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# Improving Weight Engineering through the Widespread Use of Databases

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# Database > Data

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# Introduction

- Is it possible to give the Navy more value in the weight data while saving money?
  - A database gives the opportunity to access more information faster and in more ways than a report
  - A database gives possibilities to analyze and check data more effectively than with a report
- What discussion are we proposing to start?
  - Should a database be delivered in addition to (or instead of) a report as an RP requirement?
- Why?
  - Most shipyards and design agents are using a relational database
  - Some of the value of the data is lost when it is reduced to an 80-column report or spreadsheet listing
  - Transferring a database will save time and money, and provide many benefits to the Navy compared to a report

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# Benefits for the US Navy

- During Construction
  - Potential time/cost savings
  - Improved weight and CG monitoring
- During Lifecycle
  - Updating weight data on existing vessels
  - “What if” scenarios
  - Inclining test improvement tools under development
  - Salvage
- During Early Stage Design
  - Reusing historical data
  - Ratiocination

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# What is a database?

- A database is a collection of electronic information that is organized so that it can easily be accessed, queried, managed, and updated.

- Data is defined so that it can be reorganized and accessed in a number of different ways

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# Database versus Excel

- Relational Database
  - Maintaining relations between different types of data
  - Simultaneous access (multiple users)
  - Separating functionality and data storage
  - Security features
  - Reporting capabilities

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# Accessing and Querying Data

- Sorting & Filtering
- Grouping
- Comparing
- Analyzing
- Visualization
- Reports (beyond standard reports)
- Combination of the above

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# Sorting & Filtering

- Sort data to check min/max values for QA purposes
  - Extreme values will emerge
- Filter data to find weight and CG of data collections with a specific
  - Geometric area
  - Discipline
  - Size
  - Combinations of several filters

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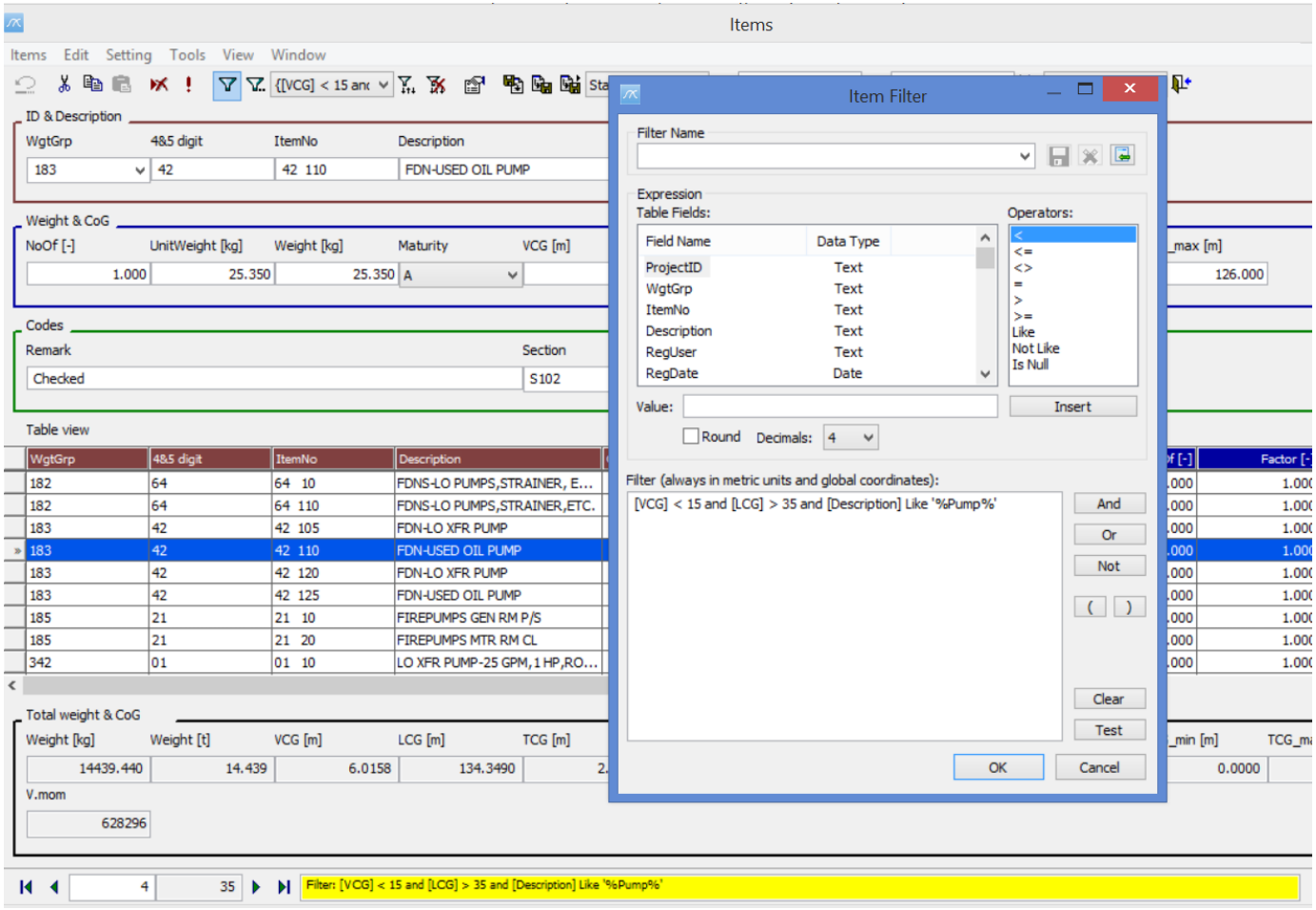
# Example

- Finding all pump equipment within a CG boundary



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# Grouping

- Get weight and CG data and summary for cross-SWBS properties like
  - Systems Weight Distribution
  - Assemblies
  - Materials

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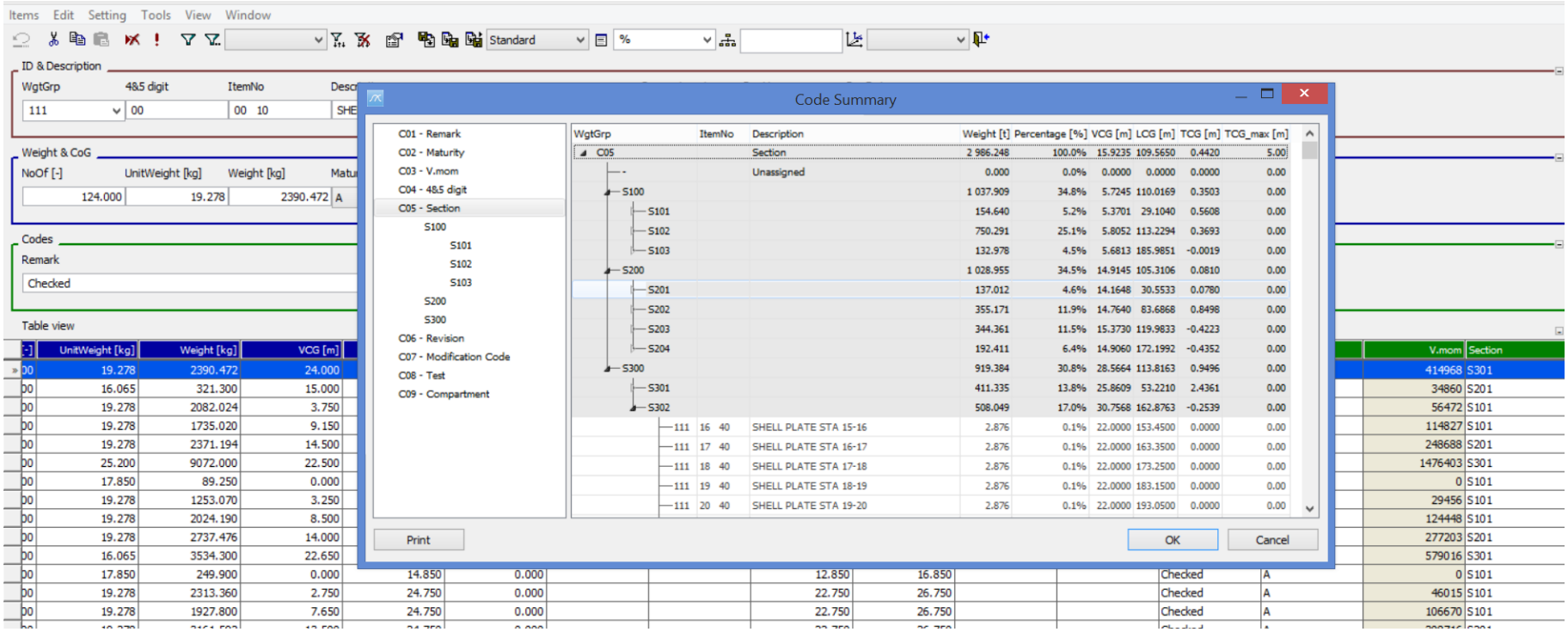
# Example

- Hierarchical module summary



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# Comparing

- Compare weight and CG data with previous revisions or projects
  - SWBS groups
  - Assemblies
  - Etc.
- Run regression on past ship data for estimation of new ships
  - Ratiocination of weight/ship parameters
  - Ratiocination of CG/ship parameters

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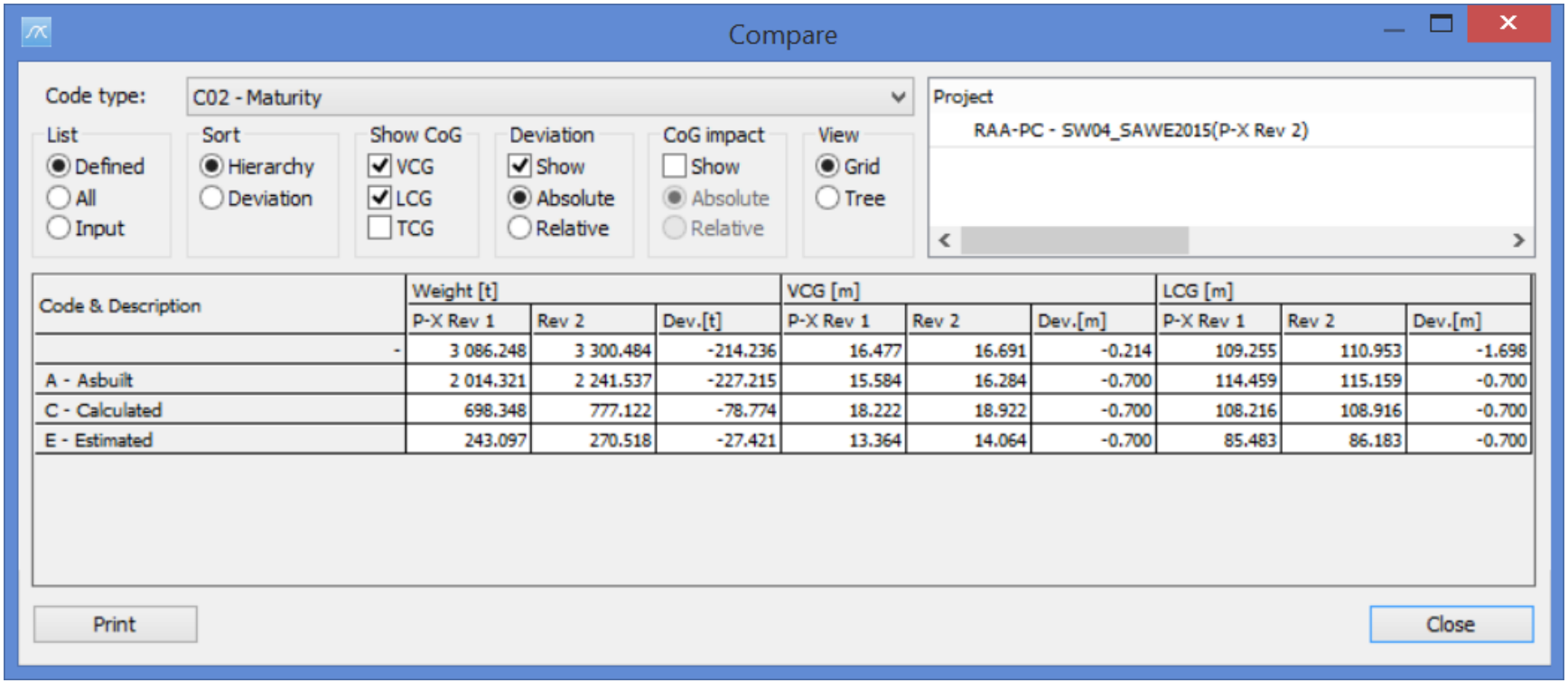
# Example

- Checking Maturity (Class) Status between revisions




| Code & Description | Weight [t] | | | VCG [m] | | | LCG [m] | | |
|---|---|---|---|---|---|---|---|---|---|
| | P-X Rev 1 | Rev 2 | Dev.[t] | P-X Rev 1 | Rev 2 | Dev.[m] | P-X Rev 1 | Rev 2 | Dev.[m] |
| - | 3 086.248 | 3 300.484 | -214.236 | 16.477 | 16.691 | -0.214 | 109.255 | 110.953 | -1.698 |
| A - Asbuilt | 2 014.321 | 2 241.537 | -227.215 | 15.584 | 16.284 | -0.700 | 114.459 | 115.159 | -0.700 |
| C - Calculated | 698.348 | 777.122 | -78.774 | 18.222 | 18.922 | -0.700 | 108.216 | 108.916 | -0.700 |
| E - Estimated | 243.097 | 270.518 | -27.421 | 13.364 | 14.064 | -0.700 | 85.483 | 86.183 | -0.700 |

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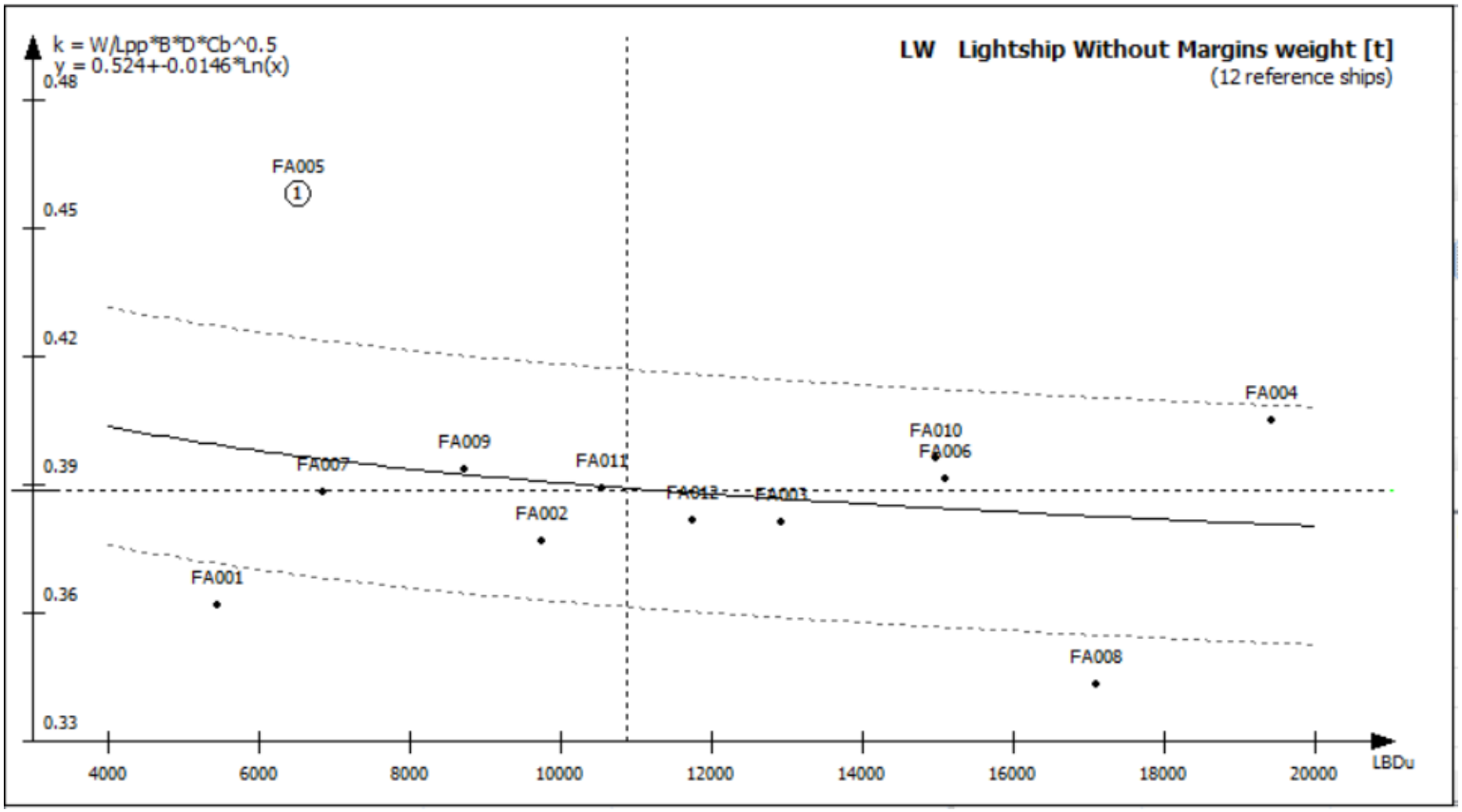
# Example

- Ratio between Weight and LBD



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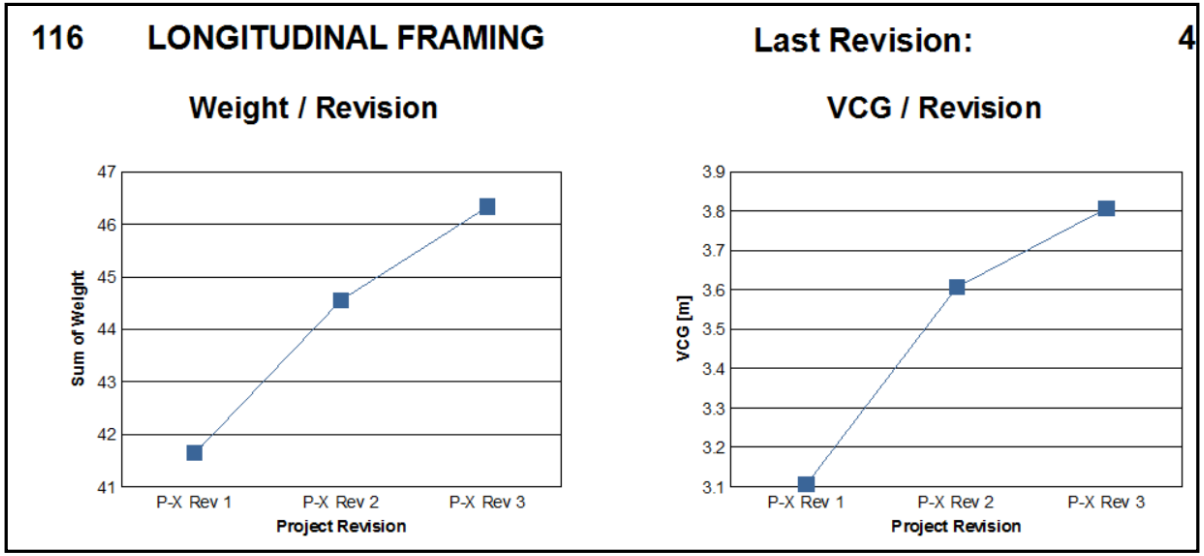
# Analyzing

- Weight Distribution Curve
- Gyradius calculations
- Find duplicates
- Trend lines
- What-if/modification studies?



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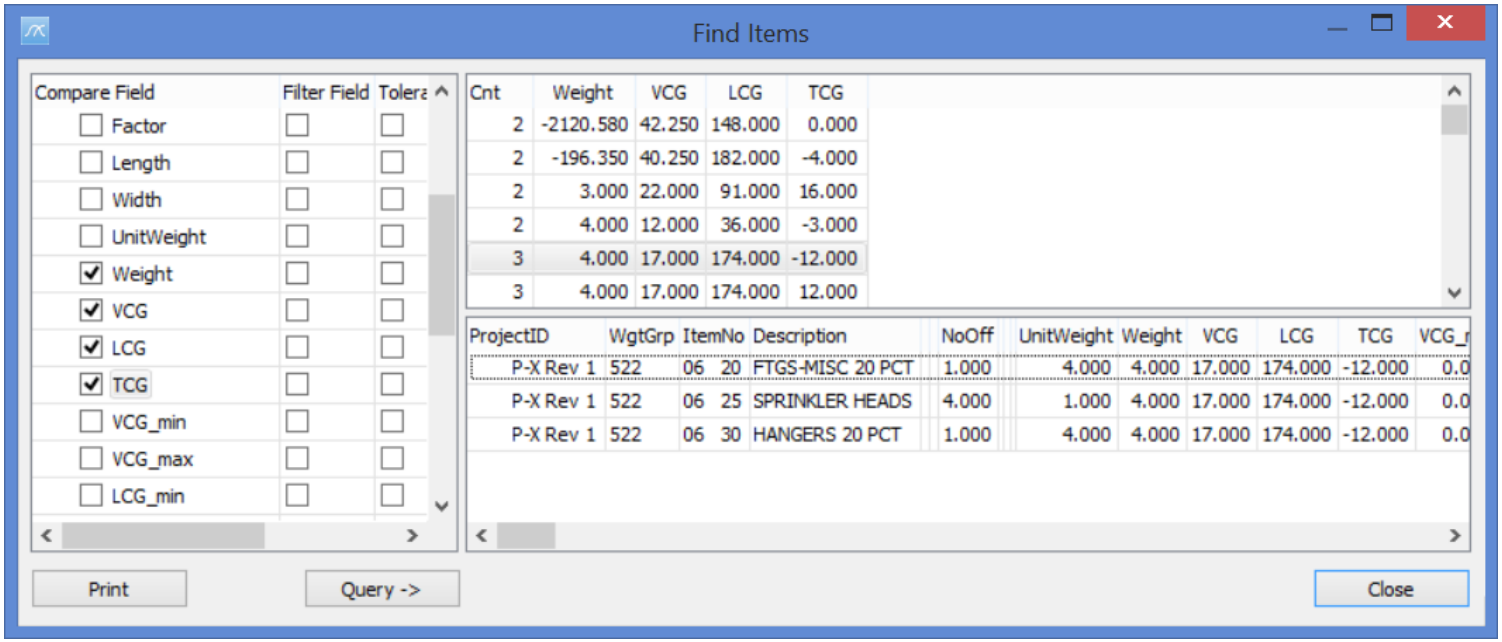
# Example

- QA of duplicate items



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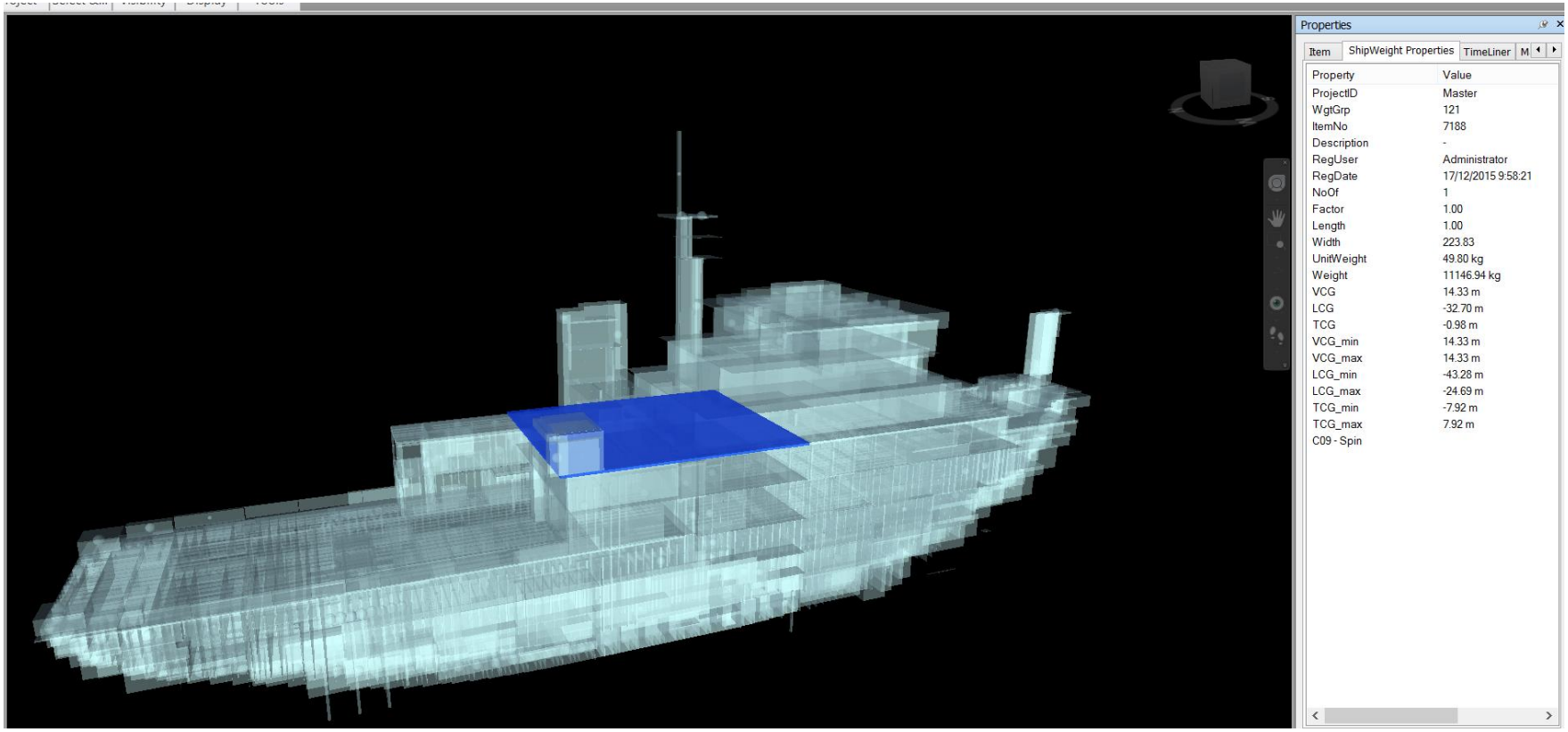
# Visualization

- QA the model visually



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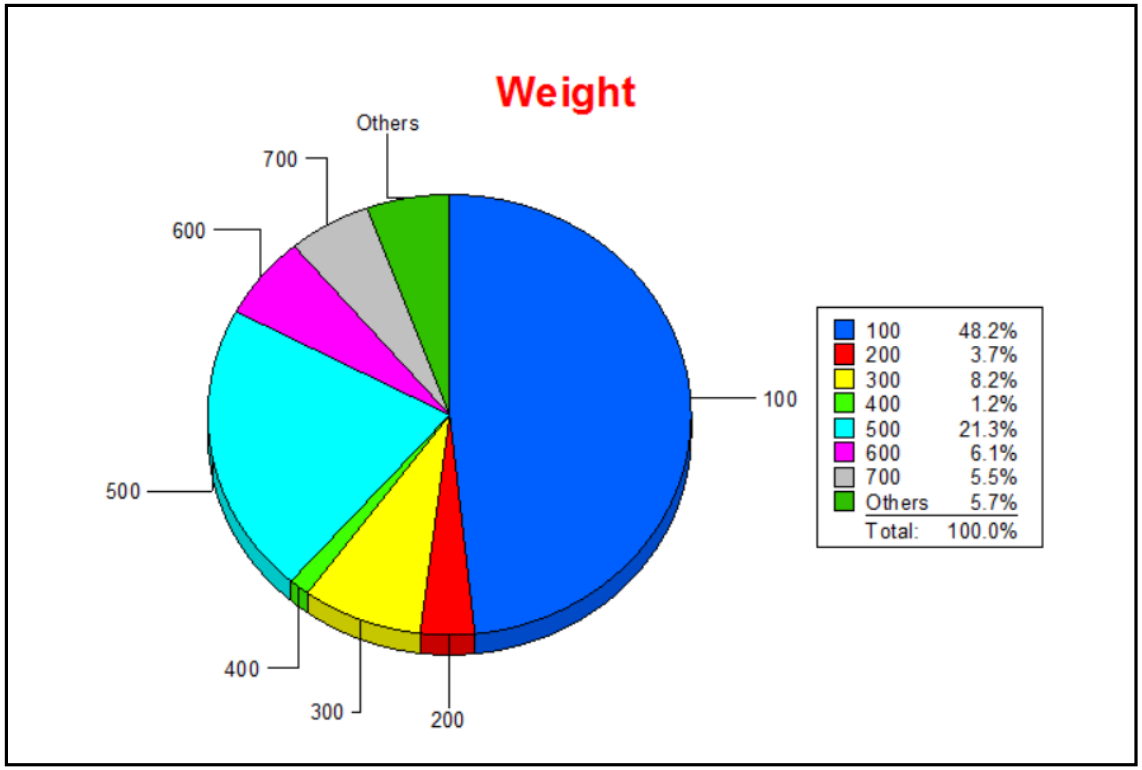
# Reports

- Graphs, Pie charts
- Trend lines
- Matrix
- Assemblies
- Etc.



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# Transferring of Data

- An XML file could be defined for easy transfer of weight data
- Why XML and transfer the entire database, not just an Excel listing of all of the items?
    - Parameters
    - History
    - Code relationships and calculation methods
    - Preserves relational information

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# Benefits

- Significantly more capabilities than traditional reports
- Less time and money spent on formatting
- Data can be re-used for parametric estimation of new designs
- Historical data can be exported to a LEAPS concept for use within ASSET
- Inclining efforts may be reduced through new tools
- Benefits during construction, life-cycle, and new designs