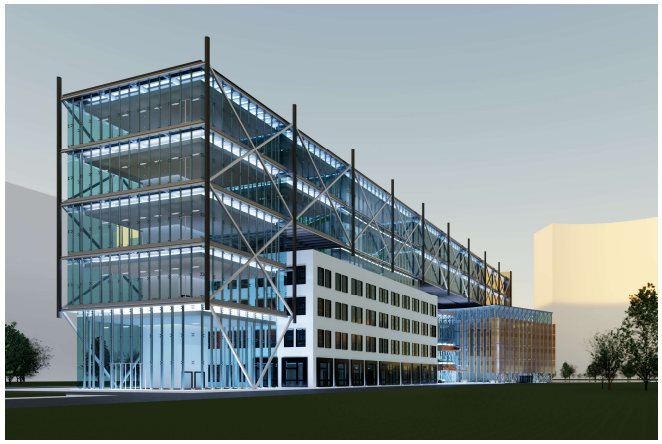
Artificial Intelligence Innovation
- Previous +
- Predicting design goals, models, drawing and project outcomes with **Predictive Design**

(Processes integrate with BIM)



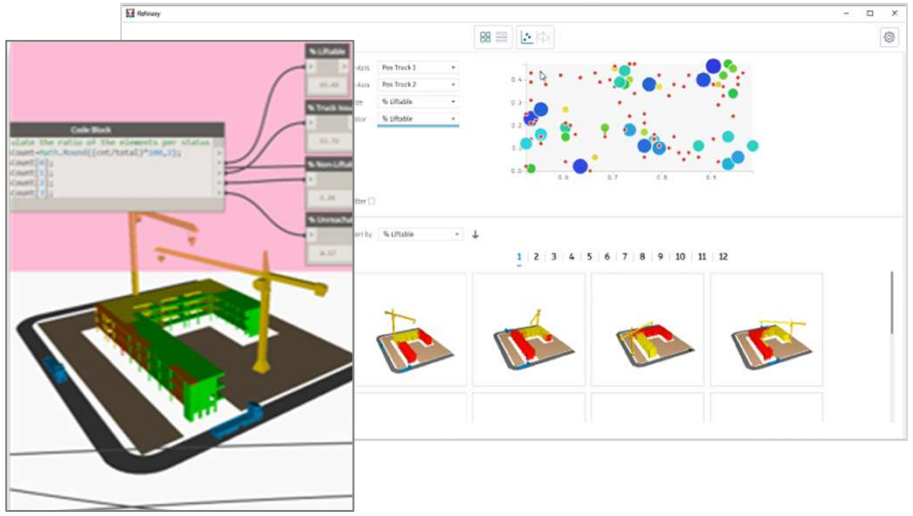
Expanding Capabilities, Extending Outcomes

BUILDING INFORMATION MODELING
Single Source of Truth for Ideas



- Parametric modeling environment for project data and visualization to create a record of design decisions

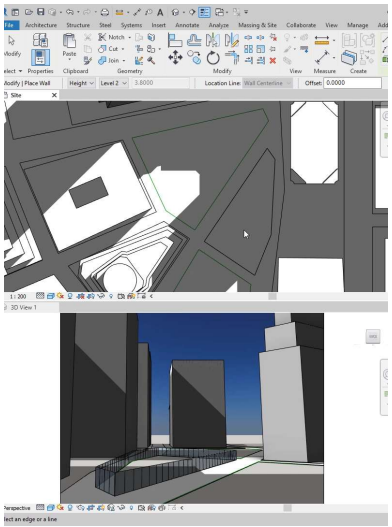
COMPUTATIONAL AND GENERATIVE DESIGN
Idea Development, Automation, Generation and Validation



- Visual scripting environment for automating design processes
- Dialogue-driven environment for optimization of designs through option generation and selection

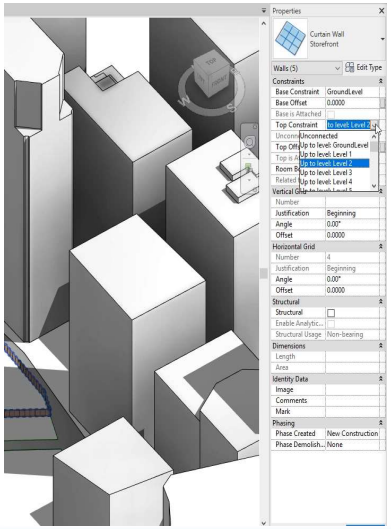
Conceptual Tower Mass – Building Information Modeling

AUTODESK® REVIT®



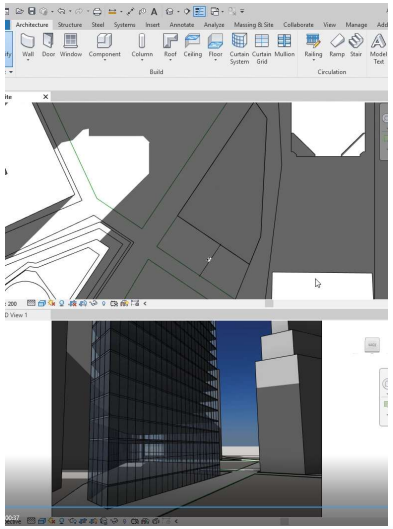
Create Geometry

AUTODESK® REVIT®



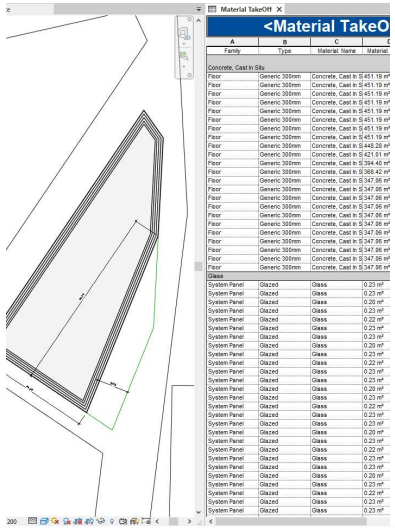
Assign Parametric Constraints

AUTODESK® REVIT®



Modify Parameters

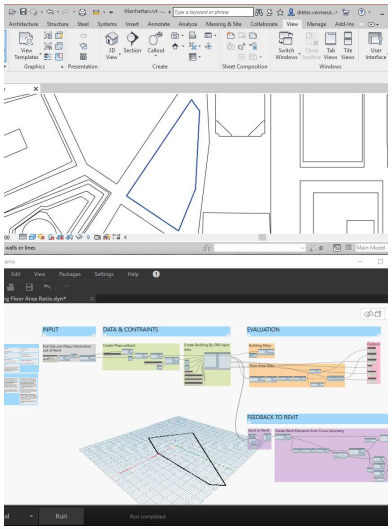
AUTODESK® REVIT®



Document the Idea

Conceptual Tower Mass - Computational Design

DYNAMO FOR REVIT



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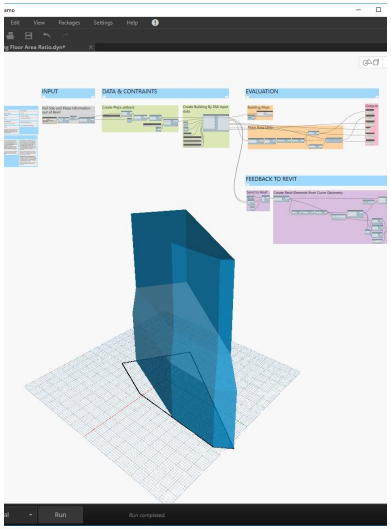

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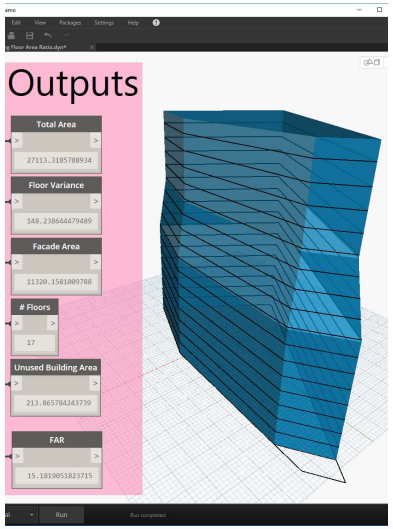

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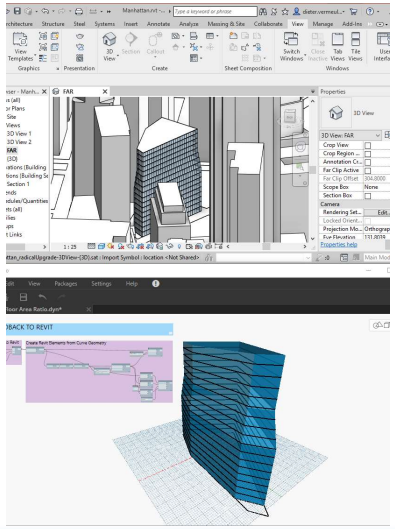
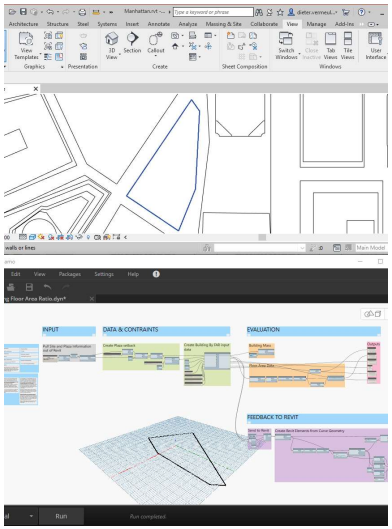


Get Boundaries → Generate Geometry → Analyze & Evaluate → Model Integration

Conceptual Tower Mass – Generative Design

DYNAMO FOR REVIT



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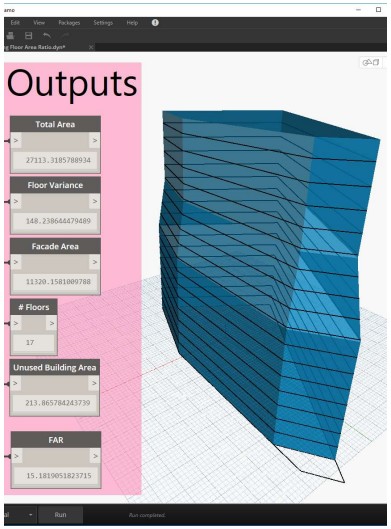
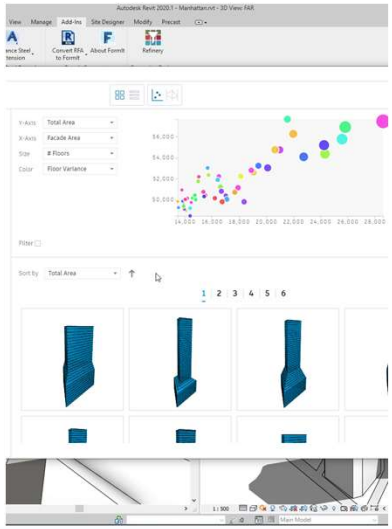
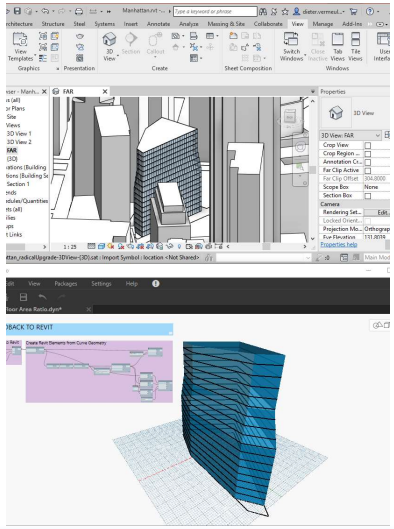


PROJECT REFINERY



AUTODESK REVIT

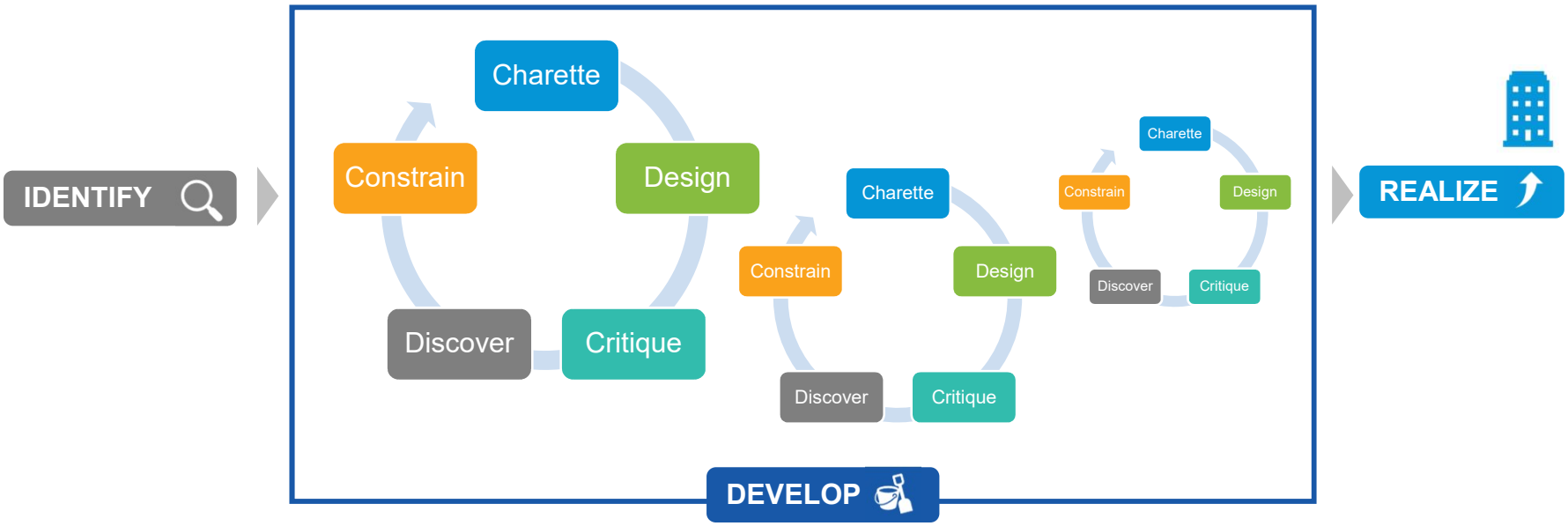


Get Boundaries → Computational Model → Generate Options → Model Integration

Traditional Project Strategy

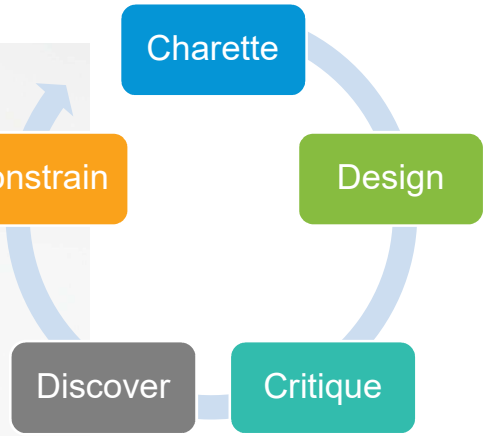
Proactive, reactive – sequences of revelations – focused on one building

Project Timeline



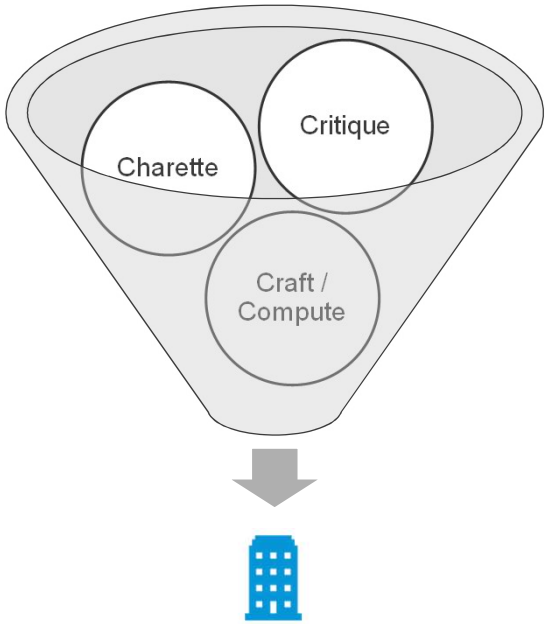
Traditional Project Strategy

“Combine strategy and luck in this exciting attempt at continuing your project or winning new work with your designs!”

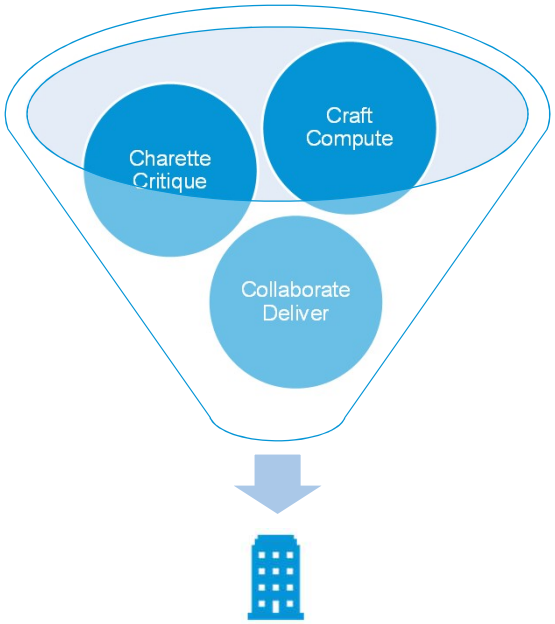


An Evolving Traditional Project Strategy

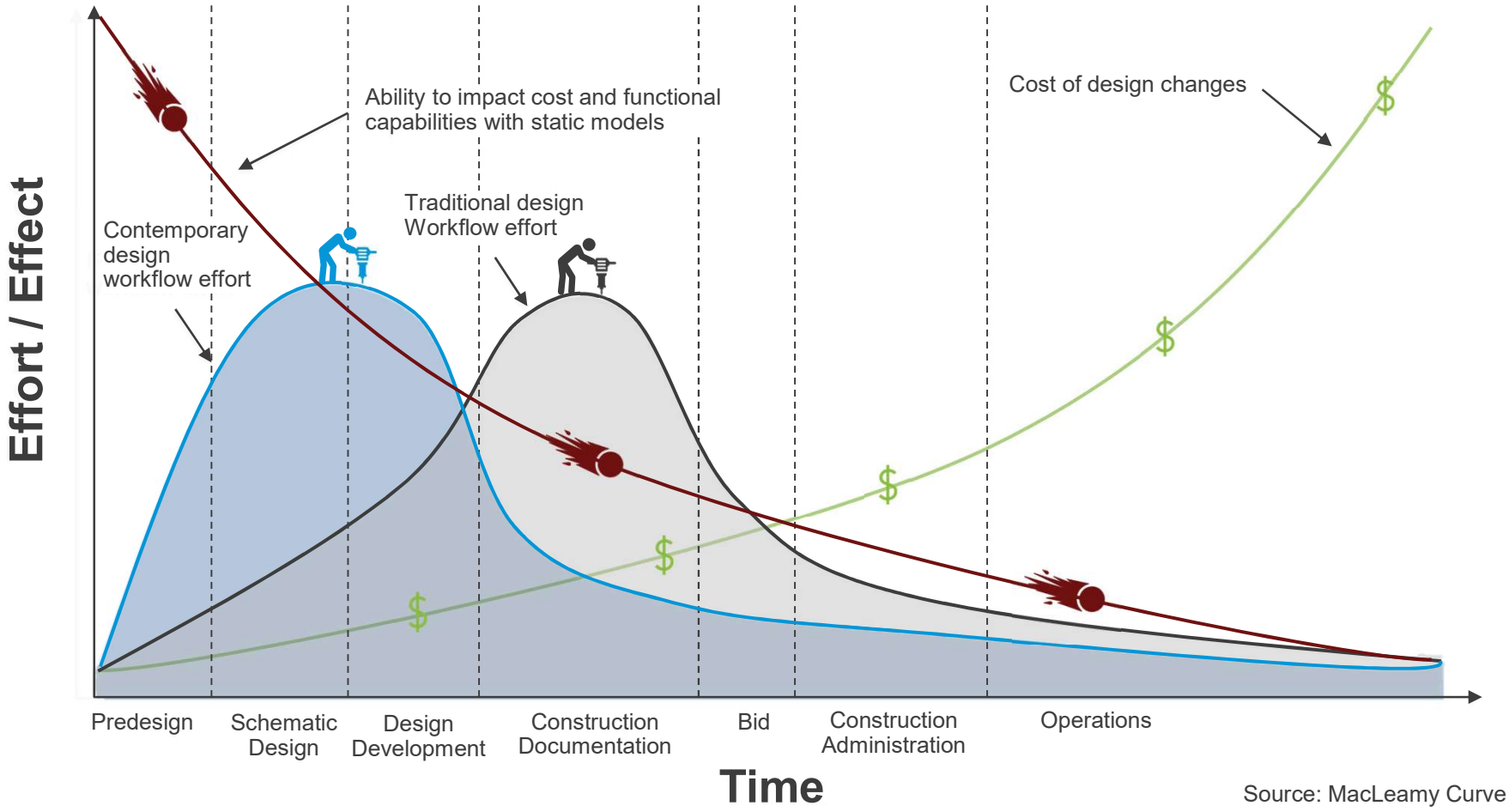
Traditional Design



Contemporary Design



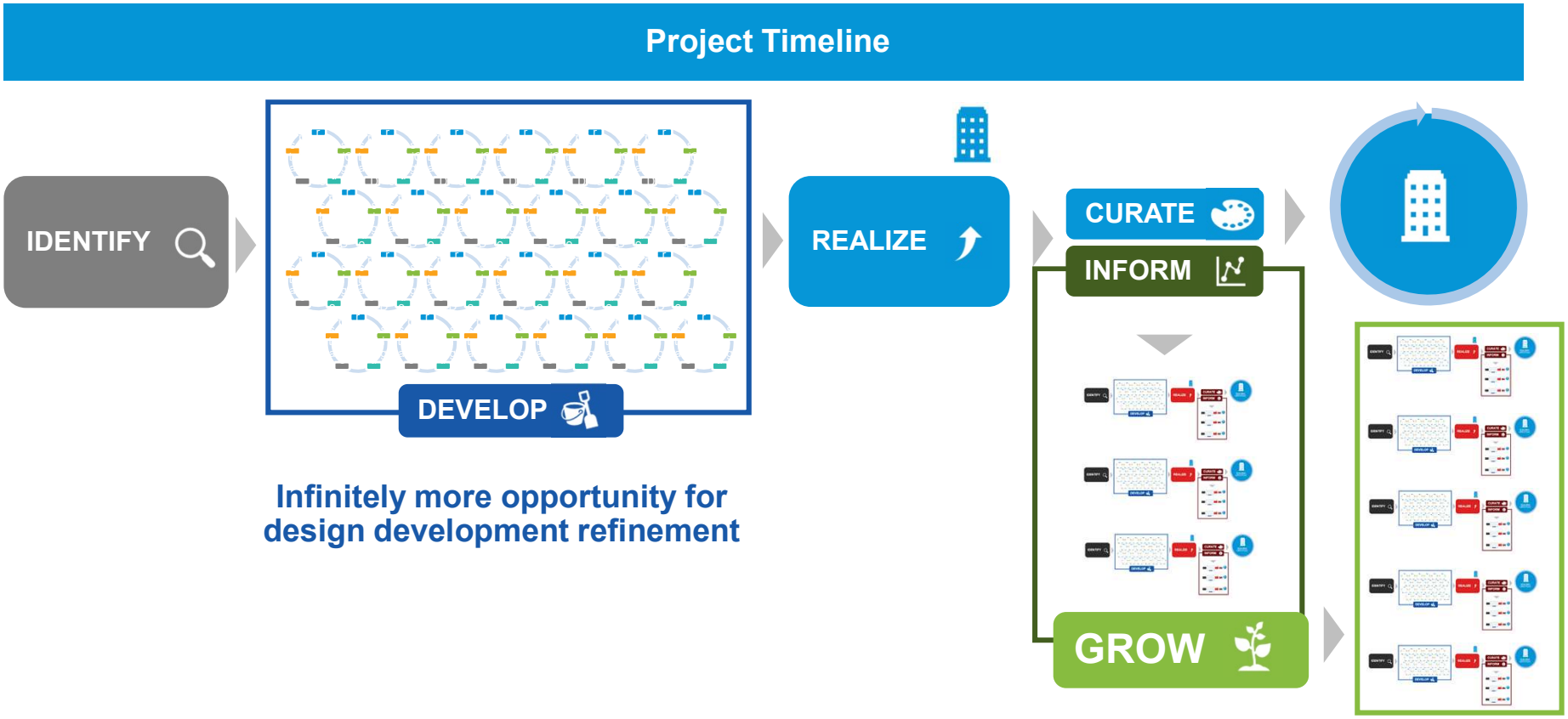
Comparing Contemporary and Traditional Design Project Strategy



Source: MacLeamy Curve

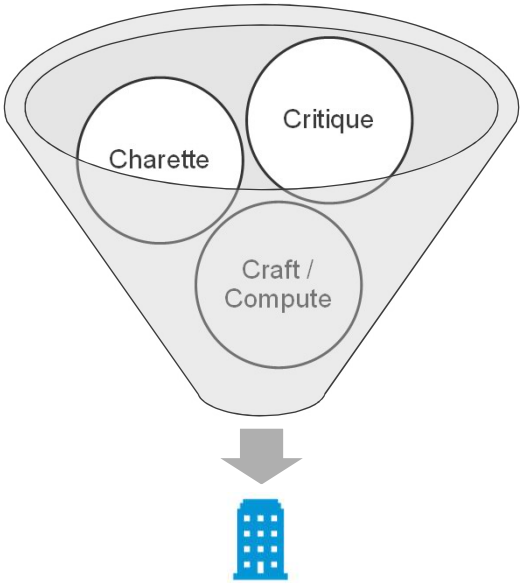
The Future of Project Strategy

Proactive – informed and flexible – outcome-driven, growth-focused

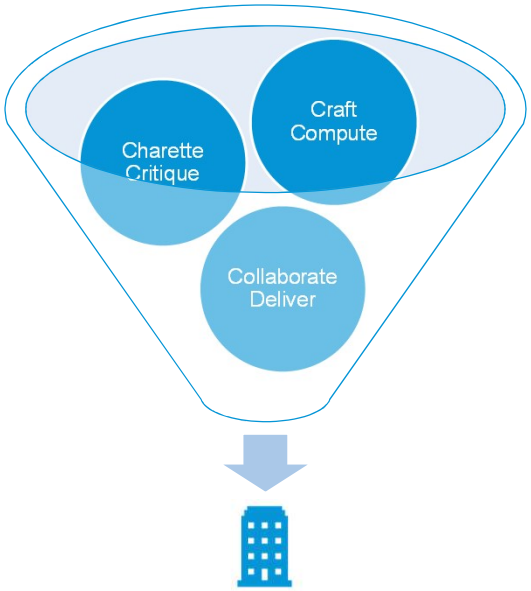


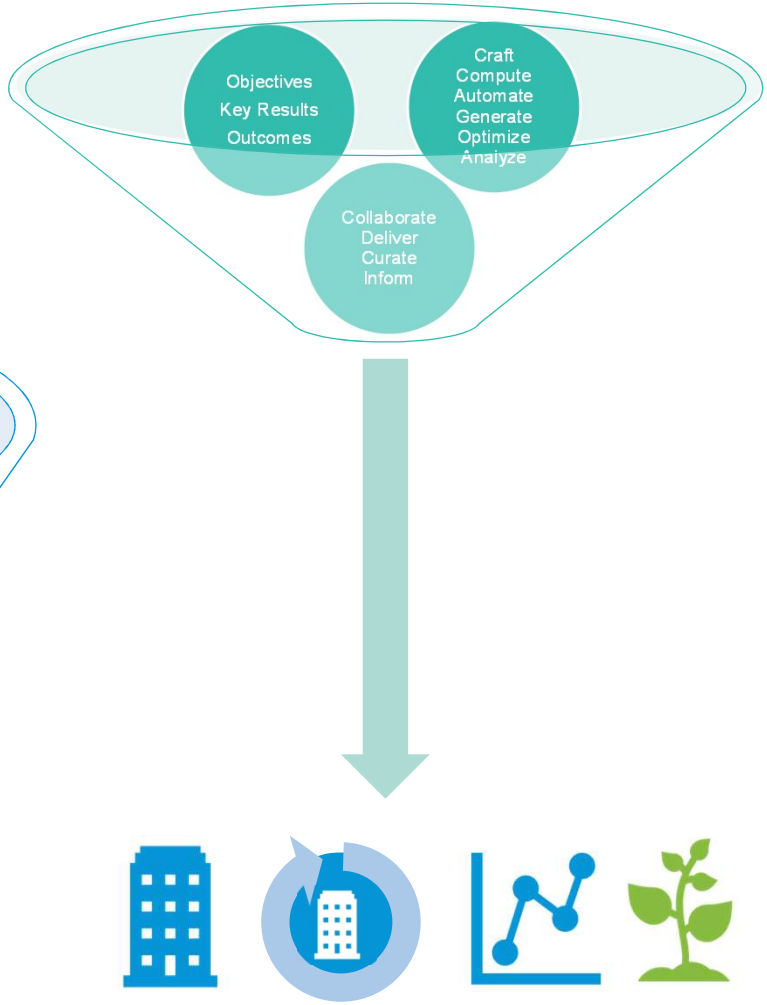
Outcome-driven Design

Traditional

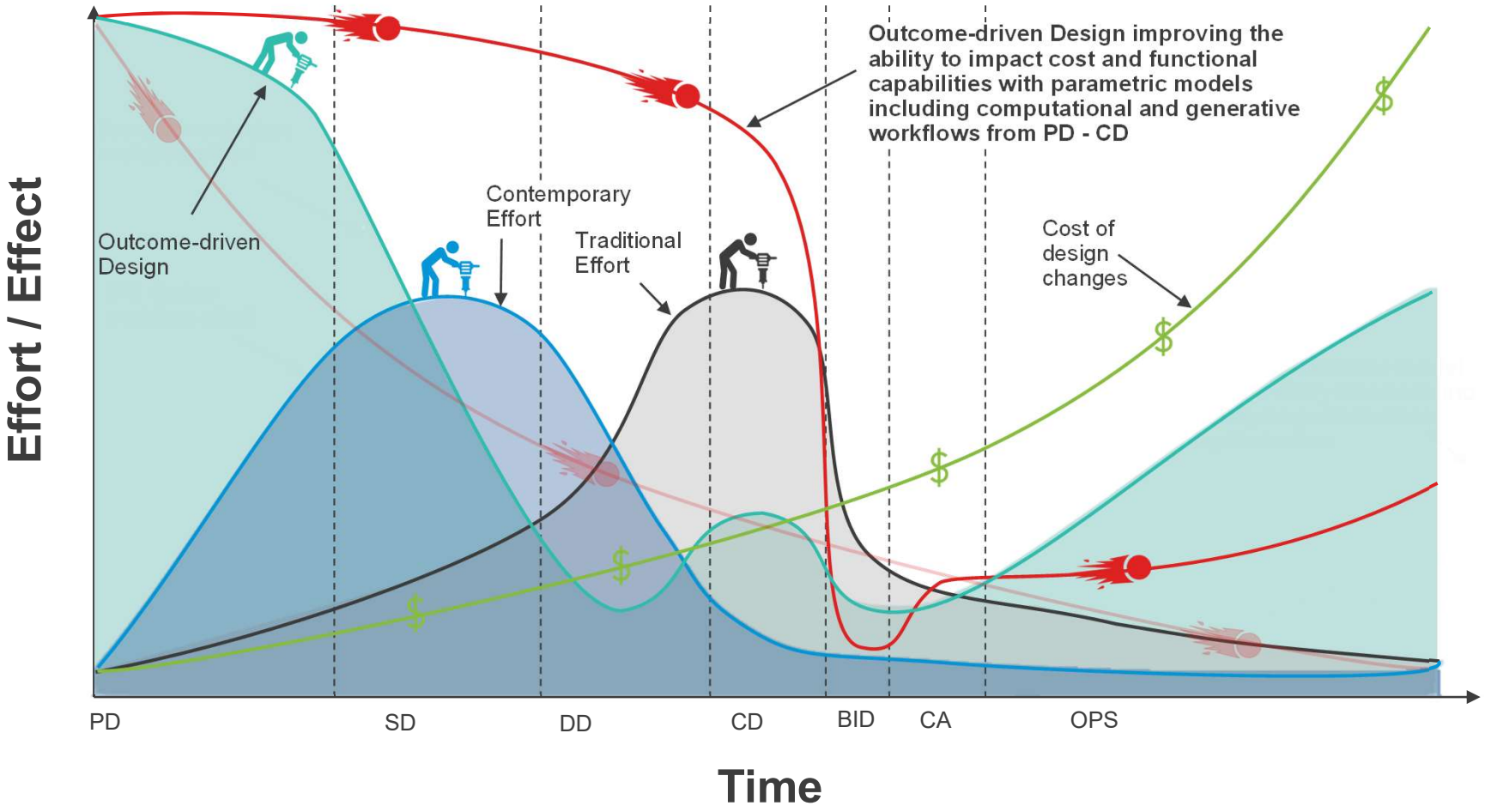


Contemporary

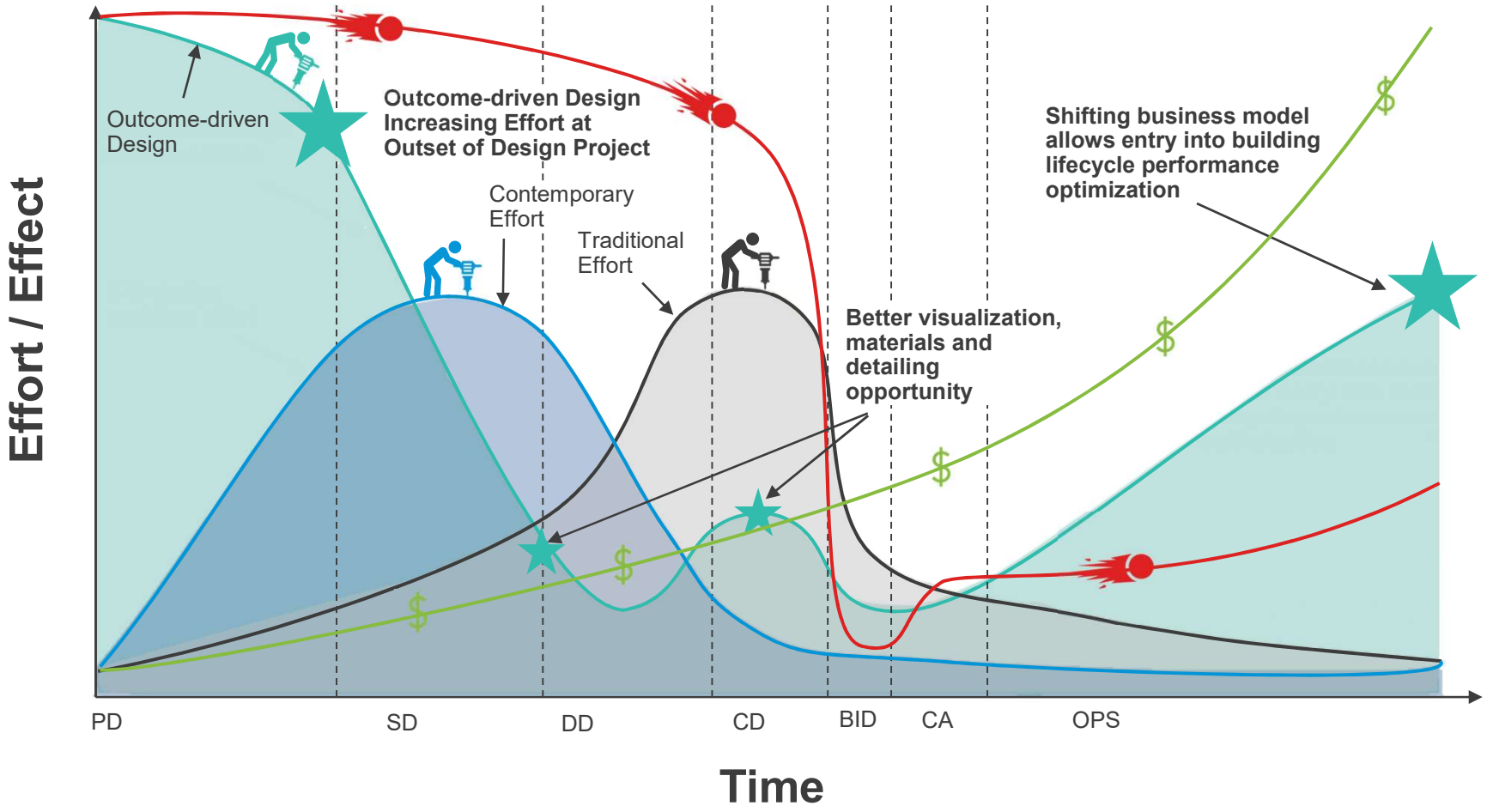




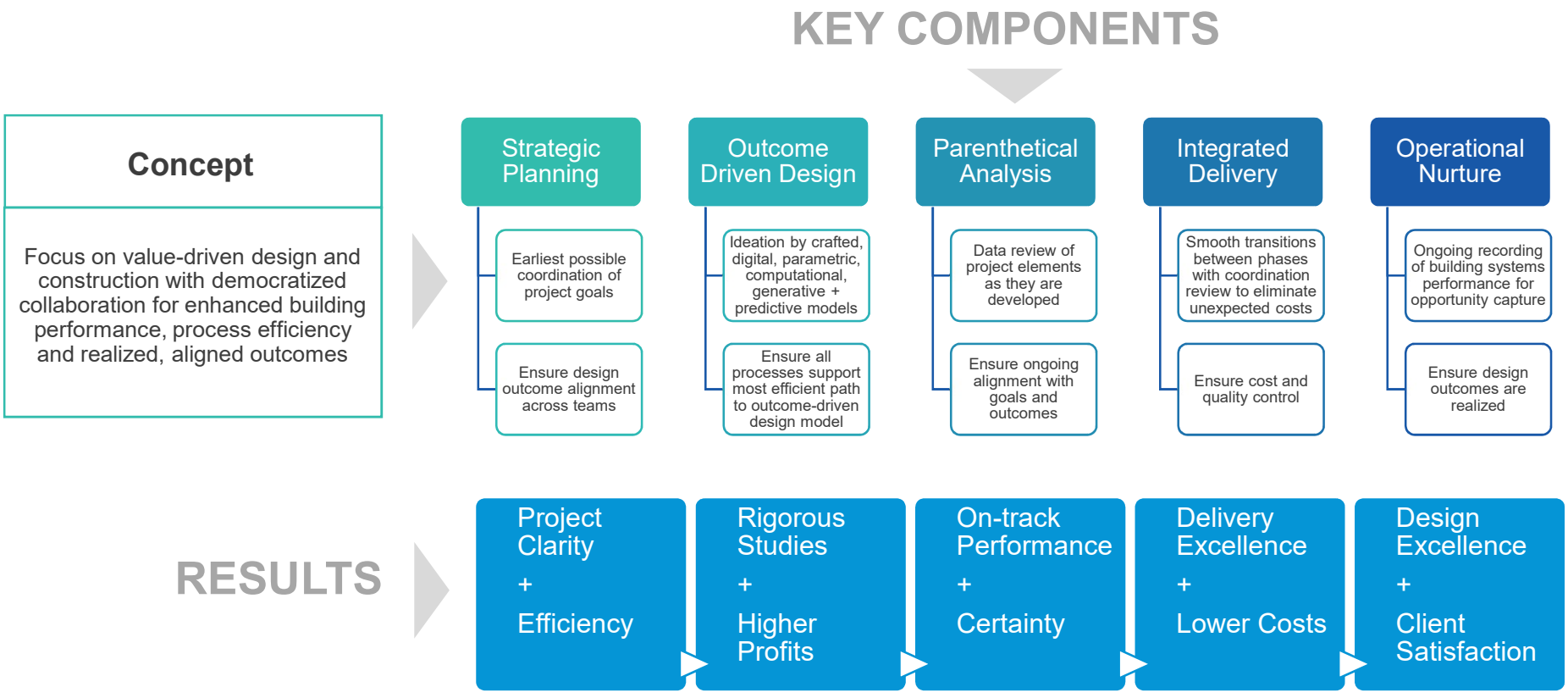
Outcome-driven Design: Shifting the Design Paradigm



Outcome-driven Design: Opportunities for Better



Outcome-driven Design Overview



In Summary

Computational and Generative Design have influenced project strategy to such a degree that a new project strategy type is unfolding: **Outcome-driven Design**

Outcome-driven Design frontloads project effort with the earliest possible stakeholder alignment, eliminates time spent on tedious tasks with inappropriate tools that are not in line with project outcomes and allows for an opportunity to add value at the back end of the design process and inform future projects – all while expanding on traditional and IPD strategies.

So What? Why is this important?

What is the business opportunity?

The Pesky Perception of Value Problem

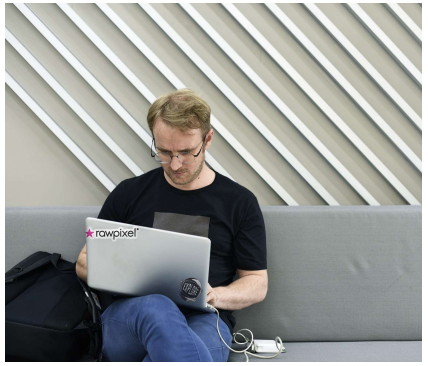
What my friends think I do.

What my society thinks I do.

What my parents think I do.

What my boss thinks I do.

What I think I do.



What I actually do.

And the Related Salary Problem

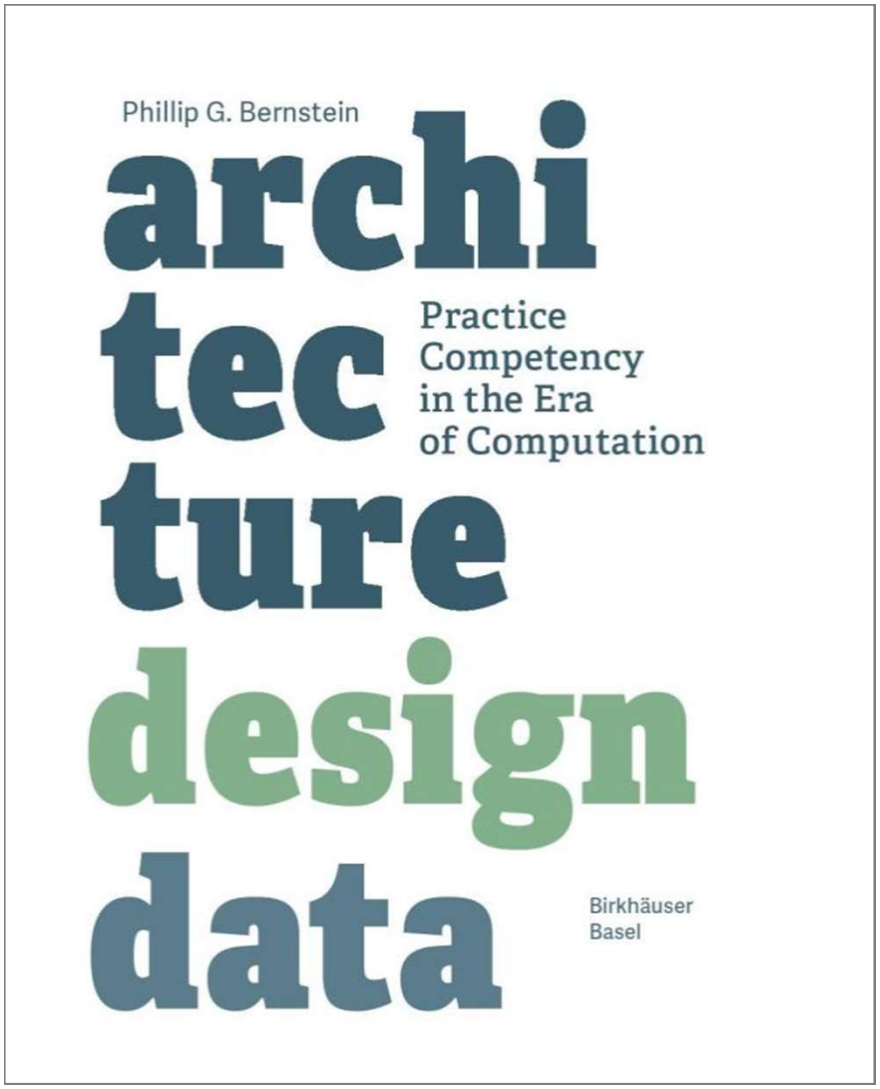
Comparing Value of Architects vs. Lawyers

Architects

- 110,000 architects / 1:3,000 in US
- Starting salary $40,000 – $60,000
- Salary after 5 years $67,000 - $85,000

Lawyers

- 1.3 million attorneys / 1:40 in US
- Starting salary $54,000 – $139,000
- Salary after 5 years $74,000 - $219,000

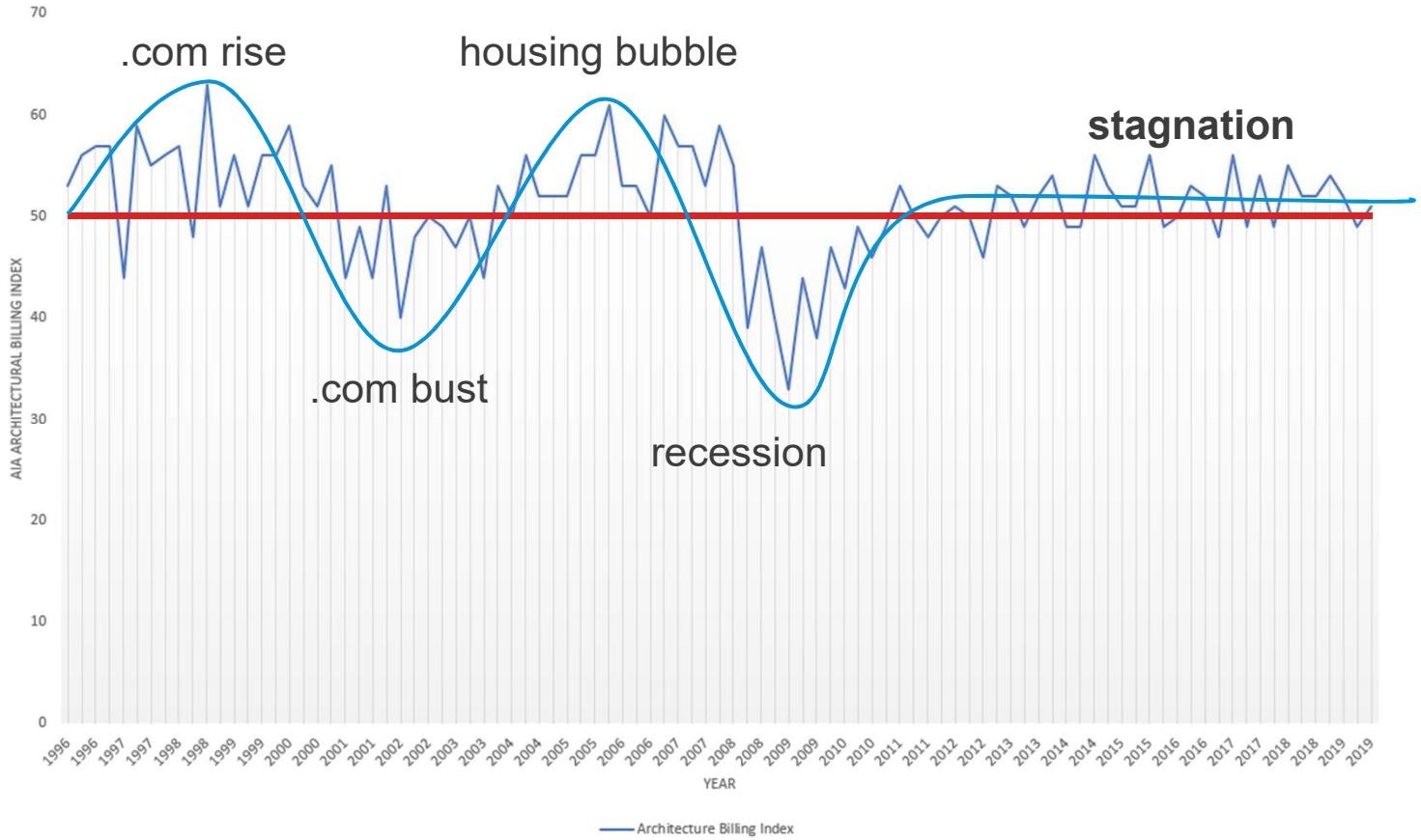


"If architects are a relatively rare commodity (which normally drives up prices) and deliver such important service to society (by creating all of the buildings that it needs to function) **why have we done such a poor job of converting the clear value we deliver into an understanding by clients and the public,** and, as a desirable consequence, getting paid accordingly?"

- Philip G. Bernstein

Source: Architecture Design Data: Practice Competency in the Era of Computation, by Phillip G. Bernstein (Birkhäuser, 2018)

A Stagnant Architectural Billing Index



And Recent Architectural Billing Index Woes

Architecture Billings Index dippe

archpaper.com/2019/09/architecture-billings-august-drop/

The Architect's Newspaper

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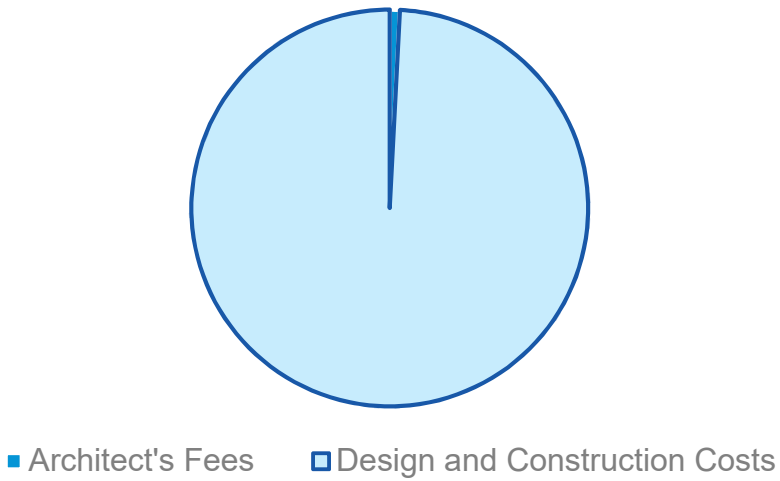
NO MONEY, MORE PROBLEMS

Architecture Billings Index dipped to record lows in August

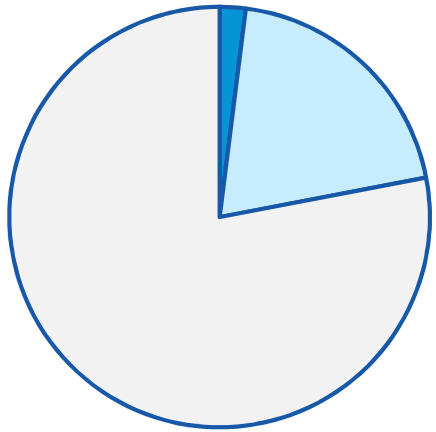
By SYDNEY FRANKLIN • September 23, 2019

Fee Structures Reveal Minimal Impact On Project Cost to Increase Compensation for Architects…

Architects' Fees as 10% Percent of Total Design and Construction Costs



Architects' Fees as .01% Percent of Total Building Lifecycle Costs

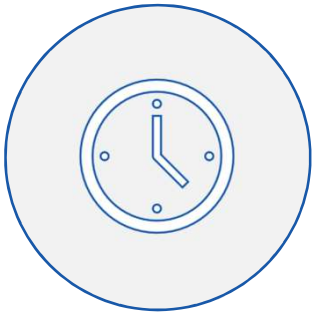


Amid a Disincentivizing Compensation System…

Lump Sum / Fixed Fee

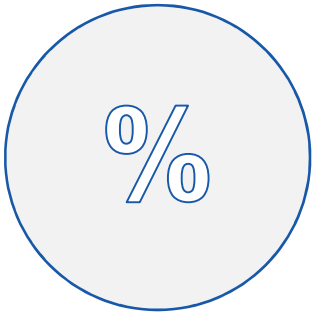
- Scope of services defined comprehensively at outset
- Schedule determined with accuracy
- Fixed price unless project parameters change

Time Basis / Variable



- Scope of services are difficult to determine or short in duration
- Predesign, partial, additional, conceptual services
- Hourly or per diem

Percentage-based Fee



- Sliding scale based on construction type
- Not suitable for renovations or highly complex projects

Producing Inefficient Buildings

We in the AEC industry know that the work performed in the design of a building project is extremely valuable.

Our work,
in it's most traditional execution:

- Reduces project costs
- Improves project timelines
- Leads to the construction of spaces that foster community development and wellness

We are known for
going above and beyond
and sacrificing our own
human needs to ensure that
projects are both beautiful and
functional to an obsessive
and even fanatical degree…

Architectural Scope of Services

LEGEND
- ▪ Indicates basic services as fee percentage
- ○ Indicates additional services

PREDESIGN

ARCHITECTURE
- ○ Facility Programming
- ○ Space Relationships/
- ○ Flow Diagrams
- ○ Project Development
- ○ Scheduling
- ○ Project Budgeting
- ○ Life Cycle Cost Studies
- ○ Economic Feasibility
- ○ Agency Consulting/
- ○ Review/Approval
- ○ Site Selection/Analysis
- ○ Utilization
- ○ Environmental Studies
- ○ Energy Studies
- ○ Existing Facilities
- ○ Surveys
- ○ Client-Supplied
- ○ Data Coordination
- ○ Services Related to
- ○ Project Management
- ○ Presentations
- ○ Marketing Studies
- ○ Special Studies
- ○ Re-Zoning Assistance
- ○ Project Promotion

SD

ARCHITECTURE
- ▪ Client-supplied Data
- ▪ Coordination
- ▪ Program and Budget
- ▪ Evaluation
- ▪ Review of Alternative
- ▪ Design Approaches
- ▪ Architectural
- ▪ Schematic Design
- ▪ Schematic Design
- ▪ Drawings and
- ▪ Documents
- ▪ Statement of Probable
- ▪ Construction Costs
- ▪ Client Consultation
- ○ Interior Design Concepts
- ○ Special Studies (Future
- ○ Facilities, Environmental
- ○ Impact, etc.)
- ○ Special Submissions
- ○ or Promotional
- ○ Presentations
- ○ Special Models,
- ○ Perspectives or
- ○ Computer Presentations
- ○ Project Management
- ○ Agency Consultation

DD

ARCHITECTURE
- ▪ Client-supplied Data
- ▪ Coordination
- ▪ Design Coordination
- ▪ Architectural Design
- ▪ Development
- ▪ Design Development
- ▪ Drawings and
- ▪ Documents
- ▪ Statement of Probable
- ▪ Construction Costs
- ▪ Client Consultation
- ▪ Agency Consultation
- ○ Interior Design
- ○ Development
- ○ Special Studies/Reports
- ○ (Planning Tenant or
- ○ Rental Spaces, etc.)
- ○ Promotional
- ○ Presentations
- ○ Models, Perspectives or
- ○ Computer Presentations
- ○ Project Management

CD

ARCHITECTURE
- ▪ Client-supplied Data
- ▪ Coordination
- ▪ Project Coordination
- ▪ Architectural
- ▪ Construction Documents
- ▪ (Working Drawings,
- ▪ Form of Construction
- ▪ Contract and
- ▪ Specifications)
- ▪ Document Checking and
- ▪ Coordination
- ▪ Statement of Probable
- ▪ Construction Costs
- ▪ Client Consultation
- ○ Interior Construction
- ○ Documents
- ○ Alternative Bid Details
- ○ and Special Bid
- ○ Documents
- ○ Project Management
- ○ Agency Consultation

BID

ARCHITECTURE
- ▪ Architect's Services
- ▪ Client-supplied Data
- ▪ Coordination
- ▪ Project Coordination
- ▪ Issue Bidding
- ▪ Documents
- ▪ Issue Addenda
- ▪ Bid Evaluation
- ▪ Construction Contract
- ▪ Client Consultation
- ○ Separate Bids or
- ○ Negotiated Bids
- ○ Services Related to
- ○ Bidders' Proposals
- ○ Project Management

CA

ARCHITECTURE
- ▪ Field Review
- ▪ Progress Reports/
- ▪ Evaluation
- ▪ Process Certificates for
- ▪ Payment
- ▪ Interpretation of
- ▪ Contract Documents
- ▪ Review of Shop Drawing
- ▪ Product Data/Sample
- ▪ Change Orders
- ▪ Substantial Performance
- ▪ Report and Certification
- ▪ Client Consultation
- ○ Interior Construction
- ○ review
- ○ Full-time Project
- ○ Representation
- ○ Administration of
- ○ Separate Contracts
- ○ Project Management
- ○ Promotional Material
- ○ Record Drawings
- ○ Agency Consultation

OPERATIONS

ARCHITECTURE
- ▪ Field Review
- ▪ Deficiency Assessment
- ▪ Review of Warranties
- ▪ Total Performance
- ▪ Inspection and
- ▪ Certification
- ▪ Client Consultation
- ▪ Start-up Assistance
- ▪ One-year Warranty
- ▪ Inspections

Consulting Scope of Services

LEGEND
- ▪ Indicates basic services as fee percentage
- ○ Indicates additional services

PREDESIGN

SPECIAL CONSULTANTS' SERVICES
- ○ Legal Survey
- ○ Geotechnical Analysis
- ○ Project Financing

SD

CONSULTANTS' SERVICES
- ▪ Structural Design Concepts
- ▪ Mechanical Design Concepts
- ▪ Electrical Design Concepts
- ▪ Statements of Probable Costs

SPECIAL CONSULTANTS' SERVICES
- ○ Civil Design Concepts
- ○ Landscape Concepts
- ○ Statements of Probable
- ○ Costs

DD

CONSULTANTS' SERVICES
- ▪ Structural Design Development
- ▪ Mechanical Design Development
- ▪ Electrical Design Development
- ▪ Statements of Probable Costs

SPECIAL CONSULTANTS' SERVICES
- ○ Civil Engineering Design Development
- ○ Landscape Development
- ○ Detailed Construction Cost Estimates or Quantity Surveys

CD

CONSULTANTS' SERVICES
- ○ Structural Construction Documents
- ○ Mechanical Construction Documents
- ○ Electrical Construction Documents
- ○ Statements of Probable Costs

SPECIAL CONSULTANTS' SERVICES
- ○ Civil Engineering Construction Documents
- ○ Landscape Documents
- ○ Detailed Construction Cost Estimates or Quantity Surveys

BID

CONSULTANTS' SERVICES
- ○ Issue Bidding Documents
- ○ Issue Addenda
- ○ Bid Evaluation

SPECIAL CONSULTANTS' SERVICES
- ○ Issue Bidding Documents
- ○ Issue Addenda
- ○ Bid Evaluation

CA

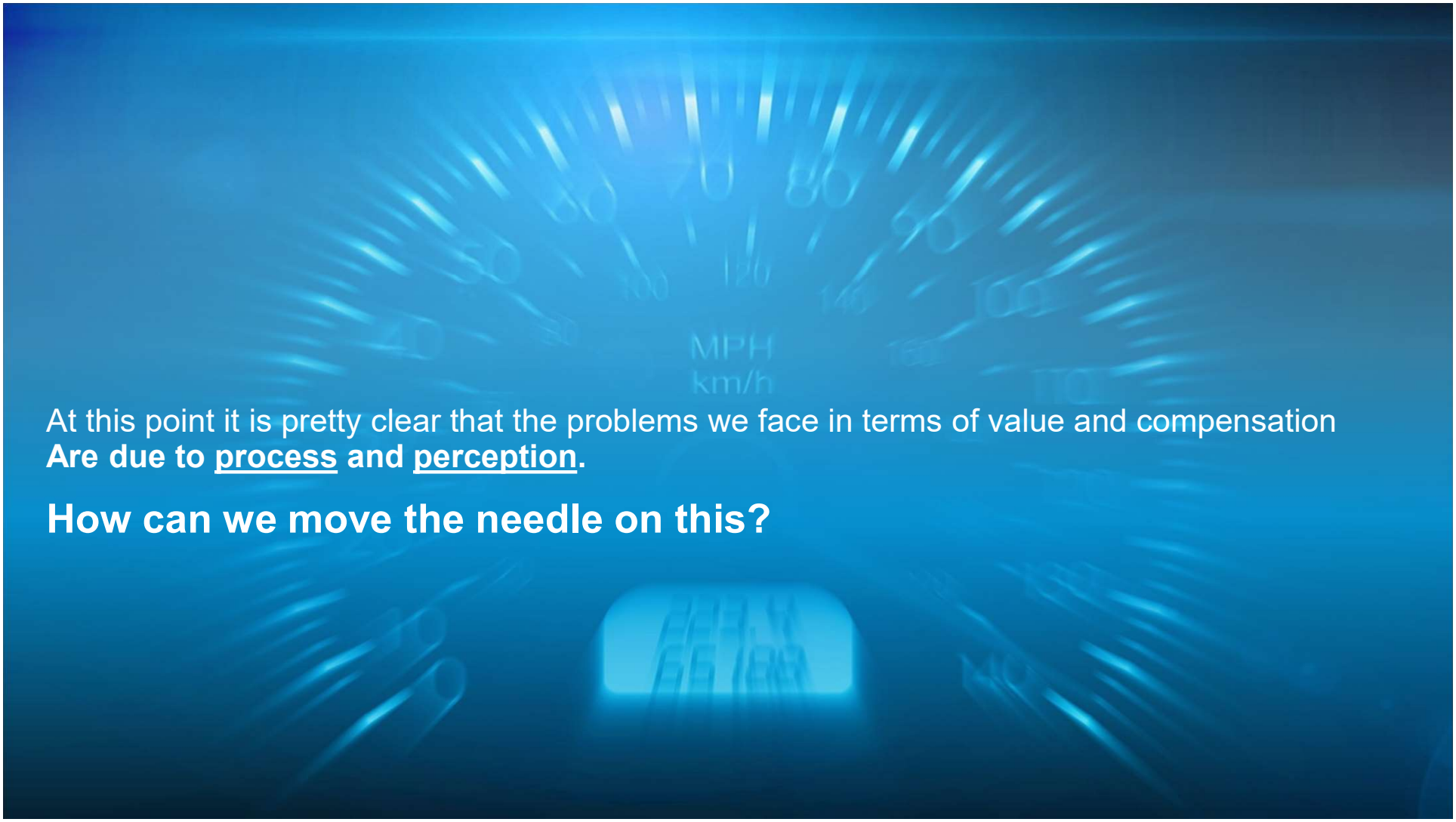
CONSULTANTS' SERVICES
- ▪ Structural review/ Reports
- ▪ Mechanical review/ Reports
- ▪ Electrical review/ Reports
- ○ Record Drawings
- ○ Certification of Progress

SPECIAL CONSULTANTS' SERVICES
- ○ Civil Construction review
- ○ Landscape Inspection
- ○ Detailed Cost Accounting

OPERATIONS

CONSULTANTS' SERVICES
- ○ Fine Arts/Crafts/ Graphics
- ○ Non-building Equipment Selection
- ○ Building Analysis and Reports
- ○ Services Related to Alterations and Demolition
- ○ Life Cycle Cost Monitoring
- ○ Environmental Monitoring
- ○ One-year Warranty Inspections

SPECIAL CONSULTANTS' SERVICES
- ○ Start-up Assistance
- ○ Systems Performance Review
- ○ Non-building Equipment Selection
- ○ Life Cycle Cost Monitoring
- ○ Services related to Alterations and Demolition



At this point it is pretty clear that the problems we face in terms of value and compensation **Are due to process and perception.**

How can we move the needle on this?

Tactics to Increase Fees and Profitability for Architects

For fixed-fee projects

Negotiation

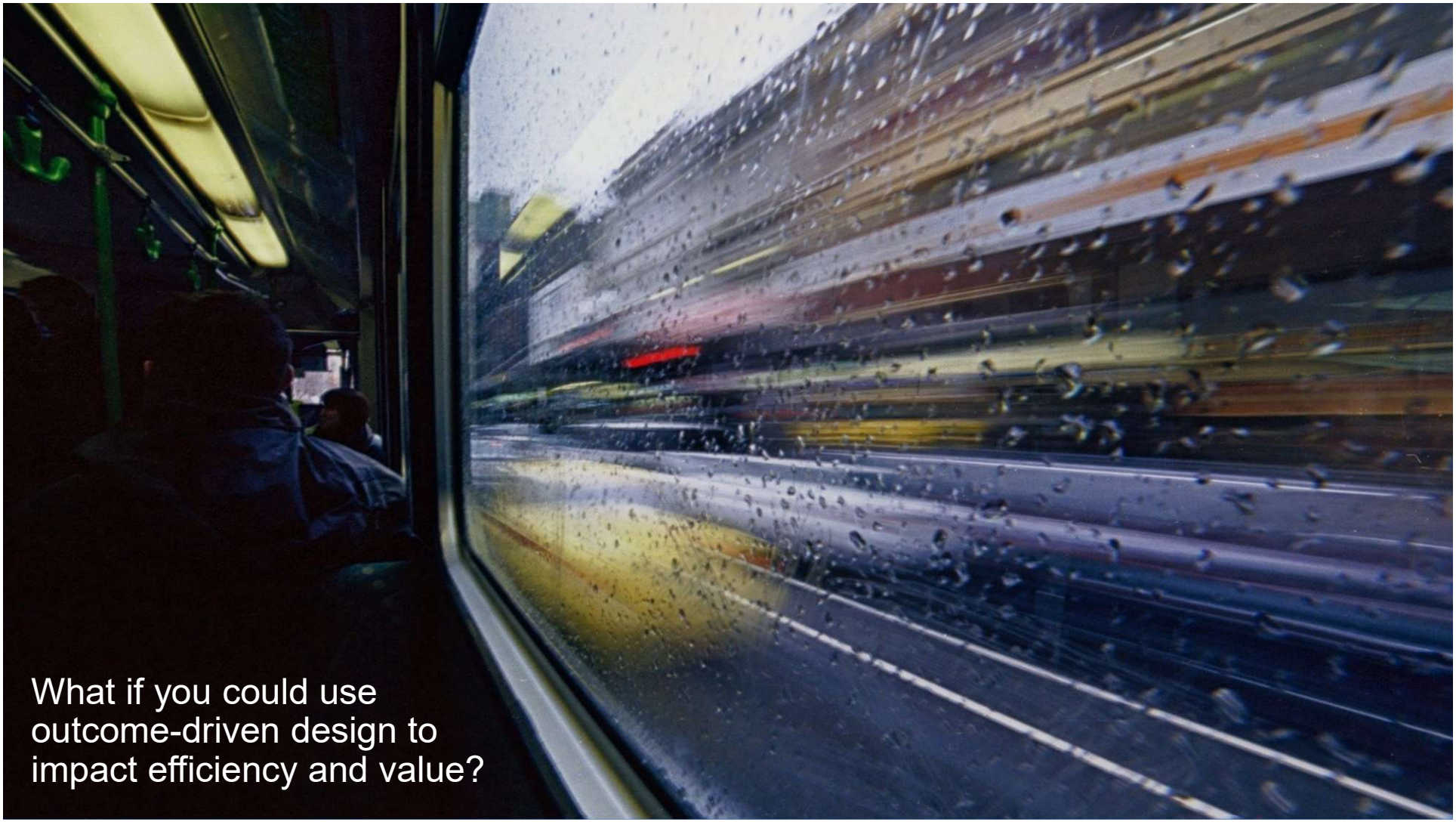
- Negotiate the highest possible fee at the outset of work
- Limited flexibility to stretch up in this approach
- Minimally able to impact gross fee

Efficiency

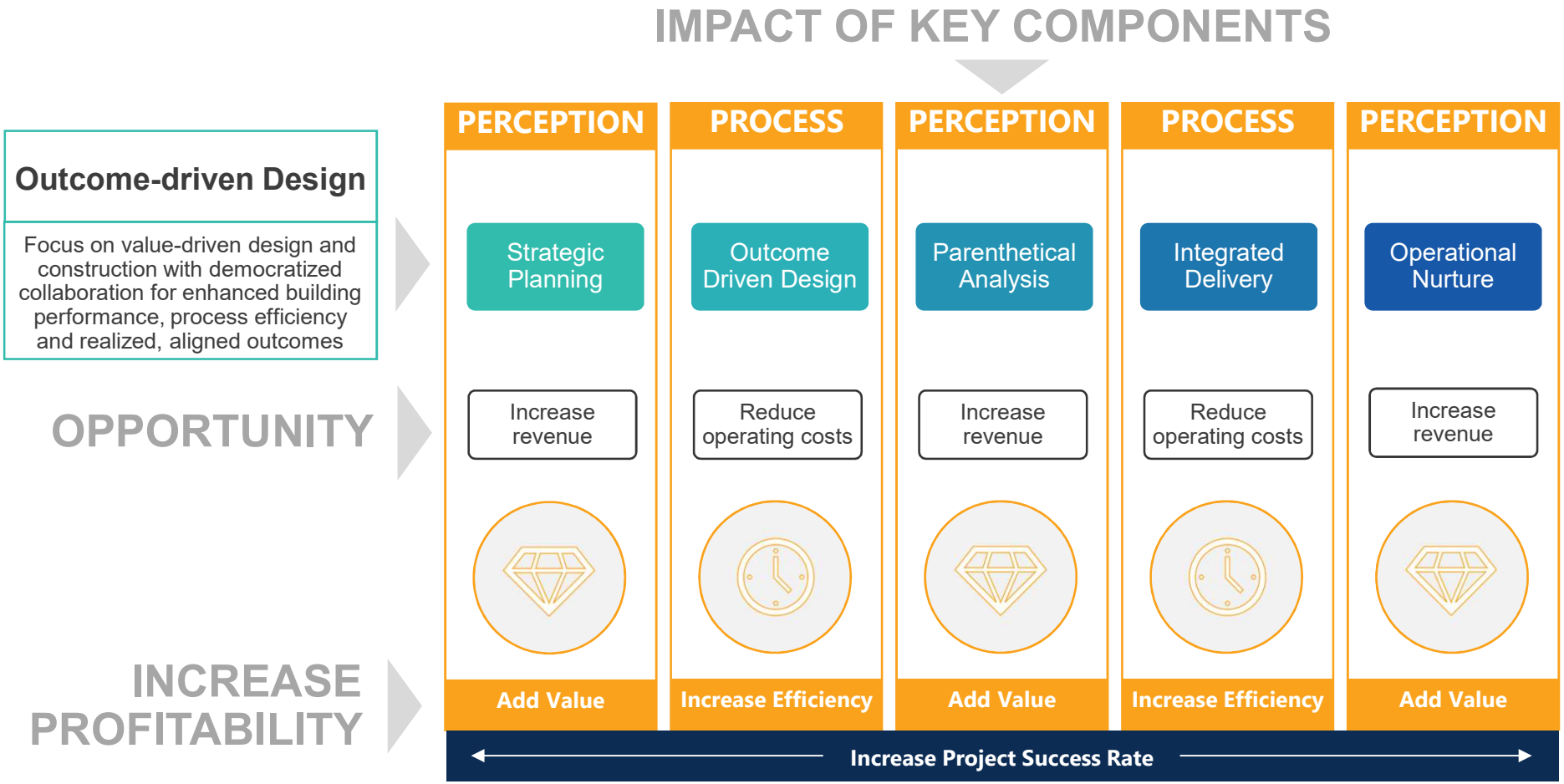
- Only complete work specific to deliverable completion
- Utilize automation and optimization on a per task basis and also in project process
- Not able to impact gross fee

Value Add

- Reconsider design processes and increase scope of services
- Creates returning client and improves future work via data
- Able to impact gross fee and extend value


What if you could use
outcome-driven design to
impact efficiency and value?

Tactics to Increase Fees and Profitability for Architects



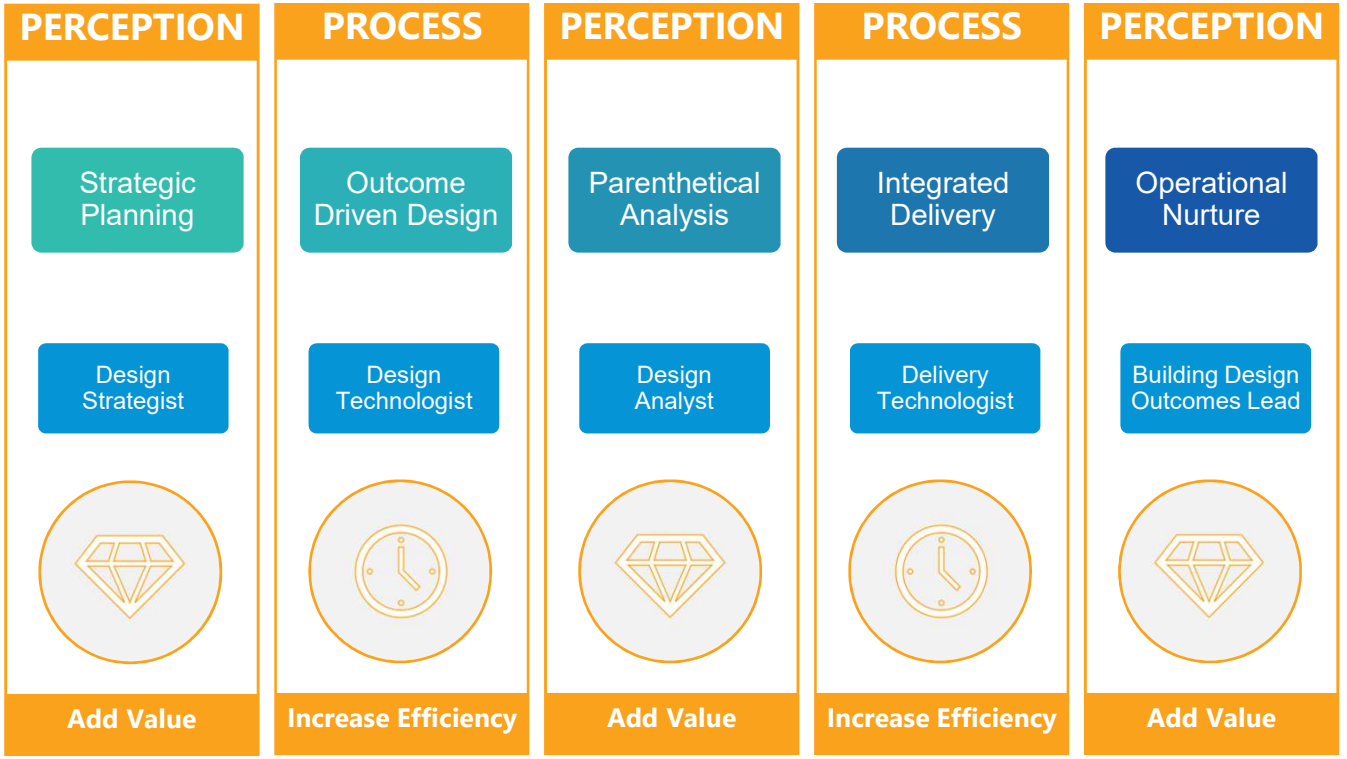
Tactics to Increase Fees and Profitability for Architects

IMPACT OF KEY COMPONENTS

Outcome-driven Design

Focus on value-driven design and construction with democratized collaboration for enhanced building performance, process efficiency and realized, aligned outcomes

NEW HIRES



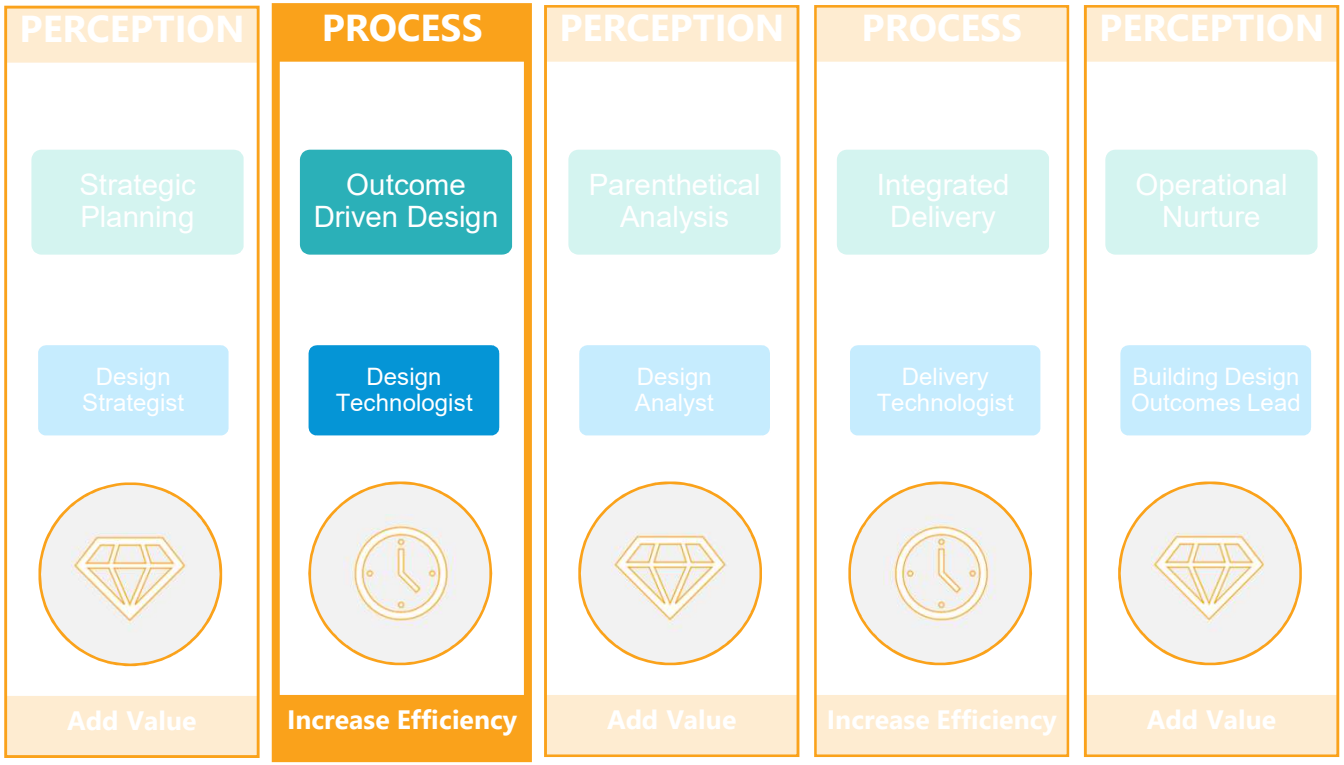
Tactics to Increase Fees and Profitability for Architects

IMPACT OF KEY COMPONENTS

Outcome-driven Design

Focus on value-driven design and construction with democratized collaboration for enhanced building performance, process efficiency and realized, aligned outcomes

NEW HIRES



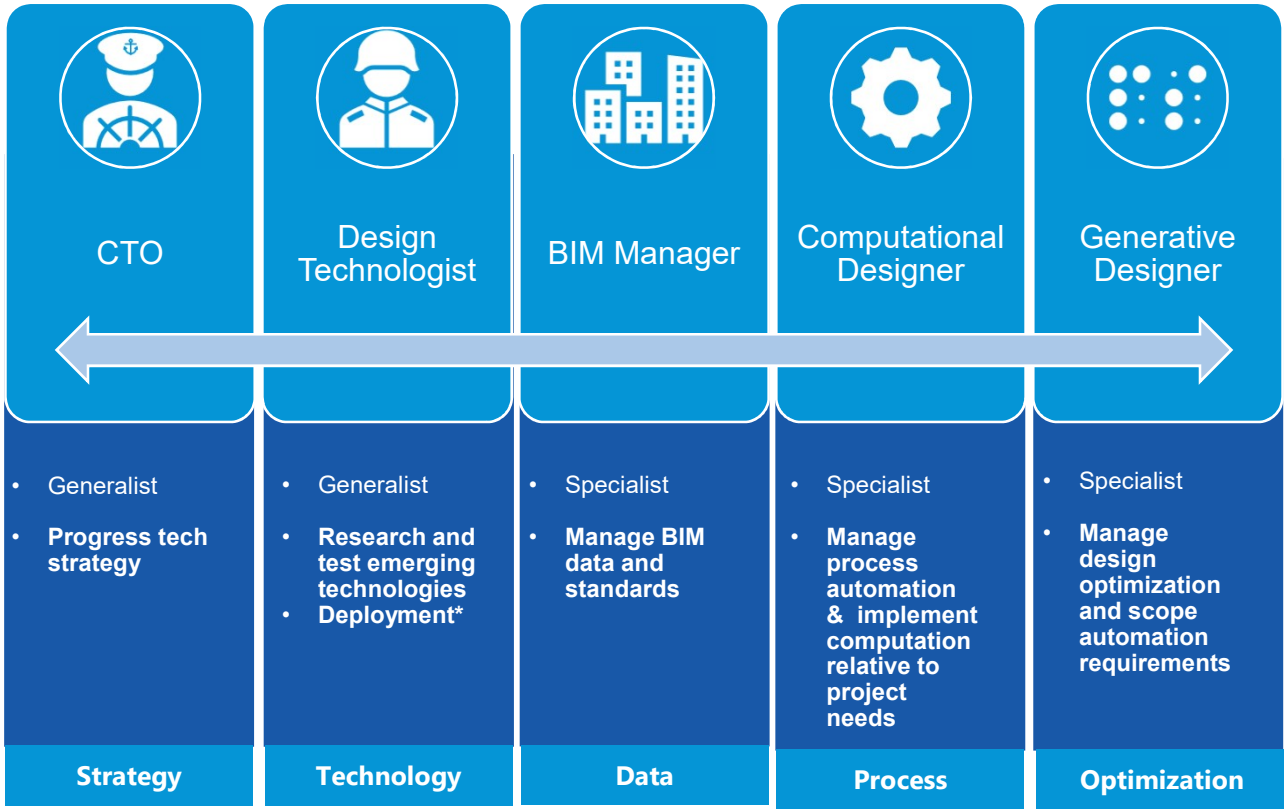
Design Technology Team for Outcome-Driven Design

Outcome-driven Design

Focus on value-driven design and construction with democratized collaboration for enhanced building performance, process efficiency and realized, aligned outcomes

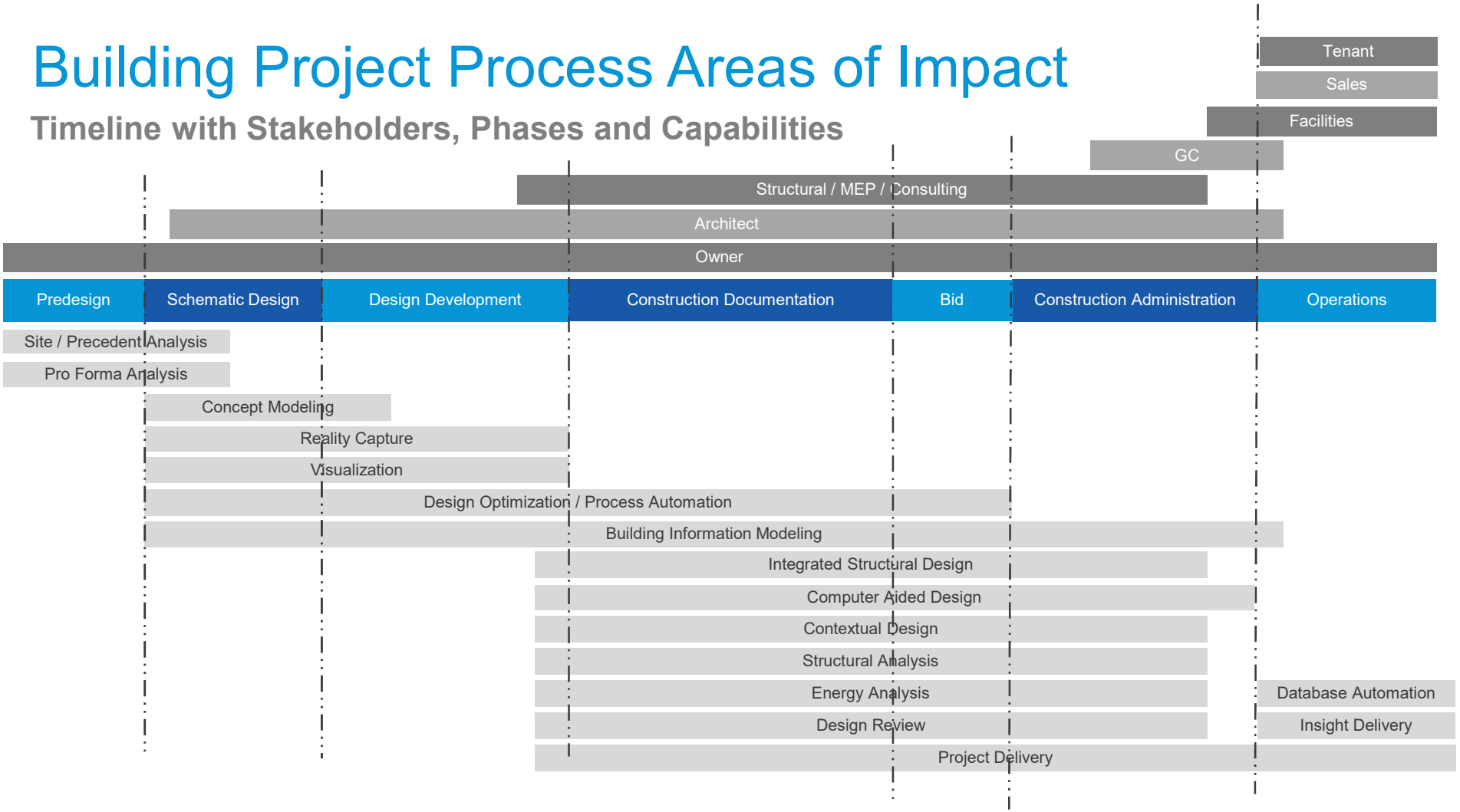
PROCESS

Increase Efficiency



Building Project Process Areas of Impact

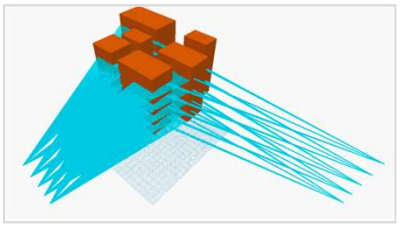
Timeline with Stakeholders, Phases and Capabilities



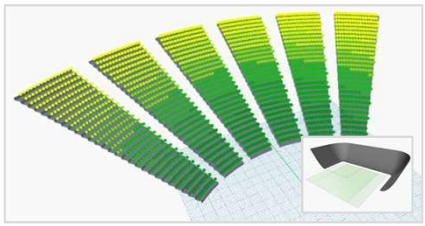
Emerging Design Processes in AEC

Computational and generative design in action

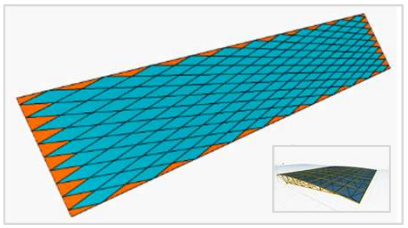
Glazing Optimization



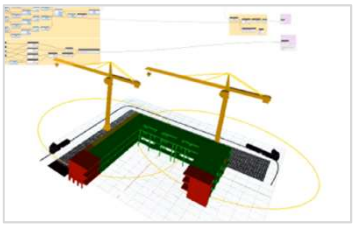
View Optimization



Stadium and Seating Optimization

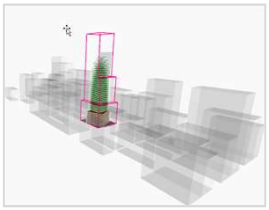


Panel Optimization

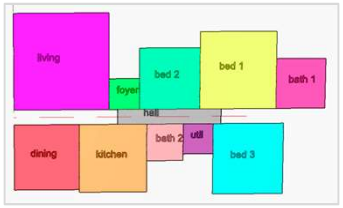


Crane Location Optimization

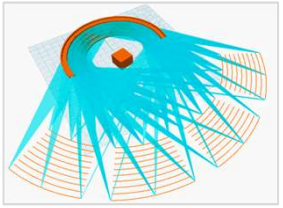
PD	SD	DD	CD	BID	CA	OPS



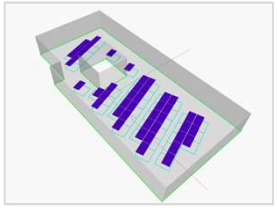
Building Mass Optimization



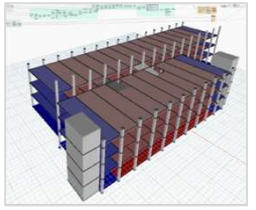
Room Layout Optimization



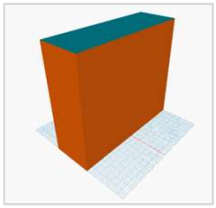
View Optimization



Open Office Desk Layout Optimization



Parking Garage Optimization



Building Cost Optimization

AUTODESK®
DYNAMO FOR REVIT

Computational Design

Process Automation

- Automate repetitive tasks for precision and speed
- Solve for complex geometric problems
- Rationalize designs with logic approach
- Rapidly test and study multiple ideas manually

Image courtesy of Flanagan Lawrence

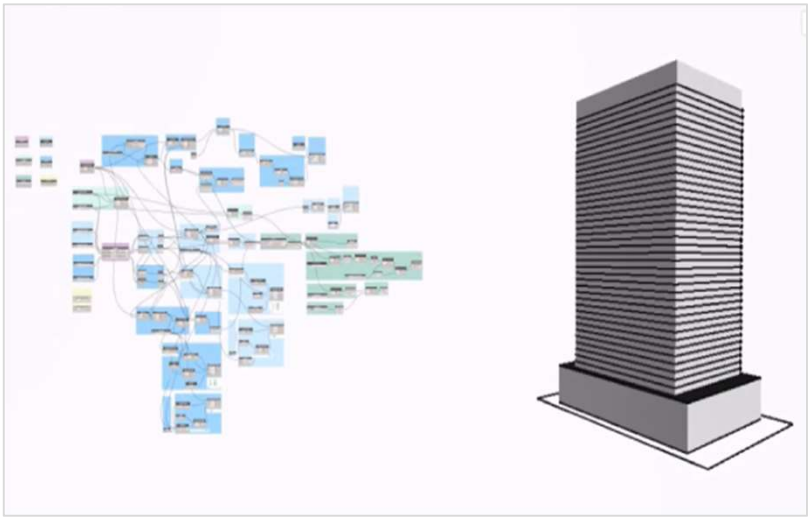
Project Objective: **Automate Building Mass + Cost**

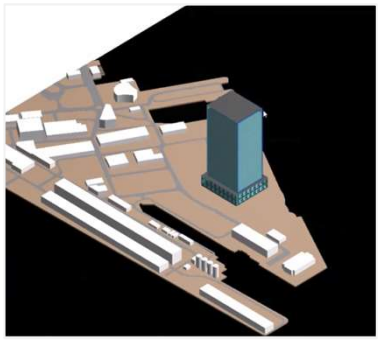
Developer: Emily Bisaga Dunne, Autodesk

Design Objectives:

- Automate mass from
- Calculate Far
- Show cost and ROI calculations as different geometries are tested manually
- Automate Revit elements from early stage mass study

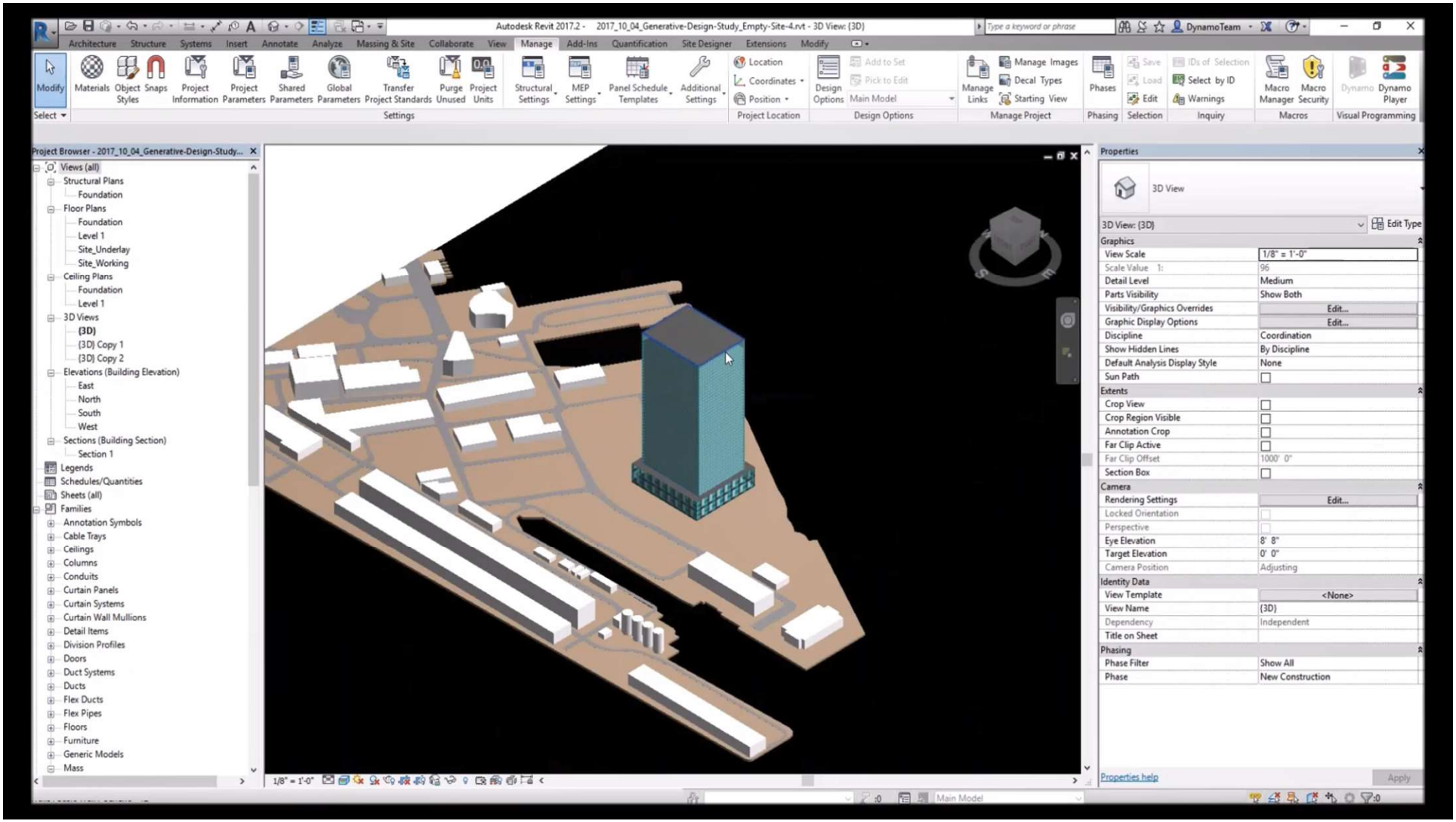
Increase Efficiency





KEY OUTCOMES:

Reduced time to design development
Increased early-stage design profit
Improved cashflow management


Autodesk Revit 2017.2 - 2017_10_04_Generative-Design-Study_Empty-Site-4.rvt - 3D View: {3D}
Architecture
Structure
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Quantification
Site Designer
Extensions
Modify
Modify
Materials
Object Styles
Snaps
Project Information
Project Parameters
Shared Parameters
Global Parameters
Transfer Project Standards
Purge Unused
Project Units
Structural Settings
MEP Settings
Panel Schedule Templates
Additional Settings
Settings
Location
Coordinates
Position
Project Location
Design Options
Add to Set
Pick to Edit
Main Model
Design Options
Manage Links
Manage Images
Decal Types
Starting View
Manage Project
Phases
Phasing
Save
Load
Edit
Selection
IDs of Selection
Select by ID
Warnings
Inquiry
Macro Manager
Macro Security
Macros
Dynamo
Dynamo Player
Visual Programming
Project Browser - 2017_10_04_Generative-Design-Study...
Views (all)
Structural Plans
Foundation
Floor Plans
Foundation
Level 1
Site_Underlay
Site_Working
Ceiling Plans
Foundation
Level 1
3D Views
{3D}
{3D} Copy 1
{3D} Copy 2
Elevations (Building Elevation)
East
North
South
West
Sections (Building Section)
Section 1
Legends
Schedules/Quantities
Sheets (all)
Families
Annotation Symbols
Cable Trays
Ceilings
Columns
Conduits
Curtain Panels
Curtain Systems
Curtain Wall Mullions
Detail Items
Division Profiles
Doors
Duct Systems
Ducts
Flex Ducts
Flex Pipes
Floors
Furniture
Generic Models
Mass
1/8" = 1'-0"
Properties
3D View
3D View: {3D}
Edit Type
Graphics
View Scale
1/8" = 1'-0"
Scale Value 1:
96
Detail Level
Medium
Parts Visibility
Show Both
Visibility/Graphics Overrides
Edit...
Graphic Display Options
Edit...
Discipline
Coordination
Show Hidden Lines
By Discipline
Default Analysis Display Style
None
Sun Path
Extents
Crop View
Crop Region Visible
Annotation Crop
Far Clip Active
Far Clip Offset
1000' 0"
Section Box
Camera
Rendering Settings
Edit...
Locked Orientation
Perspective
Eye Elevation
8' 8"
Target Elevation
0' 0"
Camera Position
Adjusting
Identity Data
View Template
<None>
View Name
{3D}
Dependency
Independent
Title on Sheet
Phasing
Phase Filter
Show All
Phase
New Construction
Properties help
Apply
Main Model

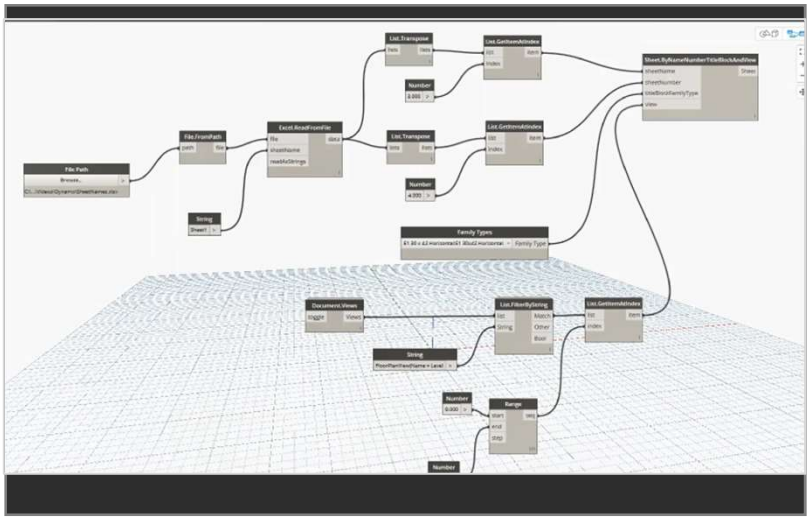
Project Objective: **Automate Sheet Development**

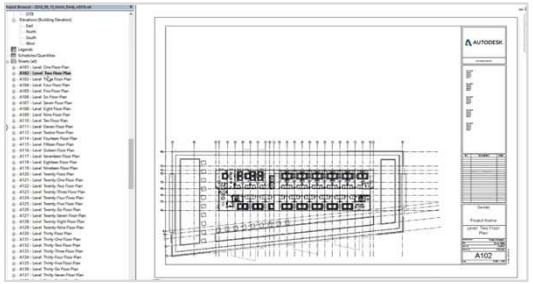
Developer: Emily Bisaga Dunne, Autodesk

Design Objectives:

- Automate the creation of sheets and the placement of view on sheets for building design set

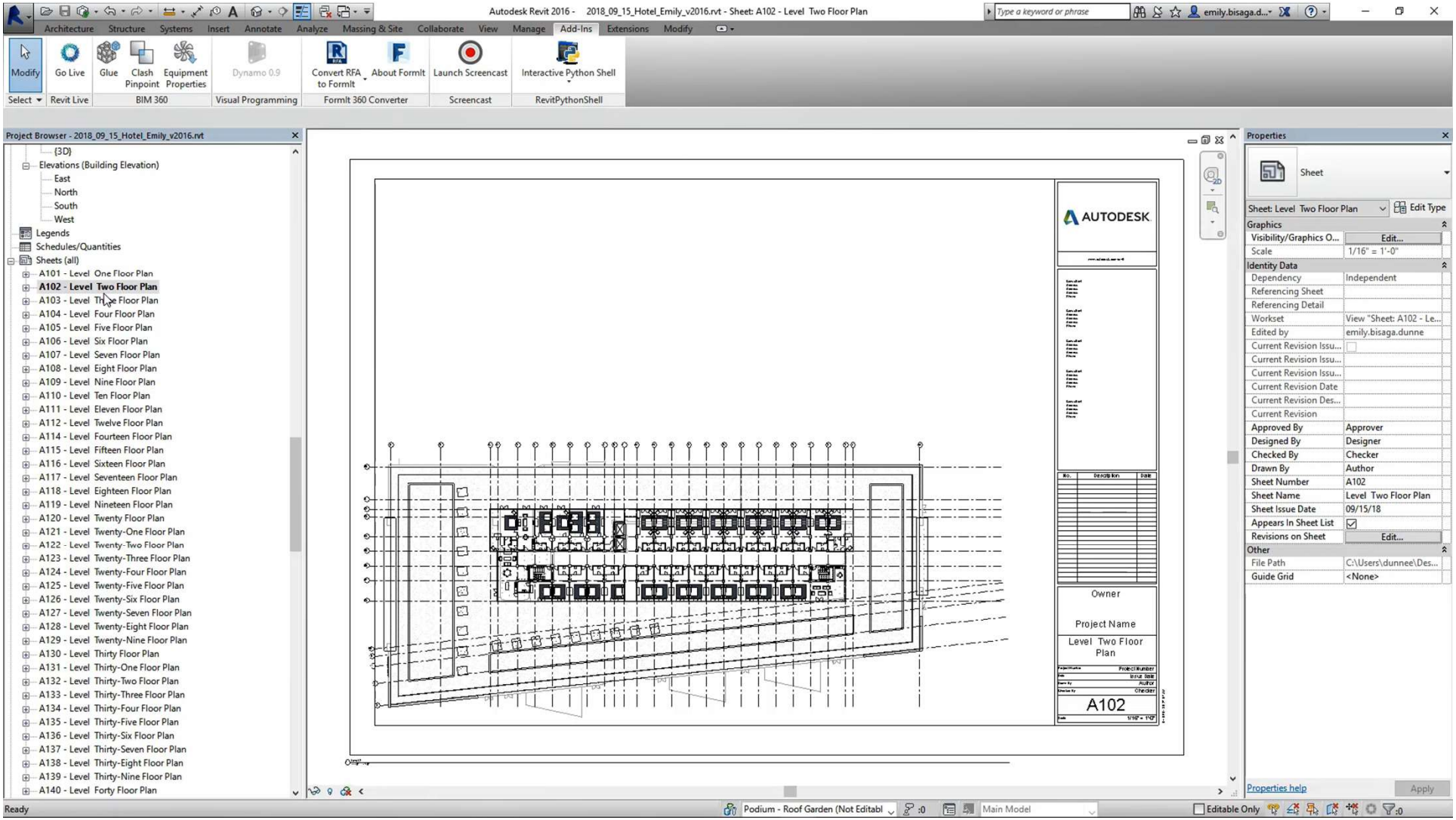
Increase Efficiency





KEY OUTCOME:

Reduced time to design development
Increased early-stage design profit
Improved design change management


Autodesk Revit 2016 - 2018_09_15_Hotel_Emily_v2016.rvt - Sheet: A102 - Level Two Floor Plan
Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Extensions Modify
Modify Go Live Glue Clash Pinpoint Equipment Properties Dynamo 0.9 Convert RFA to FormIt About FormIt Launch Screencast Interactive Python Shell
Select Revit Live BIM 360 Visual Programming FormIt 360 Converter Screencast RevitPythonShell
Project Browser - 2018_09_15_Hotel_Emily_v2016.rvt
{3D}
Elevations (Building Elevation)
East
North
South
West
Legends
Schedules/Quantities
Sheets (all)
A101 - Level One Floor Plan
A102 - Level Two Floor Plan
A103 - Level Three Floor Plan
A104 - Level Four Floor Plan
A105 - Level Five Floor Plan
A106 - Level Six Floor Plan
A107 - Level Seven Floor Plan
A108 - Level Eight Floor Plan
A109 - Level Nine Floor Plan
A110 - Level Ten Floor Plan
A111 - Level Eleven Floor Plan
A112 - Level Twelve Floor Plan
A114 - Level Fourteen Floor Plan
A115 - Level Fifteen Floor Plan
A116 - Level Sixteen Floor Plan
A117 - Level Seventeen Floor Plan
A118 - Level Eighteen Floor Plan
A119 - Level Nineteen Floor Plan
A120 - Level Twenty Floor Plan
A121 - Level Twenty-One Floor Plan
A122 - Level Twenty-Two Floor Plan
A123 - Level Twenty-Three Floor Plan
A124 - Level Twenty-Four Floor Plan
A125 - Level Twenty-Five Floor Plan
A126 - Level Twenty-Six Floor Plan
A127 - Level Twenty-Seven Floor Plan
A128 - Level Twenty-Eight Floor Plan
A129 - Level Twenty-Nine Floor Plan
A130 - Level Thirty Floor Plan
A131 - Level Thirty-One Floor Plan
A132 - Level Thirty-Two Floor Plan
A133 - Level Thirty-Three Floor Plan
A134 - Level Thirty-Four Floor Plan
A135 - Level Thirty-Five Floor Plan
A136 - Level Thirty-Six Floor Plan
A137 - Level Thirty-Seven Floor Plan
A138 - Level Thirty-Eight Floor Plan
A139 - Level Thirty-Nine Floor Plan
A140 - Level Forty Floor Plan
AUTODESK
Owner
Project Name
Level Two Floor Plan
A102
Properties
Sheet
Sheet: Level Two Floor Plan
Edit Type
Graphics
Visibility/Graphics O... Edit...
Scale 1/16" = 1'-0"
Identity Data
Dependency Independent
Referencing Sheet
Referencing Detail
Workset View "Sheet: A102 - Le...
Edited by emily.bisaga.dunne
Current Revision Issu...
Current Revision Issu...
Current Revision Issu...
Current Revision Date
Current Revision Des...
Current Revision
Approved By Approver
Designed By Designer
Checked By Checker
Drawn By Author
Sheet Number A102
Sheet Name Level Two Floor Plan
Sheet Issue Date 09/15/18
Appears In Sheet List
Revisions on Sheet Edit...
Other
File Path C:\Users\dunnee\Des...
Guide Grid <None>
Properties help
Apply
Ready
Podium - Roof Garden (Not Editabl
Main Model
Editable Only

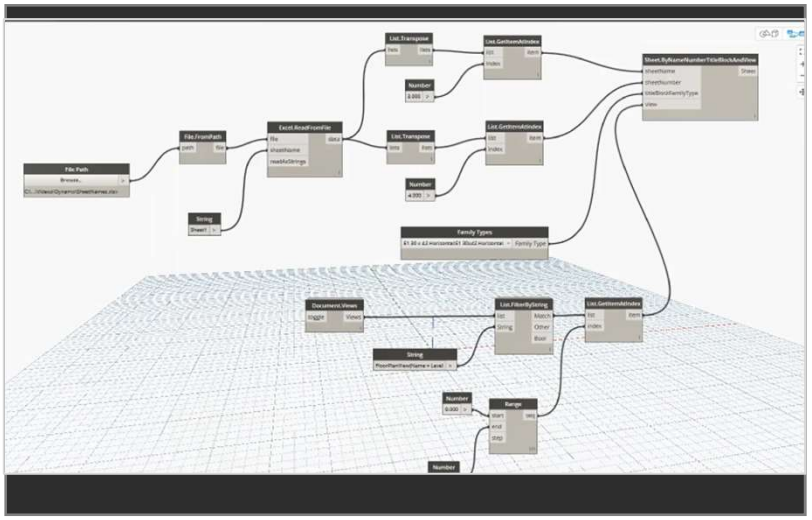
Project Objective: **Brick Layout**

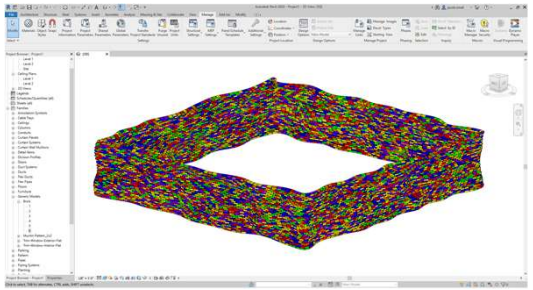
Developer: Jacob Small, Autodesk

Design Objectives:

- Place 8,388 bricks accurately along a curvy wall form
- Reduce waste

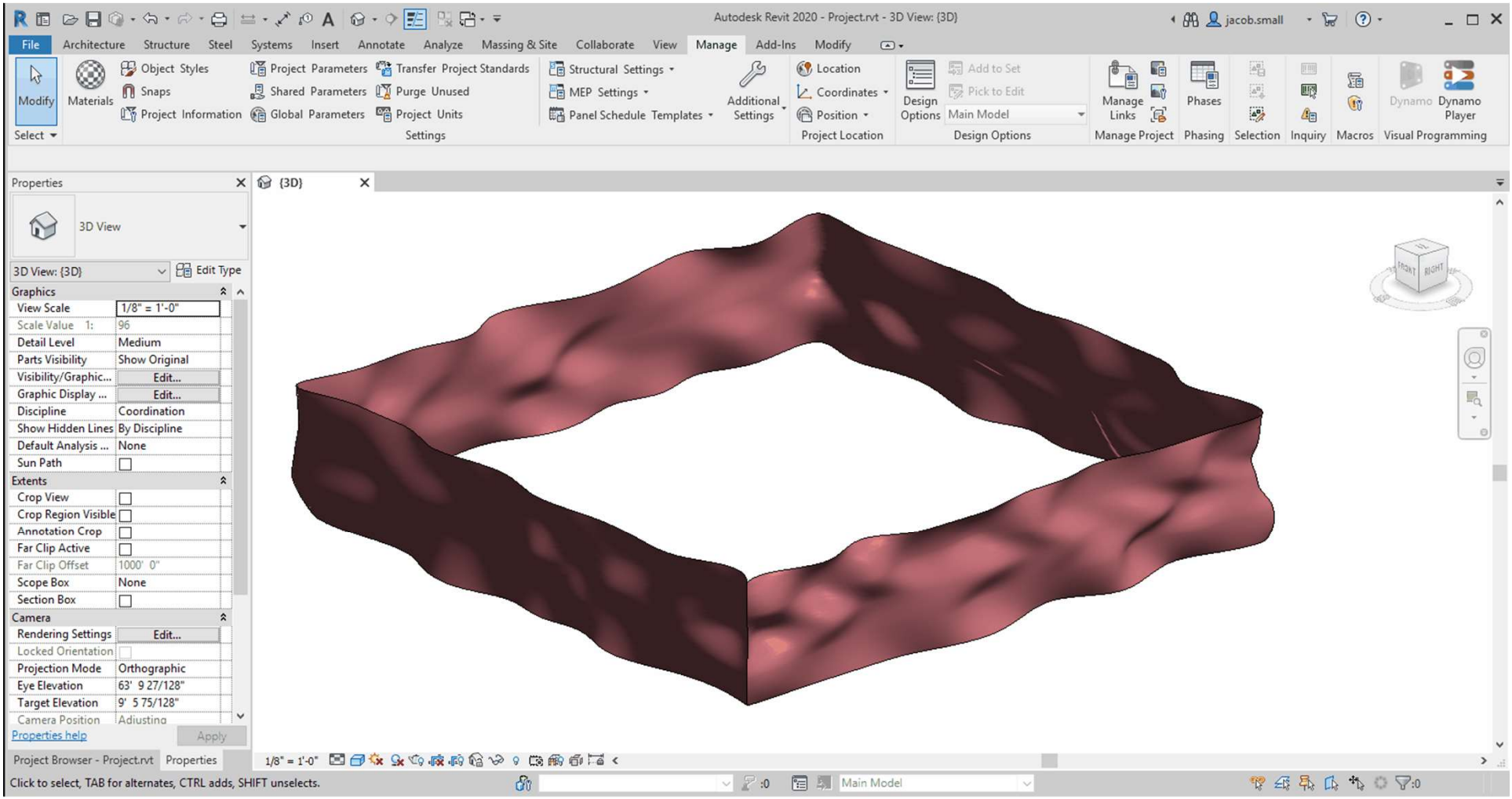
Increase Efficiency





KEY OUTCOMES:

Reduced time to construction
Improve design quality
Improve coordination

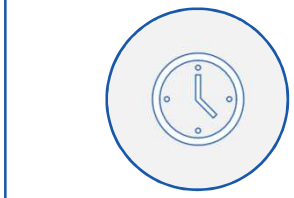

Autodesk Revit 2020 - Project.rvt - 3D View: {3D}
jacob.small
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Modify
Select
Materials
Object Styles
Snaps
Project Information
Project Parameters
Shared Parameters
Global Parameters
Transfer Project Standards
Purge Unused
Project Units
Settings
Structural Settings
MEP Settings
Panel Schedule Templates
Additional Settings
Location
Coordinates
Position
Project Location
Design Options
Add to Set
Pick to Edit
Main Model
Design Options
Manage Links
Manage Project
Phases
Phasing
Selection
Inquiry
Macros
Dynamo
Dynamo Player
Visual Programming
Properties
3D View
3D View: {3D}
Edit Type
Graphics
View Scale
1/8" = 1'-0"
Scale Value 1:
96
Detail Level
Medium
Parts Visibility
Show Original
Visibility/Graphic...
Edit...
Graphic Display ...
Edit...
Discipline
Coordination
Show Hidden Lines
By Discipline
Default Analysis ...
None
Sun Path
Extents
Crop View
Crop Region Visible
Annotation Crop
Far Clip Active
Far Clip Offset
1000' 0"
Scope Box
None
Section Box
Camera
Rendering Settings
Edit...
Locked Orientation
Projection Mode
Orthographic
Eye Elevation
63' 9 27/128"
Target Elevation
9' 5 75/128"
Camera Position
Adjusting
Properties help
Apply
Project Browser - Project.rvt
Properties
{3D}
1/8" = 1'-0"
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

Project Objective: **Utility Routing**

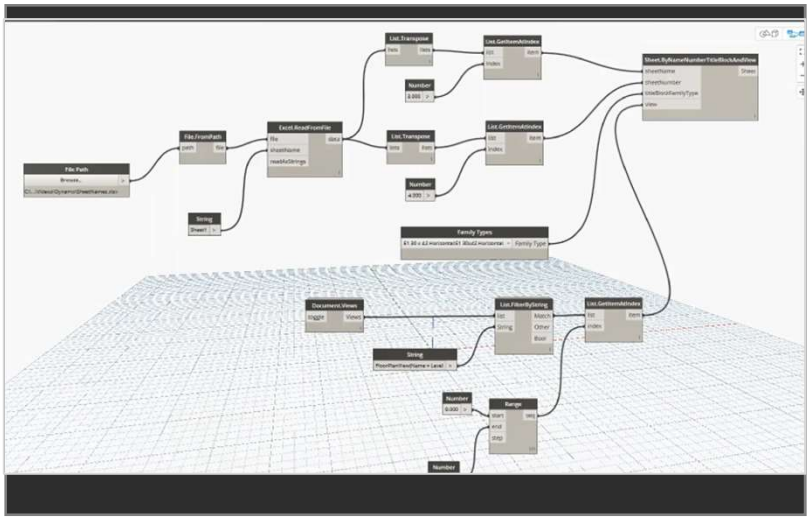
Developer: Jacob Small, Autodesk

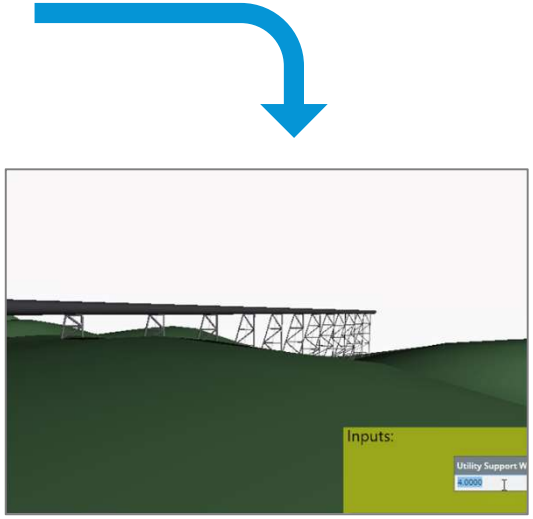
Design Objectives:

- Automates placement of a utility line on a specific terrain
- As the terrain updates, the structure and routing update



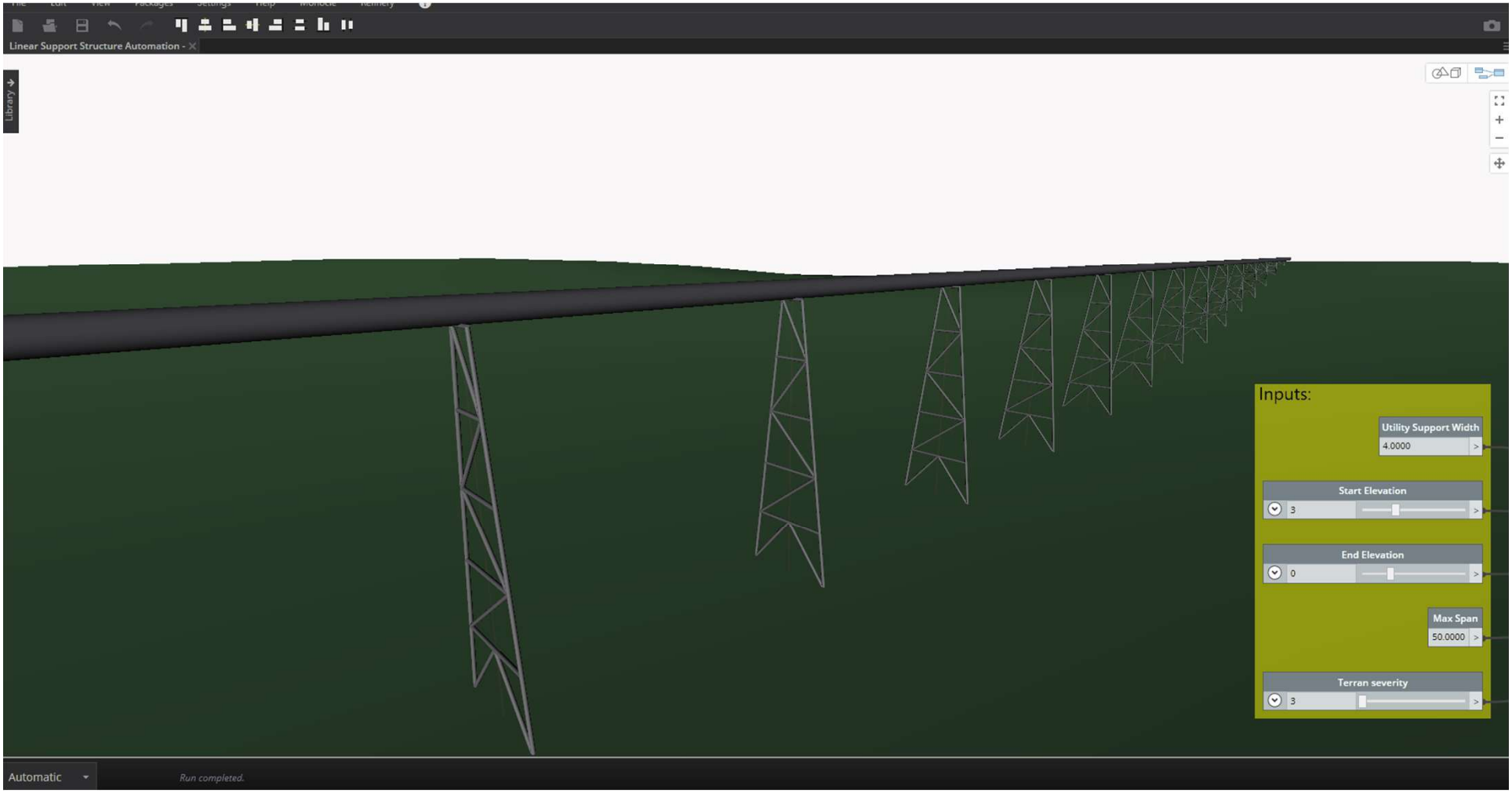
Increase Efficiency





KEY OUTCOMES:

Improved coordination
Improved design quality
Reduction in waste


Linear Support Structure Automation -
Library
Inputs:
Utility Support Width
4.0000
Start Elevation
3
End Elevation
0
Max Span
50.0000
Terran severity
3
Automatic
Run completed.

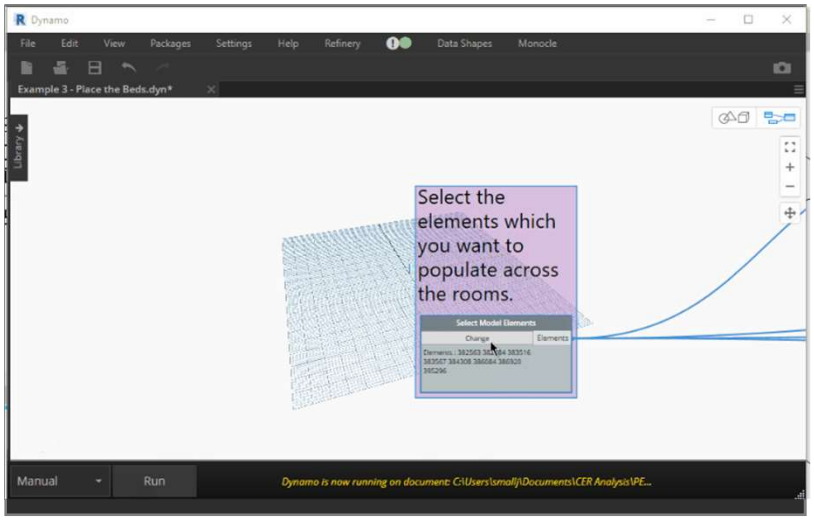
Project Objective: **Furniture Placement**

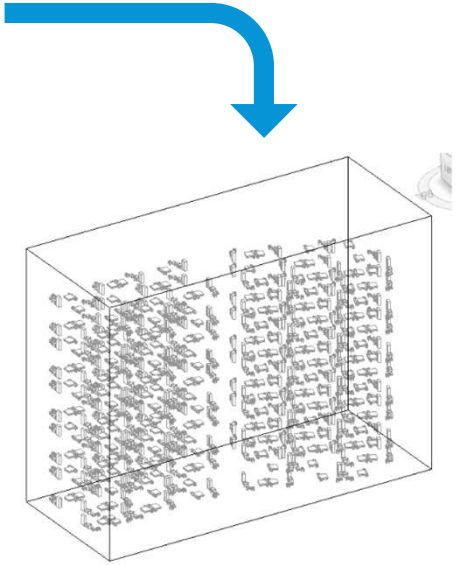
Developer: Jacob Small, Autodesk

Design Objectives:

- Automates placement of furniture within rooms by room type

Increase Efficiency



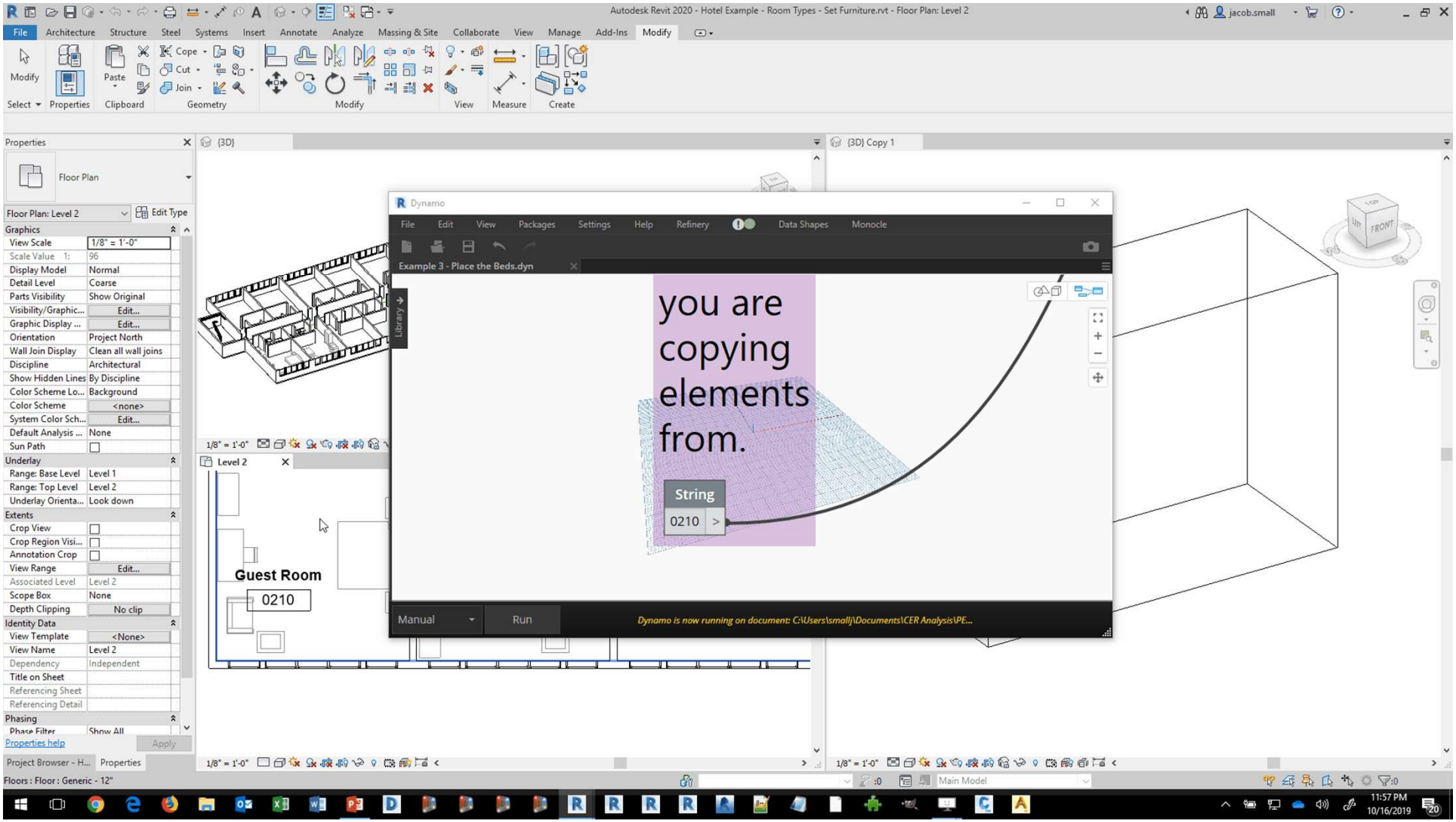


KEY OUTCOMES:

Improved coordination

Improved change management

Reduced errors


Autodesk Revit 2020 - Hotel Example - Room Types - Set Furniture.rvt - Floor Plan: Level 2
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Properties
Floor Plan
Floor Plan: Level 2
Edit Type
Graphics
View Scale
1/8" = 1'-0"
Display Model
Normal
Detail Level
Coarse
Parts Visibility
Show Original
Orientation
Project North
Wall Join Display
Clean all wall joins
Discipline
Architectural
Show Hidden Lines
By Discipline
Color Scheme Lo...
Background
Color Scheme
<none>
Default Analysis ...
None
Sun Path
Underlay
Range: Base Level
Level 1
Range: Top Level
Level 2
Underlay Orienta...
Look down
Extents
Crop View
Crop Region Visi...
Annotation Crop
View Range
Edit...
Associated Level
Level 2
Scope Box
None
Depth Clipping
No clip
Identity Data
View Template
<None>
View Name
Level 2
Dependency
Independent
Title on Sheet
Referencing Sheet
Referencing Detail
Phasing
Phase Filter
Show All
Properties help
Apply
Project Browser - H...
Properties
Floors : Floor : Generic - 12"
{3D}
{3D} Copy 1
Level 2
Guest Room
0210
Dynamo
File
Edit
View
Packages
Settings
Help
Refinery
Data Shapes
Monocle
Example 3 - Place the Beds.dyn
Library
you are copying elements from.
String
0210
Manual
Run
Dynamo is now running on document: C:\Users\smallj\Documents\CER Analysis\PE...
FRONT
Main Model
11:57 PM
10/16/2019

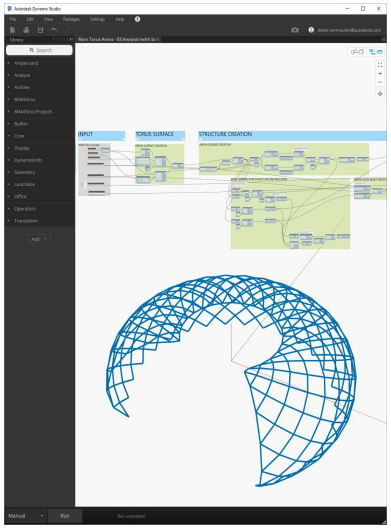
Project Objective: **Steel Diagrid Waste Evaluation**

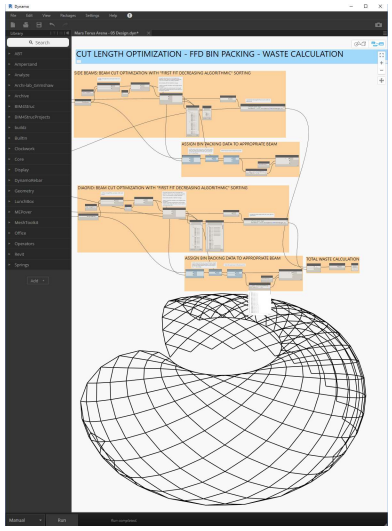
Developer: Dieter Vermuelen, Autodesk

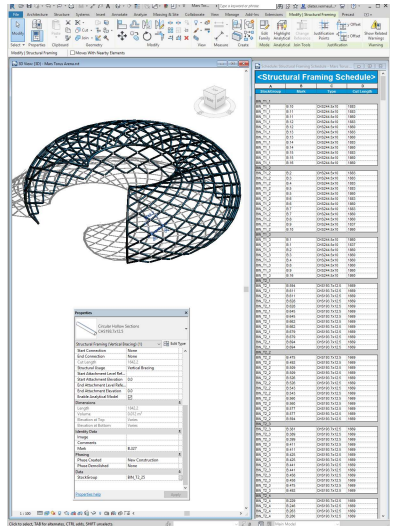
Design Objectives:

- Automates the form of a steel diagrid structure and allows for the cut length to be optimized.

Increase Efficiency





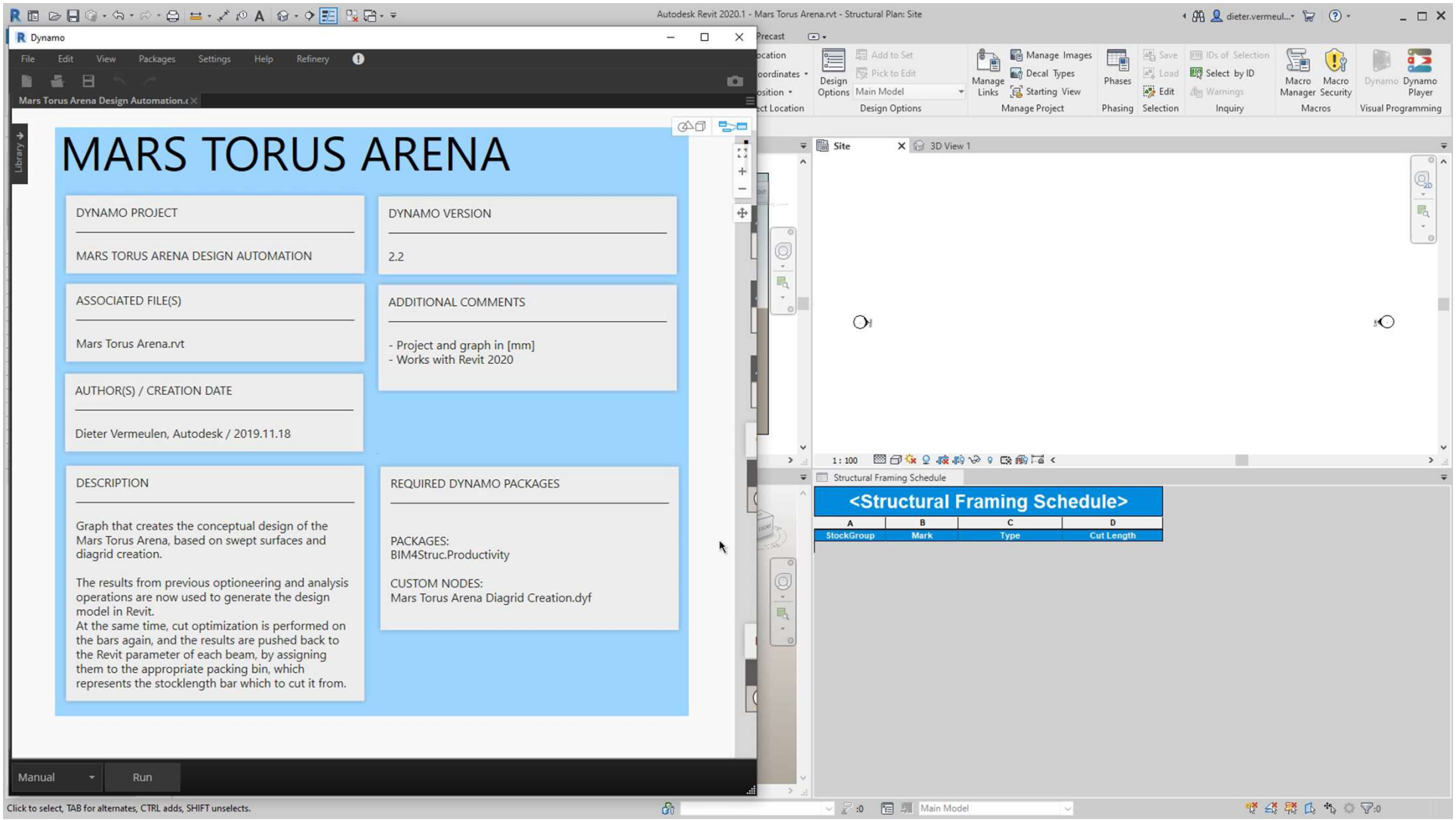


KEY OUTCOMES:

Improved data for fabrication

Reduced waste

Reduced cost


Autodesk Revit 2020.1 - Mars Torus Arena.rvt - Structural Plan: Site
Dynamo
File Edit View Packages Settings Help Refinery
Mars Torus Arena Design Automation.d
MARS TORUS ARENA
DYNAMO PROJECT
MARS TORUS ARENA DESIGN AUTOMATION
DYNAMO VERSION
2.2
ASSOCIATED FILE(S)
Mars Torus Arena.rvt
ADDITIONAL COMMENTS
- Project and graph in [mm]
- Works with Revit 2020
AUTHOR(S) / CREATION DATE
Dieter Vermeulen, Autodesk / 2019.11.18
DESCRIPTION
Graph that creates the conceptual design of the Mars Torus Arena, based on swept surfaces and diagrid creation.
The results from previous optioneering and analysis operations are now used to generate the design model in Revit.
At the same time, cut optimization is performed on the bars again, and the results are pushed back to the Revit parameter of each beam, by assigning them to the appropriate packing bin, which represents the stocklength bar which to cut it from.
REQUIRED DYNAMO PACKAGES
PACKAGES:
BIM4Struc.Productivity
CUSTOM NODES:
Mars Torus Arena Diagrid Creation.dyf
Manual
Run
Site
3D View 1
Structural Framing Schedule
<Structural Framing Schedule>
A B C D
StockGroup Mark Type Cut Length
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

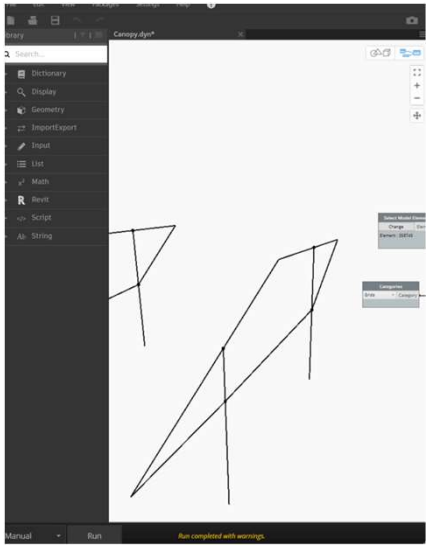
Project Objective: **Structural Framing Automation**

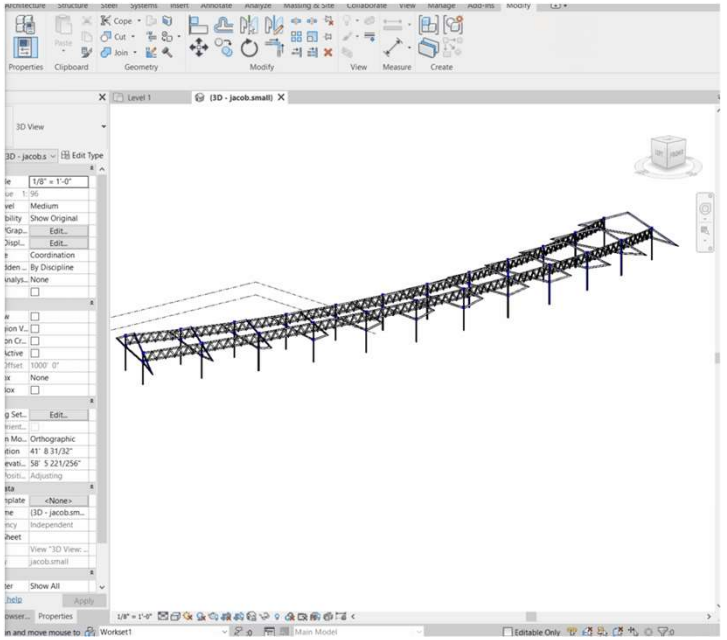
Developer: Jacob Small, Autodesk

Design Objectives:

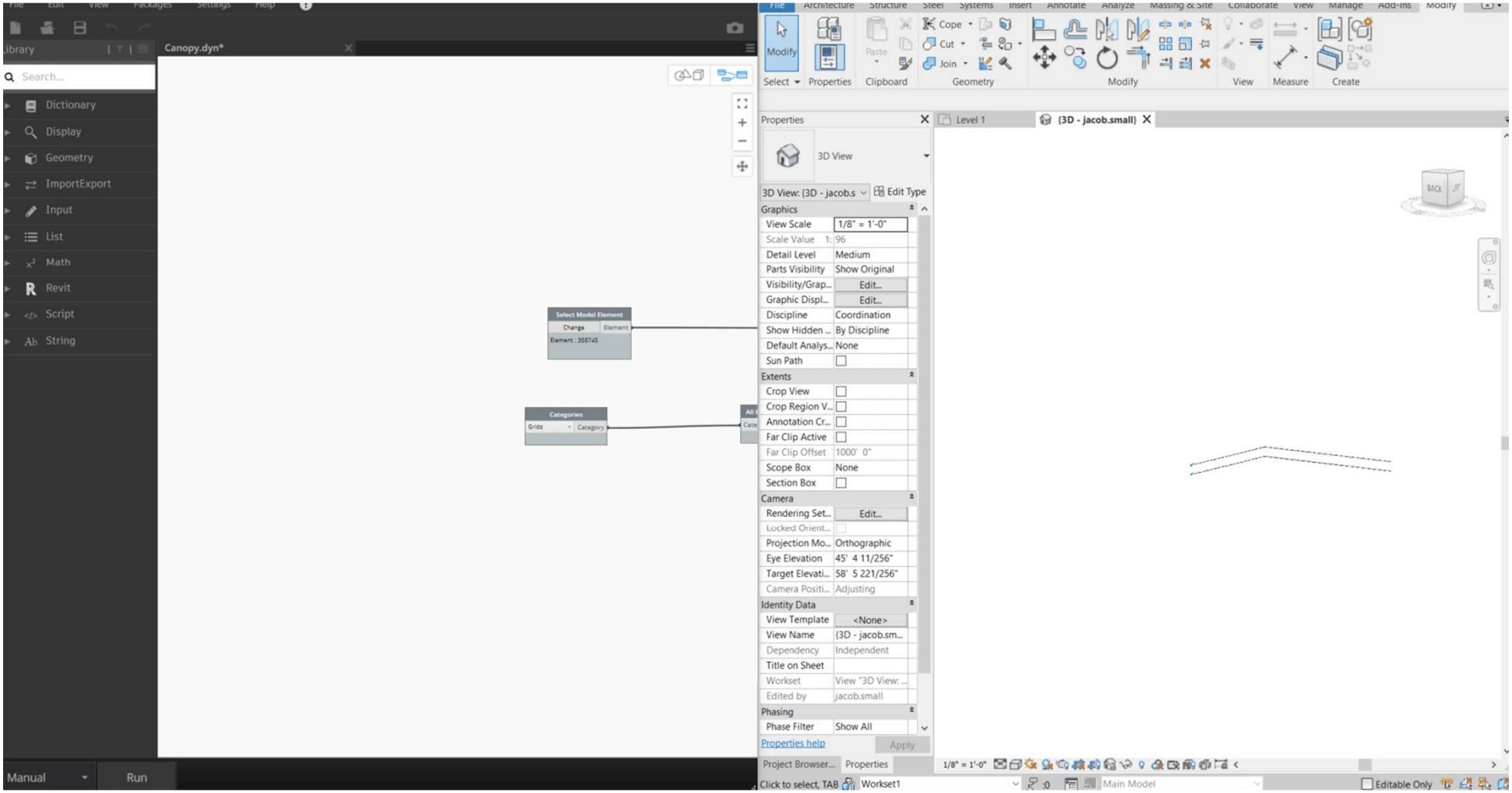
- Automates the form of a structure based on a curved form in the Revit model

Increase Efficiency





KEY OUTCOMES:
Reduced errors
Reduced time
Reduced cost


Canopy.dyn*
Search...
Dictionary
Display
Geometry
ImportExport
Input
List
Math
Revit
Script
String
Select Model Element
Change
Element
Element : 358745
Categories
Grids
Category
Manual
Run
Modify
Select
Properties
Paste
Clipboard
Cope
Cut
Join
Geometry
Modify
View
Measure
Create
Properties
3D View
3D View: (3D - jacob.s
Edit Type
Graphics
View Scale 1/8" = 1'-0"
Scale Value 1: 96
Detail Level Medium
Parts Visibility Show Original
Visibility/Grap... Edit...
Graphic Displ... Edit...
Discipline Coordination
Show Hidden ... By Discipline
Default Analys... None
Sun Path
Extents
Crop View
Crop Region V...
Annotation Cr...
Far Clip Active
Far Clip Offset 1000' 0"
Scope Box None
Section Box
Camera
Rendering Set... Edit...
Locked Orient...
Projection Mo... Orthographic
Eye Elevation 45' 4 11/256"
Target Elevati... 58' 5 221/256"
Camera Positi... Adjusting
Identity Data
View Template <None>
View Name (3D - jacob.sm...
Dependency Independent
Title on Sheet
Workset View "3D View: ...
Edited by jacob.small
Phasing
Phase Filter Show All
Properties help
Apply
Project Browser...
Properties
Level 1
(3D - jacob.small)
BACK
1/8" = 1'-0"
Click to select, TAB
Workset1
Main Model
Editable Only

Savings Analysis

Artem Boiko

Runtime 00:01:10

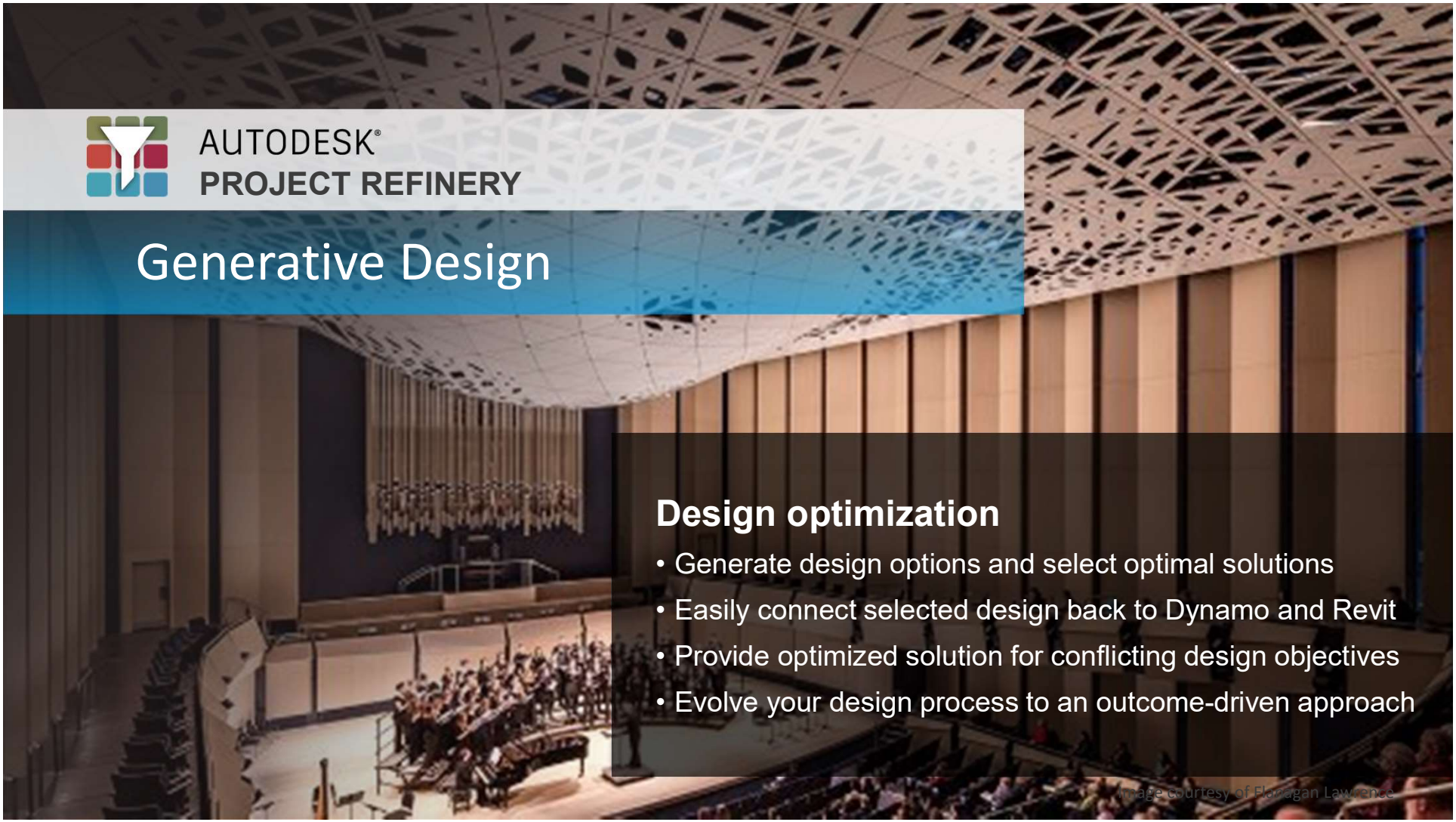
Placement completed:

- ✓ **Base Plate Column** - Eaves Columns
- ✓ **Plate Column Base 90° rotated** - Gable Columns
- ✓ **Anchor Plinth +500** - Eaves Columns (outside)
- ✓ **Anchor Plinth +500** - Gable Columns (outside)
- ✓ **Anchor Truss 90° rotated** - Gable Columns (inside)
- ✓ **Anchor Sandwichpanel** - Eaves Columns (outside)
- ✓ **Anchor Sandwichpanel** - Gable Columns (outside)

Runtime 01:02:00

Placement completed:

- ✓ **Base Plate Column** - Eaves Columns
- ✓ **Base Plate Column 90° rotated** - Gable Columns
- ✓ **Anchor Truss 90° rotated** - Gable Columns (inside)
- ✓ **Anchor Plinth +500** - Eaves Columns (outside)
- ✓ **Anchor Plinth +500** - Gable Columns (outside)
- ✓ **Anchor Sandwichpanel** - Eaves Columns (outside)
- ✓ **Anchor Sandwichpanel** - Gable Columns (outside)


AUTODESK®
PROJECT REFINERY
Generative Design
Design optimization
• Generate design options and select optimal solutions
• Easily connect selected design back to Dynamo and Revit
• Provide optimized solution for conflicting design objectives
• Evolve your design process to an outcome-driven approach
Image courtesy of Flanagan Lawrence

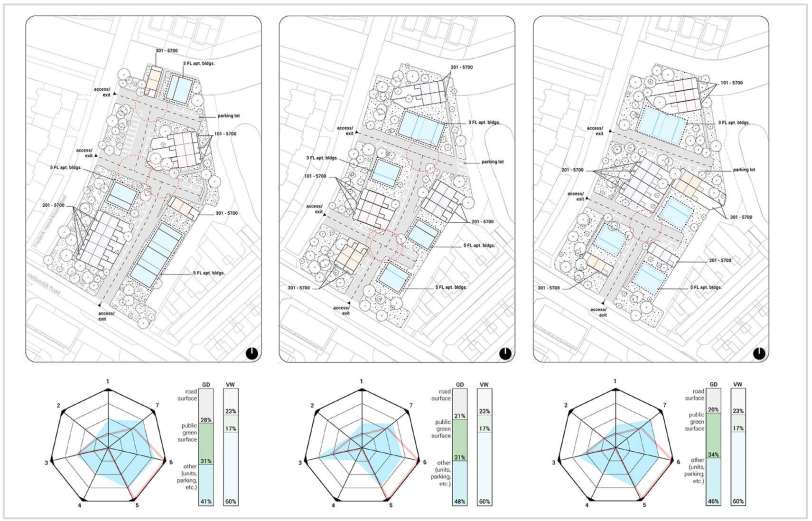
Project Objective: **Optimize Urban Neighborhood**

Developer: Van Wijnen

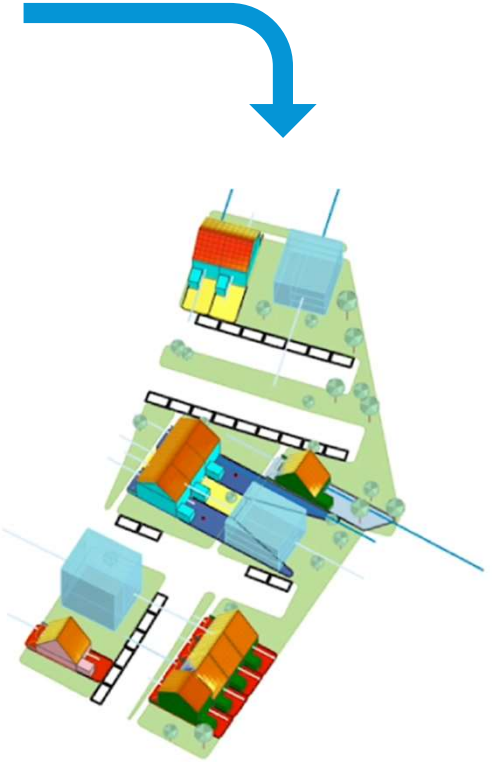
Design Objectives:

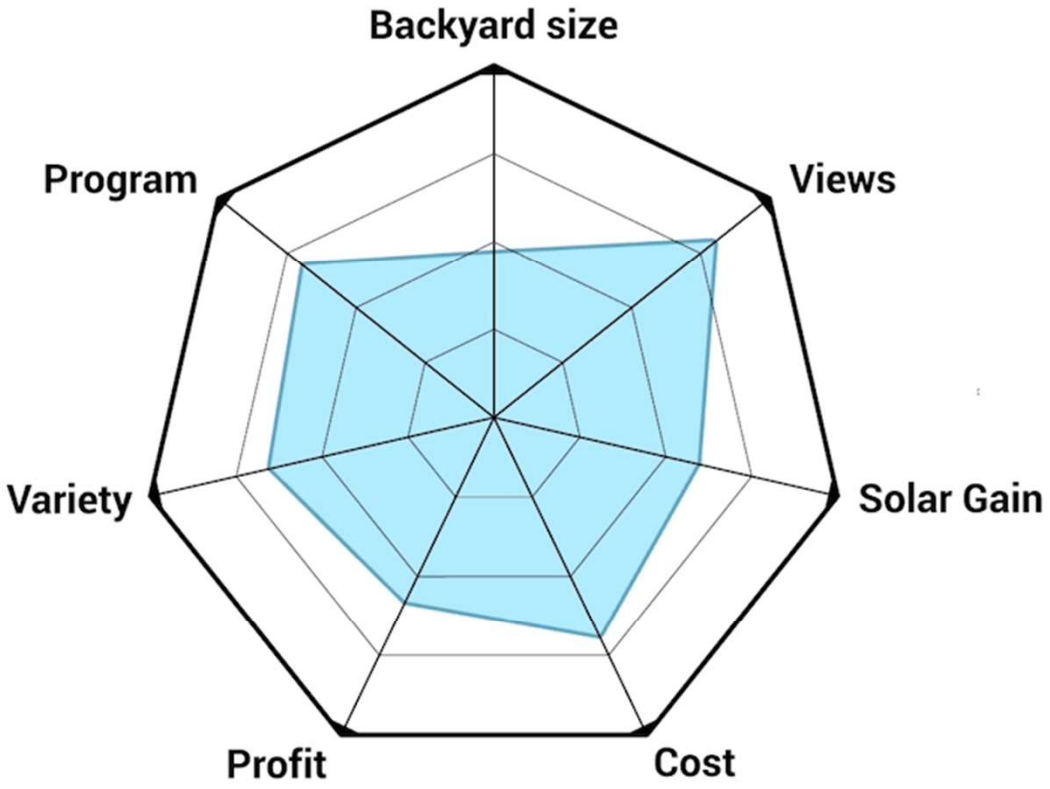
- Minimize cost
- Optimize parking
- Optimize orientation
- Optimize revenue
- Optimize ROI
- Test unit mix
- Test unit type
- Test site design

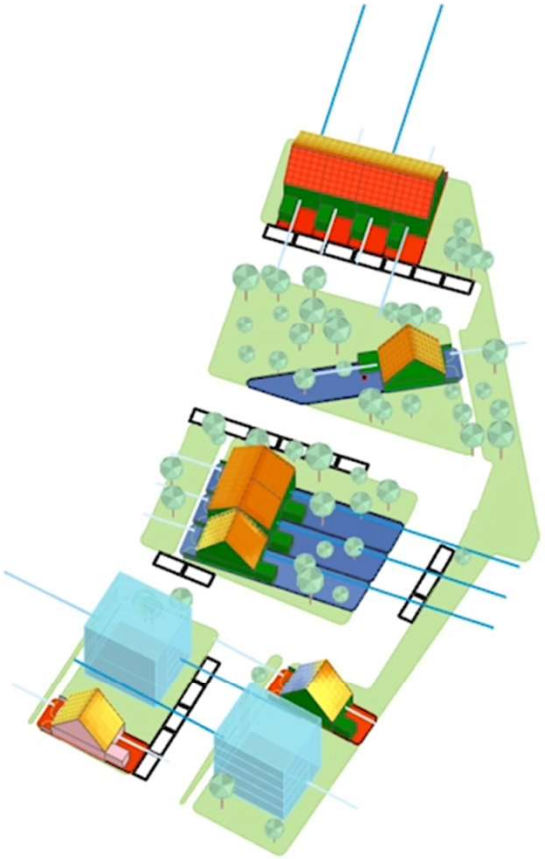
Increase Efficiency



KEY OUTCOMES:
Minimize project cost
Maximize project revenue
Maximize return on investment




Backyard size
Views
Solar Gain
Cost
Profit
Variety
Program



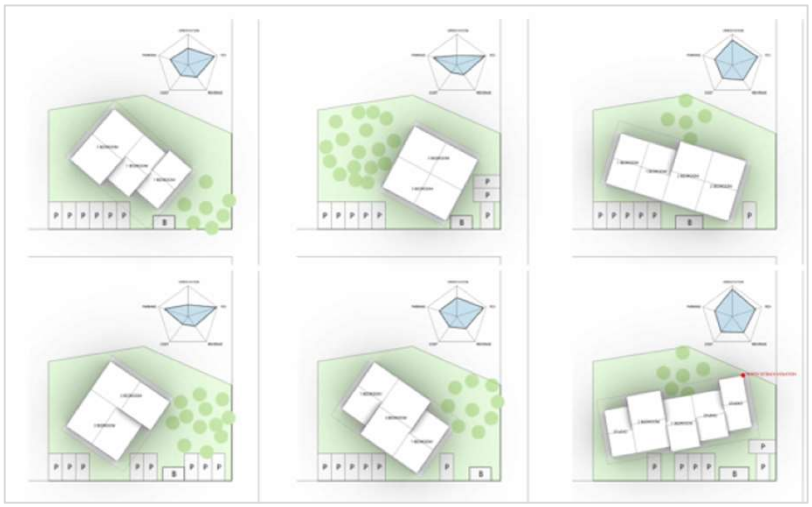
Project Objective: **Optimize Buildings For Site**

Developer: Daiwa House

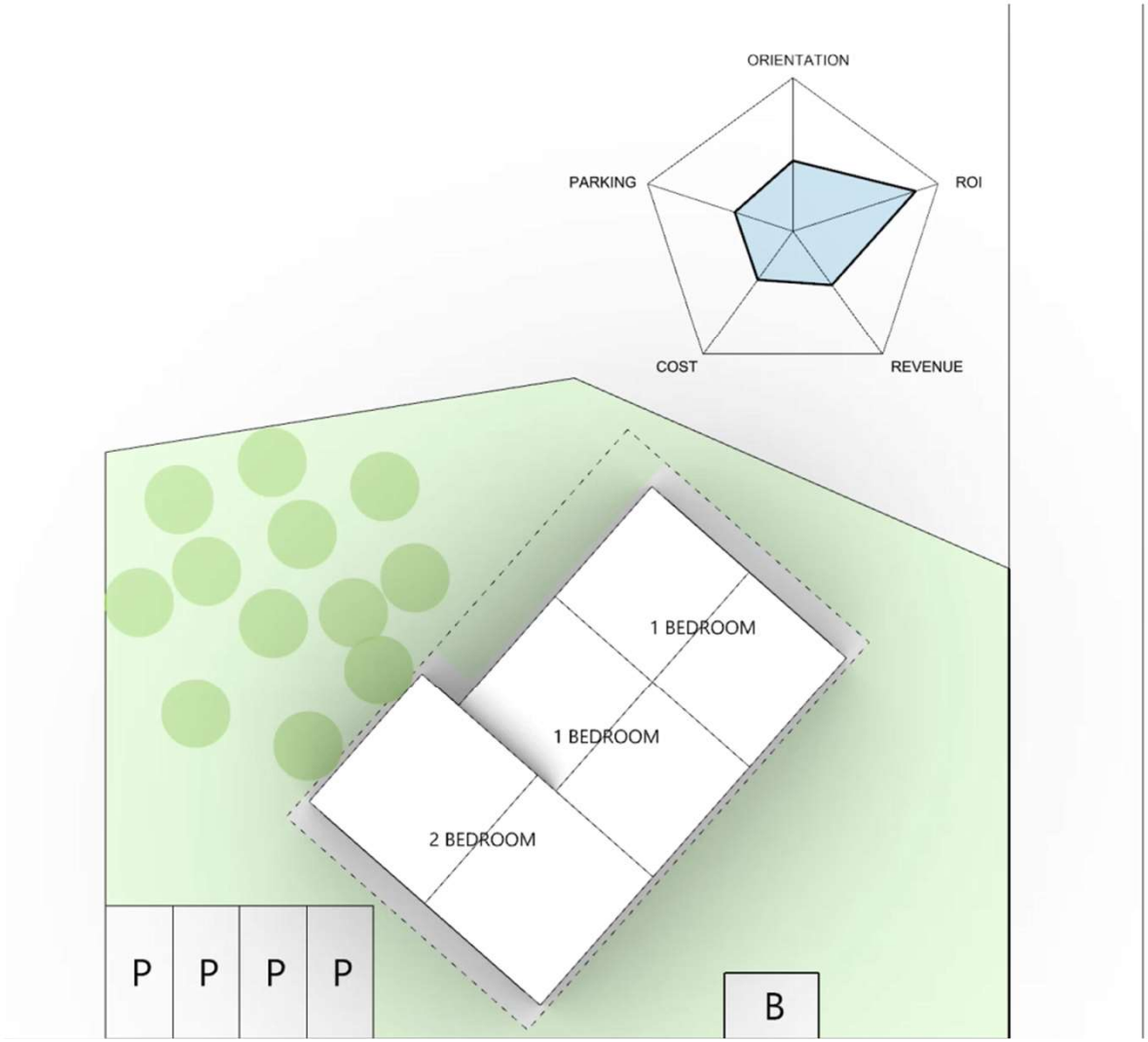
Design Objectives:

- Minimize cost
- Optimize parking
- Optimize orientation
- Optimize revenue
- Optimize ROI
- Test unit mix
- Test unit type
- Test site design

Increase Efficiency



KEY OUTCOMES:
Minimize project cost
Maximize project revenue
Maximize return on investment


ORIENTATION
ROI
REVENUE
COST
PARKING
1 BEDROOM
1 BEDROOM
2 BEDROOM
P
P
P
P
B

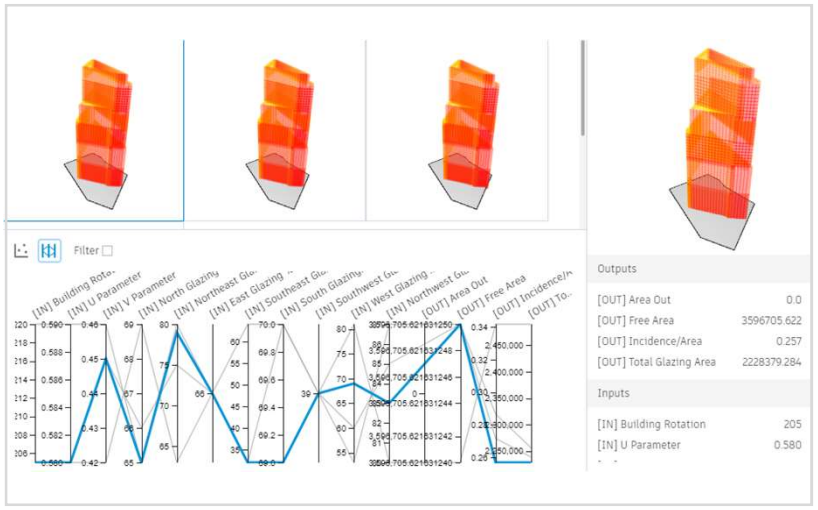
Project Objective: **Optimize Building Position**

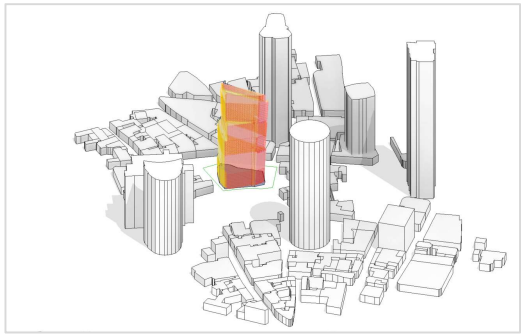
Developer: Design Tech IO* for Autodesk

Design Objectives:

- Minimize area
- Maximize free area
- Minimize incidence / area
- Maximize total glazing area

Increase Efficiency

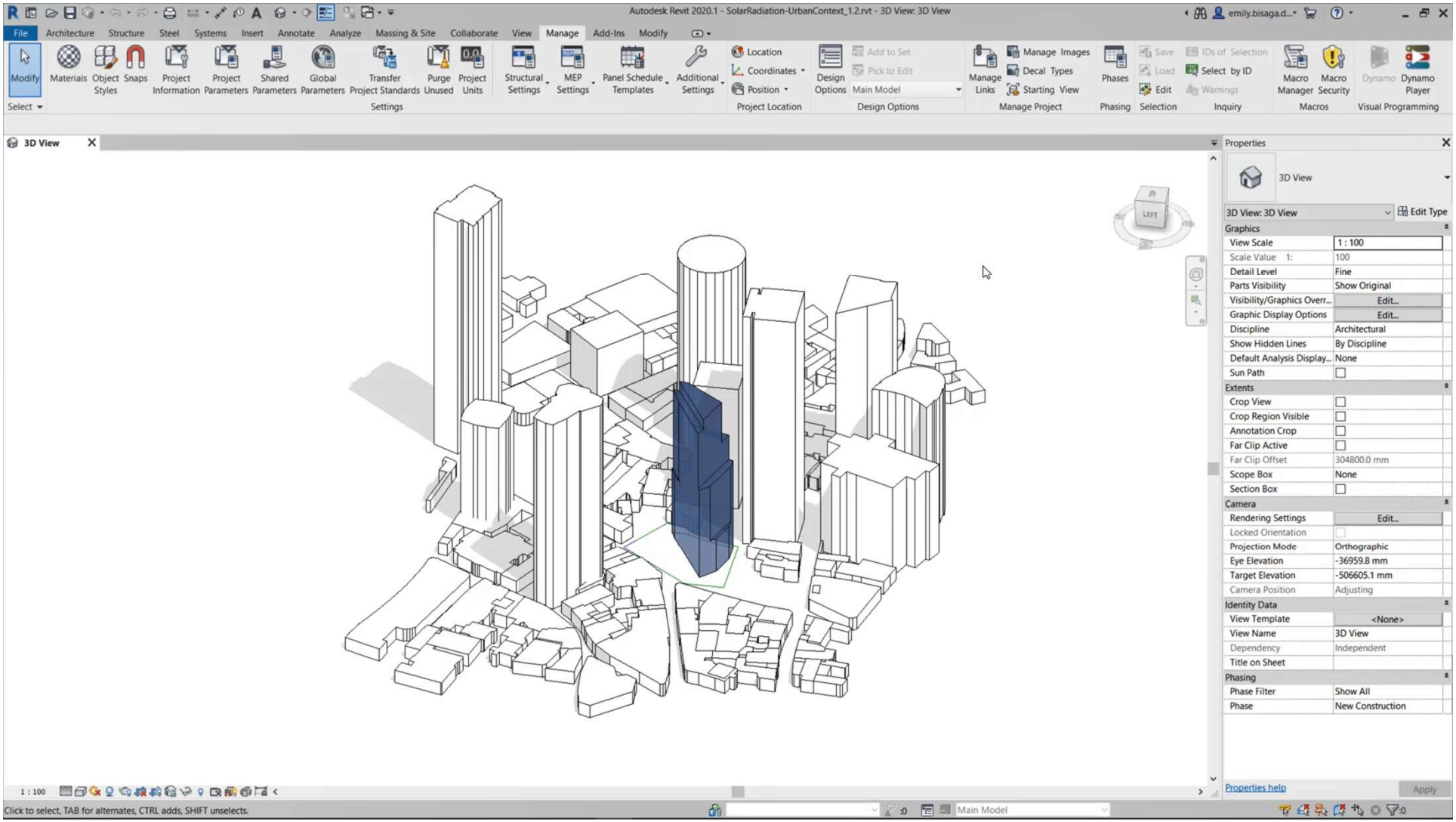




KEY OUTCOMES:

Reduced time to glazing analysis

Improved sustainability integration in design


Autodesk Revit 2020.1 - SolarRadiation-UrbanContext_1.2.rvt - 3D View: 3D View
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Modify
Materials
Object Styles
Snaps
Project Information
Project Parameters
Shared Parameters
Global Parameters
Transfer Project Standards
Purge Unused
Project Units
Structural Settings
MEP Settings
Panel Schedule Templates
Additional Settings
Settings
Location
Coordinates
Position
Project Location
Design Options
Add to Set
Pick to Edit
Main Model
Design Options
Manage Links
Manage Images
Decal Types
Starting View
Manage Project
Phases
Phasing
Save
Load
Edit
IDs of Selection
Select by ID
Warnings
Selection
Inquiry
Macro Manager
Macro Security
Macros
Dynamo
Dynamo Player
Visual Programming
3D View
LEFT
Properties
3D View
3D View: 3D View
Edit Type
Graphics
View Scale 1 : 100
Scale Value 1: 100
Detail Level Fine
Parts Visibility Show Original
Visibility/Graphics Overr... Edit...
Graphic Display Options Edit...
Discipline Architectural
Show Hidden Lines By Discipline
Default Analysis Display... None
Sun Path
Extents
Crop View
Crop Region Visible
Annotation Crop
Far Clip Active
Far Clip Offset 304800.0 mm
Scope Box None
Section Box
Camera
Rendering Settings Edit...
Locked Orientation
Projection Mode Orthographic
Eye Elevation -36959.8 mm
Target Elevation -506605.1 mm
Camera Position Adjusting
Identity Data
View Template <None>
View Name 3D View
Dependency Independent
Title on Sheet
Phasing
Phase Filter Show All
Phase New Construction
Properties help
Apply
1 : 100
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

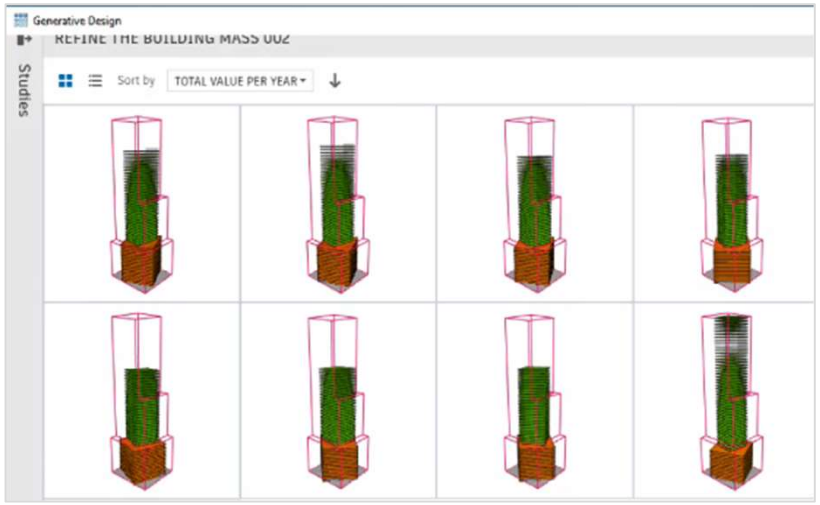
Project Objective: **Optimize Building Program**

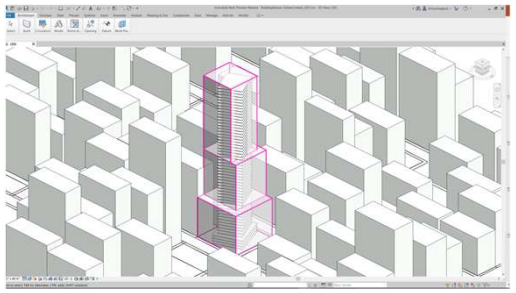
Developer: Refinery Team, Autodesk

Design Objectives:

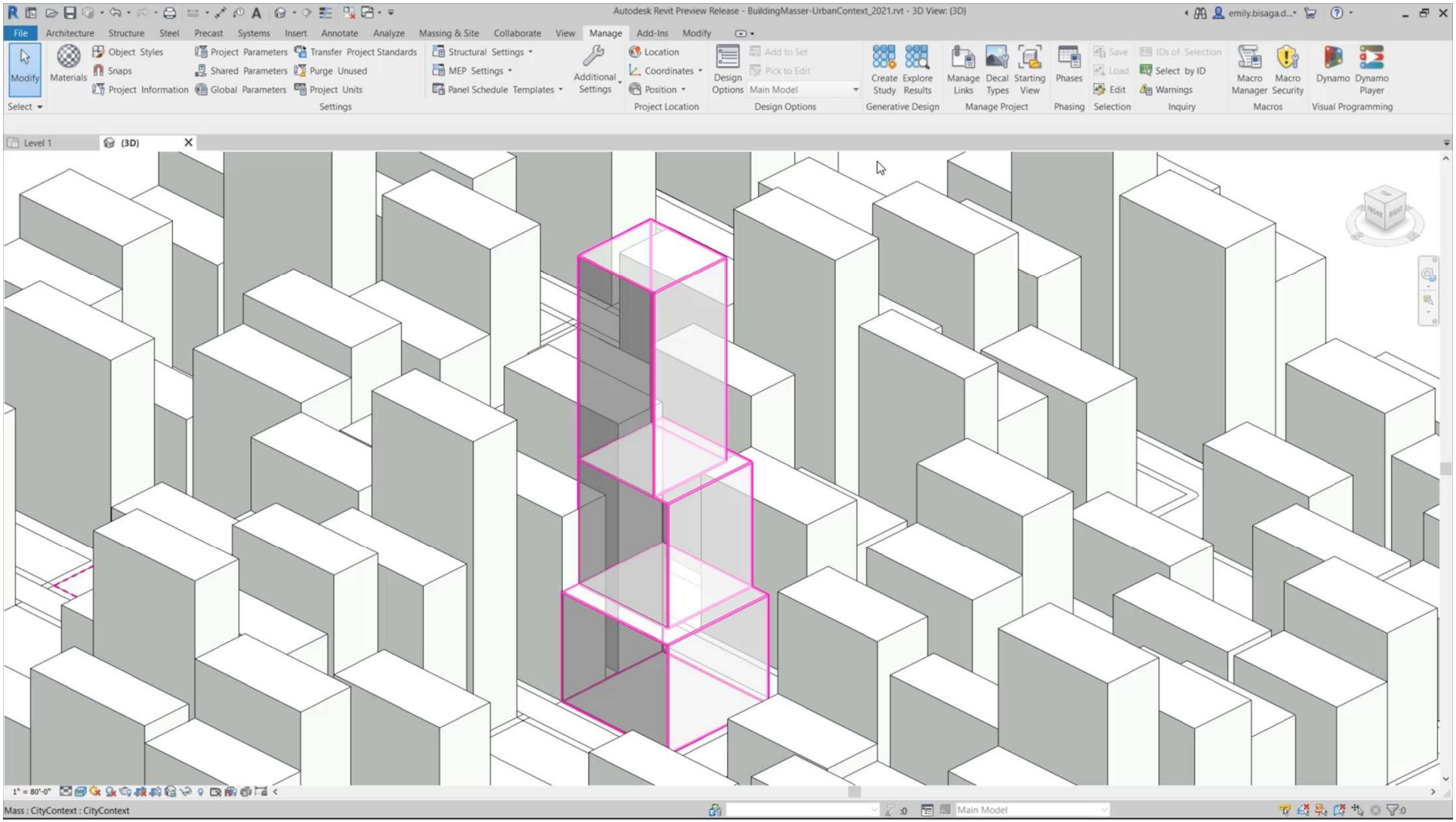
- Study massing
- Study program
- Calibrate via cost
- Calibrate via value
- Explore ratio of retail to office
- Explore office dimensions
- Explore rotation on site

Increase Efficiency





KEY OUTCOMES:
Minimize project cost
Maximize project value per year
Add value via pro forma visualization


Autodesk Revit Preview Release - BuildingMasser-UrbanContext_2021.rvt - 3D View: {3D}
File
Architecture
Structure
Steel
Precast
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Modify
Materials
Object Styles
Snaps
Project Information
Project Parameters
Shared Parameters
Global Parameters
Transfer Project Standards
Purge Unused
Project Units
Structural Settings
MEP Settings
Panel Schedule Templates
Additional Settings
Location
Coordinates
Position
Design Options
Add to Set
Pick to Edit
Main Model
Create Study
Explore Results
Manage Links
Decal Types
Starting View
Phases
Save
Load
Edit
IDs of Selection
Select by ID
Warnings
Macro Manager
Macro Security
Dynamo
Dynamo Player
Select
Settings
Project Location
Design Options
Generative Design
Manage Project
Phasing
Selection
Inquiry
Macros
Visual Programming
Level 1
{3D}
1" = 80'-0"
Mass : CityContext : CityContext
Main Model

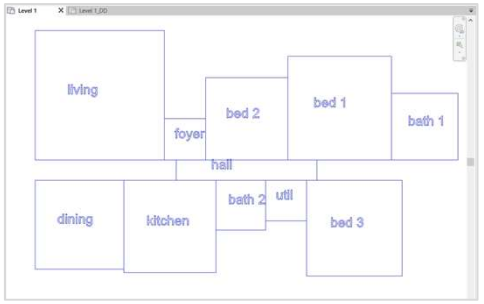
Project Objective: **Optimize the Floor Plan Layout**

Developer: Jacob Small for Autodesk

Design Objectives:

- Generate layout options
- Reduce unwanted noise in room adjacencies
- Minimize proximity score
- Minimize noise score
-

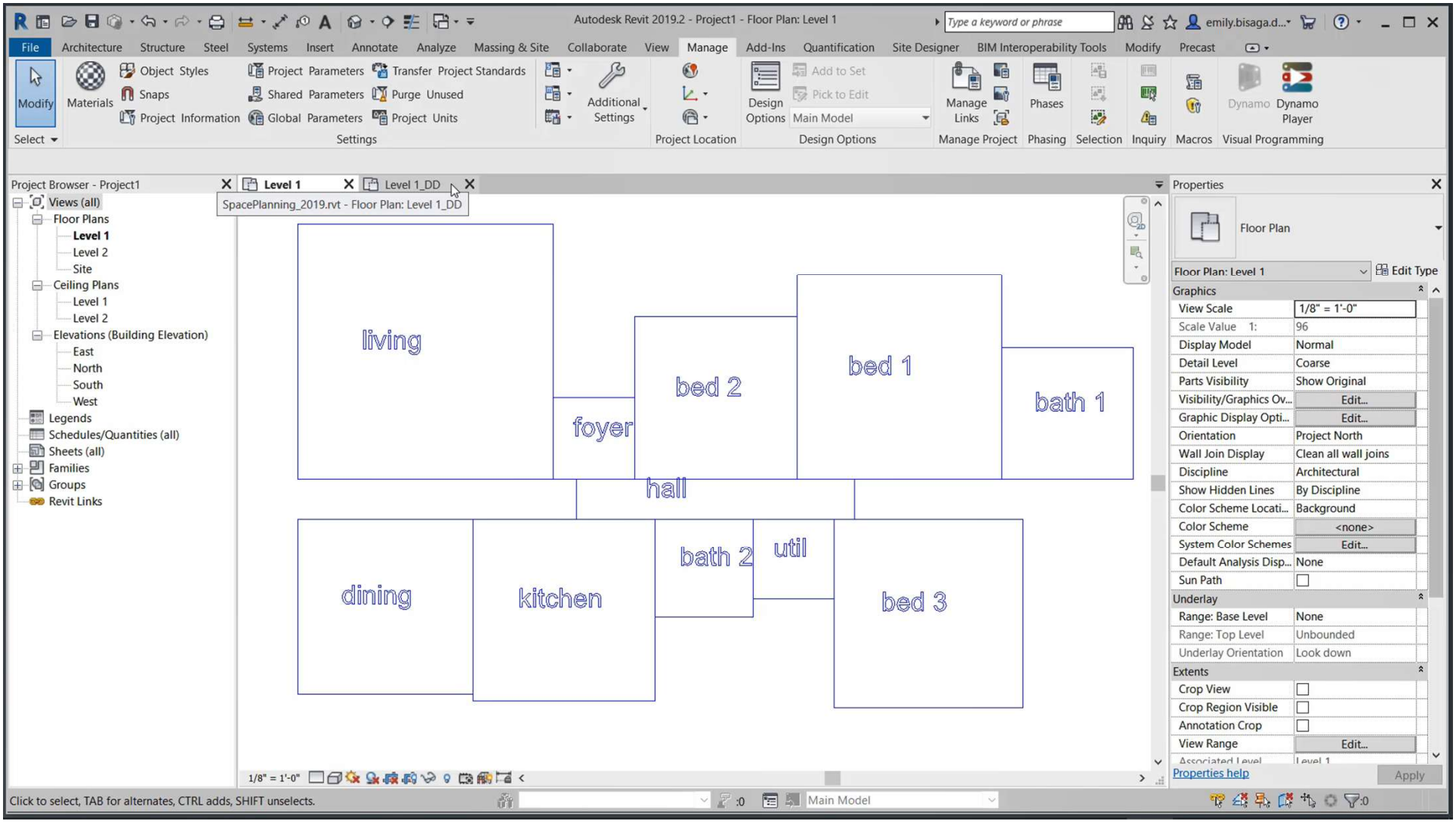
Increase Efficiency



KEY OUTCOMES:

Improve customer experience

Improve wellness


Autodesk Revit 2019.2 - Project1 - Floor Plan: Level 1
Type a keyword or phrase
emily.bisaga.d...
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Quantification
Site Designer
BIM Interoperability Tools
Modify
Precast
Modify
Select
Materials
Object Styles
Snaps
Project Information
Project Parameters
Shared Parameters
Global Parameters
Transfer Project Standards
Purge Unused
Project Units
Settings
Additional Settings
Project Location
Design Options
Add to Set
Pick to Edit
Main Model
Design Options
Manage Links
Manage Project
Phases
Phasing
Selection
Inquiry
Macros
Dynamo
Dynamo Player
Visual Programming
Project Browser - Project1
Views (all)
Floor Plans
Level 1
Level 2
Site
Ceiling Plans
Level 1
Level 2
Elevations (Building Elevation)
East
North
South
West
Legends
Schedules/Quantities (all)
Sheets (all)
Families
Groups
Revit Links
Level 1
Level 1_DD
SpacePlanning_2019.rvt - Floor Plan: Level 1_DD
living
foyer
bed 2
bed 1
bath 1
hall
dining
kitchen
bath 2
util
bed 3
1/8" = 1'-0"
Properties
Floor Plan
Floor Plan: Level 1
Edit Type
Graphics
View Scale
1/8" = 1'-0"
Scale Value 1:
96
Display Model
Normal
Detail Level
Coarse
Parts Visibility
Show Original
Visibility/Graphics Ov...
Edit...
Graphic Display Opti...
Edit...
Orientation
Project North
Wall Join Display
Clean all wall joins
Discipline
Architectural
Show Hidden Lines
By Discipline
Color Scheme Locati...
Background
Color Scheme
<none>
System Color Schemes
Edit...
Default Analysis Disp...
None
Sun Path
Underlay
Range: Base Level
None
Range: Top Level
Unbounded
Underlay Orientation
Look down
Extents
Crop View
Crop Region Visible
Annotation Crop
View Range
Edit...
Associated Level
Level 1
Properties help
Apply
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

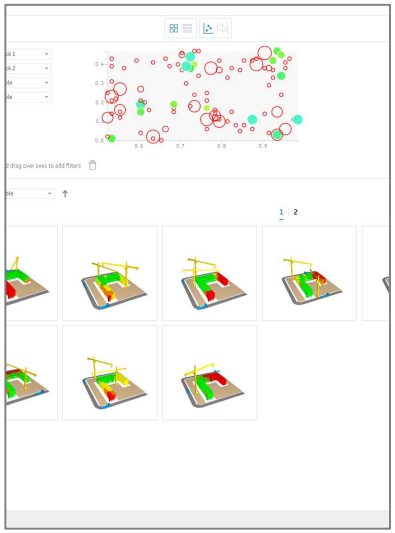
Project Objective: **Crane Position Optimization**

Developer: Dieter Vermeulen for Autodesk

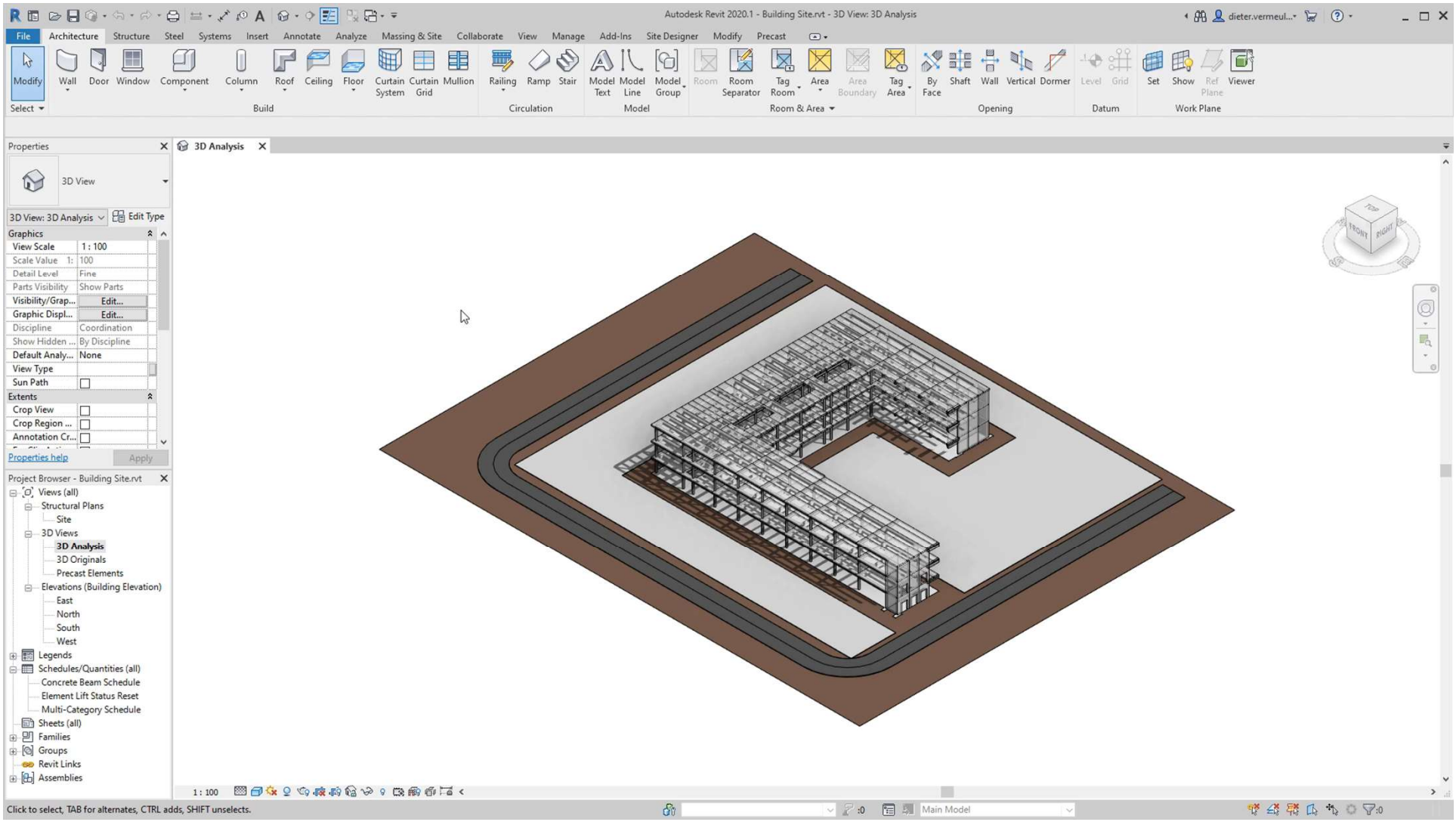
Design Objectives:

- Ensure crane locations are in best possible positions

Increase Efficiency



KEY OUTCOMES:
Reduce waste
Improve coordination


Autodesk Revit 2020.1 - Building Site.rvt - 3D View: 3D Analysis
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Site Designer
Modify
Precast
Modify
Wall
Door
Window
Component
Column
Roof
Ceiling
Floor
Curtain System
Curtain Grid
Mullion
Railing
Ramp
Stair
Model Text
Model Line
Model Group
Room
Room Separator
Tag Room
Area
Area Boundary
Tag Area
By Face
Shaft
Wall
Vertical
Dormer
Level
Grid
Set
Show
Ref Plane
Viewer
Select
Build
Circulation
Model
Room & Area
Opening
Datum
Work Plane
Properties
3D View
3D View: 3D Analysis
Edit Type
Graphics
View Scale 1 : 100
Scale Value 1: 100
Detail Level Fine
Parts Visibility Show Parts
Visibility/Grap... Edit...
Graphic Displ... Edit...
Discipline Coordination
Show Hidden ... By Discipline
Default Analy... None
View Type
Sun Path
Extents
Crop View
Crop Region ...
Annotation Cr...
Properties help
Apply
Project Browser - Building Site.rvt
Views (all)
Structural Plans
Site
3D Views
3D Analysis
3D Originals
Precast Elements
Elevations (Building Elevation)
East
North
South
West
Legends
Schedules/Quantities (all)
Concrete Beam Schedule
Element Lift Status Reset
Multi-Category Schedule
Sheets (all)
Families
Groups
Revit Links
Assemblies
3D Analysis
TOP
FRONT
RIGHT
1 : 100
Main Model
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.

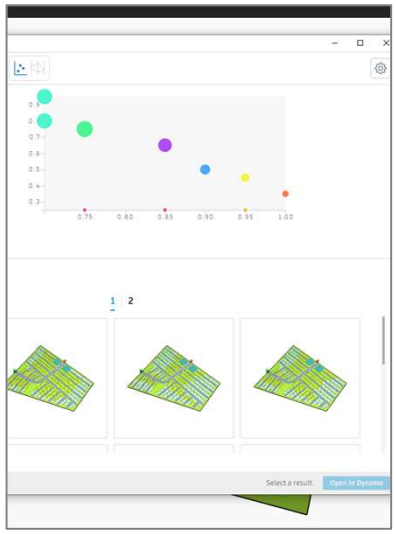
Project Objective: **Parking Layout Optimization**

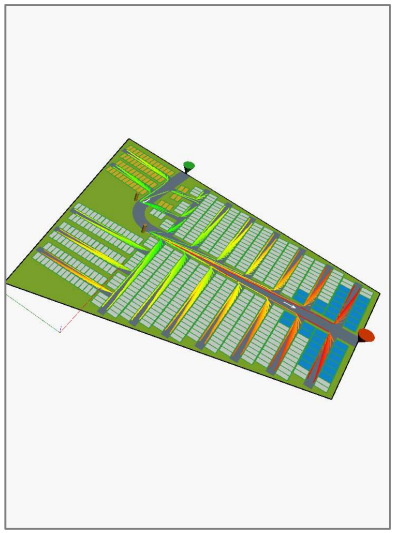
Developer: Dieter Vermeulen for Autodesk

Design Objectives:

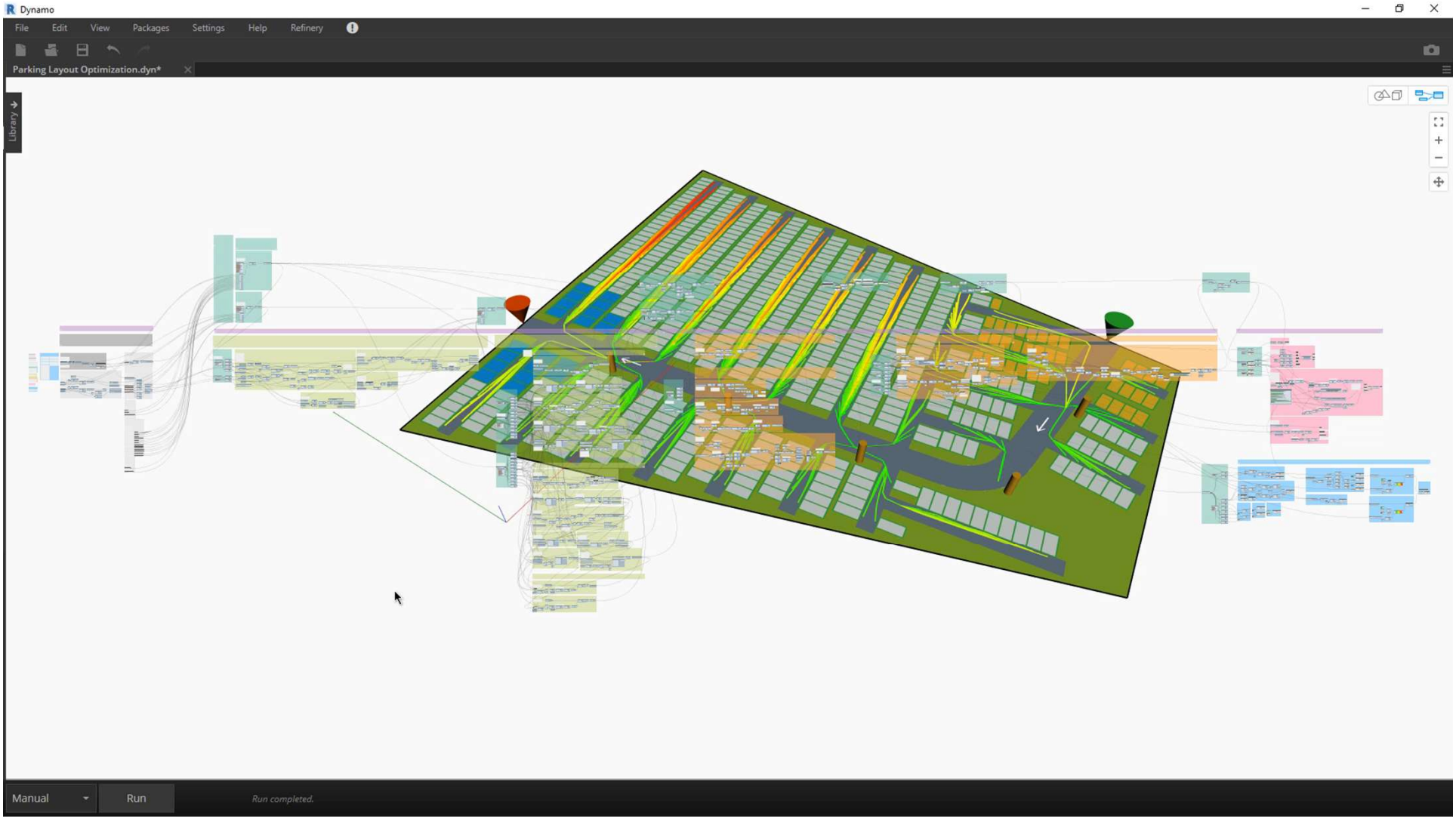
- Ensure most efficient and optimal parking layout

Increase Efficiency





KEY OUTCOMES:
Improve circulation efficiency
Reduce time to exit, Max ROI
Integrate sustainable design


Dynamo
File
Edit
View
Packages
Settings
Help
Refinery
Parking Layout Optimization.dyn*
Library
Manual
Run
Run completed.

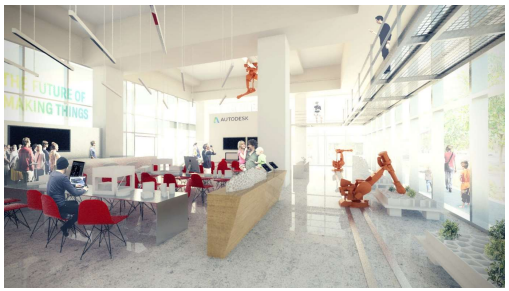
Project Objective: **Optimize Office Layout**

Developer: The Living, Autodesk

Design Objectives:

- Reduce distraction
- Accommodate varying work styles
- Optimize views to outside
- Optimize daylighting
- Improve interconnectivity
- Honor adjacency preferences

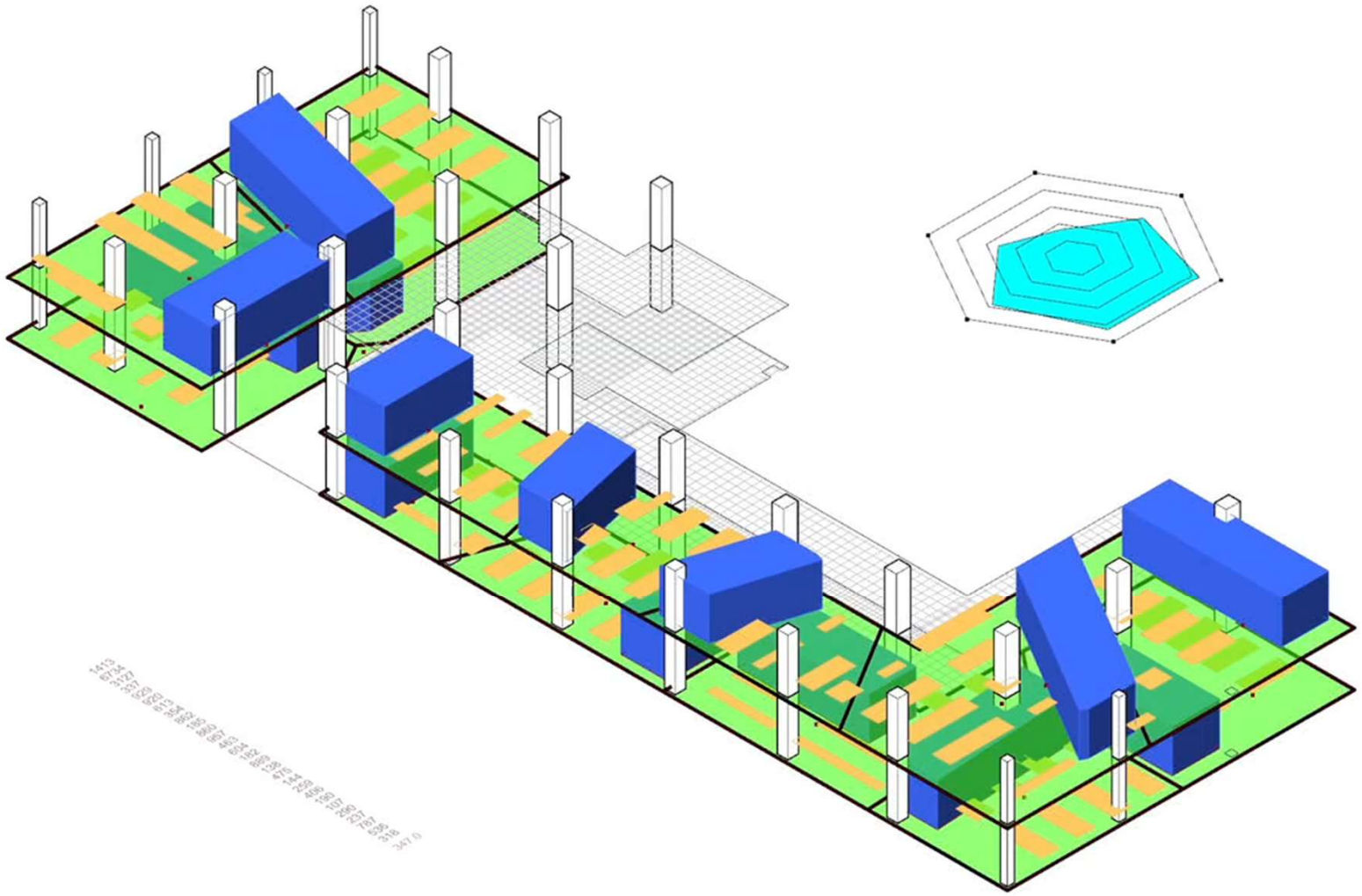
Increase Efficiency



KEY OUTCOMES:

Reduced time to optimal design discovery

Increased employee satisfaction and productivity



“We want to be able to learn from more designs than it is physically possible to generate or evaluate ‘by hand’.”

– Danil Nagy, The Living


VALUES MATTER
OUTCOMES MATTER


Rethinking the importance of **values and outcomes**.

Sampling of Values Related to Building Design

Sustainability	Completion	Experience	Exterior	Return on Investment
Cost	Preservation	Function	Interior	Maximizing FAR
Iconography	Innovation	Finish	Systems	Legacy
Maintaining Status Quo	Scale	Details	Program	Expression

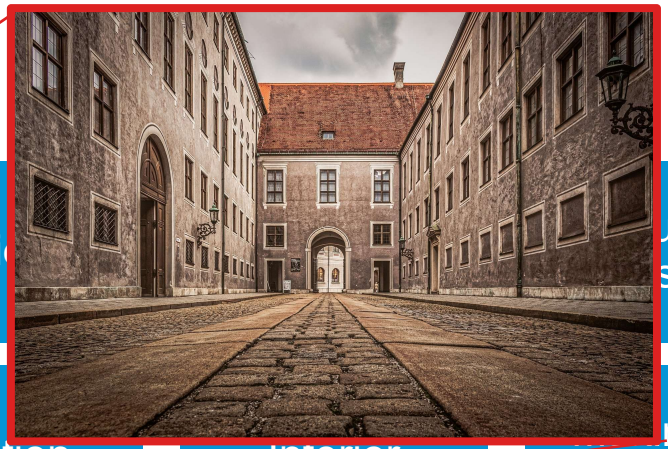
Values in Harmony

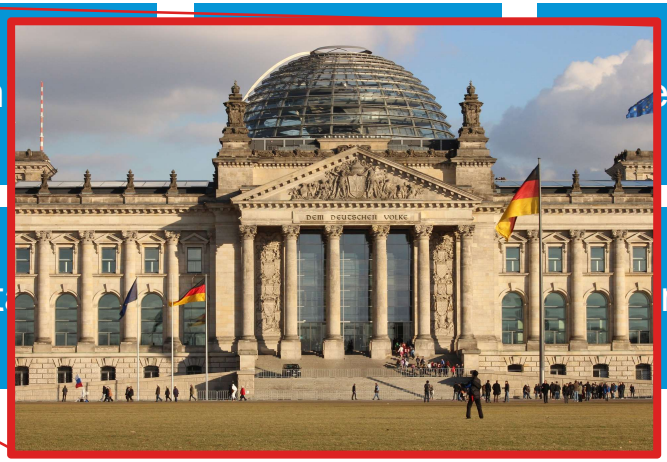
Values Possibly Coexisting Simultaneously in Project

Sustainability	Completion	Experience	Exterior	Return on Investment
Cost	Preservation	Function	Interior	Maximizing FAR
Iconography			Systems	Legacy
Maintaining Status Quo			Program	Expression

Values in Opposition

Sustainability	Completion	Experi		urn on stment
Cost	Preservation	Function	Interior	mizing FAR
Iconography	Innovation	Fin		egacy
Maintaining Status Quo	Scale	Det		ression



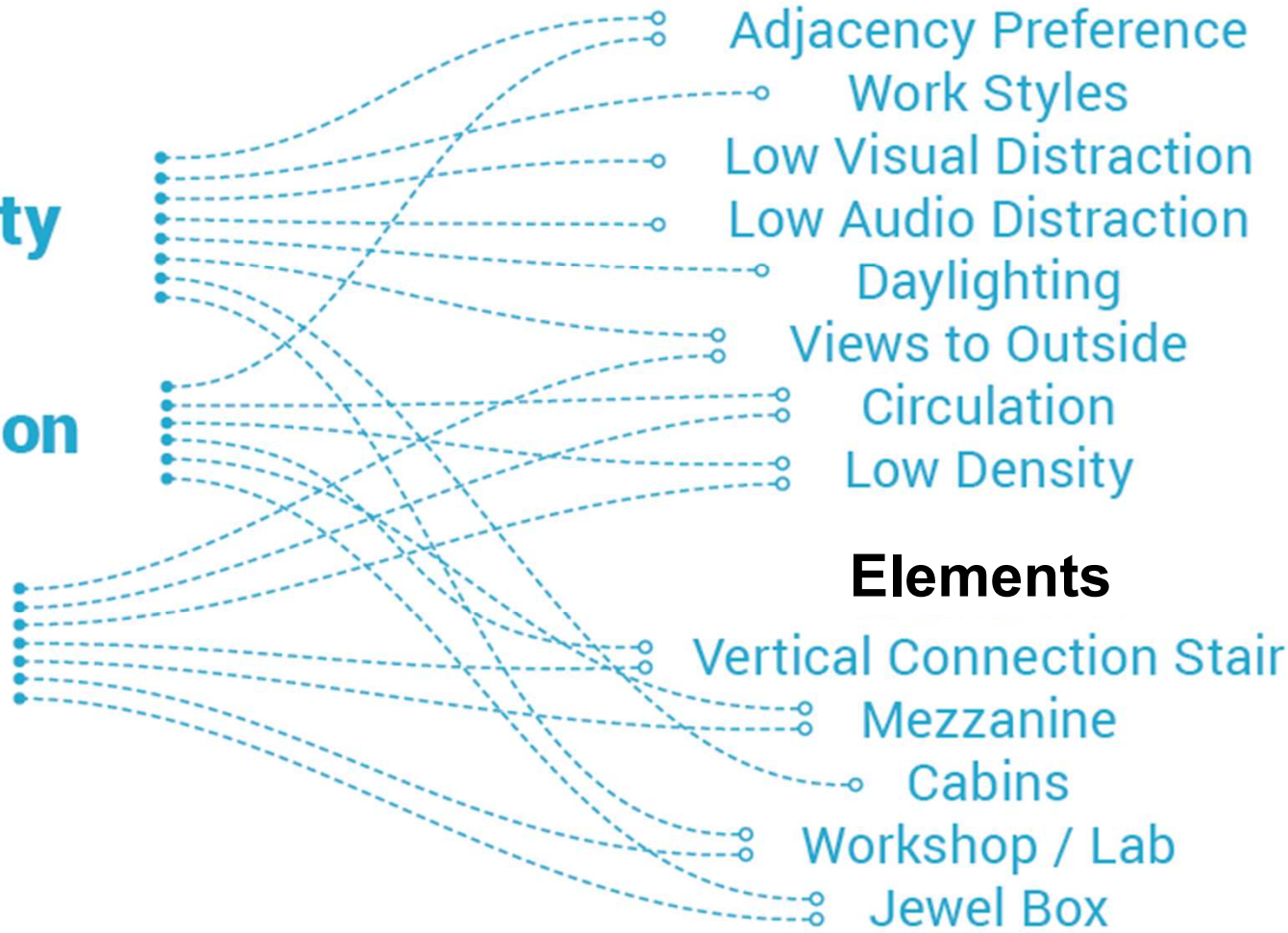


Values

+ Productivity

+ Collaboration

+ Buzz



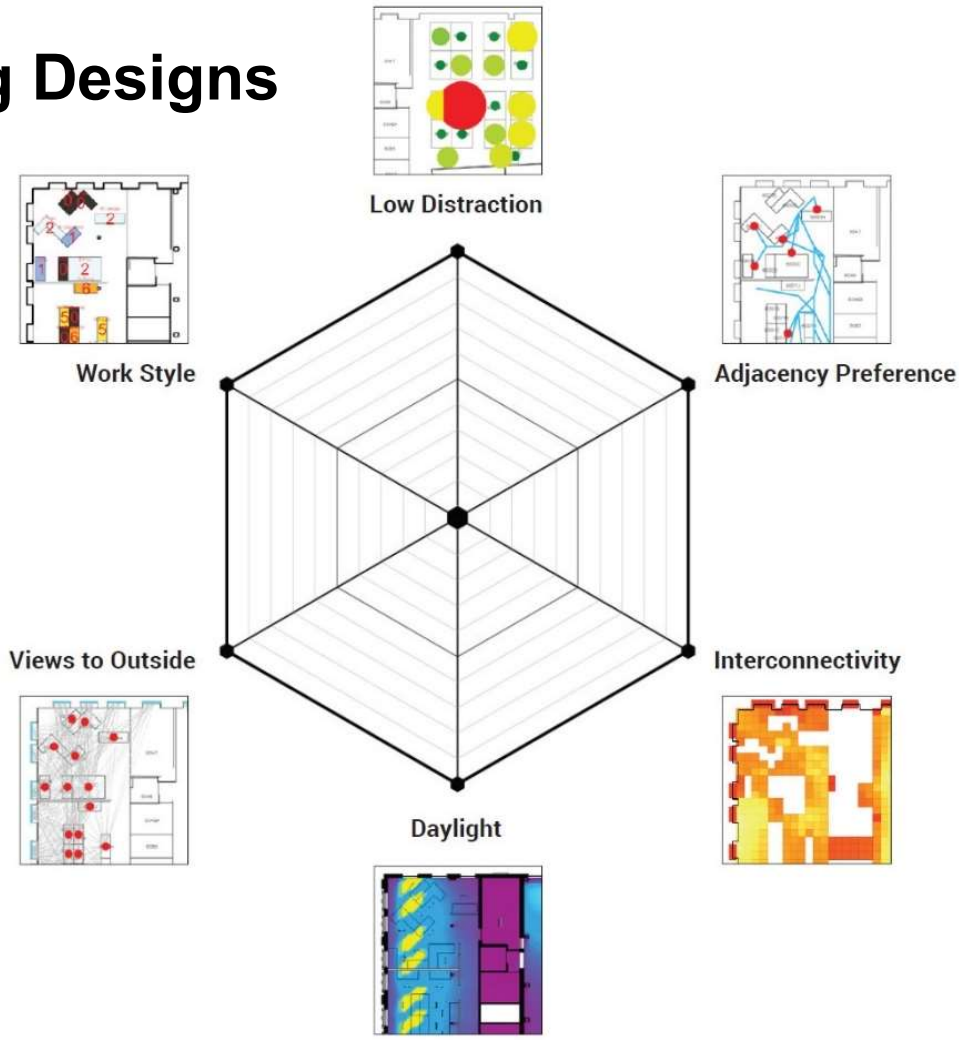
Metrics

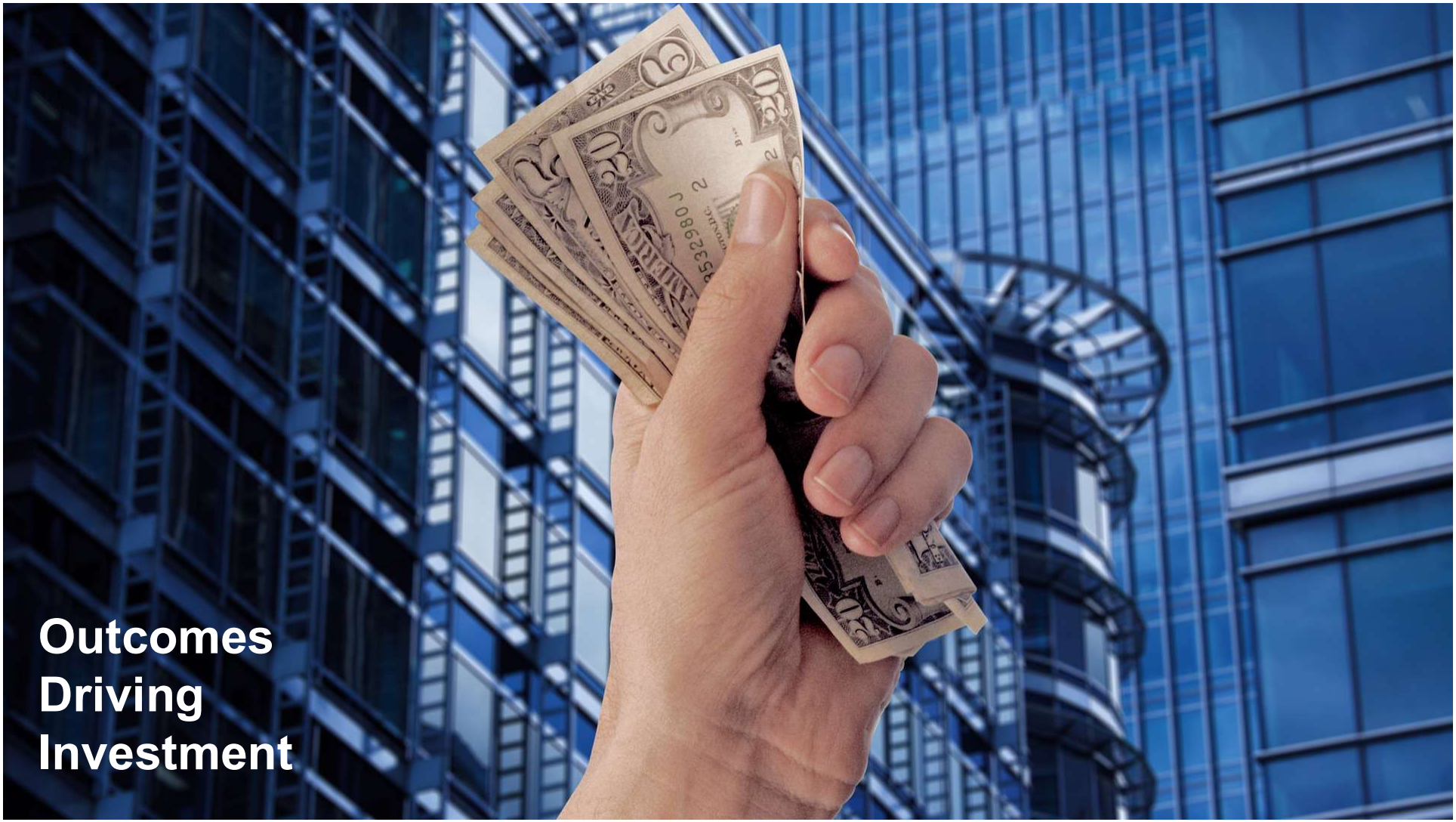
Adjacency Preference
Work Styles
Low Visual Distraction
Low Audio Distraction
Daylighting
Views to Outside
Circulation
Low Density

Elements

Vertical Connection Stair
Mezzanine
Cabins
Workshop / Lab
Jewel Box

Values Driving Designs

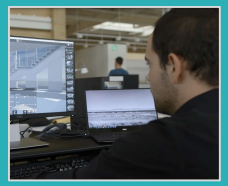



Outcomes
Driving
Investment

Power Up With Outcome-driven Design

Strategic Planning

Outcome-driven Design



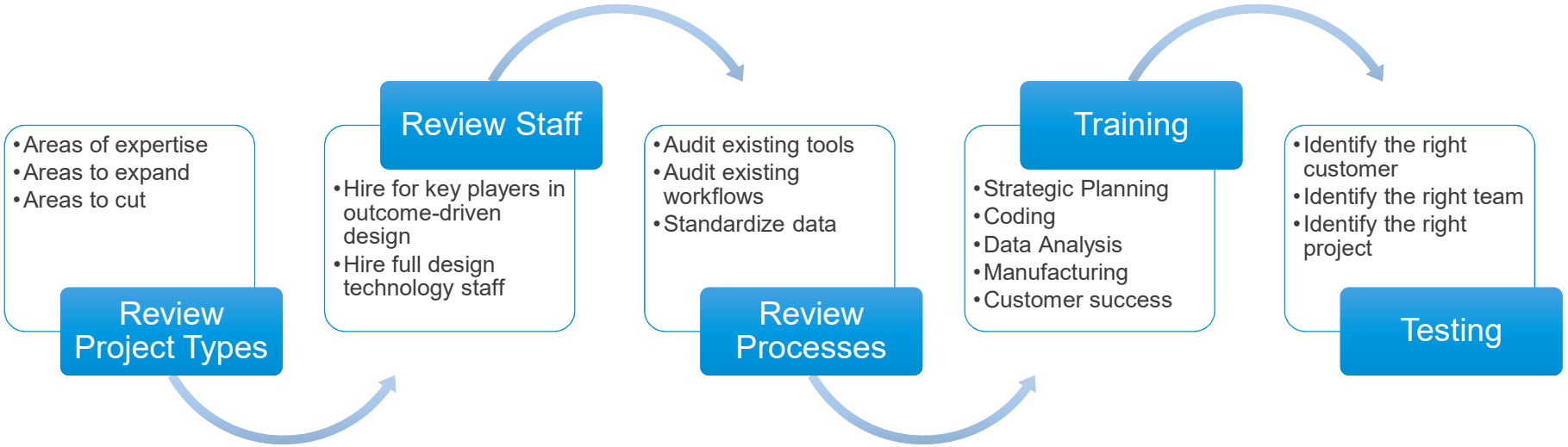
Parenthetical Analysis

Integrated Delivery

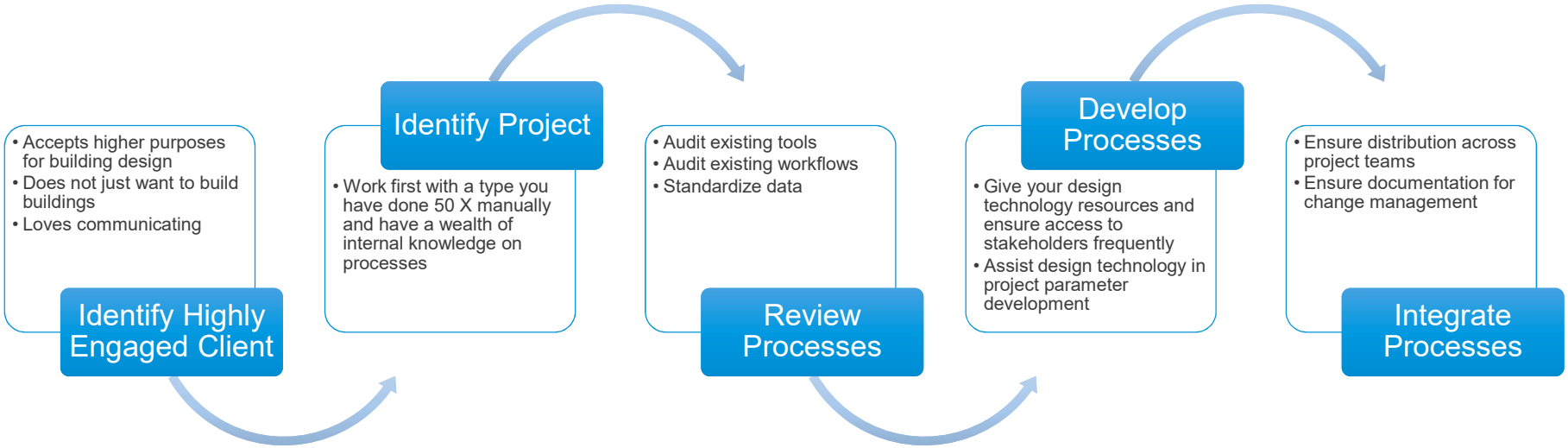
Operational Nurture

PROCESS ADOPTION OUTCOME:
BETTER BUILDINGS, FASTER, WITH LESS

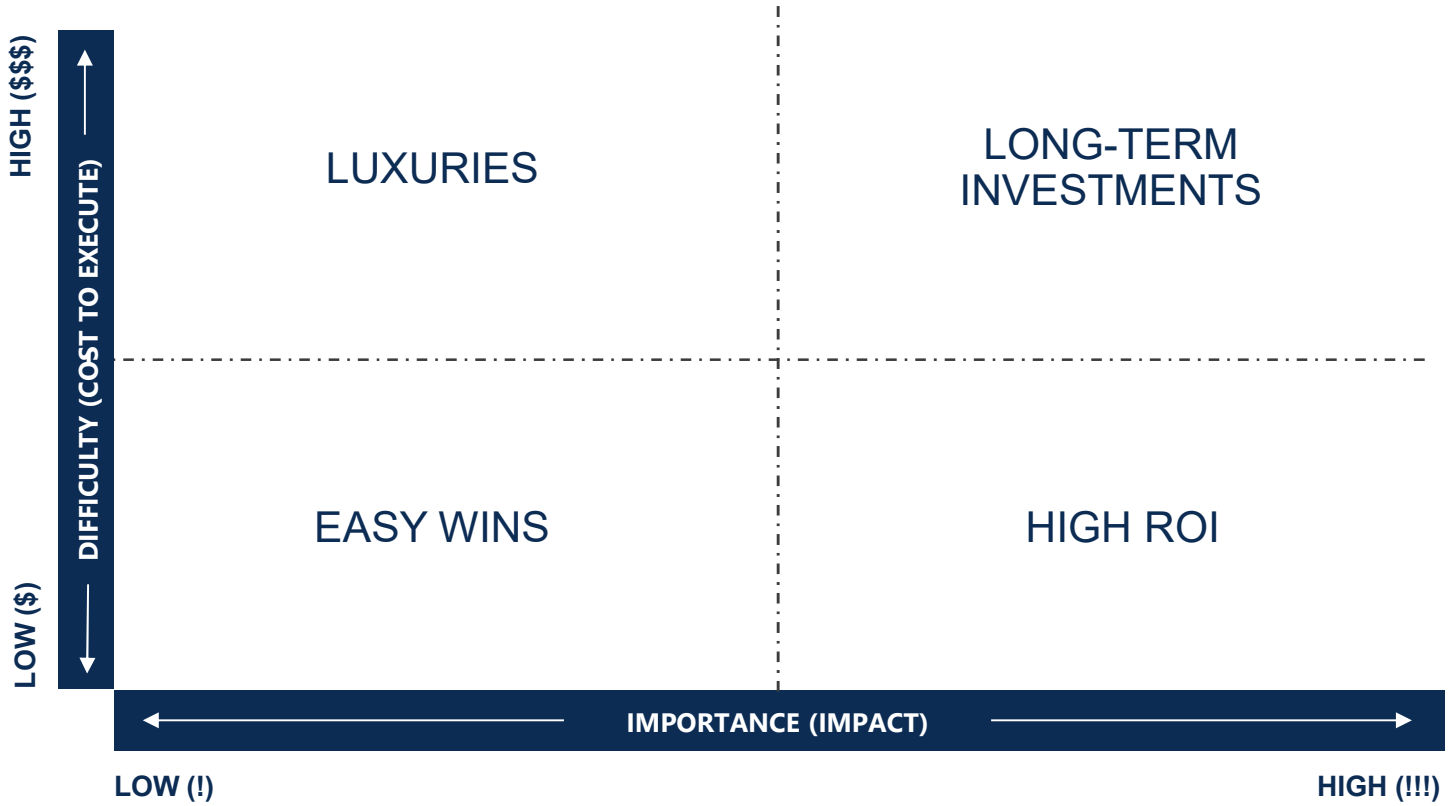
Where to Start in Redefining Project Strategy



Where to Start With Implementing Computational and Generative Design in Projects



Identifying Projects for Execution



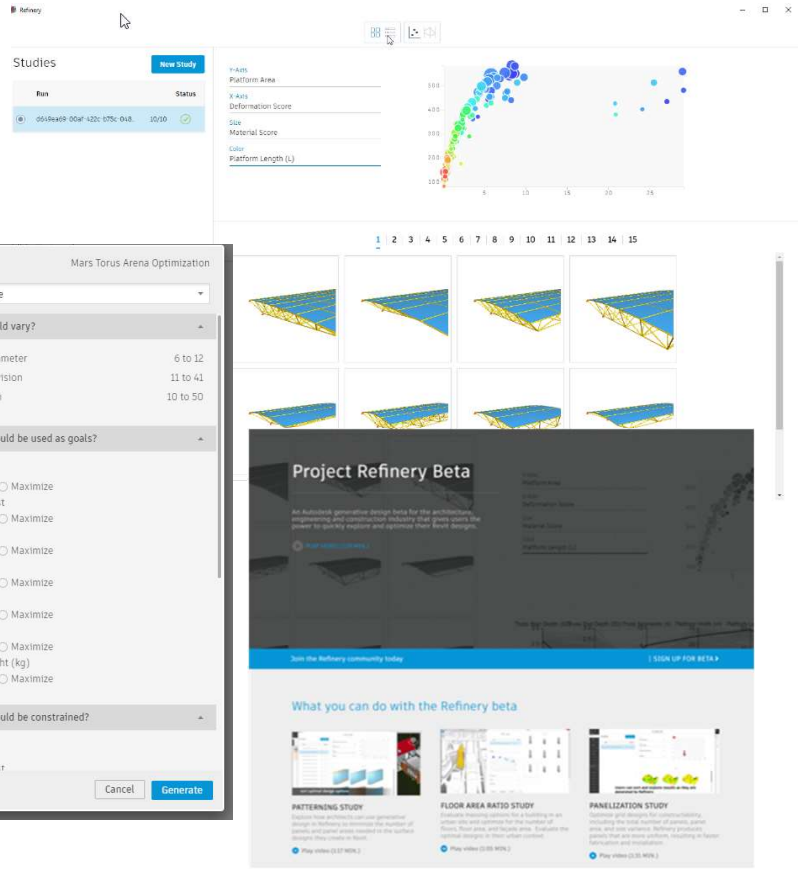
Dynamo

- Revit 2020
- Civil 3D 2020
- Advance Steel 2020
- Alias 2020
- FormIt v.17

Refinery

Public Beta Project for Generative Design in AEC

- Explore and optimize designs
- Uses NSGA-II optimization algorithm
  Learn more here:
  https://www.iitk.ac.in/kangal/Deb_NSGA-II.pdf
- Advanced results display
- Syncing selected option back to Dynamo
- More information and beta access:
  www.autodesk.com/solutions/refinery-beta



Additional Resources

Getting Started with Dynamo:

https://primer.dynamobim.org/

https://dynamobim.org/learn/

Dynamo Forum for questions, inspiration:

https://forum.dynamobim.com/

Project Refinery:

https://www.autodesk.com/solutions/refinery-beta

https://refineryprimer.dynamobim.org/

Generative Design education:

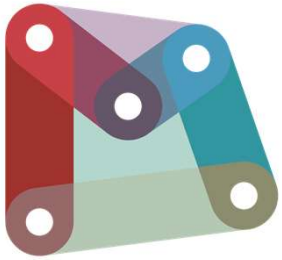
https://medium.com/generative-design

Design Script:

http://designscript.io/DesignScript_user_manual_0.1.pdf

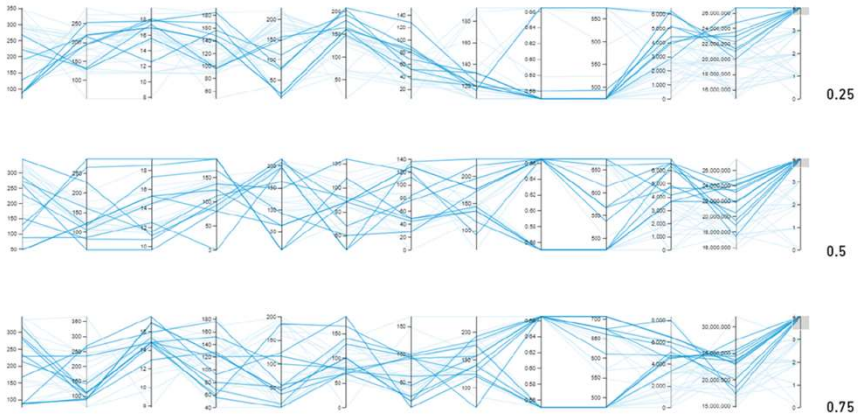
https://dynamobim.org/wp-content/links/DesignScriptGuide.pdf

https://github.com/Amoursol/dynamoDesignScript



http://dynamobim.org/a-world-of-user-groups/

Toronto Generative Design Residency

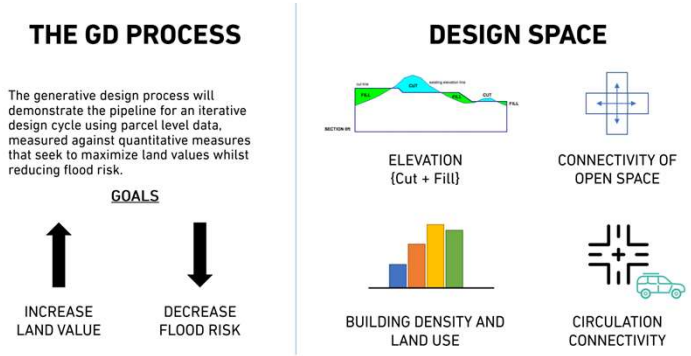


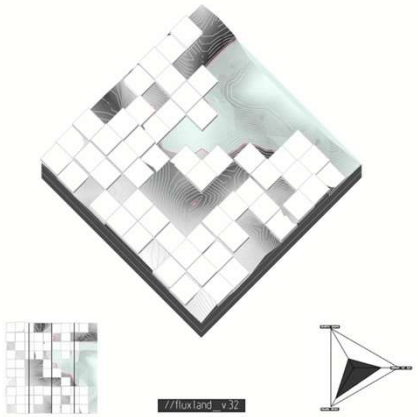
Exploring Generative Design for Coastal Resilience

Published on July 27, 2019

Isaac Seah
Incoming Business Technology Analyst

7 articles + Follow





Checklist for Outcome-driven Design Project

- ❑ Determine project is an Outcome-driven Design project
- ❑ Mandate integrated project delivery methodology
- ❑ Ensure architects, technologists, engineers, consultants, contractors and all relevant parties to the design, construction and operation of the building are signed into a contract that incentivizes design excellence and starts collaboration at the inception of the work.
- ❑ Hold a week long offsite to determine big picture goals and project strategy with the client, including techniques such as LUMA for value discovery.
- ❑ Ensure clarity around building lifecycle objectives, initiatives, tactics and key results.
- ❑ Ensure commitment to design process strategy and development trajectory up front.
- ❑ Develop flexible parametric BIM model appropriate for the building typology
- ❑ Develop parenthetic design analysis dashboard that captures the flexing design metrics
- ❑ Reduce time spent in rework and development through computational design integration
- ❑ Improve performance through holistic generative design approach at key process points
- ❑ Spend more time in tight coordination with architecture, systems and environmental teams for added value through enhanced detailing and design performance
- ❑ See project through to construction/completion with reduced errors and improved quality
- ❑ Monitor the lifecycle of the building and hold reality to proposal
- ❑ Recommend future work for the building based on usage and experience.
- ❑ Inform future typologies with results

Sampling of Opportunities for Process Automation

Schematic Design:

- Sun settings slider
- Match elements to reference plane
- Space and room data automation and manipulation
- Calculate FAR and GFA values
- Diagramming
- Expedited initial studies

Design Development:

- Scope box review
- View range management
- Parameter assignment
- Create sheets and place Views on Sheets
- Excel square footage to family instance
- Area boundary to floor element
- Populates rooms with equipment / furnishings
- Manipulating grids
- Auto-dimensions grid lines
- Automating wall chamfers
- Create levels from excel

Construction Documentation:

- Equipment to Excel
- Columns splicing
- Write to mechanical equipment
- Auto-set all equipment locations by space name
- Caissons to topography
- Create sheets and place Views on Sheets
- Populates rooms with equipment / furnishings
- Linked elements intersecting spaces data transfer
- Manipulating tags
- Updating text
- Swapping title blocks
- Place a legend on multiple sheets

Construction Administration:

- Update design quickly
- Pipe height adjustment
- Construction field report automation
- Export instance and type parameters to excel
- Shop drawing review
- Clash detection
- Coordination

Sampling of Opportunities for Generative Design

[Residential] Floor plan layout optimization

[Residential] Cabinet layout and location optimization

[Environmental] Sound reduction and wellness optimization through form location and material optimization

[Performance Hall] Seating automation and layout optimization, acoustic panel optimization

[Healthcare] Lift system location optimization

[Environmental] Building form optimization based on the impact of a shadow on a common space

[Academic] Desk layout automation and optimization

[Office] Workstation layout optimization

[Healthcare] Robotic sanitation system path of travel route optimization

[Multi-family] Unit mix automation and layout optimization

[Urban Plan] Optimize plan layout for bicycle transit requirements – think smart cities

[Engineering] Structural system optimization based on waste reduction and building envelope

Conclusions

Computational and Generative Design are influencing design strategy

A new project strategy type is unfolding: **Outcome-driven Design**

Building design is facing **process and perception** problems related to compensation

The path to increasing profit and fees starts with **design efficiency and adding value**

Computational and Generative Design

- Move the needle on design efficiency
- Add value
- Integrate into existing processes.

Implementing Generative Design in a project requires
A shift in mindset on project strategy and early implementation in a project

Reach new heights with tangible design outcomes and expanding opportunities

Where will you go next?