

# ITA COSUF Workshop 6 December 2023



Digitalization of tunnels

Towards BIM-based operation and maintenance

Preceded by ITA COSUF Activity Group Meetings and  
General Assembly on 5 December 2023

Venue: –  
[Empire Riverside Hotel](#)  
Hamburg  
Germany





# Experiences of BIM applications in Italy



## Certificate

Standard **ISO 14001:2015**

Certificate Registr. No. **01 104 2217578**

Certificate Holder: **FINELCO SRL**  
VIALE VENEZIA 2  
27100 PAVIA PV  
Italy

Scope: **Provision of engineering services**

Proof has been furnished by means of an audit that the requirements of ISO 14001:2015 are met.

Validity: **The certificate is valid from 2023-11-21 until 2026-11-20.**  
First certification 2023

2023-11-27

TÜV Rheinland Cert GmbH  
Am Grauen Stein - 51105 Köln

# Finelco srl

## Certificate

Standard **ISO 45001:2018**

Certificate Registr. No. **01 213 2217578**

Certificate Holder: **FINELCO SRL**  
VIALE VENEZIA 2  
27100 PAVIA PV  
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TÜV Rheinland Cert GmbH  
Am Grauen Stein - 51105 Köln

## Certificate

Standard **ISO 9001:2015**

Certificate No. **39 00 1252210**

TÜV Rheinland Italia S.r.l. certifies:

Certificate Holder: **FINELCO SRL**  
VIALE VENEZIA 2  
27100 PAVIA PV  
Italy

Scope: **Provision of engineering services**

IAF sector: **34**

Proof has been furnished by means of an audit that the requirements according to ISO 9001:2015 are fulfilled.

The due date for all future audits is 10-17

Validity: **The certificate is valid from 2023-11-21 until 2026-11-20**  
First certification 2023-11-21

2023-11-27

TÜV Rheinland Italia S.r.l. - Via E. Mattei, 3  
I - 20010 Pogliano Milanese (MI)



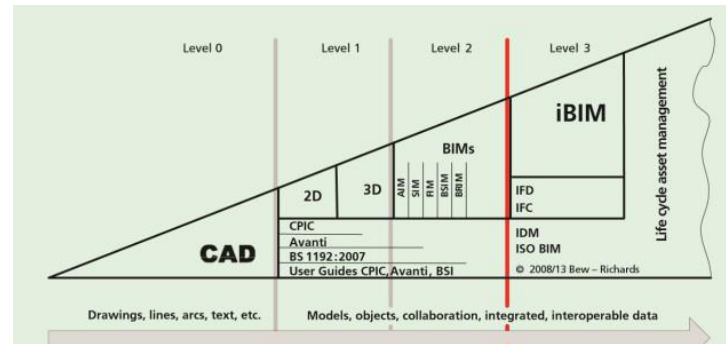
# THEMES

- Design Levels in BIM
- Fields of application of digital twins
- Experiences
- Critical issues
- Possible future application areas



# DESIGN LEVELS IN BIM

- ✓ Definitive design: the civil discipline has a high level, the plant engineering discipline highlights the main dimensions
- ✓ Executive design: compared to the precedence phase, there will be a precise definition of the civil components and the steps of the plant distribution are identified, providing correct positioning of the elements
- ✓ Constructive design: the level is brought to the specific and precise understanding of the elements present for all disciplines



- ✓ **UNI 11337: strength or weakness?**
- ✓ Definition of the geometric (LOG) and information (LOI) level of the elements;
- ✓ Specific requests for data to be entered;
- ✓ Growing use at a national level standardization and ease of communication between professionals;
- ✓ Lack of clarity in requests from clients;
- ✓ Difficulty in understanding for non-BIM;
- ✓ Each project has its own standard and specific requests.



- ✓ Management platform that uses the BIM model (in open IFC format) as the basis for the management of infrastructural elements in the field. For the plant engineering discipline, management platforms are being developed that interface with the model through IT environments.
  
- ✓ **Maintenance and development of IT standards:**
- ✓ It is necessary to establish what the final objective is by involving the management platform provider
- ✓ the database of verified information on the work;
- ✓ the register and location of the individual components of the building and technological assets;
- ✓ the possibility of managing space management digitally;
- ✓ the reference system for operation and maintenance;
- ✓ the enabling structure for energy monitoring; the logical and informative visual resource with advanced graphic representation.

## External legacy systems for the digital twin

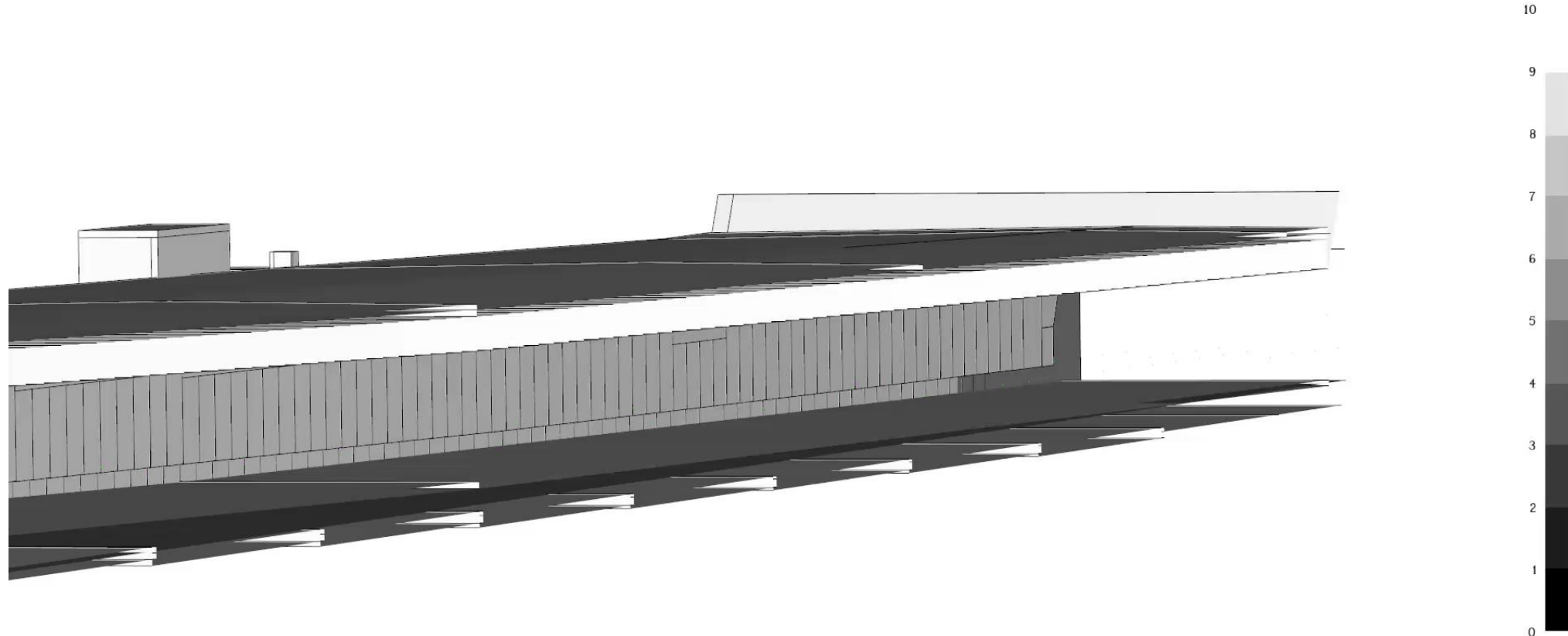


# FIELDS OF APPLICATION OF DIGITAL TWINS



TÜVRheinland®  
Precisely Right.

Exited: 0 / 490 VIS\_C0.9H0.1  
(m)





# FIELDS OF APPLICATION OF DIGITAL TWINS



TÜVRheinland®  
Precisely Right.

Exited: 0/958 VIS\_C0.9H0.1  
(m)

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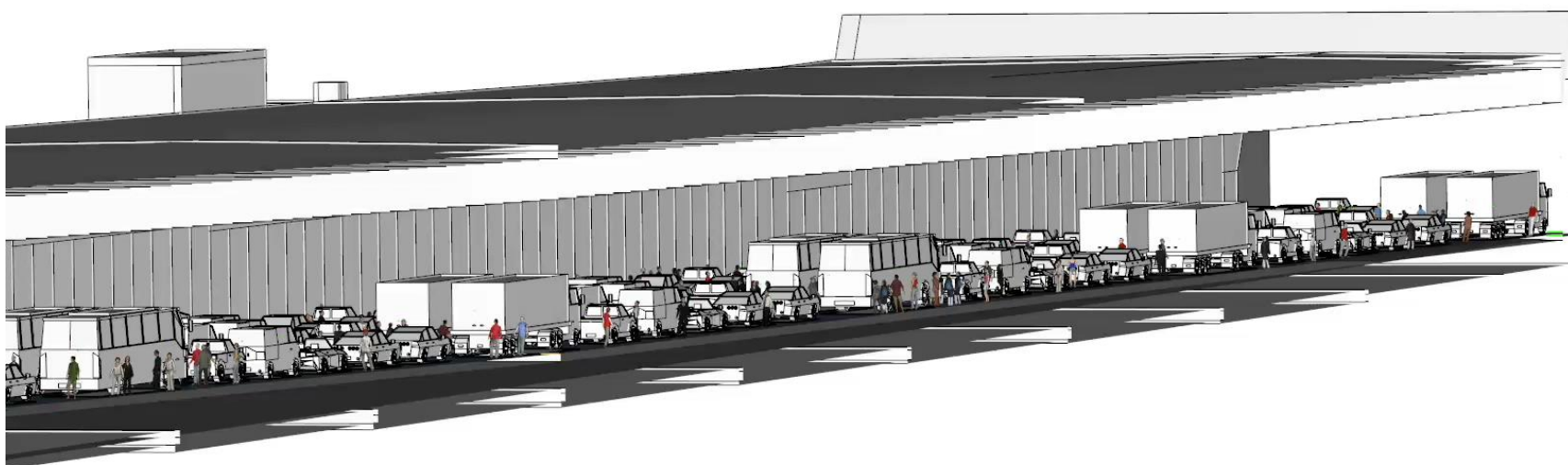
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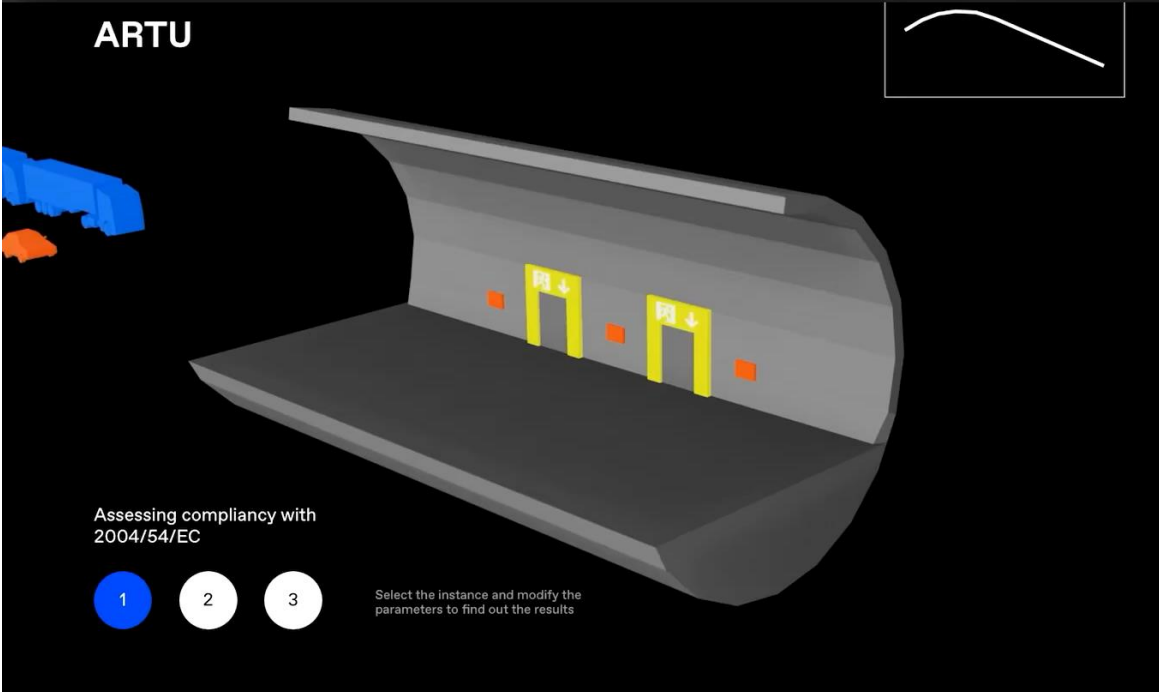




# FIELDS OF APPLICATION OF DIGITAL TWINS



## ARTU



Assessing compliancy with 2004/54/EC

1 2 3 Select the instance and modify the parameters to find out the results

Length 2.5 Km

Slope 2%

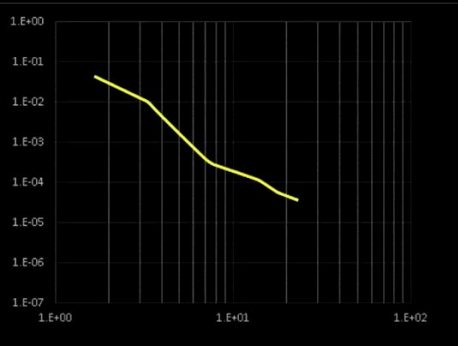
Annual Average Daily Traffic 30000

Percentage of HGV (25%) veh/day

Number of emergency exits (4)

Noise barriers NO


### FN CURVE



F (Frequency)	N (Number of failures)
1.0	0.05
10.0	0.001
100.0	0.00001

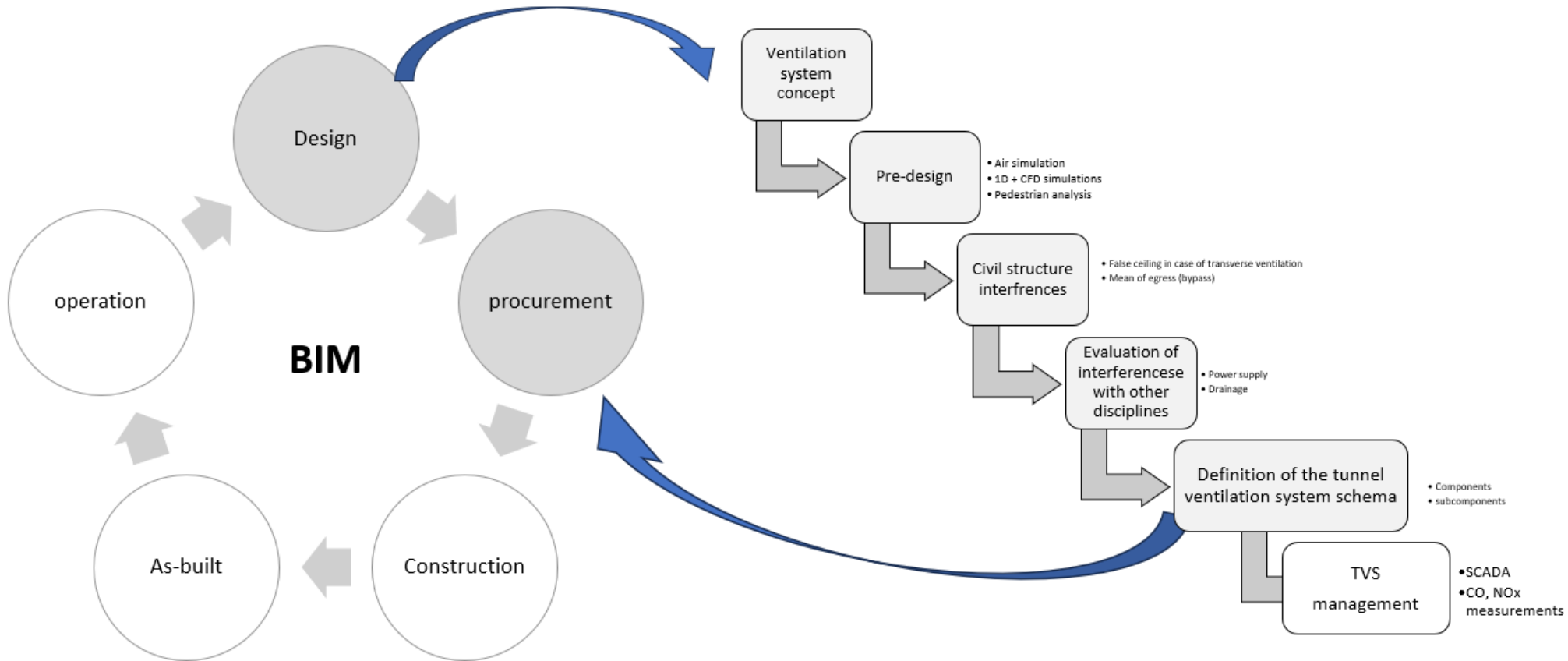
### AVERAGE FED

FED=0.70



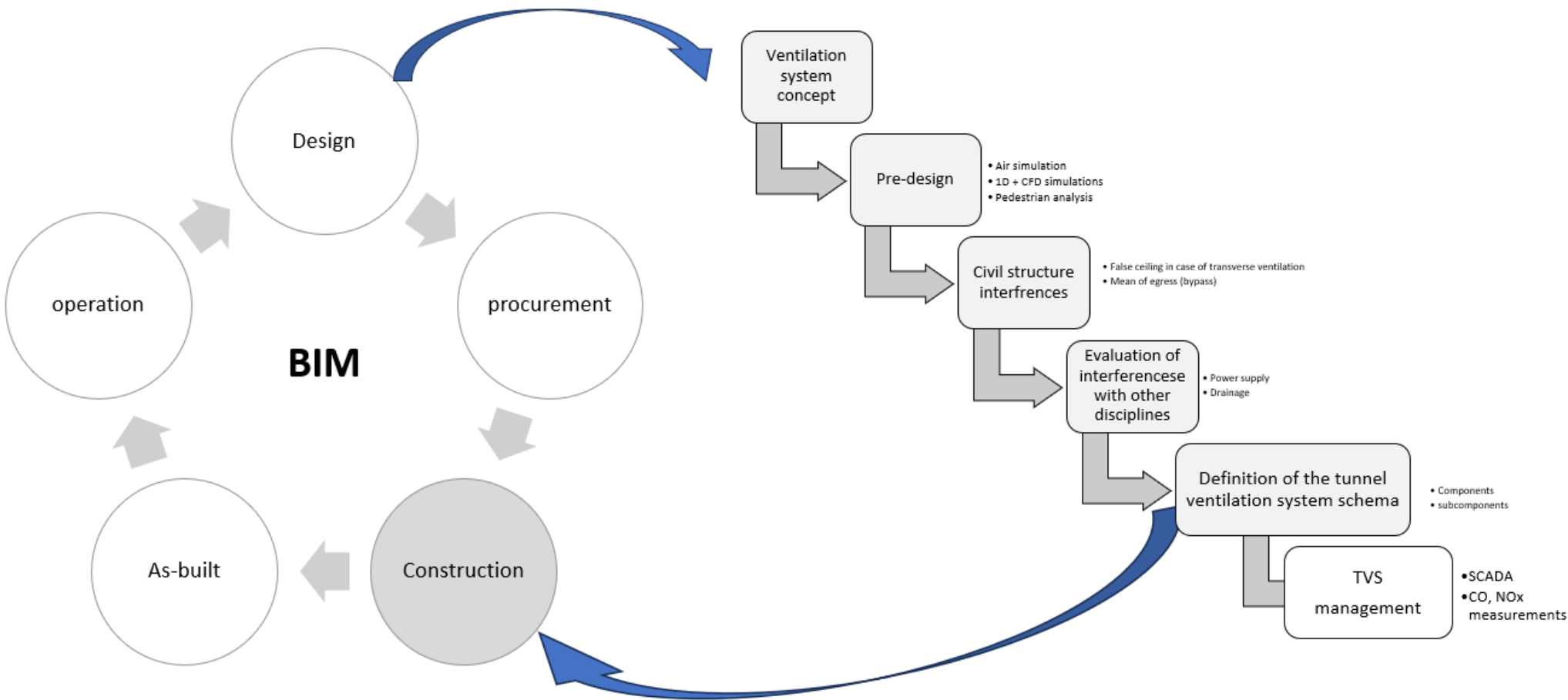


## BIM project life cycle: TVS (tunnel ventilation system)



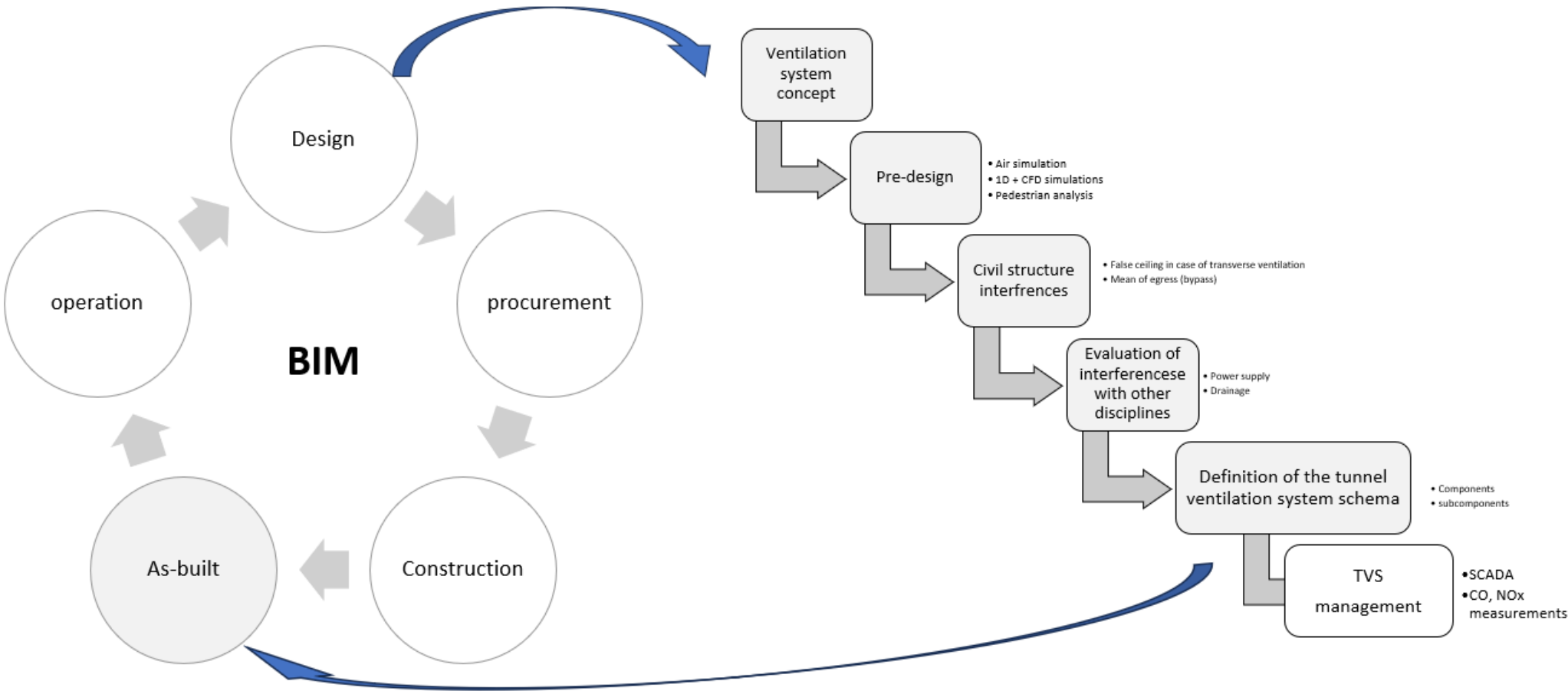


## BIM project life cycle: TVS (tunnel ventilation system)



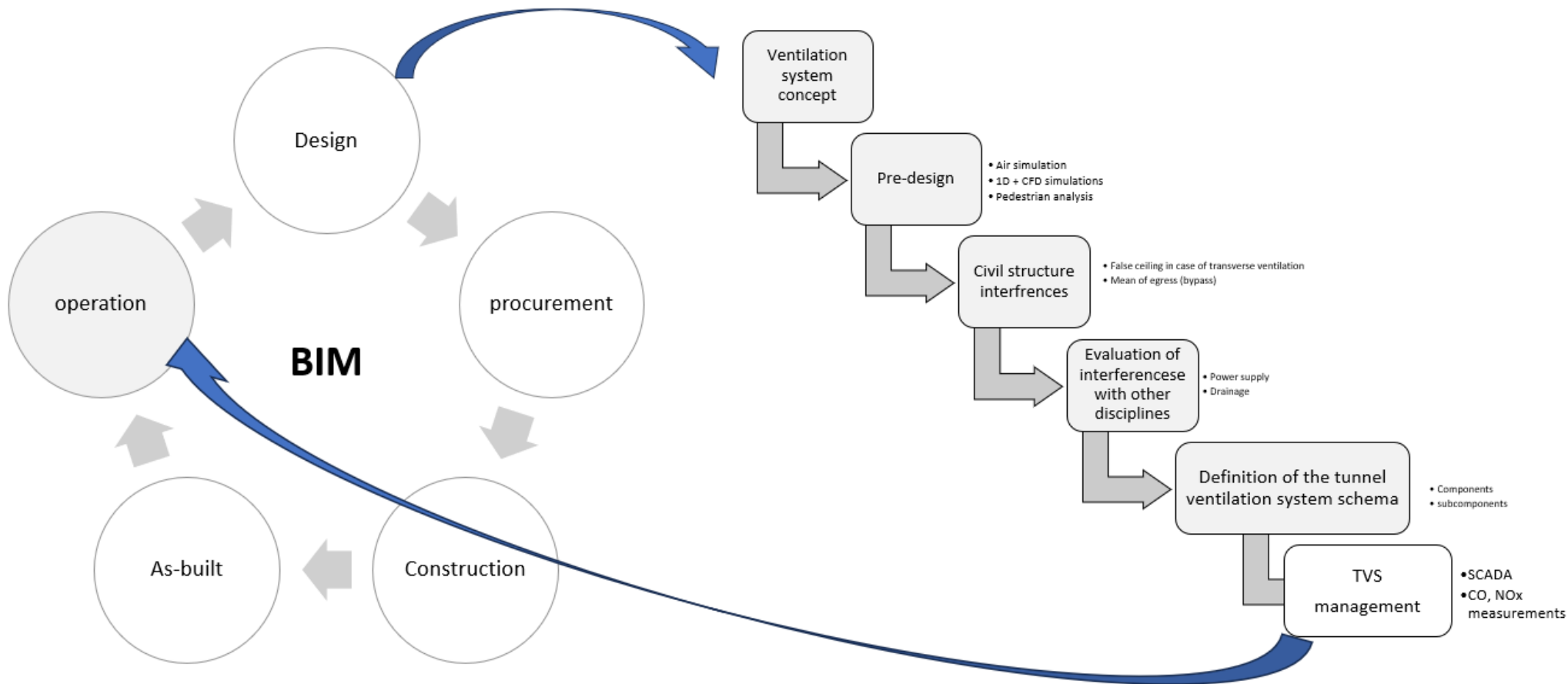


## BIM project life cycle: TVS (tunnel ventilation system)





## BIM project life cycle: TVS (tunnel ventilation system)





**BIM as an added method for the objective to be achieved**

## **IFC Model → CFD → Simulation**

- ✓ **Standardization of families and coding**
  - ✓ **Data collection**
  - ✓ **Interoperability**
  - ✓ **Insert the management component right away (but experience is needed);**
  - ✓ **The parameters entered into the model elements during design are not sufficient. The model would remain a passive element**
  - ✓ **Use of templates**
  - ✓ **Database to query the model and prevent maintenance errors**
- 
- ✓ **TOOLS FUNCTIONAL FOR SAFETY**



- ✓ The advantages, resulting from the dual combination between BIM and Digital Twins, can be summarized as follows:
- ✓ optimization of safety procedures and maintenance planning guaranteed by the certain data inserted in the BIM model;
- ✓ greater compatibility of the components to be replaced given by the certification of those inserted during the design phase of the work;
- ✓ higher reliability in archiving data from maintenance operations (updating);
- ✓ ease in adopting regulatory adjustments and opportunities to access government incentives
- ✓ the control of consumption spent compared to an energy saving baseline;
- ✓ the guarantee of the efficiency and effectiveness of contracts obtained through the transparency and traceability of Facility Management services;
- ✓ Monitoring of the services provided and control of the work carried out;
- ✓ the transparency of the results obtained by monitoring performance over time;
- ✓ the optimization of BIM processes oriented towards future management.



Thank you

Simone Casa  
Finelco