Auditing mega projects: Data analysis
Established in 1931

One of the top 20 largest accounting and advisory firms in the United States according to Accounting Today’s 2013 list of “Top 100 Firms”

More than 1,600 professionals

Baker Tilly Virchow Krause, LLP is the largest US Baker Tilly International independent member firm

Baker Tilly International is the eighth largest public accounting network with representation in more than 131 countries

Convenient, seamless resource for worldwide needs
From **concept** and **funding** to **controls** and **compliance**, Baker Tilly has more than 250 dedicated construction and real estate industry professionals to assist with your facility development project through all stages of the development lifecycle.
Today’s topics:

- Testing programs
- Tool sets
- Data sources
- Data challenges
Learning objectives

> Understand data management challenges
> Identify project data pools
> Differentiate different data types
> Identify data analytics tools
> Recognize when to use data analytics tools
Using automated or computer aided tools to perform routine tests, computations and tasks

> Quantitative tests
  - Labor rate computation
  - Overtime hours analysis
  - Duplicate payment testing

> Qualitative tests
  - Missing documentation
  - Change order authorization
  - Trend analysis

> Document management
What is NOT data analytics?

- Replacement for a thorough audit program
- Substitute for human review
- The answer to inadequate staffing and experience
- Easier than manual compilation and computations; however, it may be faster
When to use automated tools

- High quality and accurate data capture is faster than manual entry
- When the time saved through automated techniques exceeds set up, testing and data capture time
- Accuracy achieved through automation exceeds manual analysis and quality review
Data management challenges

- Volume of data
- Efficient storage, search and retrieval of data
- Variety of data types
- Data quality and integrity
- Differentiating between source documents and compiled documents
- Cloud-based computing
- Data security
Objective: Build a project data library that can be queried for quantitative and qualitative analysis.
A prerequisite to successful data analytics is an ability to locate the data we want to analyze.

Therefore, we need to capture and store project documentation in a manner that enables an auditor to efficiently locate and retrieve source documents.
## Data warehousing overview

### Transactional Systems

<table>
<thead>
<tr>
<th>Finance</th>
<th>Materials Management</th>
<th>Sales &amp; Marketing</th>
<th>Purchasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logistics</td>
<td>Production Planning</td>
<td>Human Resources</td>
<td>Manufacturing</td>
</tr>
</tbody>
</table>

### Analytical Applications

<table>
<thead>
<tr>
<th>Strategic Analysis</th>
<th>Operational Analysis</th>
<th>Profitability Analysis</th>
<th>Performance Mgmt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment justification</td>
<td>Process costing</td>
<td>Business unit</td>
<td>EVA / SVA</td>
</tr>
<tr>
<td>Value chain alliances</td>
<td>Reengineering</td>
<td>Customer / Channel</td>
<td>Customer satisfaction</td>
</tr>
<tr>
<td>Product development</td>
<td>Internal benchmarking</td>
<td>Product / Brand</td>
<td>Quality, cost &amp; time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Financial Reporting &amp; Analysis</th>
<th>Budgeting/Forecasting</th>
<th>Customer Relationship Mgmt</th>
<th>Knowledge Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidations</td>
<td>Sales</td>
<td>Customer demographics</td>
<td>Intranet strategy</td>
</tr>
<tr>
<td>External reporting</td>
<td>Margins</td>
<td>Consumer demographics</td>
<td>Skills Inventory</td>
</tr>
<tr>
<td>Tax reporting</td>
<td>Volumes</td>
<td>Market share/penetration</td>
<td>Document management</td>
</tr>
</tbody>
</table>

### System Integration

<table>
<thead>
<tr>
<th>Data Map/Common Data Model</th>
<th>Extract, Transform &amp; Load</th>
<th>Systematize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rules and logic</td>
<td>Data feeds</td>
<td>Data storage</td>
</tr>
<tr>
<td>Universal chart of accounts</td>
<td>Data conversion</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Process classification scheme</td>
<td>System interfaces</td>
<td>Maintenance &amp; automation</td>
</tr>
<tr>
<td>Key volumes/non-financial data</td>
<td>Customizations</td>
<td></td>
</tr>
</tbody>
</table>

### Delivery Mechanisms

<table>
<thead>
<tr>
<th>Intranet / Web-deployed</th>
<th>Groupware</th>
<th>Microsoft Applications</th>
<th>Hard Copy Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intranet / Web-deployed</td>
<td>Groupware</td>
<td>Microsoft Applications</td>
<td>Hard Copy Reports</td>
</tr>
</tbody>
</table>

### Systematize

| Data storage | Infrastructure | Maintenance & automation | |
|--------------|----------------|---------------------------|
Data storage architecture: Audit life cycle model

- **Pre-Planning**
  - Statements of work
  - Contracts
  - Contractor due diligence

- **Planning**
  - Interviews
  - Policy documents
  - Budgets
  - Audit programs

- **Fieldwork**
  - Testing results

- **Reporting**

- **Quality Review**
Data storage architecture: Construction life cycle model

Proof of concept
- ROI computations
- Lender’s requirements
- Stakeholder requirements

Design

Pre-construction
- Engineering
- Procurement
- Planning

Construction

Commissioning

Turnover
Data storage architecture: Data source model

Owner
- Contracts
- Purchase orders
- A/P data
- Policies and procedures
- Oversight reports

EPC
- Engineering
- Procurement
- Construction
- Change orders
- Pay applications

Subcontractor
- Contracts
- Change orders
- Pay applications
- Claims

Controls Agent
- PM handbook
- Schedules
- Progress reports
- Claims

Commissioning Agent
- Control schedules
- Test results
- Audit reports

Audit Documents
- Control schedules
- Test results
- Audit reports

Claims
- Pay applications
- Change orders
- Construction
- Procurement
- Engineering

Owner
- Contracts
- Purchase orders
- A/P data
- Policies and procedures
- Oversight reports

EPC
- Engineering
- Procurement
- Construction
- Change orders
- Pay applications

Subcontractor
- Contracts
- Change orders
- Pay applications
- Claims

Controls Agent
- PM handbook
- Schedules
- Progress reports
- Claims

Commissioning Agent
- Control schedules
- Test results
- Audit reports

Audit Documents
- Control schedules
- Test results
- Audit reports
<table>
<thead>
<tr>
<th>Document search and management engine tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; Adobe</td>
</tr>
<tr>
<td>&gt; MS Windows</td>
</tr>
<tr>
<td>&gt; Sharepoint</td>
</tr>
<tr>
<td>&gt; SQL Server</td>
</tr>
<tr>
<td>&gt; MS Access</td>
</tr>
<tr>
<td>&gt; Google search engine</td>
</tr>
<tr>
<td>&gt; Yahoo search engine</td>
</tr>
<tr>
<td>&gt; Oracle/Primavera project management</td>
</tr>
<tr>
<td>&gt; Viewpoint</td>
</tr>
<tr>
<td>&gt; SAP</td>
</tr>
<tr>
<td>&gt; Meridian/Trimble</td>
</tr>
<tr>
<td>&gt; Tririga/IBM</td>
</tr>
<tr>
<td>&gt; IBMNotes/Domino</td>
</tr>
</tbody>
</table>
SEO is not just for your website but for your document management system as well.

Documents that are keyworded will enhance your search capabilities and dramatically speed up document retrieval.
A few basic steps are all that is necessary to achieve successful source document keywording:

- Build a master keyword dictionary. Keywords are typically based on the kind of information in the document.
  - Contract
  - Payroll
  - Employee

- Tag the documents with the keywords
  - Automated
  - Manual
When keywords are not an option consider using standard file naming conventions that include:

> Creation date
> Version
> Creator
> WBS reference
Project documentation examples

- Contracts
- Policies and procedures
- Applications for payment
- Progress reports
- Time sheets
- Payroll reports
- Employee rosters
- Handwritten logs
  - Job site sign in sheets

- Equipment specifications
- Material specifications and certifications
- Permits
- Inspection reports
- RFI logs
- Controls schedules
- Change orders
- Job cost ledgers
Source documents are usually made available to the auditor in the format most convenient to the document owner/author.

The practical reality to an auditor is we *rarely* get documents in Excel or MS Access enabling data analytics.

And when we do, the arithmetic still needs to be verified before we can rely on the document.
Below is a list of the most commonly available data types

- Paper
- Portable document format (pdf)
- MS Excel spreadsheet
  - With formulas
  - Values only
- Scanned images
- MS Word
- MS Access
- CAD files
## Data conversion tools

- IDEA
- ACL
- Monarch
- Adobe
- AutoCad LT
- Manual data entry

## Conversion Considerations

- Document clarity
- Document layout
- Document source
  - Handwritten
  - Computer generated
- Quality review time
Data pools

> Payables
  - Invoices
  - Check registers
> Time sheet
> Change orders
> Control logs
  - RFI logs
  - Personnel rosters
> Purchase orders

> Job cost ledger
> Emails and attachments
> Correspondence
Computer enhanced testing

Accounts payable

> Duplicate payment testing
> P.O. and invoice reconciliation
> Authorization limit testing
  – 5% pattern test
  – 10% pattern test
> Payment date compliance
> Lien waiver reconciliation
> Pattern testing
  – Clustered transactions
Job cost ledger

- Cost shifting
- Budget shifting
- Transaction date compliance
  - Timing difference reconciliation
- Accrual reconciliation
- Overbilling / Underbilling analysis
Direct labor

> Billing rate compliance
> Overtime compliance
> Staffing and personnel compliance
  – Ghost employees
> Charge time patterns
> Certified payroll compliance
> Economic benchmarking
  – Job creation
  – WBE/DBE compliance
  – Geographic spend analysis
Change orders

- Duplicate value queries
- Summation queries
- Duplicate text queries
- Mismatched dates
- Aging reports
  - Length of time to approve a change
  - Length of time between multiple levels of approval
- Inconsistent pricing
  - Markups
  - Unit rates
  - Labor rates
Computer enhanced testing

- Missing documentation
- Missing authorizations
- Substitute authorizations
Case study: Rework

Rework is the cost to repair or replace defective workmanship.

Facts
> Custom manufactured valves are installed under an EPC contract
> Valve tests fail and the cause is determined to be a defective valve

Results
> Manufacture replaced the valve at the manufacture’s cost
> Subcontractor issued a change order to the EPC to reinstall the valve
> EPC passed through a change order to the Owner to reinstall the valve that included fees for CM, bond, insurance and general conditions.
Case study: Rework

Audit program

> Review contract to determine who is responsible for replacement valve installation
> Query job cost ledger for manufacture credits
> Query job cost ledger for backcharges to manufacturer
> Query A/P ledger for payment to subcontractor

Results

> EPC is responsible for defective work and equipment
> EPC backcharged the manufacture for the cost of reinstallation
> Owner denied change order approval to EPC
> Subcontractor was paid and lien waiver obtained for change order work
Case study: Force majeure

Facts

> EPC contract provides for economic relief due to severe weather conditions outside typical expected conditions for the construction zone.

> Over the last twelve months:
  - 14 workdays were lost due to rain and wind conditions
  - 5 additional workdays were lost due to a hurricane and post hurricane recovery
  - Photos of the jobsite after each weather event were posted to the project SkyDrive

Result

> EPC submits a change order to the owner for:
  - 19 days of schedule relief due to weather delays
  - Labor and equipment to clean up and restore the site to pre-storm conditions
  - Cost of equipment and materials lost or damaged during the storms
Case study: Force majeure

Audit program

> Review force majeure terms and conditions
> Query the SkyDrive for the job site damage photos and log the event dates
> Query the SkyDrive for the job site photos documenting the job site prior to the weather events
> Query the National Weather Service and verify storm dates and locations
> Reconcile weather events with force majeure terms and conditions
> Query the time sheet database and extract labor entries for the weather event periods
> Reconcile material and equipment damage with job site photos and collaborating source documents
> Verify labor change orders with EPC and subcontractor change order terms
Results

> 10 of the 14 workdays lost resulted from typical weather for the area
> Change order included labor for people not affected by the weather
  – Engineering and procurement people that are not based at the job site
> Job site photos showed the storm damaged materials were not secured according to the severe weather guidelines for the job site
> Change order price was renegotiated to reflect actual cost due to force majeure
> 9 days of schedule relief was issued
> Costs resulting from the hurricane were submitted for insurance reimbursement
Should an EPC contractor collect CM fees on change orders due to material delays?

A. Yes
B. No

*Please respond using the polling section in the WebEx screen to the right.*
Case study: Material delays change order

Facts

> Subcontractor work was suspended due to critical path material delays
> Subcontractor issued a change order for two days of standby labor, equipment and general conditions
> EPC prepared a change order to the Owner for the subcontractor costs plus CM, insurance, bonds and general conditions fees
> EPC was responsible for the procurement of construction materials
> Material supplier added an expedited processing fee to the material costs
> Subcontractor redeployed crews to other work at the job site.
Audit program

> Verify subcontractor standby labor time
> Verify subcontractor standby equipment time
> Re-compute general conditions
> Review EPC contract for supply chain logistics responsibility
> Review supply delivery reports to verify delayed material deliveries

Results

> Subcontractor standby costs were supported by the time sheets and equipment logs
> Additional general conditions were denied because the two days of standby time did add to the subcontractor’s general conditions costs
> EPC was denied fees for the change order. EPC was responsible for procurement and timely delivery of materials.
Questions?

Reminder: To qualify for the CPE credit, you must complete the evaluation form at the end of the webinar.

Visit bakertilly.com/construction-audit-webinar for recordings of today’s presentation and other topics in this series.
Pursuant to the rules of professional conduct set forth in Circular 230, as promulgated by the United States Department of the Treasury, nothing contained in this communication was intended or written to be used by any taxpayer for the purpose of avoiding penalties that may be imposed on the taxpayer by the Internal Revenue Service, and it cannot be used by any taxpayer for such purpose. No one, without our express prior written permission, may use or refer to any tax advice in this communication in promoting, marketing, or recommending a partnership or other entity, investment plan, or arrangement to any other party.

Baker Tilly refers to Baker Tilly Virchow Krause, LLP, an independently owned and managed member of Baker Tilly International. The information provided here is of a general nature and is not intended to address specific circumstances of any individual or entity. In specific circumstances, the services of a professional should be sought. © 2012 Baker Tilly Virchow Krause, LLP