Understanding the Cost of Quality

Glenn Cottrell, IBACOS
What defines Quality?
Quality Spend
Cost of Quality: Defined

A methodology that allows an organization to determine the extent to which its resources are used for activities that prevent poor quality, that appraise the quality of the organization’s products or services, and that result from internal and external failures.

What dollars are spent and why?
Failure Costs?

Insight: What are you setting aside in accruals?

New Homes & Building Materials Warranty Report, Warranty Week

• 2007-2013 trend of new homebuilder accruals at 1.1% of sales (May 8, 2014)

Theresa Weston

• Mean accrual per unit study across 13 public builders (2012-2016 data)
Warranty Accruals

- Costs are accrued based upon historical experience
- Factors that affect the Company’s warranty liability include
  - the number of homes sold,
  - historical and anticipated rates of warranty claims, and
  - cost per claim
Summary Report for Warranty Accruals/Closings

Anderson-Darling Normality Test
- A-Squared: 1.37
- P-Value: <0.005

- Mean: 4919.3
- StDev: 2187.6
- Variance: 4785574.1
- Skewness: 1.08786
- Kurtosis: 0.94721
- N: 45

95% Confidence Interval for Mean
- 4262.0
- 5576.5

95% Confidence Interval for Median
- 3588.1
- 5563.9

95% Confidence Interval for StDev
- 1811.0
- 2763.4

95% Confidence Intervals
Boxplot of Warranty Accruals/Closings

Year

Warranty Accruals/Closings

Boxplot of Warranty-Litigation/Closing

Year

Warranty-Litigation/Closing


0 10000 20000 30000 40000 50000 60000 70000 80000 90000
Summary Report for Warranty-Litigation/Closing

Anderson-Darling Normality Test
- A-Squared: 1.19
- P-Value: <0.005

Summary Statistics:
- Mean: 22278
- StDev: 16061
- Variance: 257965410
- Skewness: 1.51068
- Kurtosis: 3.41148
- N: 39
- Minimum: 4071
- 1st Quartile: 8042
- Median: 18684
- 3rd Quartile: 31769
- Maximum: 81571

95% Confidence Intervals:
- For Mean: 17071 to 27484
- For Median: 13072 to 23456
- For StDev: 13126 to 20699

95% Confidence Interval for Mean:
- Lower: 17071
- Upper: 27484

95% Confidence Interval for Median:
- Lower: 13072
- Upper: 23456

95% Confidence Interval for StDev:
- Lower: 13126
- Upper: 20699
Understanding the Cost of Quality
Cost of Quality: Failure Spends

Cost-overruns
Delays
Dissatisfaction
Fines
Litigation

Rework
Turnover
Warranty
Waste
Cost of Quality: Prevention Spends

- Compensation
- Contracting
- Documentation
- Engagement
- Expectations

- Recognition
- Specification
- Training
- Value Engineering
Cost of Quality: Appraisal Spends

Audits
Commissioning
Inspections
Supervision
Surveying
Testing
Cost of Quality: IBACOS Survey

PAF PROFILE: HOME BUILDER PERCEPTION

- Failure 42%
- Appraisal 32%
- Prevention 27%
Cost of Quality: Pheng & Ke-Wei Study

PAF PROFILE:
CONSTRUCTION
INDUSTRY

The Shift
Cost of Quality: Pheng & Ke-Wei Study

PAF PROFILE:
CONSTRUCTION INDUSTRY

Cost of Quality: Pheng & Ke-Wei Study

PAF PROFILE:
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Cost of Quality: Pheng & Ke-Wei Study

PAF PROFILE:
CONSTRUCTION INDUSTRY

Mmmmmmm... Bacon!
Rol: Benchmark Study

PARTICIPANTS

21 Completed surveys
Single-family builders (Primary business)
Diverse range in volume
- 4 @ less than 200 homes
- 6 @ 200 – 500 homes
- 6 @ 501 – 1000 homes
- 1 @ 1001 – 5000 homes
- 4 @ More than 5000 homes
9.6% of U.S. closings
RoI: Benchmark Study

DATA POINTS

- % Revenue on construction
- $ Superintendent compensation
- # of Homes carried
- % Turnover of construction staff
- # Days in cycle time (target and actual)
- # of Wasted days in cycle
- % Construction cost overruns
- # Dumpsters for construction waste
- $ Dumpster haul fees
- # Warranty claims
- $ Spent on warranty
## RoI: Benchmark Study

### “BENCHMARK” BUILDER

<table>
<thead>
<tr>
<th>Metric</th>
<th>Low</th>
<th>High</th>
<th>Avg.</th>
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</thead>
<tbody>
<tr>
<td># Homes Carried</td>
<td>5</td>
<td>45</td>
<td>15.1</td>
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<tr>
<td>Turnover (construction)</td>
<td>&lt;5%</td>
<td>&gt;20%</td>
<td>10.5%</td>
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<tr>
<td>Target Cycle Time (days)</td>
<td>55</td>
<td>135</td>
<td>89.5</td>
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<tr>
<td>Actual Cycle Time (days)</td>
<td>55</td>
<td>152</td>
<td>101</td>
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<tr>
<td>Wasted Days</td>
<td>&lt;1</td>
<td>&gt;5</td>
<td>2.9</td>
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<tr>
<td>Warranty Items</td>
<td>&lt;2</td>
<td>&gt;10</td>
<td>5.1</td>
</tr>
</tbody>
</table>
RoI: Benchmark Study

METRICS

Cost Variance  Execution
Construction Oversight  Incentives
Customer Delight  Jobsite Waste
Cycle Time  Training
Documentation  Value Engineering
Employee Engagement  Warranty
Rol: Benchmark Study

METRICS

- Cost Variance
- Construction Oversight
- Customer Delight
- Cycle Time
- Documentation
- Employee Engagement
- Execution
- Incentives
- Jobsite Waste
- Training
- Value Engineering
- Warranty
RoI: Cycle Time

SURVEY RESULTS

What is your target cycle time per home in working days?

- **Mode:** 75 working days
- **Average:** 89.5 working days
- **Minimum:** 55 working days
- **Maximum:** 135 working days

What is your actual cycle time per home in working days?

- **Mode:** 105 working days
- **Average:** 101 working days
- **Minimum:** 55 working days
- **Maximum:** 152 working days
RoI: Cycle Time

EXPERT INTERVIEWS +

Eric Timmis, TrueNorth Development
• 1 day saved in construction = $500+ thru effective use of overhead (resources)

George Casey, Stockbridge Associates
• 5% reduction in build cycle =
  • $250 savings thru effective use of working capital (less $ tied up in WIP), OR
  • $950 added margin thru increased volume using same working capital constraints

Division Purchasing Lead, Top 20 Builder
• Easily several hundred $ savings from trades efficiency
RoI: Cycle Time

OPPORTUNITY

ASSUMPTIONS
• 101 day build cycle
• 2% cycle time reduction by eliminating dry runs, appropriate crew sizes, etc.
Rol: Cycle Time

\[
\text{OPPORTUNITY} = $1,680 \text{ Savings per home}
\]

\[
(\text{# of days in actual build cycle}) \times (\text{fully loaded carry costs / day}) \times (\% \text{ possible reduction}) = $ \text{ Savings per home}
\]

PLUS

\[
(\text{# of additional homes delivered using same working capital}) \times (\$s \text{ added margin per home}) \div (\text{total # of homes delivered annually}) = $ \text{ Savings per home}
\]
Rol: Cost Variance

SURVEY RESULTS

What is the amount spent per home on cost over construction budget?

$50 MIN

$1,844 AVG

$1,500 MODE

$7,000 MAX

What is your cost variance as a % of hard construction costs?

0% MIN

1.06% AVG

3.5% MAX
EXPERT INTERVIEWS +

Noelle Tarabulski, Builder Consulting Group

• Implementing Variance Purchase Orders (VPOs) can reduce hard construction costs:
  - 1% immediately (just because you’re asking why)
  - 3-4% overtime (identifying and addressing waste)

ARC Document Solutions

• 1/3rd of construction cost overruns due to poor documentation / document control
  (Research study results; published February 11, 2015)
Role: Cost Variance

OPPORTUNITY

ASSUMPTIONS

• Hard cost overruns per unit = $1,800
• Reduce overall hard cost by 0.5% through VPOs
• Reduce cost overruns by 20% through improved documentation/document management
Rol: Cost Variance

**OPPORTUNITY** = $1,300 Savings per home

($s average selling price) x (% spent on hard construction costs) x (% possible reduction) = $ Savings per home

PLUS

($s spent on cost overruns per unit) x (% possible reduction) = $ Savings per home

$2,980
RoI: Jobsite Waste

SURVEY RESULTS

How many dumpsters are used during construction of a single home?

- **1 MIN**
- **2.29 AVG**
- **1 MODE**
- **5 MAX**

What is the “haul fee” per dumpster?

- **$100 MIN**
- **$380 AVG**
- **$350 MODE**
- **$735 MAX**
RoI: Jobsite Waste

EXPERT INTERVIEWS +

NAHB
• Average # of dumpsters = 3+ per unit
• Average waste removal costs = $1,200 per unit

Scott Sedam, TrueNorth Development
• Job-site waste = $300-$500 usable material per dumpster
RoI: Jobsite Waste

OPPORTUNITY

ASSUMPTIONS

• 33% jobsite waste reduction thru:
  – Upfront design
  – Accurate take-offs / Trade partnering
Rol: Jobsite Waste

**OPPORTUNITY** = $590 Savings per home

(#{of dumpsters per home}) x [($ haul feel per dumpster) +
($s of usable materials thrown away per dumpster)] x
(% possible reduction) = $ Savings per home

$3,570
RoI: Customer Delight

SURVEY RESULTS

How many legitimate service/warranty items are reported per home following closing?

- Less than 2 MIN
- 5.1 AVG
- 3 MODE
- More than 10 MAX
RoI: Customer Delight

EXPERT INTERVIEWS +

Paul Cardis, Avid Ratings

• Every 1 (%) point decrease in customer satisfaction results in an average 8% increase in customer service requests the following year
• Average # of service requests per home = 15
• Product Satisfaction is the strongest predictor of customer referrals

President, NHQ Gold Award Winner

• Responding to a single service requests costs $250
RoI: Customer Delight

EXPERT INTERVIEWS +  (cont.)

JD Power and Associates (2006)

• A 1 (%) point increase in customer satisfaction levels can yield 0.17 additional recommendations per homebuyer

• 20% of overall customer satisfaction is driven by the builders’ warranty / customer service => Their experience living in their new home
Rol: Customer Delight

OPPORTUNITY

ASSUMPTIONS

• 1 (%) point increase in overall customer satisfaction resulting in:
  - 8% fewer service requests
  - 0.17 extra recommendations per buyer
• 5% conversion of additional recommendations to sales
Rol: Customer Delight

**OPPORTUNITY** = $360 Savings per home

(# warranty items per home) x ($s to respond to each item) x (% possible reduction) = $ Savings per home

PLUS

(overall customer satisfaction %) x (% possible improvement) x (# added recommendations per customer) x (# of customers) x (% conversion rate) = (# added sales)...

(# added sales) x ($s profit per sale) ÷ (total # of homes delivered annually) = $ Savings per home

$3,930
<table>
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<tr>
<th>Category</th>
<th>Value</th>
<th>Category</th>
<th>Value</th>
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<tr>
<td>Cycle Time</td>
<td>$1,680</td>
<td>Construction Oversight</td>
<td>$  635</td>
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<tr>
<td>Cost Variance</td>
<td>$1,300</td>
<td>Documentation</td>
<td>$  600</td>
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<tr>
<td>Warranty</td>
<td>$1,090</td>
<td>Jobsite Waste</td>
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<tr>
<td>Value Engineering</td>
<td>$  940</td>
<td>Execution</td>
<td>$  565</td>
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<tr>
<td>Incentives</td>
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<td>Employee Engagement</td>
<td>$  435</td>
</tr>
<tr>
<td>Training</td>
<td>$  725</td>
<td>Customer Delight</td>
<td>$  360</td>
</tr>
</tbody>
</table>

$10,000 per home opportunity