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If You Build It, They Will Come – Making Project Historical Data Useful

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At the 2007 AACE International Annual Meeting, Transaction Paper EST-02 presented the reasons and procedures for establishing an historical database system of project information. Todd Pickett and BruceElliott clearly stated the problem, requirements and steps to implement an historical database [1]. This paper will explore deeper into the subject of implementing an historical project database, citing specific activities from implementation of the Bechtel Oil, Gas and Chemicals (OG&C) Central Metrics Database (CMD).

IF YOU BUILD IT…

Bechtel OG&C experienced the same problems identified by the authors – a reduction in work and experienced personnel in the 1980's – that led to a loss of project knowledge and historical data with which to compare new work. Project procedures at that time only required that a one-page summary report be prepared for senior management upon project completion (See figure 1).

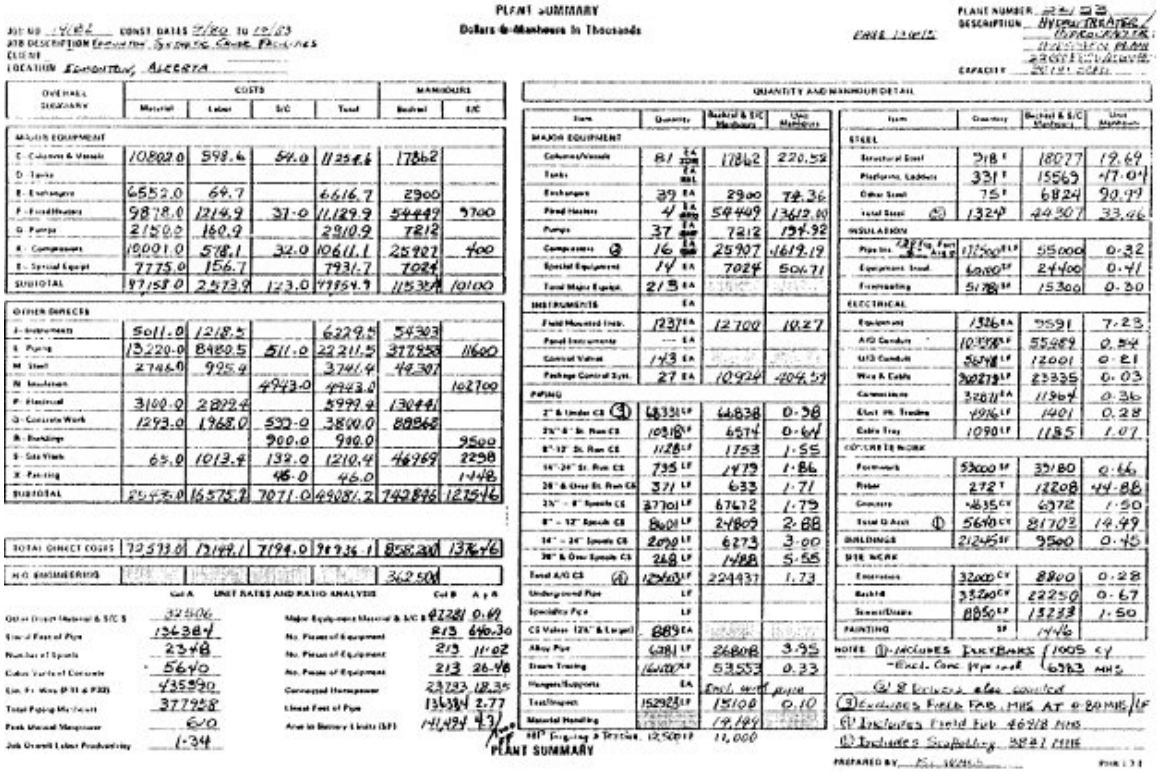

Figure 1—Historical Project Summary

This simple form was initially prepared manually by the project controls manager or his or her designee. With the rapid deployment of personal computers in the latter part of the 1980s and the 1990s these manual reports were replaced with two-page reports first created in Lotus 1-2-3 and then in Microsoft Excel. To protect the sensitive

Bechtel OG&C commercial and business information contained there-in, the reports were printed on red paper to reduce the possibility of easy photocopying. The restricted, distributed copies became known as the "red sheets," for obvious reasons. While senior managers could each have a copy of the red sheet reports in their offices the report volumes were impractical for them to carry with them to use in reviews of projects worldwide.

In 2005, a major business review produced a software initiative for project controls to improve the quality, consistency and availability of OG&C historical metrics, the "red sheets." The CMD development was initiated to produce a controlled-access database for Bechtel OG&C's confidential business data, and for that data to be available to senior management worldwide.

Fortunately the prerequisites for data collection identified by Pickett and Elliott already existed within Bechtel OG&C's Global Business Unit.

- "A structured, coded index of project cost, resource and activity categories."[2] Bechtel OG&C's estimating Code of Account, Appendix A, had been in place for several years and formed the basis for reporting categories with which senior management was already familiar.
- A cost control system that provides a "means for capturing and storing estimated and actual project costs and resource data" [3]. A Microsoft Access 97 database system, PCWorks, had been used for several years to store the project necessary for populating the CMD. Recently that system has been redeveloped as an Oracle database application named ePCWorks.
- A project classification system to serve as "a method to categorize your projects in such a way that meaningful data can be identified and organized by the various types of projects" [4]. Bechtel OG&C identifies all its projects by major process technology type. Typical processes include refining, gas liquefaction, regasification and coking. Estimate type classification includes the five classes of AACE International 17R-97, and additional definitions such as Front End Load (FEL), Front End Engineering and Design (FEED), Lump Sum Turnkey (LSTK) or Forecast 1 [5].

Because Bechtel OG&C had in place the necessary prerequisites for defining and populating an historical database work progressed quickly. To make the database truly accessible worldwide a web-based implementation was selected. Development began in early 2006.

Pickett and Elliott also identified some of the criteria for choosing and implementing a software system. Again, Bechtel OG&C met many of these criteria prior to starting the CMD. Some of the criteria are the following::

- "Developed Software – Therefore, when making the decision to develop software, your company must have a vision of what the final product will look like…[6]" The initial implementation mimicked the formats of the "red sheets." Initial design definition was thus simplified because of this existing data format. The data categories of the red sheets are presented in Appendix B.
- "Software development experts - ... These service providers (software developers) will help you determine your requirements, provide enhanced specification writing, and then create custom software to meet your needs [7]." The Bechtel OG&C development team consisted of a senior estimating manager for design definition with oversight from other project controls personnel, and a single full-time program developer. The design definition process was carefully thought out, with data structures to be provided and how the elements of that structure would be displayed. It was detailed and complex, with multiple levels of data storage and summation defined in advance. The design called for four levels of metrics and attributes:

    - Level 1 – project metrics options;
    - Level 2 – project metrics;
    - Level 3 – discipline metrics; and
    - Level 4 – project attributes.

- The process produced a substantial work specification, 26 pages of data relationship diagrams. The amount of work was sufficiently large that it had to be pared back for the initial implementation. The display formats were left to the programmer, an experienced user of estimating software. His screen suggestions were modified based on comments by the senior estimating manager and others of the oversight committee. This division of design between the managers for data definition and the programmer for screen definition worked quite well even though it involved some rework.
- "Shortened implementation time – Putting a historical database system in place requires many hours of concentrated effort."[8] The initial deployment was made within 6–8 months as a screen-view only version.

CMD web pages were created for 34 category details, as identified in Appendix C. There were no printed reports available except by capturing and printing the screen images.

The CMD opening screen, which reminds users of the complete definition of data quality and of the confidential nature of the data they will view, is presented in figure 2.

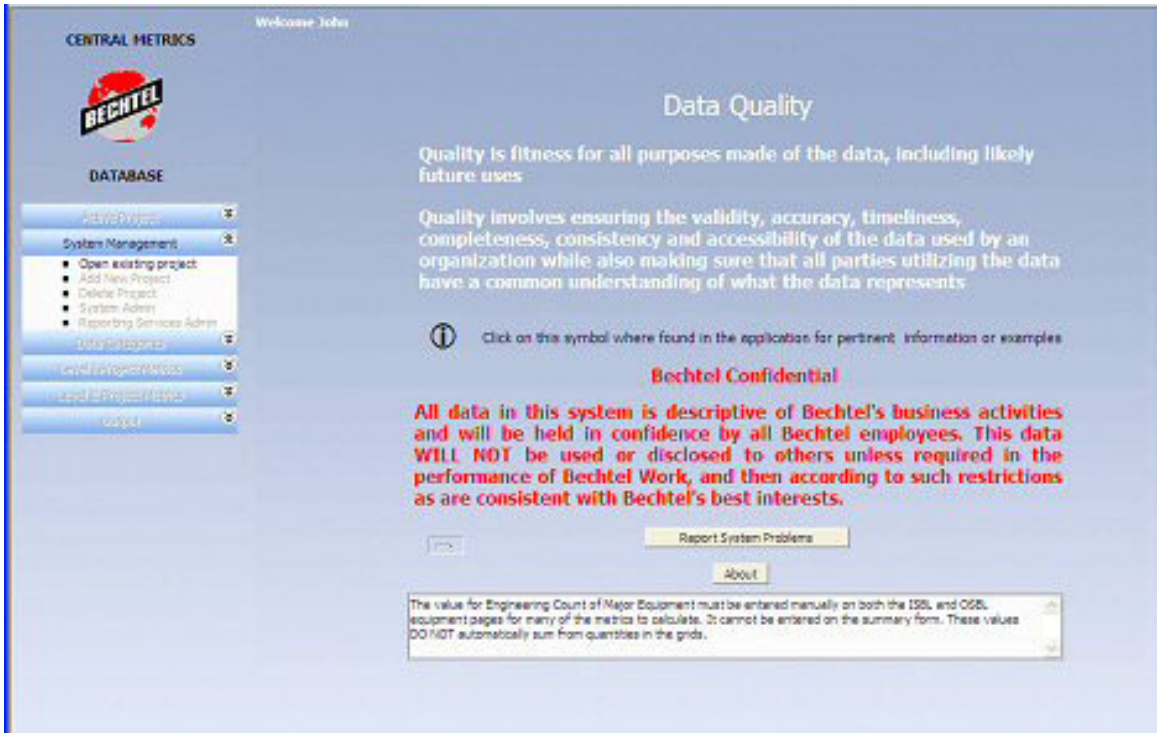

Figure 2 – CMD Opening Screen

The project selection screen is shown in figure 3.

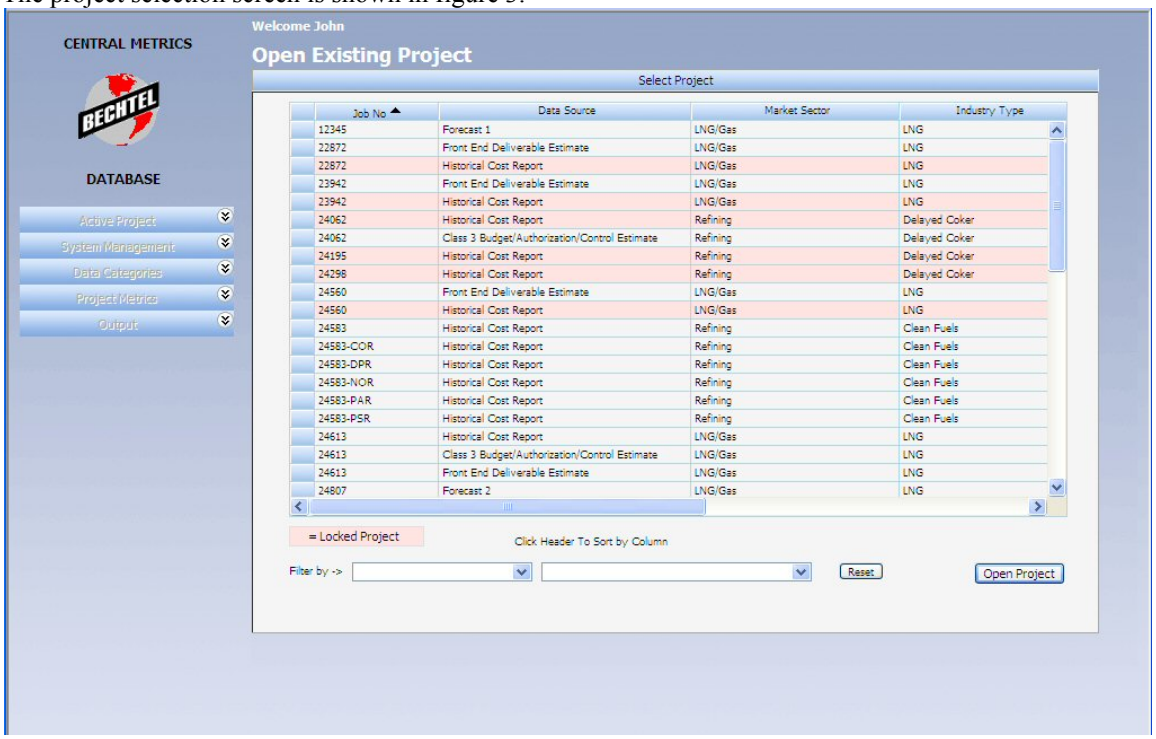

Figure 3 – Open Existing Project

The project summary screen is presented in figure 4. Also shown are the data category selections previously mentioned, Appendix C.

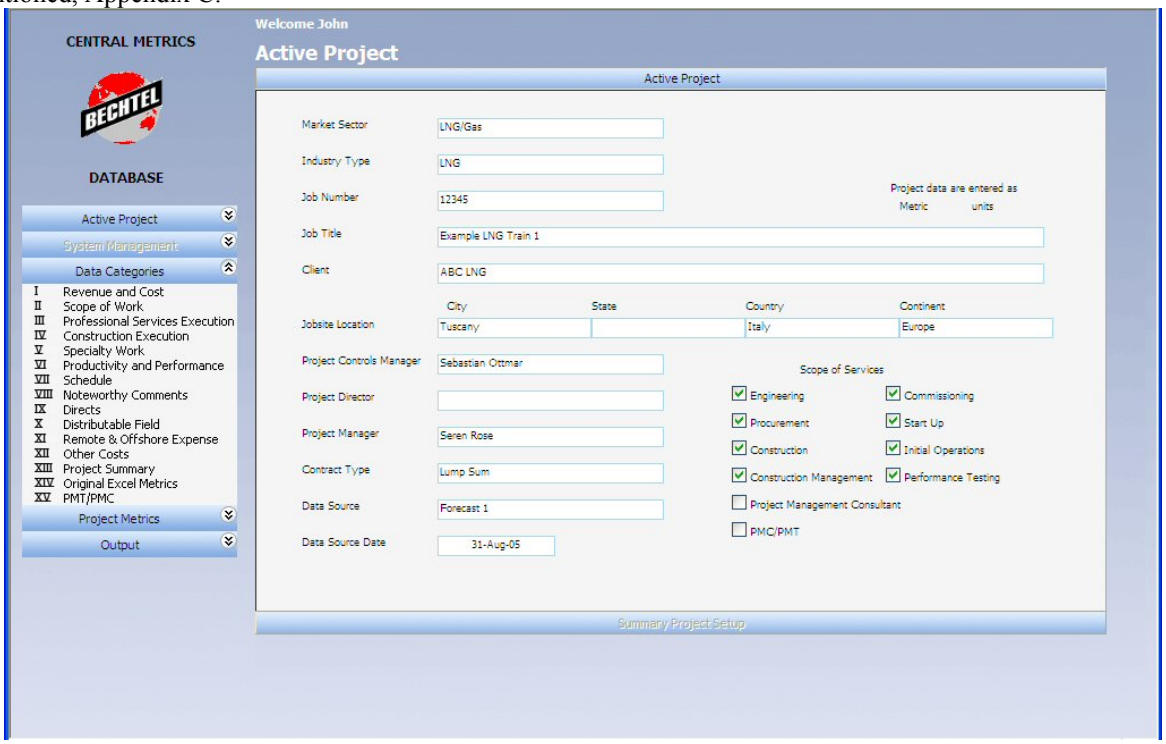

Figure 4 – Active Project Data Categories

The CMD implementation environment includes the following:

- an SQL Server 2005 Database;
- visual Studio Development Suite, including
  - VB.net
  - ASP.net
  - ADO.net; and
- SQL server reporting services 2005 for report development.

Database security was implemented using form authentication to set program permissions based on the users' corporate email user name and CMD user program level assignment. Each employee may thus be assigned specific permissions to read, write, print reports, or print comparison reports for individual projects.

Bechtel OG&C has focused recently on specific process technologies, so input templates were created for each of them.

These included the following:

- natural gas liquefaction (LNG);
- liquid regasification (Regas);
- delayed coking (Coker); and
- integrated combined cycle gasification (IGCC).

An additional generic template was created for data entry of projects using other process technologies. The technology-specific templates were created to permit unique parametric variables for project identification, detailed work scope and default schedule milestones.

One of the significant challenges of any database project is actual data population. Previous "Red Sheet" data, which had been converted to a Microsoft Access database, was loaded into the CMD. This effort was complicated because several different copies of the Access database existed with different project data, "multiple versions of the truth". The CMD has eliminated this problem by retaining all data in a single database.

Data entry was accomplished using both project controls and estimating personnel. To avoid disagreements regarding data validity each project's project controls manager (PCM) is required to validate the data and certify its completion and accuracy. This single point of responsibility has produced the major benefit that certified project data is no longer questioned for its accuracy. Once the PCM has validated the project data the project is "locked" by the system administrator from further changes, and is identified to the user as a validated project. To support ongoing operations, data entry and validation into the CMD is now a part of standard Project Controls' procedures.

…THEY WILL COME.

The initial success of the CMD and its acceptance and support from senior management provided direction for development of additional features.

In 2007, a request for printed reports and printed project comparisons was made. Figure 5 presents the report selection screen.

Figure 5 – Report Selection

Additions to project metrics calculations were also made to include both bulk material cost per piece of major equipment and bulk material cost as a percentage of major equipment cost. Metric screen forms were created to display these values, and new comparison reports were created. Custom reports for comparison of construction indirects and home office jobhours were developed for senior management evaluation.

For 2008, development efforts are focusing on creating functionality to permit summary level mega-projects to be segregated by major subproject or contract. That is, a mega-refinery expansion project might include several stand-alone units such as a coker, a hydrotreater and a naphtha unit. Because each of these units may be managed by independent project management teams, an ability to view their data independently has been requested. This feature will permit each subproject's data to be used in project comparison reports with other units of the same process technology. The data in these "child" projects is summed to populate the information for the mega-project. Additionally, the mega-project may have its own supervisory contract and budget for monitoring and reporting.

Also, in 2008, Bechtel OG&C's web applications are expected to migrate to Microsoft Sharepoint. This will necessitate some rework of the programs and security modules, as normally occurs during major software environment updates.

Finally, there is exploration of automatic data transfer from the project cost control system, ePCWorks, directly into the CMD. The benefits in decreasing job-hours for data population, reducing data entry errors, and increasing accuracy by electronic data transfer may be substantial.

The level of detail included in the CMD, while an accurate replacement of the "red sheets," is not totally adequate for OG&C's Estimating requirements and senior management's requests for even greater levels of detail. To that end an expansion of some of the input forms and reports is being drafted.

REFERENCES

1. Pickett, Todd W. and Bruce G. Elliott, "*Transforming Historical Project Data into Useful Information,"* **2007 AACE International Transactions**, AACE International, Morgantown, WV.
2. Ibid, p. 2.
3. Ibid.
4. Ibid.
5. "*Cost Estimate Classification System,"* Revision August 1997, **AACE International Recommended Practice No. 17R-97**, AACE International, Morgantown, WV
6. Pickett, Todd W. and Bruce G. Elliott, "*Transforming Historical Project Data into Useful Information,"* **2007 AACE International Transactions**, AACE International, Morgantown, WV, p. 4.
7. Ibid

Note: There is no "Appendix A" with this paper. The author only cites Appendices B and C.

APPENDIX B – BECHTEL OG&C "RED SHEET" CATEGORIES

project summary;
TIC cost breakdown - original, current and forecast budgets;
total cost breakdown by ISBL and OSBL forecast;
project wage rates;
schedule data;
total job-hours – home office and construction;
material quantity unit rates;
project metrics;

APPENDIX C – BECHTEL OG&C CENTRAL METRICS DATABASE INFORMATION CATEGORIES

1. revenue and cost;
2. scope of work;
   a. ISBL;
   b. OSBL;
   c. marine facilities; and
   d. pipelines.
3. professional services execution;
4. construction execution;
   a. construction methodology;
   b. significant subcontracts;
   c. labor force;
   d. work schedule;
   e. wage rates;
   f. direct subcontract cost makeup;
   g. camp facilities; and
   h. field non-manual job-hours.
5. specialty work;
6. productivity and performance;
7. schedule;
   a. schedule summary;
   b. schedule milestones – engineering;
   c. schedule milestones – procurement; and

   d. schedule milestones – construction.
8. noteworthy comments;
   a. comments; and
   b. changes to scope.
9. direct costs;
   a. ISBL bulks;
   b. ISBL equipment;
   c. ISBL WBS structure;
   d. OSBL bulks;
   e. OSBL equipment; and
   f. OSBL WBS structure.
10. distributable field costs;
11. remote and offshore expenses;
12. other costs;
   a. other project costs; and
   b. escalation, contingency, fee and other costs .
13. project summary;
14. original excel metrics; and
15. PMT/PMC.

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