Model Auditing To Get The Job Done

(BuildSA – April 2021)

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VIRTUAL BUILT
Design and Construction Technology

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Overview

- **What** is model auditing?
- **Why** is model auditing important?
- **How** are models audited?
  - Types of model auditing criteria (project, best practice, bespoke)
  - Tools that can be used for model auditing
- How to **Automate** model auditing + **Challenges** to Automation
- **Live** Demonstration

General Model Management Concepts

Most people think of:

- Good quality models
- For everyone in the team
- Usually 1 key party responsible for the model QA process
- Reporting and follow-up

But Model management sounds so booooring…

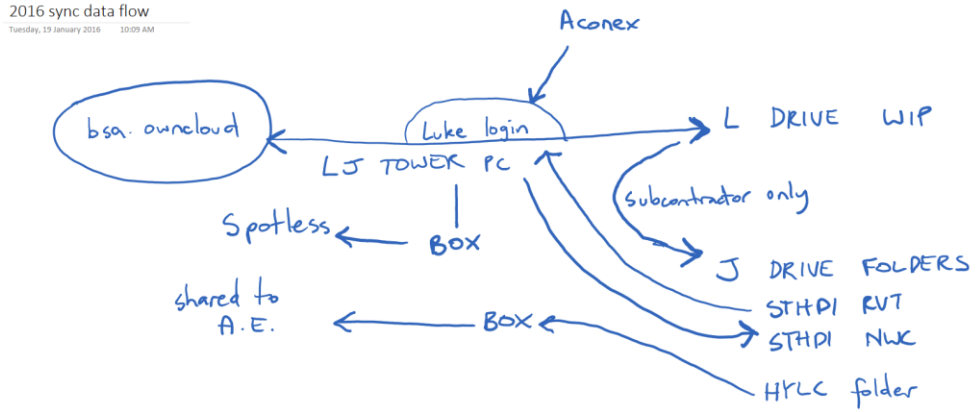
Not if we think about the BIG PICTURE

- Efficiency (good models = less rework)
- Quality (good models = better work)
- Performance (good models = faster)
- Automation (get a machine to work for you)

Communication during Model Management

What can it involve?

- Quality control
  - Finding problems
- Batch processing
  - Fixing models
- Communicating with the Modelling Team or upper level stakeholders
  - Communicating requirements
  - Digesting results



What is Model Auditing?

- **Not** the same as Model Coordination or Design Compliance Checking
- Can involve checking BIM files against:
  - **Project Compliance Criteria**
    - Levels, Grids, Coordinates
  - **Good Modelling Practices**
    - Imported CAD?
  - **Bespoke Project Requirements**
    - Asset Parameters

Necessary to do your own work properly

Faster and more efficient for the whole team

Usually for Asset Handover, FM, Operations

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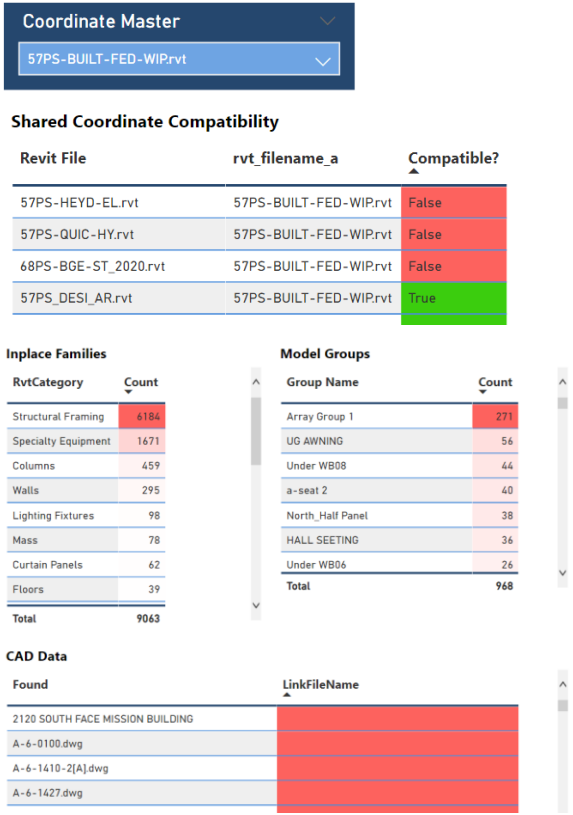
Why is Model Auditing important?

- Sometimes Mandated and Required
- Not just for Revit (consider IFC, infrastructure)
- Ultimate goals are:
  - **Risk Mitigation** *(meet the deliverable requirements)*
  - **Efficiency** *(good models = less rework)*
  - **Quality** *(good models = better work)*
  - **Performance** *(good models = faster)*
  - **Automation** *(get a machine to work for you)*

How are Models audited?

- Types of model auditing criteria
  - **Project Compliance**
    - Best defined in Control Model
  - **Industry Best Modelling Practice**
    - Keep track of current trends
  - **Bespoke or Custom Requirements**
    - Understand the execution plan



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Example

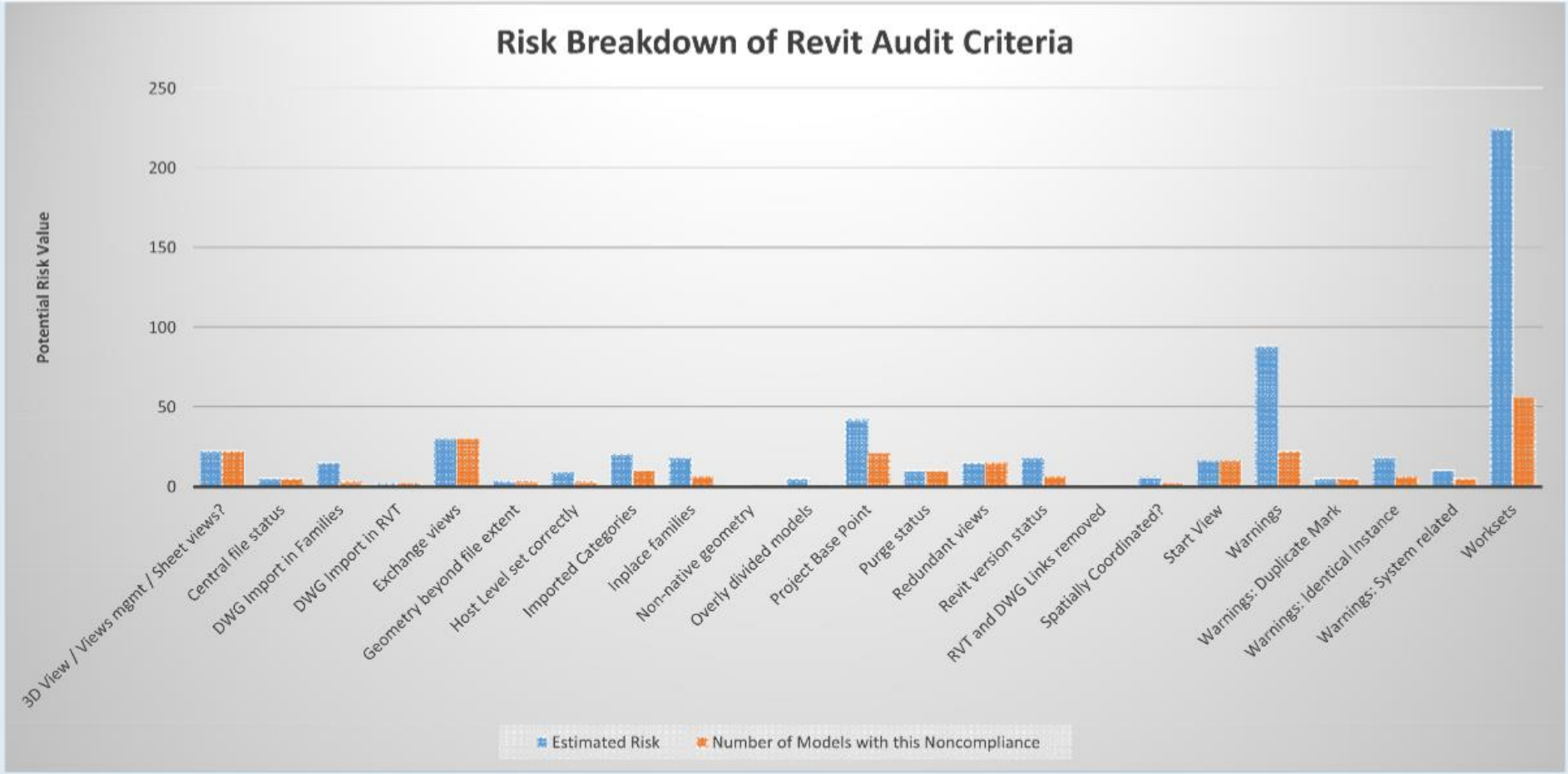
0. MODELLING PRACTICE AND SETUP	No
Model segregation method is appropriate	No
Model is in Revit 2015 format	No
Model is a Central File	No
Model has been purged	No
Location has been set to "Adelaide"	No
Model Shared Coordinates and Project Base Point comply with BEP (site name set to RAH SITE)	No
Model geometry only present within obvious file extent	No
Host level for elements is set correctly	No
Model has no "Inplace Families"	No
Model is stable (ie. Not corrupt)	No
1. DWG LINKS or IMPORTS	No
AutoCAD (DWG) Object Styles and Line Types have been removed	No
DWG Links are removed from RVT	No
DWG Imports are removed from RVT	No
Imported Objects tab in Object Styles dialog contains no entries	No
DWG Imports inside Families do not exist (refer "Imports in Families" node in Object Styles)	No
Model contains only native Revit geometry items	No
2. REVIT LINKS	No
Any links required to produce the drawings in (7) are to remain Linked and Loaded (refer to (20) for re-pathing requirements)	No
All other RVT links are removed from file	No
3. LINKS	No
All other link types not specifically described in (1) or (2) have been removed	No

4. START VIEW	No
Start View selection is set correctly in "Manage - Starting View"	No
Revision is shown	No
Revision matches Aconex version	No
5. 3D VIEW	No
1 x 3D Orthographic view set to Wireframe; Locked; Front/Right View has been provided	No
6. EXCHANGE VIEWS	No
All model and annotation Categories not required are hidden in Exchange Views (this includes Materials and redundant elements such as Grids, tags, text, reference plans and lines)	No
The following required Exchange Views have been provided: - RCP Coordination and Floor Plan View per Level - Navisworks Export Views (By Sector and Level)	No
7. SHEET VIEWS	No
Views that have been issued on sheets have been retained in model	No
View Templates, View Filters, Visibility/Graphics and details typically applied	No
Applicable Legend Views and Schedules retained in conjunction with any sheet view issued	No

8. GROUPS	No
All groups are ungrouped and removed from browser	No
9. REDUNDANT VIEWS MANAGEMENT	No
All redundant views not required in (5), (6) and (7) are deleted (ie. 3D Views, Exchange Views, Sheet Views remain)	No
10. WARNINGS	No
Warnings have been reduced to below 50	No
Warnings: Identical Instance have been cleared	No
Warnings: System related have been cleared	No
Warnings: Duplicate Mark have been cleared	No
11. WORKSETS	No
All elements are properly and consistently applied to Worksets	No
Workset naming complies with the workset management document previously submitted by the Contractor	No
There are no items on "Workset1"	No
All Levels and Grids are on the "Shared Levels and Grids" workset, and there are no other items on this workset	No
There are no worksets based on user / modeller name (ie. JoeBloggs)	No
Empty or archived worksets have been removed	No
12. ROOMS AND SPACES	No
All unnecessary Rooms and Spaces have been deleted	No
All redundant Rooms and Spaces have been deleted completely (in Schedule)	No
All required Rooms and Spaces are properly enclosed and bounded by room bounding elements	No
13. PURGE	No
All Redundant data has been purged	No
14. UNIFORMAT CODE	No
UniformatClassification_2010.txt from Assembly Code Settings has been selected	No
15. UNIFORMAT CODES APPLIED	No
Correct UniformatClassification Codes have been applied as "Assembly Code" parameter to all elements	No
16. ADDITIONAL PARAMETERS ADDED TO MODEL	No
"Asset Code" Instance parameter is correctly added	No
"Designation Code" Type parameter is correctly added	No
17. ADDITIONAL PARAMETERS DATA INPUT	No
Asset Code parameter is correctly applied (code by Spotless)	No

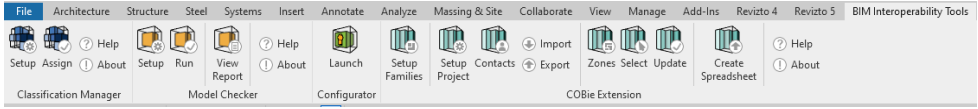
Example rvt audit dashboard

Thursday, 12 February 2015 3:42 PM



Tools that can be used for Model Auditing

- Inbuilt to the Authoring Software
  - Revit Model Checker, Cobie Tools



- Addins
  - Dynamo, BIMlink??

- Software
  - Solibri, Revizto v5

- **Project Intelligence Platforms**
  - **Deep Space**

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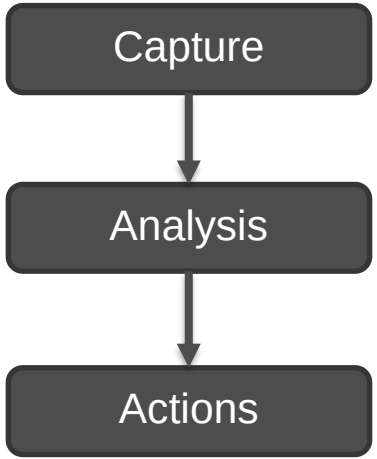
How to Automate Model Auditing

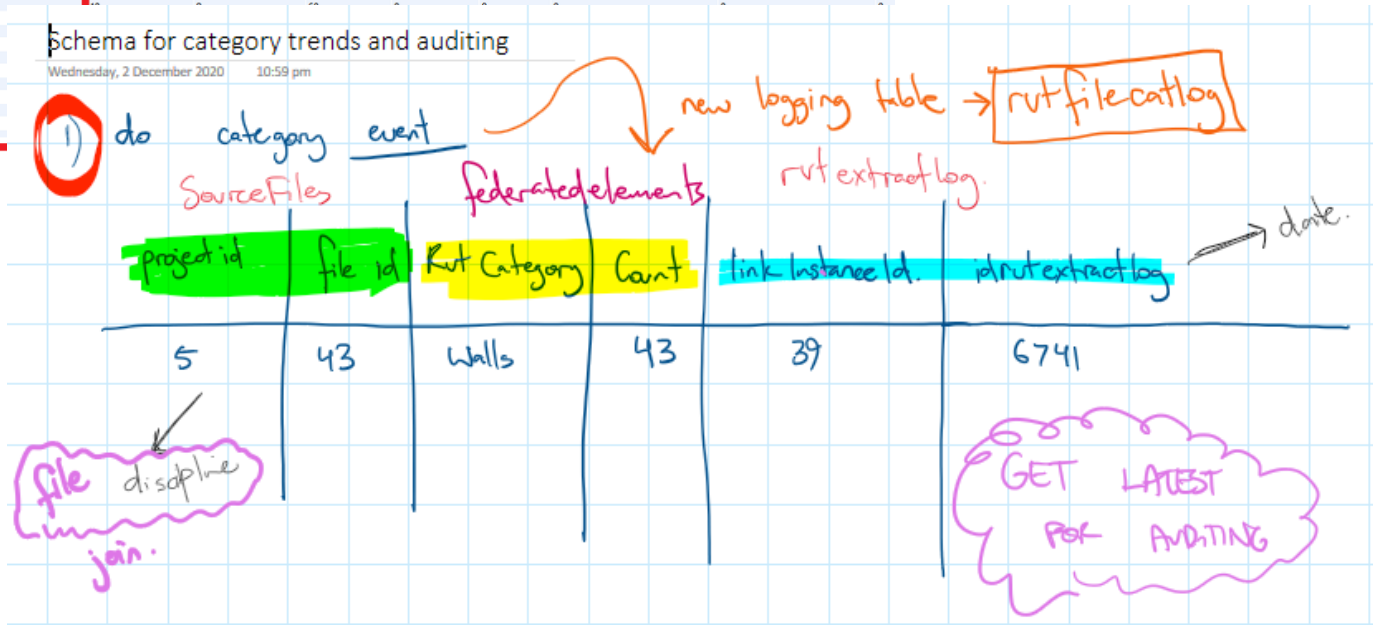
- **Automate** Data Capture with Appropriate Tools
- **Reproducible** Reports or Dashboards
    - Relational Data Model
- Give **Actionable** Insights
- Allow for a cycle of checking and fixing models

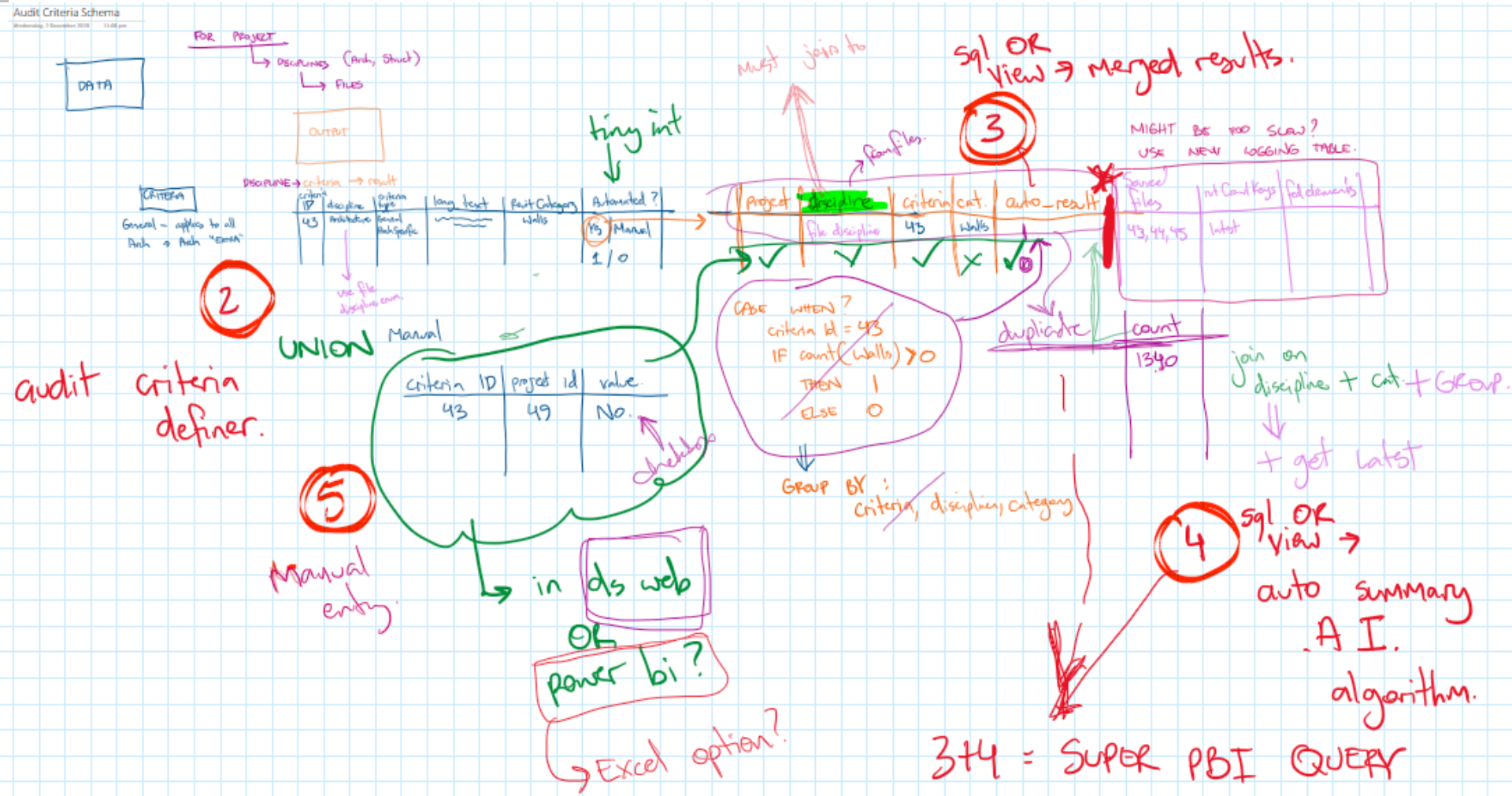


Challenges to Automated Auditing

File_Size	Dataset_Count	Family_Instance_Count	View_Count	Sheet_Count	Schedule_Count	Workset_Count	Warning_Count	Warning_Element_Count	Level_Count	Grid_Count	Material_Count	DWG_Link_Count	Import_Count	Detail_Line_Count	Group_Count	Inplace_Family_Count
120	80696	21099	519	82	0	2	0	0	21	122	85	0	2914	16029	0	0
160	45980	12868	214	1	6	44	29	65	18	114	53	0	9	14814	9	0
251	93407	295	2073	198	26	52	3	6	16	139	113	2	474	87454	441	0
360	133577	29585	1929	161	0	41	34	752	7	142	160	0	0	2364	0	0
217	71433	20852	1242	96	0	46	1	0	4	111	121	0	0	371	0	0
241	62383	15434	1169	102	0	41	16	26	5	130	135	0	0	429	0	1
19	8398	3933	29	19	0	8	1	0	15	80	42	0	0	17	0	0

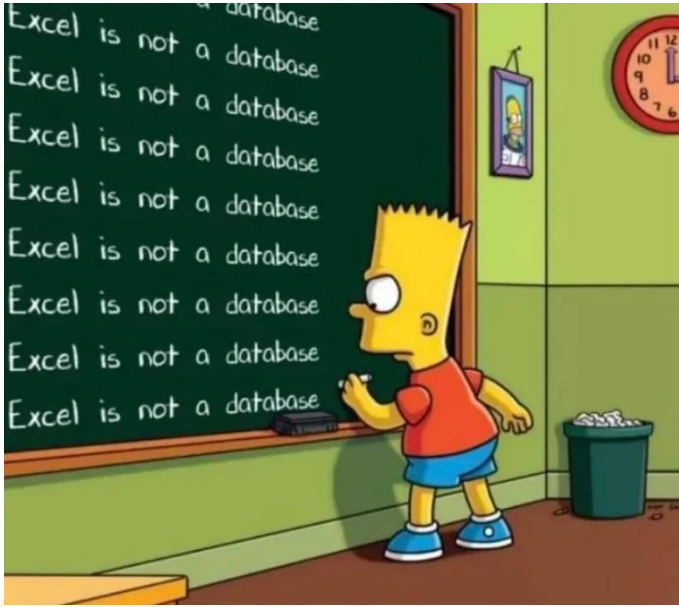
Data_Categories_Count	Family_Categories_Count	Views_not_on_Sheets	System_Classification_Undefined_Count	Failed_Audit_Sections	Passed_Audit_Sections	Automation_Perf	Family_Instances	Family_Types	With_Designation_Code_Data_Type	With_Assembly_Code_Data_Type	Wit
42	10	233	NULL	0	0	0	0	0	0	0	0
43	11	214	16	11	9	30	0	0	0	0	0
32	2	1	NULL VALUE	12	8	30	0	0	0	0	0
59	20	66	0								
55	16	53	NULL VALUE								
62	21	89	NULL VALUE								
25	5	10	0								
26	5	37	134								
30	5	16	926								
32	6	16	28								
35	7	59	7								
31	5	11	5								
25	5	9	0								




Audit Criteria Schema
DATA
FOR PROJECT
DISCIPLINES (Arch, Struct)
FILES
OUTPUT
DISCIPLINE → criteria → result
CRITERIA
General – applies to all
Arch → Arch "extra"
criteria ID
discipline
criteria type
long text
Fail Category
Automated ?
43
Architecture
General Rule Specific
Walls
43 Manual
1 / 0
use file discipline even
tiny int
2
audit criteria definer.
UNION
Manual
Criteria ID
project id
value
43
49
No.
checkbox
5
Manual entry
in ds web
OR
power bi?
Excel option?
Must join to
sql OR View → merged results.
3
project
discipline
criteria
cat.
auto_result
file discipline
43
Walls
Revit files
CASE WHEN ?
criteria id = 43
IF count(Walls) > 0
THEN 1
ELSE 0
GROUP BY : criteria, discipline, category
duplicate
count
1340
MIGHT BE TOO SLOW ?
USE NEW LOGGING TABLE.
Saved files
Int Cent Keys
Fail elements
43, 44, 45
latest
join on discipline + cat. + GROUP.
+ get latest
4
sql OR View →
auto summary
A I.
algorithm.
3+4 = SUPER PBI QUERY

Problems with Excel-based Workflows

- Duplication of effort
- Distributed / decentralised
- Potential loss of data
- Analysis difficult when dealing with Big Data



Need the big *<data>* picture...

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What is Big Data?

The concept and the challenges:

- **Big data** is a field that treats ways to **analyze**, systematically **extract** information from, or otherwise deal with data sets that are too large or complex to be dealt with by **traditional data-processing application software**.

- Data with many cases (**rows**) offer greater statistical power, while data with higher complexity (more attributes or columns) may lead to a higher false discovery rate.[2]

- Big data challenges include **capturing** data, data **storage**, data **analysis**, search, sharing, transfer, **visualization**, querying, updating, information privacy and **data source**.

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Relational Data Model =

Project Intelligence Platform

Deep Space Schema

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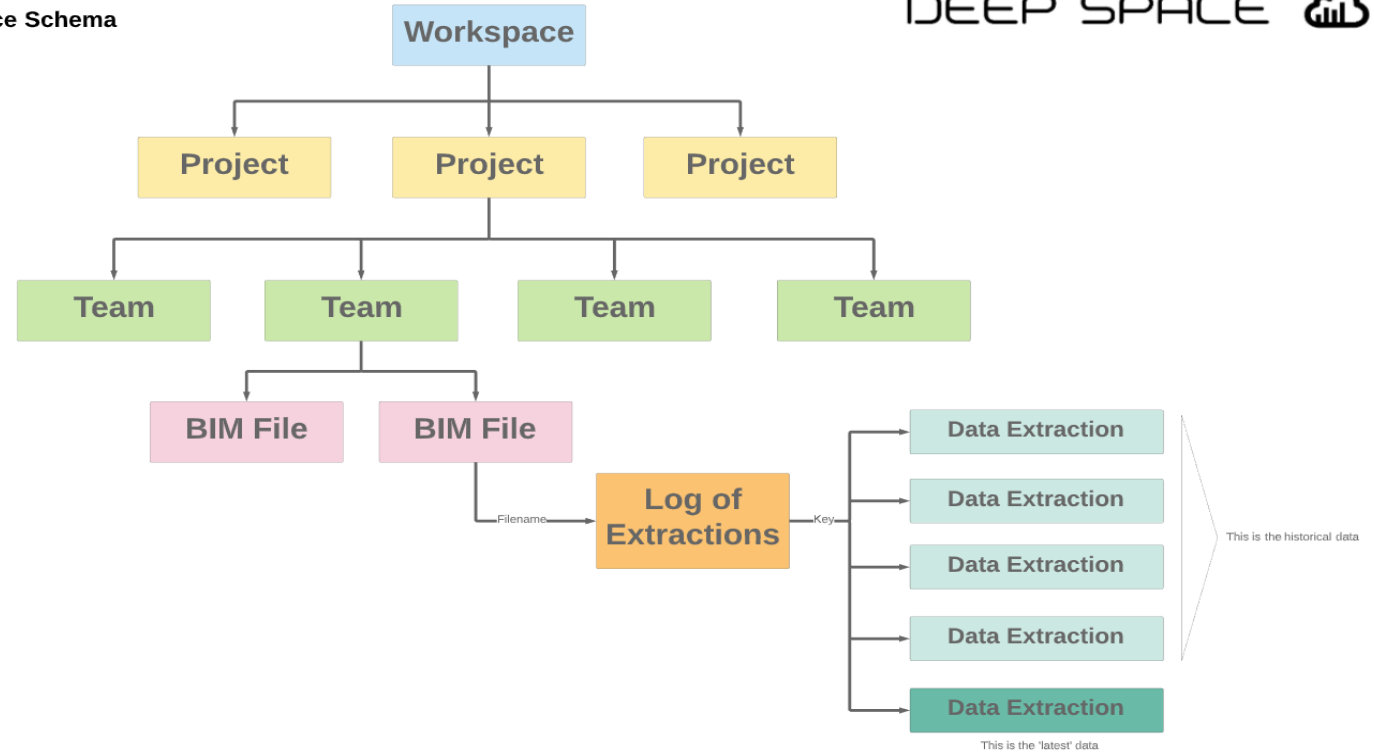
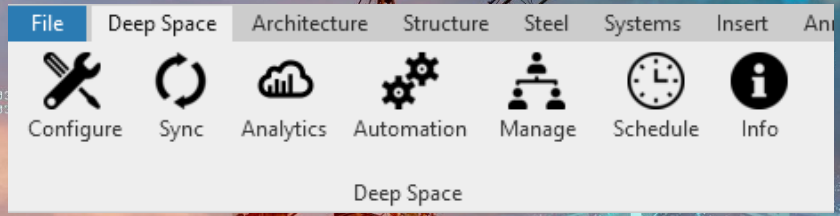


Demonstration of a Model Data Capture Tool:

Deep Space Sync for Revit



Example of a Model Audit Dashboard

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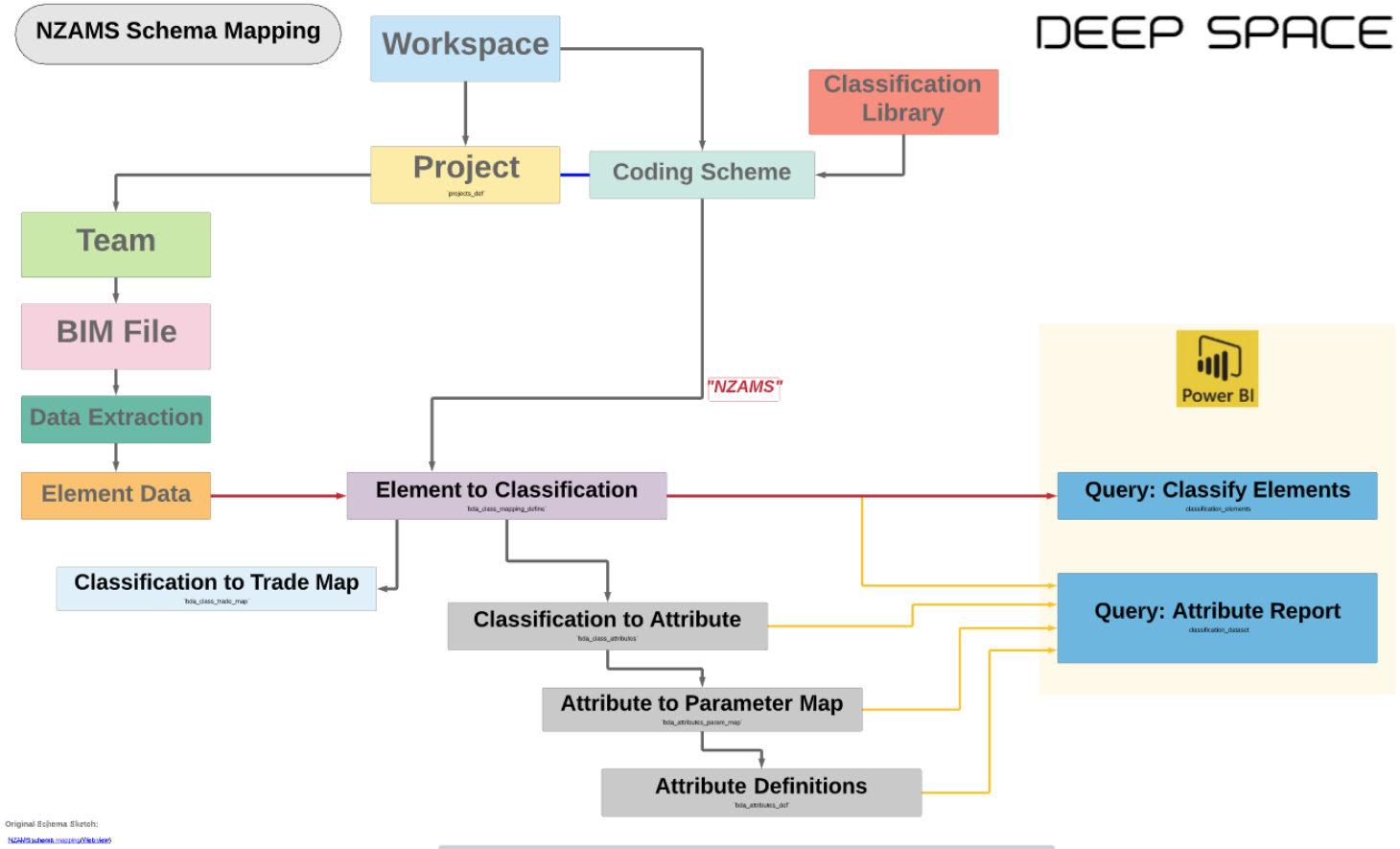
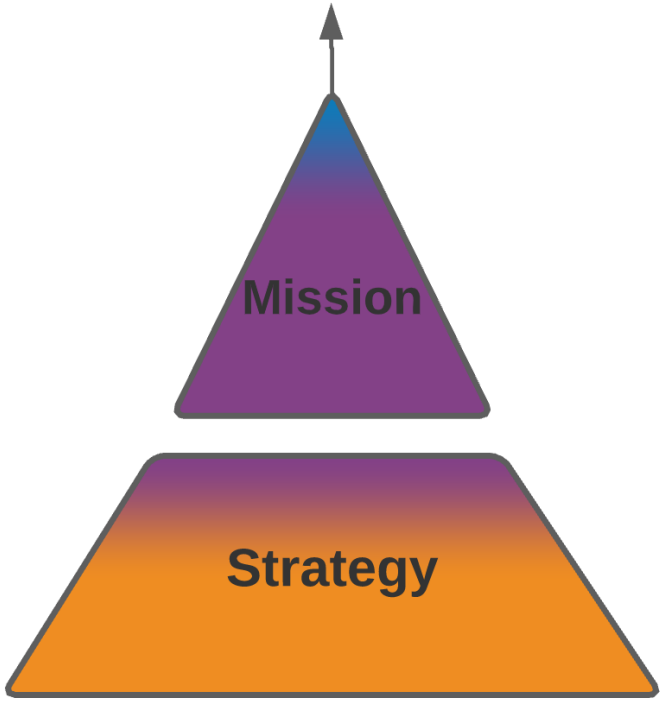
Future? Automation + Machine Learning + AI



A Project Intelligence Platform



The Deep Space Mission is to

Optimise the Construction and Operation

of the Built Environment

Our strategy is to

Build the best Project Intelligence Platform

serving our customers insight, clarity, actions through model and data analytics

Questions?

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