

The Bentley PDS analysis interface (STRAIT) is used to read the PDS stress module neutral files (*.n). It is employed by many major PDS companies, including Air Products, Burns & McDonnell and Fluor, to design new plants and refurbish existing plants.

Making PDS interoperable

With this white paper, Bentley Systems demonstrates to PDS users a path to broad interoperability for reuse and choice, to a comprehensive portfolio encompassing all infrastructure disciplines for all plant projects, and to sustained return on existing equity in PDS.

Since the launch of PDS in the mid 1980s, the users of this software for plant design have made substantial investments in time creating project data, related catalogs, and specifications within PDS. In parallel, most PDS users have incrementally developed and evolved business workflows, work processes, and system interfaces to complement the PDS 3D modeling environment. Together, these efforts have improved overall project execution efficiencies over the course of the past three decades. Now, with the introduction of SmartPlant, the user community faces a potential end of PDS's product life. Moreover, with SmartPlant, PDS users are being forced to learn yet another Engineering-IT system. Bentley Systems, Inc., based in Exton in the US-state of Pennsylvania, has developed a fundamental migration approach that minimizes project and business risk when choosing a transition to a new 3D plant design system. As a result, PDS users have an alternative path forward, so called 'Bentley's Smart Plan'. A survey conducted by the vendor in

2008 found that 90 percent of users said the transition from PDS was important to their business. Yet only 28 percent said they had sufficient information to make a business decision as to which path forward to take. This white paper now closes that information gap by describing the Smart Plan for PDS users, the vendor's application portfolio as an alternative, and ways in which return on existing equity in PDS can be sustained.

Smart Plan for PDS Users

Based on discussions with users over the past decade, Bentley has incrementally committed resources as part of a continuous innovation strategy to support PDS users as they develop their use of PDS while considering their future transition options. This included a commitment in 2002 to provide continued support and development of a specific version of MicroStation/J used as the underlying technology platform on which PDS is based today. Bentley continues this commitment with the Smart

Plan. The next phase in the vendor's approach centers around providing PDS users with the ability to continue to leverage MicroStation and ProjectWise platforms natively access all PDS data for reference outside of PDS publish PDS models, piping catalogs, and specifications by way of ISO 15 926 for other applications transition to and adopt OpenPlant applications to modify existing PDS projects or use OpenPlant applications for new projects. Bentley's MicroStation provides intrinsic interoperability with Autodesk's DWG platform, assuring universal accessibility for dispersed project teams and for lifecycle data reuse. MicroStation robustly supports applications for every infrastructure discipline and will always proactively evolve to incorporate new data types, such as 3D PDF and point clouds. Bentley's ProjectWise collaboration servers are used by the majority of PDS user organizations (even to manage PDS DGN deliverables) and are mission critical to managing distributed enterprise workflows across other disciplines and projects. The ProjectWise PDx Dynamic Review Service natively references and extracts all PDS model and file data with full fidelity directly from PDS's existing Oracle or SQL Server databases without requiring PDS software. Unlike the traditional DGN/DRV file

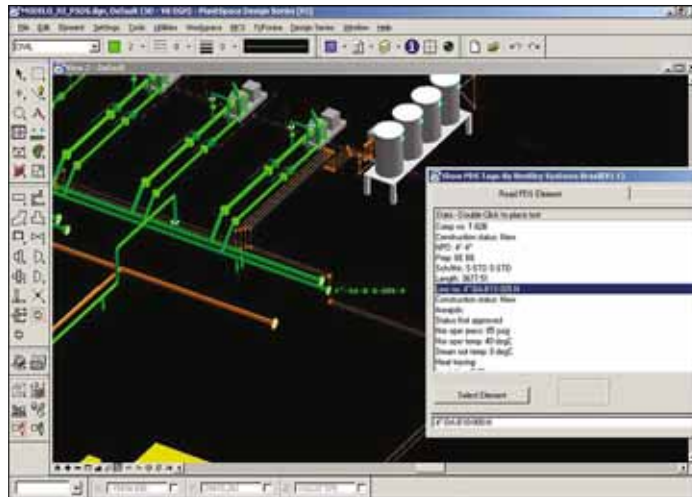
route, ProjectWise PDx Dynamic Review Service opens up the entire PDS project database and provides read access to anyone using MicroStation, ProjectWise Navigator, or ConstructSim. The Bentley OpenPlant ModelServer V8i automates the migration of full PDS models, as well as piping catalogs and specifications, to ISO 15 926 so that PDS data can be readily shared across enterprise lifecycle applications.

Transition to and adopt OpenPlant applications to modify existing PDS projects or use OpenPlant applications for new projects: PDS models that have been automatically migrated to OpenPlant ModelServer are available to be edited and reused by any OpenPlant application, such as OpenPlant Modeler V8i – with changes and new models being maintained by OpenPlant ModelServer. This enables the secure management of both components and files, and avoids writing back to PDS. So while the integrity of any existing PDS database can never be jeopardized, owner/operators can generate increasing returns on the investment it represents. PDS users can now leapfrog into a modern, agile, open software environment that assures them data reuse and interoperable choices among multiple toolsets for integrated projects across all aspects and all types of plant creation, operations, and adaptation. The vendor's new OpenPlant offerings combine the robust platform and dynamic collaboration servers for accessibility, concurrent component- and file-based workflows, and comprehensive applications and services. At the same time, the Smart Plan makes the unwarranted overpricing of current proprietary 3D piping applications.

Many PDS users have already taken the first steps in their Smart Plan. The vendor has proven that by assuring forward interoperability, such succession strategies – for instance, with DGN and DWG – offer compelling business opportunities. The vendor has absolutely established the viability of natively referencing complete PDS models, and of bringing forward their value through ISO 15 926-based interoperable accessibility.

1. Using PDS in a MicroStation V8i environment

MicroStation has remained the preferred graphics platform for PDS users



Picture: Bentley Systems

PDS intelligence can be easily viewed using MicroStation V8i

for more than 20 years, and continues to be integrated and used within PDS as the core of the system. MicroStation V8i brings unparalleled advances to the core platform technology, offering opportunities to expand into new markets, extend business competitiveness, and increase overall productivity. However, because PDS does not run on the latest MicroStation V8i platform, current PDS users are not able to take full advantage of its productivity and time-saving enhancements. But all is not lost. Many PDS users are already benefiting from the latest MicroStation V8i features while continuing to work in the MicroStation/J environment on which PDS is based. Without additional configuration or compromising file fidelity, PDS users can take full advantage of MicroStation V8i functionalities.

Today's plant design projects require combinations of software applications to accommodate specific disciplines or tasks. Applications may also be provided by multiple vendors. Depending on what applications are required, users may need to switch between MicroStation/J and MicroStation V8i on the same workstation. For PDS users, this work process is supported by Bentley, giving them more choice to extend the business value from current software investments.

As part of the vendor's effort to continually add Select value, PDS users are able to apply MicroStation/J licenses to MicroStation V8i projects using Select Server. Licenses can be switched on and off as required, allowing PDS users to employ the same pool of MicroStation/J licenses for MicroStation V8i projects as demand varies over the life of a PDS project. The OpenPlant suite supports both desktop and server-based licensing together with practi-

tioners' Passport Subscriptions, which in many cases cost less than the maintenance charges for other vendor's proprietary software systems. In practice, this means users can select and use the right combination of seats and discipline-specific software to match the profile and variations in project demand.

Bentley's engineering applications can also read PDS models through a single interface, which allows users a choice when it comes to pipe stress, nozzle stress, and fluid or pulsation analysis tools. Through this common interface, PDS users can accurately and efficiently evaluate pipe geometry, loads, pipe properties, support types, and locations. Through a common neutral file, Bentley's engineering applications enable PDS users to perform a wide range of integrated analysis tasks.

2. Using PDS in a ProjectWise V8i environment

Today, PDS users can index and query the PDS data within ProjectWise. By querying the PDS data from the component index, users can view components and their associated intelligence using MicroStation or Bentley Navigator to synchronize the PDS data source with the ProjectWise component index using a common data model. The common data model provides integration by using the same ProjectWise content management environment to transact all project data, including PDS, MicroStation or Autocad files, and other CAD data files.

ProjectWise is also used to effectively manage PDS outputs. PDS production deliverables (for example piping isometrics and orthographic drawings), can be automatically tagged and routed to

ProjectWise folders using the integration capabilities within ProjectWise. Project team members can share the PDS model as a reference file within other V8i-compatible applications. This work process also takes full advantage of ProjectWise features, including change control, distribution, and archiving at various stages in the document lifecycle.

3. Bentley OpenPlant

OpenPlant has been developed to uniquely meet the new requirements of today's globally sourced, loosely coupled project environments addressing the following requirements: universal accessibility, concurrent file- and component-based workflows, and comprehensive applications and services. The OpenPlant breakthrough is that it uniquely addresses all of these modern requirements in combination: **Universal accessibility.** OpenPlant incorporates the MicroStation platform to provide intrinsic interoperability across DGN- and DWG-based interfaces and applications already familiar to almost all infrastructure professionals, especially those in plant operations. By way of the MicroStation platform, OpenPlant users are assured of information modeling continuity, including proactive support of emerging data types such as 3D PDF and laser point clouds.

OpenPlant Services packaging enables ease of use and affordability, as MicroStation installations and licensing are not required, together with role-based subscription licensing. OpenPlant is intrinsically based on the open ISO 15 926 data schema, assuring universal accessibility for dispersed project teams using disparate systems across the project lifecycle.

Concurrent file- and component-based workflows. OpenPlant fully leverages ProjectWise collaboration services, which are mission critical to managing distributed enterprise workflows across a wide range of disciplines and project types. Designed for today's real-world project environments encompassing individual practitioners, globally distributed EPC contractors, and small- and large-scale modularization of plant projects, OpenPlant meets and addresses the resulting challenges for design, engineering, and handover throughout the project lifecycle.

Comprehensive applications and services. OpenPlant supports applications for every infrastructure discipline with software and information modeling services that enable the integration of civil, geotechnical, electrical, instrumentation, equipment, structural, piping, and environmental engineering and construction.

Bentley OpenPlant applications provide an integrated set of tools based on internationally recognized industry standards and formats (ISO 15926, XML, DGN, DWG, and PDF). These enable engineering contractors and plant owners to create and maintain the digital information about a plant across its lifecycle. Core to the vendor's approach is a data management and interoperability backbone based on ProjectWise and the OpenPlant (ISO 15 926) schema handling both files and data.

OpenPlant Modeler V8i, the first commercially available 3D plant modeling software based on ISO 15 926, is more versatile and productive than any existing 3D piping application on the market today. Crucially, OpenPlant Modeler V8i supports project workflows for engineering, tracking, and management at the component – 'data-centric' – design level, while concurrently accepting and producing conventional, 'file-based design' work packages.

OpenPlant ModelServer V8i provides for the management of components on a ProjectWise server for distributed team collaboration. In addition, OpenPlant ModelServer V8i can automatically migrate PDS models, as well as associated piping catalogs and specifications, to ISO 15 926. As a result, PDS data can be readily shared across other OpenPlant applications.

OpenPlant Isometrics Manager V8i extracts isometric information in a neutral format so it can be easily maintained, modified, and tracked outside of design systems. This new tool provides management control capabilities for pipe models and isometrics from not only OpenPlant, but also PDS.

What does OpenPlant mean to an engineering contractor or a plant owner/operator at a business, project, and facility level?

For the engineering contractor:

- OpenPlant allows information to be managed at a component level so that engineering processes and project timescales can be compressed.

- OpenPlant gives management immediate access to progress and performance metrics to manage project milestones better.
- OpenPlant provides a repeatable environment for managing handover requirements to meet widely varying owner-operator requirements.

For the plant owner/operator (O/O):

- OpenPlant helps reduce unscheduled plant shutdowns. It keeps plant information up to date, accurate, and available to those who require it.
- OpenPlant helps to reduce the surplus material ordered by every project. It provides a central, managed backbone that integrates all engineering disciplines and project systems. So from the ERP-based purchasing system to the project management system scheduling the construction, everyone involved in the procurement process can see what is required, what has been purchased, what is on site, and when deliveries are scheduled.
- OpenPlant automatically populates operations and maintenance systems, reducing handover costs. It offers a wide range of tools for connecting to and managing information from EPC systems.
- O/Os can select engineering contractors based on their expertise, rather than on the CAx system they use. OpenPlant will connect to and manage information in any format from any system.
- O/Os can easily assess the impact of new environmental regulations and satisfy regulatory requirements. OpenPlant tracks the full audit history of plant data — documents and components — across all stages of the lifecycle. It can also manage proposed changes and determine their impact.

4. Protecting data investments

The ability to exchange existing or legacy data among CAD systems provides users with more choices when it comes to maintaining or extending operating margins on current and future projects. In the same way, data exchange helps to reduce risk of a schedule overrun during engineering data hand-over into plant operations. When combined with other OpenPlant applications, Bentley PDx Dynamic Review utilizes and fully exploits legacy 3D

CAD data in a format that is readily accepted by a growing family of compatible CAD applications.

PDx Dynamic Review connects to a PDS project and accesses all design information within the project without requiring PDS software or licenses. Unlike the traditional DGN/DRV file route, PDx Dynamic Review opens up the entire PDS project database and provides read access to anyone using MicroStation V8i or ProjectWise Navigator V8i, or open applications that can read an ISO 15 926 data model. Users can see the breakdown structure of the PDS model in a hierarchy browser, select and zoom to individual objects, and display all PDS property information for any object in a property dialog using the same display order used in PDS.

PDx Dynamic Review saves PDS data into the ISO 15 926 format, thus allowing a PDS project to be accessed and re-used in an open format with other ISO 15 926-compliant applications, such as OpenPlant PowerPID. Once in this open format, users can collaborate on a heterogeneous project. It also enables legacy PDS data to be saved into the ISO 15 926 format, extending the life of the data beyond the life of the PDS application. The information can be accessed and managed across the lifecycle of the infrastructure using tools such as ProjectWise Lifecycle Server.

Integrating PDx Dynamic Review with ProjectWise enables PDS users to add value to current PDS workflows by automating the review process and distributing and tracking PDS content across the project. This is provided by ProjectWise PDx Dynamic Review Service working with ProjectWise Integration Server.

PDx Dynamic Review operates on native PDS project design files. It can be run from any workstation since only the PDS files are required. The resulting 3D model conforms to the OpenPlant ISO 15 926-based public domain schema. The object class definition returned from the process is defined in a mapping file, which uses the relational database management system (RDBMS) table referenced by the geometric objects as the primary identifier. The resulting plant model has the full hierarchical engineering structure of the original process plant design. It creates native MicroStation design files (DGN format) or i-Models. The application

does not require a PDS license to access the original PDS source data. As a result, PDx Dynamic Review re-establishes control of the evolving digital information asset and enables work-sharing and collaboration among companies with different CAD systems exchanging data with other plant design systems. The ability to exchange data between disparate applications into a neutral model, without loss of information, also allows users to capitalize on existing resource investments. It also removes dependencies on closed, proprietary plant design systems by removing migration dependencies from legacy products such as PDS.

5. PDS data handover

Advances in the MicroStation V8i tag format provide a fundamental data storage and handover environment that exploits the portability of MicroStation design files. This is especially useful for owner/operators who do not want the burdens of investing in, training on, and maintaining a complex 3D design system that impose work-process changes requiring specialized CAD expertise. PDS model intelligence can now be delivered by EPCs in MicroStation V8i format, allowing owner/operators to review and utilize 3D models to support plant operations.

Using MicroStation V8i tag functionality, EPCs can retain full PDS model and data intelligence to an agreed tag data format within a V8i file. This eliminates the need to maintain the PDS model. It also provides a simple yet cost-effective handover option. DGN file format gives owners a wider range of options to extend the value of their PDS investment based on viewing and querying plant data held in DGN or DWG files using Bentley View – a free, easy-to-use viewer viewing and querying plant data held in DGN or DWG files using Bentley Navigator – a powerful visualization and simulation application extending tag data held in a DGN file to include materials management information or business system data from SAP using simple isometric sketch tools to capture as-built changes in DGN files.

And, of course, with PDx Dynamic Review Service, PDS models can be saved in the ISO 15 926 format, extending the life of the data to match the life of the plant itself.

In capital projects, O/Os are increasingly using data warehousing technology to capture and manage data from engineering and technical information sources (such as models and documents) as part of handover from their contractors. This information is extracted from a multitude of different engineering design, analysis and related systems.

O/Os and a growing number of EPCs use data repositories and data warehouses to capture and manage the fidelity (consistency, completeness, and correctness) of information handed over within the extended enterprise – contractors, sub-contractors, vendors, and suppliers – which is then used to populate downstream operations systems. This integration has been shown to save significant time, effort, and money during handover. Data warehouses are further used to manage subsequent engineering changes during operations. In a survey of PDS users, 80 percent of respondents said that having better change management within the PDS environment would make them more competitive. At the core of the vendor's approach to supporting handover into operations are ProjectWise, a repository of engineering content data that improves the quality, visibility, and reliability of data coming in from multiple systems and data sources ProjectWise Lifecycle Server, a full-feature engineering data warehouse and repository.

Both combine and use the OpenPlant schema to capture PDS project data associated with a physical asset to populate ProjectWise Lifecycle Server.

While PDS design tools focus on design and engineering, ProjectWise Lifecycle Server is designed to also capture and store a full change history of PDS data for the entire lifecycle of the asset. ProjectWise Lifecycle Server provides the perfect complement to the PDS design system, with full change control, management, and reporting combined with change impact analysis.

As the cornerstone to a managed data handover environment, ProjectWise Lifecycle Server has a powerful data consolidation engine that takes data from a variety of sources, including PDS, and ensures that data are stored only once. Data are stored in an open, neutral format. Storage, presentation, and business rules are independent of the source that created the data. These are requirements for lifecycle data ma-



agement, in which data and assets must be viable over decades.

6. Value proposition

The process industry seeks to capitalize on the productivity benefits of data-centricity – such as the ability to collaborate across time zones, multiple office locations, and geography – and the power to manage change to a new level of granularity. The tools and technologies provided by Bentley's OpenPlant applications enable and accelerate fundamental change in work process and associated workflows, lowering overall cost of ownership based on lower seat

cost – subscription-based licensing means the cost to deploy the required functionality for each OpenPlant design seat is typically one-third that of the vendor's competitors.

reduced deployment time – The time required to install the software with associated project requirements and have the software up and running in production is typically less than half that of competitive products.

reduced operational costs – Rather than requiring one information system (IS) staff member for every five design seats, a single IS staff member typically supports 20 to 30 seats of Bentley software, significantly reducing the on-

going support costs over the lifetime of the project.

Another important advantage, which must be considered a priority when evaluating a PDS transition strategy, is that Bentley's plant design applications have the largest trained and globally available user base of any plant design vendor.

INFOCORNER

For further detail concerning a comprehensive migration strategy to a new 3D plant design system:

www.bentley.com/openminds

