The Value of Building Commissioning Study (NCCx Results)

Working Together. Building Excellence.

Tom Poeling, PE, CEM, CCP

2019 BCxA President

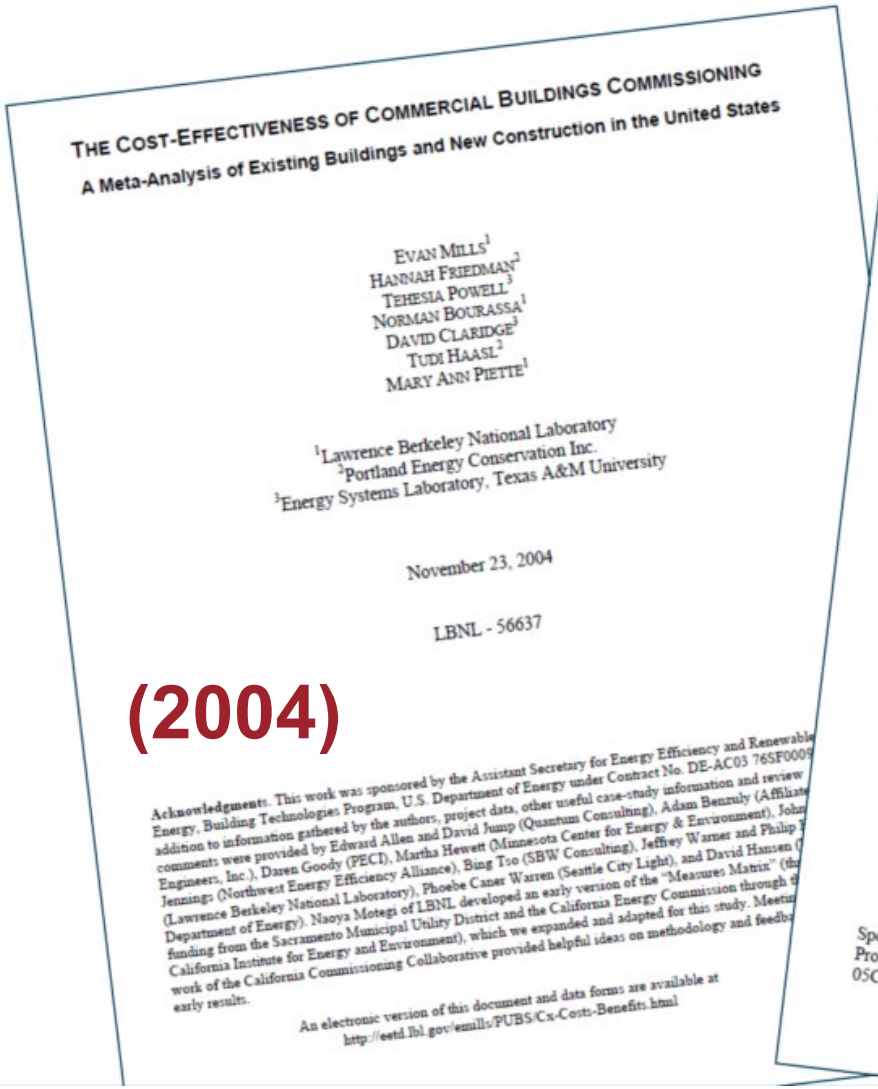
Director – U.S. Engineering Construction

BCxA™ Building Commissioning Association

Learning Objectives

1. Present the results of a joint BCxA/LBNL study that provides updated metrics on the value of (NCCx) commissioning.
2. Provide data that can be used by commissioning stakeholders to promote the industry.
3. Understand market opportunities to improve the commissioning industry.
4. Understand Cx scope of work improvements to improve delivery process.

Prior LBNL Studies – Cost Effectiveness of Commercial Building Commissioning



THE COST-EFFECTIVENESS OF COMMERCIAL BUILDINGS COMMISSIONING

A Meta-Analysis of Existing Buildings and New Construction in the United States

EVAN MILLS[1]
HANNAH FRIEDMAN[2]
TEHESIA POWELL[3]
NORMAN BOURASSA[1]
DAVID CLARIDGE[3]
TUDI HAASL[2]
MARY ANN PIETTE[1]

[1]Lawrence Berkeley National Laboratory
[2]Portland Energy Conservation Inc.
[3]Energy Systems Laboratory, Texas A&M University

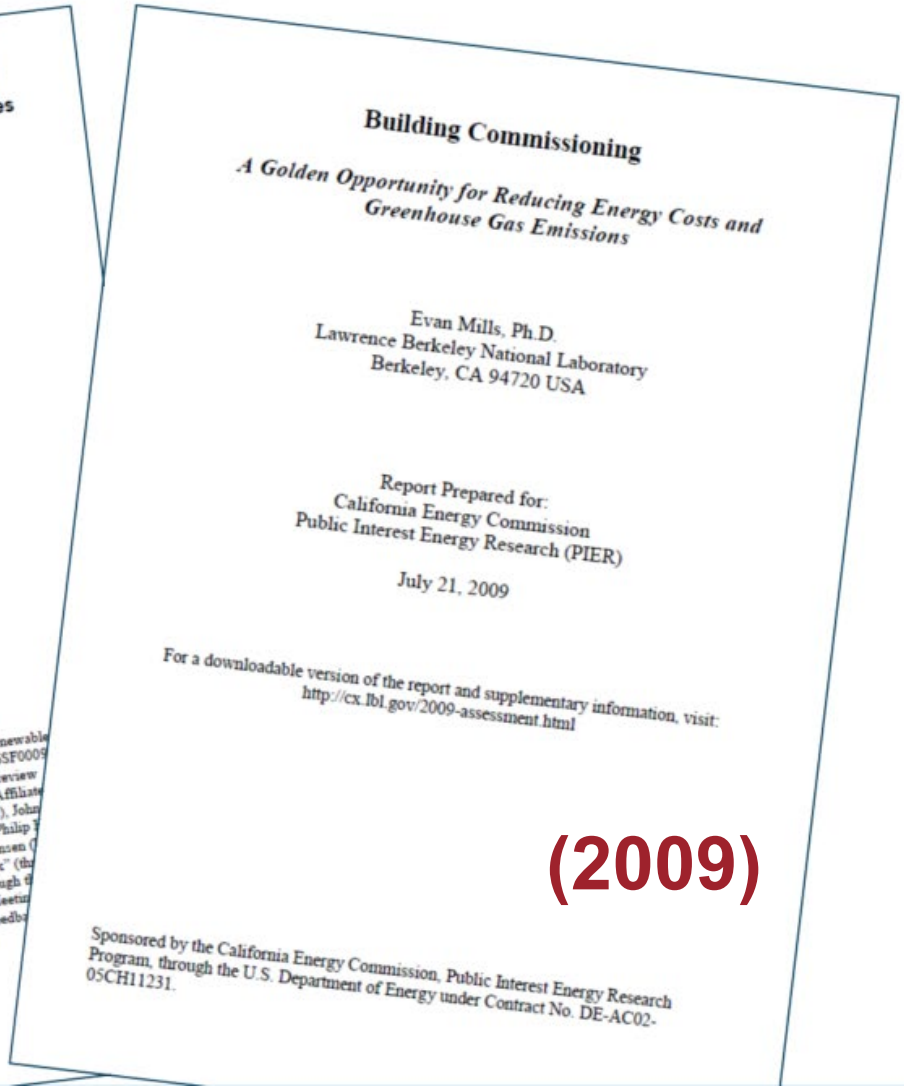
November 23, 2004

LBNL - 56637

(2004)

Acknowledgments. This work was sponsored by the Assistant Secretary for Energy Efficiency and Renewable Energy, Building Technologies Program, U.S. Department of Energy under Contract No. DE-AC03 76SF0009 addition to information gathered by the authors, project data, other useful case-study information and review comments were provided by Edward Allen and David Jump (Quantum Consulting), Adam Benzuly (Affiliate Engineers, Inc.), Daren Goody (PECI), Martha Hewett (Minnesota Center for Energy & Environment), John Jennings (Northwest Energy Efficiency Alliance), Bing Tso (SBW Consulting), Jeffrey Warner and Philip (Lawrence Berkeley National Laboratory), Phoebe Caner Warren (Seattle City Light), and David Hansen (Department of Energy). Naoya Motegi of LBNL developed an early version of the "Measures Matrix" (th funding from the Sacramento Municipal Utility District and the California Energy Commission through t California Institute for Energy and Environment), which we expanded and adapted for this study. Meetin work of the California Commissioning Collaborative provided helpful ideas on methodology and feedb early results.

An electronic version of this document and data forms are available at
http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html



Building Commissioning

A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions

Evan Mills, Ph.D.
Lawrence Berkeley National Laboratory
Berkeley, CA 94720 USA

Report Prepared for:
California Energy Commission
Public Interest Energy Research (PIER)

July 21, 2009

For a downloadable version of the report and supplementary information, visit:
http://cx.lbl.gov/2009-assessment.html

(2009)

Sponsored by the California Energy Commission, Public Interest Energy Research Program, through the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

Value of Commissioning Study - Goals

- Refresh the LBNL 2009 survey
  - Maintain consistency in the dataset
  - Reflect changes to the industry due to maturity
  - Define effects of changes to Cx approach (such as Ongoing Cx)
  - Include economics for Cx of new and additional systems
  - Expand database for different building types, markets
- Establish new baseline for Cx metrics
- Identify appropriate level of data to gather
- Create an iterative process for data gathering
- Engage industry to provide more feedback over time on project level and market level trends

Value of Commissioning Study

Data Survey - LBNL

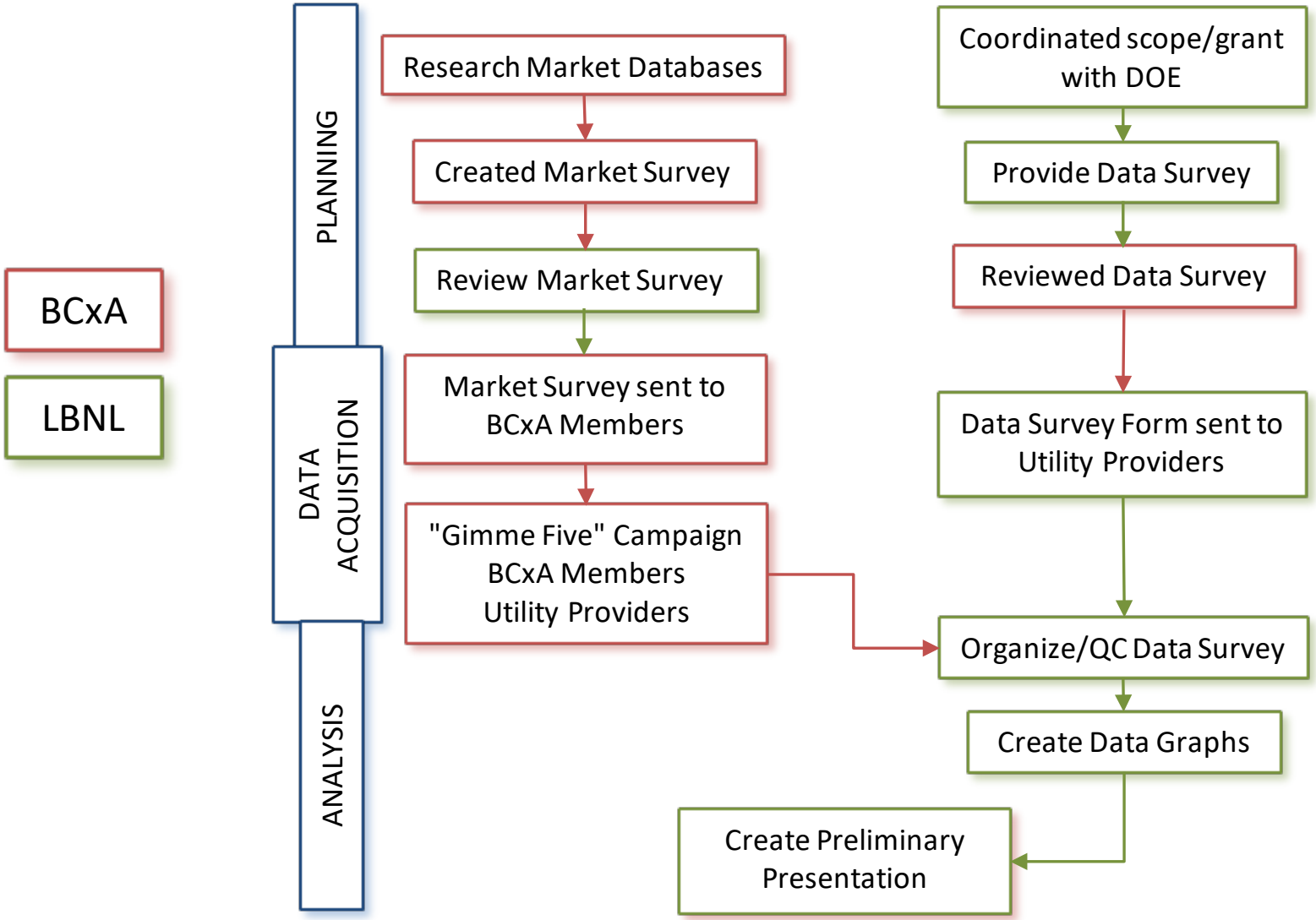
(NCCx, EBCx, OCx)

- Project Specific Description
- Reason for Cx
- Deficiencies & Measures
- Cx Cost Data
- Scope of Cx
- Baseline Energy Use & Savings
- Non-Energy Impacts

Market Survey - BCxA

- Company information
- Certification
- NCCx Market Factors
- NCCx SOW Tasks
- EBCx Market Factors
- EBCx Economics
- EBCx SOW Tasks
- OCx Economics
- OCx SOW Tasks

BCxA / LBNL Roles



Data Survey Statistics

New Construction Cx	2009 Study	2018 Study
# of Buildings	82	101
# of Projects (w/cost data)	74	71
Floor Area (SF)	8,813,925	22,217,059
Construction Cost	$2.2B	$10.1B
# of States Represented	10	18

Existing Building Cx	2009 Study	2018 Study
# of Buildings (total)	562	738
# of Projects (w/energy savings data)	300	705
Floor Area (SF)	90,410,884	252,159,847
# of States Represented	21	18

Discussion Topics

- Building data: Preliminary narratives regarding Cx Value metrics
  1. **NCCx – Cost Summary**
  2. **NCCx – Market Demand Factors**
  3. **NCCx – Scope of Work Observations**
- Review Data Survey Results
  - What's Changed?
  - Check Calibration
  - Market Drivers & Issues

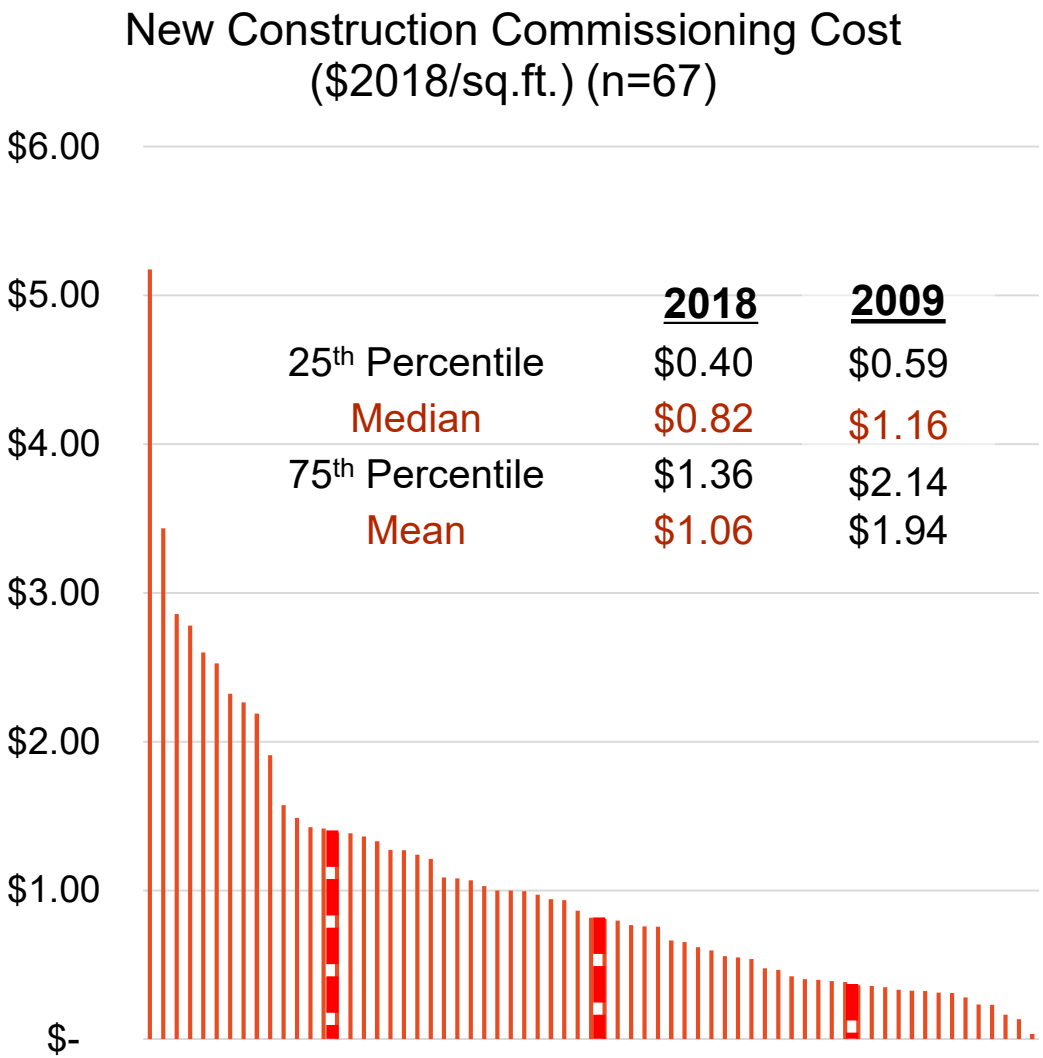
Value of Cx (NCCx) Study Results

Cost Summary

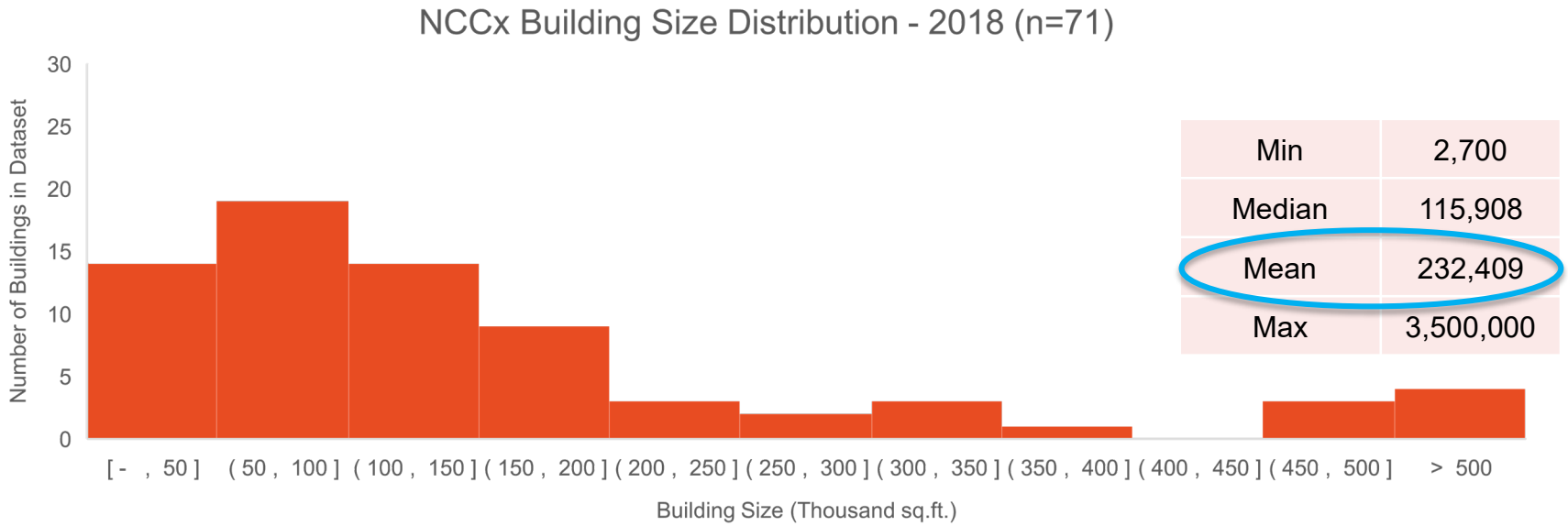
Market Demand Factors

Scope of Work Observations

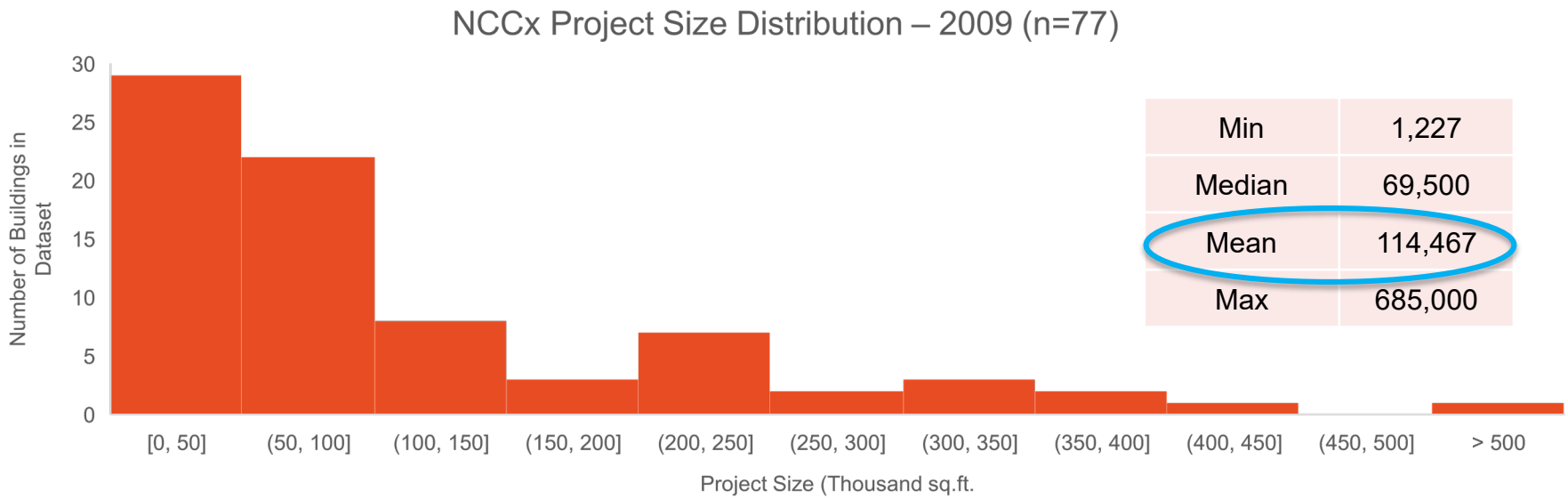
NCCx Cost per Square Foot



Building Size Distribution: NCCx

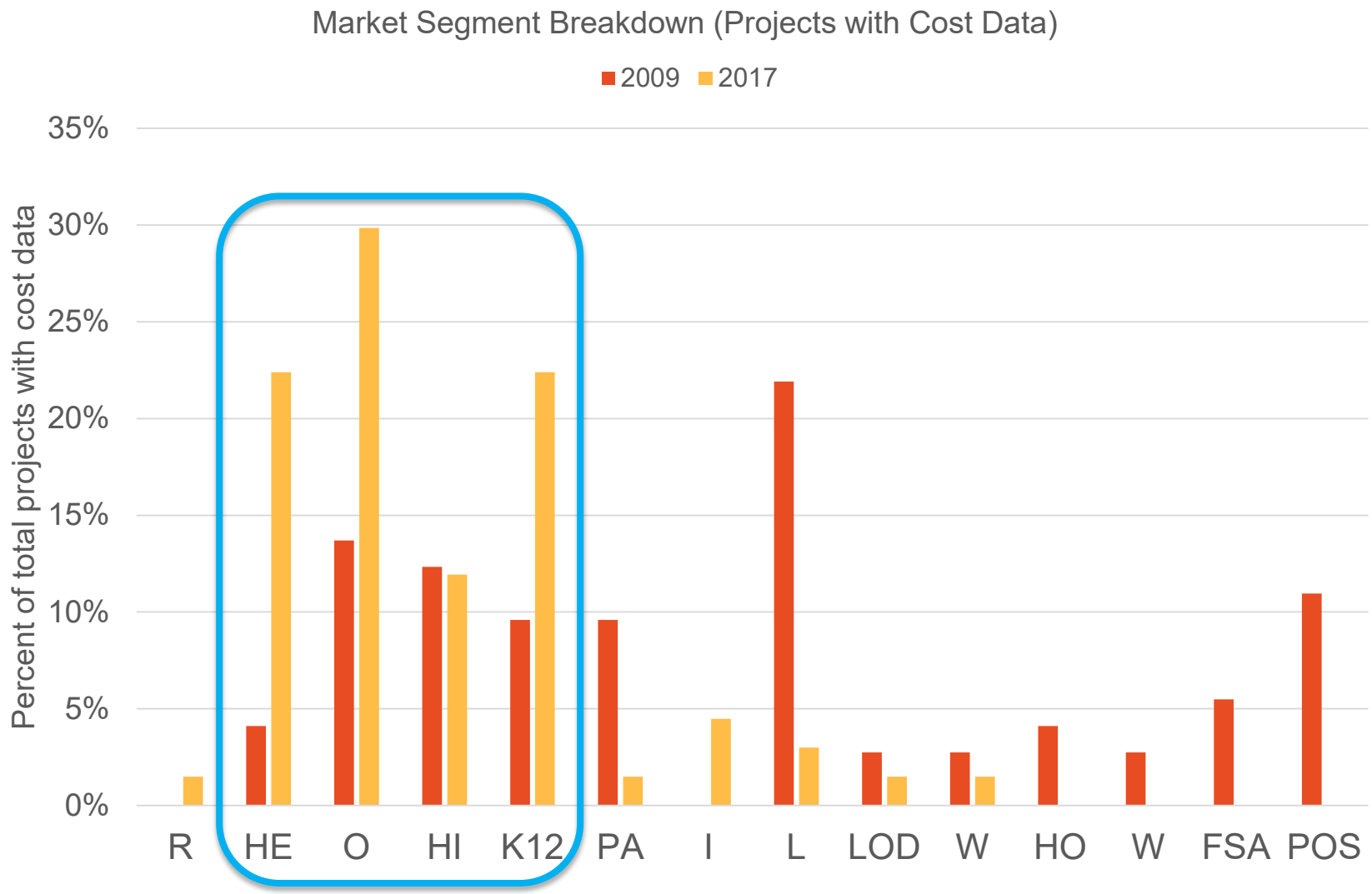


Min	2,700
Median	115,908
Mean	232,409
Max	3,500,000



Min	1,227
Median	69,500
Mean	114,467
Max	685,000

NCCx Cost by Building Type



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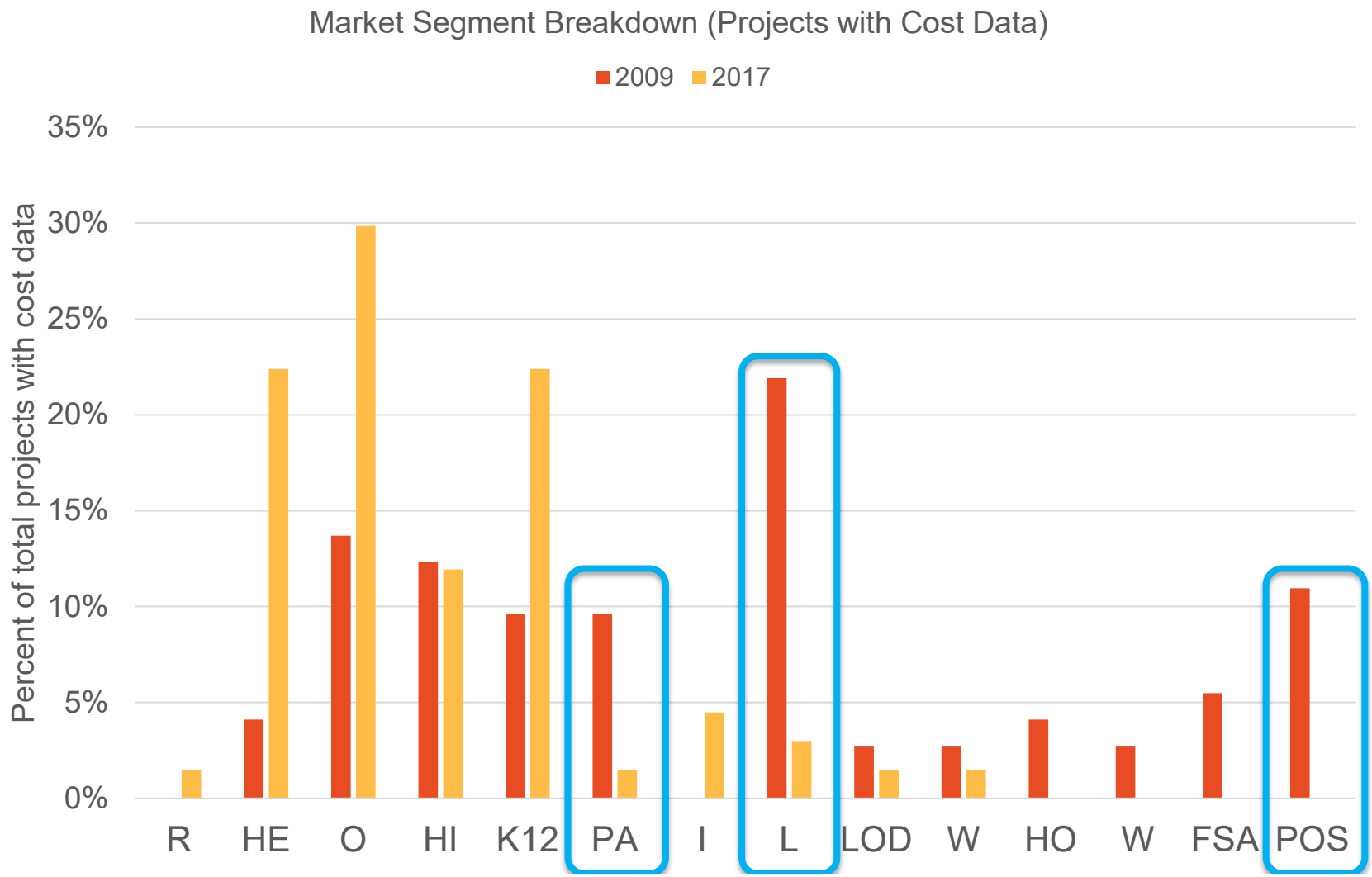
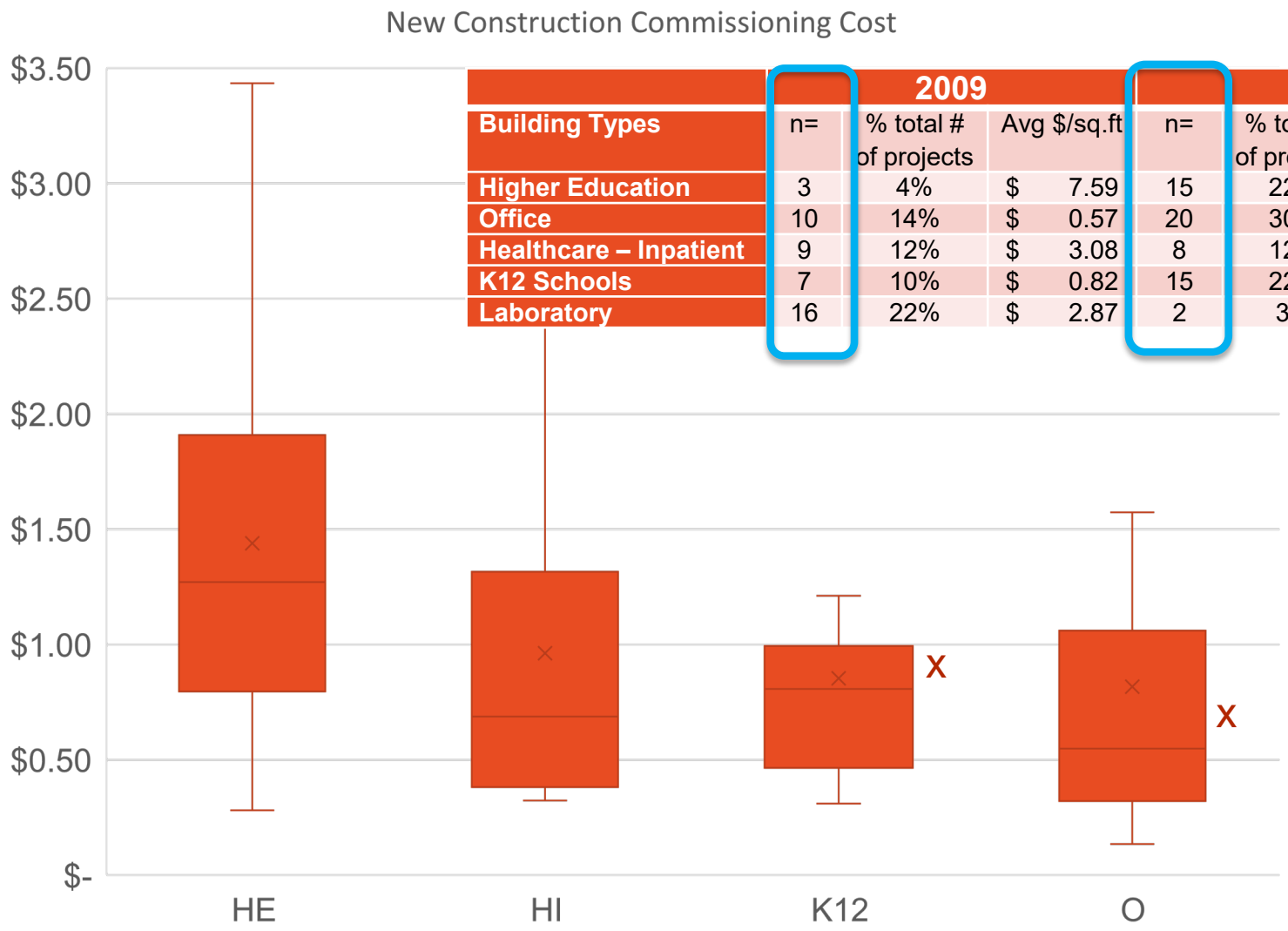
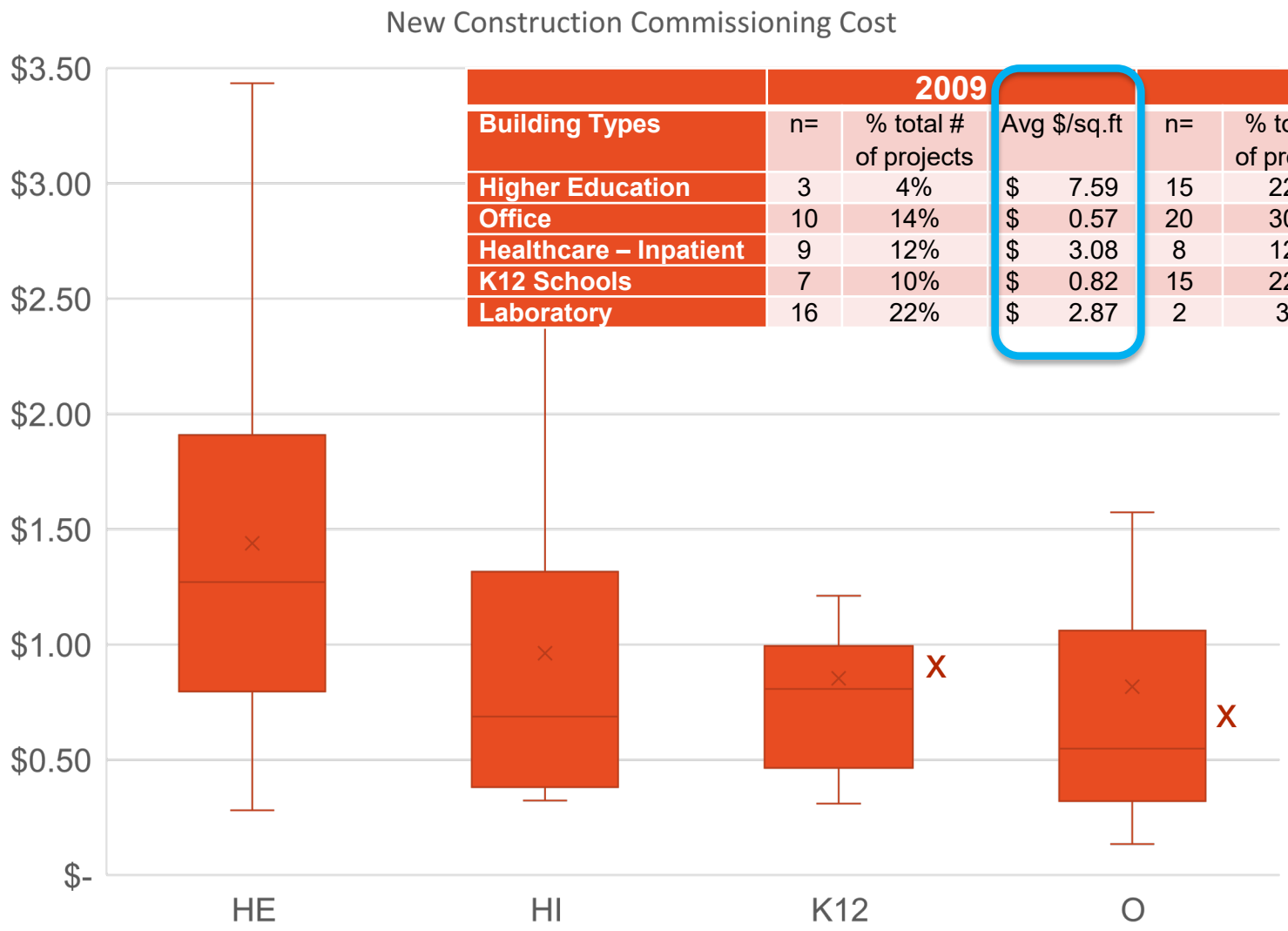


NCCx Cost by Building Type



	2009			2018		
Building Types	n=	% total # of projects	Avg $/sq.ft	n=	% total # of projects	Avg $/sq.ft
Higher Education	3	4%	$ 7.59	15	22%	$ 1.44
Office	10	14%	$ 0.57	20	30%	$ 0.82
Healthcare – Inpatient	9	12%	$ 3.08	8	12%	$ 0.96
K12 Schools	7	10%	$ 0.82	15	22%	$ 0.85
Laboratory	16	22%	$ 2.87	2	3%	$ 0.79

NCCx Cost by Building Type



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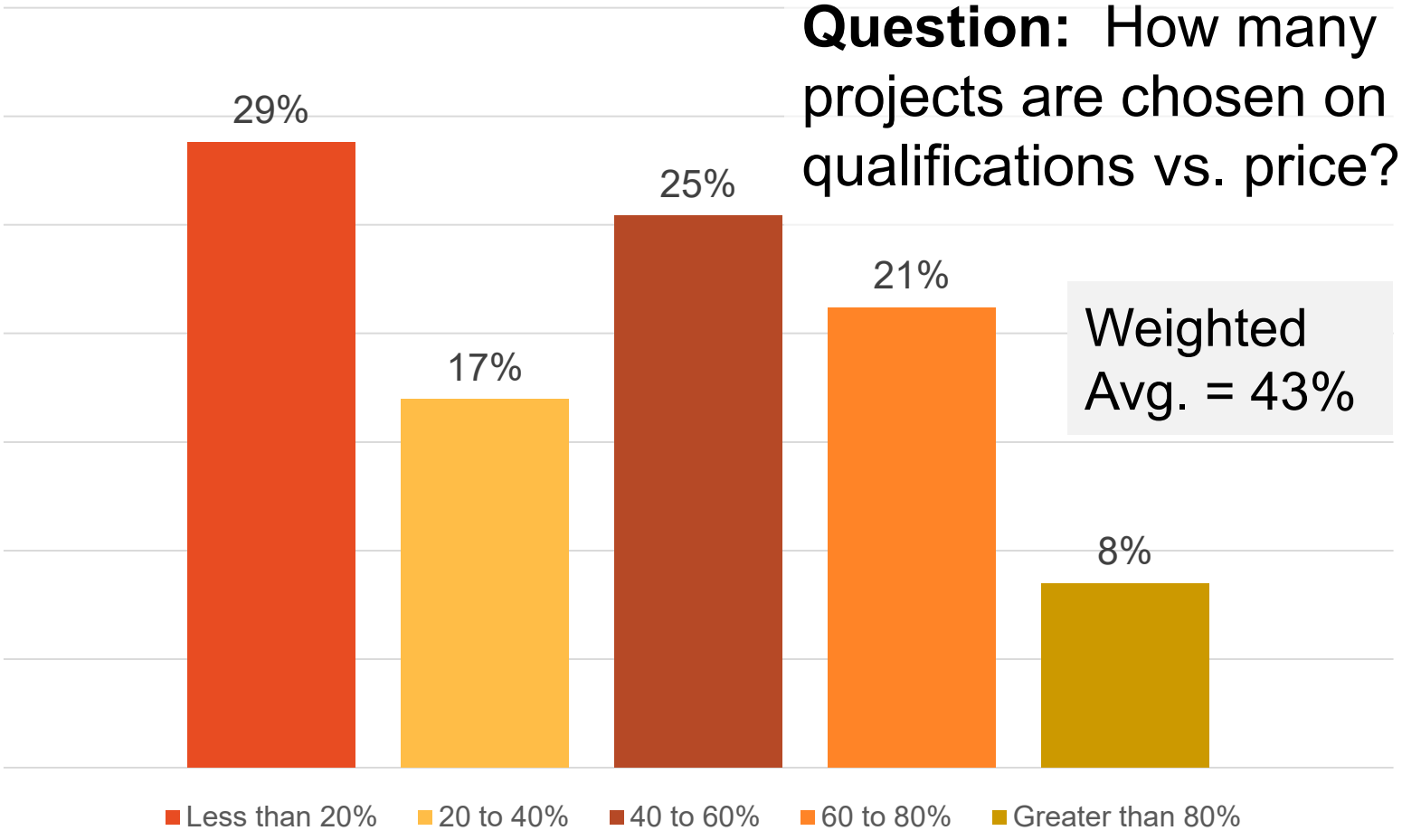
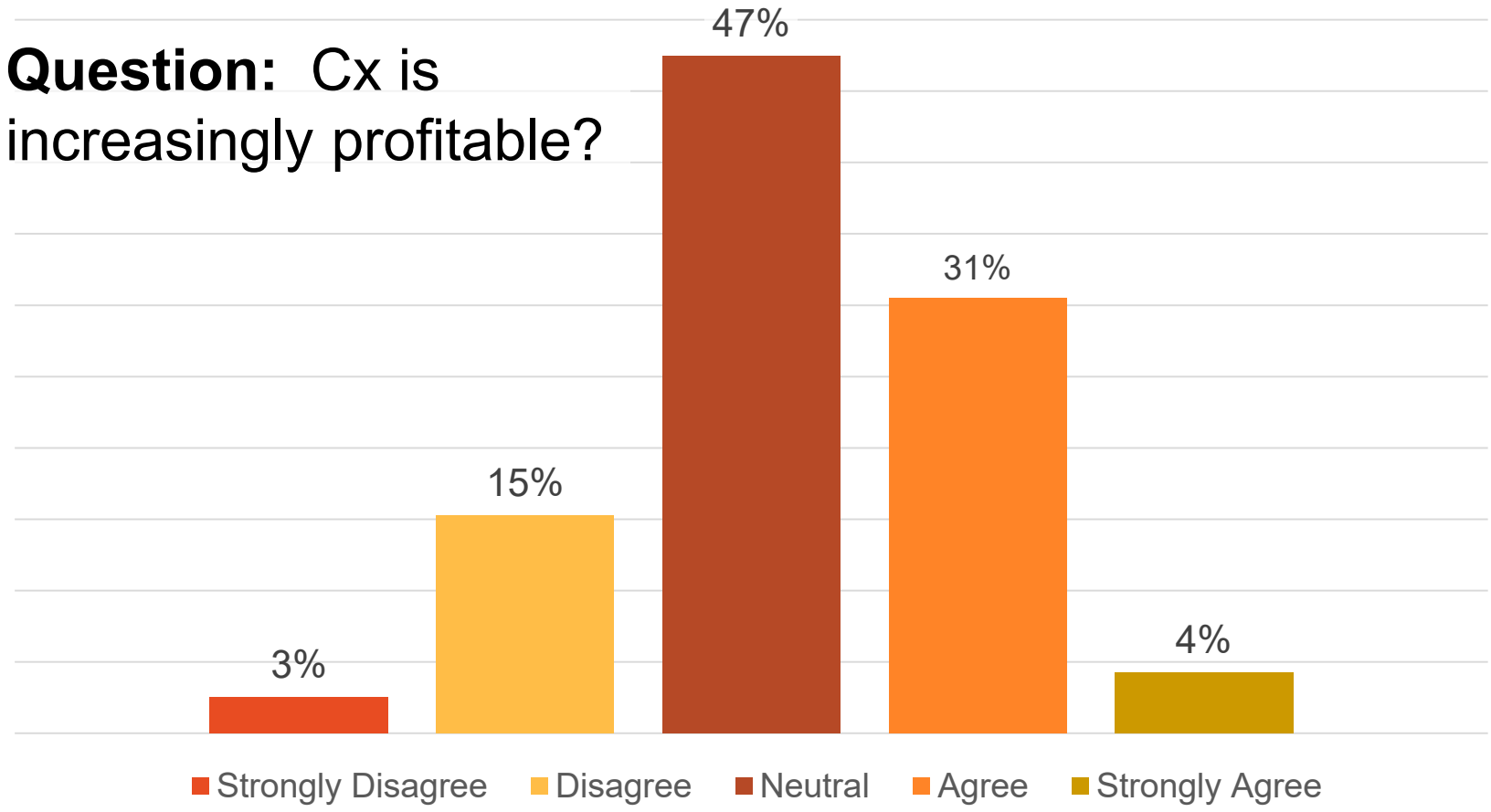
NCCx Cost: Qualifications vs. Price Based Selections



Question: How many projects are chosen on qualifications vs. price?

Weighted Avg. = 43%

NCCx Cost: Cx is increasingly profitable?



NCCx Commoditization Concerns

1. Overall **NCCx costs/SF** appear lower, but…..
2. 2018 data field contains 2X more **SF per building**
3. **Building type** mix is different. Less data for Public Assembly, Laboratories, and Public Safety (higher $/SF in 2009).
4. NCCx fee ranges for higher education and healthcare are less volatile than 2009. NCCx fee ranges for office and schools are more stable (and increasing).
5. Over 40% of NCCx work is selected based on **qualifications vs. price**
6. Cx firms are reporting stable/increased **project profitability**
7. ***Be very careful to qualify NCCx costs using other metrics than just overall $/SF***
8. ***Use a range to report NCCx costs***

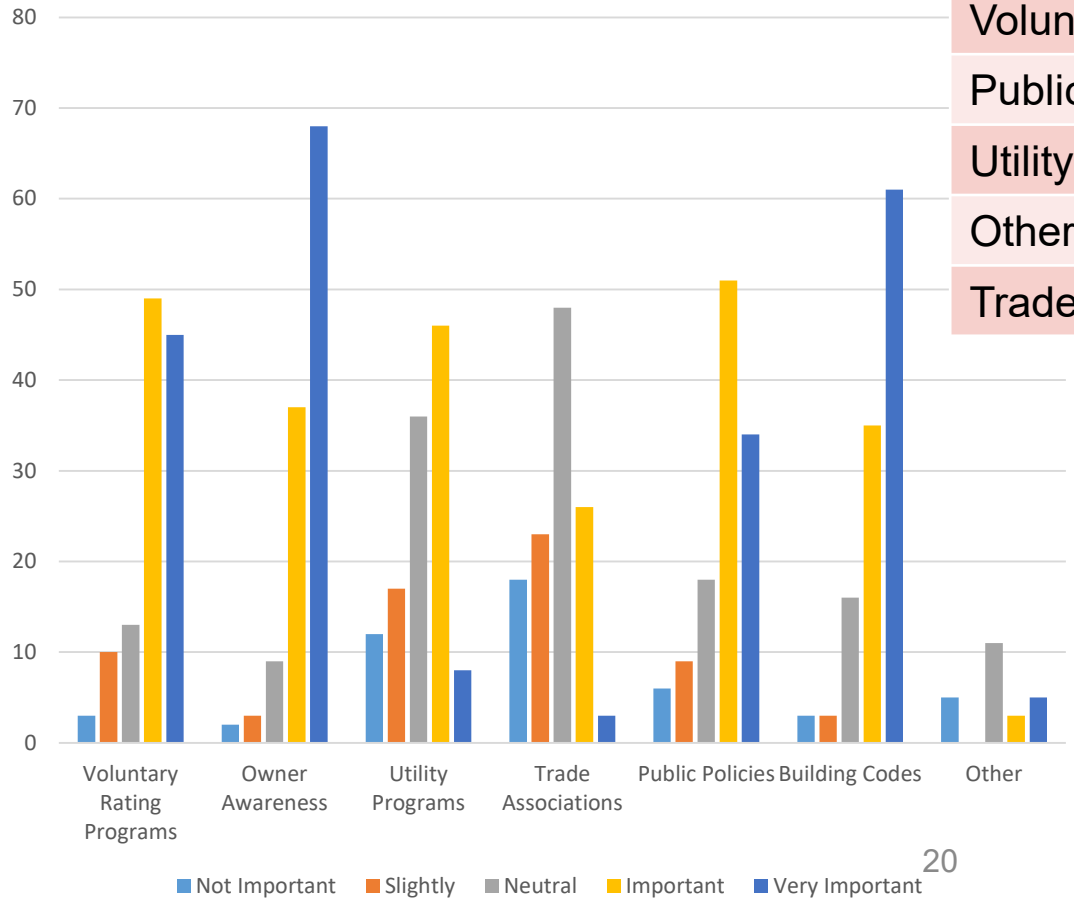
Value of Cx (NCCx) Study Results

Cost Summary

Market Demand Factors

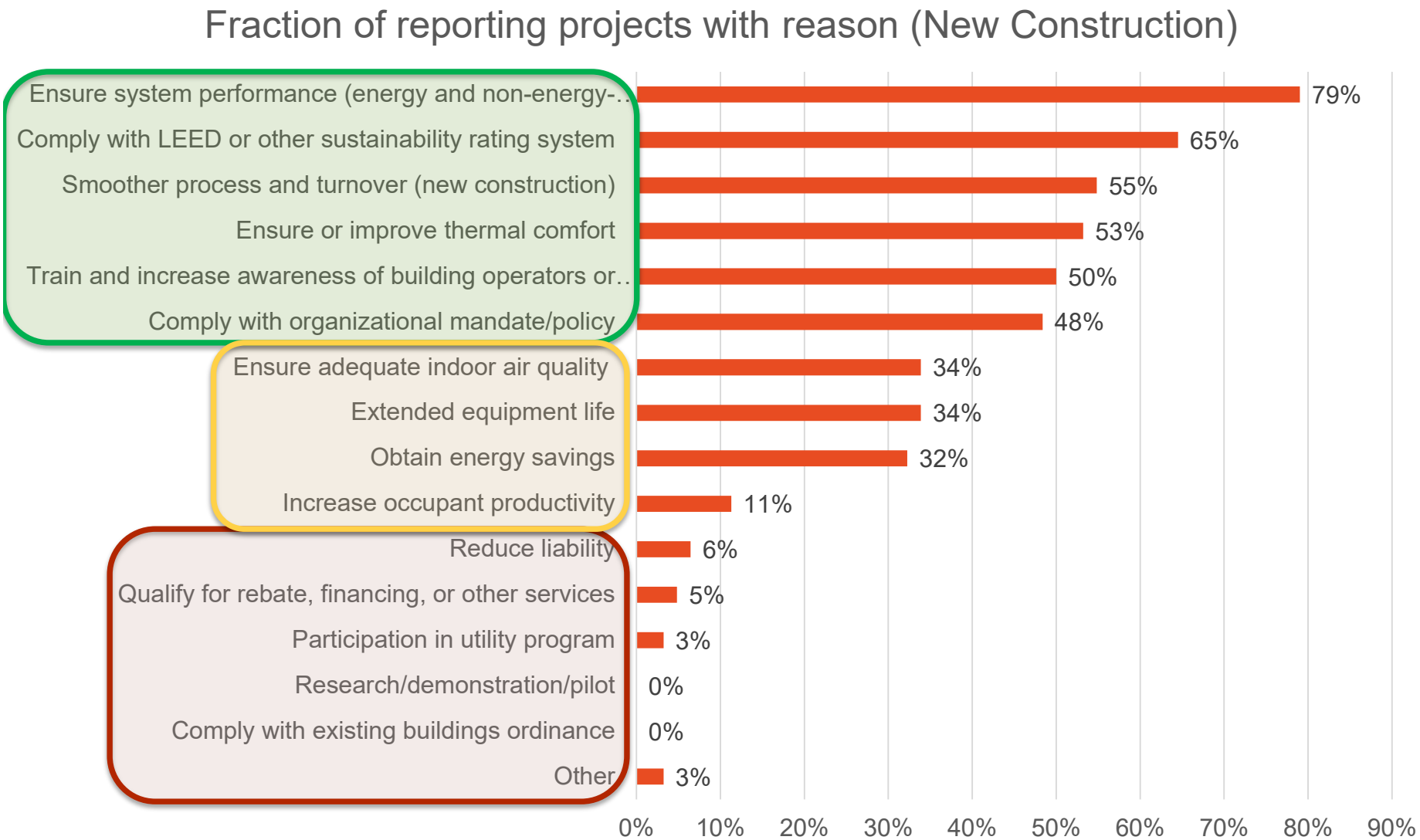
Scope of Work Observations

Reasons for Executing NCCx



Factors that Drive Cx?	(Out of 5.0)
Owner Awareness	3.82
Building Codes	3.74
Voluntary Rating Programs	3.65
Public Policies	3.54
Utility Programs	3.11
Other	2.92
Trade Associations	2.75

Reasons for Implementing NCCx



Reasons for Implementing NCCx

Reasons that Increased (2009 to 2018)

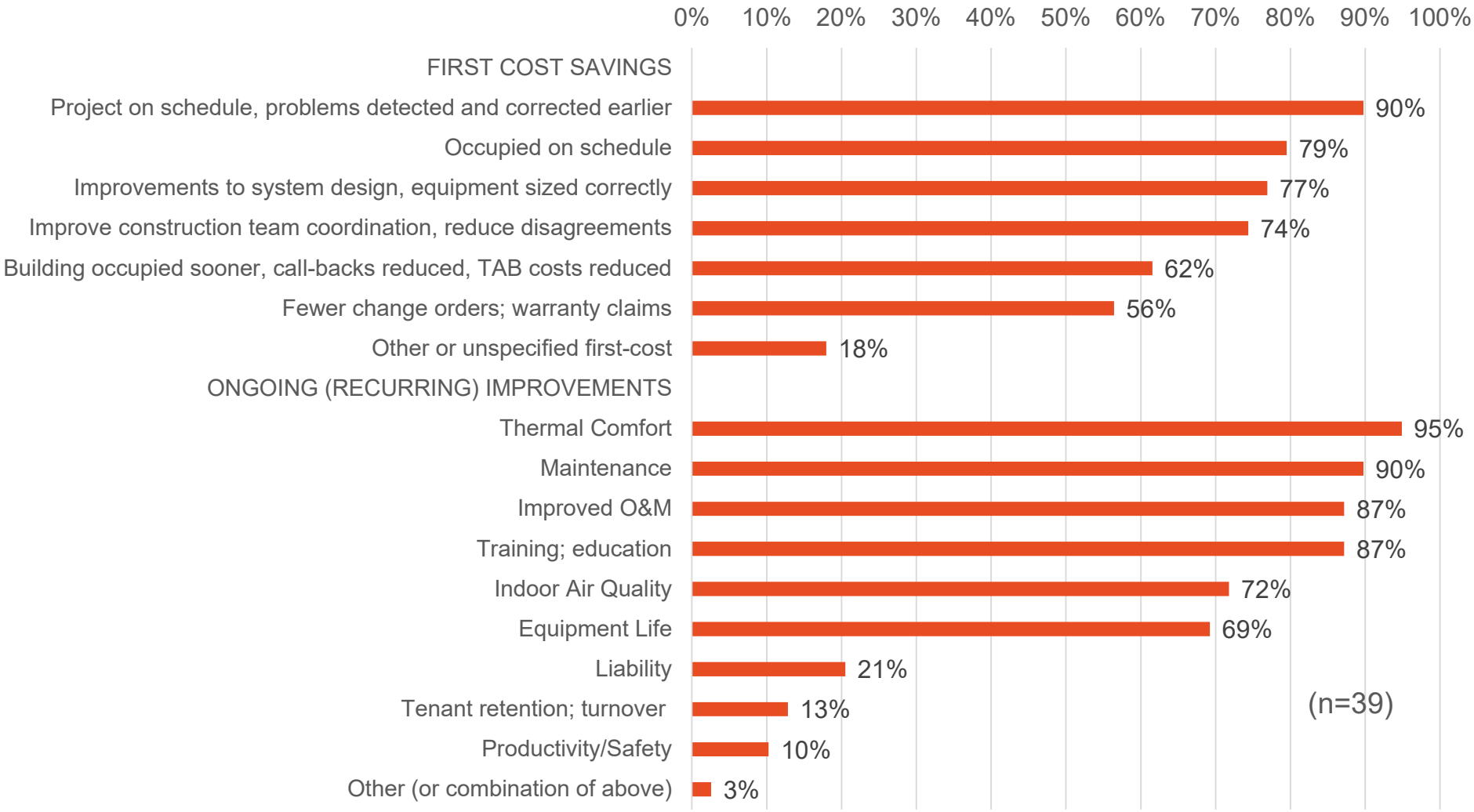
Fraction of reasons to embark on NCCx	2009	2018	Difference
Comply with LEED or other sustainability rating system	15%	65%	**50%**
Comply with organizational mandate/policy	0%	48%	**48%**
Smoother process and turnover (new construction)	26%	55%	**29%**

Reasons for Implementing NCCx

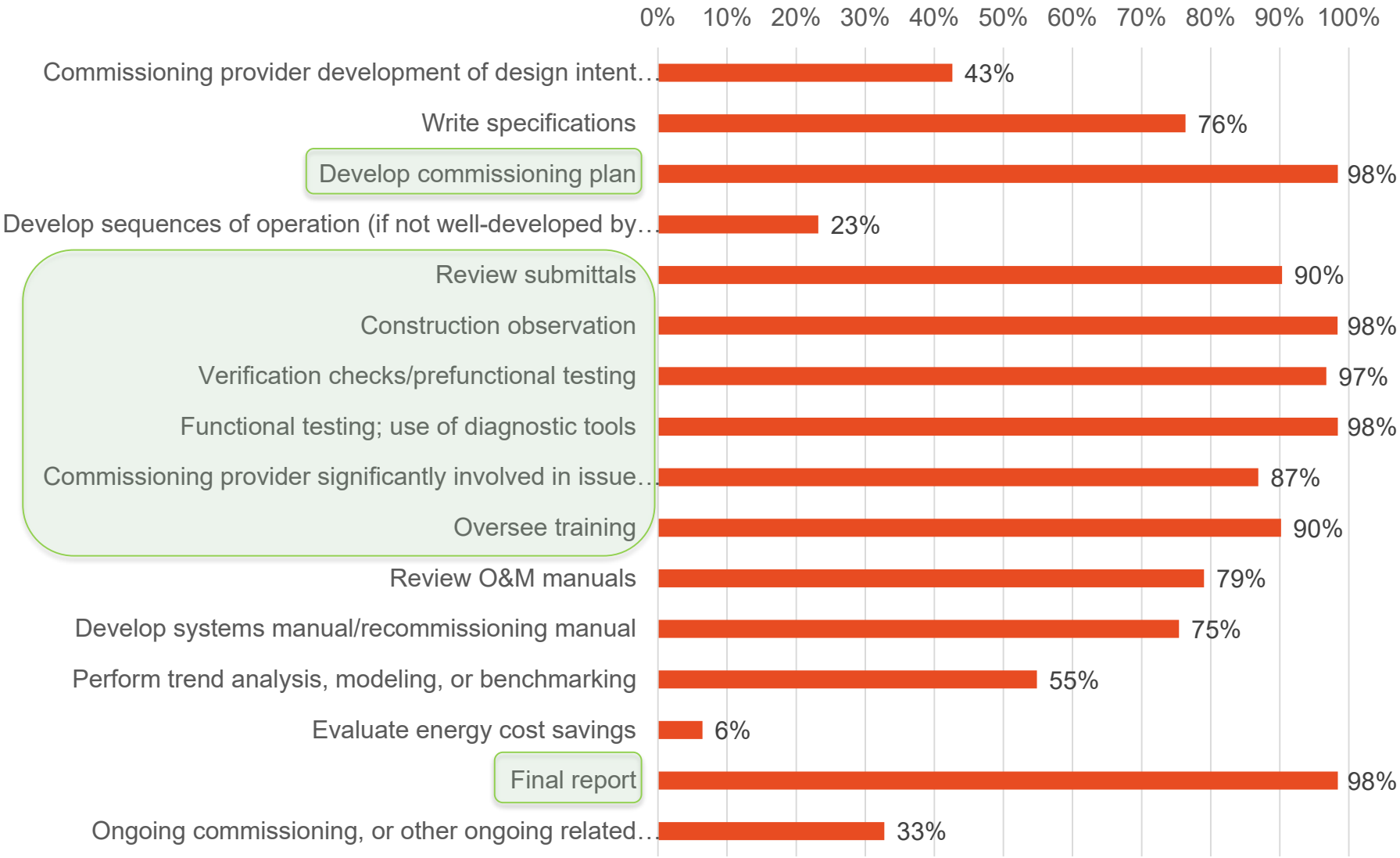
Reasons that Decreased (2009 to 2018)

Fraction of reasons to embark on NCCx	**2009**	**2018**	**Difference**
Ensure adequate **indoor air quality**	75%	34%	**-41%**
Participation in utility program	42%	3%	**-39%**
Obtain **energy savings**	65%	32%	**-33%**
Ensure or improve **thermal comfort**	72%	53%	**-19%**
Train and increase awareness of building operators or occupants	61%	50%	**-11%**

NCCx: Projects Reporting Non-Energy Benefits



Activities included in New Construction Commissioning Scope (n=62)



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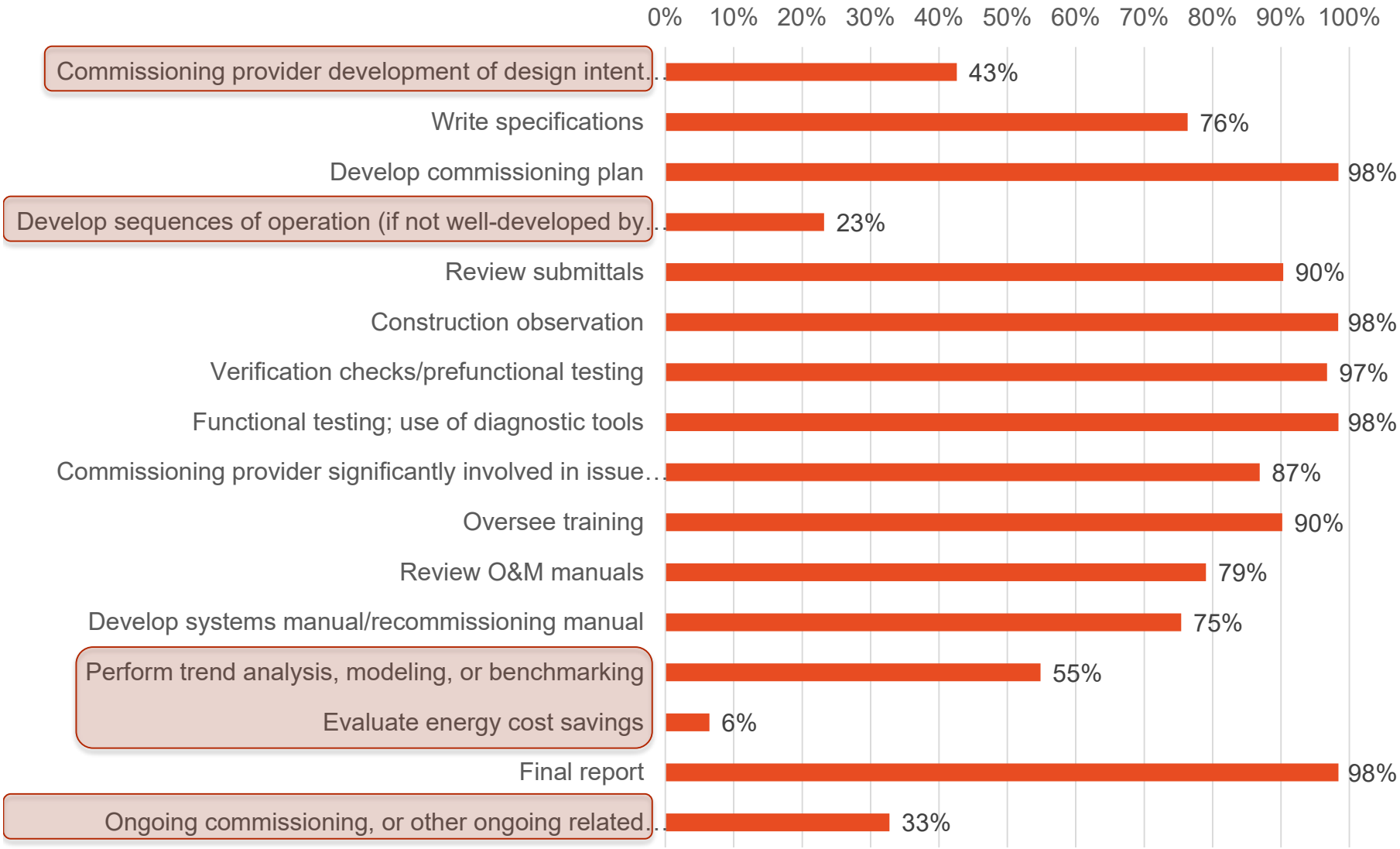


NCCx Market Factors

1. Owner awareness – highest driving factor
2. NCCx demand driven by regulation and codes
3. Several non-energy benefits obtained thru NCCx
   a) Schedule improvement
   b) Smooth turnover
   c) Training
4. Building performance metrics (energy, IAQ) has lost some emphasis
5. Core Cx scope of work is performed on each project
6. Opportunity to improve frequency of scope items:
   a) OPR/Design Intent document
   b) Controls sequence development
   c) Energy cost calculations
   d) Post-occupancy tasks

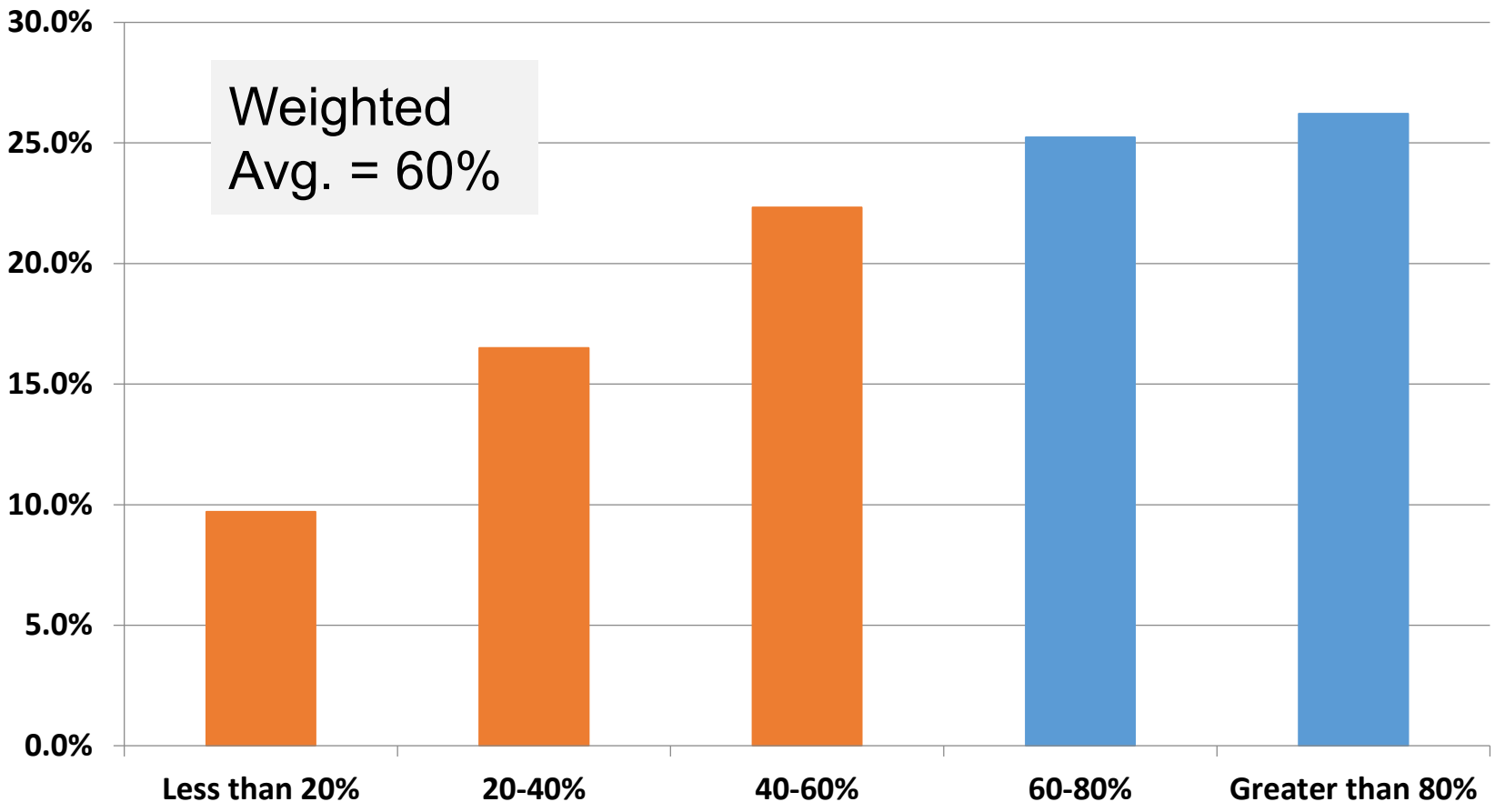
Value of Cx (NCCx) Study Results

Cost Summary

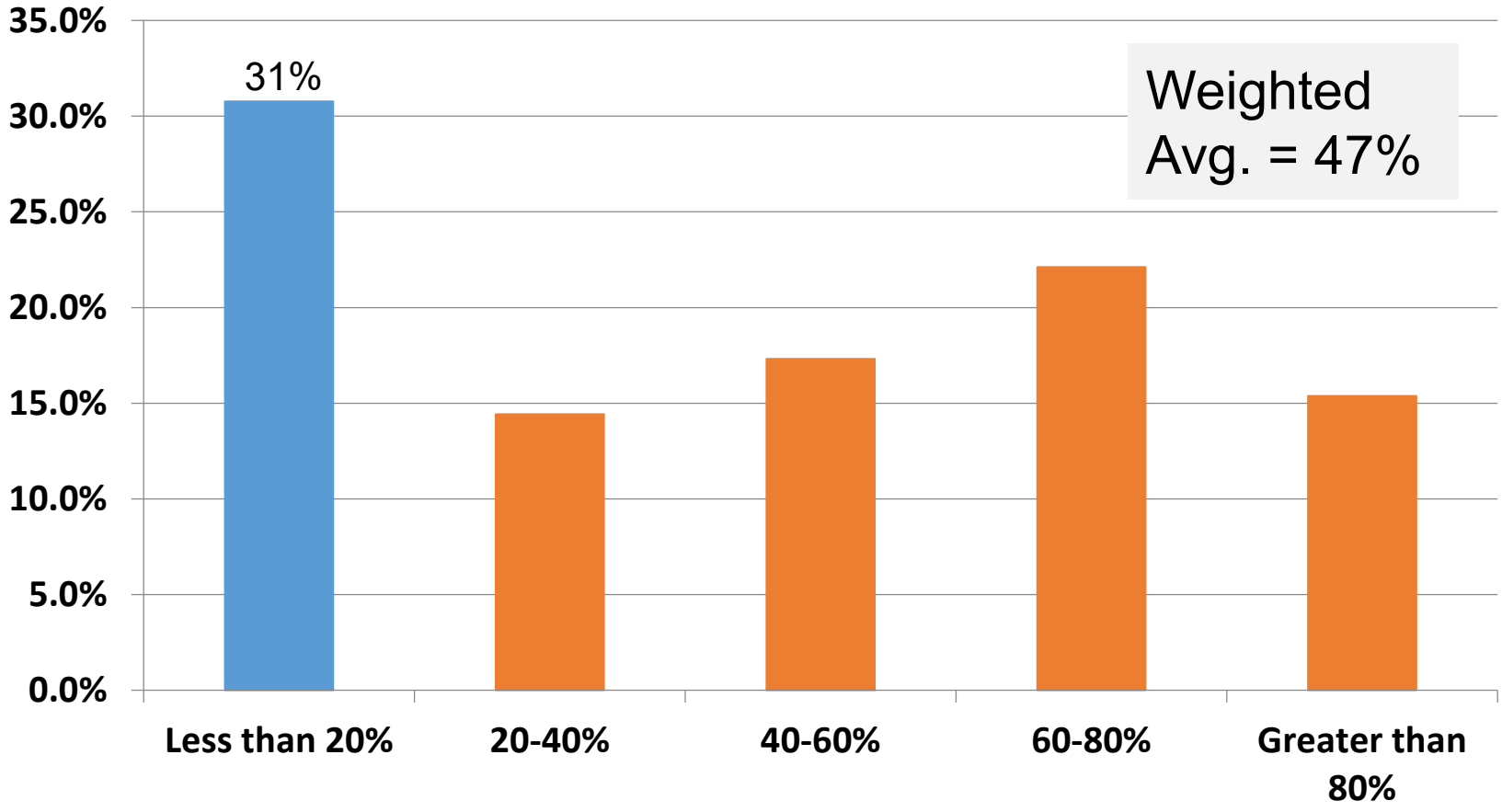
Market Demand Factors

Scope of Work Observations

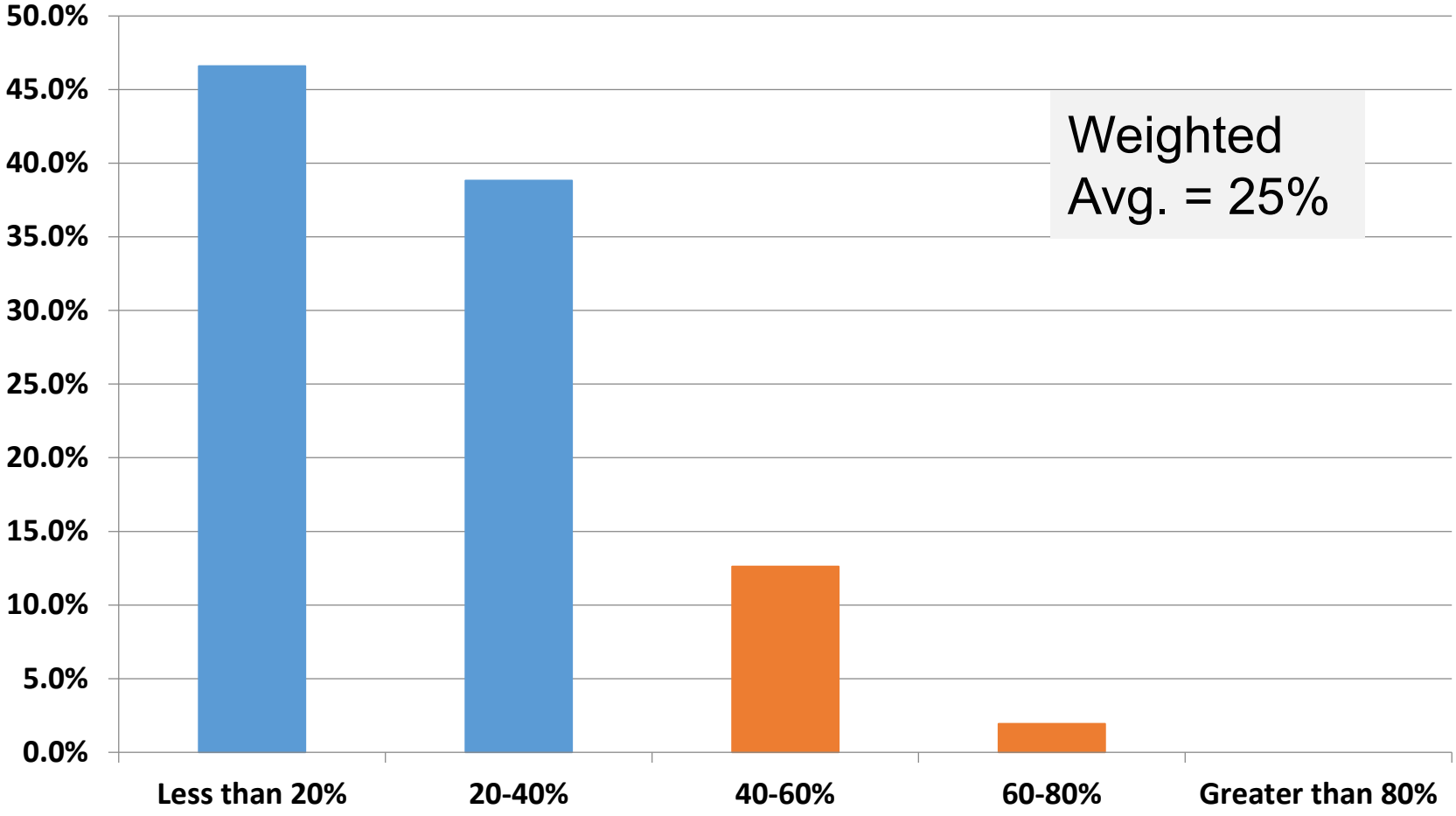
Percentage of NCCx Projects include Design Phase Cx Services? (26)



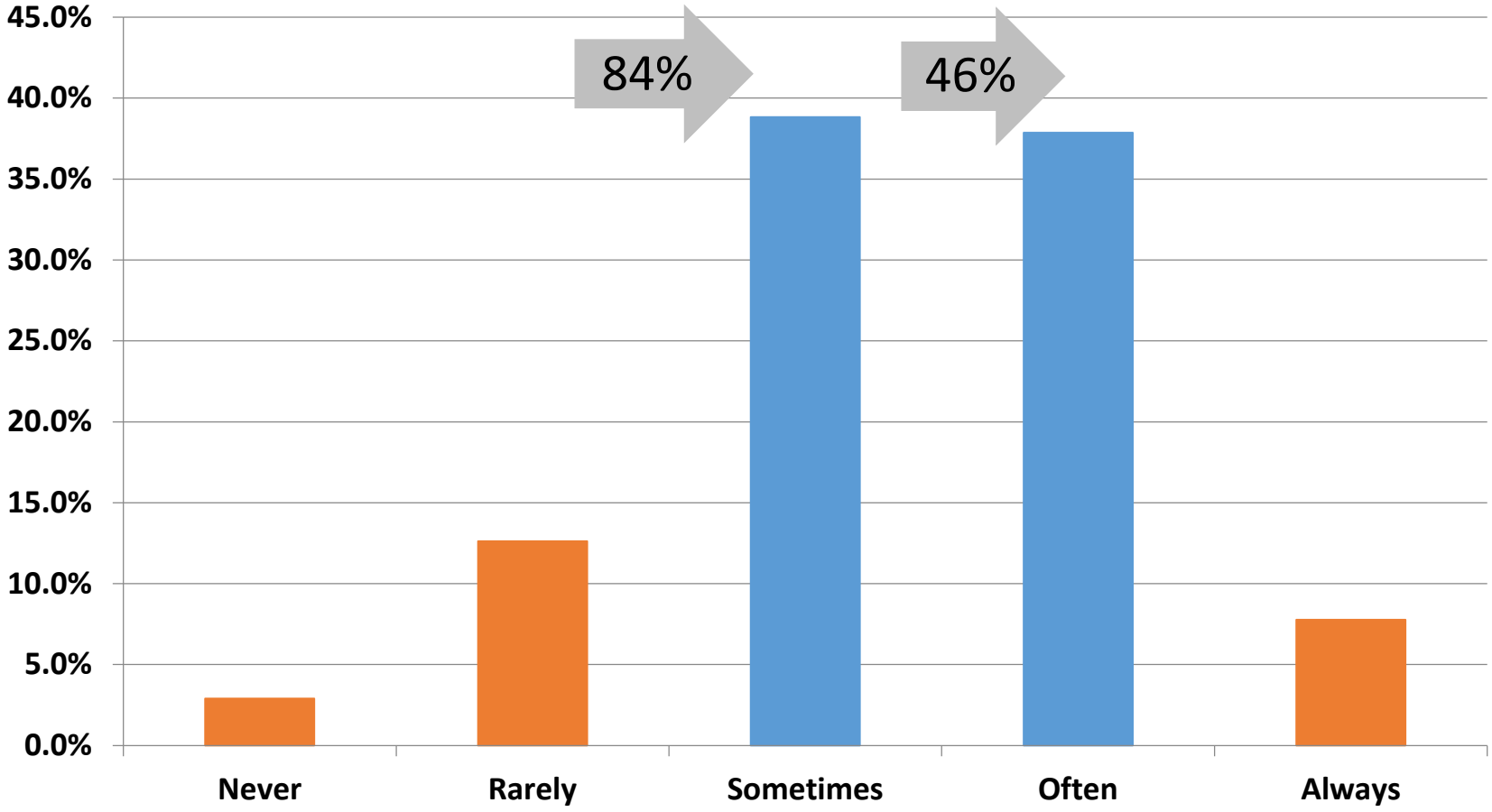
Percentage of NCCx Projects where OPR is Developed for Owner? (30)



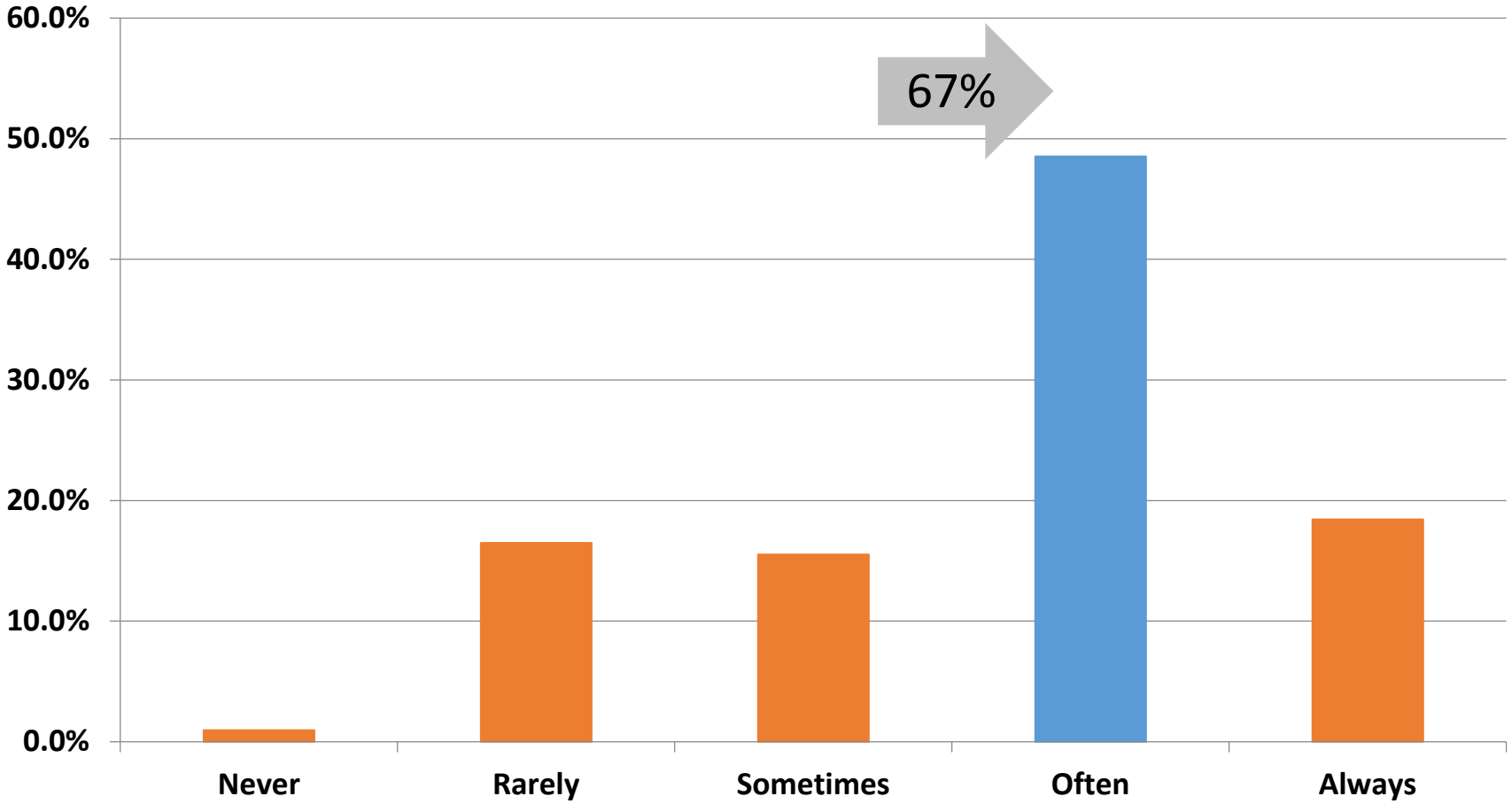
Percentage of Cx Issues Discovered during Design Phase? (33)



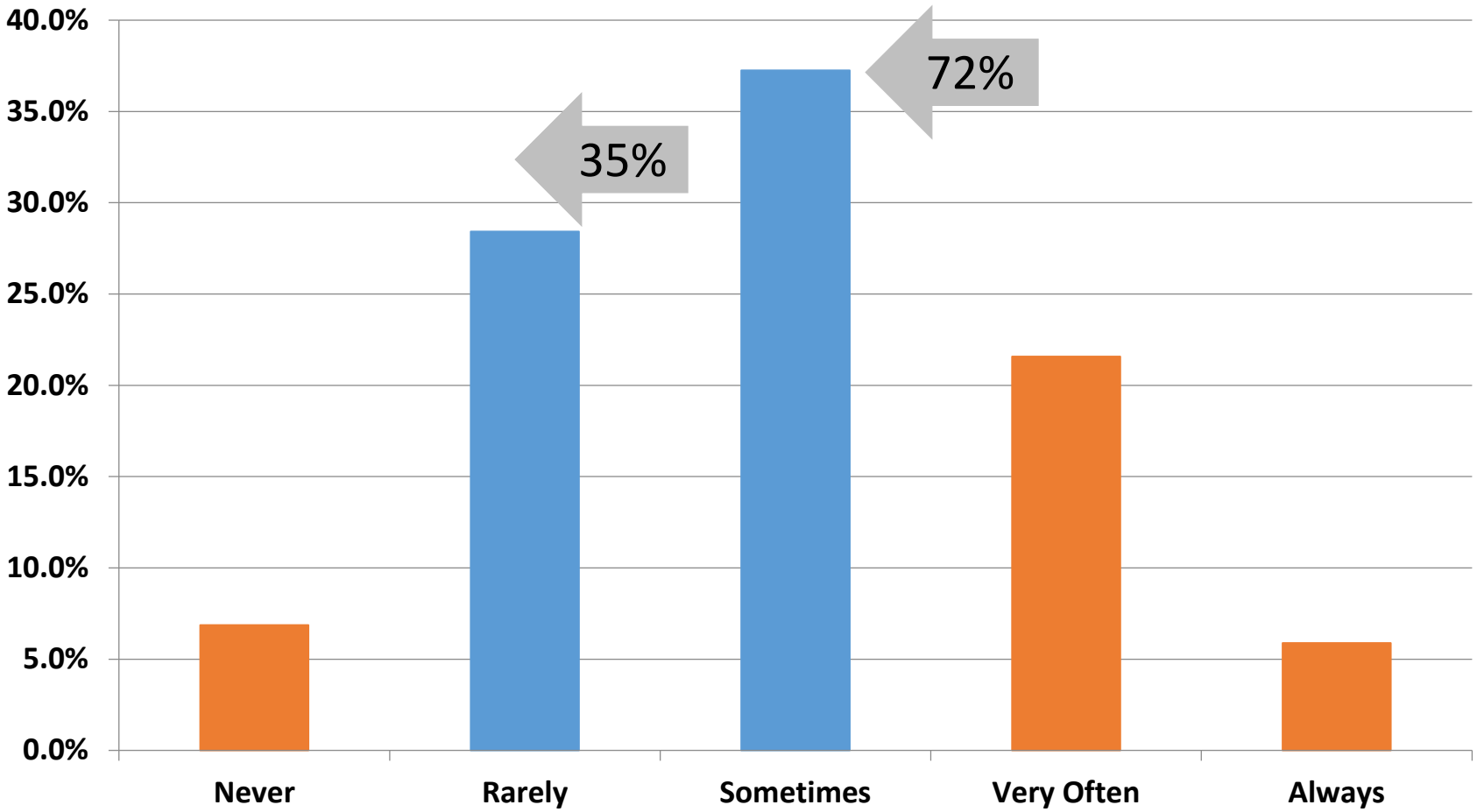
How often are Cx Review Comments in Design Phase are incorporated in Contract? (43)



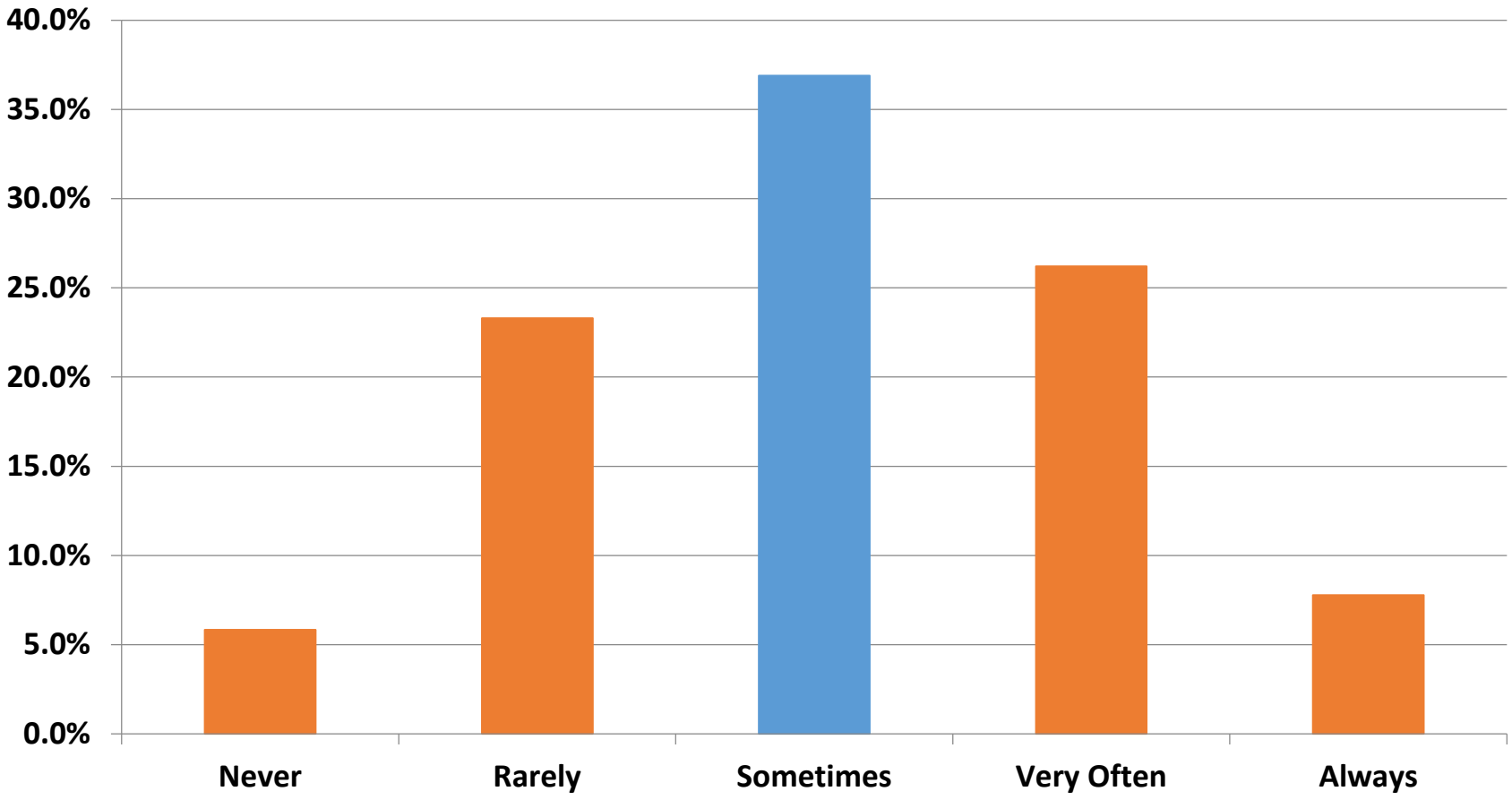
How often were control sequences created <u>without</u> collaboration between design and Cx? (39)



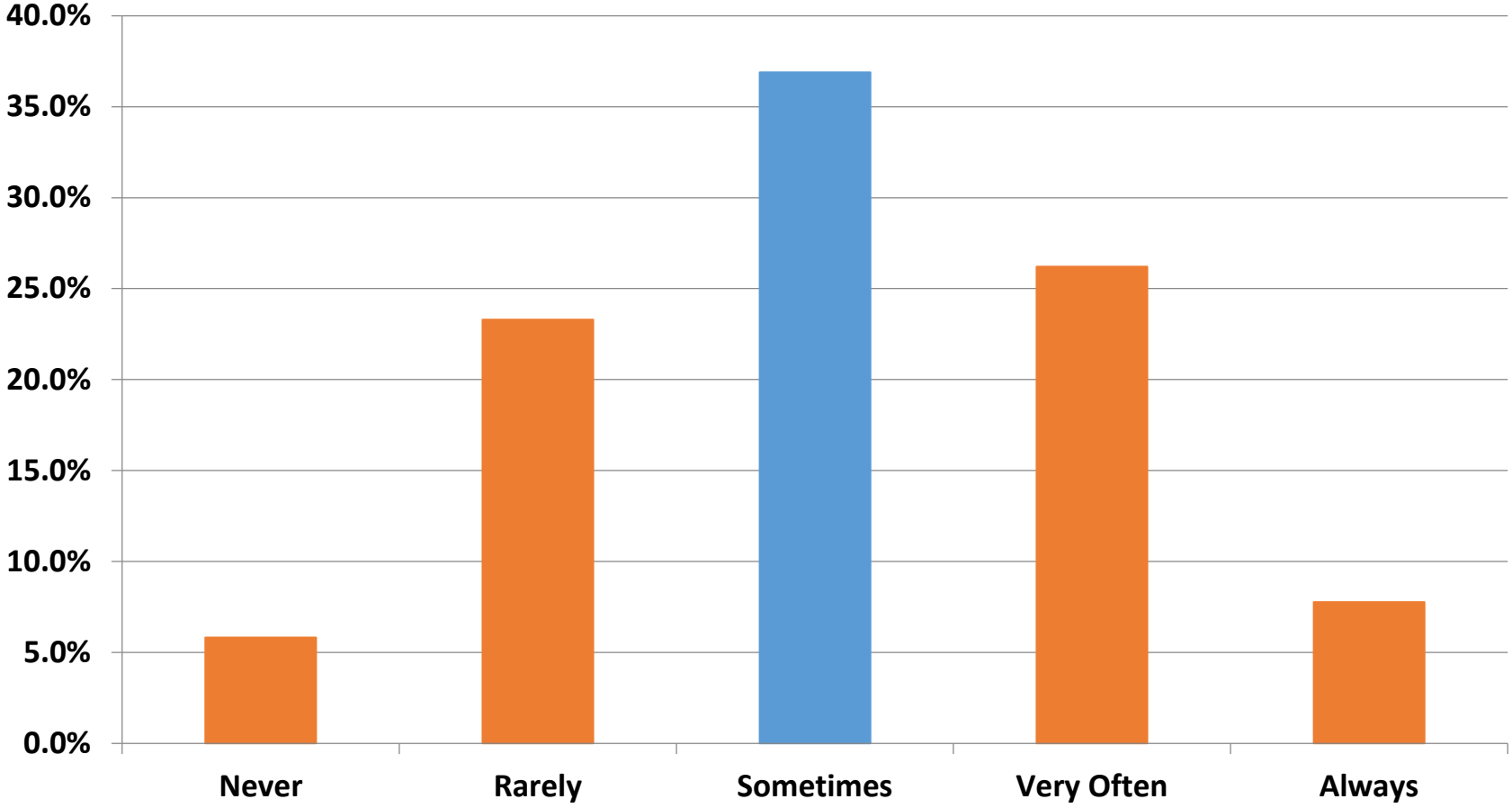
How often does NCCx meet with facility personnel during design? (41)



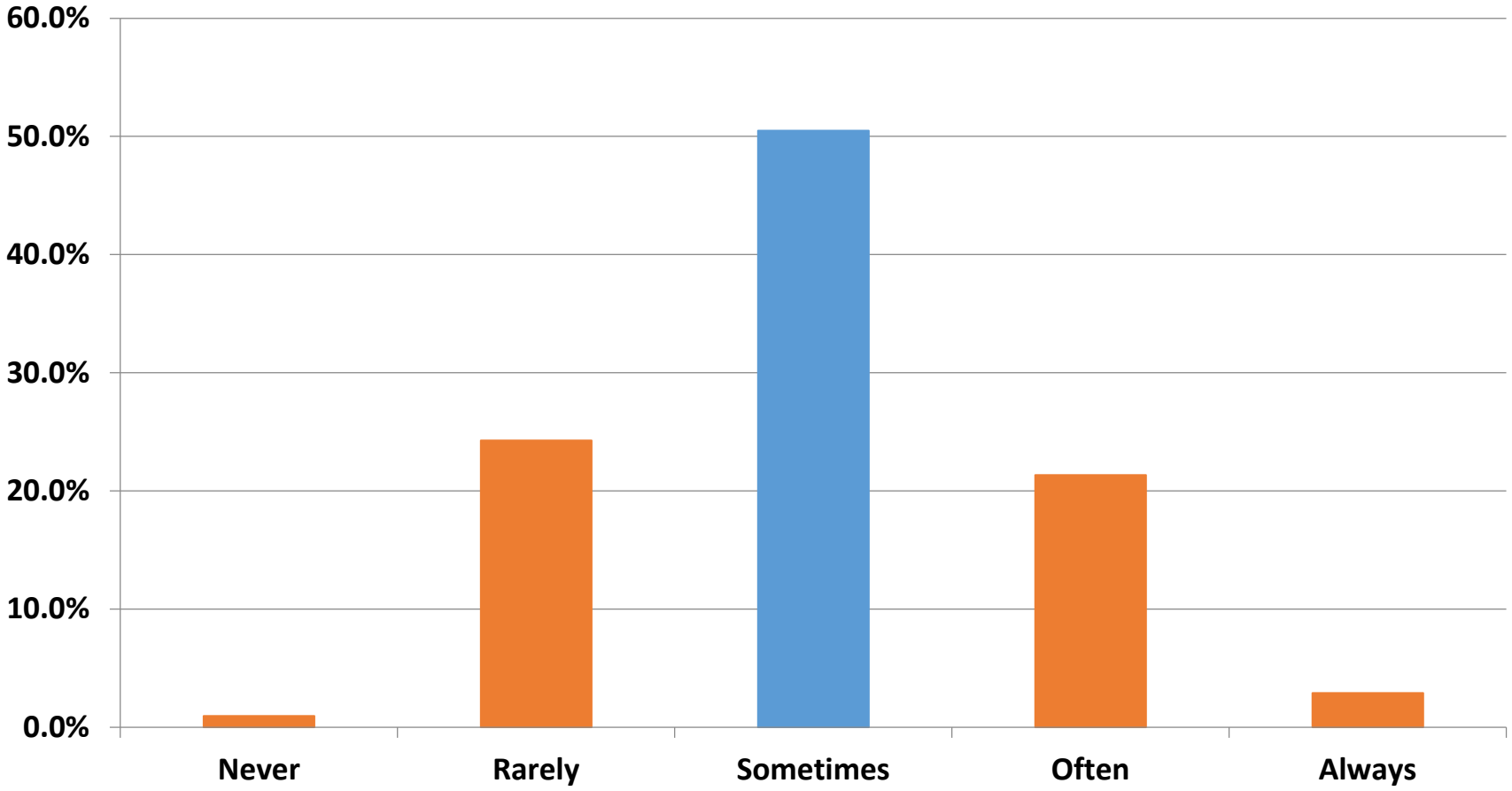
How often is detailed Cx schedule integrated with construction schedule? (42)



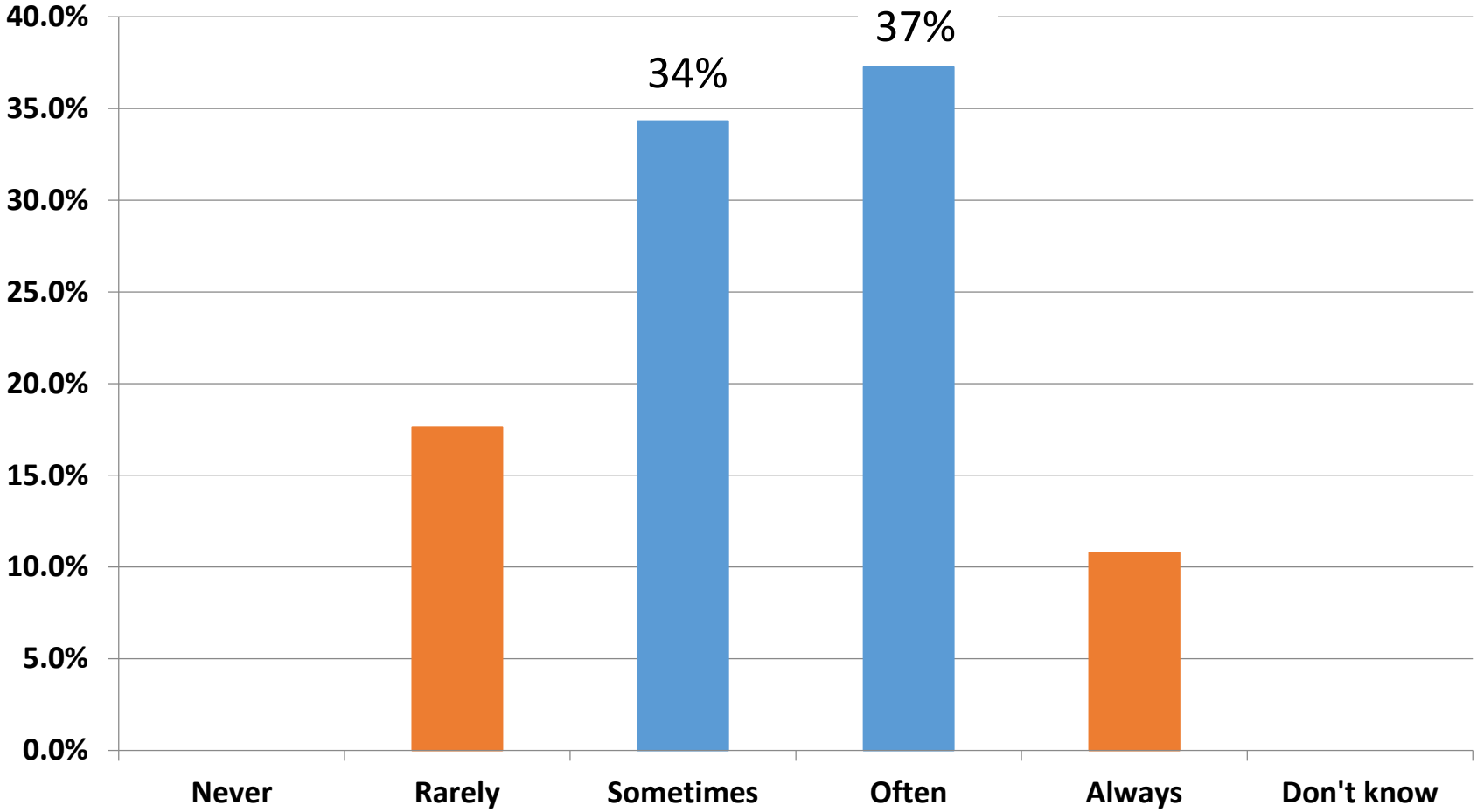
How often do controls coordination meetings occur (engineer, contractor, Cx)? (45)



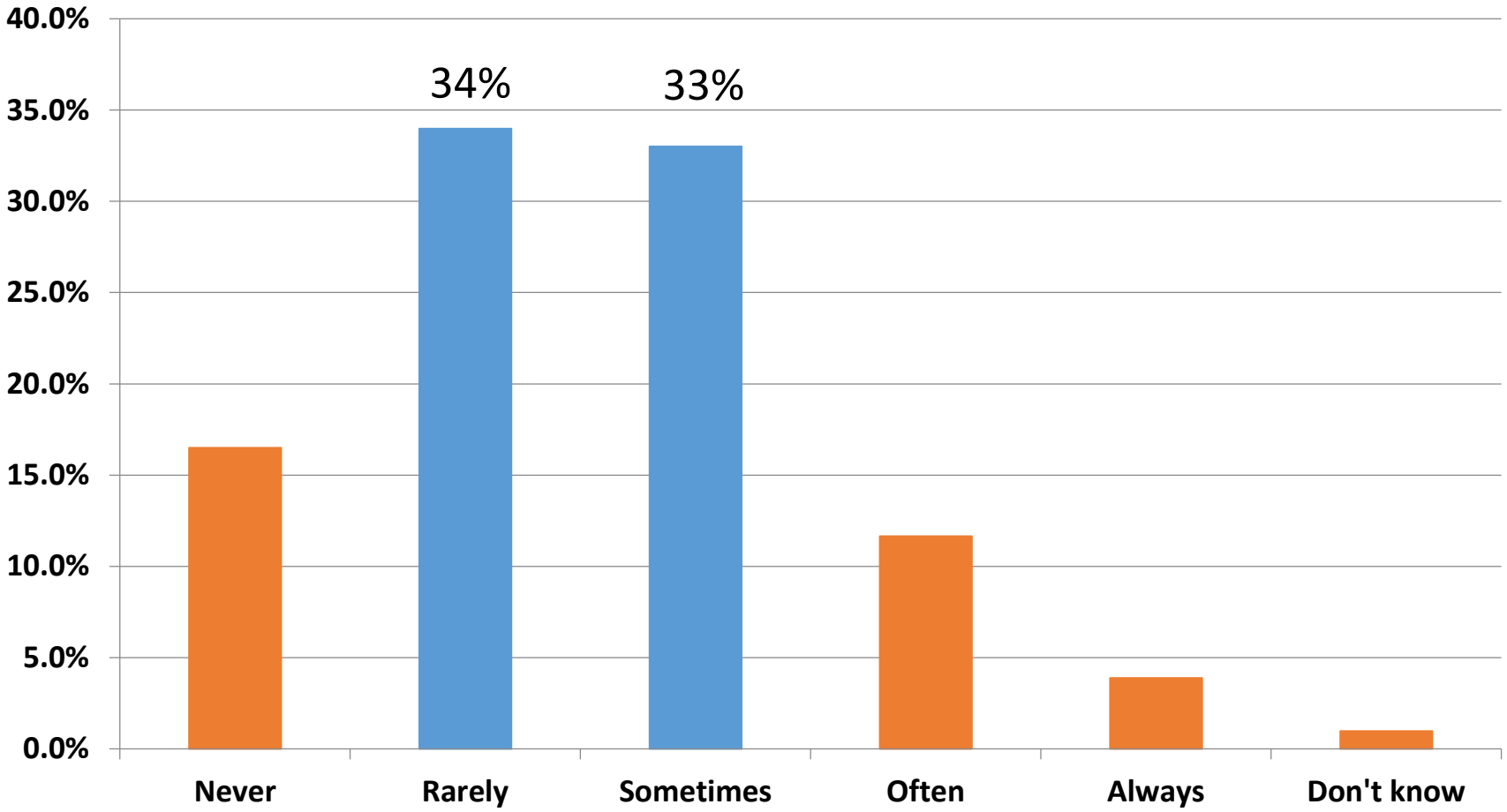
How often are equipment startups well coordinated ahead of time? (49)



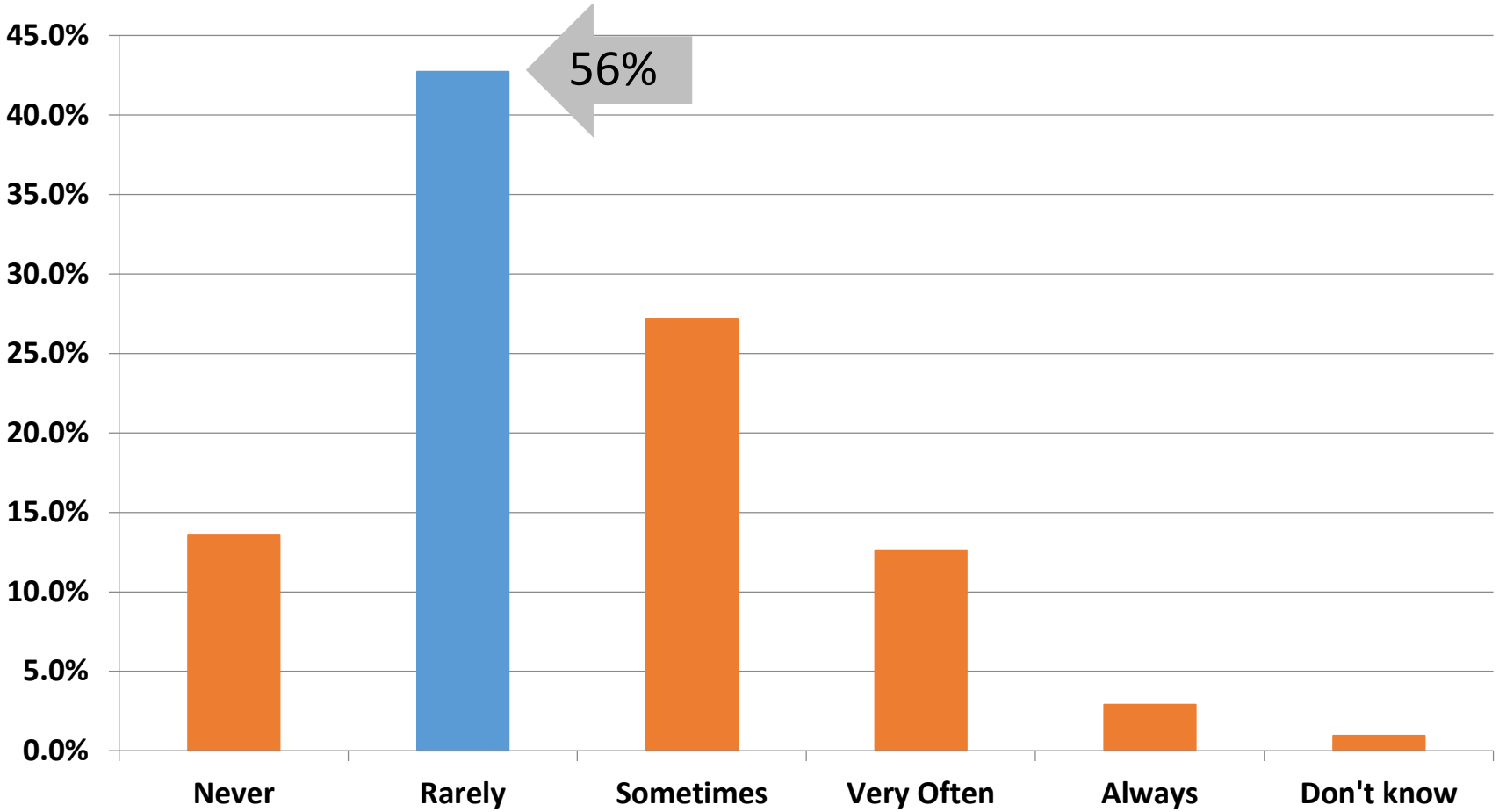
How often do Cx issues remain open after Beneficial Occupancy? (52)



How often is a Post-turnover occupant survey of satisfaction conducted? (53)



How often are OCx tasks included after Warranty is complete? (54)



NCCx Market Survey – SOW Takeaways

1. Design phase Cx services are included in over 60% of NCCx projects.
2. Design phase Cx review comments are incorporated in contract documents over 80% of the time.
3. Design phase issues constitute ≈ 25% of all NCCx issues.
4. Opportunity to improve frequency of NCCx scope items:
   a) OPR/Design Intent document
   b) Controls sequence development/Controls coordination meetings during submittals
   c) Scheduling/Equipment startup coordination
   d) Collaboration with facility personnel/Follow-up with occupants
5. OCx SOW is included more often (44% = “sometimes” or better)

Additional Information

Deliverables will be posted to website,

https://www.bcxa.org/knowledge-center/

- Technical Narratives
- Blogs
- Presentations
- Data, Research
- Related Surveys

Questions?

tom.poeling@usengineering.com