Standardize Virtual Design and Construction Performance Metrics and Key Performance Indicators

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The Case for Standardized Metrics

- Reliable *platform* to share data
- Basis for objective *comparisons*
- Coordinated Evidence to *inform decisions*
Standardized & Scalable Sets of KPI: Call for Global Collaboration

- Economy
- Country
- City
- Enterprise
- Project
- Facility & Infrastructure
- Processes & Meetings
- Part

Productivity Rate → Societal Impact → User Engagement → Parts Optimization

Concept: Strategic Building Innovation. bimSCORE

Sources: Teicholz | ESRI | fracturereality.io | CNN
Takeaways

1. Focus on Meaningful Metrics; prioritize what can be done.
2. Link metrics to major organizational goals
3. Standardize metrics to support head-to-head comparisons
4. Develop a Holistic System of Comparable Metrics
5. Compile reliable evidence to support decisions
6. Select metrics to inform workflow management
Focus on Meaningful Metrics, Prioritize what can be done
What really matters?

• How many clashes can be found, or how smoothly the project comes together?

• How many items can be checked off RFI lists, or how quickly we address the most critical issues?

• Keeping a regular meeting schedule, or getting things done?
Link metrics
to major organizational goals
Our Five Zeros

- Zero loss-making projects
- Zero environmental incidents
- Zero accidents
- Zero ethical breaches
- Zero defects

Based on our Code of Conduct and strategy, the Five Zeros are important that you should always be working towards.

600 DAYS DIRECT SCHEDULE REDUCTIONS
32 DAYS AVERAGE SCHEDULE DUE TO VDC PROCESS

25% AND GREATER PRODUCTIVITY INCREASES

2.95% AVERAGE DIRECT COST REDUCTIONS

Skanska Vision and Values

Metrics from Mortenson

Standardize Metrics
to support head-to-head comparison

Source: keydifferences.com
Firm BIM Maturity Comparisons

<table>
<thead>
<tr>
<th>Project</th>
<th>Score</th>
<th>Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm A</td>
<td>66</td>
<td>♦</td>
</tr>
<tr>
<td>Firm B</td>
<td>56</td>
<td>♦</td>
</tr>
<tr>
<td>Firm C</td>
<td>51</td>
<td>♣</td>
</tr>
<tr>
<td>Firm D</td>
<td>35</td>
<td>♣</td>
</tr>
<tr>
<td>Firm E</td>
<td>35</td>
<td>♣</td>
</tr>
<tr>
<td>Firm F</td>
<td>32</td>
<td>♣</td>
</tr>
<tr>
<td>Firm G</td>
<td>31</td>
<td>♣</td>
</tr>
<tr>
<td>Firm H</td>
<td>25</td>
<td>♣</td>
</tr>
<tr>
<td>Firm I</td>
<td>23</td>
<td>♣</td>
</tr>
<tr>
<td>Firm J</td>
<td>23</td>
<td>♣</td>
</tr>
<tr>
<td>Firm K</td>
<td>20</td>
<td>♣</td>
</tr>
<tr>
<td>Firm L</td>
<td>20</td>
<td>♣</td>
</tr>
</tbody>
</table>

*Note: The diagram shows the comparison of BIM maturity scores across different firms. Each firm is represented by a score and a set of icons indicating their position on the maturity scale.*
Tracking latency, average postponement, and overall commitment reliability

<table>
<thead>
<tr>
<th></th>
<th>AVERAGE LATENCY TYP A (Only Accounting Delayed Issues, Not Early Closing)</th>
<th>AVERAGE LATENCY TYP B (Accounting both Delayed Issues and Early Closing)</th>
<th>AVERAGE LATENCY TYP C (Accounting both Delayed Issues and Early Closing)</th>
<th>Average Postponement</th>
<th>Overall Commitment Reliability</th>
<th>Commitment Reliability Ranking</th>
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</thead>
<tbody>
<tr>
<td>Design Architect</td>
<td>7.0</td>
<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>21.0</td>
<td>4</td>
</tr>
<tr>
<td>Civil Design</td>
<td>4.0</td>
<td>7.0</td>
<td>7.0</td>
<td>6.0</td>
<td>24.0</td>
<td>6</td>
</tr>
<tr>
<td>Kitchen Design</td>
<td>2.0</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
<td>15.0</td>
<td>3</td>
</tr>
<tr>
<td>Executive Architect</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
<td>1.0</td>
<td>7.0</td>
<td>1</td>
</tr>
<tr>
<td>MEP Design</td>
<td>6.0</td>
<td>8.0</td>
<td>6.0</td>
<td>3.0</td>
<td>23.0</td>
<td>5</td>
</tr>
<tr>
<td>Interior Design</td>
<td>1.0</td>
<td>1.0</td>
<td>2.0</td>
<td>7.0</td>
<td>11.0</td>
<td>2</td>
</tr>
<tr>
<td>Resort</td>
<td>5.0</td>
<td>3.0</td>
<td>8.0</td>
<td>8.0</td>
<td>24.0</td>
<td>6</td>
</tr>
<tr>
<td>Owner</td>
<td>8.0</td>
<td>6.0</td>
<td>9.0</td>
<td>9.0</td>
<td>32.0</td>
<td>9</td>
</tr>
<tr>
<td>Landscape Design</td>
<td>9.0</td>
<td>0.0</td>
<td>9.0</td>
<td>9.0</td>
<td>27.0</td>
<td>8</td>
</tr>
</tbody>
</table>

Source: SBI-bimSCORE
Operational Excellence: Enterprise Facility Lifecycle BIM Program

Oprimize Maintenance • Identify & Mitigate high-risk equipment investments

Only 5% of work orders are un-scheduled

Yet 34% of labor hours are un-scheduled

89% of un-scheduled labor hours are generated by 11% of assets → high maintenance risk

HISTOGRAM of Labor Hours for Un-scheduled Work Orders (excluding outliers*)

*some outliers require 100 to 2,484 Labor Hours / Work Order

Median = 2 Labor Hours / Work Order
Develop a Holistic System of Comparable Metrics

Source: linkresearchtools.com
Global Benchmarking

Planning
- Conventional
  - Provide Vision, Standards, Measurable Objectives

Adoption
- Typical
  - Engage the Entire Ecosystem, Integrate Workflows

Technology
- Advanced
  - Advance from Representation to Optimization

Performance
- Best
  - Demonstrate Achievements

- Innovation
161 projects from the CIFE Certificate Program

- **811** total performance indicators
- **535** unique performance indicators
<table>
<thead>
<tr>
<th>Categories</th>
<th>Indicators</th>
<th>Metrics</th>
<th>Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client Objectives</td>
<td>Satisfaction</td>
<td>Client Satisfaction</td>
<td>[20] Estimate the client’s satisfaction with selected performance objectives (E.g. Sustainability, Building quality etc.)</td>
</tr>
<tr>
<td></td>
<td>Satisfaction</td>
<td>Project Performance Satisfaction</td>
<td>[14] Estimate the satisfaction for different aspects of project performance (E.g. Design clarity, Meeting effectiveness etc.)</td>
</tr>
<tr>
<td></td>
<td>Design Performance</td>
<td>Design Alternatives</td>
<td>[15] # of major design alternatives considered for the project</td>
</tr>
<tr>
<td></td>
<td>Design Performance</td>
<td>Design Robustness</td>
<td>[18] Cost of remediation / renovations performed after the completion of construction to remedy deficiencies in DESIGN</td>
</tr>
<tr>
<td></td>
<td>Construction Performance</td>
<td>Schedule Variance</td>
<td>[16] % of construction tasks completed early or on-time relative to the baseline/planned construction schedule</td>
</tr>
<tr>
<td></td>
<td>Construction Performance</td>
<td>Cost Change</td>
<td>[17.1] % of construction cost change caused by Discretionary (Intentional) changes</td>
</tr>
<tr>
<td></td>
<td>Construction Performance</td>
<td>Cost Change</td>
<td>[17.2] % of construction cost change caused by Non-Discretionary (unplanned) changes</td>
</tr>
<tr>
<td></td>
<td>Operation Performance</td>
<td>Operation Reliability/Construction Quality</td>
<td>[19] Total % of operation/maintenance issues reported in the first five (5) years of operation</td>
</tr>
<tr>
<td></td>
<td>ICE</td>
<td>Decision Durability</td>
<td>[11.1] % of construction costs resulting from changed decisions</td>
</tr>
<tr>
<td></td>
<td>ICE</td>
<td>Stakeholder Engagement</td>
<td>[11.2] List typical root causes of changed decisions</td>
</tr>
<tr>
<td></td>
<td>ICE</td>
<td>Response Management</td>
<td>[12] % of re-visited decisions</td>
</tr>
<tr>
<td></td>
<td>BIM</td>
<td>Level of Development (LoD)</td>
<td>[6] % of BIM objects that meet targeted LoD requirements BY DISCIPLINE</td>
</tr>
<tr>
<td></td>
<td>BIM</td>
<td>Model Element LoD Compliance by Discipline</td>
<td>[7] % of BIM objects that meet targeted LoD requirements by MODEL USE</td>
</tr>
<tr>
<td></td>
<td>BIM</td>
<td>Model Element LoD Compliance by Model Use</td>
<td>[8] % of BIM objects that meet targeted attribute DATA requirements by MODEL USE</td>
</tr>
<tr>
<td></td>
<td>PPM</td>
<td>Commitment Reliability</td>
<td>[9] % of design and construction issues and/or decisions that are resolved on or before their original commitment date</td>
</tr>
<tr>
<td></td>
<td>PPM</td>
<td>Commitment Reliability</td>
<td>[10] Average latency (# of days late) of design and construction issues and/or decisions relative to their commitment date</td>
</tr>
</tbody>
</table>

600+ Metrics >> 10 Key Performance Indicators >> 5 Categories
### ICE (Integrated Concurrent Engineering): Decision Durability

- On average, 31% decisions are revisited

### 5 Categories of Key Performance Indicators

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<th>Inputs</th>
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<td>Client Objectives</td>
<td>Satisfaction</td>
<td>Client Satisfaction</td>
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<td></td>
<td>Satisfaction</td>
<td>Project Performance Satisfaction</td>
<td>[14] Estimate the satisfaction for different aspects of project performance (e.g., design clarity, meeting effectiveness etc.)</td>
</tr>
<tr>
<td></td>
<td>Design Alternatives</td>
<td>Design Alternatives</td>
<td>[15] Number of major design alternatives considered for the project and number of additional revisions performed after the major design alternatives were selected</td>
</tr>
<tr>
<td></td>
<td>Project Completion Schedule</td>
<td>Schedule Variance</td>
<td>[16] % of construction tasks completed early or on-time relative to the baseline/planned construction schedule</td>
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<tr>
<td></td>
<td>Schedule Performance</td>
<td>Cost Change</td>
<td>[17,1] % of construction cost change caused by Discretionary (intentional) changes, [17,2] % of construction cost change caused by Non-Discretionary (non-intentional) changes</td>
</tr>
<tr>
<td></td>
<td>Operation Performance</td>
<td>Operation Reliability/Construction Quality</td>
<td>[19] Total % of operation/maintenance issues reported in the first five (5) years of operation</td>
</tr>
</tbody>
</table>

### ICE for Decision Management

- Decision Durability
  - [11.1] % of construction costs resulting from changed decisions
  - [11.2] List typical root causes of changed decisions
  - [12] % of re-visited decisions

### BIM

- Level of Development (LoD)
  - Model Element LoD Compliance by Discipline
  - Model Element LoD Compliance by Model Use
  - Model Element DATA Compliance by model use

- Data Compliance
  - % of BIM objects that meet targeted LoD requirements by DISCIPLINE
  - % of BIM objects that meet targeted LoD requirements by MODEL USE
  - % of BIM objects that meet targeted attribute DATA requirements by MODEL USE

### PPM

- Commitment Reliability
  - Commitment Reliability

---

**600+ Metrics >> 10 Key Performance Indicators >> 5 Categories**
Compile reliable evidence to support decisions

Source: conceptdraw.com
**Evidence** - Comparable performance metrics correlated to decisions

**Advice** - Inform decisions to achieve desired outcomes
1973

New York → Houston
2.5 Hours (1973) → 4 Hours (2018)

London → Edinburgh
1 hr 15 mins (1995) → 1 hr 25 mins (2018)

Madrid → Barcelona

2018

Add an average of **two minutes** to each flight since 2008

$ 1,360,000 saving

Lightweight Carbon fibre composites for airplane:

- Can reduce the weight of an aircraft by up to 20%
- Each kg cut means a saving of roughly $1m in costs over the lifetime of an aircraft

Source: https://www.bbc.co.uk/news/business-25833264
<table>
<thead>
<tr>
<th></th>
<th>Typical Hotel Guestroom</th>
<th>Hospital Bathroom</th>
<th>Prefabricated Hospital Bathroom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># of Parts</strong></td>
<td>8,350 – 12,650</td>
<td>4,000</td>
<td>60</td>
</tr>
<tr>
<td><strong>For 440 Bathrooms:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>98.5% Reduction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>from 1,700,000 to 25,000</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Select metrics to inform workflow management
Controllable Factors

- Publish Goals and Provide meaningful management information
- Adopt and Integrate technology to achieve goals
- 80% Commitment Reliability

Uncontrollable Factors

- Economic Downswings
- Skilled Labor Availability
- Client Decision-making
Outcome Metrics  Lagging / Product / Result Indicators

- Project meets Quality Expectations
- Minimized Field Coordination Defects
- Project on Budget & on Time

Control Metrics  Leading / Process / Action Indicators

- 3D Visualization 100% for Critical Areas
- 90% BIM Coordination in every working session
- 80% Commitment Reliability
BIM Authoring Turnaround Time

- 2 months
- 2 weeks
- 2 days

Managing Priorities

- Listing 100+ unfiltered clashes
- Focusing on 10 design issues
- Optimizing design alternatives

Quantity Take Off Time

- 1 day / floor
- 1 hour / floor
- 15 min / floor

Fragmented

Interim Progress

Integrated
Invest in Meetings

# of Attendees = 10 – 20 professionals
Rate = $80 - 150/hr
Duration = 1 - 3 hours
Frequency = 12 - 50 meetings / yr
Cost = $9000 - $450,000 / yr
10% waste = $900 - $45,000 / yr
Compare the outcomes...

**Traditional Practice**
- 50 person hours / issue
- Per Issue = $7,500

**Advanced Practice**
- 29 person hours / issue
- Per Issue = $4,370

**Time Reduction**
- ≥ 81%

Source: bimSCORE
<table>
<thead>
<tr>
<th>Company</th>
<th>Discussing</th>
<th>Presenting</th>
<th>Listening</th>
<th>Sidebar</th>
<th>Solo</th>
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<tbody>
<tr>
<td>TOTAL</td>
<td>29%</td>
<td>6%</td>
<td>51%</td>
<td>1%</td>
<td>12%</td>
</tr>
<tr>
<td>Company A</td>
<td>47%</td>
<td></td>
<td>52%</td>
<td></td>
<td></td>
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<tr>
<td>Company B</td>
<td></td>
<td>63%</td>
<td>37%</td>
<td>0%</td>
<td></td>
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<tr>
<td>Company C</td>
<td></td>
<td>85%</td>
<td></td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Company D</td>
<td></td>
<td>60%</td>
<td></td>
<td>40%</td>
<td></td>
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<tr>
<td>Company E</td>
<td>41%</td>
<td>4%</td>
<td>38%</td>
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<tr>
<td>Company F</td>
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<td>Company G</td>
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<td>Company J</td>
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<td></td>
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<td>Company K</td>
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<td>11%</td>
<td>46%</td>
<td>7%</td>
<td>3%</td>
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<tr>
<td>Company L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>57%</td>
</tr>
</tbody>
</table>

Source: bimSCORE
On average, executives report investing an average of 23 hours/week in meetings in which 34% of the time is wasted.

"Most employees attend 62 meetings/month"

There are more than 3 billion meetings per year. Executive on average spend 40-50% of their working hours in meetings.

From "How CEOs Manage Time?" by Michael E. Porter and Nitin Nohria, Harvard Business Review
Contact Us

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