

Towards Developing a National Digital Engineering Standard

Lessons from the N2 KwaMashu ISO 19650 BIM Pilot

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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

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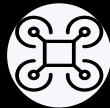


SANRAL's Digital Engineering Response

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





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,
requirements, produces
BEP and MIDP
MIDP

All governed through the Common Data Environment.

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SANRAL
DETT
DIGITAL ENGINEERING TASK TEAM

SANRAL
A

Raising
the **BIM**
tide

OIR

What SANRAL Needs as an Organisation

The OIR is structured around **SANRAL's SANRAL's Horizon 2030** strategic pillars, pillars, with each pillar linked to specific information needs flowing into the AIR and EIR.

Roads

Asset inventory, condition, construction data

Road Safety

Incident reports, audit findings, enforcement data

Stakeholders

Consultation records, socio-socio-economic indicators indicators

Mobility

Traffic flow, travel time, electronic payment data

Transformation

Local participation, Skills development, SMME development

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AIR

What Information Assets Must Carry

Turning physical infrastructure into structured, query able 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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Fit-for-Purpose Information

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

Geometry

- LOIN — Preliminary design
- LOIN — Detailed design (coordinated)
- LOIN — As-built record
- Drawings must be extracted from the model

Data

- 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

- 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



Single Source of Truth

One location for all project information — 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
authoring space for each
discipline and stage

01 — Shared

Under review — verified by
by originator, not yet formally
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

Preliminary, Detailed Design, Tender, Built — aligned with EIR stage gates

MIDP & TIDP

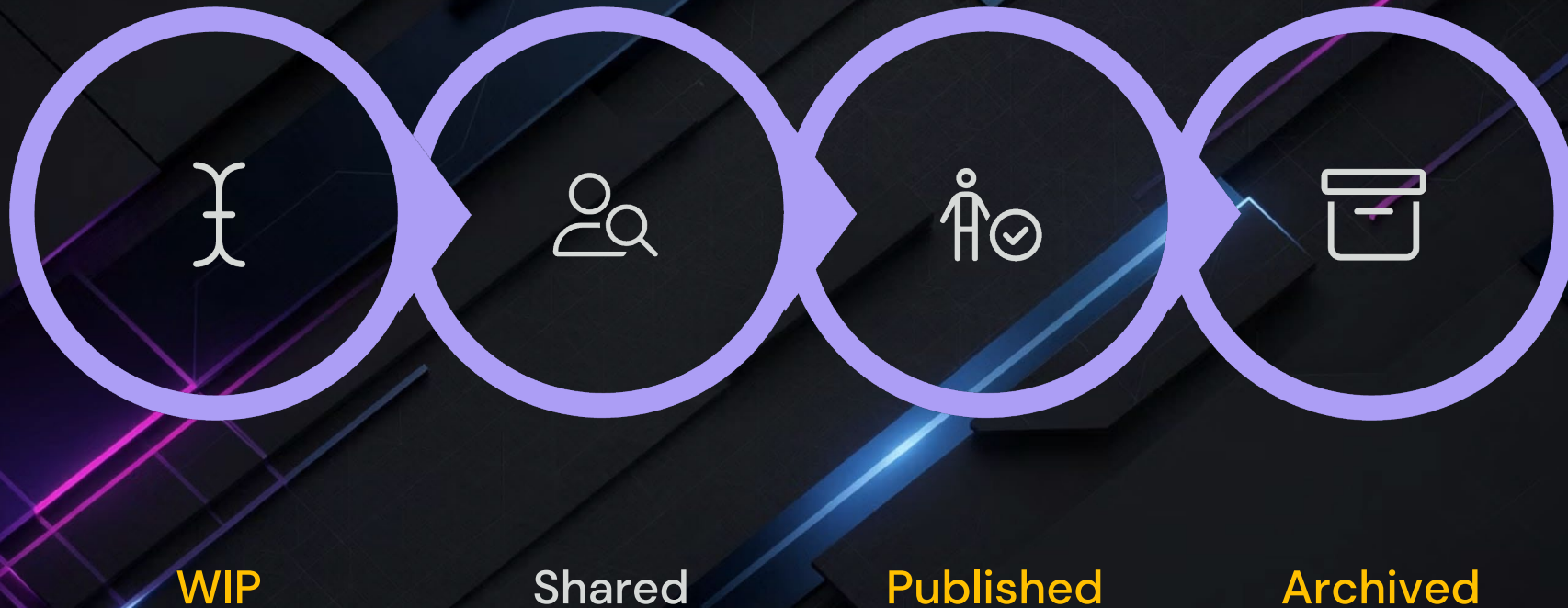
Master and Task Information Delivery Plans schedule what is produced, by whom, and by when

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 & Existing Systems 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; 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



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Way Forward

1

1 — DE Pilots

2

2 — Refine DE Standard

3

3 — Repeat and Rollout



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Digital Engineering
starts before the
model.

THANK YOU!!

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