A STANDARDIZED SYSTEM FOR DATA EXCHANGE?

By Miroslav Schonauer, PhD, Dipl Ing

SINCE THE EARLY DAYS OF COMPUTERS, information technology has played a significant role in the steel design and construction industry. Within the last decade, various steel software packages—with applications from the conceptual design to the fabrication of steel—have been developed. And with the availability of increasingly powerful personal computers, this software is now widely used throughout the steel construction industry. The software packages, as a rule, focus on specialized areas, such as plant modeling, structural analysis, member design, connection design, detailing and manufacturing. While the high standards of individual packages has been acknowledged by the industry, the necessity of data integration between different packages is becoming ever more important.

The need to exchange models via EDI (Electronic Data Interfaces) is now recognized as the potentially largest time and cost saving factor within a project workflow. EDI also has the advantage of significantly reducing errors in re-entering data and of being able to have extremely tight revision controls within projects. Therefore, the demand for EDI links between packages is more frequently put to software suppliers, and it is sometimes a crucial factor in the software purchase choice.

There are currently two types of links between steel-related software packages:

1. Direct one-to-one links
2. CIMsteel Integration Standard (CIS) links.

DIRECT LINKS

This concept is based on the software application native file formats, i.e. input, output or neutral files. The import translators must be capable of reading the other package's applications file and of mapping the data into the native database. The export translators write out the internal database as the other package's applications input file. If the file formats are well documented, these translators are relatively easy to develop, although some complexity may arise, e.g. when the section names are not the same, or when the steel members default orientation differs between the packages. The disadvantage is that linking to a new application, writing a new translator and maintaining the link depending on any file format changes in the third party application.

The EDI between plant modeling and detailing/fabrication software packages is probably the most important example in the industry.

As an example, there exists an interface between Intergraph's PDS/FrameWorks and AceCad's StruCad. The industrial designer, who models the primary steel layout, which is coordinated with other engineering disciplines (piping, electrical, etc), uses PDS/FrameWorks. The design can be downloaded into the SDNF file (Steel Detailing Neutral File), which can be easily emailed to the detailer/fabricator, who uses StruCad. There is no need to create and send any drawings, since StruCad's SDNF import translator will automatically import the model ensuring 100% compatibility with the FrameWorks steel layout. Once the secondary steel and all the connection details are modeled within StruCad, the full model can be electronically transferred back to PDS/Frameworks, via StruCad's PML export translator. The PML file contains the fully detailed model described in the Intergraph's Parametric Modeling Language by means of the linear, the area and the volume elements. This transfer enables invaluable automatic PDS interference checking between the detailing (modeled at the fabricator's offices) and the piping (from the original PDS model).

Innovative engineers from Fluor Daniel Irvine offices have recently gone a step further. They have approached StruCad's developers with various requests for automatic revision control of the EDI between PDS/FrameWorks and StruCad. The result of this joint venture is the SDNF revision control import translators within StruCad. After the original SDNF model is imported and partially or fully detailed, it is very likely that by then, the revisions will be made in the original FrameWorks model. If the new (revised) SDNF file is sent to the fabricator, StruCad's revision control translators will categorize the members as "deleted", "new" or "modified". The system will then give the user the option to erase the "deleted" members, merge the "new" members and finally to adjust the attributes for the "modified" members. This SDNF revision import can be repeated as many times as the revised SDNF files are sent. This whole process is automatic and paperless.

A real project using these links has already been successfully executed. The project time saving due to the revisions link was estimated at one to two weeks. This link is already being used on other Fluor Daniel projects. It is an excellent example of an advanced direct link, which is usually project-team requested.

CIMSTEEL LINKS

CIMsteel (Computer Integrated Manufacturing of Steel) is a visionary project aimed at dramatically improving the competitiveness of the constructional steel industry.

This project involves software developers, designers, steel fabricators, research institutions and universities. The CIS (CIMsteel Integration Standards) are probably one of the most attractive segments of this project, creating a great deal worldwide interest. The CIS aims to revolutionize computer data exchange between software packages by introducing internationally agreed standards for the data throughout the life-cycle of a steelwork project. The software vendors have agreed to develop CIS export and import translators for their products, converting the data to and from the CIS neutral files.

The CIS files are based on ISO/STEP (International Standards Organization / Standards for the Exchange of Product model data) principles. All the entities and attributes of a steel-work structure, from the analytical model to detailing and fabrication are described in an EXPRESS language data schema, which has been developed over the past five years by the Leeds

University Computer Aided Engineering Group. This schema is referred to as LPM (Logical Product Model).

There are numerous advantages to the "open" standard approach, compared to the direct links. The CIS are independent of any single software source, encouraging their adoption by a wide range of applications. The users are free to get the best individual software packages for their needs and are not limited to one vendor's suite of products. The software developers have to write and maintain only one CIS import/export translator, which enables data transfer from/to any application with the compatible translators.

However, on the downside of the CIS, the translators are relatively complex to implement, and a considerable effort is needed from the software providers, including constant consultations with the LPM schema developers.

Many software vendors are involved with the project, including Intergraph, AceCad Software, QSE/Research Engineers, GoData, TDV, DSC, CSC, CADs, Integer, etc. So far, the commercial translators are only available from AceCad Software, for their package StruCad (detailing), and in QSE Space (analysis). Both packages have DEP1 and DEP2 import and export translators, which enables seamless bi-directional data exchange.

These links were first demonstrated in London, last year. Intergraph's PDS/FrameWorks (plant design) and GoData SSC (estimating) also took part with their prototype CIS translators. This demonstration was once again staged during the AISC Conference (NSCC '97), at Chicago, this year. The demonstration was based on a real job hopper structure provided courtesy of Foster Wheeler Energy Ltd, and their client, ICI.

The industry will surely continue to rely on direct links, with more demands for advanced concepts, such as the SDNF revision control capabilities. Only the future will show if and when the CIS will be adopted as the industry standard.

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ANOTHER STANDARD

IN ADDITION TO CIMSTEEL, OTHER STANDARDS ARE STARTING TO EMERGE. Most notable is a data exchange standard developed by Fab/Trol Systems, which they call KISS (Keep It Simple Steel). The open standard, which has been released into the public domain, was developed to create a neutral ASCII format for transferring job specifications and bill of materials information with associated sequencing, labor and CNC data for cut lists, purchasing, inventory reduction, scheduling, and production control.

According to Douglas Cochrane, Fab/Trol's chief technology officer, the KISS standard is not meant to supplant CIMSteel, but rather to supplement it. "KISS is an effort to provide a workable solution today to one segment of the larger problem while the emerging standards evolve. It is our hope that as KISS becomes commonly used, AISC, ISO and/or CIMSteel will give it their blessing and incorporate it into the developing world standard."

According to Cochrane, most steel-related software programs already produce some form of ASCII listing of the bill of materials and related information. A KISS file is simply a common format in which to structure this information for universal data transfer. Each line of the file begins with a single-character code that defines whether the data in that line is a detail record (containing material information, such as the drawing, mark, quantity, type, size and length), a labor record (containing a labor process to be applied, such as cuts, holes, copes or welds), a sequence record or CNC data. A complete specification is available upon request from Fab/Trol (132 E. Broadway, Suite 636, Eugene, OR 97401; ph: 541/485-4719; fax: 541/485-4302; email: cochrane@fabtrol.com; web: http://www.fabtrol.com).

The purpose behind the standard is to improve compatibility between the various products used by fabricators. "A fabricator should be able to pick and choose the mix of products that best meets his or her individual needs, knowing that the products are compatible with each other," Cochrane explained. "Proprietary, mutually exclusive systems force our clients to choose between one complete system and another. This ultimately weakens both the vendor and the industry as a whole. A good case in point was Structural Software [a once popular but now defunct steel software vendor], which attempted to be all things to all people within a closed architecture and ended up being nothing to anyone."

Currently, only Fab/Trol and AceCad Software (StruCad) support the KISS standard, while Computer Detailing Corporation and the SteelPlus Network are actively working on links. In addition, CadVantage, Dogwood Technologies, CompuSteel, CSC (X Steel), SteelCad International, Steel Solutions (Steel 2000) and Godata have all tentatively committed to supporting KISS links in the future.

CORRESPONDENCE

Dear Editor:

We recently had the opportunity to read the article by Ala Saadeghvaziri in the March 1997 edition of Modern Steel Construction magazine.

It is regrettable that the author has made comments on a tragic construction accident in Pennsylvania that he based on an analysis that has major deviations from the actual conditions. The author's analysis certainly does not represent the conditions present during the girder collapse. We consider it erroneous to apply conclusions from this analysis to the situation in Pennsylvania. We are also unaware of any contact by the author or your magazine with the Department of Transportation to verify the facts presented.

Gary L. Hoffman, P.E.
Chief Engineer, Highway Administration, PennDOT

Editor's Response:

The article was not intended to comment on the specifics of the Pennsylvania situation. In retrospect, the article should have made clear that Saadeghvaziri's study was not meant as an analysis of the Pennsylvania accident or even to be applicable to that situation. We apologize for any confusion.

Dear Editor:

Duane Miller's article "What Every Engineer Should Know About Welding" in your May issue was informative and timely. As Duane pointed out in regards to the preheat issue, the way in which the procedures are welded and tested does necessarily represent the properties that can be expected on the job. Although mechanical testing may not be perfect, it's far better than no testing at all. Even of greater concern is how pre-qualified procedures are accepted a face value and applied with confidence by contractors doing welding to AWS D1.1. Applying the pre-qualified variables is anything but a guarantee of performance for any given application. It is impossible to apply the pre-qualified variables for every application; there are just too many circumstances that affect the weld properties to use pre-qualified for any critical welds.

Developing and testing WPS's not only verifies mechanical properties but it forces the contractor to become familiar with code and demonstrates their ability in regards to equipment and personnel. In light of the Northridge welding failures, I would suggest that anyone responsible for quality should insist on going to the modest expense of testing each procedure to be used whether considered pre-qualified or not. The pre-qualified criteria would be better used as a guide for procedure development and testing. To rely on the pre-qualified variables can have devastating results.

Testing of WPS's should be done in the company's own interest as well as their clients. Procedure testing need not be repeated for each job. To say that it's the engineer-of-record's responsibility for weld performance, as stated by AWS D1.1, is really reaching, in my opinion, since most engineers-of-record have only a casual working knowledge of welding. Other fabrication codes, such as ASME, assign the welding contractors the responsibility for their own work.

If testing under realistic conditions, rather than conditions that favor bogus test results, was mandatory, public safety would be better served. Additionally, if random production tests were conducted for critical applications, as they are in other industries, we would not have to rely so heavily on understaffed inspection agencies. It would have a self-regulating affect. It is time to recognize that just saying "it meets code" is no excuse for using shoddy materials and/or work practices.

Steven J. Jorgenson
Welding Consultant
Whittier, CA

Dear Editor:

Your "Off the Beam" column (June 1997) was right on the money! Our office (Harley Ellington Design) has just had a wonderful experience using Ram Analysis' RamSteel, SDS/2 by Design Data, and a fabricator's self-produced translator. Once a comfort level was established, the engineer reviewing the shop drawings can spend time on known trouble spots instead of checking every last bolt (excuse the exaggeration). The fabricator can plow through the pieces with confidence, as well.

However, the fabricator needed to develop his own translator with help from the software vendors. Still, as you stated and we experienced, a "clean data exchange would be a boon to engineers and fabricator's..."

Mike Vernier
Via email