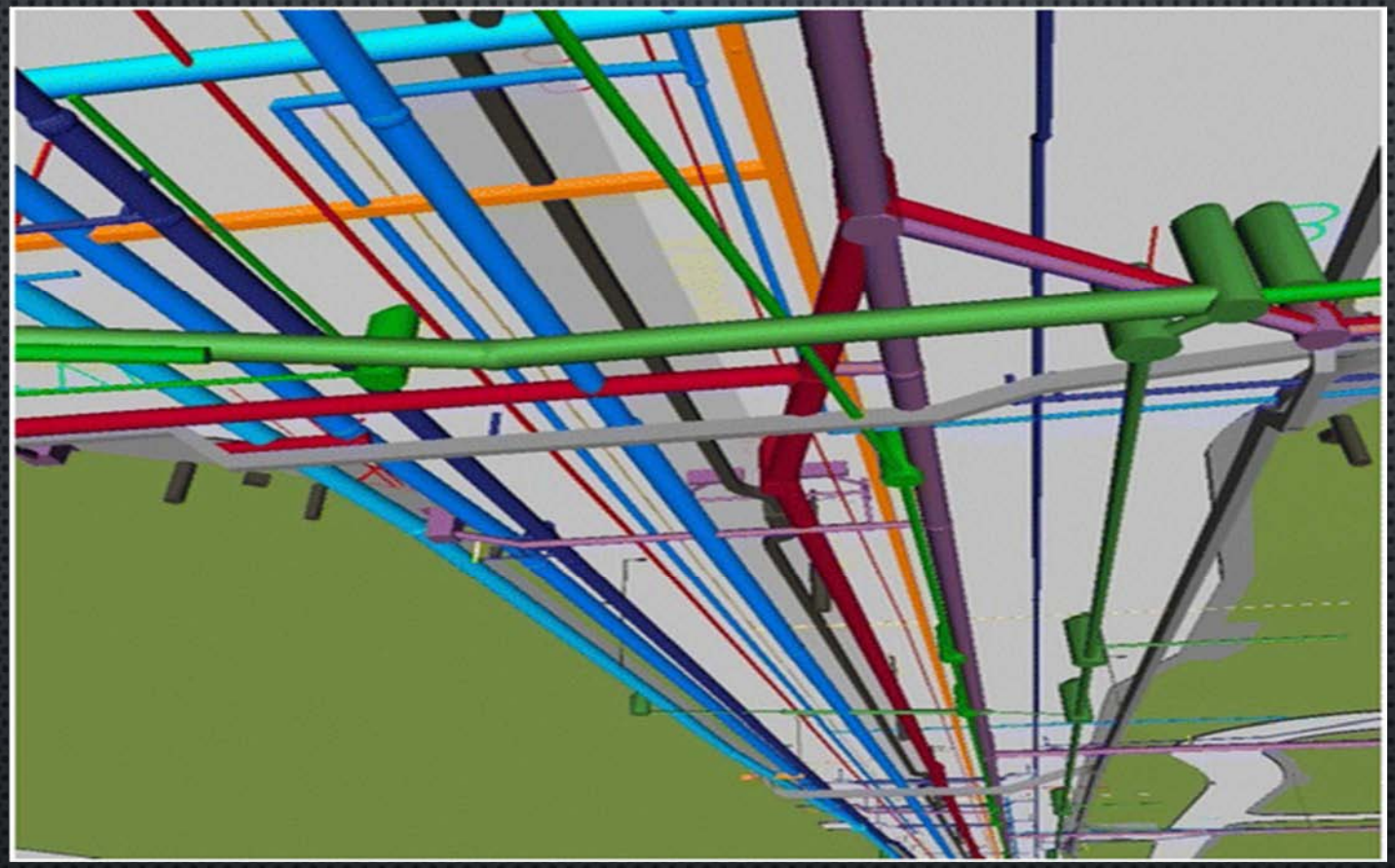


WHAT LIES BENEATH
BENEFITS, CHALLENGES & RISKS ASSOCIATED WITH USING BIM/CIM ON UTILITY INFRASTRUCTURE.

www.linkedin.com/in/noelcarrollbim

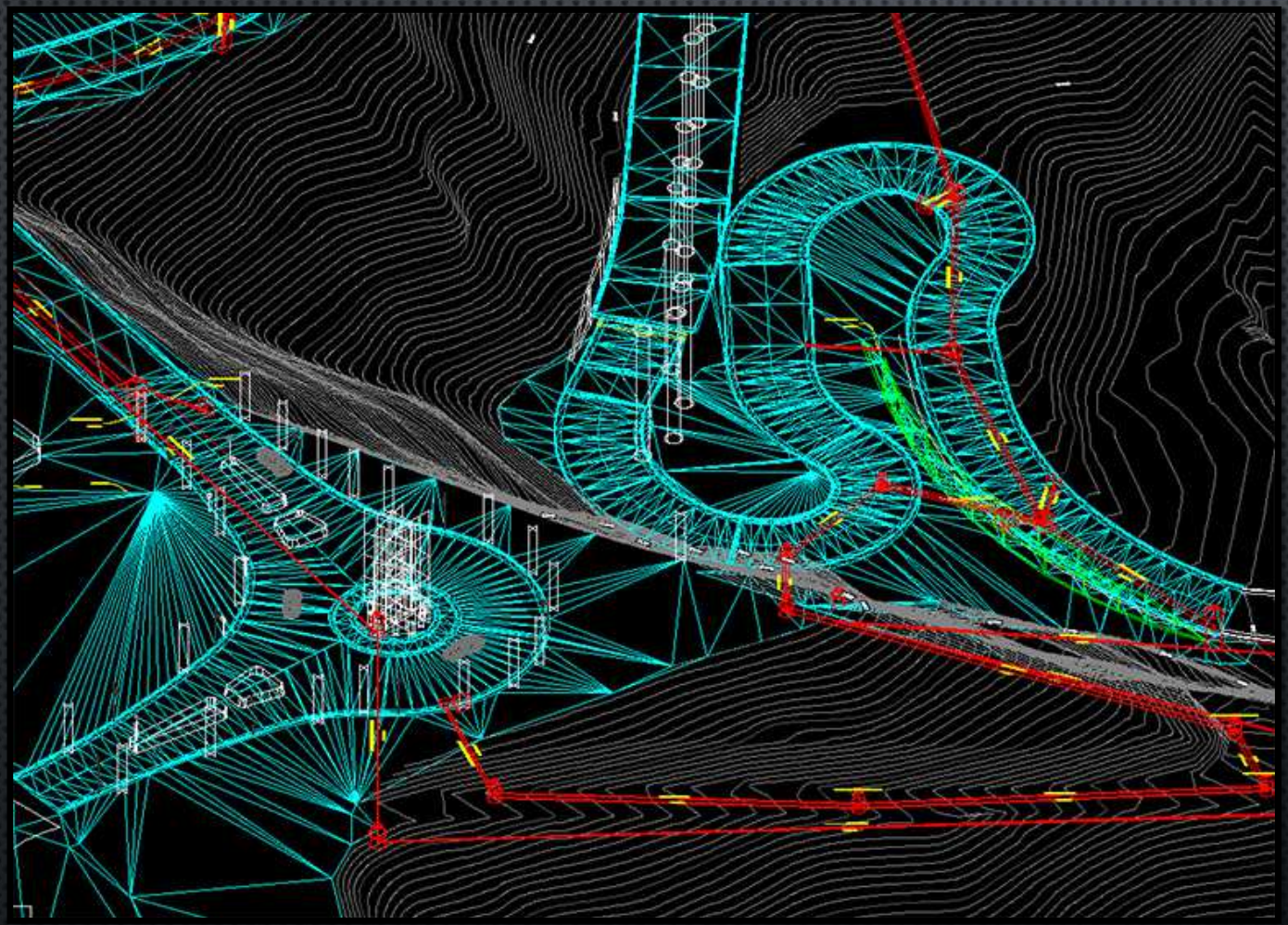
JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

- RENEWABLES
- ENVIRONMENTAL
- WATER & WASTEWATER
- STRUCTURES
- HOUSING, HOTELS, COMMERCIAL

LOCAL AUTHORITIES, UTILITIY PROVIDERS, COMMERCIAL ENTITIES AND INDUSTRIES IN IRELAND AND OVERSEAS.

INTRODUCTION

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS



3D Civil on Windfarms, Roads & All Utility Design

diatec

What Lies Beneath Benefits, Challenges & Risks associated with using BIM/CIM on Utility infrastructure.

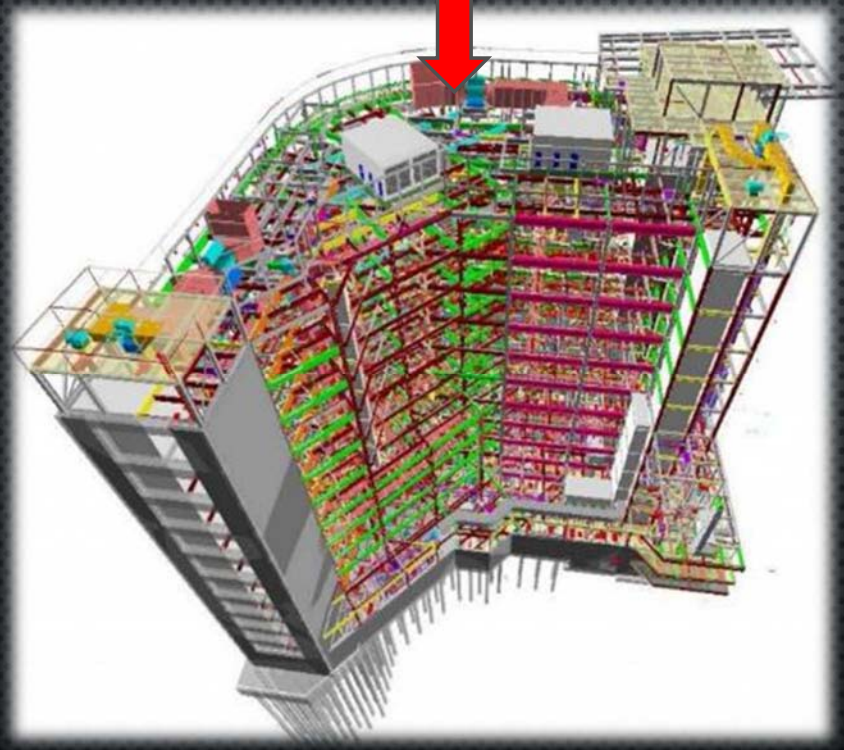
GMIT
INSTITIÚID TEICNEOLAÍOCHTA NA GAILLIMHE-MAIGH EO
GALWAY-MAYO INSTITUTE OF TECHNOLOGY

What Lies Beneath?

RESEARCH PROJECT

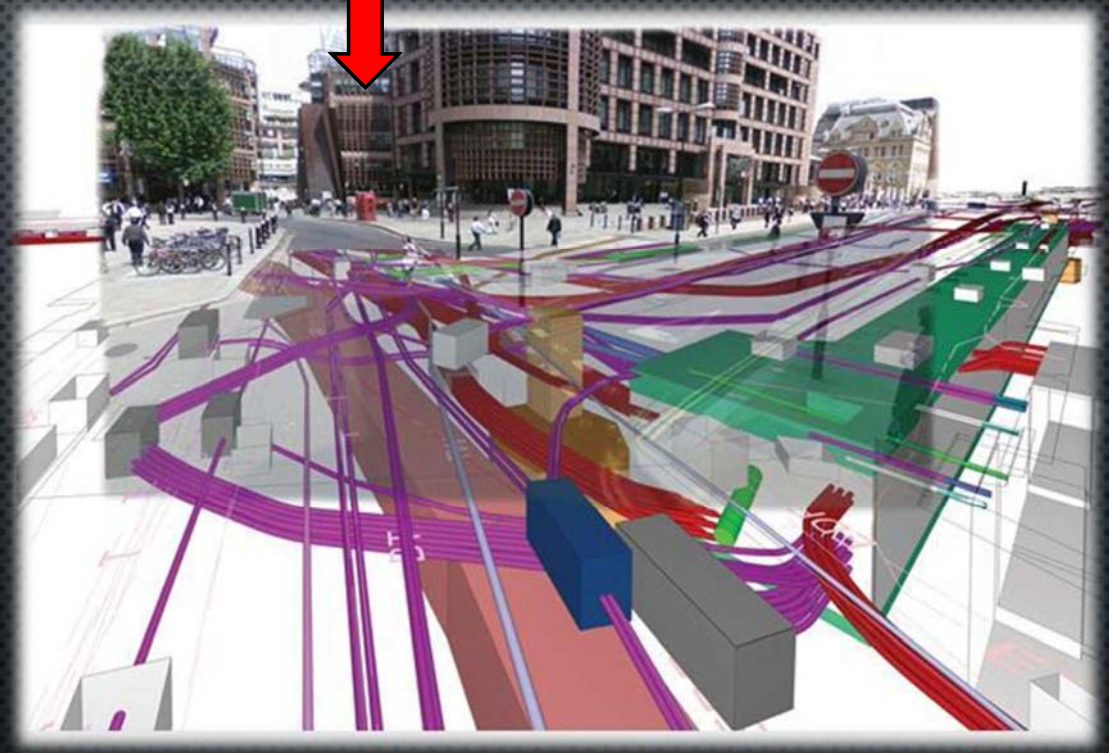
JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

A BUILDING MODEL (BIM)



OR VERTICAL BIM

A CIVIL MODEL (CIM)



OR HORIZONTAL BIM

WHAT LIES BENEATH?

REASON FOR RESEARCH

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Gap between Horizontal BIM (BIM infrastructure) and Vertical Buildings (BIM Construction).

	Scopus	Engineering Village	Science Direct	Web of Science	Totals
BIM Infrastructure	50	71	11	46	178
BIM Construction	1057	901	183	675	2816
Totals	**1107**	**972**	**194**	**721**	**2994**

Lack of Research on Utility Infrastructure - 6 papers

Categories of civil infrastructure		Industry cases					Academic pa
		Europe	North and South Americas	Asia	Oceania and Africa	Total	Total
I Bridges		3	8	10		21	27
II Roads		9	17	7	2	35	8
III Railways		5	4	8	1	18	4
IV Tunnels			2			2	12
V Airports, ports and harbors	Airports	1	1	3		5	1
	Ports and harbors	1				1	
	Sub-total	2	1	3		6	1
VI Energy infrastructure	Power generation	2	7	20	3	32	3
	Oil and gas	1	1	4		6	2
	Mine	1	2	1	2	6	
	Sub-total	4	10	25	5	44	
VII Utility infrastructure	Utility		2	2	2	6	3
VIII Recreational facility infrastructure	Recreational facilities		3	4		7	
IX Water management infrastructure	Water and wastewater facilities	3	14	9	2	28	1
	Dams, canals and levees		4			4	
	Sub-total	3	18	9	2	32	1
Grand total		26	65	68	12	171	62

WHAT LIES BENEATH?

UTILITY BIM EXPERIENCE

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

THE ISLAND OF DIYAR AL MUHURRAQ – BAHRAIN

12 MAN-MADE INTERCONNECTING ISLANDS ON NORTH EAST BAHRAIN

WHAT LIES BENEATH?

UTILITY BIM EXPERIENCE

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

East Sitra Social Housing Project

Athlone Main Drainage - Tunnels & Shafts.

Facebook Data Centre

WHAT LIES BENEATH?

BENEFITS

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Making sense of the chaos

Asset Management

Capacity analysis

Capturing Existing Conditions

Checking Standards

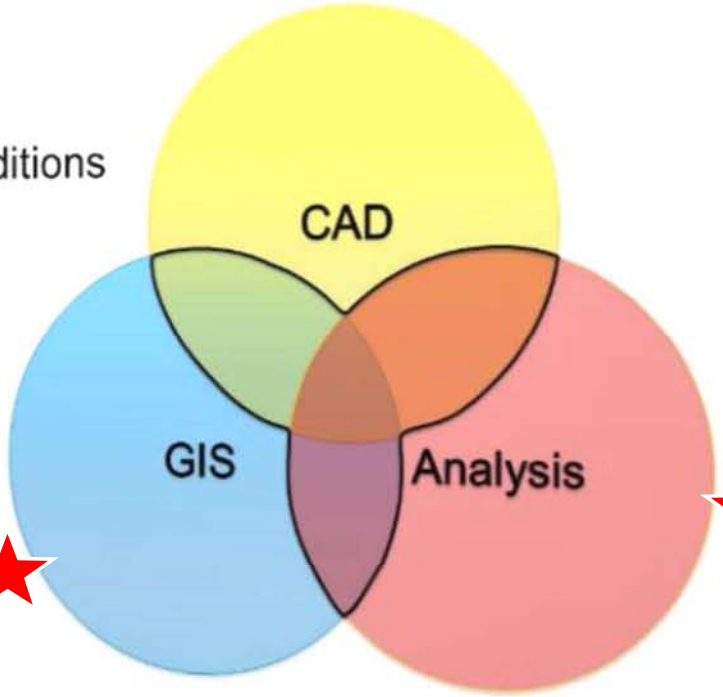
★ Clash detection

Developing concepts

Drafting Plans

★ Documenting designs

Environmental analysis



Liaising with the public

★ Machine control

Means & Methods

Maintenance of Traffic

Risk Management

★ Scheduling

★ Sizing components

★ Quantity take-off

Value engineering

WHAT LIES BENEATH?

MACHINERY & SURVEYING

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

SETTING OUT
Stake out data - surfaces, alignments, reference points

GPS - CONTROL DIGGING BENEFITS

NO OVERDIGGING

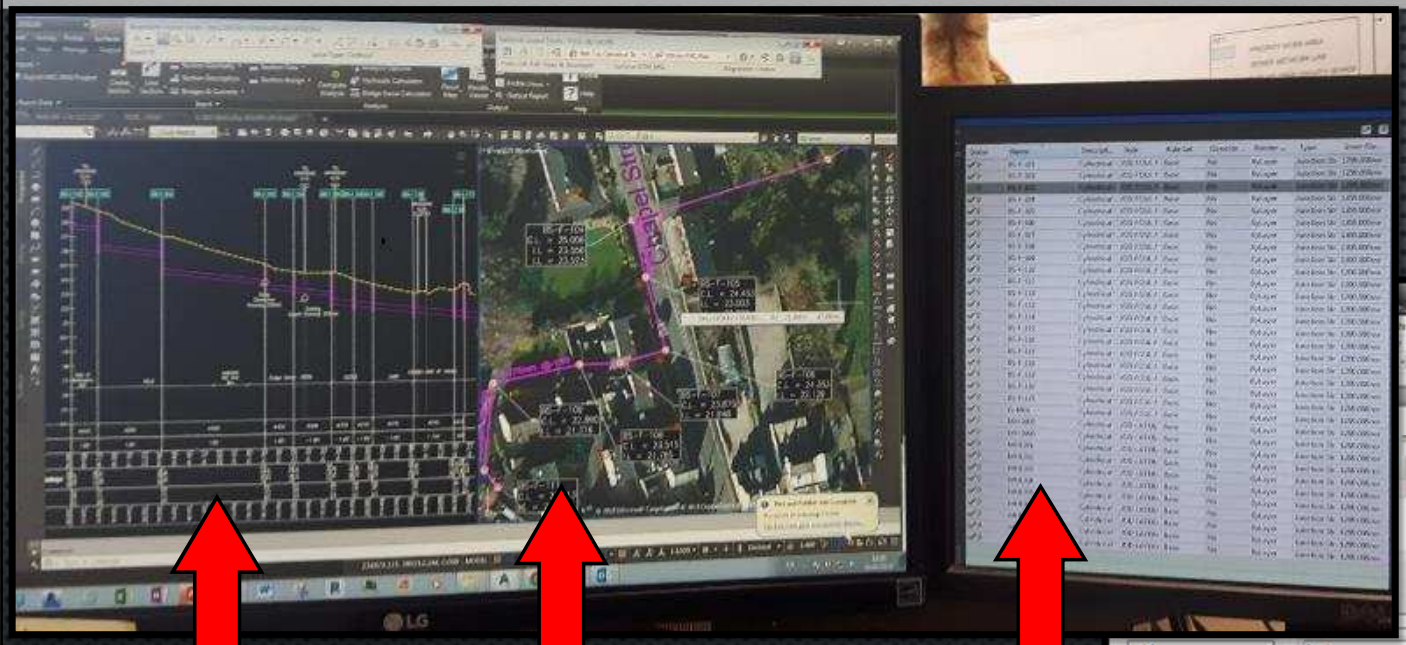
SAFER

PRECISE SLOPES FOR PIPELINES

WHAT LIES BENEATH?

VISUALIZATION & QUANTITIES

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

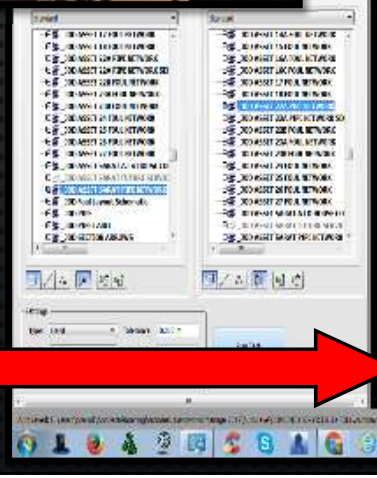


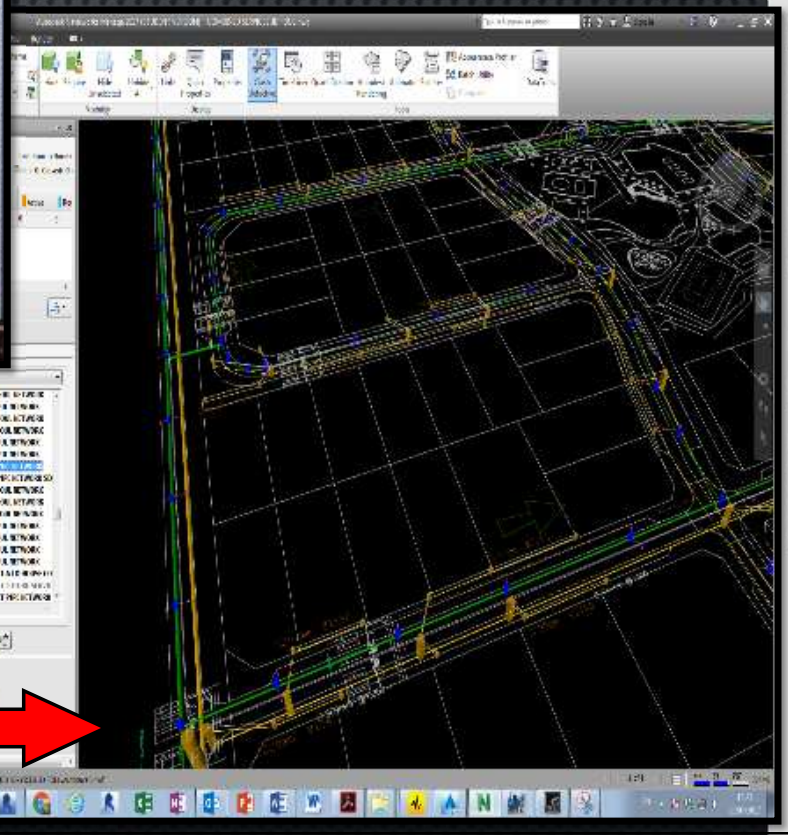
LONG SECTION

PLAN

SCHEDULE
DIYAR 8000 MH's
Areas, Volumes &
Quantities

CLASH DETECTION NAVISWORKS –
STORM V FOUL





WHAT LIES BENEATH?

PROJECT LIFECYCLE

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

A typical state or local authority led BIM infrastructure project is illustrated in the following Figure.3.15

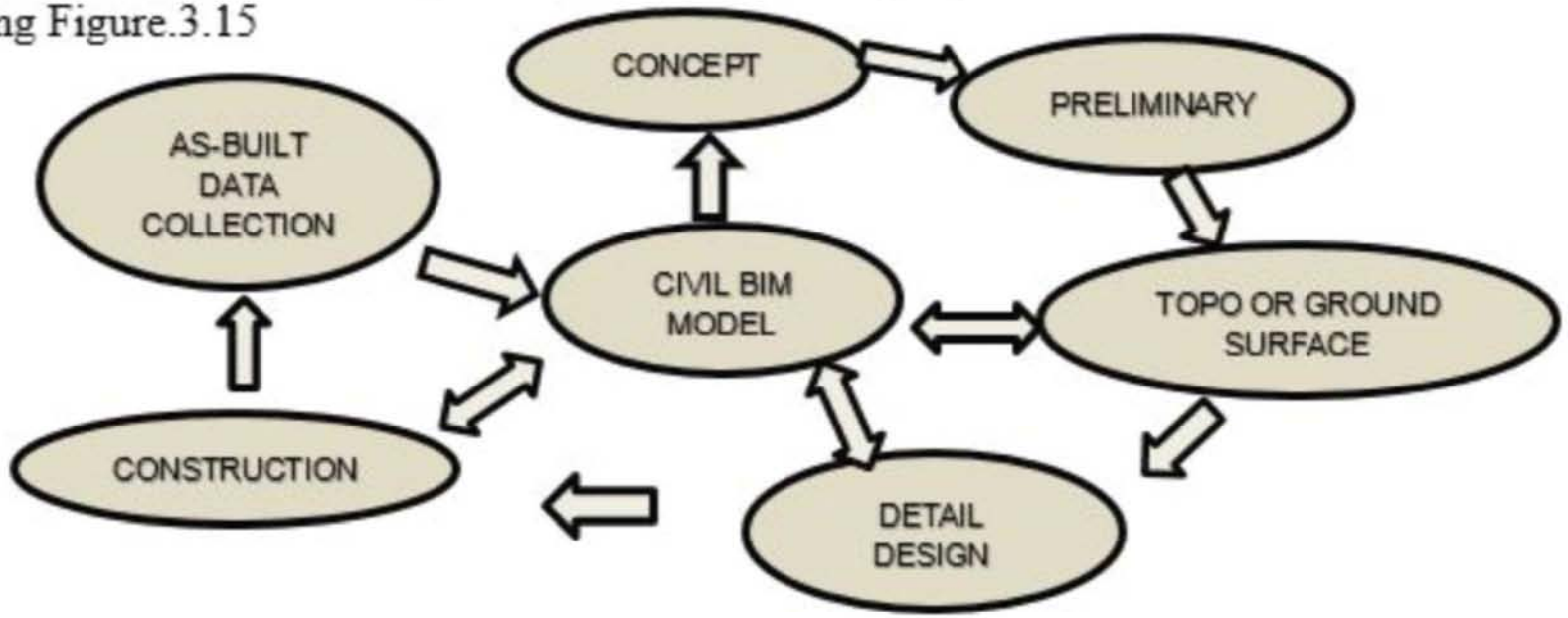
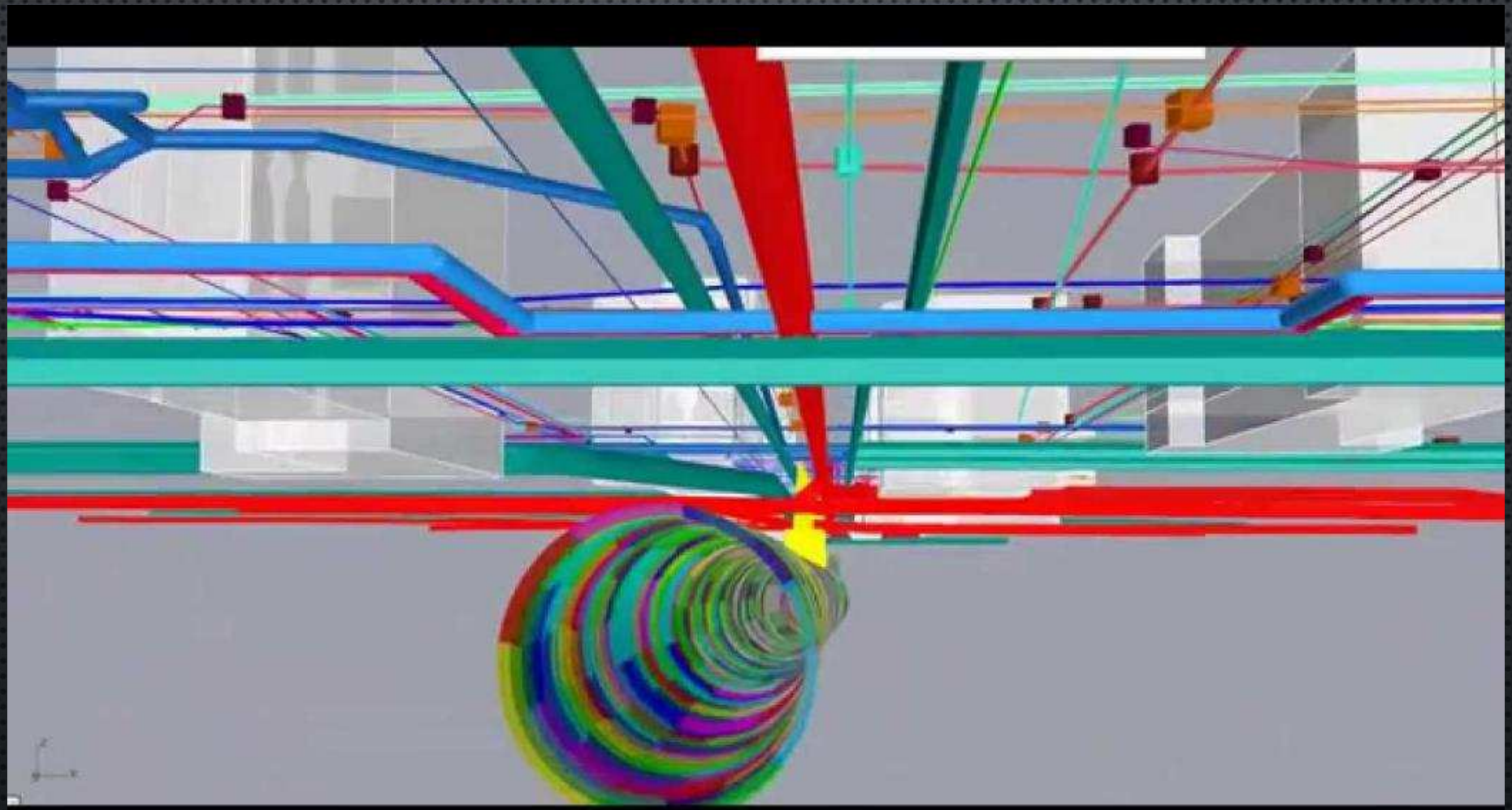


Figure 3.1.5 Infrastructure project process

WHAT LIES BENEATH?

AS BUILT BIM TUNNELING

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS



PIPE INVERTS, COVER LEVEL & GRADIENTS

WHAT LIES BENEATH?

BIM ACTIVITIES

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

52% DESIGN MEETINGS

Diyar Al Muharraq
Manhole Report AinElAbd.BahrainGrid
Job Number : 10001
FOUL MANHOLES Pre-Construction
ASSET 12A

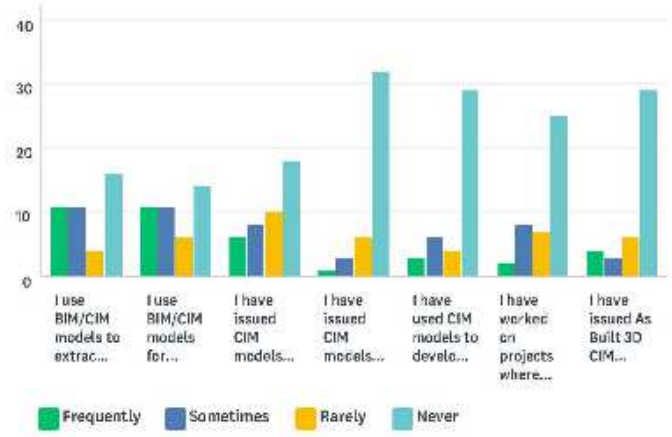
Name	Insertion Northing	Insertion Easting	Cover Level	Connected Pipes
12 A F01	2909071.64	464186.95	2.88	1.00
12 A F02	2909133.58	464155.10	2.73	2.00
12 A F03	2909194.14	464120.09	3.09	2.00
12 A F04	2909254.17	464084.02	2.96	2.00
12 A F05	2909313.30	464046.24	2.74	2.00
12 A F06	2909371.28	464008.57	3.13	3.00
12 A F07	2909406.11	464063.31	3.03	1.00
12 A F08	2909336.81	463941.50	2.82	2.00
12 A F09	2909309.71	463876.77	2.86	2.00
12 A F10	2909288.42	463809.82	3.15	2.00

52% QUANTITIES

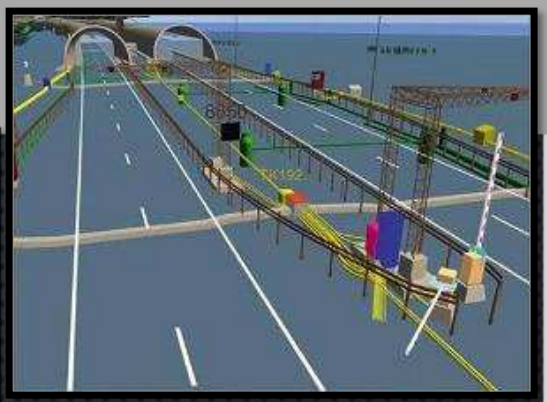
21% DRONES & SURVEYING

Q8 Please indicate how many times you have carried out the following activities?

Answered: 42 Skipped: 0



	FREQUENTLY	SOMETIMES	RARELY	NEVER	TOTAL	WEIGHTED AVERAGE
I use BIM/CIM models to extract quantities during design	26.19% 11	26.19% 11	9.52% 4	38.10% 16	42	2.60
I use BIM/CIM models for consultation during design meetings	26.19% 11	26.19% 11	14.29% 6	33.33% 14	42	2.55
I have issued CIM models to surveyors for setting out	14.29% 6	19.05% 8	23.81% 10	42.86% 18	42	2.95
I have issued CIM models to machine drivers so they can carry out Machine control digging/tunnelling	2.38% 1	7.14% 3	14.29% 6	76.19% 32	42	3.64
I have used CIM models to develop program of works	7.14% 3	14.29% 6	9.52% 4	69.05% 29	42	3.40
I have worked on projects where drones have monitored performance and progress of works	4.76% 2	19.05% 8	16.67% 7	59.52% 25	42	3.31
I have issued As Built 3D CIM models to Local authorities or Utility providers at the end of a project	9.52% 4	7.14% 3	14.29% 6	69.05% 29	42	3.43



21% PROGRAM

15% 3D AS BUILT

9% CONTROL DIGGING

WHAT LIES BENEATH?

CHALLENGES - SOFTWARE SELECTION

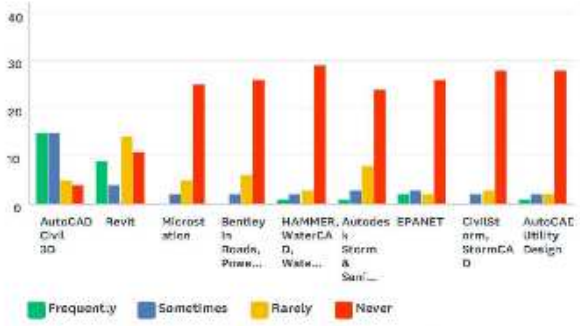
Bentley
Advancing Infrastructure

Micro Drainage
an XP Solutions company

GRAPHISOFT
ARCHICAD

Q4 Please indicate which software you use for Utility Infrastructure design?

Answered: 41 Skipped: 1



	FREQUENTLY	SOMETIMES	RARELY	NEVER	TOTAL RESPONDENTS
AutoCAD Civil 3D	38.46% 15	38.46% 15	12.82% 5	10.26% 4	39
Revit	24.32% 9	10.81% 4	37.84% 14	29.73% 11	37
Microstation	0.00% 0	6.25% 2	15.63% 5	78.13% 25	32
Bentley In Roads, Power GEOPAK, MXROAD and Power Civil	0.00% 0	5.88% 2	17.65% 6	76.47% 26	34
HAMMER,WaterCAD, WaterGEMS, SewerCAD, SewerGEMS	2.86% 1	5.71% 2	8.57% 3	82.86% 29	35
Autodesk Storm & Sanitary Analysis	2.86% 1	8.57% 3	22.86% 8	68.57% 24	35
EPANET	6.06% 2	9.09% 3	6.06% 2	78.79% 26	33
CivilStorm, StormCAD	0.00% 0	6.06% 2	9.09% 3	84.85% 28	33
AutoCAD Utility Design	3.03% 1	6.06% 2	6.06% 2	84.85% 28	33

#	OTHER (PLEASE SPECIFY)	DATE
1	Microdrainage	8/14/2017 9:20 AM
2	AutoCAD	8/2/2017 12:54 PM
3	MicroDrainage, POS	8/2/2017 10:22 AM
4	Ticked EPANET and SSA but we use Third Party add on for Civil 3D from Devotech called IDAS for all wet services	8/2/2017 7:19 AM
5	Infraworks	8/1/2017 8:37 PM
6	Graphisoft Archicad	8/1/2017 6:20 PM
7	Navisworks, Infraworks	8/1/2017 1:40 PM

REVIT

AUTODESK NAVISWORKS

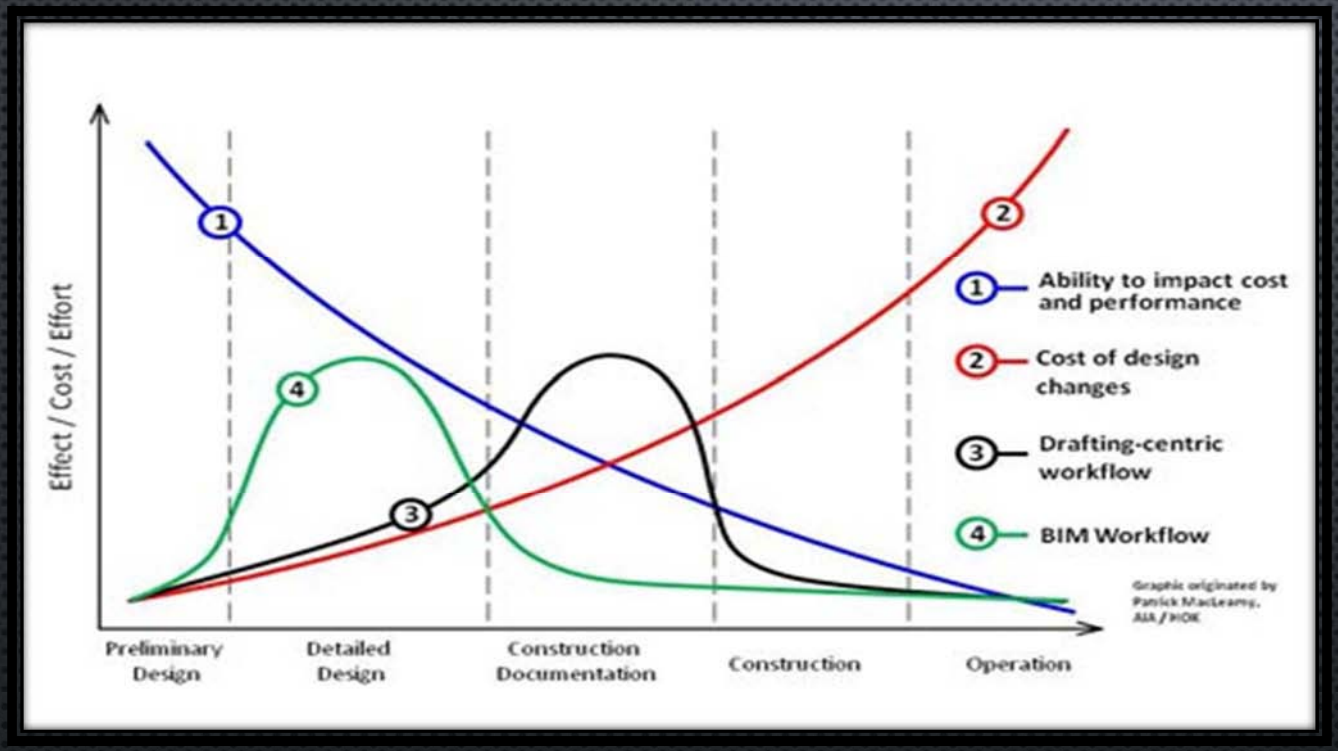
AUTODESK CIVIL 3D

16 SOFTWARE PACKAGES

WHAT LIES BENEATH?

CHALLENGES–DESIGN CURVE

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS



70% design curve changed significantly when using BIM/CIM.

65% of the respondents cited a lack of client

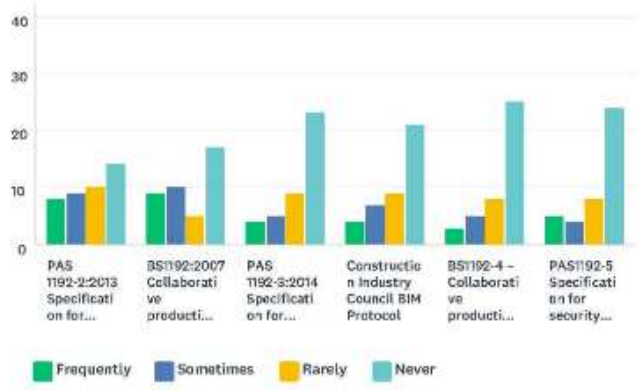
WHAT LIES BENEATH?

BIM LEVEL 2 STANDARDS?

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Q13 Please indicate your level of use of the following standards and publications.

Answered: 41 Skipped: 1



	FREQUENTLY	SOMETIMES	RARELY	NEVER	TOTAL	WEIGHTED AVERAGE
PAS 1192-2:2013 Specification for information management for the capital/delivery phase of construction projects using building information modelling	19.51% 8	21.95% 9	24.39% 10	34.15% 14	41	2.73
BS1192:2007 Collaborative production of architectural, engineering and construction information. Code of practice	21.95% 9	24.39% 10	12.20% 5	41.46% 17	41	2.73
PAS 1192-3:2014 Specification for information management for the operational phase of assets using building information modelling	9.76% 4	12.20% 5	21.95% 9	56.10% 23	41	3.24
Construction Industry Council BIM Protocol	9.76% 4	17.07% 7	21.95% 9	51.22% 21	41	3.15
BS1192-4 – Collaborative production of information Part 4: Fulfilling employer's information exchange requirements using COBie – Code of practice	7.32% 3	12.20% 5	19.51% 8	60.98% 25	41	3.34
PAS1192-5 Specification for security-minded building information modelling, digital built environments and smart asset management	12.20% 5	9.76% 4	19.51% 8	58.54% 24	41	3.24

50%

50%

27%

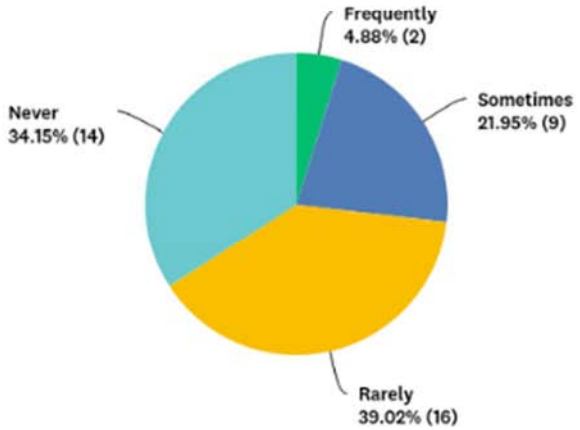
WHAT LIES BENEATH?

EIR - BIM LEVEL 2

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Q17 Please indicate how often you receive an Employers Information Requirement(EIR) document outlining BIM/CIM requirements at the beginning of a project?

Answered: 41 Skipped: 1



65% IMPORTANT

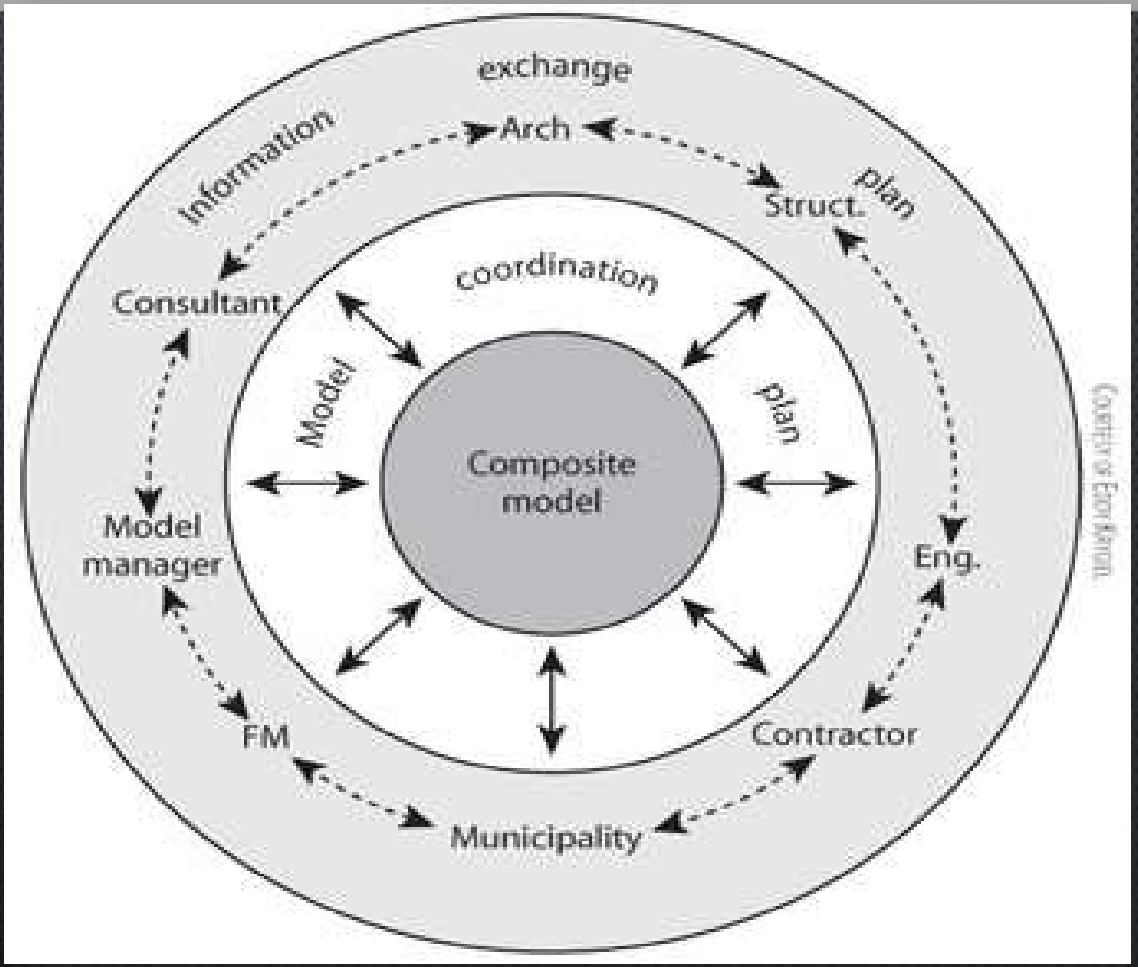
EMPLOYERS INFORMATION REQUIREMENTS (EIR)
STANDARDS AND PROCESSES TO BE ADOPTED BY THE SUPPLIER AS PART OF THE PROJECT DELIVERY PROCESS.

73% RARELY OR NEVER RECEIVE

WHAT LIES BENEATH?

RISKS

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS



Who owns the model??.
Copyright Laws and other legal channels

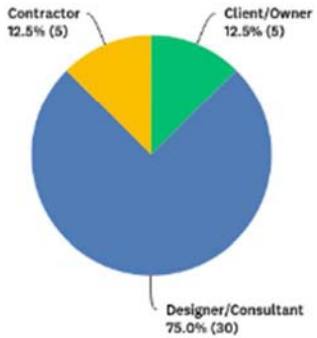
WHAT LIES BENEATH?

STEPS TO IMPLEMENT BIM

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Q14 In your opinion who has done most of the heavy lifting in implementing BIM/CIM to the constructions industry?

Answered: 40 Skipped: 2

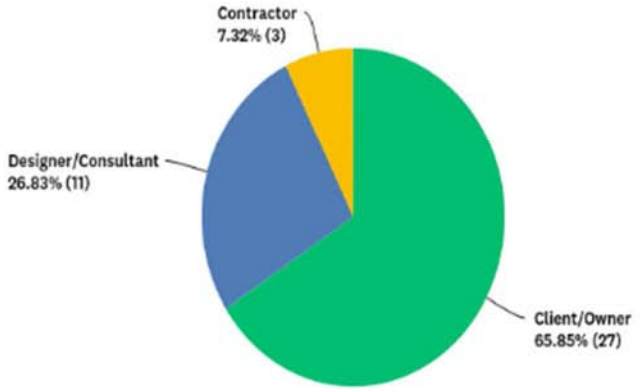


The Most Heavy Lifting?
- 75% Designers

Who Most Benefits Most?
- Client 65%

Q15 In your opinion who benefits most from BIM/CIM?

Answered: 41 Skipped: 1



WHAT LIES BENEATH?

NAME CHANGE ?

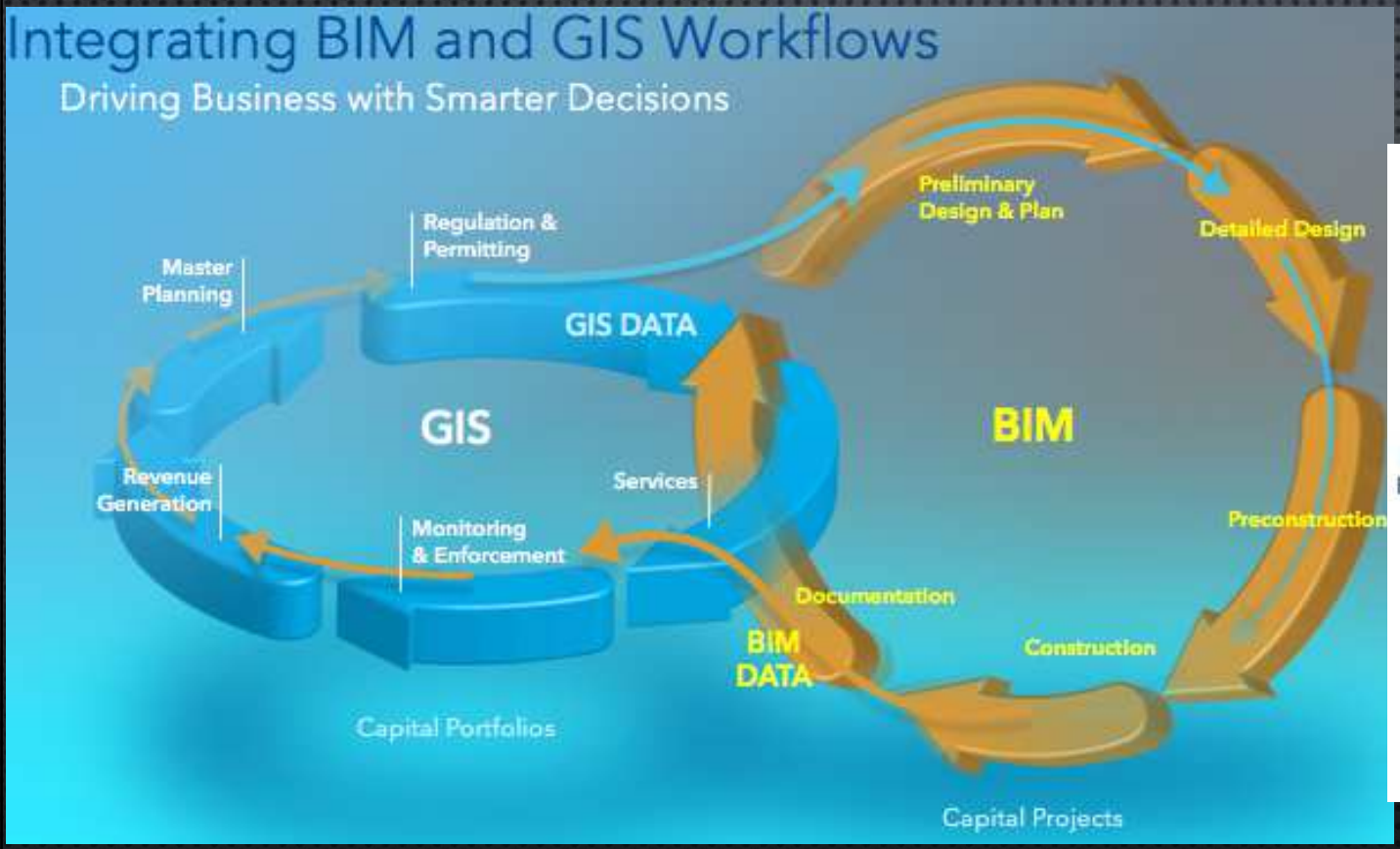
JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

or Civil Information Modelling (CIM)

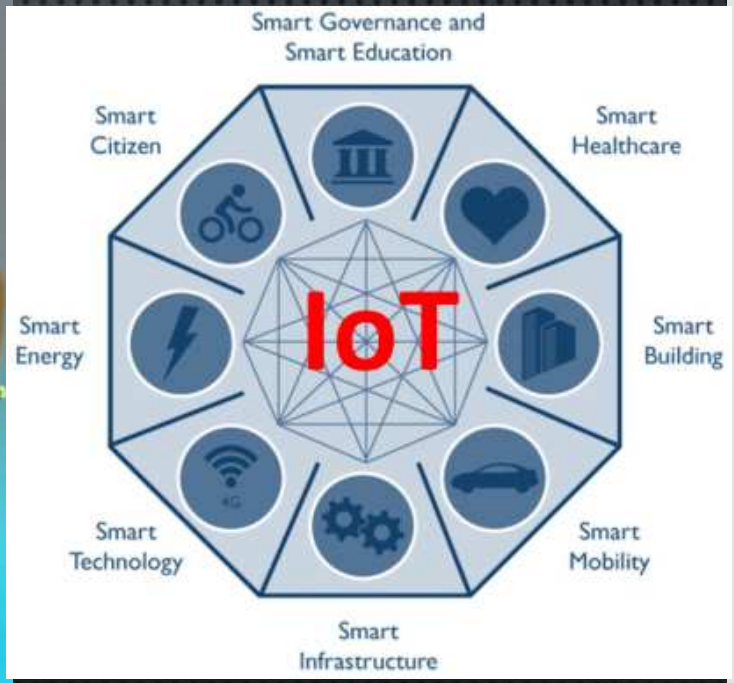
WHAT LIES BENEATH?

THE FUTURE

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS



SMART TOWNS & CITIES



3D GEO INFORMATION MODELLING (GEOIM)

INTERNET OF THINGS --(COLLECT & EXCHANGE DATA)

WHAT LIES BENEATH?

www.linkedin.com/in/noelcarrollbim