

UNIVERSIDAD DE LIMA

With the support of:
Stanford Center for Professional Development
CIFE

2nd INTERNATIONAL VDC CONGRESS (CIVDC)

INTEGRATING NEW TECHNOLOGIES AND COLLABORATIVE PROJECT MANAGEMENT PROCESSES TOWARDS A LEADING CONSTRUCTION INDUSTRY IN INNOVATION AND RESULTS

From May 25th to 28th, 2021

In collaboration:

CÍRCULO DE ESTUDIOS VDC CITTIC VDC DICTIONARY BIM FORUM BRASIL BIM Forum Chile Lean Construction Institute Red VDC LATINOAMÉRICA Comunidad BUENAS PRACTICAS

1

UNIVERSIDAD DE LIMA


With the support of:
Stanford Center for Professional Development
CIFE

2nd INTERNATIONAL VDC CONGRESS (CIVDC)

Subject Heading 4: VDC en VDC in Megaprojects BIM at São Paulo Metro Company



Antonio Ivo Mainardi
Metrô de São Paulo

2



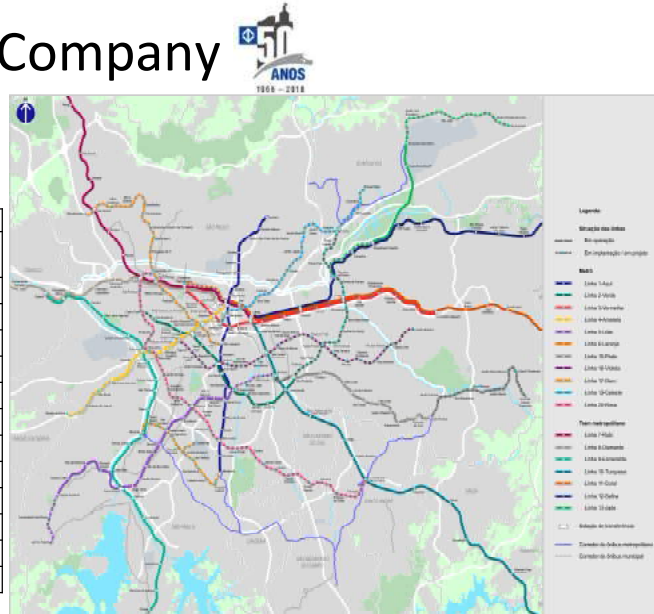
UNIVERSIDAD DE LIMA

With the support of:


The São Paulo Metro Company

- 5 millions trips/day
- 6 lines




Line	Operation		Construction		Project	
	Extension [km]	Stations	Extension [km]	Stations	Extension [km]	Stations
1-Blue	20,2	23				
2-Green	14,7	14	8,0	8	7,6	6
3-Red	22,0	18				
4-Yellow	11,5	10	1,4	1	3,4	2
5-Lilac	19,9	17			7,7	5
6-Orange			13,4	15	6,0	4
15-Silver	12,9	10	1,7	1	11,3	7
16-Violet					21,9	21
17-Gold			6,7	8	4,3	5
19-Heavenly					17,6	15
20-Rose					30,2	25
Total	101,2	82	31,2	111	110	186

3



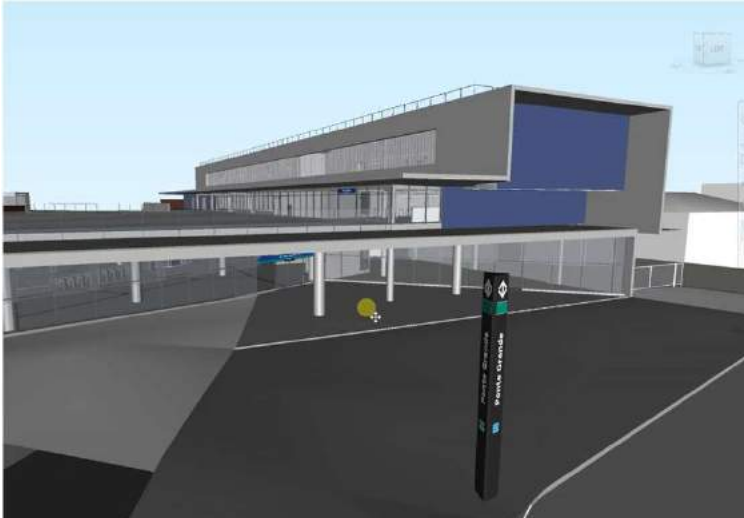
UNIVERSIDAD DE LIMA

With the support of:





Ponte Grande Station - 2013



- Architecture, Structure, Visual Communication, Landscape and Plumbing
- Achievements
 - Authoring experience
 - Approving experience
 - Knowledge of collaborative process
 - Knowledge that BIM is more than geometry
 - Maturity for other disciplines



4




UNIVERSIDAD
DE LIMA


With the support of:



Ipiranga Station - 2016



- Architecture, Structure, Visual Communication, Plumbing and Lightning
- Achievements
 - Improvement approving methods
 - RACI Matrix interdependency
 - BCF Comments standards
 - New deliverables methods
 - More collaborative with other company departments



5

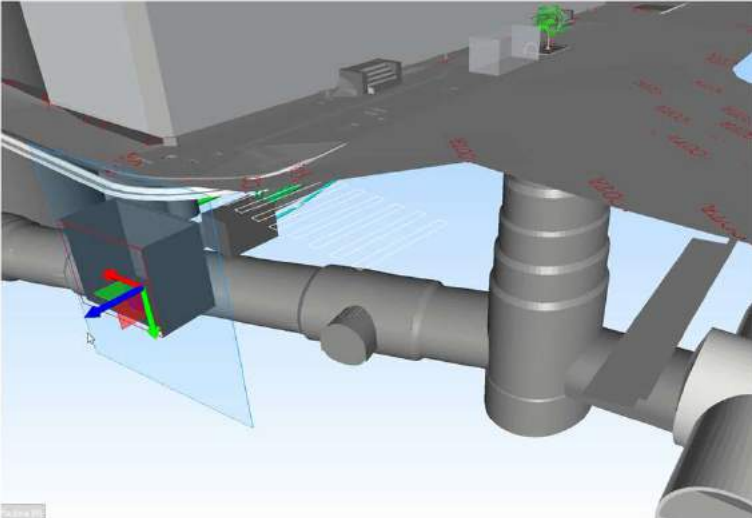


UNIVERSIDAD
DE LIMA

With the support of:



Complementary Tunnel - 2019

- Architecture, Structure, Visual Communication, Plumbing, Lightning, Topography and Urban Infrastructure
- Achievements
 - More disciplines
 - Maturity improvement for scope and contracts
 - The need of integrated projects (Civil + Systems/MEP)



6

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

What we are doing...

Laser Scan for topography and existing buildings

The image is split into two parts. On the left, a computer monitor displays a software interface with a 3D point cloud scan of a building structure. On the right, a blue pickup truck is shown from the rear, equipped with a laser scanner mounted on a blue frame on its bed. The truck has labels for 'Laser Scanner', 'Topografía', and 'Drones'.

7

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

What we are doing...

Simulations

The image shows two 3D simulation models of a transit station. The left model shows a top-down view of a platform with yellow and blue figures representing people moving along the platform. The right model shows a side view of a station with multiple levels and platforms, with blue and yellow figures representing people moving through the space.

8

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

What we are doing...

Simulations - CFD

Celsius

9

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

What we are doing...

Simulations - Lightning

10



UNIVERSIDAD DE LIMA

With the support of:





What we are doing...

Simulations - Analysis





11



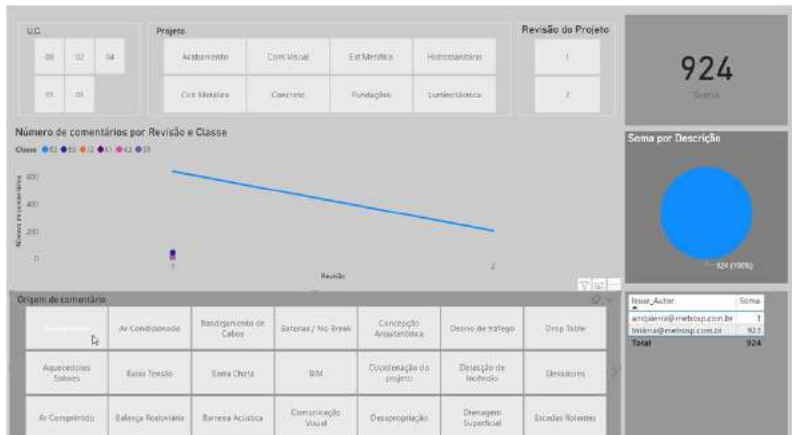
UNIVERSIDAD DE LIMA

With the support of:

What we are doing...

Coordination data



Projeto				Revisão do Projeto	
Acabamento	Com. Visual	Est.Métricas	Hydrosanitários	1	
Cão Metálica	Concreto	Fundações	Luminotécnica	2	

Número de comentários por Revisão e Classe						
Classe	01	02	03	04	05	06
Revisão	1					2

Ordem de comentário						
Air Condicionado	Balancamento de Cálculo	Baterias / No Break	Circulação	Arquitetônica	Desenho de espaço	Drum Table
Aquecedores Sábios	Bater Tostado	Barras Chave	BIM	Coordenação do projeto	Detecção de Interferência	Elevadores
Air Condicionado	Balança Redutora	Barreira Acústica	Comunicação Visual	Desapropriação	Demarcação Superficial	Escadas Rotativas

Issue_Actor	Soma
antonioivo@metrosp.com.br	1
brunara@metrosp.com.br	923
Total	924

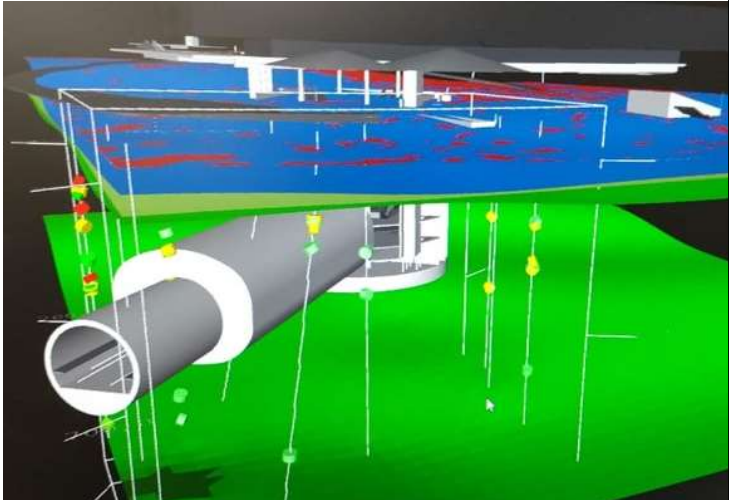
12

UNIVERSIDAD DE LIMA

With the support of:
Stanford Center for Professional Development
CIFE

Next level...2021

- + Disciplines
 - Geotechnical investigation
 - Roads and signage
 - Earthwork
 - Drainage
 - Electrical
 - Railroad + signage
 - Telecom
 - Superstructure
 - Acoustic treatment ...



A 3D BIM model showing a cross-section of a tunnel and its surrounding infrastructure. The tunnel is a large grey cylinder with a white interior. Above it, there's a blue and red surface representing roads and signage. Below the tunnel, there's a green area representing earthwork and drainage. Various colored lines and markers are visible, indicating different disciplines like geotechnical investigation, electrical, and telecom.

13

UNIVERSIDAD DE LIMA

With the support of:
Stanford Center for Professional Development
CIFE


Next level...2021

Modular standard projects




A 3D BIM model of a modular standard project. It shows a tall, cylindrical structure composed of several stacked modules. To the left, there's a separate module with a circular opening. Above the main structure, there's a smaller, more complex structure with a flat roof and some internal details.

14




UNIVERSIDAD DE LIMA

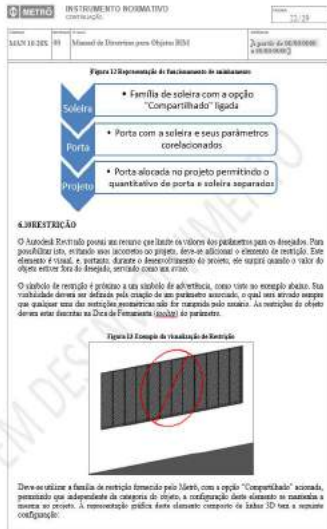
With the support of:




Next level...2021

Object's standards






15



UNIVERSIDAD DE LIMA

With the support of:




Next level...2021

BIMdata

IFC standards


Revit Mapping

Data Managing





Parâmetro	Fonte	RVTPara...	RVTshared	RVTshar...	RVTshar...	IFCparametro	IFCItem	IFCtipo
Largura	Nativo	Width				Width	Qty_BaseQuantities	Length
Altura	Nativo	Height				Height	Qty_BaseQuantities	Length
Código do Vão	PsetMetro	Código do Vão	68023A2b-9a79-4f	Text		Código do Vão	Qty_BaseQuantities	Text
Quantidade de módulos	PsetMetro	Modulo_Quantidade	F170b39b-27e3-4c	Integer		Modulo_Quantidade	Metro	Integer
Largura do módulo	PsetMetro	Modulo_Largura	0a34104e-42b4-4a	Length		Modulo_Largura	Metro	Length
Código Metro	PsetMetro	Código Metro	3bc61648-69d2-4f	Text		Código Metro	Metro	Text
Malha	PsetMetro	Malha	0ab8150-29a1-4e	Length		Malha	Metro	Length
Saída de Emergência	Mapeado	Saída de Emergência	#072924d-79ea-4e	Yes/No		FireExit	Pset_DoorCommon	Boolean
Operação da porta	Mapeado	Operation				Operation	ItcDoorStyleOperationE num	Text
Resistência ao fogo	Nativo	Fire Rating				FireRating	Pset_DoorCommon	Text
Classificação Acústica	Mapeado	Classificacao Acustica	F71ac026-d6db-4f	Text		AcousticRating	Pset_DoorCommon	Text

16



UNIVERSIDAD DE LIMA

With the support of:

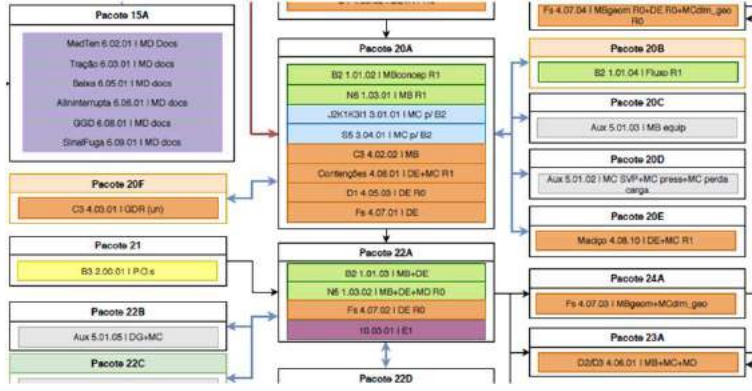



Next level...2021

New payment method

Evolutive criteria

Integrated packages



17



UNIVERSIDAD DE LIMA

With the support of:




Cultural change



BIM is about people, not technology

18



UNIVERSIDAD DE LIMA

With the support of:




Cultural change

- ✓ **20 days;**
- ✓ **47 speakers;**
- ✓ **52 presentations;**
- ✓ **254 attends;**
- ✓ **Average: 84 per day;**



PROJETO

inovAçãoBIM

OBJETIVOS BIM E O AVANÇO DA MADURIDADE


MACÉ DE SÃO PAULO 2018



47



PALESTRANTES

19



UNIVERSIDAD DE LIMA

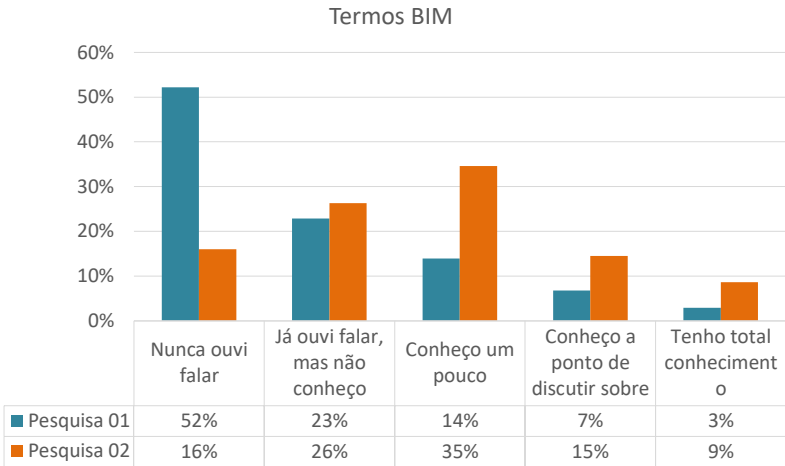
With the support of:

Cultural change

- IFC - Industry Foundation Classes
- LoD - Level of Detail
- LoI - Level of Information
- COBie
- ABNT NBR 15965
- BuildingSmart
- Parametrização
- BCF - BIM Collaboration Format
- PEB - Plano de execução BIM
- MAN 10-203 - Manual de Diretrizes BIM
- CIM - City Information Modeling
- CAD - Computer Aided Design
- CFD - Computational Fluid Dynamics
- CAFM - Computer-Aided Facility Management
- MVD - Model View Definition
- IoT - Internet of Things
- Laser Scanning
- GIS / SIG - Sistema de Informação Geográfica

Termos BIM



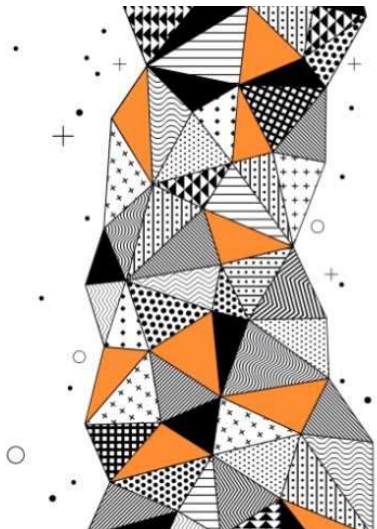
	Nunca ouvi falar	Já ouvi falar, mas não conheço	Conheço um pouco	Conheço a ponto de discutir sobre	Tenho total conhecimento
■ Pesquisa 01	52%	23%	14%	7%	3%
■ Pesquisa 02	16%	26%	35%	15%	9%

20

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

Cultural change



. PORTAL_CONSTRUÇÃO_DIGITAL

LOREM IPSUM
LOREM IPSUM
LOREM IPSUM
LOREM IPSUM
LOREM IPSUM
LOREM IPSUM


inovaçãoBIM

21

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

Cultural change



22

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

Cultural change

- 1º Digital Construction Workshop

23

UNIVERSIDAD DE LIMA

With the support of: Stanford Center for Professional Development CIFE

Cultural change

- 1º Digital Construction Workshop

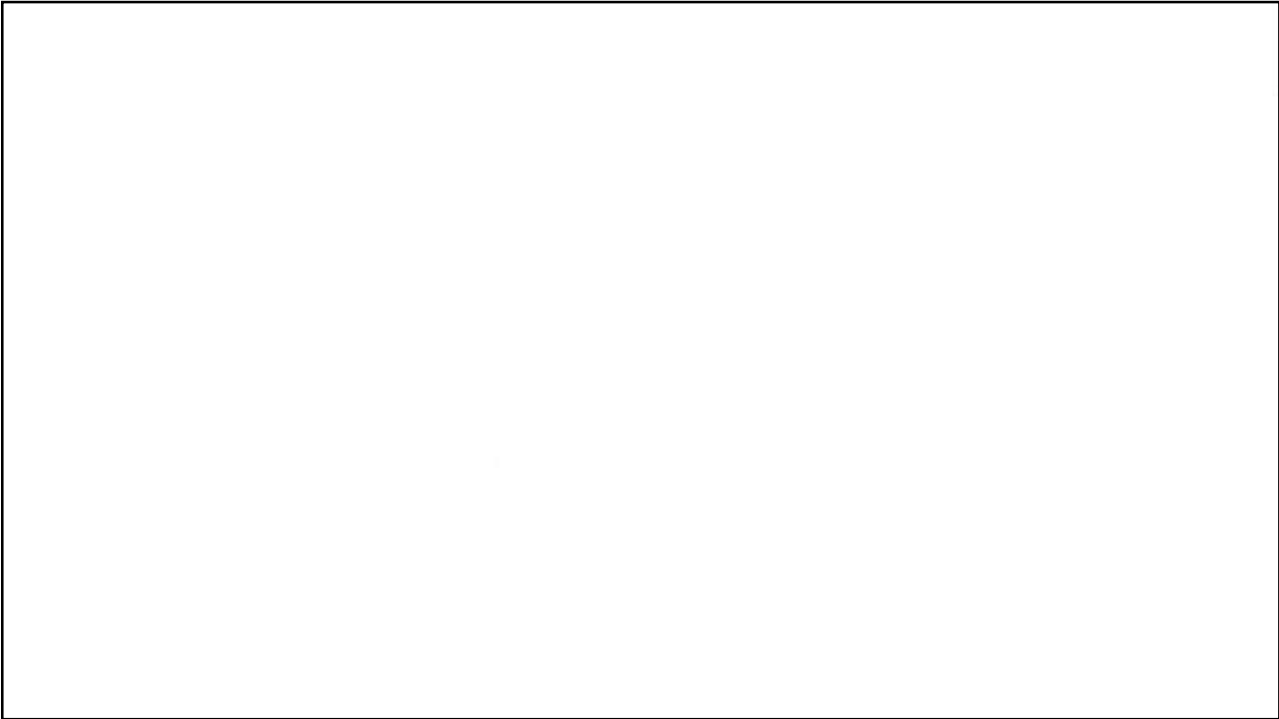
Silvani Pereira P

Paulo Meca DE


Luís Lemos DE/GEM

Carlos Paixão DE/GPR



24







25




With the support of:












¡THANK YOU!

 METRO.SP.GOV.BR
 IMAINARDI@METROSP.COM.BR
 [/IVOMAINARDI](https://www.linkedin.com/company/IVOMAINARDI)
 [@IVOMAINARDI](https://www.facebook.com/IVOMAINARDI)



In collaboration:

26