Bentley
Advancing Infrastructure

BCDE Common Data Environment

Lot 2 – Cloud Software

Services Definition

Prepared for UK Government G-Cloud 13

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BCDE Common Data Environment
Lot 2 – Cloud Software
Services Definition

BENTLEY CONTRACTING ENTITY

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EXECUTIVE SUMMARY

Bentley provides BCDE Common Data Environment, the leading CDE for Clients wanting to digitise estates, capturing supplier-delivered project information, and maintaining this throughout the asset lifecycle. Users will benefit from a dedicated CDE, deployed in a secure private UK cloud environment, helping Government departments procure asset information in accordance with UK industry standards.

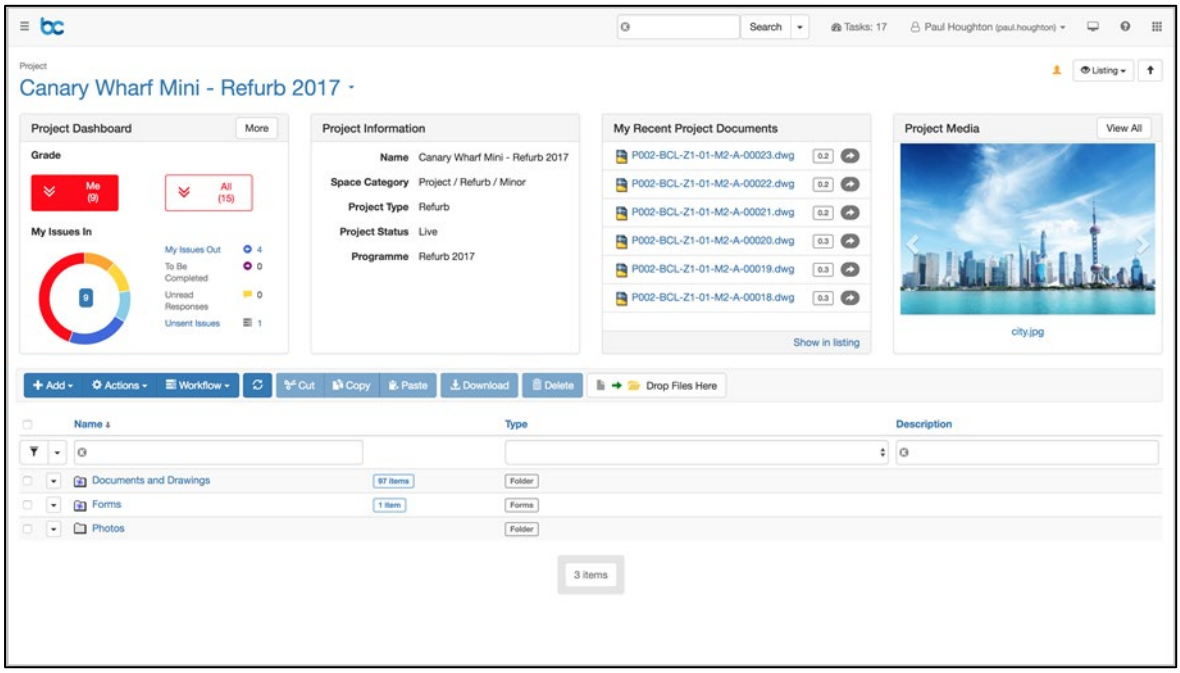


Figure 1 Project Landing Page -Prompting users to complete their tasks and giving immediate access to key data

Bentley input in to the 2011 UK BIM strategy and remains close to those developing the UK Government's Digital Built Britain strategy. Bentley has been long standing member of:

- The Leadership Team which produced BIS BIM Strategy Paper.
- The UK BIM Alliance Technology Group (and before that the BIM technologies Working Group).

Bentley continues to push the boundaries of Information Management by enabling linking to open internal and external data sources such as those available from User's own ERP systems or mapping providers (e.g., OSM), creating a richer picture of the User's asset over its lifecycle.

BCDE is suitable for contractors and consultants as well as asset owners in the public and private sectors covering defence, infrastructure (aviation, rail, marine and highways), energy and utilities, retail, and property. It supports the assured and verified delivery of project information, and the definition and maintenance of a full digital estate. BCDE enables teams to manage capital projects more efficiently and effectively and provide estate teams and their extended supply chain with an intuitive and data rich environment supporting improved decision making around asset maintenance and performance.

BCDE Overview

BCDE's core CDE system combines over twenty-five years of investment and development into Project Information Management and workflows, culminating in an easy to use, responsive and highly functional CDE.

Today, BCDE is used by over 25,000 different organisations. BCDE's alignment to industry standards coupled with its flexibility and integration capabilities makes it a great choice for organisations delivering projects (CAPEX) as well as those managing estates (OPEX).

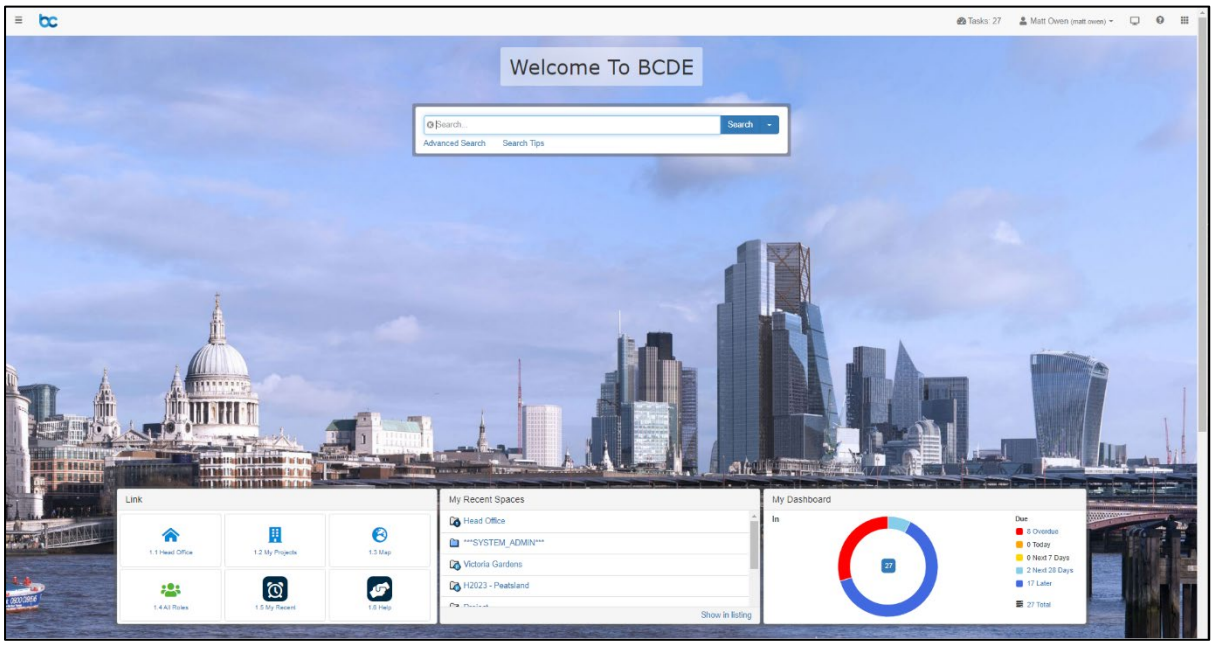


Figure 2 Home page of BCDE

BCDE's User interface (UI) has been designed to provide users with quick and easy access to project information. Our visual interface is highly configurable, allowing you to create logical routes to information for users based on role, location, etc. Most users spend unnecessary amounts of time searching for data and our interface enables even infrequent users to quickly navigate large sets of information. All contractual documentation entered into BCDE will have been subject to validation against required naming, meta-data, and approval protocols. This ensures that good quality information enters the system, improving collaboration and retrieval of information. Automated version control ensures users have access to the latest information and dashboards provide users with a clear view of their tasks and responsibilities.

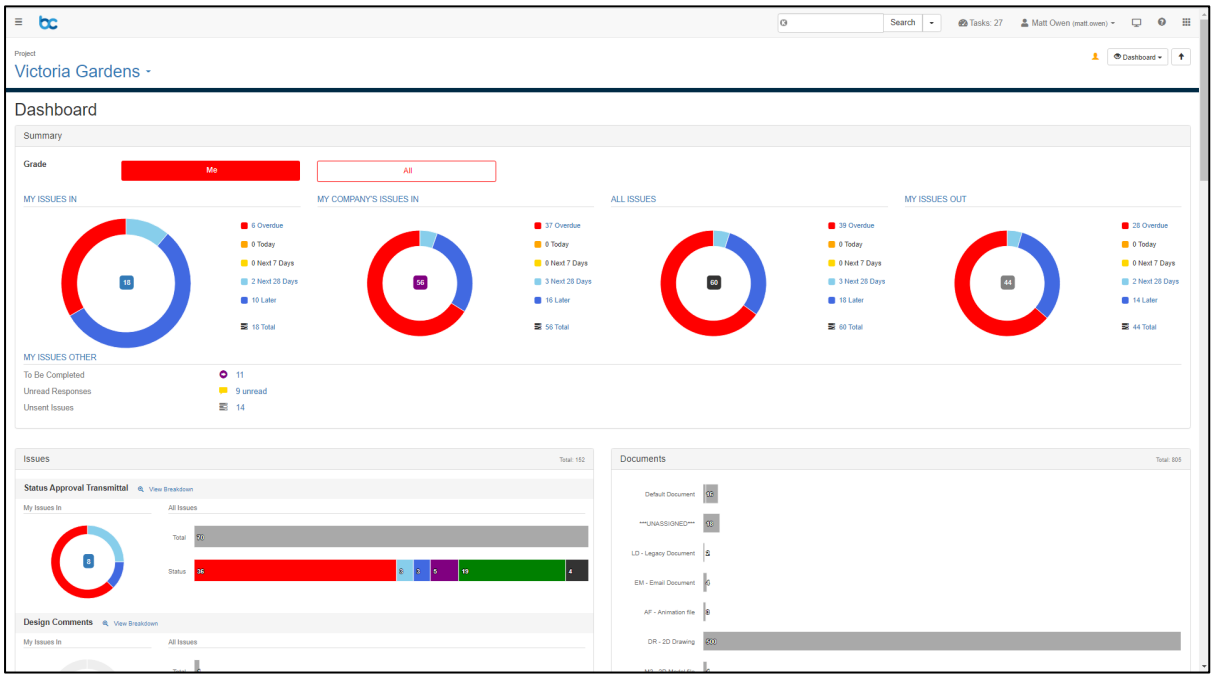


Figure 3 Project Space Dashboard

Standards Compliance

BCDE provides a centralised environment to manage and control the flow project and asset information in accordance with Standards (where required) to ensure data is managed in an efficient and compliant manner.

An example of this is our standard ISO19650 configuration where Work in Progress (WIP), Shared, Published, Archived states are all pre-configured and use meta-data fields of Status and Approval Status to drive the state transitions.

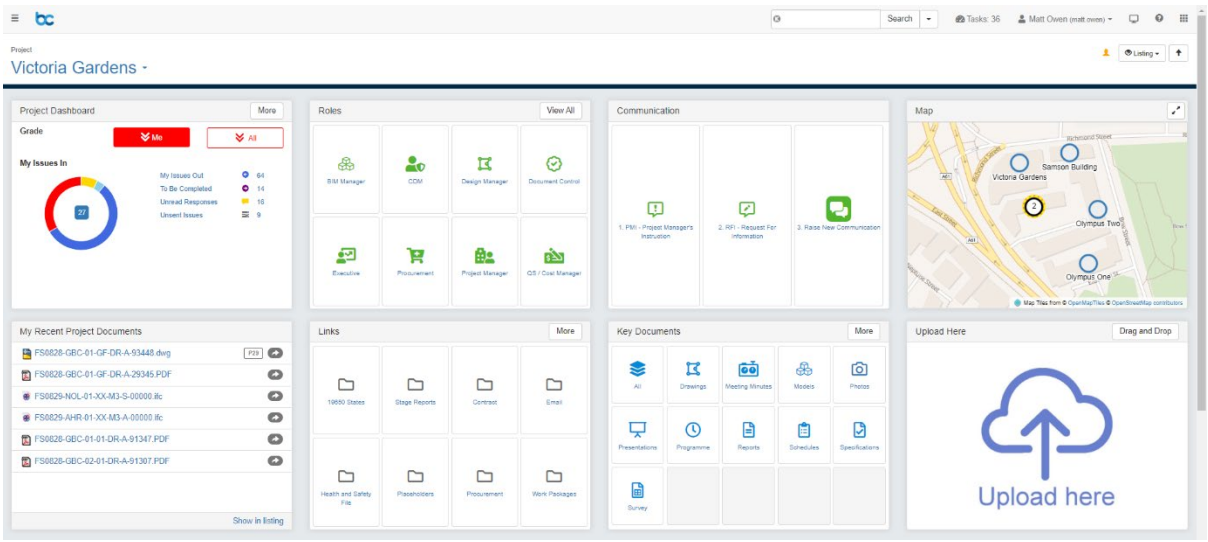


Figure 4 Configured Space layout with content portlets

Documents uploaded to the CDE can be tagged with required meta data fields, such as Status, Volume, Level/Location, Role etc. (fields will be auto-tagged where possible).

Naming convention standards can be enforced in the system and the delivery of information can be tracked using Placeholders.

BCDE's Placeholder functionality also provides tools for users to retrieve compliant file names from the system.

Ultimately BCDE will allow a User to standardise the way projects manage information across their projects. With an information rich, standards driven environment, cross project reporting and analysis is easily enabled. Project team members also benefit from using a templated approach to Project Information Management, reducing administrative burdens, and reducing risk from using incorrectly controlled or out of date information.

Document Issuing and Tracking

All documents and drawings have an issue (e.g., transmittal) history associated with them. The image below shows a page that is accessed via an icon next to each document which shows the Issue history.

The example below shows the document has been issued 3 times, once as part of a general transmittal and twice as part of a workflow for Sharing and then Client Sharing. The distribution tab has also been expanded to display a traditional Issue Sheet style view which shows the users who have been distributed information and when.

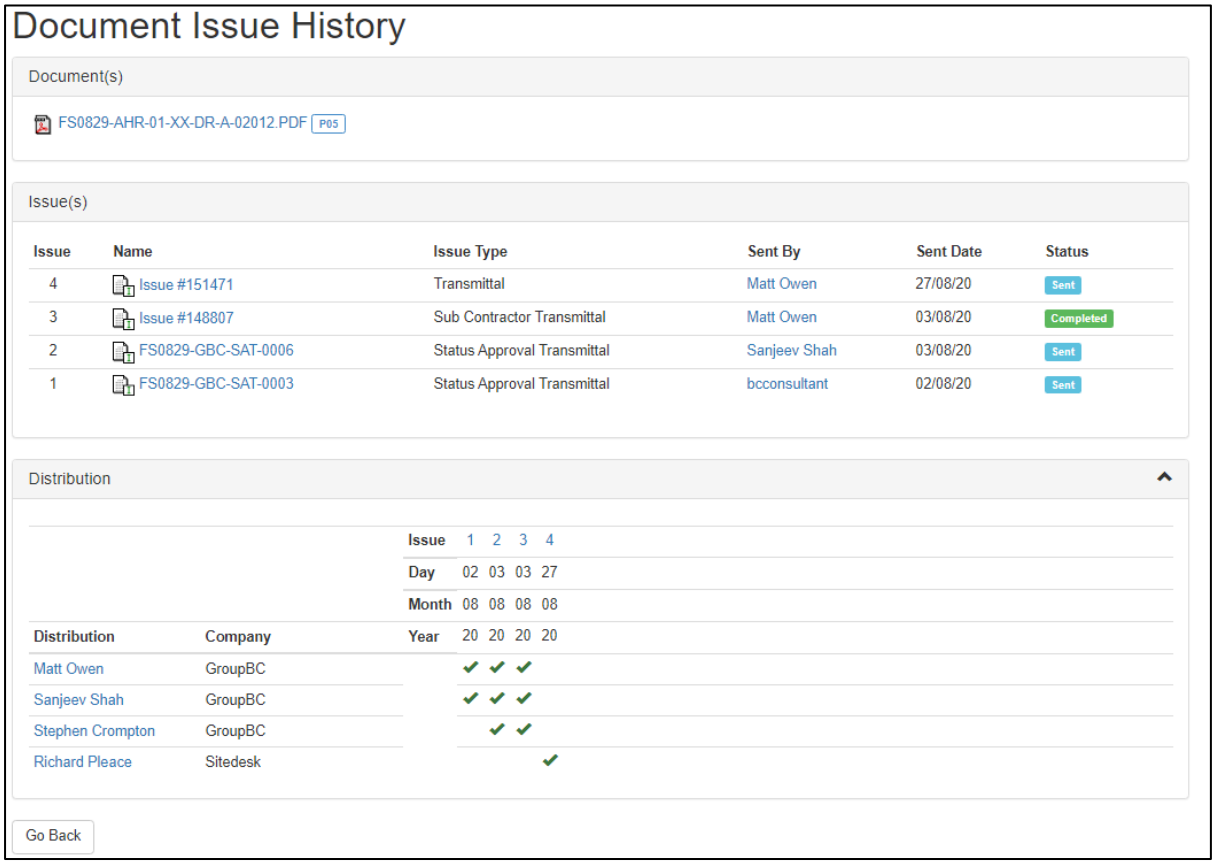


Figure 5 Document and Issue audit history

These logs allow users to clearly view decisions made throughout a document or models' lifecycle and access any comments and associated documentation. Critical to this is ease of access to this information. Within a single click, a full audit history of a document can be viewed.

Activity logs are available against all documents. Records of all actions, revisions, downloads, meta-data updates etc. are all recorded and retained in an immutable record.

View, Comment and Markup

An essential element to the CDE is the ability to subject information to review and approval.

BCDE has been designed to make the commenting and approval process as simple and easy as possible. Users that have been Issued information will receive an email with a link directly to the Issue, as well as dashboard items pointing them towards their task. Via a "Respond button" users are taken to the Review page where they can comment, mark up and set approval statuses (if assigned).

Users can determine what information is captured at this point, we typically see contractors provide the reviewers with comment and electronic mark-up options as well as the ability to upload a comment sheet/scanned drawing. Statuses are usually captured via a drop-down list. As BCDE is highly configurable, a User may decide to capture additional fields during this process and are free to dictate what information is captured by reviewers.

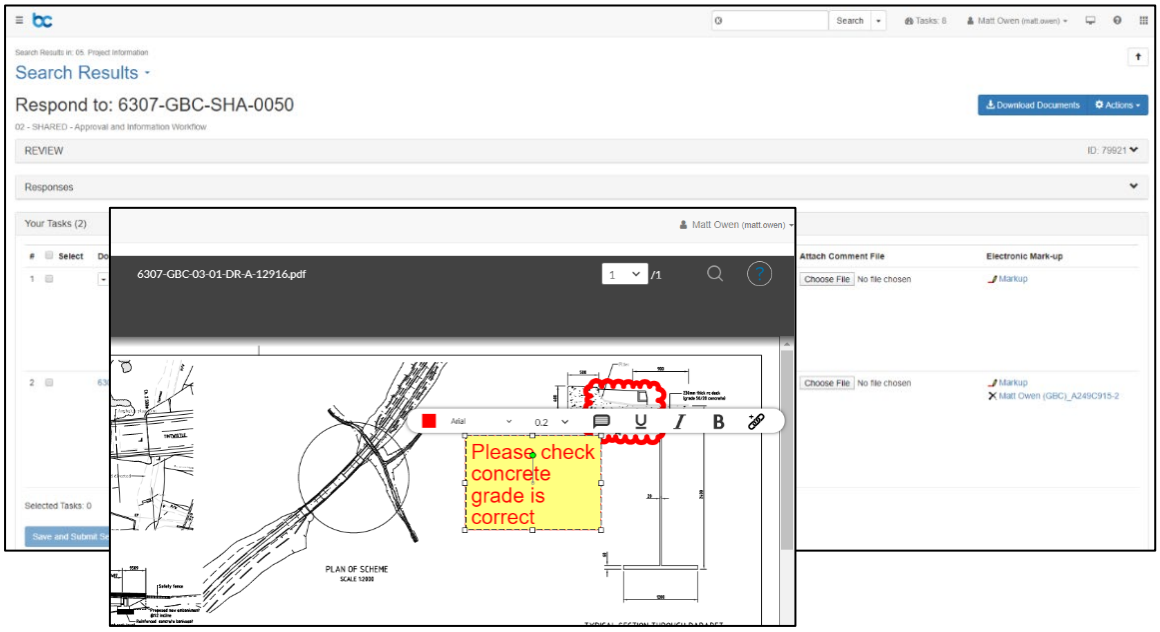


Figure 6 Drawing Mark-up linked to Issues

Electronic mark-ups can be overlaid with others to provide additional context. Furthermore, the Compare tool highlights changes to a drawing revision in colour to provide additional context for the reviewer/approver. All comments captured are easily viewed when looking at an Issue.

Approval statuses can dictate the visibility of information to users in other parts of the CDE. For example, only approved information may be surfaced in a Shared or Construction issue area.

Workflows, Business Processes and Forms

BCDE provides administrators with the ability to create and template workflows (subject to license Tier) to ensure compliance and good information management. Processes from simple QA checks to complex contract management workflows can be created and deployed to users.

Reports on the status of information in workflows can easily be created. In addition to the workflow progress information displayed on the dashboard, Saved Searches can be made available to all users which provide quick access to useful sets of information, such as all Approved drawings or all Construction Issue plans relating to a certain location on the project.

An example of these reports is shown below where Saved Searches are used to structure the CDE and provide easy access to sets of documents and models (note, icons can be changed and branded to suit user's corporate branding themes).

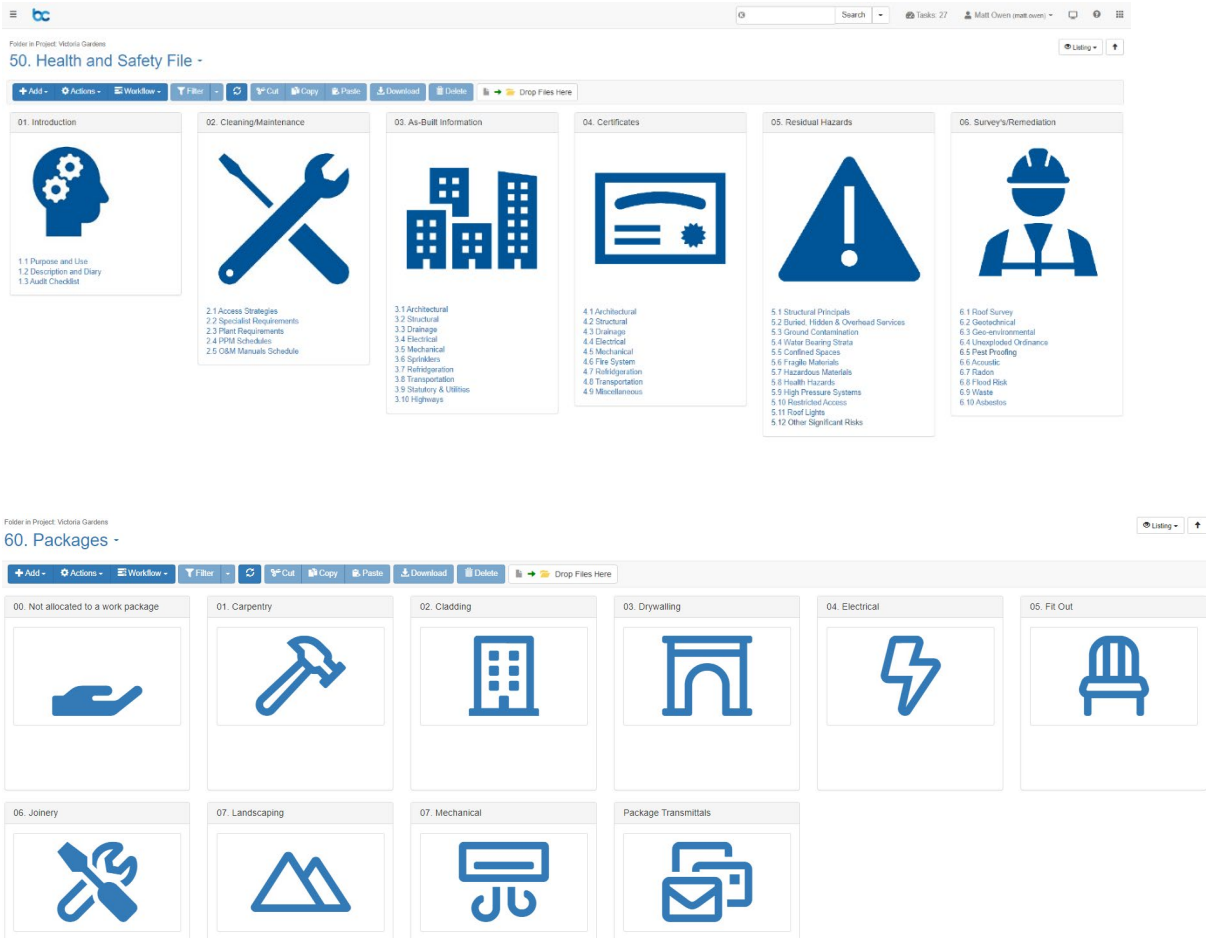


Figure 7 User Configured Space layout

Forms can be created to match these processes and workflows can be designed to ensure information processes appropriately.

1 INTEGRATION POTENTIAL

Upon successful deployment and roll-out of BCDE, many of our clients will look at connecting BCDE with other systems to share data. Often this results in being able to access externally created data within BCDE. Examples of previous integrations that have been carried out include visualising GIS data pulled through from ESRI Arc GIS, populating project or asset data from systems such as Salesforce or Asset management systems, sharing documents and information with Maximo for Facilities Management purposes.

BCDE offers several ways of integrating with other systems, from light touch integrations using iFrames to more robust integration options using our open REST API.

1.1 Integrations via the "BCDE Open API"

The BCDE REST APIs are included as part of the standard software and are available on the BCDE Portfolio Subscription Tier.

The BDCE API provides the following benefits when integrating with third-party applications:

- Exposure of the most common BCDE capabilities enabling business processes to be integrated and automated, securely, removing overheads and the risk of user-error
- Secure Integration with third-party applications using industry-standard protocols.
- Optimised performance for large sequences of API calls made through batching capability.

The APIs are fully documented and can be used by User's technicians as well as third parties on request (following approval by administrators). (Subject to acceptable usage).

- We encourage our users to take advantage of the API and carry out any required integrations using their in-house resources or trusted third parties.

1.2 Integrations via "External Portlets"

External Portlets are a feature in BCDE that enables a user with Portlet configuration abilities to setup content to be displayed that originates from other 3rd party web applications. Bring data from multiple separated sources into a single application (BCDE) so standard users can consume the information with ease, and they don't need to go looking for the data across multiple applications. This allows BCDE to be the information hub of the project, programme, portfolio, and estate.

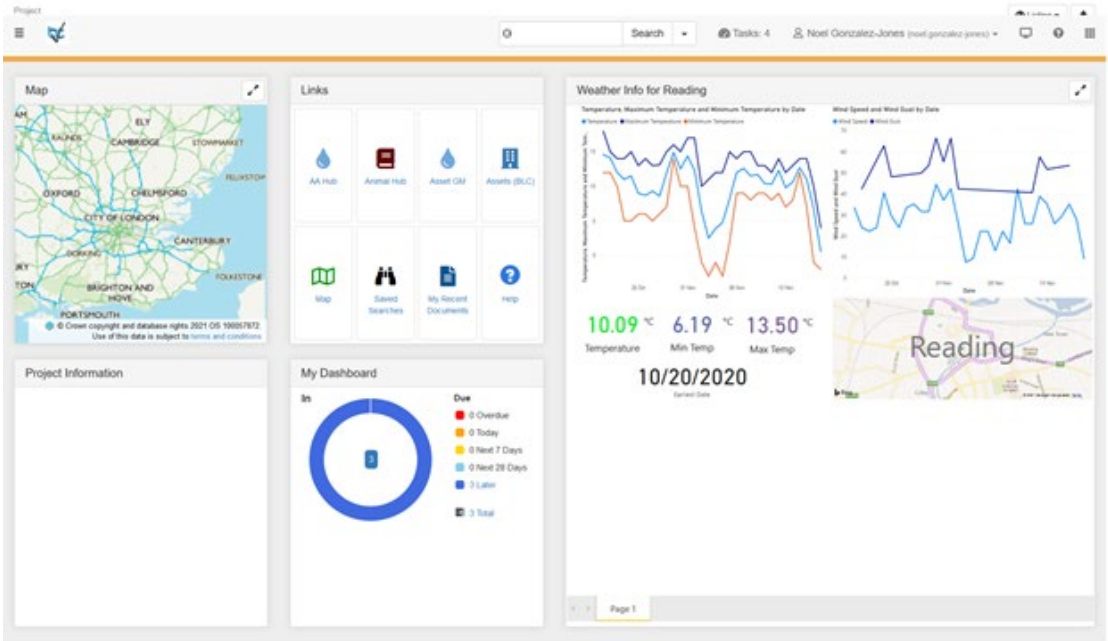


Figure 8 External Portlet configured to display weather data from PowerBI

In addition, BCDE can also securely pass the identity of an authenticated user to the third-party Web App using JSON Web Tokens to allow for seamless interaction via the BCDE interface of the 3rd Party tool for the user.

1.3 Integrations via ETL using "BCDE Sync"

Bentley have developed an ETL (Extract, Transform and Load) module. This was initially designed to allow the Supply Chain to streamline Data Drops from their BCDE PIM CDE to their client BCDE AIM CDE. In this example, if a major supplier, or even a regional board, is using their own instance of BCDE for a Capital Delivery project, they can ensure that their information is properly QA'D in their own system prior to delivering it into User's CDE. This ensures that only relevant, checked, and approved information will be stored in Client's AIM CDE and that it is not cluttered with irrelevant and that all users can trust the information that is there and understand its intended purpose.

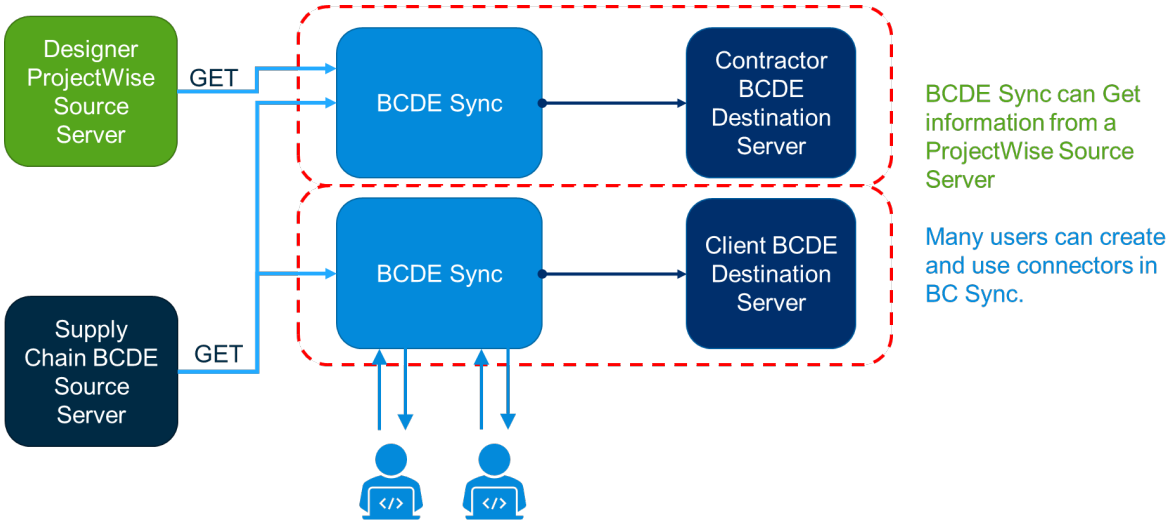


Figure 9 High level workflow diagram of BCDE Sync publishing process

The module has recently also been extended to allow users that need to deliver information from Bentley's ProjectWise Design Integration Datasources via the Bentley Connect Portal directly to BCDE without the need to program "hard wired" APIs between the two systems. As of Q2 of 2022 this extension is in Early Access for Beta usage prior to full general availability targeted for the near future.

2 OVERVIEW OF THE BCDE SERVICE

The core BCDE system is a highly configurable, flexible cloud-based common data environment (CDE) that Users can set up to suit its preferred ways of working, conforming to its business processes, rather than imposing standards on the organisation.

BCDE offers:

- An HTML5 interface providing a simple, clean and modern user experience for all users. The zero-install interface is touch enabled and suitable for use across desktop, laptop, tablet and smart phone devices, supporting mobile working and dynamically scaling to fit the screen.
- Dashboards to monitor tasks, workflows and contract communications by their completion status.
- Collaborative tools to work on documents with internal or external parties.
- Built-in (e.g., transmittal) workflows with in-system discussion threads – all archived, auditable and searchable.
- Simple, intuitive user interfaces and workflows to support the information access and sharing needs of infrequent users.
- Powerful search and audit capabilities going well beyond standard logging capabilities.
- The BCDE Portfolio License edition provides, opportunities for Integration with corporate systems such as ERP and CRM to give applications access to documents held in BCDE, through a documented REST API. (Self-service documentation provided).
- Optional Two factor authentication[1].
- Integration with SAML2 compliant authentication, to support single sign-on with Azure Active Directory[2].
- Support for QR codes on physical assets linked directly to documents.
- Visualise assets and projects on a map. Allow users to geographically locate a project based upon their knowledge of where it is.
- Integrated 2D viewer and access to complementary 3D document viewer[3].

[1] Requires separate User Subscription purchased from Twilio

[2] Federated Single Sign On through Integration with Bentley IMS

[3] Additional Model and file Viewing capability through Bentley iTwin Services. See Bentley iTwin Service Description on separate G-Cloud 13 listing. Additional costs may be incurred for this capability if required.

- Integrated automated visual Workflow designer based on BPMN with BCDE Workflow module.

2.1 Common Data Environment

The key features of BCDE include:

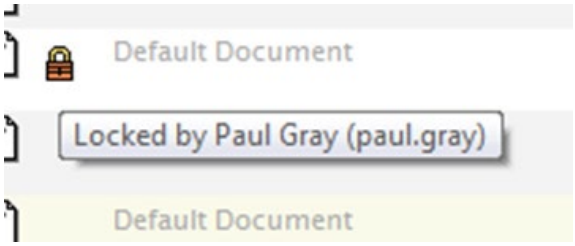
- Document uploading using:
  - "drag and drop" (single documents or multiple documents
    - Zero installation for modern (HTML5) supporting browsers
  - Browse for document
  - Home drag and drop can support single or multiple documents being upload to the home screen. After upload, the File and Process feature shows the documents uploaded and their destinations based upon the configured filing rules
  - Bulk uploads can support automatic metadata tagging from contents of a .csv file
- Document download for single or multiple documents, or whole folder structures with their constituent documents
- Full file maintenance functions, for example copy, move and rename
- There are no restrictions on the types of document that can be stored
- Storing e-mails in project specific mail folders, including, where appropriate, the email attachments. Details of sender, recipients, date sent, and subject are stored and searchable.
- Sending, copying or forwarding e-mails into the document management system from an individual user's e-mail client[4]
- A document check out/check in procedure to prevent multiple concurrent updates of documents
- 

Figure 10 Check-in/Check-out Procedure – ensures effective version management of any document

[4] Through provision of a secure (POP3) mail server account by the User

- All revisions of documents are stored as new versions, the old versions are immutable
- A full, immutable, audit trail of all activity on a document, including read events. Each action is attributable to an identified, named individual. Details of activity are held against each version of a document as appropriate
- Work with related files effortlessly
  - The Document Renditions functionality allows related files to be bundled together, helping reduce clutter in your projects whilst allowing you to capture everything. Store a PDF file and associate with it its native forms, for example DWG or another CAD format, or a Microsoft Office document
  - Batch-upload primary documents and their renditions
- Simple document tagging and retrieval
  - With the Taxonomy field documents can be tagged with a multi-level attribute (supporting e.g., UniClass)
  - A straightforward interface makes it simple to create a taxonomy field from scratch. If a taxonomy has already been defined in a spread sheet, then this can be imported from a CSV file
  - Browsing a large taxonomy is quick but searching will provide matches instantly. This allows finding a specific value out of Quickly find the one value you need from thousands.
  - Export a Taxonomy field into a .csv file, edit it in a spread sheet application and import back into BCDE
- Metadata drop-down lists in BCDE allow users to type to filter to quickly select a value in a long list of options:
  - Setting metadata, and searching or filtering for documents is fast with no need to scroll through thousands of values
- 

Figure 11 Type ahead selection of values makes selection quick and simple

  - Simplified management of dropdowns and multi-selects

  - Import lists for the drop down and multi-select fields from a .csv file. Export existing lists to a .csv file for manipulation and subsequent re-import.

- Access rights are fully configurable, allowing control of access at folder, sub folder or individual document. Access can also be controlled by groups of individuals (for example particular job roles) or to employees of a company.
- Provision of templates for new projects that allow:
  - Creating a Space from a template gives each Space (project, asset, etc.) a well-defined starting point. This feature also includes templating of folder structures, document types, metadata fields, user memberships and access rights.
  - Sharing a Space template with specific users (without a template area) on the system for ease of devolved project (Space) administration.
- Providing powerful search tools that allow:
  - Documents to be located by searching for key words, contents, metadata tags, and events in the audit trail.
  - Documents are only returned in search results if the user is authorised to access them.
  - Searches to be saved for later use and be scheduled to run at predetermined days and times.
  - Exporting search results to .csv files.
  - Searching content to find documents irrespective of their names or metadata even when information is incorrectly named and tagged.
- Asset tags and document QR codes
  - QR codes can be printed out, attached to any object and scanned by anyone with a suitable mobile device. A QR code is typically a link to a web page that can be loaded on a mobile device with a data connection. This might be a link to a drawing (of the space which details the tagged building part).
  - Documents, folders, projects, searches and more can have a QR code generated for them. Scanning the QR code will take the user to the item.
  - Multiple items can be selected in BCDE at once and asset tags can be printed out to an Avery® Label Sheet, as demonstrated in Figure 4. A physical item can be linked to data and documents stored on BCDE by simply sticking a label to the asset.

Figure 12 QR Codes – selecting and printing out tags for multiple items

  - Whereas printed information does not guarantee that the latest version is used, with BCDE's QR code support, the user can embed a QR code in a drawing or document that points to the specific version. The QR code on the printed document clearly shows the latest version.
  - Each item in BCDE has a unique web address. This can be shared via email or physically via a QR code shown on one mobile device and scanned on another. No typing is required.

- BCDE currently integrates with the Brava! view and mark-up tool from OpenText. This allows:
  - Viewing of documents, including drawings, even if the user does not have the appropriate editing software available on their local PC.

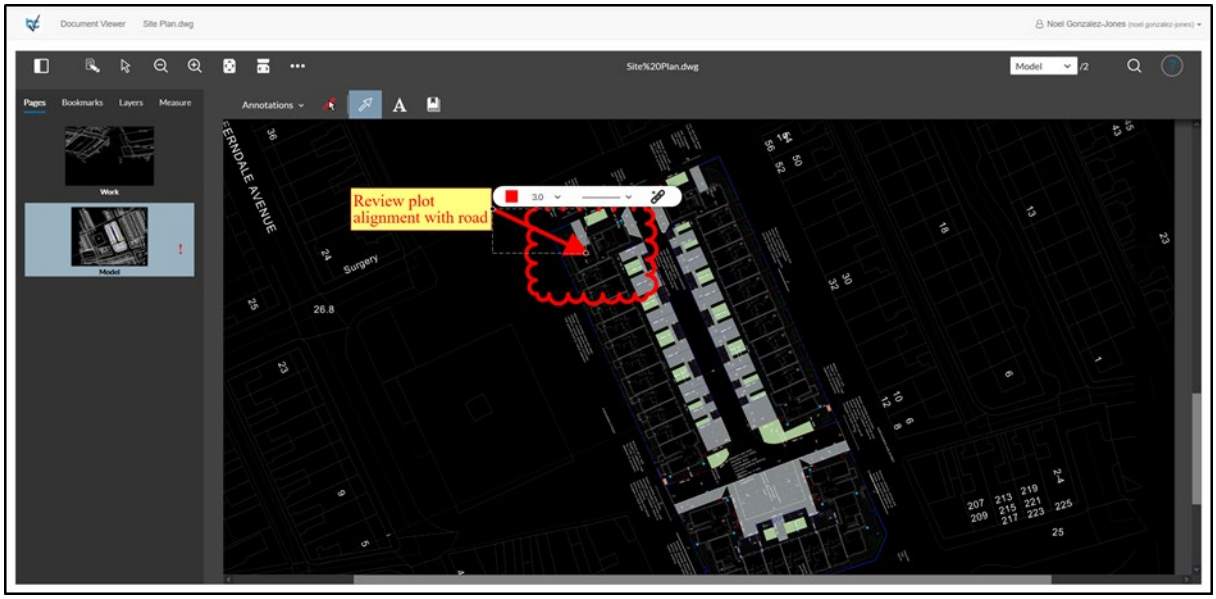


Figure 13 Document mark-ups through the Brava! viewer make it easy to communicate queries or instructions to other collaborators

  - Marking up of documents without changing the source file.
  - Two versions of, for example, a drawing can be compared to highlight differences.

  - Produce measurements from viewed documents.

- Bentley 3D model and data viewing capabilities[3]
  - Bentley's leading iTwin Platform delivers federation of native model formats, extraction and normalisation of model attributes and properties and hugely scalable, zero-install visualisation through modern web browsers.

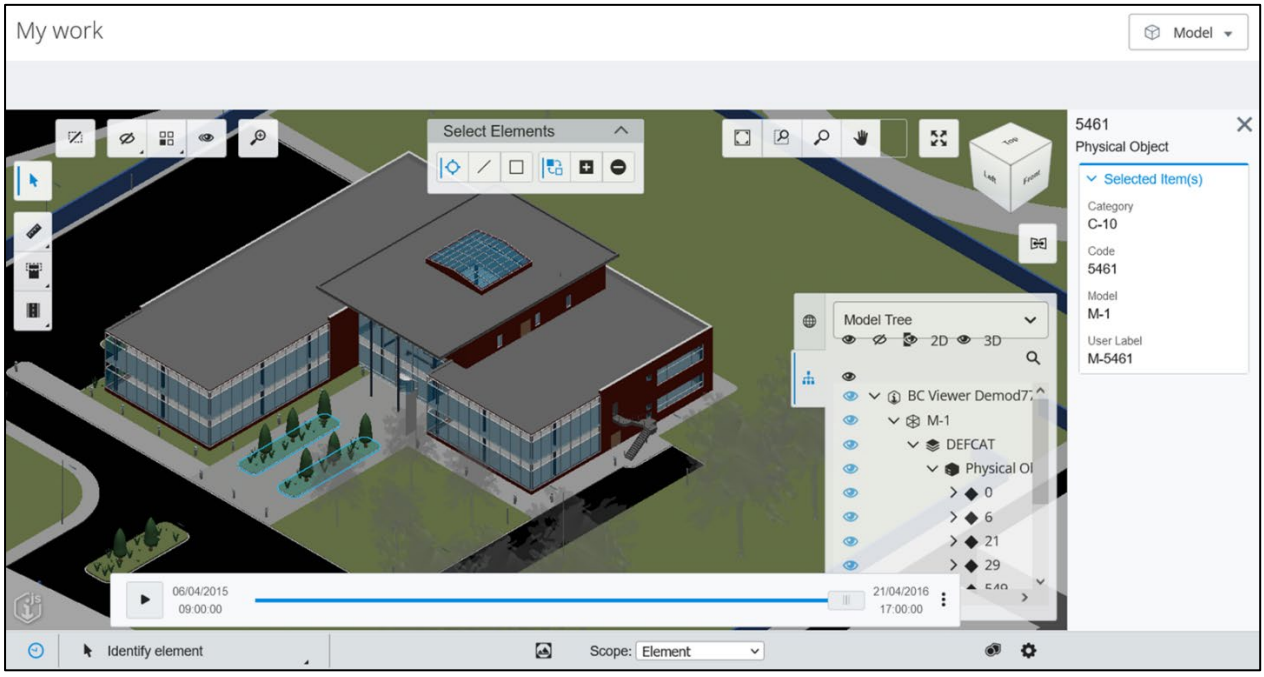


Figure 14 3D Model file viewing with Bentley iModel JS

- Placeholders
  - A Placeholder is an expectation (or a stub) for a document.

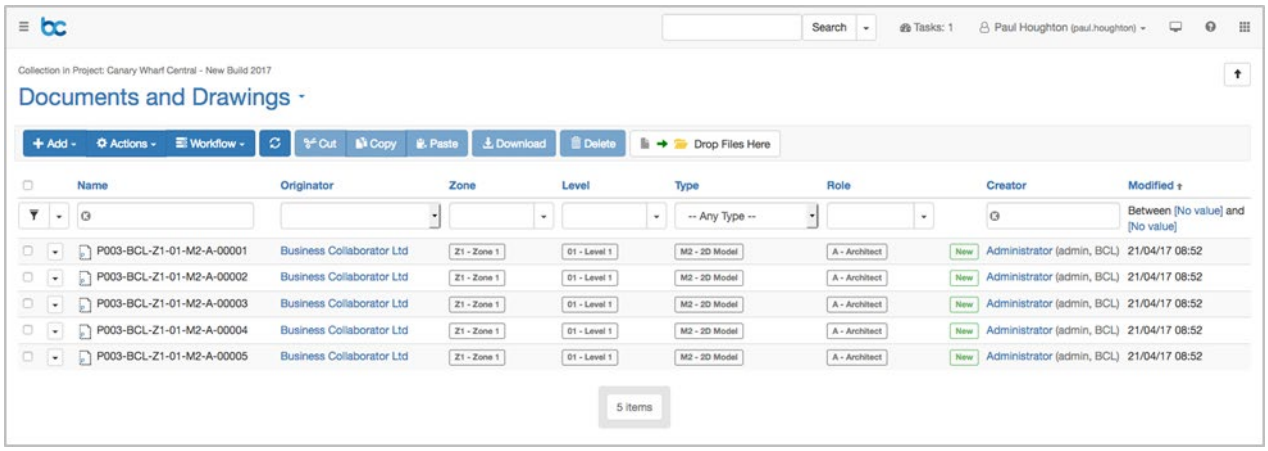


Figure 15 Placeholders - a design lead can schedule out a series of drawing numbers and reserve their use for the design team by using Placeholders

  - Placeholders for documents can be added into all areas (Spaces, Folders, Collections) in CDE.

  - One or many Placeholders can be created at once.

- Placeholders can be restricted such that they may only be fulfilled by a specific company.
- Placeholders can have their metadata pre-defined.
- A Placeholder can be fulfilled by a user simply by dragging and dropping a document into the container of the Placeholder. Multiple placeholders can be fulfilled at once in this manner.

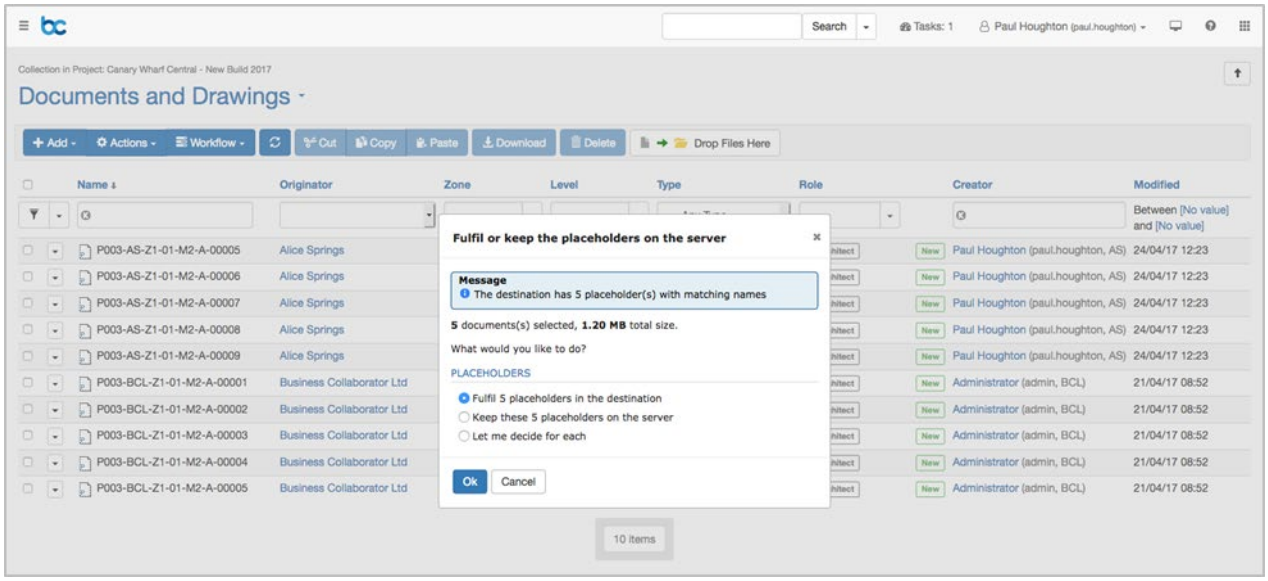


Figure 16 Fulfilling Multiple Placeholders – uploading documents in batches improves user productivity

- Import multiple Placeholders from a .csv file, to create and set the type/metadata for all matching documents in a simple single process.

- Document Number Generator
  - The Document Number Generator can create Placeholders rapidly; it allows names for Placeholders to be generated according to a defined naming convention, simply by a user specifying type and metadata.

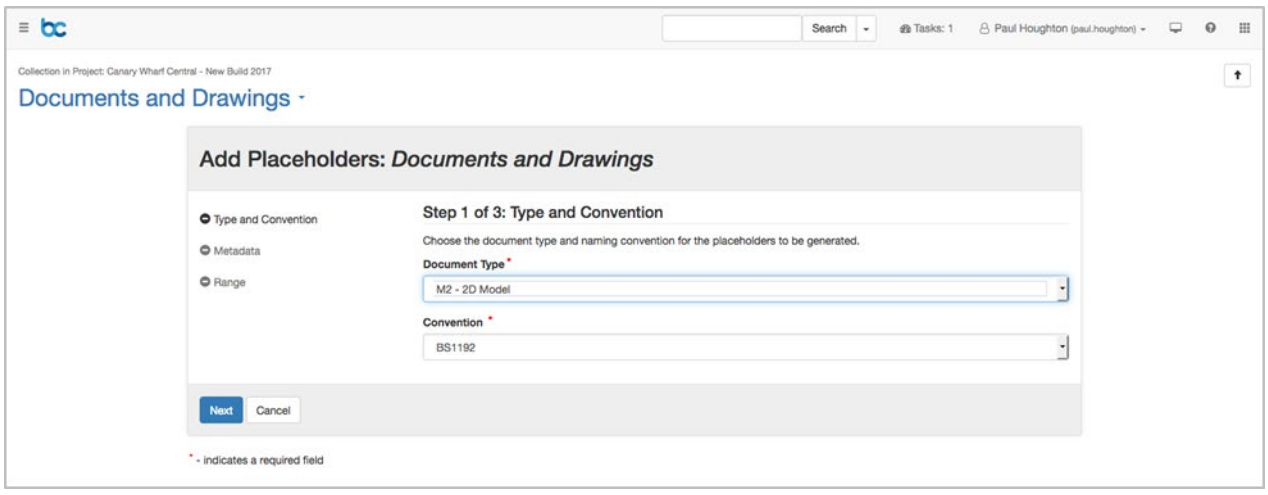


Figure 17 Adding Placeholders Step 1 – the user begins the process by choosing document type and the preferred naming convention

- Multiple naming conventions can be supported and associated with specific document types, for example, contractual documents could use a different naming convention from non-contractual documents.

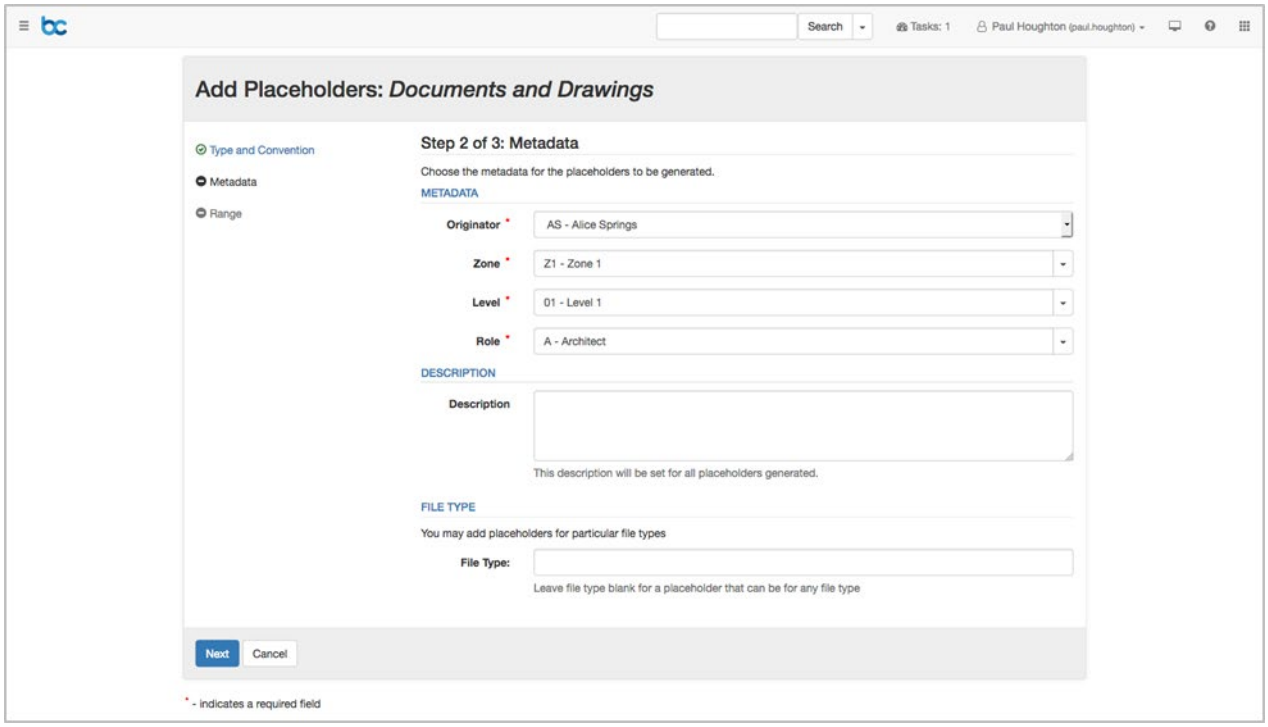


Figure 18 Adding Placeholders Step 2 – The user can set the metadata in the naming convention and optionally the description and file type

- Creating large numbers of Placeholders is straightforward with the Document Number Generator.

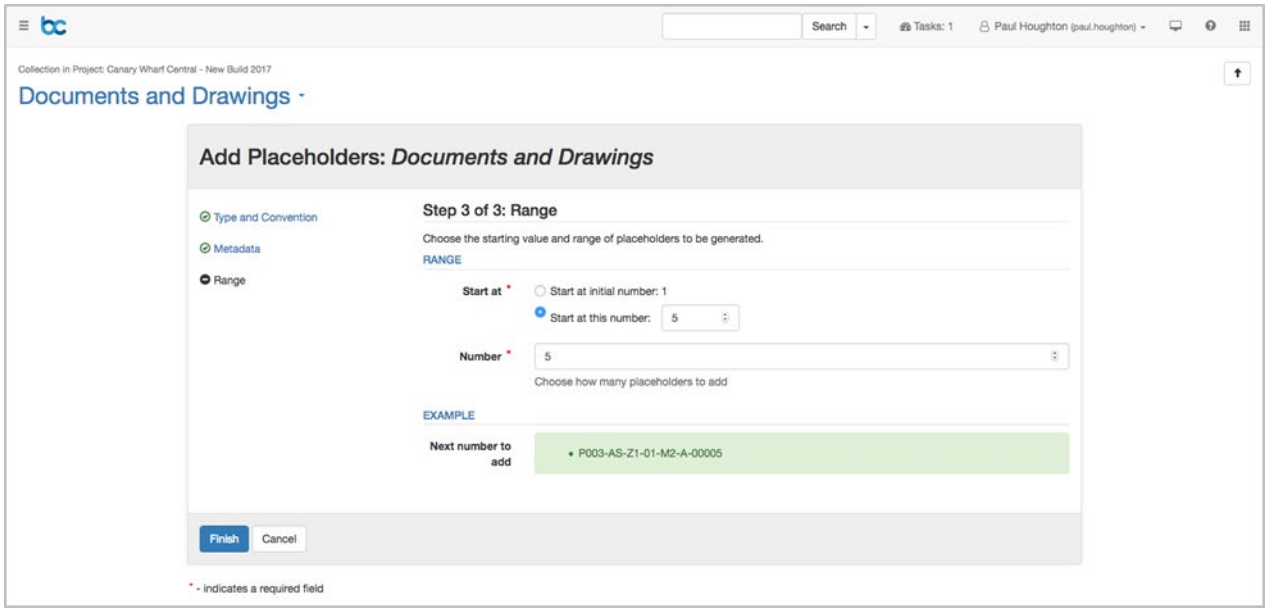


Figure 19 Adding Placeholders Step 3 – the user can choose the starting number and how many placeholders they need to create

2.2 BCDE Workflow (available with BC7.5+)

A visual workflow engine based on the BPMN 2.0 standard (Business Process Modelling Notation), enabling users to design and initiate automated workflows in BCDE Spaces/Projects to controlling the document flow with minimal user interaction required. (Pre-build templates workflow are available with BCDE Project, Workflow designer only available in BCDE Program and Portfolio).

2.2.1 Automated workflow for documents

Benefits

- Documents can be taken through automated, multi-step workflows. Simplifying sharing of information with Projects and Assets
- Associate automated workflows with Projects, Assets, Programmes, etc. via Schema, sub-schema, and folder types.
- Schema or space constraints may be ignored by workflows defined for a schema.
  - Implementation of processes may be simplified.
  - Constraints may restrict the manual use of Issue Types involved in a process, without preventing an automated workflow from harnessing the Issue Types.
- Many document related workflows may be automated, in particular, those required by ISO19650 processes.
- Documents may have their metadata modified as part of an automated process, removing the need for manual interventions.
- One workflow may trigger one or many other workflows, allowing complex processes to be broken down into component parts. This may simplify the user experience and the management of the workflows.

Practical Uses

- Define a check, review, and approve workflow for all "A" status documents added during design and construction stages.
- Set the status field of a document to approved if the client approved the document.
- Define a set of workflows for Projects that is separate from those for Assets.
- Use constraints to prevent the Check Issue Type from being used manually. Allow workflow to ignore this constraint.

2.2.2 Graphically design workflows in BPMN

Benefits

- Visually build simple and complex workflow with an elegant editor.
- Powerful tools to help align components, make space, insert new components, or rearrange entire sections at once.
- Support a key subset of open standard BPMN capabilities.

- Associate automated workflows with Projects, Assets, Programmes, etc. via Schema, sub-schema, and folder types

Practical Uses

- Build your business process using BPMN and link it to a Project, Asset, or Programme.
- Make room for an additional distribution step towards the end of the check, review, and approval workflow.

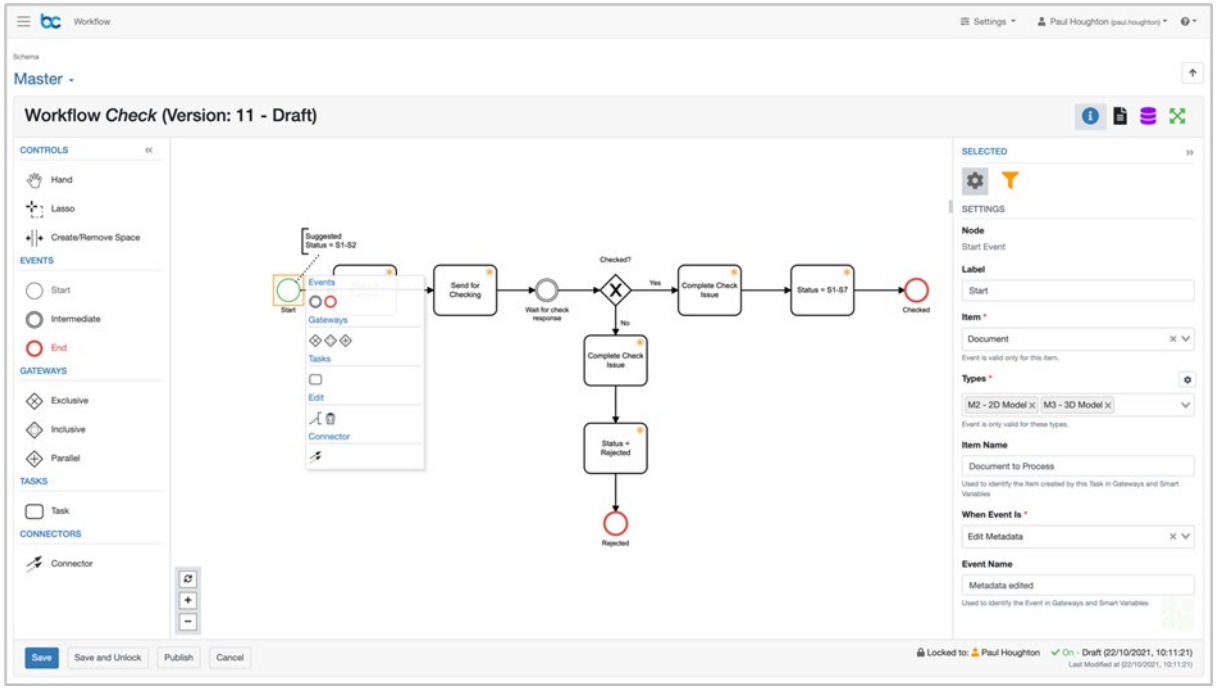


Figure 20 Visual Workflow designer utilising BMPN standards to automate document workflows within BCDE

2.3 Manage workflows

Benefits

- Version control allows for workflow to evolve without impacting currently implemented business processes.
- A clear audit trail helps identify what changes have been made to a workflow, by whom and when.
- Workflows may be temporarily turned off or archived when no longer needed to keep things tidy.
- Workflow instance tracking
  - Visually track progress of a document through a workflow.
  - Debug errors and warnings in a workflow.
  - Ensure that stalled workflows are addressed and restarted.
  - Define under what circumstances a workflow is complete.

Practical Uses

- Identify what changed that may have broken a workflow.
- Clear out workflows that are no longer relevant to business processes.
- End-users can see where their documents are in the check, review, and approve workflows.
- End-users can investigate a workflow he manages to resolve any problems as and when they occur.

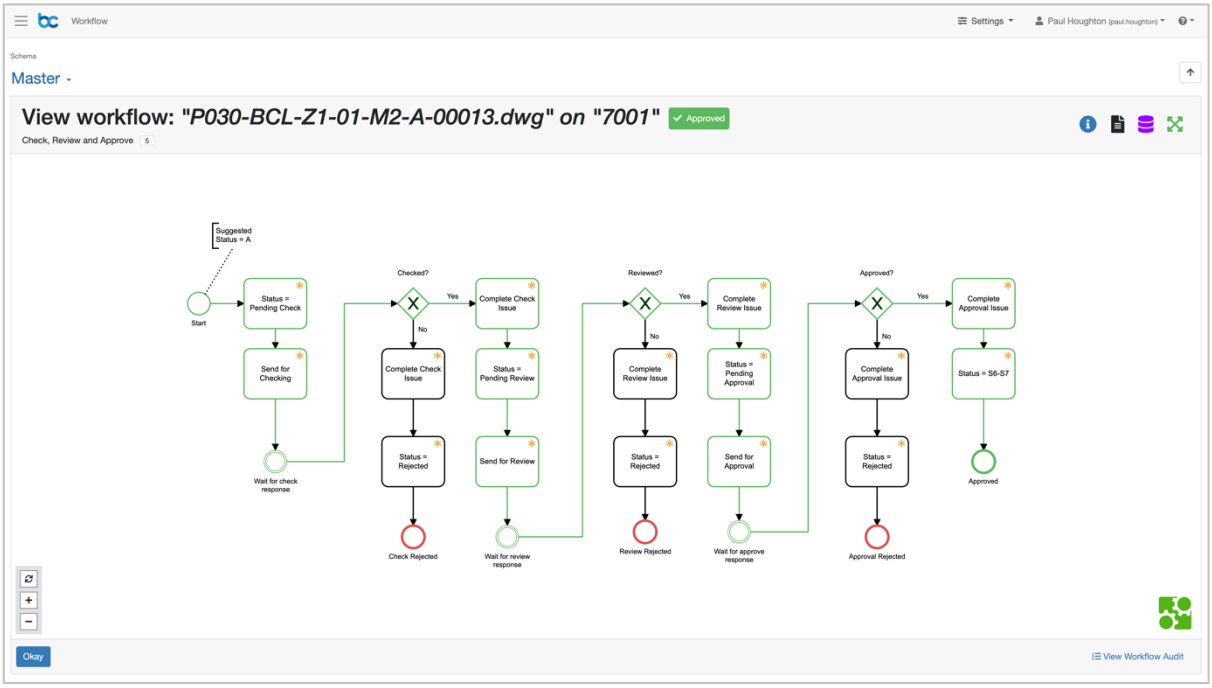


Figure 21 An audit trail captures where each path was completed.

2.4 Connect to BCDE via Web Services API and Automate through Triggers

Subject to your BCDE license edition, a User can seamlessly integrate BCDE with other systems to:

- Automate manual BCDE processes to reduce errors and save costs
- Create projects from templates, adding membership, setting access rights, and adding documents within the Web Services REST API.
- Simplify repetitive tasks by automating them, thus reducing costs and increasing accuracy

A User can integrate systems with BCDE to Link ERP, Internal Document Management System, Intranet, CMS, etc. with BCDE.

Users can define processes that begin in one system and end in another, for example, creating a project in an ERP system could automatically add a collaboration area on BCDE with a project manager assigned - without having to involve system administrators or project managers. In addition, BCDE Triggers could be used to update project details in an ERP system when these are updated in BCDE.

Users can connect using industry standards such as:

- REST and JSON for Web Services API. These standards are used by Google, Facebook, Twitter, IBM and Yahoo to name but a few
- OAuth is an open protocol to allow secure API authorisation in a simple and standard method from desktop and web applications, used by Google, Twitter and Yahoo

2.5 Responsive Phone and Tablet Ready Interface

The Quartz Interface has been designed from the ground up to work across desktop, laptop, tablet, and phone devices, thereby supporting mobile working. The Quartz interface is zero install, and it brings a consistent, modern experience across all devices to upload documents, browse and search for information, send, and receive workflows, support dashboards and tasks.

CDE delivers a set of out of the box portlets and a graphical dashboard that make it clear what a user needs to do and by when. These portlets may be configured in a Layout within one or more views to deliver a user experience which is specific to the project, asset, programme, or other Space which is being navigated:

- The Space Dashboard provides a high-level overview of user's tasks within the Space.
- The Space Information shows all Space metadata (attributes), giving access to information defined on the Space.
- My Recent Space Documents shows the most recent documents a user has interacted with in the Space, whereas
- The Space Media - displays thumbnails for a defined set of images uploaded to the Space.
- Additional customisation options include:
- Displaying images in a grid formatting data for an intranet/extranet showing dates in a Gantt format enabling news and blogs viewing information as a product/asset catalogue
- Editing theme to specify colours for Home, Classifications, Schema and Sub-Schema
- Editable Location bar icons and colours for easier navigation
- System wide news notifications shown on the Home page

2.6 Asset and Estate Information Management

Under the BCDE Portfolio license (as described in BCDE Lot 2 – Cloud Software – Pricing), the core project information management CDE extends to include capabilities for asset information management (AIM) enabling property and asset focused teams to digitise their entire estate of digital assets, and geo-locate them on a map for ease of reference and navigation.

2.7 GeoNavigate (formally GeoLink)

The GeoNavigate module enables layers of geo-spatial information to be visualised and overlaid onto the map, placing assets and projects (represented by one or many GPS points) into a geographical context.

User will be able to make better decisions, at an earlier stage thanks to the visibility of open GIS data. One of the key benefits is that a standard set of open GIS data can help with planning, delivery, and maintenance.

Activation of this optional module can facilitate the incorporation of Users' GIS data into its decision-making process. Importing GIS data to move information out of departmental silos can help User's enrich its analytical process, including simple KML (Google Earth) file uploads which can be rendered in Spaces alongside existing data layers.

2.7.1 Key Benefits

The benefits of GeoNavigate include:

- Links the GIS Map interface to the BCDE environment, allowing a map interface to navigate to documents within BCDE, thus reducing time spent looking for associated documents:
  - Data layers – allow Users to make better decisions based upon geographic information[5] contextually surfaced within e.g., projects, that might normally only be available through specialised GIS software systems
  - KML files can be visualised for a project or asset without requiring a third-party tool. (No need to upload the data to Google.) For example: it is easy to create a site map for User's project to link to key documentation in BCDE. Survey data can be shown on a map and linked to detailed reports for key points of interest.

2.8 BCDE Sync (Data and Design Information Transfer Tool)

A unique solution from Bentley that enables projects (Spaces) in separate BCDE servers to be connected to support the seamless transfer of information deliverables (typically for client acceptance) between supplier and client parties running BCDE.

This allows each party to maintain a full and thorough audit trail, for example from PIM to AIM (a contractor project information BCDE solution integrated and transmitting information to a client project and/or asset information BCDE solution.)

This module addresses the challenges relating to manual file administration and verification and issues traditionally associated with manual processing (uploading/downloading) files between disparate and disconnected CDE systems.

[5] Requires secure or public access to GeoSpatial end points provided by the User, based either on open standards (WMS, WMTS) or ESRI ArcGIS (REST) end points.

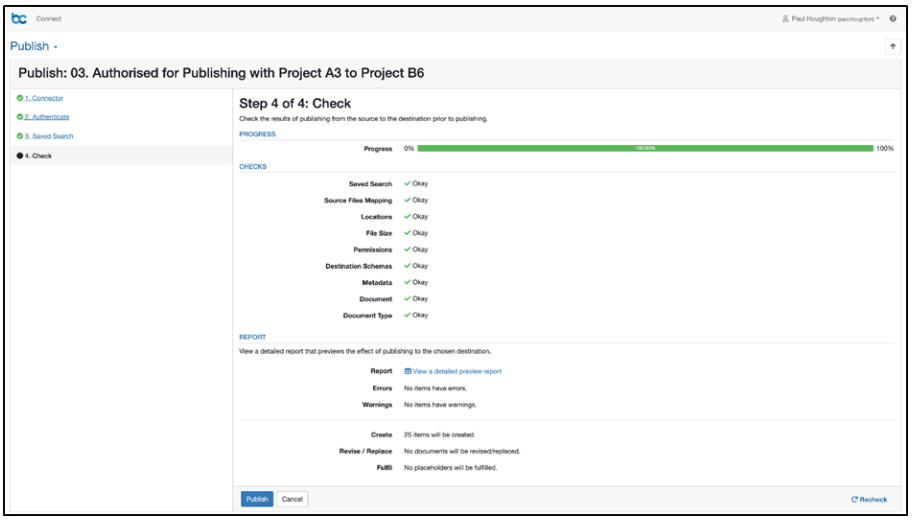


Figure 22 BCDE Sync carries out a range of checks prior to completing the transfer to ensure that there will be no problems

2.8.1 Key Benefits of BCDE Sync

In a world where everyone has their own CDE - from clients to contractors to supply chain members, methods to transferring documents and data have become necessary and essential. Most often, transferring is a manual process, managed by a person, thus prone to errors. This is where BCDE Sync brings the following benefits:

- Repeatable and consistent file and metadata transfer.
- Connectors between different BCDE Servers can be built by one but used by many. Remove the reliance on single individuals to complete a business-critical task.
- Saving time because the task is setup by a person once but completed many times by BCDE Sync.

2.8.2 Key Features of BCDE Sync

BCDE Sync enables transfer of data files including metadata between different BCDE Servers.

- Fuzzy mapping between folder and metadata structure of different BCDE Servers to simplify the transfer of the files to the correct destinations.
- Simple wizard process to help users configure connectors that can be re-used or amended for the duration of the project delivery life cycle.
- Connectors are sharable between BCDE Sync users.
- Full audit log of each transfer.

3 HOSTING

A secure, reliable hosting service is provided offering capacity and performance appropriate to a business-critical application.

This service provides:

- A service level agreement offering a minimum of 99.9% availability
- Data backed up at least daily and retained for 15 days
  - Optionally the frequency of backups and length of retention can be modified to meet User's requirements
- Data backups held in, and Disaster Recovery service offered from, a secondary site
- Access to the Brava! Document view and mark-up tool
- Content searching
- Options for:
  - Disaster Recovery
  - Anti-Malware and Anti-Virus
  - Intrusion Detection
  - Encryption at Rest
  - DDoS protection
- SSL/TLS encryption of data transfer between the server and client devices
- Each Installation is a "Private Cloud" which is completely independent of other clients of the application and hosting services. This allows for configurations, and hardware and software upgrades to be applied at dates and times convenient to each individual client

3.1 Backup/Restore and Disaster Recovery

3.1.1 Backup/Restore

By default, data is backed up (overnight) and mirrored to secondary site daily. These backups are retained for 15 days. It is possible to increase both the frequency of backup (to reduce the amount of data lost in the event of failure) and retention period.

3.1.2 Disaster Recovery

Bentley offers a range of options to meet varied requirements. In all cases a configured server is available in the secondary site as a "replica" of the main server at the primary site. The objective is to re-establish service from the secondary site, using the last successfully completed data mirror, in the event, for example, of the catastrophic loss of service from the main site.

The available options are:

1. "Warm" standby VM server, usually lower power than the production server, objective to re-establish a "skeleton" service within 24 hours.
2. "Warm" standby, fully configured identical replica of the production server, objective to re-establish as close to identical service as possible within 24 hours.

3.2 Service Management Details

3.2.1 Fully Managed Hosting

This service includes:

- Proactive monitoring and management of hosted service
- Installation of operating system and utility software upgrades and patches
- Installation and configuration of SSL/TLS encryption (assuming a URL in the format "xxxxx.withbc.com")
- Application monitoring (including installation and patching of BCDE specific software such as Tomcat and other supporting software)

3.3 Service Constraints

3.3.1 Maintenance Schedule

All system housekeeping activities are scheduled at times chosen to minimise any impact on the users. No system outage is required for these regular activities as BCDE has been designed to permit these processes to take place whilst the service is running.

Any other planned one-off activities, for example, major upgrades to hardware or software, which require a service interruption, will be undertaken at dates and times (usually outside normal office hours) agreed with User to ensure that the disruption to the users is minimised.

3.3.2 Configuration

BCDE provides many powerful configuration options which curtail the need for customisation. Configuration choices, typically variations around a defined standard delivery, are designed to persist through software version upgrades thus decreasing the effort and cost associated with such events. Accordingly, where possible, Bentley will encourage the use of configuration as opposed to bespoke customisations.

3.3.3 Schedule for Deprecation of Functionality/Features

Bentley reserves the right to withdraw functionality, features and support for 3rd Party services as required to maintain the BCDE system stability and security. This deprecation of functionality will be done in communication with users, notifying them of the advised migration path and dates when these items will no longer be supported by the BCDE Product or Support teams.

4 SERVICE LEVELS

4.1 Support and Maintenance Service

The service includes a telephone and email help desk during office hours (9:00 am to 5:30 pm), excluding English Bank Holidays.

Free upgrades to point releases (i.e., from 7.5.x to 7.5.y) of BCDE are provided.

Engineering time required to configure new capability, or to make any custom applications work with the latest version of BCDE will be chargeable on a time and material basis.

4.2 Telephone and Email Support Desk Service

During normal working hours (9:00 am – 5:30pm Monday to Friday excluding English bank holidays), the Support desk is available for call logging Priority 1, 2 and 3 requests.

The contact details are:

- Email: requests for Support Services can be sent by email to bc.support@bentley.com

4.3 Support Request Prioritisation

Bentley will assign a priority to the Support Services request in accordance with the priorities below.

- Priority 1 - This priority should be assigned to a support request if all users are unable to use the BCDE Software Service and as a result are unable to continue with their normal course of business.
- Priority 2 - This priority should be assigned to a support request if all users are unable to use an important feature of the BCDE Software Service and as a result are being caused major inconvenience, but are not prevented from continuing with their normal course of business.
- Priority 3 - This priority should be assigned to a support request if one or more users are unable to use a feature or if it has minimal business impact and as a result are being caused some but not major inconvenience or provision of help and guidance is required.

In the event that User does not agree with the assigned priority, the escalation procedure shall apply.

4.4 Target Response and times

Once a support request has been logged, Bentley will assign the support request to a support consultant for Response and Resolution. Bentley's target Response times are as follows:

Priority Response:

- Priority 1 1 working hour
- Priority 2 2 working hours
- Priority 3 8 working hours

These times are based on Bentley's normal working hours.

Bentley shall use all reasonable endeavours to meet the Response times set out above. If Bentley reasonably believes that it will be unable to meet such times, Bentley shall contact User with a revised estimate using all reasonable endeavours to provide a response as soon as possible thereafter.

4.5 Error correction

Where it has been established that there is an error in the Software Service, the following procedures will be used to provide corrections:

- In the event that the error has been resolved in a more current release of the Software than the one being used by User, Bentley will make available the more current release
- In the event that the error has not been resolved in a more current release of the Software than the one being used by User, Bentley will use the following procedures in accordance with the priority assigned to the Support Services request as detailed below:
  - Priority 1 - a workaround or solution will be provided to the Customer as soon as reasonably possible, In the event that an appropriate workaround or solution is not possible, then a software fix will be delivered as soon as reasonably possible
- In the case of other error, Bentley and its software partners will use all reasonable endeavours to achieve the following:
  - Priority 2 - provide an accepted workaround and provide a correction in the next release of the Software if feasible to do so;
  - Priority 3 – provide an accepted workaround and evaluate the suitability of providing a correction in the next release of the Software and to do so if appropriate and feasible; and

Where it has been established that there is an error in the Hosting Services, the following procedures will be used to provide corrections in accordance with the priority assigned to the Support Services request:

- Priority 1 - use best endeavours to restore the Hosting Services
- Priority 2 - use reasonable endeavours to restore any affected components of the Hosting Services
- Priority 3 - not applicable

5 TECHNICAL REQUIREMENTS

This section details the IT infrastructure and PC system requirements for using BCDE Project, Program and Portfolio version 7.5 onwards.

BCDE is accessed via the Internet and a standard web browser. Internet access is therefore required to use BCDE. This section describes the IT environment and settings required to optimise the use of BCDE.

5.1 Browser and Operating System support

The BCDE version 7.5 is supported across the following web browsers:

	Windows 7	Windows 8.1	Windows 10	iOS	iOS (Tablet and Phone)	Android (Tablet and Phone)	Notes
Internet Explorer 11	★☆☆	★☆☆	★☆☆				*Support only until 1 January 2023*
Edge*			★★★				
Mozilla Firefox*	★★★	★★★	★★★	★★★			
Google Chrome*	★★★	★★★	★★★	★★★		★★☆	
Apple Safari*				★★★	★★☆		

Figure 23 Supported Browsers

★☆☆ Limited period of support available

★★☆ Best, but only supports the Quartz interface and not all add-ins are compatible

★★★ Best, but not all add-ins are compatible

* The latest version of this web browser is supported. (Note that these browsers get regular releases and updates, some as often as every 6 weeks at the time of writing).

5.2 Screen resolution

5.2.1 Graphite (Admin/Power-user) Interface

The minimum supported screen resolution in the Graphite interface is 1024 by 768 pixels.

The recommended screen resolution in the Graphite interface is 1280 by 1024 pixels and above.

JavaScript must be enabled in the web browser to use the Graphite interface.

5.2.2 Quartz (Common user) Interface

The Quartz Interface is designed to be simple, modern, and responsive. It scales from desktop/laptop down to tablet/smartphone devices. It is designed for use with a mouse, trackpad, or touch screen.

The minimum supported screen resolution in the Quartz Interface is 320 by 568 pixels. (iPhone SE size.)

The recommended screen resolution in the Quartz Interface is 375 by 667 pixels or greater. (iPhone 7 size).

5.2.3 Web Browser Settings

Web browser settings should permit users to download and store cookies. Cookies are used by BCDE authentication. (Note that the date and time on the local computer must be sufficiently accurate for the authentication cookie to be valid and enable authentication to the BCDE server.)

Browsers should be configured to permit the use of JavaScript which is used extensively by the BCDE interface.

About Bentley Systems

Bentley Systems (Nasdaq: BSY) is the infrastructure engineering software company. We provide innovative software to advance the world's infrastructure – sustaining both the global economy and environment. Our industry-leading software solutions are used by professionals, and organisations of every size, for the design, construction, and operations of roads and bridges, rail and transit, water and wastewater, public works and utilities, buildings and campuses, mining, and industrial facilities. Our offerings include MicroStation-based applications for modeling and simulation, ProjectWise for project delivery, AssetWise for asset and network performance, Seequent's leading geoprofessional software portfolio, and the iTwin platform for infrastructure digital twins. Bentley Systems employs more than 4,500 colleagues and generates annual revenues of approximately $1 billion in 186 countries.

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