Autodesk Revit and the Power of Data

Proactive Model Management

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Holger de Groot

National Director of BIM, MArch, PGDipArch

Since 2017:	HDR, Australia
2015 - 2017:	Grimshaw Architects, Australia
2010 - 2015:	HDR TMK and SSP, Germany
2001 - 2010:	Various Positions in the AEC Industry

As National Director of BIM for the Australian region, my role is to **supervise and guide** Digital Practice Leaders at HDR. I am responsible for **implementing** and advising leadership on the corporate Digital Practice **BIM Strategy**, interacting with **various disciplines** and advising on BIM matters at all levels.

Mehdi Blanchard

Associate Technology Innovation Specialist

Since 2011:	HDR, Australia
2003 - 2011:	Graphisoft Australia / Central Innovation
1998 - 2002:	Cap Gemini

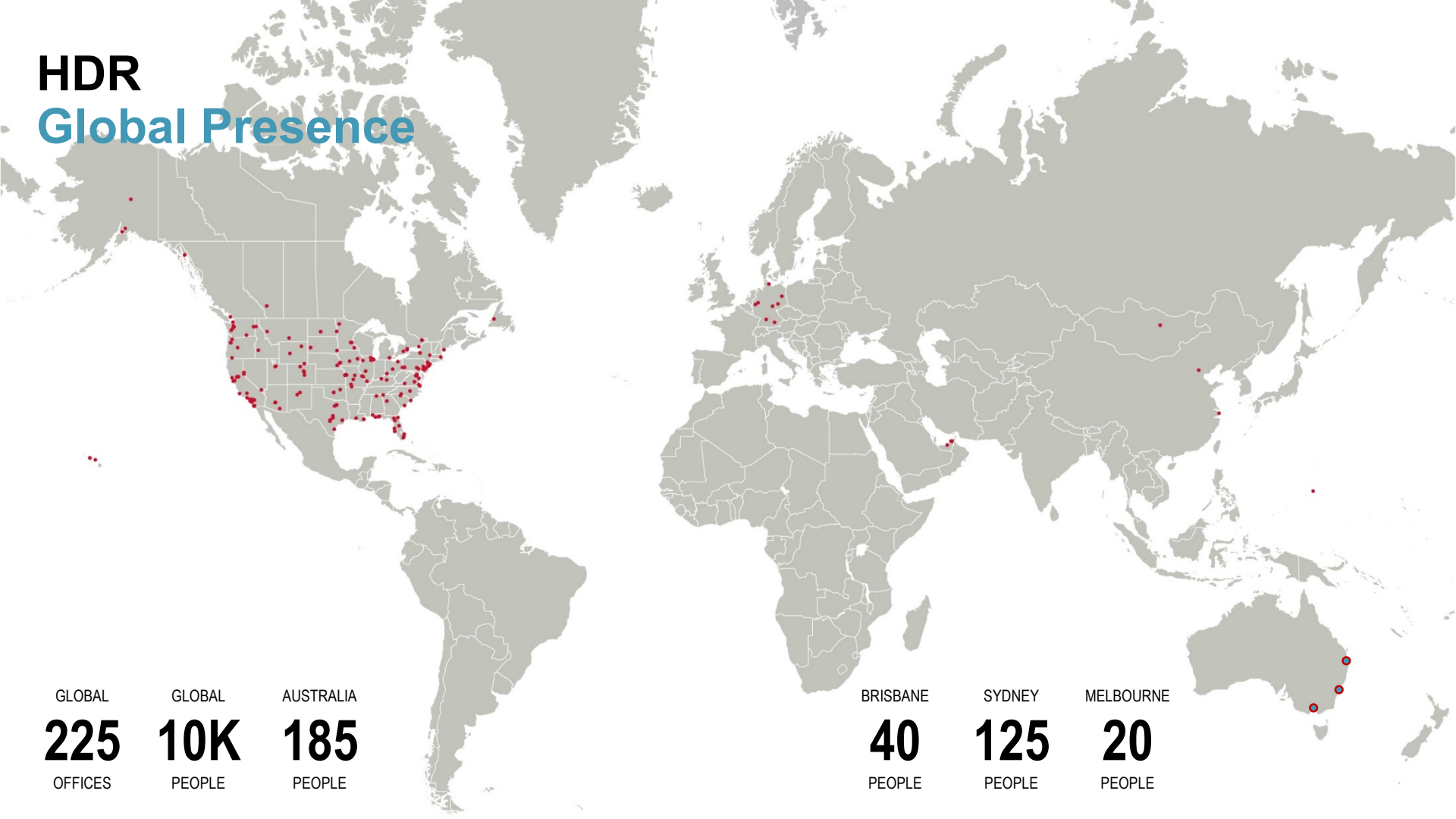
As a Technology Innovation Specialist, my role is to **assess** new technologies and find **creative** ways to implement them in our workflow. I also research, design and develop **custom software solutions** for HDR globally.

HDR
Profile

HDR is a creative firm for architecture and engineering with experience spanning over 40 years in the Australian market. With more than 10,000 employees in 225 offices worldwide, we have access to highly informed best practice, innovative future-thinking and top talent from around the world, allowing us to contribute world-class intellect, expertise and specialist knowledge to our projects.

HEALTH
COMMERCIAL
DEFENCE + GOVN'T
RETAIL + MIXED USE
+ URBAN LIVING
EDUCATION, SCIENCE +
TECHNOLOGY

HDR
Global Presence



GLOBAL	GLOBAL	AUSTRALIA
225	10K	185
OFFICES	PEOPLE	PEOPLE

BRISBANE	SYDNEY	MELBOURNE
40	125	20
PEOPLE	PEOPLE	PEOPLE

Autodesk Revit and the Power of Data
Proactive Model Management

Quality Assurance

Key Performance Indicators

Infrastructure & Collecting Data

Microsoft Excel, Dynamo & Macros

Visualising & Optimising

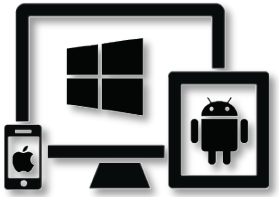
Microsoft PowerBI, Autodesk Revit & D3

Autodesk Revit and the Power of Data

Proactive Model Management

Autodesk Revit support and training to build up a high level of user knowledge **needs time**.

Issues arising from inexperienced users in models and **Revit's inability to provide feedback**, hence further hindering learning.

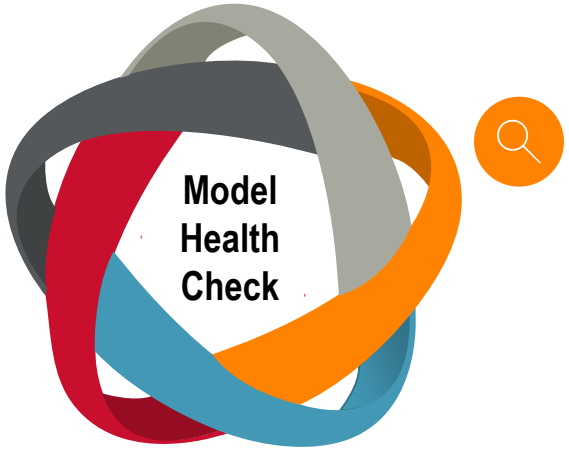


It was time to develop something for our project teams that is a little bit more **flexible and easy to access**.

Quality Assurance

Key Performance Indicators

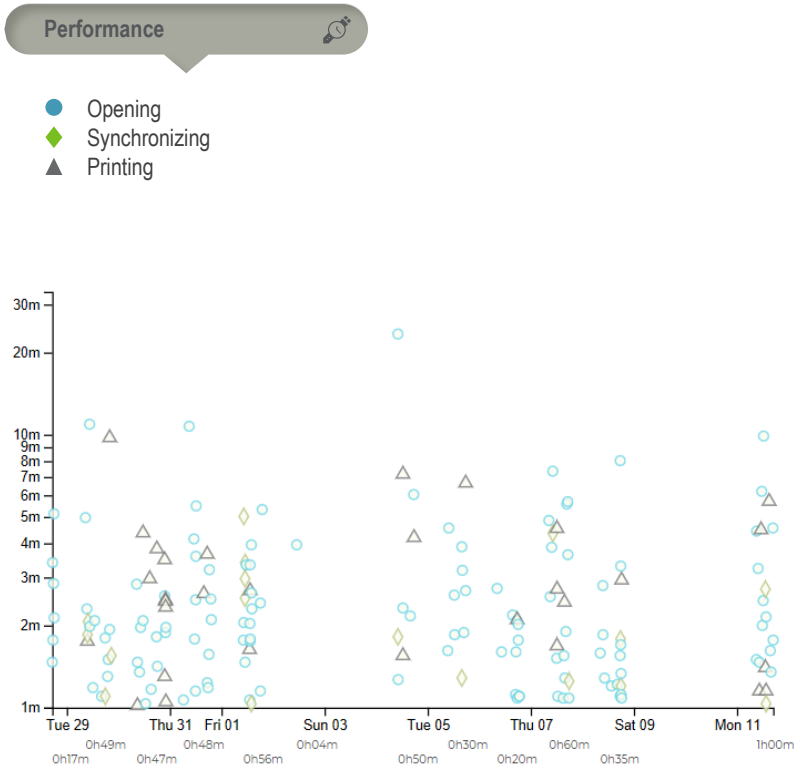
Quality Assurance
Step One

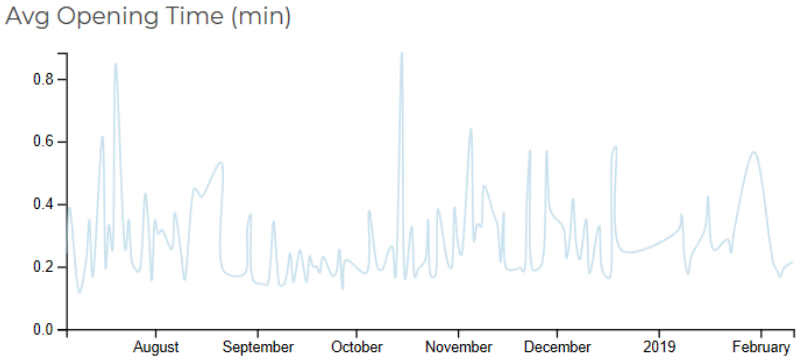


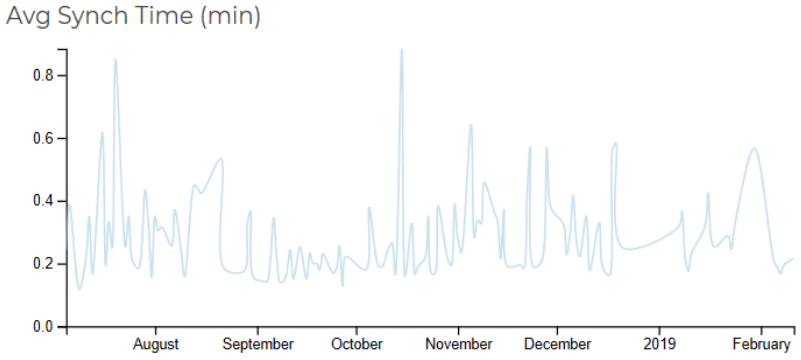
Defining KPIs

› Key Performance Indicators allow us to measure and discuss what we are trying to improve.

Quality Assurance
Key Performance Indicators







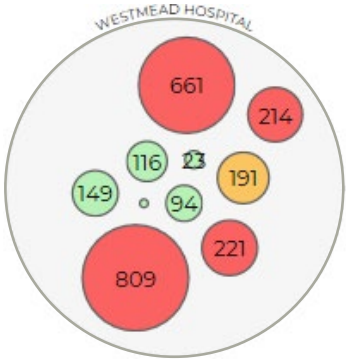
Quality Assurance
Key Performance Indicators

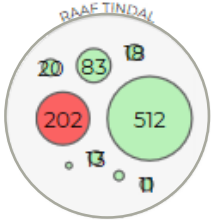
Performance

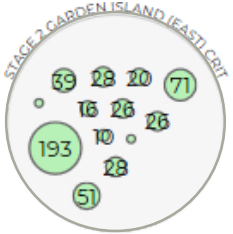
- Opening
- Synchronizing
- Printing

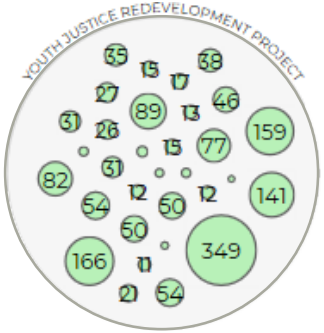
Model Size

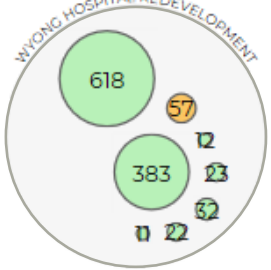
- X < 300 MB
- 300 MB < X > 400MB
- X > 400 MB

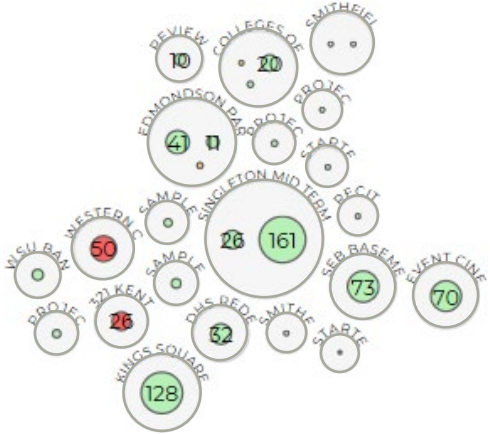












Quality Assurance
Key Performance Indicators

Performance

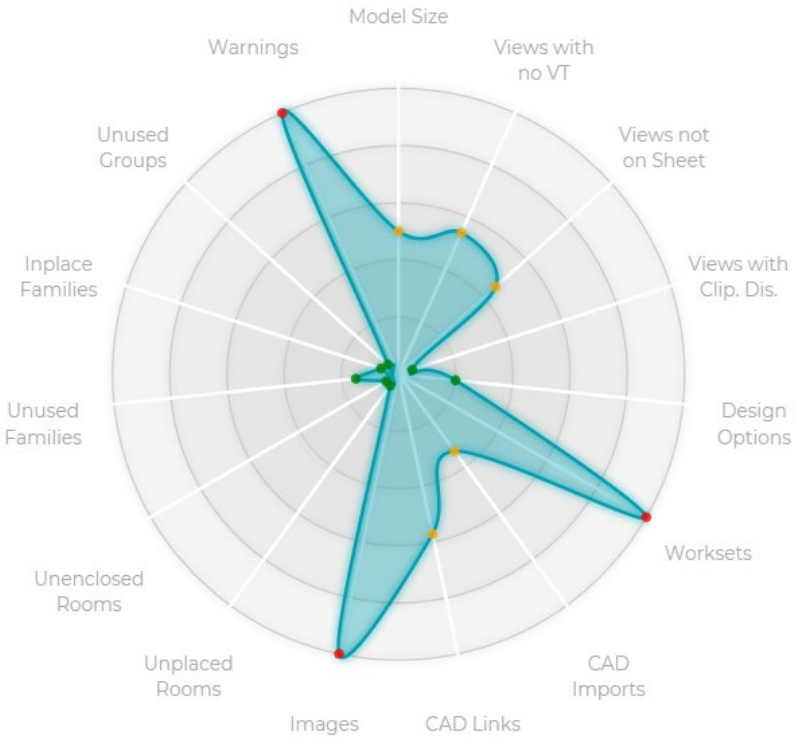
- Opening
- Synchronizing
- Printing

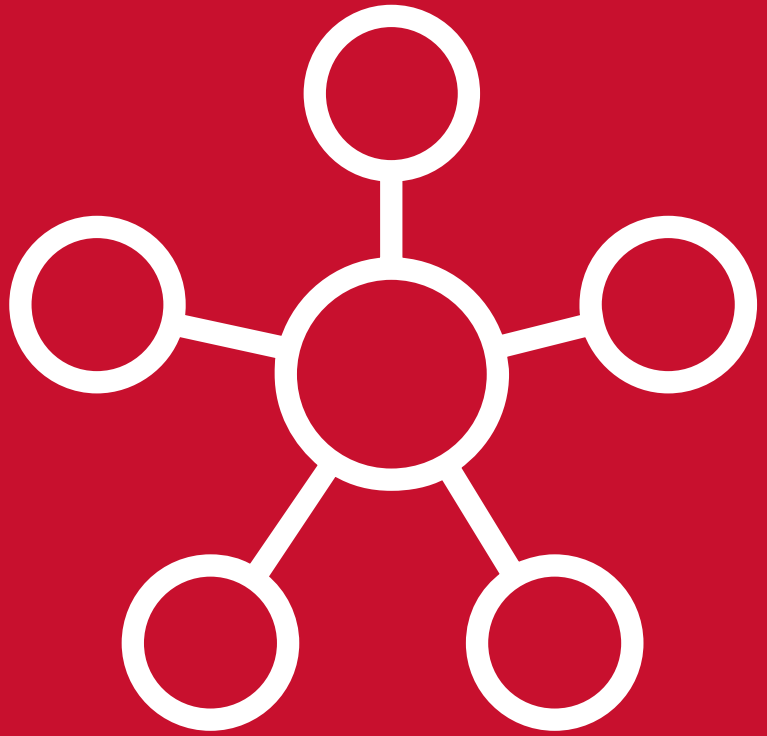
Model Size

- X < 300 MB
- 300 MB < X > 401MB
- X > 400 MB

File Data

- Warnings
- Unused Groups + Families
- In-place Families
- Unenclosed + Unplaced Rooms
- CAD Links + Imports + Images
- Views with no View Template
- Views not on Sheet
- Views with Clipping Disabled
- Design Options + Worksets

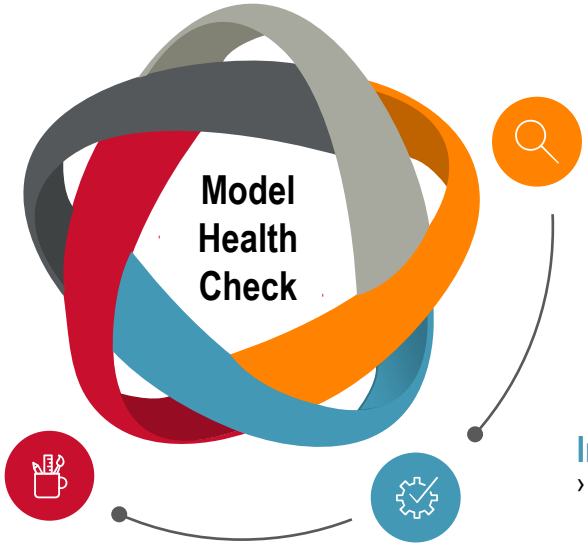




Infrastructure & Collecting Data

Microsoft Excel, Dynamo & Macros

Infrastructure & Collecting Data
Step Two & Three

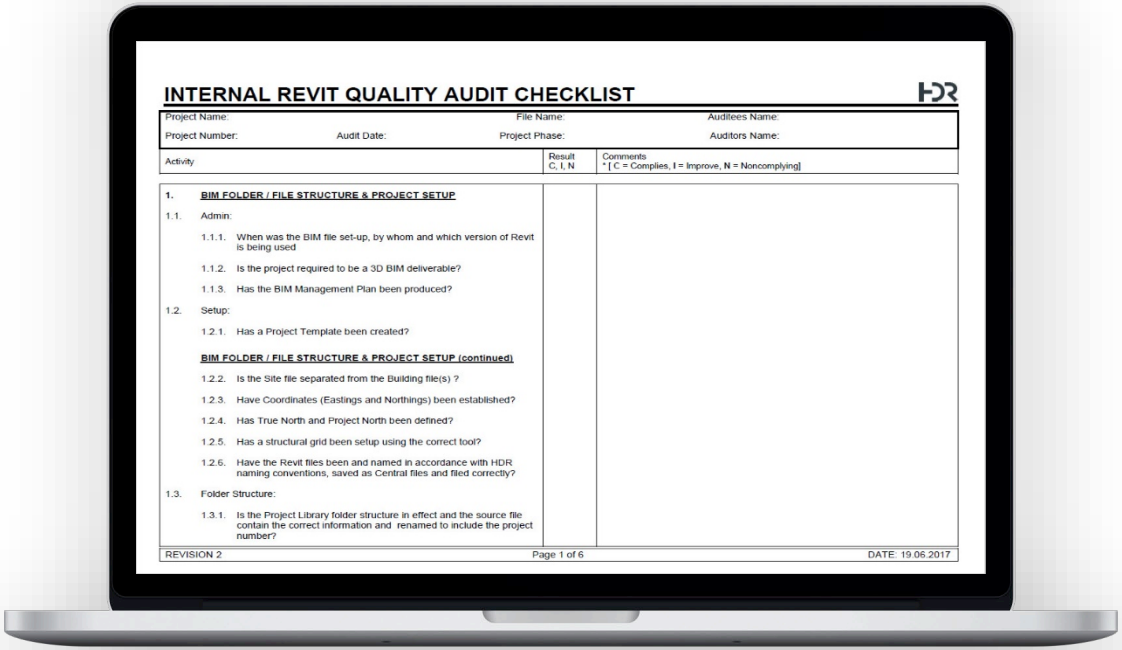


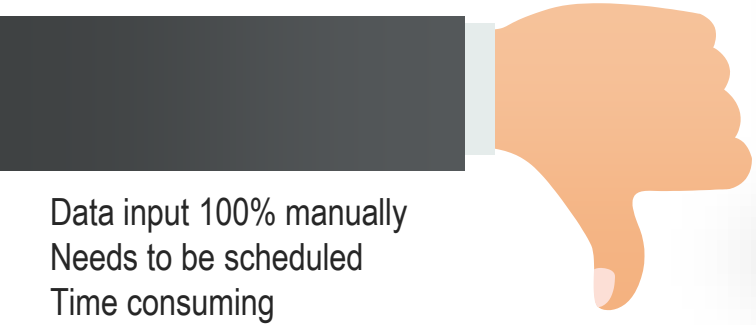
Defining KPIs
› Key Performance Indicators allow us to measure and discuss what we are trying to improve.

Collecting Data
› Integrating the structure and collecting the data of the individual models.

Infrastructure
› Infrastructure includes various pieces of software and is an upfront investment.

Infrastructure & Collecting Data
Microsoft Excel

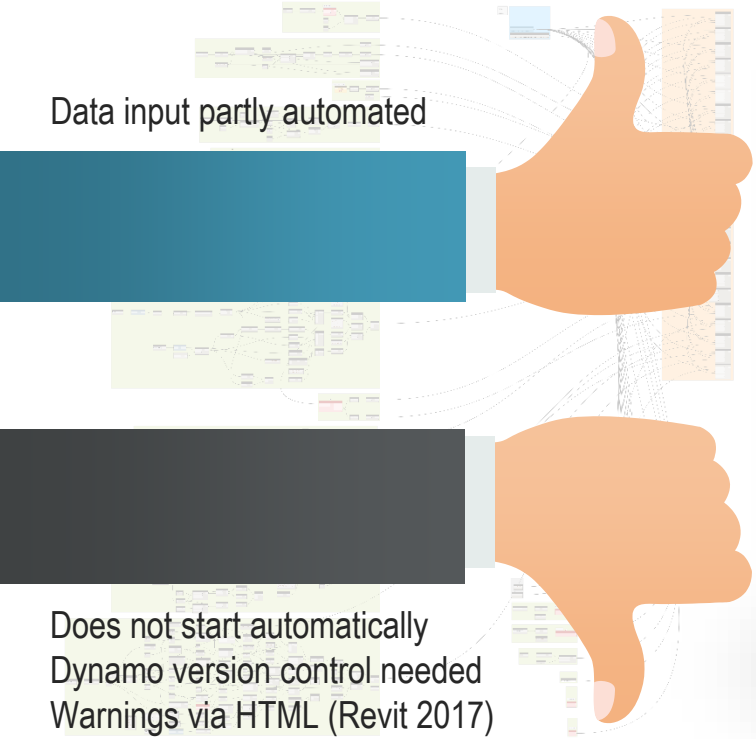




Data input 100% manually
Needs to be scheduled
Time consuming

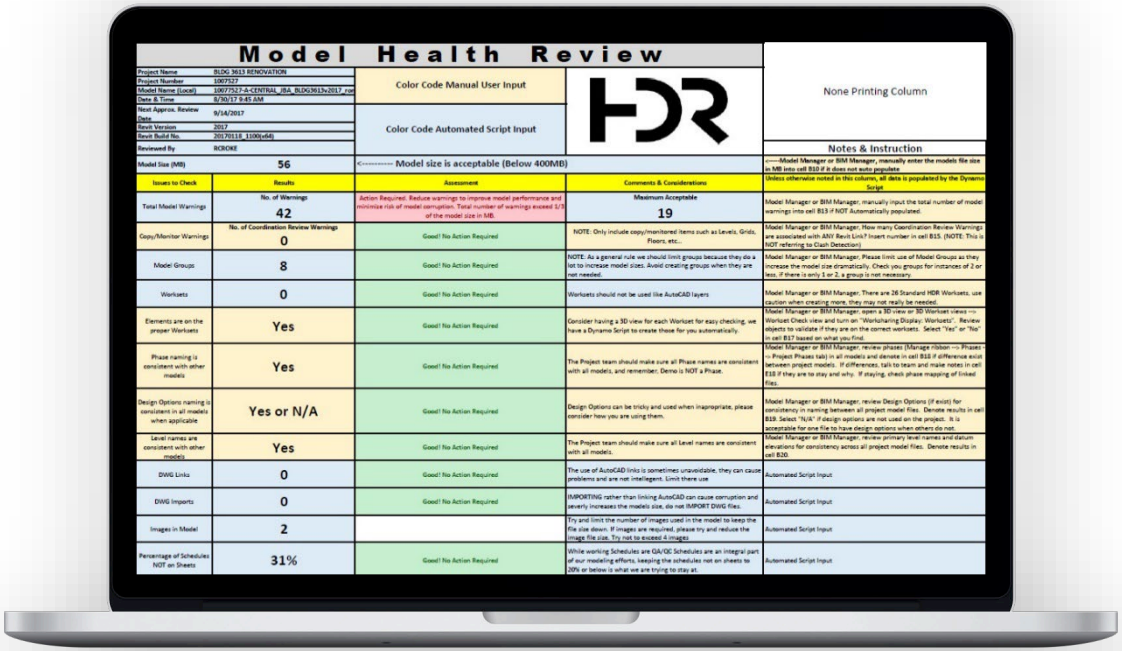
Infrastructure & Collecting Data

Dynamo



Data input partly automated

Does not start automatically
Dynamo version control needed
Warnings via HTML (Revit 2017)



Model Health Review

Project Name	BLDG 3613 RENOVATION	Color Code Manual User Input		None Printing Column
Project Number	10077527			
Model Name (Local)	10077527-A-CENTRAL_JBA_BLDG3613v2017_rar	Color Code Automated Script Input		
Date & Time	9/30/17 9:45 AM			
Next Approx. Review Date	9/14/2017			Notes & Instruction
Revit Version	2017			
Revit Build No.	20170118_1100(x64)			
Reviewed By	RCBOKE			<----Model Manager or BIM Manager, manually enter the models file size in MB into cell B10 if it does not auto populate.
Model Size (MB)	56	<---------- Model size is acceptable (Below 400MB)		Unless otherwise noted in this column, all data is populated by the Dynamo Script

Issues to Check	Results	Assessment	Comments & Considerations	
Total Model Warnings	No. of Warnings: 42	Action Required. Reduce warnings to improve model performance and minimize risk of model corruption. Total number of warnings exceed 1/3 of the model size in MB.	Maximum Acceptable: 19	Model Manager or BIM Manager, manually input the total number of model warnings into cell B13 if NOT Automatically populated.
Copy/Monitor Warnings	No. of Coordination Review Warnings: 0	Good! No Action Required	NOTE: Only include copy/monitored items such as Levels, Grids, Floors, etc...	Model Manager or BIM Manager, How many Coordination Review Warnings are associated with ANY Revit Link? Insert number in cell B15. (NOTE: This is NOT referring to Clash Detection)
Model Groups	8	Good! No Action Required	NOTE: As a general rule we should limit groups because they do a lot to increase model sizes. Avoid creating groups when they are not needed.	Model Manager or BIM Manager, Please limit use of Model Groups as they increase the model size dramatically. Check you groups for instances of 2 or less. If there is only 1 or 2, a group is not necessary.
Worksets	0	Good! No Action Required	Worksets should not be used like AutoCAD layers	Model Manager or BIM Manager: There are 26 Standard HDR Worksets, use caution when creating more, they may not really be needed.
Elements are on the proper Worksets	Yes	Good! No Action Required	Consider having a 3D view for each Workset for easy checking, we have a Dynamo Script to create these for you automatically.	Model Manager or BIM Manager, open a 3D view or 3D Workset views => Workset Check view and turn on "Worksharing Display: Worksets". Review objects to validate if they are on the correct worksets. Select "Yes" or "No" in cell B17 based on what you find.
Phase naming is consistent with other models	Yes	Good! No Action Required	The Project team should make sure all Phase names are consistent with all models, and remember, Demo is NOT a Phase.	Model Manager or BIM Manager, review phases (Manage ribbon => Phases => Project Phases tab) in all models and denote in cell B18 if difference exist between project models. If differences, talk to team and make notes in cell E18 if they are to stay and why. If staying, check phase mapping of linked files.
Design Options naming is consistent in all models when applicable	Yes or N/A	Good! No Action Required	Design Options can be tricky and used when inapropriate, please consider how you are using them.	Model Manager or BIM Manager, review Design Options (if exist) for consistency in naming between all project model files. Denote results in cell B19. Select "N/A" if design options are not used on the project. It is acceptable for one file to have design options when others do not.
Level names are consistent with other models	Yes	Good! No Action Required	The Project team should make sure all Level names are consistent with all models.	Model Manager or BIM Manager, review primary level names and datum elevations for consistency across all project model files. Denote results in cell B20.
DWG Links	0	Good! No Action Required	The use of AutoCAD links is sometimes unavoidable, they can cause problems and are not intelligent. Limit there use	Automated Script Input
DWG Imports	0	Good! No Action Required	IMPORTING rather than linking AutoCAD can cause corruption and severly increases the models size, do not IMPORT DWG files.	Automated Script Input
Images in Model	2		Try and limit the number of images used in the model to keep the file size down. If images are required, please try and reduce the image file size. Try not to exceed 4 images	Automated Script Input
Percentage of Schedules NOT on Sheets	31%	Good! No Action Required	While working Schedules are QA/QC Schedules are an integral part of our modeling efforts, keeping the schedules not on sheets to 20% or below is what we are trying to stay at.	Automated Script Input

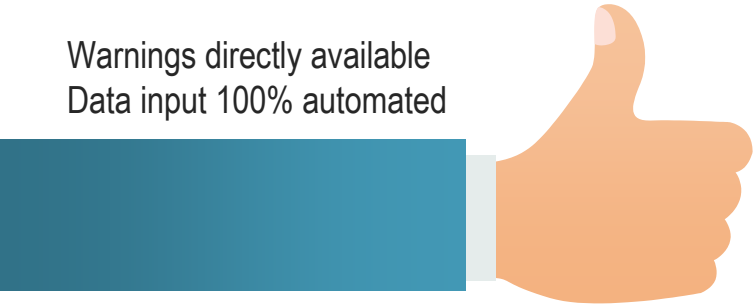
Infrastructure & Collecting Data

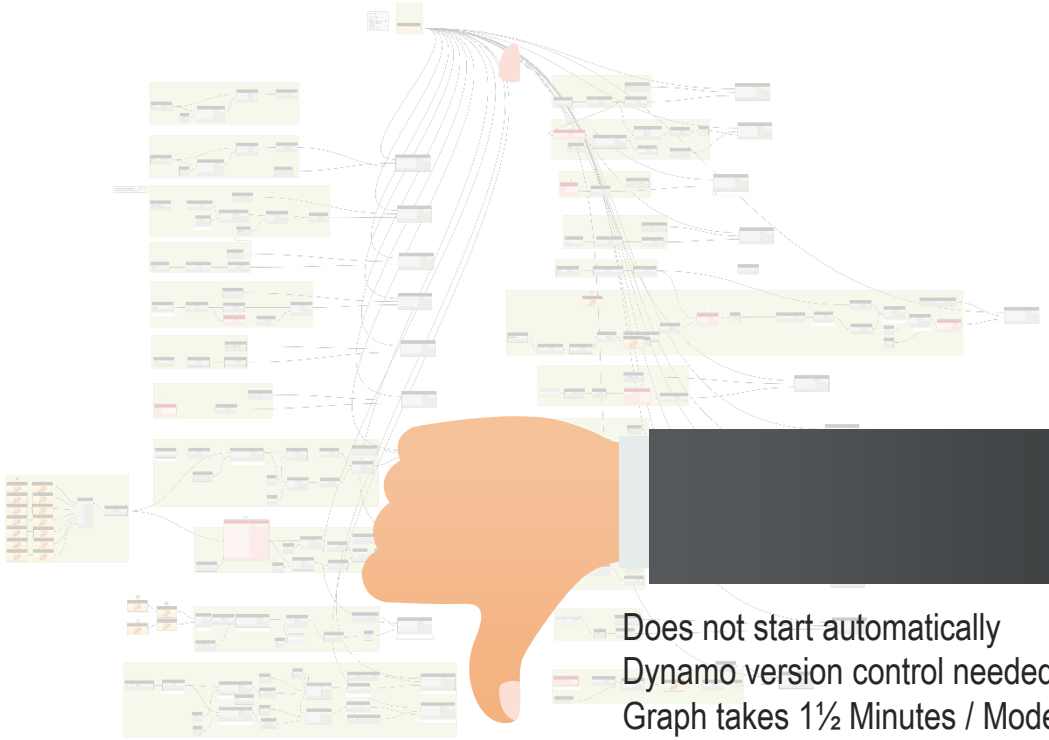
Dynamo

83%

MODEL DATA - HEALTH ASSESMENT				
MODEL SIZE	GROUP INSTANCES	GROUP TYPES	UNUSED GROUPS	
388	168	27	0	
LINK / IMPORT DATA				
DESIGN OPTIONS	WORKSETS	CAD IMPORTS	CAD LINKS	IMAGES
8	24	0	5	25
ROOM DATA				
AREA OF ROOMS	ROOMS	UNPLACED ROOMS	UNENCLOSED ROOMS	
3566	115	4	0	
FAMILY DATA				
LOADED FAMILIES	UNUSED FAMILIES(%)	INPLACE FAMILIES	WARNING COUNT	
654	14 *	116	239	
VIEW DATA				
TOTAL VIEWS	TOTAL SHEETS	VIEWS WITH NO VT	VIEWS NOT ON SHEET	CLIPPING DISABLED
763	313	77	77	0

Warnings directly available
Data input 100% automated





Does not start automatically
Dynamo version control needed
Graph takes 1½ Minutes / Model

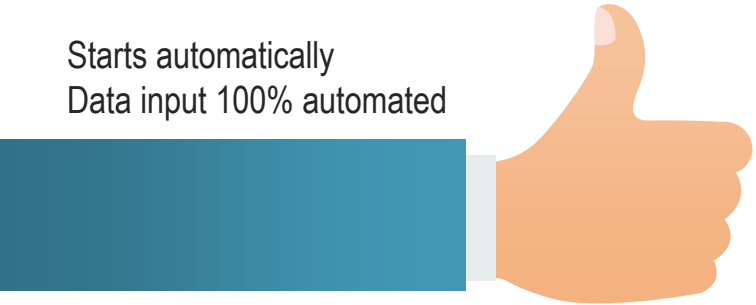
Infrastructure & Collecting Data
Macros

MODEL HEALTH ASSESMENT Status: 11/02/19 3:00:24 PM

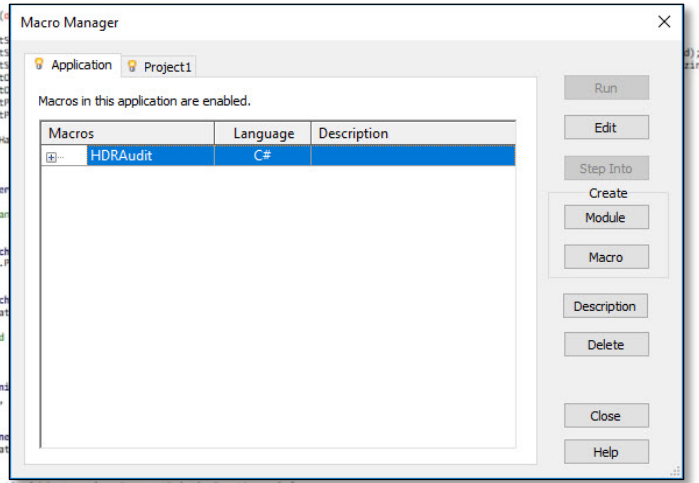
8.6

MODEL SIZE	GROUP INSTANCES	GROUP TYPES	UNUSED GROUPS	
25	24	4	0	
LINK / IMPORT DATA				
DESIGN OPTIONS	WORKSETS	CAD IMPORTS	CAD LINKS	IMAGES
0	12	0	1	1
ROOM DATA				
AREA OF ROOMS	ROOMS	UNPLACED ROOMS	UNENCLOSED ROOMS	
35	6	1	0	
FAMILY DATA				
LOADED FAMILIES	UNUSED FAMILIES(%)	INPLACE FAMILIES	WARNING COUNT	
105	34 N1	0	4	
VIEW DATA				
TOTAL VIEWS	TOTAL SHEETS	VIEWS WITH NO VT	VIEWS NOT ON SHEET	CLIPPING DISABLED
88	32	10 N2	36 N2	0

Starts automatically
Data input 100% automated



```
string ACTIVITY_FOLDER = "RevitActivity";
string WARNINGS_FOLDER = "RevitWarnings";
char ACTIVITY_FILE_SEP = '@';
DateTime idlingStartingTime;

int INTERVAL_BETWEEN_AUDIT = 4; //Hours

private void Module_Startup(object sender, EventArgs e)
{
    this.Application.DocumentSaved += new EventHandler<DocumentSavedEventArgs>(Application_DocumentSaved);
    this.Application.DocumentSynchronizedWithCentral += new EventHandler<DocumentSynchronizedWithCentralEventArgs>(Application_DocumentSynchronized);
    this.Application.DocumentSynchronizingWithCentral += new EventHandler<DocumentSynchronizingWithCentralEventArgs>(Application_DocumentSynchronizing);
    this.Application.DocumentOpening += new EventHandler<DocumentOpeningEventArgs>(Application_DocumentOpening);
    this.Application.DocumentOpened += new EventHandler<DocumentOpenedEventArgs>(Application_DocumentOpened);
    this.Application.DocumentPrinting += new EventHandler<DocumentPrintingEventArgs>(Application_DocumentPrinting);
    this.Application.DocumentPrinted += new EventHandler<DocumentPrintedEventArgs>(Application_DocumentPrinted);
}

private void Module_Shutdown(
{
    this.Application.DocumentS
    this.Application.DocumentS
    this.Application.DocumentS
    this.Application.DocumentO
    this.Application.DocumentC
    this.Application.DocumentP
    this.Application.DocumentP

    this.Idling -= new EventHa
}

Revit Macros generated code
public void Unused_PlaceHolder
{
    // This is just to keep ar
}

void Application_DocumentSynch
    startActivity(e.Document.P
}

void Application_DocumentSynch
    endActivity(e.Document.Pat

    // Auditing Now if needed
    startAudit(e.Document);
}

void Application_DocumentOpeni
    startActivity(e.PathName,
}

void Application_DocumentOpene
    endActivity(e.Document.Pat
}

void Application_DocumentPrinting(object sender, DocumentPrintingEventArgs e) {
    startActivity(e.Document.PathName, "PRINT", true);
}
```

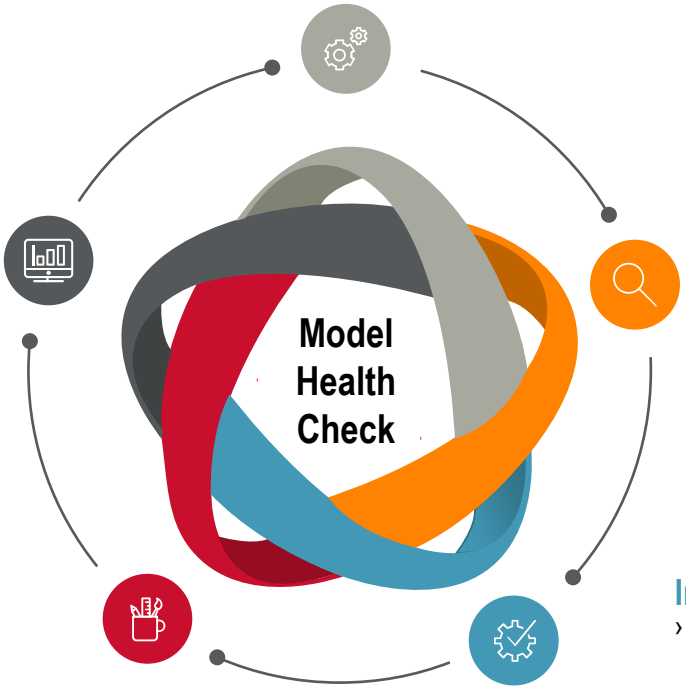


Visualising & Optimising

Microsoft PowerBI, Autodesk Revit & D3

Visualising & Optimising
Step Four & Five

Optimising
› Here we review the data that is being used based on a given problem and its rating system.



Visualising Data
› Visualising the data that will be used to measure the quality of your models.

Defining KPIs
› Key Performance Indicators allow us to measure and discuss what we are trying to improve.

Collecting Data
› Integrating the structure and collecting the data of the individual models.

Infrastructure
› Infrastructure includes various pieces of software and is an upfront investment.

Visualising & Optimising
Autodesk Revit`

Complies with Office Standards
Needs Maintenance and Improvement
Non-Compliant with Office Standards

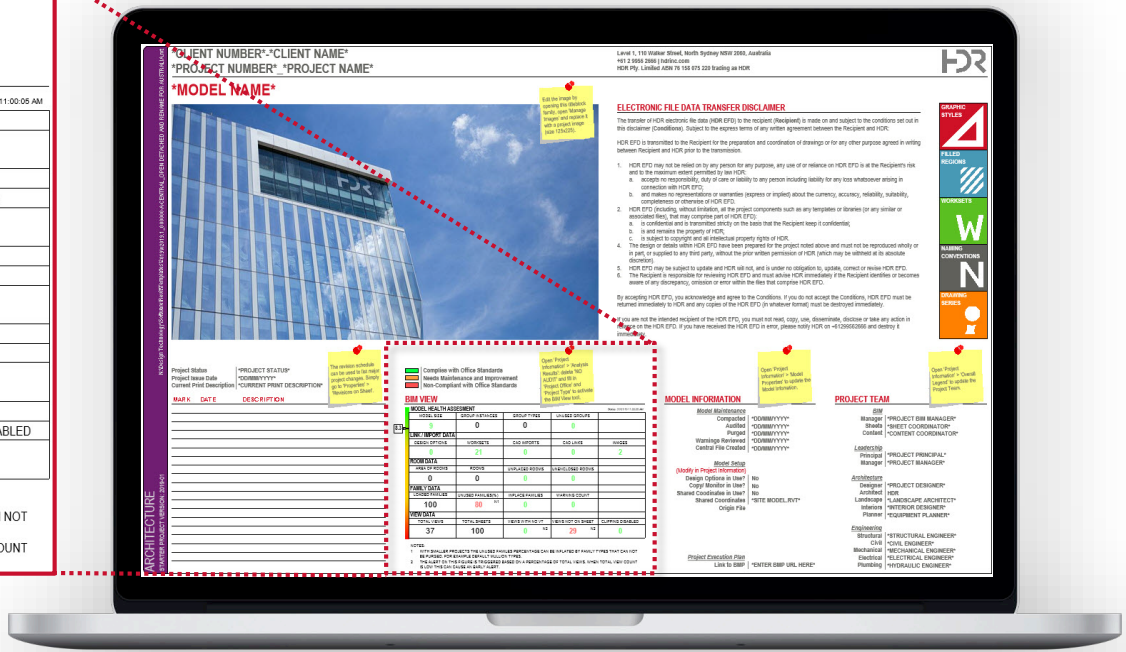
BIM VIEW

MODEL HEALTH ASSESMENT Status: 31/01/19 11:00:05 AM

8.3

MODEL SIZE	GROUP INSTANCES	GROUP TYPES	UNUSED GROUPS	
9	0	0	0	
LINK / IMPORT DATA				
DESIGN OPTIONS	WORKSETS	CAD IMPORTS	CAD LINKS	IMAGES
0	21	0	0	2
ROOM DATA				
AREA OF ROOMS	ROOMS	UNPLACED ROOMS	UNENCLOSED ROOMS	
0	0	0	0	
FAMILY DATA				
LOADED FAMILIES	UNUSED FAMILIES(%)	INPLACE FAMILIES	WARNING COUNT	
100	80 N1	0	0	
VIEW DATA				
TOTAL VIEWS	TOTAL SHEETS	VIEWS WITH NO VT	VIEWS NOT ON SHEET	CLIPPING DISABLED
37	100	0 N2	29 N2	0

NOTES:
1 WITH SMALLER PROJECTS THE UNUSED FAMILES PERCENTAGE CAN BE INFLATED BY FAMILY TYPES THAT CAN NOT BE PURGED. FOR EXAMPLE DEFAULT MULLION TYPES.
2 THE ALERT ON THIS FIGURE IS TRIGGERED BASED ON A PERCENTAGE OF TOTAL VIEWS. WHEN TOTAL VIEW COUNT IS LOW THIS CAN CAUSE AN EARLY ALERT.



Visualising & Optimising
Microsoft PowerBI

Allows comparability

License costs
Compatibility issues
Needs training and support

Visualising & Optimising
D3 - Data-Driven Document

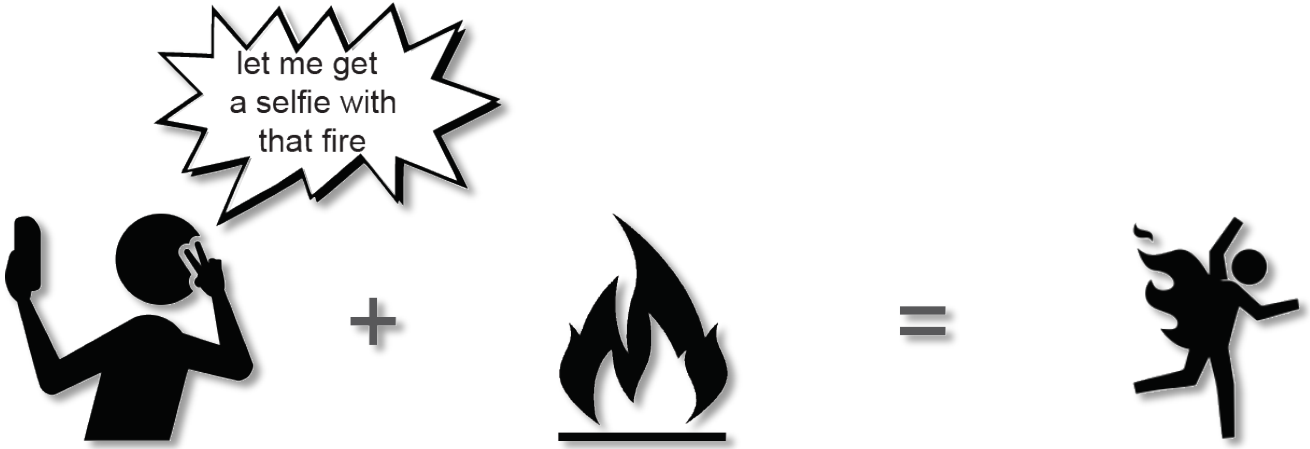
Allows comparability
No additional license costs
Clear and easy to understand

Lesson Learned

Proactive Model Management

Lesson Learned
Proactive Model Management

- As a team, model health is **everyone's responsibility**.
- Project model metrics **shall be visible to every team member**.
- BIM Managers shall keep an eye on the metrics so they **know who to help**.



Thank you.

Level 1, 110 Walker Street
North Sydney NSW 2060 Australia
T: +61 2 9956 2666 D: +61 2 99562622
E: holger.degroot@hdrinc.com