Developing a National Digital Engineering Standard

Lessons from the N2 KwaMashu ISO 19650 BIM Pilot

BIM CoDE-SA Workshop 8 · 2026

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DIGITAL ENGINEERING TASK TEAM

SANRAL
BUILDING SOUTH AFRICA THROUGH BETTER ROADS

PRESENTER

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Why This Matters

The industry is shifting from delivering drawings to delivering structured data.

The Global Direction

- Digital engineering is advancing rapidly worldwide
- Asset owners are moving toward structured, lifecycle information
- ISO 19650 is becoming the international standard for BIM information management

The SANRAL Challenge

- Road and bridge assets managed in a fragmented way
- Highly varied capture technologies across projects
- Information not always reusable across the asset lifecycle
- Large scale projects with voluminous information in lever arch files

SANRAL's Digital Engineering Response

Four strategic objectives guiding our digital engineering programme

1

Enhance Data Capture & Asset Management

2

Increase Organisational Awareness & Buy-in

3

Leverage Open Innovation

4

Establish a Knowledge Hub

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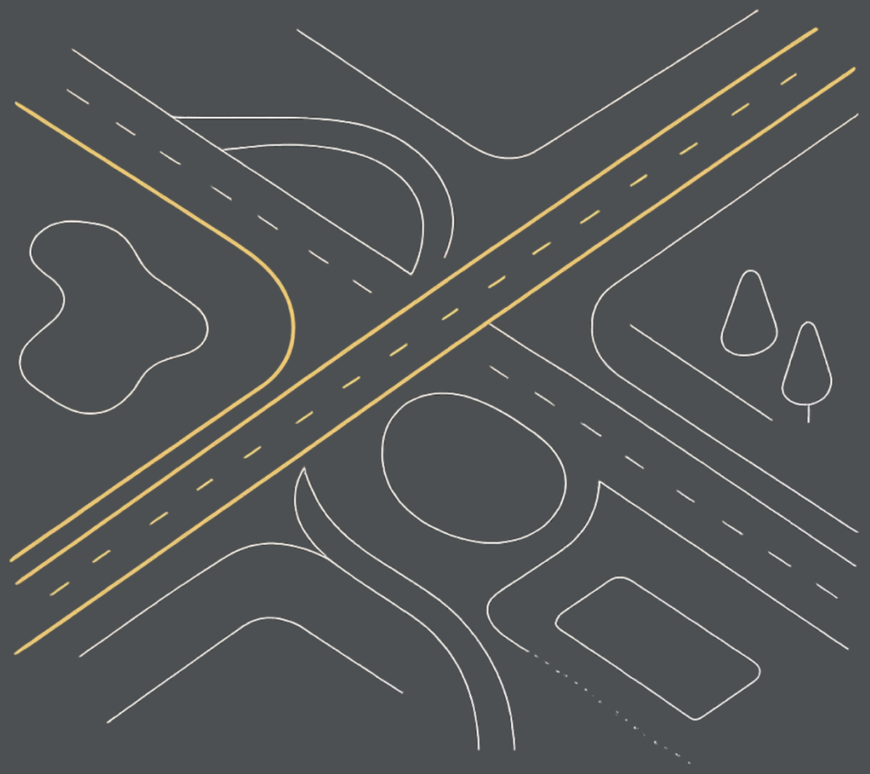

CASE STUDY

The N2 KwaMashu ISO 19650 BIM Pilot

Project Details

- **Route:** N2, Section 25 — KwaMashu Corridor
- **Extent:** Umgeni Interchange (km 20.72) to South of Mount Edgecombe Interchange (km 30.45)
- **Type:** Road Upgrade — Concept → Preliminary → Detailed Design → Construction

Scope of Works

- Design of the Kwamashu Interchange – On ramps and off ramps as well as structures.

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Roles, Governance and Value

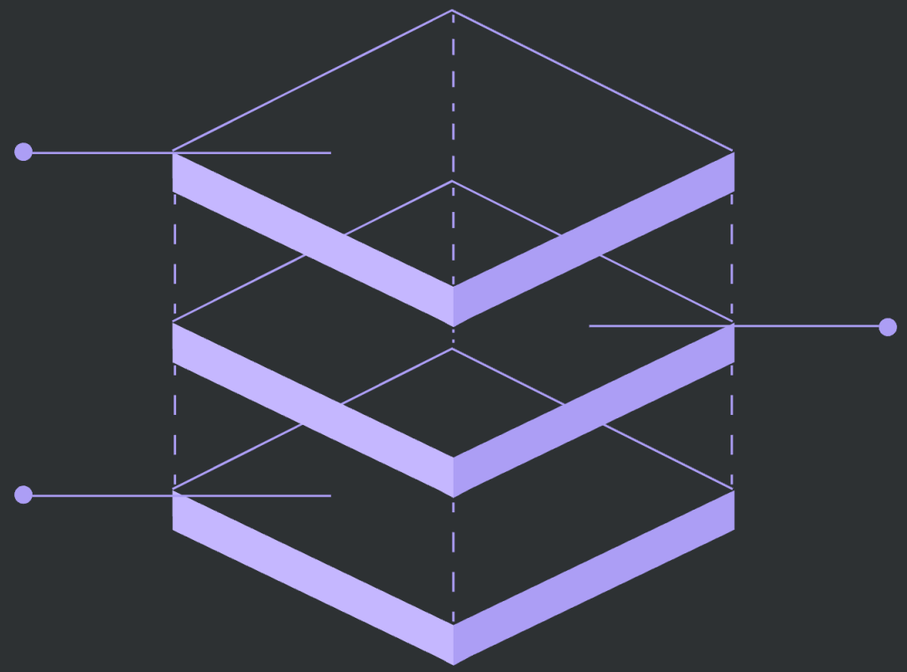
Clear accountability for who defines requirements, who translates them, and who produces the information.

Appointed Parties

Sub-consultants produce discipline-specific information via CDE

Appointing Party

SANRAL defines OIR, AIR, EIR requirements



Lead Appointed Party

Naidu Consulting translates requirements, produces BEP and MIDP

All governed through the Common Data Environment.

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OIR

What SANRAL Needs as an Organisation

The OIR defines what information SANRAL requires to fulfil its mandate — planning, operating and maintaining South Africa's national road network. It is structured around SANRAL's Horizon 2030 strategic pillars, with each pillar linked to specific information needs flowing into the AIR and EIR.

The OIR shifts BIM from "we need to build a model" to "we need to define what information the asset owner actually requires."

Roads

Asset inventory, condition, construction data

Road Safety

Incident reports, audit findings, enforcement data

Stakeholders

Consultation records, socio-economic indicators

Mobility

Traffic flow, travel time, electronic payment data

Asset Management

Lifecycle decisions, performance benchmarks

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AIR

What Information Assets Must Carry

Turning physical infrastructure into structured, queryable data objects.

Structures

- Road surfacing, base, sub-base and subgrade
- Paved shoulders and rehabilitation layers
- Surfacing treatments and overlays
- Asset ID, material type, thickness, drainage type
  - Bridges, culverts, retaining walls and tunnels
  - Bridge deck, beams/girders, bearings, expansion joints
  - Structural embankments
  - Asset ID, span, material, structural condition index
    - Culverts, pipes and stormwater channels
    - Side drains, catchpits and attenuation ponds
    - Asset ID, size, material, hydraulic capacity
    - Condition and maintenance history

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AIR DETAIL

From Asset Type to Required Data

Each asset attribute is traceable from design through to maintenance — aligned with TMH 22.

Location	Road ID, section, chainage, GPS coordinates, span references
Condition & Performance	IRI, rutting, crack index, deflection, bearing capacity, TMH 19 thresholds
Usage & Demand	AADT, heavy vehicle percentage, load class, toll revenue data
Maintenance & Intervention	Last rehab cycle, inspection frequency, trigger thresholds, intervention records
Financial & Commercial	Unit replacement cost, renewal cost, residual life, warranty details
Documentation & Metadata	As-builts, QC test results, geotechnical reports, design certificates

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EIR

What the Appointed Party Must Deliver

The Exchange Information Requirements define exactly what must be produced, in what format, and by when — across all project stages. Issued by SANRAL and forming part of the contractual documentation.

Deliverables

What must be submitted at each project stage gate

Formats

PDF, DWG/DGN, IFC 4.3, Revit native files

Milestones

Linked to project stage gates — Stages A through N

CDE Workflows

WIP → Shared → Published → Archived

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EIR DETAIL

Fit-for-Purpose Information

Each deliverable carries agreed expectations across three dimensions — ensuring information is usable, traceable and handover-ready.

Geometry

Level of Detail (LOD)

- LOD 300 — Preliminary design
- LOD 350 — Detailed design (coordinated)
- LOD 500 — As-built record
- Drawings must be extracted from the model

Data

Level of Information Need (LOIN)

- Asset attributes required at each stage
- IFC 4.3 for open data exchange
- Linked directly to AIR asset categories
- Feeds the Asset Information Model (AIM)

Documents

Deliverable Format & Acceptance

- PDF for record; native files for BIM workflow
- Named per CDE naming convention
- Submitted through CDE — no email submission
- Subject to formal review and approval

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CDE

Common Data Environment

The CDE is not storage. It is where governance happens.

Single Source of Truth

One location for all project information — no parallel email or file-sharing chains

Controlled Access

Role-based permissions managed by the BIM Lead — only authorised parties can publish

Version Control

Every revision tracked — approved records cannot be overwritten or deleted

Review Workflows

Formal approve, reject and resubmit process built into every submission

Audit Trail

All submissions, approvals and rejections logged — visible and time-stamped

CDE Platform: Autodesk Construction Cloud (ACC) — Owned and managed by Lead Appointed Party (BIM Lead)

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CDE: Naming Conventions & Folder Structure

Naming Convention

Standardised file identity — reduces ambiguity, supports traceability and audit.

General Format: `[Project No]-[Doc No]-[Originator]-[Chainage]-[Type]-[Role]`

Example: `N2KM-00123-CNS-KM01+250-DRG-DGN`

Bridges

- Pre-Approved: `[Bridge No]-[Sheet No]-[Description]`
- Approved: `[SANRAL Doc#]-[Bridge No]-[Sheet No]-[Description]`
- Signed Record: `[Sheet No]-[SANRAL Doc#]-SIGNED-RECORD-[Bridge No]`

CDE Folder Structure

00 — WIP

Work-in-Progress — authoring space for each discipline and stage

01 — Shared

Under review — verified by originator, not yet formally approved

02 — Published

Authorised information — formally accepted and available to all parties

03 — Archived

Superseded versions — maintained for audit and regulatory compliance

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BIM Execution Plan: Translating Requirements

The BEP is the project team's operating manual for digital delivery — responding to the EIR and mapping every client requirement to a delivery method, responsible party, and reference document.

Roles & Responsibilities

RACI matrix defines Responsible, Accountable, Consulted and Informed parties for all BIM activities

CDE Procedures

Autodesk Construction Cloud (ACC) established as the project CDE with defined access and upload controls

Level of Information

LOD 300 (Preliminary), LOD 350 (Detailed Design), LOD 500 (As-Built) — aligned with EIR stage gates

MIDP & TIDP

Master and Task Information Delivery Plans schedule what is produced, by whom, and by when

Quality & Compliance

Clash detection, compliance checks and review workflows integrated into the CDE submission process

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Workflow for Review and Acceptance

Files may only progress forward after formal approval. All submissions, approvals, rejections and archiving are logged in the system audit trail — creating a controlled feedback loop between information producer and BIM Coordinator.

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Lessons from the Pilot to Date

1 **ITIS Must Be the Receiving Environment**

BIM delivers value only if structured data lands in a system that can use it. ITIS integration is the end goal, not an afterthought.

2 **Defining Requirements Is the Most Valuable Part**

More value comes from the OIR, AIR and EIR than from the models themselves. Information clarity must come before technology.

3 **Translate Existing Conventions Carefully**

SANRAL already has naming conventions and procedures. These must be mapped into the ISO 19650 framework — not replaced blindly.

4 **Start Small and Scale**

Running one project well builds more institutional confidence than a full rollout. Proof of concept comes first.

5 **Training Needs Routine Refreshers**

The project runs across two parallel systems (Standard MoP and ISO 19650). Regular upskilling is essential for compliance.

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Current Limitations

◷ Still Developing

- Full model-based delivery — project is not ISO 19650 by design; consultant team must remain cognisant
- ITIS integration — structured BIM outputs not yet connected to the receiving system
- Advanced model validation and automated compliance checking
- Organisation-wide adoption beyond this pilot project
- PIR (Project Information Requirements) — still in progress

Institutional Implications for SANRAL

Moving from a pilot to a national programme requires structural change

01

Head Office Prescribes the AIR

02

Project Engineers Must Understand Requirements

03

Manual of Procedures Evolves

04

Provincial Digital Roles Are Needed

05

Technical Excellence Academy Pilots Build Internal Capability

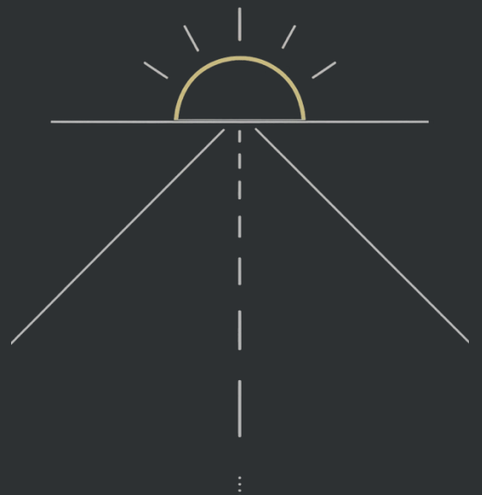
Way Forward

From pilot documentation to internal workflows to a national digital engineering standard

1 — Pilot

2 — Internal TEA Workflows

3 — National DE Standard



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Digital engineering starts before the model.

THANK YOU!!