OGC Workshop Underground Infrastructure

City Infrastructure Lifecycle Management
A Platform Approach

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3DEXPERIENCE Powers…

… our Brand Applications…

…for 12 Industries

- Transportation & Mobility
- Aerospace & Defense
- Marine & Offshore
- Industrial Equipment
- High Tech
- Consumer Goods - Retail
- Consumer Packaged Goods - Retail
- Life Sciences
- Energy, Process & Utilities
- Architecture, Engineering & Construction
- Financial & Business Services
- Natural Resources
City Infrastructure Lifecycle Management

++ Platform for data collection, storage, integration, management, analysis, and visualization

++ Interoperability: possible integration capabilities of Standards via 3DEXPERIENCE Platform

++ Virtual | Operational Twin: Design Build | Build Run

++ Role of Dynamic modeling and prediction for Lifecycle Management

++ Project experiences in above and underground infrastructure modeling and mapping
3DEXPERIENCE Platform for City Infrastructure

3DEXPERIENCECity® Infrastructure

Business Platform

Collaborative 3DEXPERIENCE Platform

Technology Suite

Dynamic Data Model

Data Capturing | Data Storage | Data Aggregation | Data Analytics | Data Visualization | Data Security | Data Warehousing

Data Security | Data Warehousing

National Datasets | City Data | Environmental Data | Utilities | Sensors and live data

Design | Simulation | Data Analytics | Business Operations | Any Application
3DEXPERIENCE Platform | Cross Domain Approach

From silos services … to smart advanced services

- Road
- Traffic
- Electricity
- Water | Gas Distribution

- Intelligence
- Connectivity
- Device

New advanced services
- Water Distribution
- Road
- Traffic
- Electricity
- Smart Transportation

- Holistic city management
- Collaborative Smart City Platform
- Smarts interconnected and multipurpose devices
3DEXPERIENCE Platform connects the dots

By moving from a file-based approach to an object-centric approach

This avoids gaps, overlaps and silos over decades between:

- People
- Organizations
- Responsibilities

EDMS*  
Electronic Document Management System

![Diagram showing the transition from paper documents to electronic documents and EDMS, highlighting finer information granularity and zero discrepancy, exceptions, failures, rework, latency, and delay.](image-url)
## City Infrastructure Lifecycle Management

### Interoperability: The Integration of Standards via the Platform

<table>
<thead>
<tr>
<th>How its governed and represented</th>
<th>Information represented</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOM</strong> ISO/IEC 15288</td>
<td>Buildings</td>
</tr>
<tr>
<td><strong>KML</strong> ISO 55000</td>
<td>Terrain &amp; Land use</td>
</tr>
<tr>
<td><strong>OGC</strong> ISO 16739</td>
<td>Road &amp; Traffic</td>
</tr>
<tr>
<td>ISO 10303 (STEP) ISA 95</td>
<td>Rail</td>
</tr>
<tr>
<td><strong>CityGML ISO TCS211</strong></td>
<td>Basements, Cellars</td>
</tr>
<tr>
<td><strong>CityGML 3.0</strong></td>
<td>Cable network</td>
</tr>
<tr>
<td><strong>CI/ASCE 38-02</strong></td>
<td>Utilities</td>
</tr>
<tr>
<td>ANSI/ASCE/EWRI 12-13, 1313, 14-13</td>
<td>Telecommunications</td>
</tr>
<tr>
<td>ANSI/ASCE/EWRI 56-10, 57-10</td>
<td>Water</td>
</tr>
<tr>
<td>ISO 15926 (Xmplant)</td>
<td></td>
</tr>
<tr>
<td><strong>ASCE/EWRI 45-05, 46-05 &amp; 47-05</strong></td>
<td>Road Tunnels</td>
</tr>
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<td><strong>ASCE/EWRI 12-05, 13-05 &amp; 14-05</strong></td>
<td>Subways</td>
</tr>
<tr>
<td><strong>GML; GeoSciML</strong></td>
<td>Sewage</td>
</tr>
<tr>
<td><strong>EarthResourceML</strong></td>
<td></td>
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<tr>
<td><strong>INSPIRE</strong></td>
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</table>

- **Depth**
  - 0 m
  - 15-50 m
  - 100 m onwards

- **Classification**
  - Surface
  - Near-Surface
  - Subsurface

- **Geology**
  - Geotech, RQD etc
New visions for 3DEXPERIENCE City Model

Build-Up
3DEXPERIENCE Platform | City Lifecycle

3DEXPERIENCity® SERVICES

3DXCity IOT - IOE
Interoperable interconnected object management and tracking in the real | virtual city, Geo-located and updated in real time, Consulting

3DXCity Business Operations
Data analytics, planning and optimization for service providers and companies in the city context, turn urban data into business opportunity, Logistics, Consulting

3DXCity Simulation
Model and simulate impacts of urban choices in real time, compare alternatives, systemic approach Visualization of results 1-4 d, Consulting

3DXCity Design
Imagine, Design, realize iProjects For the Future in the 3DEXPERIENCity and share, evaluate and validate, Consulting

3DEXPERIENCity® SDK
Develop value added aps Propose online services Deliver content

3DEXPERIENCE® PLATFORM

3DXCity Data
Upload and access 3DEXPERIENCity Data in one click, Push data to improve it Build Digital City Reference

3DXCity Cockpit
City 3D Navigation, data federation, data crawling, city dashboard information Present data in real time

3DXCity Navigation
Life-style tool for navigating the Real | Virtual city Geolocated and updated in real time

3DXCity Collaboration
Share data, processes Capitalize on city projects

3DXCity Forum
Access and Exchange btw cities and citizens

3DX | The 3DEXPERIENCE® Company
City Infrastructure Lifecycle Management

Virtual | Operational Twins – from Design Build – to Build Run

- Infrastructure’s complete functionality, the operation of the geometrical, mechanical, electrical and electronic systems of system can be simulated, tested and optimized. Similar analysis and simulations are conducted to test and optimize the production of the infrastructure. What traditionally is known in the industry as Product Life Cycle Management (PLM) is now applied as City (Infrastructure) Life Cycle management (C(I)LM).

- The advantages of the City Infrastructure Life Cycle Management for the design is obvious: as it enables to create a coherent link between Design-Build and Built-Run for the entire infrastructure systems in cities – a process through which significant optimizations can be achieved prior to building and managing that infrastructure.
City Infrastructure | Virtual Twin

End-to-end User Experience

**R2V** Insights from Experience in Life

**Reality** Enriched **Design**

**RUN**

**IMPROVE**

**BUILD**

**DESIGN**

**Intelligence In Context**

**Virtually** Enriched **Experience**

**V2R**
City Infrastructure Virtual Twin
Virtually Validated Design

R2V Insights from Experience in Life Reality Enriched Design

RUN

IMPROVE

BUILD

DESIGN

Intelligence In Context Virtually Enriched Experience

V2R

Digital Mock-Up:
3D CAD, configuration management

Simulation:
Project execution simulation and refinement

Requirements:
Operational & Technical specifications
City Infrastructure Virtual Twin
Digitally Augmented Operation

Insights from Experience in Life
Reality Enriched Design

RUN

IMPROVE

BUILD

Intelligence In Context
Virtually Enriched Experience

V2R

Infrastructure Digitalization:
Laser Scan / Point of Clouds

Augmented Reality:
Operational guidelines

IIoT:
Real-time and historical process data connectivity
City Infrastructure Virtual Twin

Real-time Experience Optimization

R²V
Insights from Experience in Life
Reality Enriched Design

RUN

IMPROVE

BUILD

DESIGN

Intelligence In Context
Virtually Enriched Experience

V²R

Condition-Based Monitoring:
- Edge computing
- Process & Asset Monitoring

Analytics/Dashboarding:
- Asset in Operation,
  Process Optimization,
  360° view

Machine learning:
- Operational Intelligence

Maintenance:
- Predictive maintenance,
  Prescriptive analytics

Energy Efficiency:
- Energy monitoring & optimization

Real-time Experience Optimization
City Infrastructure Virtual Twin
Accurate Data Enriched Simulation

R²V Insights from Experience in Life
Reality Enriched Design

RUN

IMPROVE

BULD

DESIGN

Intelligence In Context
Virtually Enriched Experience

V²R

Mission Preparation:
Clash detection, elaboration of Electronic Work Instructions

Mission rehearsal:
Virtual Training / Immersive Training / Safety

Fitness For Service:
Functional & Dysfunctional simulation
City Infrastructure Lifecycle Management

Project Experiences in Above and Underground Infrastructure

- Infrastructure Maintenance Planning
- Wastewater Collection
- Hydro Power

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- Infrastructure Networks
- Freshwater Intake
- Environment Model
Infrastructure Design & Design Analysis

Implementation example – Wastewater Collection

Some of the standards (not an exhaustive list) that can be used for data exchange –
++ Geographical annotation and visualization for 2D & 3D KML for earth browsers,
++ Data transfer standard for geological data and geosciences GeoSciML for earth data, (CityGML)
++ Urban Subsurface Drainage ASCE/EWRI 12-05, 13-05, and 14-05 Standard Guidelines for the Design of Urban Subsurface Drainage,
++ Systems Engineering Standard & ILCM: ISO / IEC 15288 for Systems engineering standards, ISO 15926 for Plant data exchange,

A comprehensive interface and data standard are required to combine different utility types, geology in a collaborative environment.
Infrastructure Design + Design Analysis

Implementation example – Freshwater Intake

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++ Geographical annotation and visualization for 2D & 3D KML for earth browsers,
++ Data transfer standard for geological data and geosciences GeoSciML for earth data, (CityGML)
++ Systems Engineering Standard & ILCM: ISO / IEC 15288 for Systems engineering standards, ISO 15926 for Plant data exchange,
++ Existing Subsurface Utility Data CI/ASCE 38-02 Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data,

A comprehensive interface and data standard are required to combine different utility types, geology in a collaborative environment.
Infrastructure Design + Realization

Implementation example

Infrastructure Planning and Project Management

Implementation example – Maintenance Planning

BIM, 3D model

Process Flow and Behaviors

Master schedule

Throughput Analysis

What If Scenarios

Labour and Equipment Utilization
Infrastructure Design + Realization

Implementation example

Currently some of the standards that can be used for partial data exchange – KML for earth browsers, GeoSciML for earth data, CityGML, ISO 10303 STEP for mechanical data, ISO | IEC 15288 for Systems engineering standards, ISO 55000 Asset Management, ISO 15926 for Plant data exchange, ISO 16739 and ISO 29841 for IFC BIM models.
City Infrastructure Networks Model

Efficient, low noise and odour controlled system for an excellent high class living standard

HOW IT WORKS

1. Waste is disposed off through hoppers installed in the reception. Compaction hoppers or outdoor drop off points.
2. The waste will be temporarily stored in the storage area above the discharge valve.
3. Exhausts create suction pressure and an air flow in the pipelines.
4. The discharge valve is opened and the waste drops to the main line.
5. The on-line transport takes the waste to the collection station for further transport.
6. The waste drops into refuse containers via systems, the air separator.
7. Refuse containers are transported by trucks to dumping grounds, incineration plants, etc.
8. The exhaust air will pass through the Dust and Odour Filtration before being discharged into the atmosphere.

BENEFITS

The benefits of our CleanVAC System:
- "Zeroised System" — improves hygiene standards
- Automated Processing System — increases efficiency, reduces maintenance input
- High safety and security standards
- Green Power house savings
- Lessitage truck and waste line
- Improve city image, create pleasant surrounding
- Less noise
- Reduce vectors and pest issues
- Adaptable for food waste, recycling collection, and hospitals
City Infrastructure Environment Model