12-2015

Process improvement of Crane Compliance Using Agile Methodology

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by

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A Starred Paper

Submitted to the Graduate Faculty of

St. Cloud State University

In Partial Fulfillment of the Requirements

for the Degree

Master of Engineering Management

December, 2015

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Abstract

XYZ Corp has business operations spread all over world in Australia and North America. It owns nearly 20,500 cranes and the number been increasing daily resulting in difficulty in their maintenance and compliance check. This need to be handled and the process need to be automated for handling cranes compliance checks. Self-service should be enabled by implementing SSAS Tabular model.

Acknowledgments

I am introducing you to my capstone project; this project document wouldn't have been possible without the valuable guidance and support from many individuals and organizations.

I would like to take this opportunity to thank Dr. Hiral Shah, Associate Professor, for Engineering Management Program, at St. Cloud State University without whose support, encouragement, and guidance this project would not have been a reality.

It gives me an immense pleasure to thank Dr. Ben Baliga, Professor and Graduate Director for Engineering Management Program, at St. Cloud State University for his support and guidance.

Also, I would like to thank Prof. Balsy Kasi for serving on the committee and support throughout the project.

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Chapter 1: Introduction

Introduction

XYZ Corp started in 1884 as a masonry company and has grown into one of the largest and most respected construction, mining, and engineering organizations in North America and beyond. XYZ Corp is committed to safety, quality and the environment, which is reflected in our core values: people, integrity, excellence, and stewardship.

The XYZ Corp's workforce includes more than 12,000 core staff and 21,000 skilled craft workers, totaling over 33,000 employees. XYZ Corp is a private company, owned by active employees, creating a level of motivation that keeps the company on top. HCL Global Systems offers services to Kiewit in a variety of markets, successfully delivering some of the most challenging projects. Some of the markets they include:

- Power
- Transportation
- Oil, gas, and chemical
- Building
- Mining
- Water / wastewater

As a construction, mining, and engineering leader, XYZ Corp is a Fortune 250 company with revenues more than $11.8 billion. XYZ Corp is consistently ranked among Engineering News-Record's Top 10 contractors. With no operational long-

term debt, XYZ Corp's strong balance sheet offers clients the assurance that their projects will get completed.

Problem Statement

In order for the Regional Managers to take a business decision they had a little information about the number of cranes that were assigned for their projects. A manager would have to raise a IT Request and follow a IT process to dig into SAP ECC tables for getting the information about upcoming monthly and annual inspections and their meter readings, and counts the number of exceptions (If a meter reading is recorded without Daily Visual Inspection DVI or Cranes in storage recording meter reading are considered as Exceptions). Information about cranes that were in storage mode was also missing.

Nature and Significance of the Problem

Regional Managers, to take a business decision, have little information about the number of cranes that were assigned for the projects and they have to dig into SAP ECC tables for getting the information about upcoming monthly and annual inspections and their meter readings, and count the number of exceptions. It also needs to get the information about the crane that is stored in particular projects. To achieve this Regional Manager need to raise an IT Request and it will be assigned to a developer and developer takes 2-3 business working days in gathering the requested information and preparing a report.

Now, business and its operations have been expanded worldwide, the legacy procedure in finding the same has become difficult in getting the information and

making decision on it. This legacy manual procedure takes about 2-3 days in collecting the information which is a lot of time.

Objective of the Project

The objectives of the project were:

- Reducing the time for collecting information which is a manual process by automating the same.
- Reducing the time required for processing a report to less than 1 minute.
- To create an environment where users can generate customized reports.

Project Questions

- What is the need for SSAS Tabular Model Crane Compliance? What are its benefits?
- What are the benefits of automating the compliance checks?
- What is the need of making this tool as self-service?
- What are the stages/ phases of Implementation and Testing?
- What are the acceptable date ranges for this tool to work effectively?
- What are the security levels for accessing the tool?

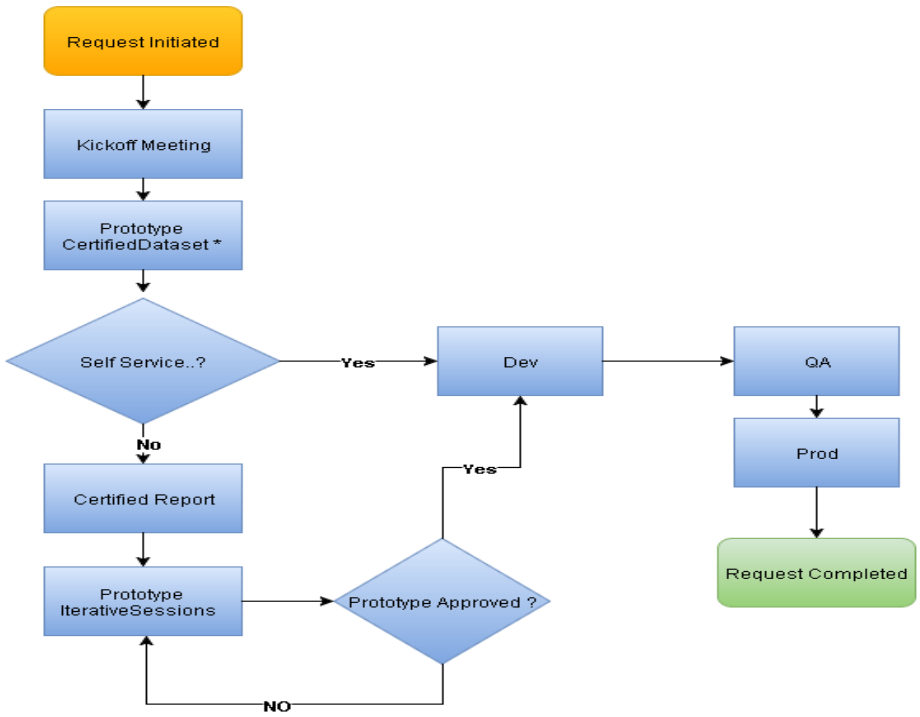
Chapter 2: Background and Review of Literature

Introduction

This chapter focuses towards reviewing the literature of the problem, literature related to the methodology that has been implemented in the process of solving the problem and the background of Company XYZ Corp and the issues related to it.

Literature Review

This review presents the methods that the researchers will undertake in the conduct of the study with the system development life cycle as basis. Figure 1 illustrates the process in implementing a project.



* Rapid iterative process requires dataset identification and certification using stage data as source during analysis with business.

** Development script finalization happens after prototype approved, prior to QA. (Example: new tables, stored procedures, functions, views).

Figure 1: Illustration of the Process of Implementing a Project (Kiewit, 2015)

Kick-off meeting: Once a request is received by the DART team and there is bandwidth to begin working, the DART team should schedule a SQ1D (Square 1 Discussion) with their business partners to begin eliciting the user story and requirements. This is also the time that Project Manager will discuss the availability of resources and come up with a high level plan (Kiewit, 2015).

The deliverable from this meeting is the drafting of an elicitation or formal functional requirements document. The objective is to obtain enough information to build base level queries to review for first iteration of working sessions. This starts the prototyping process.

Prototyping/mock-ups: One of the most important procedures to create a successful report is to create a prototype/mock-up early on. It is the responsibility of the Business Analyst and Developer to initiate the prototype during the initial working sessions. Several tools are available to create prototypes: SSRS/Tableau/Excel/Etc. All report requests should have a mock-up, along with any other pertinent information about the functionality requested on the report. Use the mock-up to gain buy in from the business. The data should be as representative of production as possible, this will help eliminate re-work when the report is moved to production (Kiewit, 2015).

Prototype–certified dataset: The initial prototype sessions will be to work through the required dataset. Developer will use their local desktop, pulling in stage data as a source. This provides a mirror of production for collaboration with the business ensuring the right tables, elements, and expected output is identified. This will ensure successful report prototyping sessions to follow (Kiewit, 2015).

Prototype–certified report: Report prototyping is also a collaborative effort for the Business Analyst, the Developer and the Business. The Business Analyst will be documenter of these sessions. Once a semi-working prototype is available the business may ask for access. Developer will distribute to Dev environment, and continue to point to stage data. Business representative will need access to the Dev server. The Developer will not code any changes until the business is ready to approve the prototype and disable the semi-working stage version. This is to avoid two active versions of code for the same business object (Kiewit, 2015).

Quality assurance testing: Once prototype is approved, Developer will finalize coding and complete unit testing. Once complete Developer will move version to code to QA environment, and Business Analyst will review output product for accuracy, usability, and quality. The business will follow with use case testing and data validation. If there is need for performance testing, such as report or query processing time; the report can be moved to stage environment to work through these inefficiencies in a production-like environment. Once the collaborative group as a whole approves the report, it can be scheduled for deployment (Kiewit, 2015).

Background of the Problem

The XYZ Corp includes more than 12,000 core staff and 21,000 skilled craft workers, totaling over 33,000 employees. XYZ Corp owns a total of 52,527 equipment including cranes of all type, vehicles used at the construction zones. This number of owned equipment had been increasing.

Table 1: Number of Equipment and Cranes Owned by XYZ Corp on Yearly Basis

S. NO	Year NO	No of Owned EQP	No of Cranes
1	2010	18,638	2765
2	2011	24,439	3468
3	2012	27,892	5468
4	2013	33,673	9776
5	2014	37,088	12076
6	2015	55,098	20479

Earlier number of cranes were less and owing the cranes and renting them to other projects is a part of the XYZ Corp's business As the number were increasing the maintenance become difficult by the regional managers who owns it. Cranes has a huge liability when compared to other types of equipment. So it needs to be properly handled and maintained.

Earlier process involved in crane compliance: XYZ Corp manages the Regions and Regions owns the equipment and assigns to the projects.

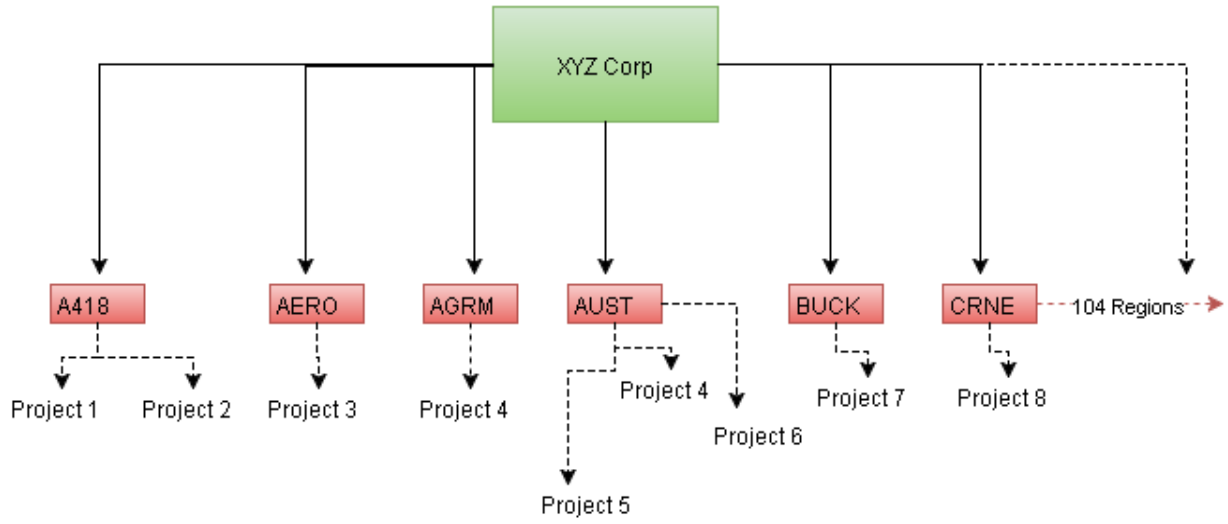


Figure 2: Illustration of the XYZ Corp's Project Hierarchy Tree

XYZ Corp has 104 Regions where its operations were performed. These 104 Regions were assigned with a separate Regional Manager that looks after the business of that Region. A Region Manager of a Region decides the projects and assignment of equipment for the project. In a region there might be multiple projects handled. If a region is short of equipment then it can get equipment from other Region and if a Region has equipment that is having no use in the current project then it can rent that piece of equipment to other company that is outside XYZ Corp. Here is the list of Regions of XYZ Corp. Figure 3 illustrates the list of Regions of XYZ Corp.

A418 - LDG A-418 DYKE	GULF - GULF INTERCOSTAL CONST	KIWM - KIEWIT-WEEKS-MASSMAN JV; GOETHALS(2016)
AERO - AERO AUTOMATIC/JET PIPE	HSMC - HAYSTACK MINING CO	KLEQ - KEARL LAKE EQUIP
AGRM - AGRIUM MINING CO	KALM - KIEWIT-ALARIE-LOWER MATTTAGAMI	KMEN - KIEWIT/MASON/EBC/NEILSON
AHDS - KMC/PCL (AHDSP INTERCHANGE)	KBAC - KBAC CONSTRUCTORS AJV, EQ	KNUV - KIEWIT-NUVUMIUT (RAGLAN/MINING
AKJV - ABRAMS KIEWIT JOINT VENTURE	KBAM - KIEWIT BRIDGE AND MARINE	KOS1 - OFFSHORE 1 EQUIPMENT SERVICES
AUS1 - AUSTRALIA 1 EQUIPMENT SERVICES	KBGP - KIEWIT BUILDING GROUP	KOSV - KIEWIT OFFSHORE SERVICES
AUST - AUSTRALIA	KCJV - KC CONSTRUCTORS JV; ARKENDALE (2034)	KPHT - KPH TURCOT (CO 2051)
BUC1 - BUCKSKIN MINING (CO 1330)	KECA - KIEWIT ENERGY - CANADA	KPJV - KIEWIT PITTMAN JV (CO 2032)
BUCK - BUCKSKIN MINING	KECO - KECO- CONSTRUCTION SERVICES	KPWC - KIEWIT POWER CONSTRUCTORS
CADR - CANADIAN RESOURCES	KEUS - KIEWIT ENERGY - US	KPWE - KIEWIT POWER ENGINEERS
CHCO - CHERNE CONTRACTING	KFCI - KIEWIT/FCI MANSON (BAY BRIDGE)	KSEQ - KIEWIT/SUNDT, AJV MISC EQUIP
CLKI - CLARK/KIEWIT III (PROJECT 3)	KFCV - FCV-KIEWIT CONSTRUCTORS	KSSD - KIEWIT/SUNDT, SAN DIEGO AIRPORT
CNT1 - CENTRAL 1 EQUIPMENT SERVICES	KGRU - GRUE PG-KIEWIT, A PARTNERSHIP	KWG1 - KIEWIT GENERAL MASON JV (CO 1563)
CNTR - CENTRAL	KIAE - KIAE - KIEWIT-AECON (CO 2062)	KWGM - KIEWIT GENERAL MASON JV
CONT - CONTINENTAL FIRE ALARM	KIAL - KIEWIT-ALARIE	KWPH - KIEWIT PHELPS JV (2004)
COVE - IHI/KIEWIT COVE POINT JV (2015)	KIAU - KIEWIT-AUSTIN (CO 2059)	MAR1 - MARINE 1 EQUIPMENT SERVICES
CRNE - CRANE SERVICES	KIBB - KIEWIT-BILFINGER BERGER	MARY - MARYSTOWN
EAST - EASTERN	KICS - KIEWIT INTEGRATED CONSTRUCTION SOLUTIONS	MATL - MATERIALS
ECA1 - EQUIPMENT SERVICES CANADA 1	KIED - KIEWIT-ELLISDON, A PRTRSHP EQ	MD20 - MD200 CONSTRUCTORS
ECAD - EASTERN CANADA	KIFL - KIEWIT/FLATIRON (PORTMANN)	MECI - MEC INDUSTRIAL
ECR1 - EQUIPMENT SERVICES CRANE 1	KIHP - KIEWIT/HERZOGS/PARSONS	MECT - MEC TRANSPORTATION
EHC1 - EQUIPMENT SERVICES HEAVY CIVIL 1	KIKV - KIEWIT-KVAERNER CONSTRUCTORS	MING - MINING
EST1 - EAST 1 EQUIPMENT SERVICES	KIMT - KIEWIT LOUISIANA, MASSMAN, TRA	MTT1 - MTT EQUIPMENT SERVICES (CO 2012)
GANT - GANOTEC	KIPA - KIEWIT-PARSONS (A-25)	MTTE - MTT EQUIP SERVICES (CO 2012)
GNTW - GANOTEC WEST	KISD - KIEWIT SHEA DESAL JV (1569)	NCAL - NORTHERN CALIFORNIA
KIWK - KIEWIT CONSTRUCTORS/WEEKS MARI	KISH - KIEWIT SHEA CONST JV (CO. 2067)	NGAT - NORTHGATE CONSTRUCTORS
NGT1 - NORTHGATE CONSTRUCTORS (CO 1486	SEST - SOUTHEAST	TCWE - TIC- WESTERN
NWST - NORTHWEST	SGAT - SOUTHGATE (CO 2038 & 2039)	TCWY - TIC- WYOMING
PCCP - PCCP CONSTRUCTORS, AJV	SMMC - SAN MIQUEL MINING CO	UNAS - UNASSIGNED
PWR1 - POWER 1 EQUIPMENT SERVICES	SPZ1 - SPECIALIZED FLEET EQUIPMENT SERVIES	UNGD - UNDERGROUND
SCAL - SOUTHERN CALIFORNIA	SWST - SOUTHWEST	VTCO - VALLEY TRANSIT CONSTRUCTORS
SCNT - SOUTH CENTRAL	TCCA - TIC- CANADA	WCAD - WESTERN CANADA
TCIB - TIC- IBBERSON	TCMA - TIC – MARINE	WCMC - WALNUT CREEK MINING
TIC1 - TIC 1 EQUIPMENT SERVICES	TCSO - TIC- SOUTHERN	WST1 - WEST 1 EQUIPMENT SERVICES
	TCSW - TIC- SOUTHWEST	WSUM - WESTERN SUMMIT

Figure 3: Illustration of the List of Regions of XYZ Corp

XYZ Corp uses the SAP ERP for its operations. As cranes has huge liability. It needs to have compliance check on regular basis like Monthly Inspections and Annual Inspections and Daily Inspections. In case of any malfunction it needs to be serviced. The tasks in Daily Vehicle Inspection (DVI) are different from Monthly Inspections (MBI) and Annual Inspections (CRN). DVI is an auto check performed if it was used in a day. It takes meter reading before starting work and oil checks and suspensions check and informs the ERP systems through telematics. Cranes are made up of different parts and each part has its own individual life. For suppose tires has a life of 1 years and Crank has a life of 3 years and all these parts are inspected by Monthly Inspection MBI.

Literature Related to the Problem

Regional Manager is responsible for crane compliance and if they found any non-compliance in assigned crane then it should not be assigned to any project till it gets fixed. If an inspection is done for a crane then it will be available in the ERP tables. And Regional Manager to see the list of cranes that is non-compliant has to follow business process in raising an IT request. Figure 4 illustrates the legacy reporting process before implementation (Kiewit, 2015).

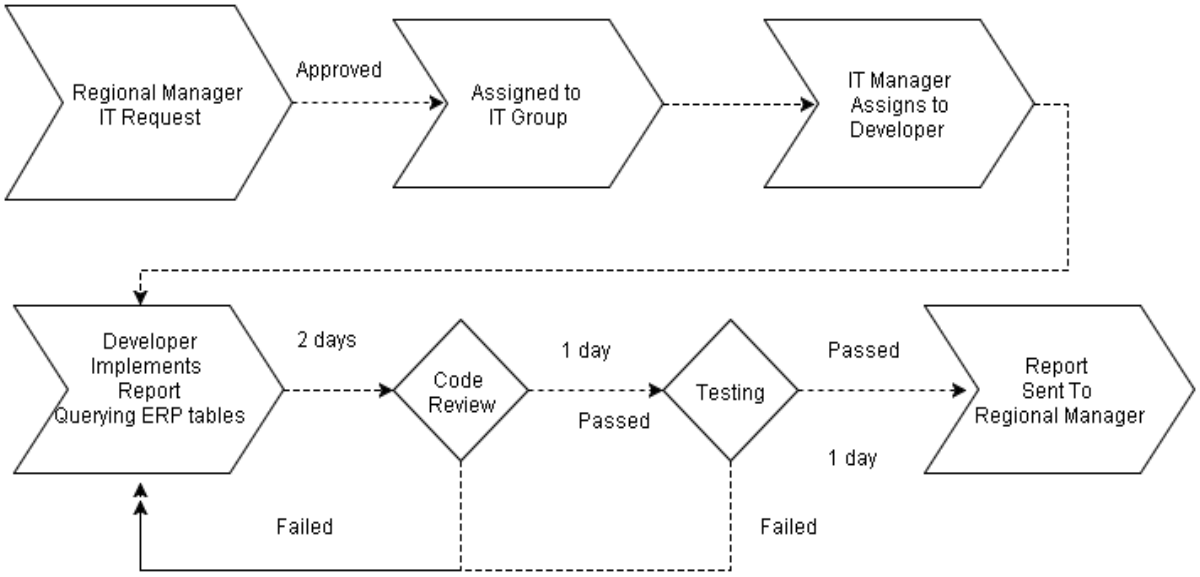


Figure 4: Illustration of the Legacy Reporting Process before Implementation

It takes 7 business days to run a compliance report if there were no bugs in the testing and implementation. Regional Manager needs to wait for 2-3 days to take decision to assign a crane to projects or to check cranes that were already assigned to the projects. And the report delivered to Regional Manager is a excel spread sheet. Regional Manager has to separate the DVI, MBI and CRN for each piece of crane and he also need to check if that crane is in storage. If a crane is in storage then it has no DVI, CRN, MBI checks. This is needed to be done for all the 104 Regions in every month.

NON Compliant conditions for Regional Managers:

1. If crane is in storage and a DVI is reported.
2. If crane is not in storage and meter readings recorded for a day even if the DVI is not reported.

3. MBI missing in a month.
4. CRN missing in a year.

This takes another day for Regional Manager to find out cranes that were non-compliant in his Region.

The Report Implementation steps takes 2 days to relate the corresponding tables in ERP and query execution time high on ERP when queried using BOBJ. Figure 5 illustrates the ER-Diagram of ERP tables for Crane Compliance Legacy Report.

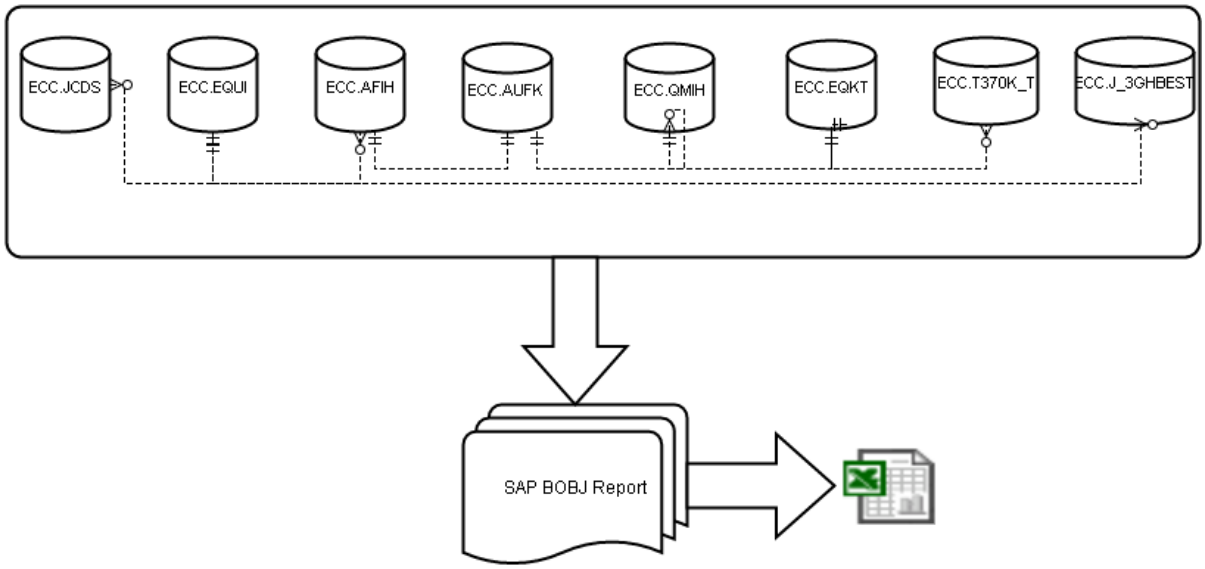


Figure 5: Legacy ER-Diagram for Crane Compliance

Since it's a ODS system INMON methodology, SAP BOBJ takes 15-20 minutes to process a query. This should be repeated for all 104 Regions every month on request.

Literature Related to the Methodology

In 2012, Microsoft released a TABULAR MODEL product in Analysis Services where it can be used on OLTP systems and also on any dimensional model. Tabular Model is an OLAP system which uses In-Memory column oriented data storage. It uses x-Velocity engine (Turley, 2013).

The best futures of this tabular model includes:

- There is no doubt that in-memory; tabular model technology is the promise of the future. It just makes sense. Several vendors have come to the same conclusion and are developing products following this paradigm.
- Data residing and processed in memory is faster than data residing in disk. This is what VertiPaq does; whether implemented as PowerPivot, an SSAS tabular model or as a SQL Server column store, it works efficiently and elegantly without the complexities and overhead of indexes, partitions, file groups and other techniques typically used to optimize on-disk data stores.
- PowerPivot models upgrade seamlessly to tabular models. This provides a path for business users and IT professionals to author models in familiar tools (Excel or Visual Studio) and then promote them to a server hosted environment.
- Tabular models are managed and stored by SQL Server Analysis Services! Although some components of the tabular engine and the designer are new and still have wrinkles to be ironed-out, the core product is based on

the solid and time-tested foundation of SSAS. This means that many of the features not implemented now will be available in future builds.

- Client applications that support SSAS multidimensional will also support tabular. In fact, any application built to work with SSAS cubes will natively work with PowerPivot and tabular as if it were a cube. This is because SSAS tabular uses the same data provider that understands both MDX and DAX queries.
- The core VertiPaq (or x-Velocity) query and aggregation engine is stable and reliable. Originally developed about 5 years ago and released with PowerPivot for Excel and SharePoint in SQL Server 2008R2 over 3 years ago, this technology has proven to be ready for serious use.
- Under most conditions, for analytic reporting, data scanned and aggregated from an in-memory data structure performs faster than other conventional options; including relational and multidimensional storage.
- Tabular can be less complex than multidimensional, OLAP SSAS. The core design and usage concepts are easier for both those who design models and for those uses use them for analysis and reporting.
- Tabular models can be easier and faster to implement because the model structure is simpler and there may be fewer steps in the design process (Turley, 2013).

Tabular model using the OLTP database: There are very rare situations in which data can flow directly from the OLTP to the analytical data model. Under most conditions, for analytic reporting, data scanned and aggregated from an in-memory data structure performs faster than other conventional options; including relational and multidimensional storage.

Building an analytical solution is complex work that starts with the correct design for the data marts. If you have a dimensional data mart, you have a database that holds dimensions and fact tables in which you can perform cleansing and computations. We need a place to cleanse the data. If you rely solely on the OLTP database, building complex queries upon it, you might finish your first data model in less time, but the structure of the queries to the OLTP database will be so complex that we will lose all the time you saved at the first new implementation. DAX, the core calculation expression language for tabular models, is fairly easy to learn. Fundamental DAX expression concepts can be easier to understand than equivalent MDX commands used in multidimensional modeling and calculations (Turley, 2013; Microsoft, Inc., 2015).

In this project the OLTP systems are the ERP Systems and this cannot be directly taken as the source for the tabular model until it is processed further on a particular granularity.

Now, in this project the methodology, OLTP systems is the source to tabular model and process data to our OLAP systems and then generate reports using Microsoft SQL Server Reporting Services SSRS.

OLAP source connections: SSAS-Tabular Model can connect to different sources like MS SQL Server, SQL Azure, Oracle, and Teradata and so on. Figure 6 illustrates the OLAP Source connection wizard of the SSAS Tabular Model in BIDS.

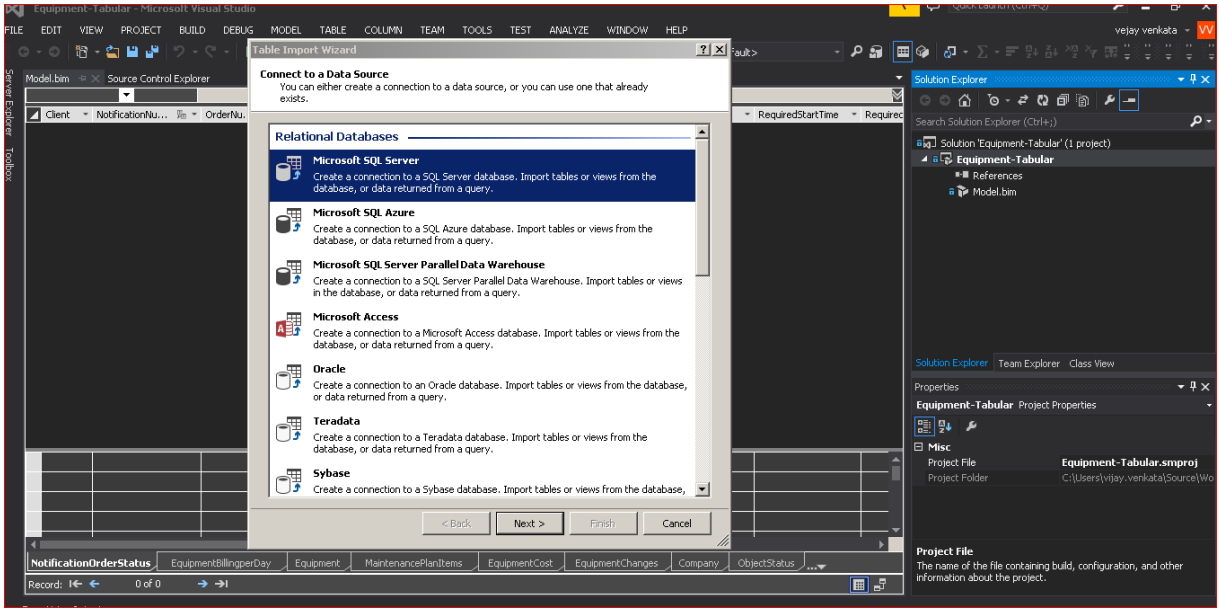


Figure 6: OLAP Source Connections

SAP ERP OLTP tables replicated in MS SQL server tables: Figure 7 illustrates the selected SAP ERP tables which were replicated in SQL Server from SAP Source Systems.

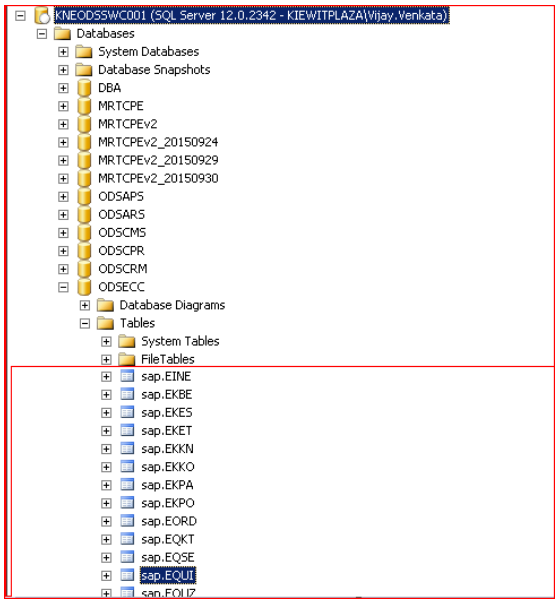


Figure 7: SAP ERP Tables Replicated in SQL Server

Transformation, data cleansing on SAP replicated tables and creating views on some required granularit: Figure 8 illustrates list of Views and stored procedures that were built on the replicated tables.

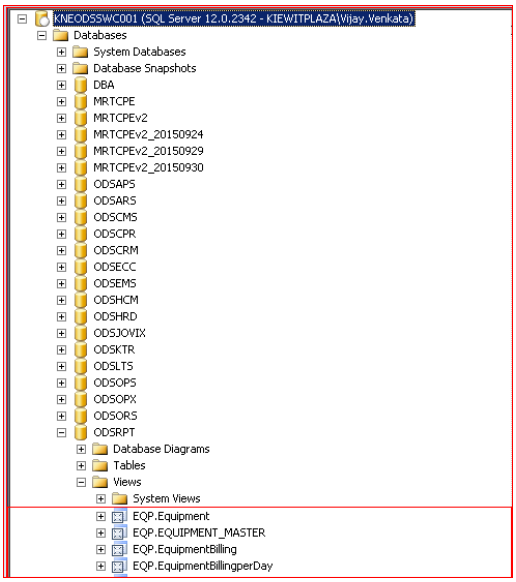


Figure 8: Views and Stored Procedure on SAP Tables

SQL server reporting services Figure 9 illustrates the design mode of the report using SDK with BIDS.

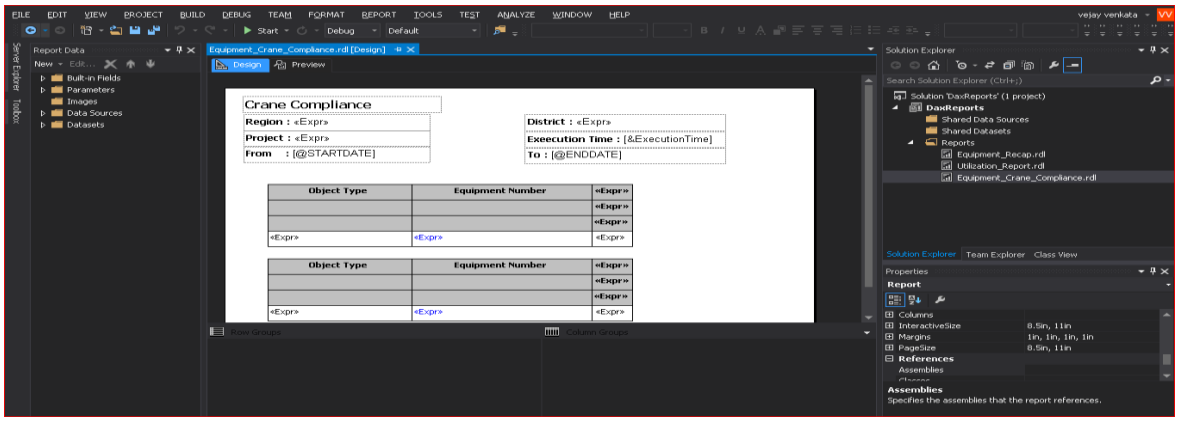


Figure 9: SSRS Report

Summary

This chapter focuses more in making readers to understand more about the literature related to problem and background literature review of methodology.

Chapter 3. Methodology

Introduction

In this SSAS Tabular model methodology, various steps were involved to measure the accomplished objective. The SSAS Tabular model methodology gives particulars about the every step of the development process. Main steps involved in the Project are the investigation, the approach, the methods used in gathering the necessary data and the development of analyzing this data (Russo & Ferrari, 2012). The most critical part of implementation of Crane Compliance involves proper architectural design for the implementation itself.

Design of Study

Once a request is received by the DART team and there is bandwidth to begin working, the DART team should schedule a SQ1D (Square 1 Discussion) with their business partners to begin eliciting the user story and requirements. This is also the time that Project Manager will discuss the availability of resources and come up with a high level plan (Kiewit, 2015).

The deliverable from this meeting is the drafting of an elicitation or formal functional requirements document. The objective is to obtain enough information to build base level queries to review for first iteration of working sessions.

The main tasks identified to start the project after kick-off meeting are in defining the objectives, identifying the potential challenges, finalizing the architectural design and work assignment to the team accounting the skillset (Kiewit, 2015).

An implementation plan was built for the project. The contents required for this project building are:

1) Architectural design.
2) Defining views and stored procedures on replicated SAP tables.
3) Tabular Model Implementation.
4) SSRS Reporting Implementation.
5) Tabular Model daily Refreshing schedule.

Steps involved in implementation measurements are as follows:

1) Deploy entire project to server.
2) Final validation and time should be measured on every report executions.
3) Reconciliation of the project should be performed.

Data Collection

The OLTP system tables were replicated in MS SQL Server database and by creating views and stored procedures on the top of replicated tables' acts as the source for the tabular model to process data. After the tabular model is processed we build a SSRS report on top of this OLAP system. This SSRS report URL will be published. And to track the time of execution of the report on the new implemented project is done with a standard report that is available in the SSRS to trace the time that is taken for a report for its execution. Figure 10 illustrates the high level architectural design plan of the implementation.

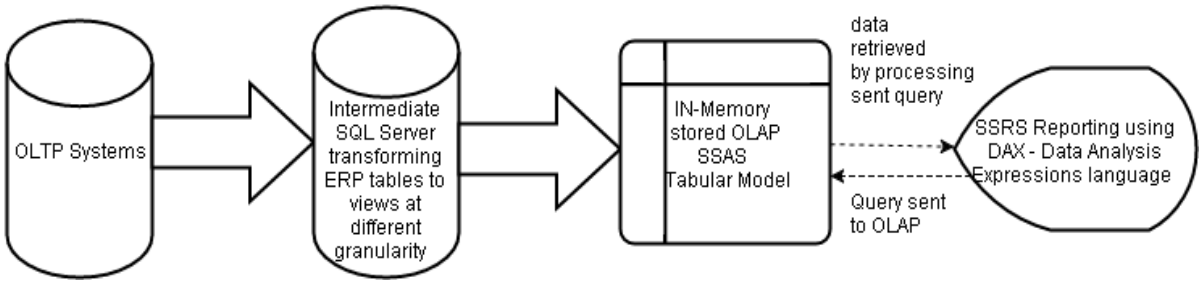


Figure 10: Architecture Plan

Creating views and stored procedures and declaring their granularity.

For implementation we created four views and one stored procedure.

Table 2: Lists of Views and Stored Procedures

S NO	Views/Stored Procedures	Granularity
1)	EQP.Equipment	Equipment level
2)	EQP.Projects	Project level
3)	EQP.usp_EquipmentStorageAnnualMontlyInspection]	Daily level for each piece of equipment.
4)	EQP.Calendar	Daily level
5)	EQP.EquipmentMeterReadings	On equipment and its time when meter readings were noted

Tabular Model Implementation: Creating a new solution file in SSAS Tabular model and selecting the source as the selected views and stored procedure and importing tables into model and defining relationships among them and deploying into the Analytical Server. Figure 11 illustrates the SSAS Tabular model in diagram pane listing the required tables.

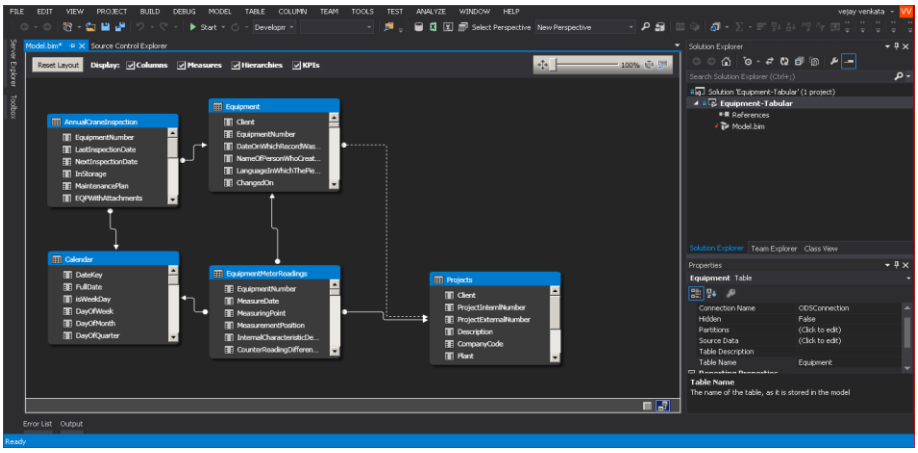


Figure 11: Tabular Model

Data analyze with SSRS Report: SSRS is a reporting tool that can be used to analyze the data. SSRS report need to be setup initially and should be defined properly to get the required look and feel.

1) Select source server.

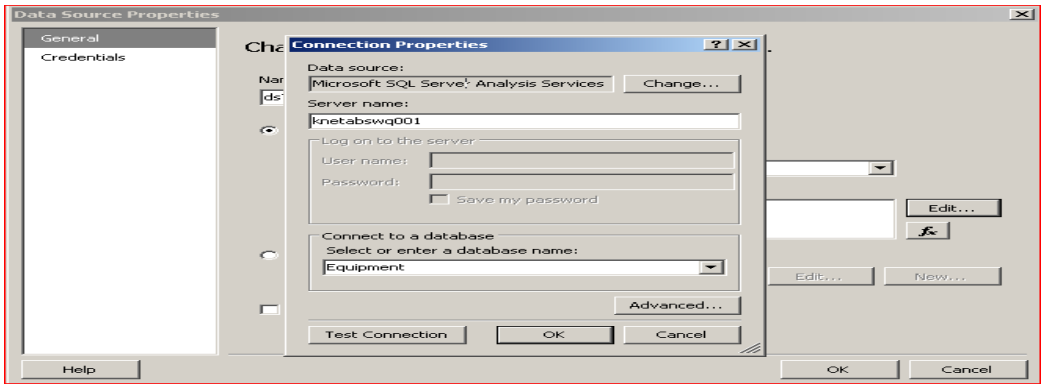


Figure 12: Illustration of the Connection Properties of the Report in the Data Source Properties Wizard

2) Define the input parameters that were used for report. Figure 13 illustrates the required Input parameters of the report to execute.

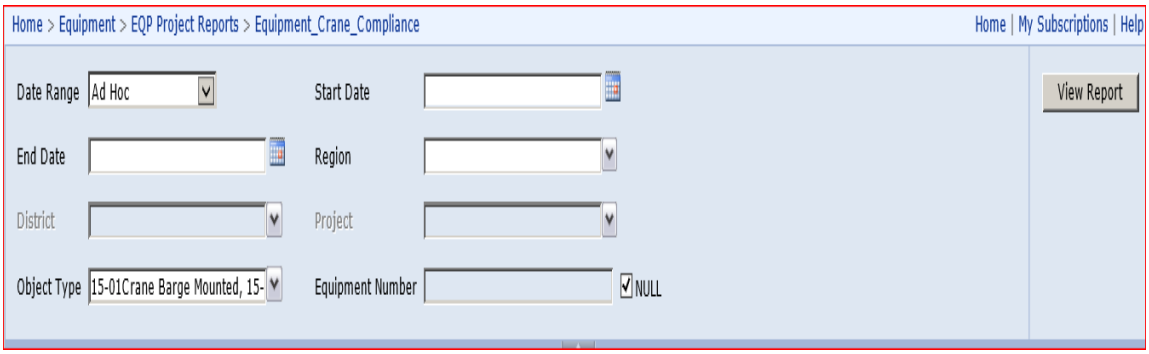


Figure 13: Illustration of the Required Input Parameters of the Report to Execute

3) Generate an analytical query using DAX to get the required dataset based on the selected input parameters. Figure 14 illustrates the DAX Query in the dataset of SSRS Report.

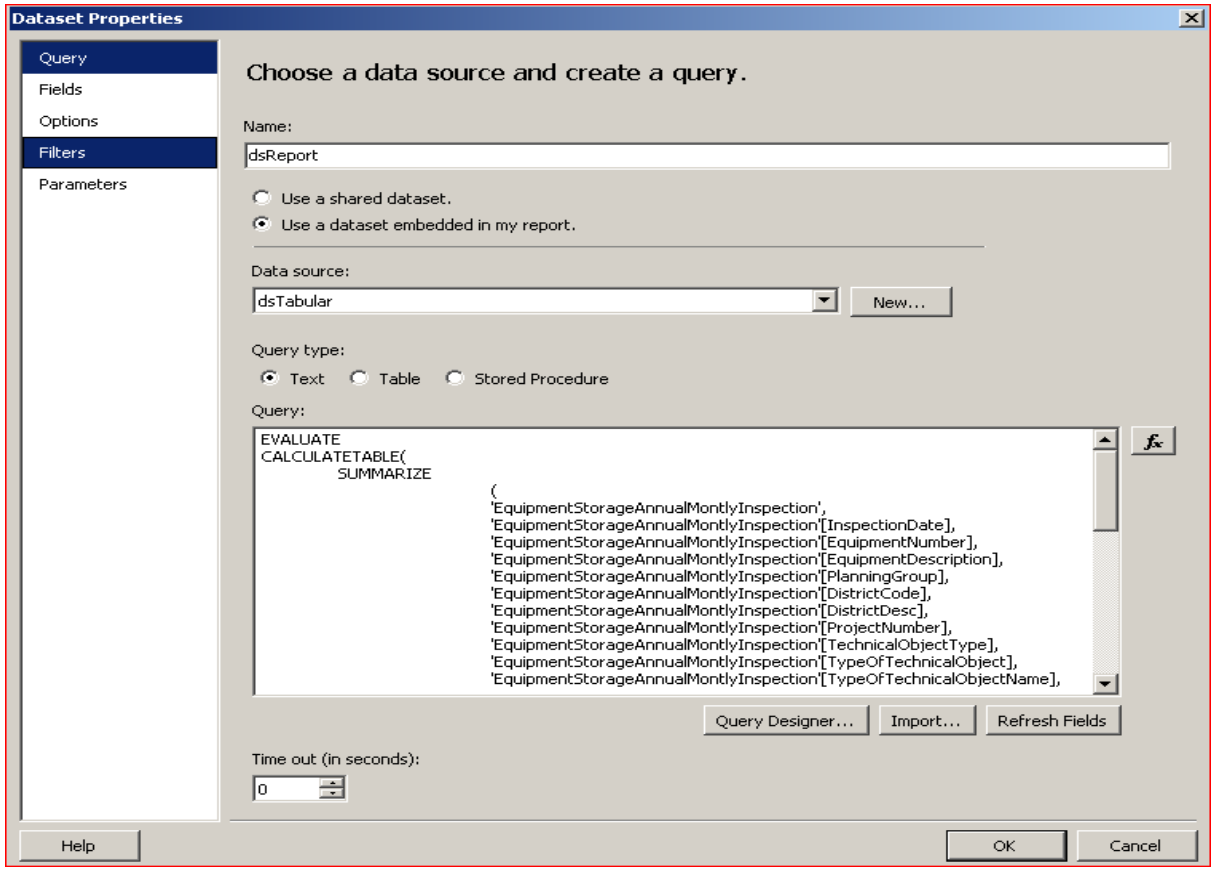


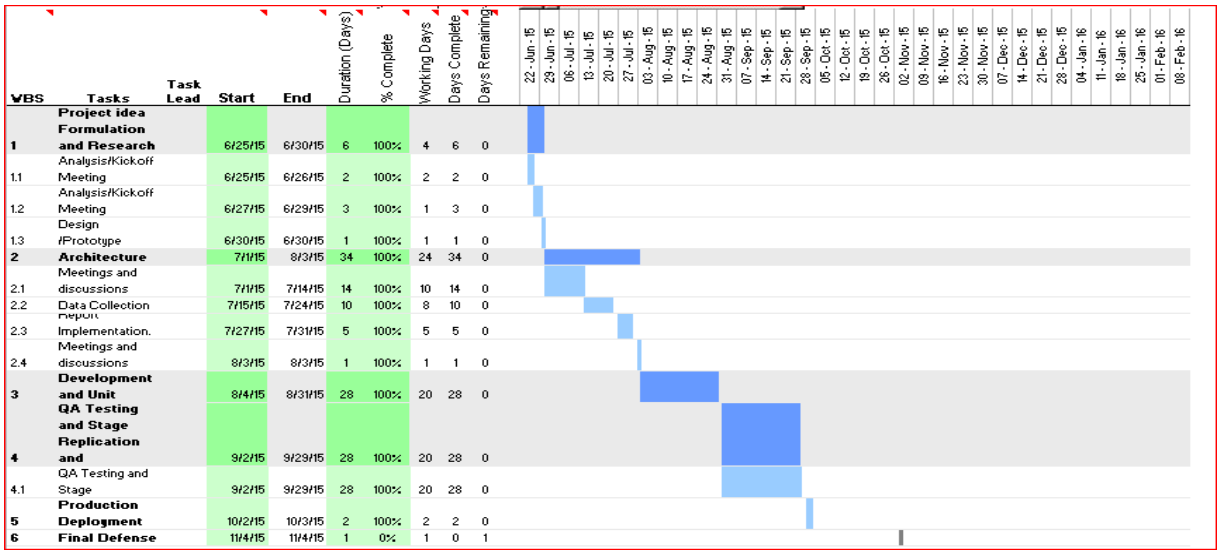
Figure 14: Illustration of the DAX Query in the Dataset of SSRS Report

Timeline

Table 3 gives the information of the project timeline. Figure 15 illustrates the Gantt chart Project Schedule.

Table 3: Timeline of Project

SNO	*Task Name*	*Duration*	*Start*	*Finish*
	Crane Compliance implementation using SSAS Tabular Model in a software development firm	***72 days***	***04/03/2015***	***09/03/2015***
1.	Project idea Formulation and Research	2 days	06/25/2015	06/26/2015
2.	Analysis/Kickoff Meeting	1 days	06/29/2015	06/29/2015
3	Design /Prototype Iterative Sessions	1 day	06/30/2015	06/30/2015
4.	Architecture plan	9 days	07/01/2015	07/10/2015
5	Meetings and discussions	2 days	07/13/2015	07/14/2015
6.	Data Collection	8 days	07/15/2015	07/24/2015
7.	Report Implementation.	5 days	07/27/2015	07/31/2015
8.	Meetings and discussions	1 day	08/03/2015	08/03/2015
9.	Development and Unit Testing	20 days	08/04/2015	09/01/2015
10.	QA Testing and Stage Replication	20 days	09/02/2015	09/30/2015
11.	Production Deployment	2 day	10/02/2015	10/03/2015
12.	Final Defense	1 day	11/04/2015	11/04/2015



WBS	Tasks	Task Lead	Start	End	Duration (Days)	% Complete	Working Days	Days Complete	Days Remaining
1	**Project idea Formulation and Research**		6/25/15	6/30/15	6	100%	4	6	0
1.1	Analysis/Kickoff Meeting		6/25/15	6/26/15	2	100%	2	2	0
1.2	Analysis/Kickoff Meeting		6/27/15	6/29/15	3	100%	1	3	0
1.3	Design /Prototype		6/30/15	6/30/15	1	100%	1	1	0
2	**Architecture**		7/1/15	8/3/15	34	100%	24	34	0
2.1	Meetings and discussions		7/1/15	7/14/15	14	100%	10	14	0
2.2	Data Collection		7/15/15	7/24/15	10	100%	8	10	0
2.3	Report Implementation.		7/27/15	7/31/15	5	100%	5	5	0
2.4	Meetings and discussions		8/3/15	8/3/15	1	100%	1	1	0
3	**Development and Unit**		8/4/15	8/31/15	28	100%	20	28	0
4	**QA Testing and Stage Replication and**		9/2/15	9/29/15	28	100%	20	28	0
4.1	QA Testing and Stage		9/2/15	9/29/15	28	100%	20	28	0
5	**Production Deployment**		10/2/15	10/3/15	2	100%	2	2	0
6	**Final Defense**		11/4/15	11/4/15	1	0%	1	0	1

Figure 15: Illustration of the Gantt Chart Project Schedule

Summary

The purpose of this chapter is to explain in detail about the process of the project life cycle using crane compliance using SSAS Tabular methodology. It explains in detail the stages involved in the project implementation. The implementation and analysis techniques which best suited the project scope were detailed. This evaluation will help future implementation of same kind.

Chapter 4: Data Presentations and Analysis

Introduction

This chapter will focus on the data, interpretation and strategies used to analyze the efficiency of the new crane compliance implementation process. Also this chapter will give us a legitimate visual representation of objective evaluation.

Data Presentation

In this section we present the actual data that was collected.

Transformation of the views and stored procedures at different granularities:

1) EQP.Equipment View.

   Equipment View is created at the granularity of equipment level so there will be distinct rows for each of its equipment. Figure 16 illustrates the code behind the Equipment View at the granularity of Equipment. Figure 17 illustrates the result set obtained by executing View.

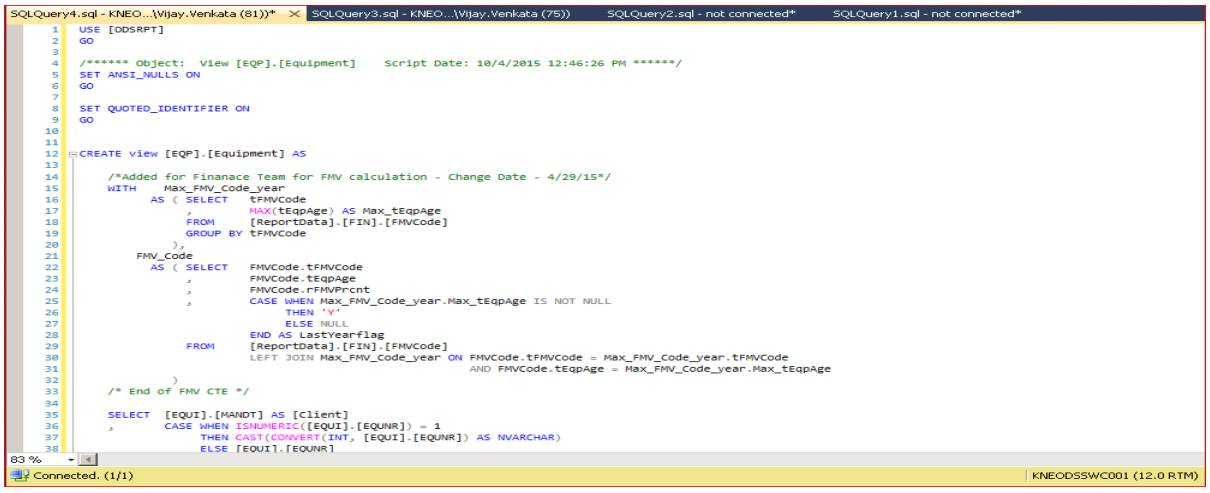
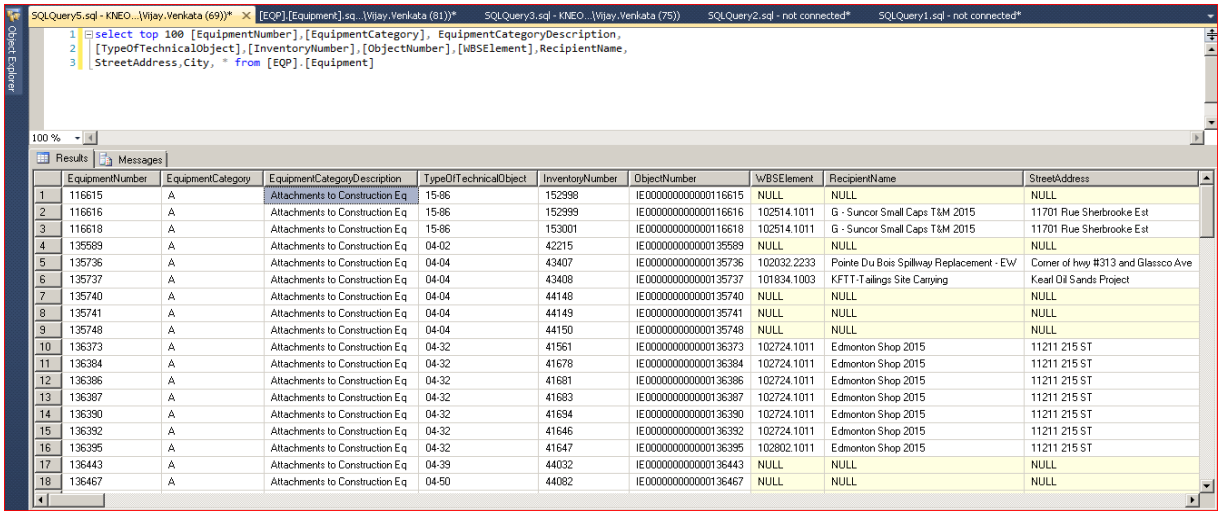


Figure 16: Illustration of the Code behind the Equipment VIEW

Actual Code:

[EQP].[Equipment].sql

Result set of this view:



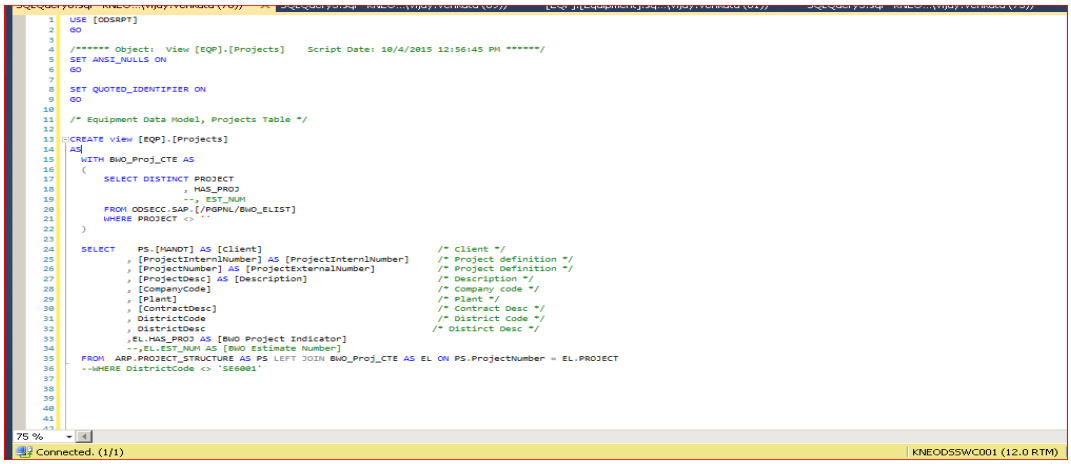
```
select top 100 [EquipmentNumber],[EquipmentCategory], EquipmentCategoryDescription,
[TypeOfTechnicalObject],[InventoryNumber],[ObjectNumber],[WBSElement],RecipientName,
StreetAddress,City, * from [EQP].[Equipment]
```

	EquipmentNumber	EquipmentCategory	EquipmentCategoryDescription	TypeOfTechnicalObject	InventoryNumber	ObjectNumber	WBSElement	RecipientName	StreetAddress
1	116615	A	Attachments to Construction Eq	15-86	152998	IE000000000000116615	NULL	NULL	NULL
2	116616	A	Attachments to Construction Eq	15-86	152999	IE000000000000116616	102514.1011	G - Suncor Small Caps T&M 2015	11701 Rue Sherbrooke Est
3	116618	A	Attachments to Construction Eq	15-86	153001	IE000000000000116618	102514.1011	G - Suncor Small Caps T&M 2015	11701 Rue Sherbrooke Est
4	135589	A	Attachments to Construction Eq	04-02	42215	IE000000000000135589	NULL	NULL	NULL
5	135736	A	Attachments to Construction Eq	04-04	43407	IE000000000000135736	102032.2233	Pointe Du Bois Spillway Replacement - EW	Corner of hwy #313 and Glassco Ave
6	135737	A	Attachments to Construction Eq	04-04	43408	IE000000000000135737	101834.1003	KFTT-Tailings Site Carrying	Kearl Oil Sands Project
7	135740	A	Attachments to Construction Eq	04-04	44148	IE000000000000135740	NULL	NULL	NULL
8	135741	A	Attachments to Construction Eq	04-04	44149	IE000000000000135741	NULL	NULL	NULL
9	135748	A	Attachments to Construction Eq	04-04	44150	IE000000000000135748	NULL	NULL	NULL
10	136373	A	Attachments to Construction Eq	04-32	41561	IE000000000000136373	102724.1011	Edmonton Shop 2015	11211 215 ST
11	136384	A	Attachments to Construction Eq	04-32	41678	IE000000000000136384	102724.1011	Edmonton Shop 2015	11211 215 ST
12	136386	A	Attachments to Construction Eq	04-32	41681	IE000000000000136386	102724.1011	Edmonton Shop 2015	11211 215 ST
13	136387	A	Attachments to Construction Eq	04-32	41683	IE000000000000136387	102724.1011	Edmonton Shop 2015	11211 215 ST
14	136390	A	Attachments to Construction Eq	04-32	41694	IE000000000000136390	102724.1011	Edmonton Shop 2015	11211 215 ST
15	136392	A	Attachments to Construction Eq	04-32	41646	IE000000000000136392	102724.1011	Edmonton Shop 2015	11211 215 ST
16	136395	A	Attachments to Construction Eq	04-32	41647	IE000000000000136395	102802.1011	Edmonton Shop 2015	11211 215 ST
17	136443	A	Attachments to Construction Eq	04-39	44032	IE000000000000136443	NULL	NULL	NULL
18	136467	A	Attachments to Construction Eq	04-50	44082	IE000000000000136467	NULL	NULL	NULL

Figure 17: Result Set of Equipment View

2) EQP.Project.

Project View is at the granularity of Project number and each row has information regarding its own project. Figure 18 illustrates the code behind the Project View at the granularity of Project. Figure 19 illustrates the result set obtained by executing View.



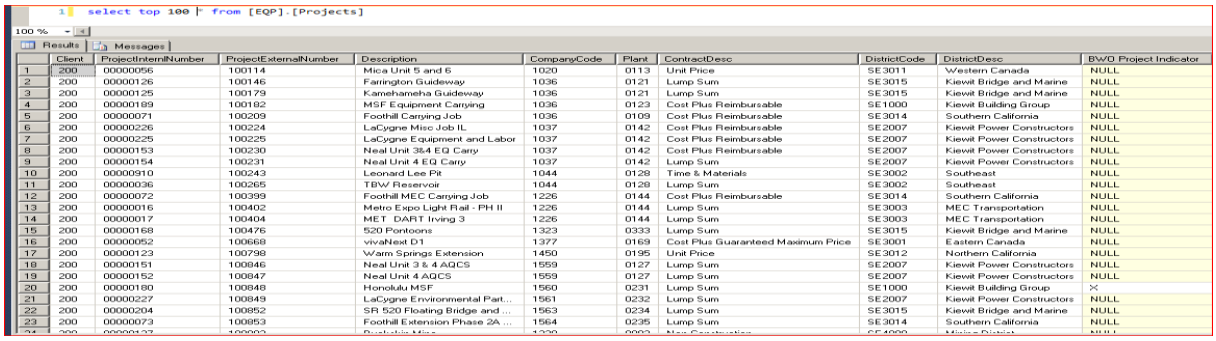
```
USE [ODSRPT]
GO

/****** Object:  View [EQP].[Projects]    Script Date: 10/4/2015 12:56:45 PM ******/
SET ANSI_NULLS ON
GO

SET QUOTED_IDENTIFIER ON
GO

/* Equipment Data Model, Projects Table */

CREATE view [EQP].[Projects]
AS
  WITH BWO_Proj_CTE AS
  (
      SELECT DISTINCT PROJECT
                    , MAS_PROJ
                    --, EST_NUM
      FROM ODSECC.SAP.[/PSPNL/BWO_ELIST]
      WHERE PROJECT <> ''
  )

  SELECT     PS.[MANDT] AS [Client]                              /* Client */
           , [ProjectInternlNumber] AS [ProjectInternlNumber]    /* Project definition */
           , [ProjectNumber] AS [ProjectExternalNumber]          /* Project definition */
           , [ProjectDesc] AS [Description]                      /* Description */
           , [CompanyCode]                                       /* Company code */
           , [Plant]                                             /* Plant */
           , [ContractDesc]                                      /* Contract Desc */
           , DistrictCode                                        /* District Code */
           , DistrictDesc                                       /* Distirct Desc */
           ,EL.MAS_PROJ AS [BWO Project Indicator]
           --,EL.EST_NUM AS [BWO Estimate Number]
  FROM  ARP.PROJECT_STRUCTURE AS PS LEFT JOIN BWO_Proj_CTE AS EL ON PS.ProjectNumber = EL.PROJECT
  --WHERE DistrictCode <> 'SE6001'
```

Figure 18: Code behind the EQP.Projects View

Actual Code of EQP.Projects

[EQP].[Projects].sql

Result Set of EQP.Projects View



```
select top 100 * from [EQP].[Projects]
```

Results | Messages

	Client	ProjectInternlNumber	ProjectExternalNumber	Description	CompanyCode	Plant	ContractDesc	DistrictCode	DistrictDesc	BWO Project Indicator
1	200	00000056	100114	Mica Unit 5 and 6	1020	0113	Unit Price	SE3011	Western Canada	NULL
2	200	00000126	100146	Farrington Guideway	1036	0121	Lump Sum	SE3015	Kiewit Bridge and Marine	NULL
3	200	00000125	100179	Kamehameha Guideway	1036	0121	Lump Sum	SE3015	Kiewit Bridge and Marine	NULL
4	200	00000189	100192	MSF Equipment Carrying	1036	0123	Cost Plus Reimbursable	SE1000	Kiewit Building Group	NULL
5	200	00000071	100209	Foothill Carrying Job	1036	0109	Cost Plus Reimbursable	SE3014	Southern California	NULL
6	200	00000226	100224	LaCygne Misc Job IL	1037	0142	Cost Plus Reimbursable	SE2007	Kiewit Power Constructors	NULL
7	200	00000225	100225	LaCygne Equipment and Labor	1037	0142	Cost Plus Reimbursable	SE2007	Kiewit Power Constructors	NULL
8	200	00000153	100230	Neal Unit 3&4 EQ Carry	1037	0142	Cost Plus Reimbursable	SE2007	Kiewit Power Constructors	NULL
9	200	00000154	100231	Neal Unit 4 EQ Carry	1037	0142	Lump Sum	SE2007	Kiewit Power Constructors	NULL
10	200	00000910	100243	Leonard Lee Pit	1044	0128	Time & Materials	SE3002	Southeast	NULL
11	200	00000036	100265	TBW Reservoir	1044	0128	Lump Sum	SE3002	Southeast	NULL
12	200	00000072	100399	Foothill MEC Carrying Job	1226	0144	Cost Plus Reimbursable	SE3014	Southern California	NULL
13	200	00000016	100402	Metro Expo Light Rail - PH II	1226	0144	Lump Sum	SE3003	MEC Transportation	NULL
14	200	00000017	100404	MET DART Irving 3	1226	0144	Lump Sum	SE3003	MEC Transportation	NULL
15	200	00000168	100476	520 Pontoons	1323	0333	Lump Sum	SE3015	Kiewit Bridge and Marine	NULL
16	200	00000052	100668	vivaNext D1	1377	0169	Cost Plus Guaranteed Maximum Price	SE3001	Eastern Canada	NULL
17	200	00000123	100798	Warm Springs Extension	1450	0195	Unit Price	SE3012	Northern California	NULL
18	200	00000151	100846	Neal Unit 3 & 4 AQCS	1559	0127	Lump Sum	SE2007	Kiewit Power Constructors	NULL
19	200	00000152	100847	Neal Unit 4 AQCS	1559	0127	Lump Sum	SE2007	Kiewit Power Constructors	NULL
20	200	00000180	100848	Honolulu MSF	1560	0231	Lump Sum	SE1000	Kiewit Building Group	X
21	200	00000227	100849	LaCygne Environmental Part...	1561	0232	Lump Sum	SE2007	Kiewit Power Constructors	NULL
22	200	00000204	100852	SR 520 Floating Bridge and ...	1563	0234	Lump Sum	SE3015	Kiewit Bridge and Marine	NULL
23	200	00000073	100853	Foothill Extension Phase 2A ...	1564	0235	Lump Sum	SE3014	Southern California	NULL

Figure 19: Result Set of Project View

3) EQP.Calendar.

Calendar is created at the granularity level of every day and it is used for cross applying project to get project information for every day. Figure 20 illustrates the code behind the Calendar View at the granularity of every day. Figure 21 illustrates the result set obtained by executing View.

```
USE [ODSRPT]
GO

/****** Object:  Table [ARP].[Calendar]    Script Date: 10/4/2015 1:04:37 PM ******/
SET ANSI_NULLS ON
GO

SET QUOTED_IDENTIFIER ON
GO

SET ANSI_PADDING ON
GO

CREATE TABLE [ARP].[Calendar](
    [DateKey] [int] NOT NULL,
    [FullDate] [datetime] NOT NULL,
    [isWeekDay] [bit] NOT NULL,
    [DayOfWeek] [int] NOT NULL,
    [DayOfMonth] [int] NOT NULL,
    [DayOfQuarter] [int] NOT NULL,
    [DayOfYear] [int] NOT NULL,
    [DayName] [varchar](25) NOT NULL,
    [WeekOfYear] [int] NOT NULL,
    [WeekName] [varchar](25) NOT NULL,
    [YearNo] [int] NOT NULL,
    [Year] [int] NOT NULL,
    [MonthOfYear] [int] NOT NULL,
    [MonthName] [varchar](25) NOT NULL,
    [CalendarQuarter] [int] NOT NULL,
    [CalendarQuarterName] [varchar](25) NOT NULL,
    [CalendarYear] [int] NOT NULL,
    [FiscalQuarter] [int] NULL,
    [FiscalQuarterName] [varchar](25) NULL,
```

Connected. (1/1) KNEODSSWC001 (12.0 RTM)

Figure 20: Code behind the EQP.Calendar

Actual Code

[ARP].[Calendar].sql

Result Set of the Calendar View

```
select top 100 * from [ARP].[Calendar]
```

Results | Messages

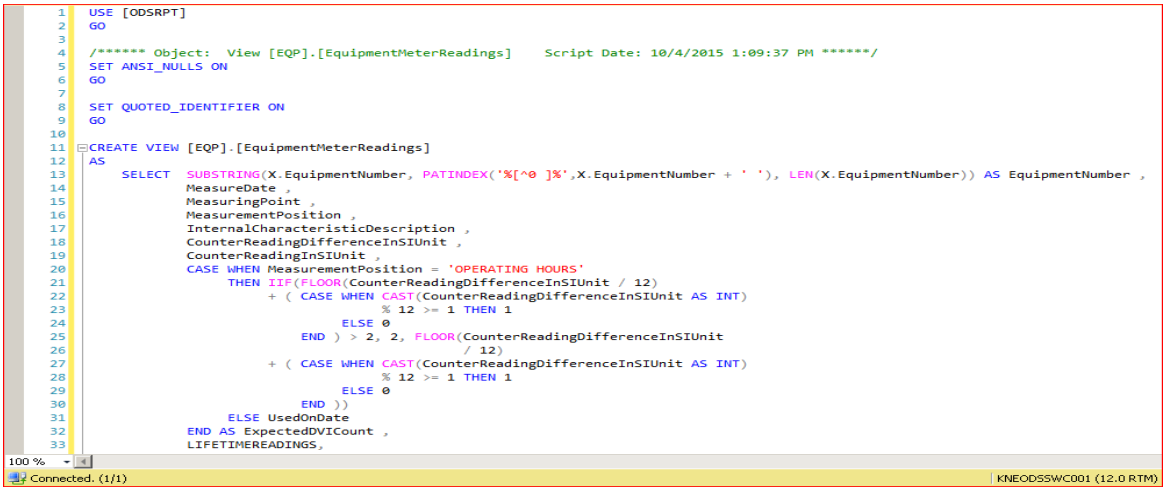
	DateKey	FullDate	isWeekDay	DayOfWeek	DayOfMonth	DayOfQuarter	DayOfYear	DayName	WeekOfYear	WeekName	YearNo	Year	MonthOfYear	MonthName	CalendarQuarter	CalendarQuarter
23	20100120	2010-01-20 00:00:00.000	1	3	20	20	20	Wednesday	4	Week 04 2010	1	2010	201001	January 2010	1	Q1 2010
24	20100121	2010-01-21 00:00:00.000	1	4	21	21	21	Thursday	4	Week 04 2010	1	2010	201001	January 2010	1	Q1 2010
25	20100122	2010-01-22 00:00:00.000	1	5	22	22	22	Friday	4	Week 04 2010	1	2010	201001	January 2010	1	Q1 2010
26	20100123	2010-01-23 00:00:00.000	0	6	23	23	23	Saturday	4	Week 04 2010	1	2010	201001	January 2010	1	Q1 2010
27	20100124	2010-01-24 00:00:00.000	0	7	24	24	24	Sunday	4	Week 04 2010	1	2010	201001	January 2010	1	Q1 2010
28	20100125	2010-01-25 00:00:00.000	1	1	25	25	25	Monday	5	Week 05 2010	1	2010	201001	January 2010	1	Q1 2010
29	20100126	2010-01-26 00:00:00.000	1	2	26	26	26	Tuesday	5	Week 05 2010	1	2010	201001	January 2010	1	Q1 2010
30	20100127	2010-01-27 00:00:00.000	1	3	27	27	27	Wednesday	5	Week 05 2010	1	2010	201001	January 2010	1	Q1 2010
31	20100128	2010-01-28 00:00:00.000	1	4	28	28	28	Thursday	5	Week 05 2010	1	2010	201001	January 2010	1	Q1 2010
32	20100129	2010-01-29 00:00:00.000	1	5	29	29	29	Friday	5	Week 05 2010	1	2010	201001	January 2010	1	Q1 2010
33	20100130	2010-01-30 00:00:00.000	0	6	30	30	30	Saturday	5	Week 05 2010	1	2010	201001	January 2010	1	Q1 2010
34	20100131	2010-01-31 00:00:00.000	0	7	31	31	31	Sunday	5	Week 05 2010	1	2010	201001	January 2010	1	Q1 2010
35	20100201	2010-02-01 00:00:00.000	1	1	1	32	32	Monday	6	Week 06 2010	2	2010	201002	February 2010	1	Q1 2010
36	20100202	2010-02-02 00:00:00.000	1	2	2	33	33	Tuesday	6	Week 06 2010	2	2010	201002	February 2010	1	Q1 2010
37	20100203	2010-02-03 00:00:00.000	1	3	3	34	34	Wednesday	6	Week 06 2010	2	2010	201002	February 2010	1	Q1 2010
38	20100204	2010-02-04 00:00:00.000	1	4	4	35	35	Thursday	6	Week 06 2010	2	2010	201002	February 2010	1	Q1 2010
39	20100205	2010-02-05 00:00:00.000	1	5	5	36	36	Friday	6	Week 06 2010	2	2010	201002	February 2010	1	Q1 2010
40	20100206	2010-02-06 00:00:00.000	0	6	6	37	37	Saturday	6	Week 06 2010	2	2010	201002	February 2010	1	Q1 2010
41	20100207	2010-02-07 00:00:00.000	0	7	7	38	38	Sunday	6	Week 06 2010	2	2010	201002	February 2010	1	Q1 2010
42	20100208	2010-02-08 00:00:00.000	1	1	8	39	39	Monday	7	Week 07 2010	2	2010	201002	February 2010	1	Q1 2010
43	20100209	2010-02-09 00:00:00.000	1	2	9	40	40	Tuesday	7	Week 07 2010	2	2010	201002	February 2010	1	Q1 2010
44	20100210	2010-02-10 00:00:00.000	1	3	10	41	41	Wednesday	7	Week 07 2010	2	2010	201002	February 2010	1	Q1 2010
45	20100211	2010-02-11 00:00:00.000	1	4	11	42	42	Thursday	7	Week 07 2010	2	2010	201002	February 2010	1	Q1 2010

Figure 21: Result Set of Calendar View

4) EQP.EquipmentMeterReadings.

EquipmentMeterReadings View is generates row at granularity level of equipment and its measured date. If equipment for supposed used today and some meter readings were recorded in ERP tables then we can expect a row in the view with the hours and miles used with it. Figure 22 illustrates

the code behind the EquipmentMeterReadings View at the granularity of days meter readings. Figure 23 illustrates the result set obtained by executing View.

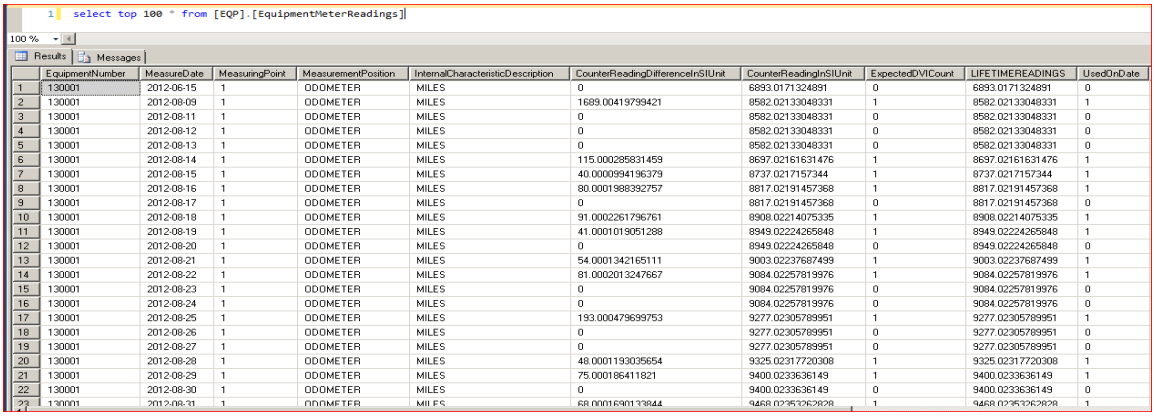


```
USE [ODSRPT]
GO

/****** Object:  View [EQP].[EquipmentMeterReadings]    Script Date: 10/4/2015 1:09:37 PM ******/
SET ANSI_NULLS ON
GO

SET QUOTED_IDENTIFIER ON
GO

CREATE VIEW [EQP].[EquipmentMeterReadings]
AS
    SELECT  SUBSTRING(X.EquipmentNumber, PATINDEX('%[^0 ]%',X.EquipmentNumber + ' '), LEN(X.EquipmentNumber)) AS EquipmentNumber ,
            MeasureDate ,
            MeasuringPoint ,
            MeasurementPosition ,
            InternalCharacteristicDescription ,
            CounterReadingDifferenceInSIUnit ,
            CounterReadingInSIUnit ,
            CASE WHEN MeasurementPosition = 'OPERATING HOURS'
                 THEN IIF(FLOOR(CounterReadingDifferenceInSIUnit / 12)
                      + ( CASE WHEN CAST(CounterReadingDifferenceInSIUnit AS INT)
                                    % 12 >= 1 THEN 1
                               ELSE 0
                          END ) > 2, 2, FLOOR(CounterReadingDifferenceInSIUnit
                                              / 12)
                      + ( CASE WHEN CAST(CounterReadingDifferenceInSIUnit AS INT)
                                    % 12 >= 1 THEN 1
                               ELSE 0
                          END ))
                 ELSE UsedOnDate
            END AS ExpectedDVICount ,
            LIFETIMEREADINGS,
```

Figure 22: Behind the EQP.EquipmentMeterReadings

Actual Code of EquipmentMeterReadings View

Result Set of EquipmentMeterReadings View



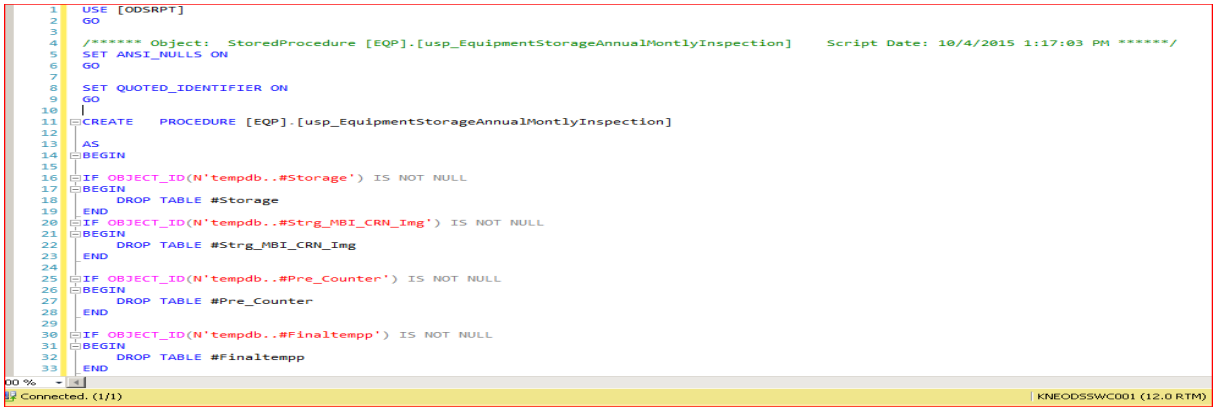
```
select top 100 * from [EQP].[EquipmentMeterReadings]
```

	EquipmentNumber	MeasureDate	MeasuringPoint	MeasurementPosition	InternalCharacteristicDescription	CounterReadingDifferenceInSIUnit	CounterReadingInSIUnit	ExpectedDVICount	LIFETIMEREADINGS	UsedOnDate
1	130001	2012-08-15	1	ODOMETER	MILES	0	6893.0171324891	0	6893.0171324891	0
2	130001	2012-08-09	1	ODOMETER	MILES	1689.00419799421	8582.02133048331	1	8582.02133048331	1
3	130001	2012-08-11	1	ODOMETER	MILES	0	8582.02133048331	0	8582.02133048331	0
4	130001	2012-08-12	1	ODOMETER	MILES	0	8582.02133048331	0	8582.02133048331	0
5	130001	2012-08-13	1	ODOMETER	MILES	0	8582.02133048331	0	8582.02133048331	0
6	130001	2012-08-14	1	ODOMETER	MILES	115.000285831459	8697.02161631476	1	8697.02161631476	1
7	130001	2012-08-15	1	ODOMETER	MILES	40.0000994196379	8737.0217157344	1	8737.0217157344	1
8	130001	2012-08-16	1	ODOMETER	MILES	80.0001988392757	8817.02191457368	1	8817.02191457368	1
9	130001	2012-08-17	1	ODOMETER	MILES	0	8817.02191457368	0	8817.02191457368	0
10	130001	2012-08-18	1	ODOMETER	MILES	91.0002261796761	8908.02214075335	1	8908.02214075335	1
11	130001	2012-08-19	1	ODOMETER	MILES	41.0001019051288	8949.02224265848	1	8949.02224265848	1
12	130001	2012-08-20	1	ODOMETER	MILES	0	8949.02224265848	0	8949.02224265848	0
13	130001	2012-08-21	1	ODOMETER	MILES	54.0001342165111	9003.02237687499	1	9003.02237687499	1
14	130001	2012-08-22	1	ODOMETER	MILES	81.0002013247667	9084.02257819976	1	9084.02257819976	1
15	130001	2012-08-23	1	ODOMETER	MILES	0	9084.02257819976	0	9084.02257819976	0
16	130001	2012-08-24	1	ODOMETER	MILES	0	9084.02257819976	0	9084.02257819976	0
17	130001	2012-08-25	1	ODOMETER	MILES	193.000479699753	9277.02305789951	1	9277.02305789951	1
18	130001	2012-08-26	1	ODOMETER	MILES	0	9277.02305789951	0	9277.02305789951	0
19	130001	2012-08-27	1	ODOMETER	MILES	0	9277.02305789951	0	9277.02305789951	0
20	130001	2012-08-28	1	ODOMETER	MILES	48.0001193035654	9325.02317720308	1	9325.02317720308	1
21	130001	2012-08-29	1	ODOMETER	MILES	75.000186411821	9400.0233636149	1	9400.0233636149	1
22	130001	2012-08-30	1	ODOMETER	MILES	0	9400.0233636149	0	9400.0233636149	0
23	130001	2012-08-31	1	ODOMETER	MILES	68.0001690133844	9468.0235326828	1	9468.0235326828	1

Figure 23: Result Set of EquipmentMeterReadings View

5) EQP.usp_EquipmentStorageAnnualMontlyInspection.

This stored procedure loads data of only cranes and it gives information about the cranes that were in storage and no of exceptions and the meter reading details with all applied business rules. Figure 24 illustrates the code behind the usp_EquipmentStorageAnnualMontlyInspection stored procedure at the granularity of every day status with meter reading for each crane. Figure 25 illustrates the result set obtained by executing View.



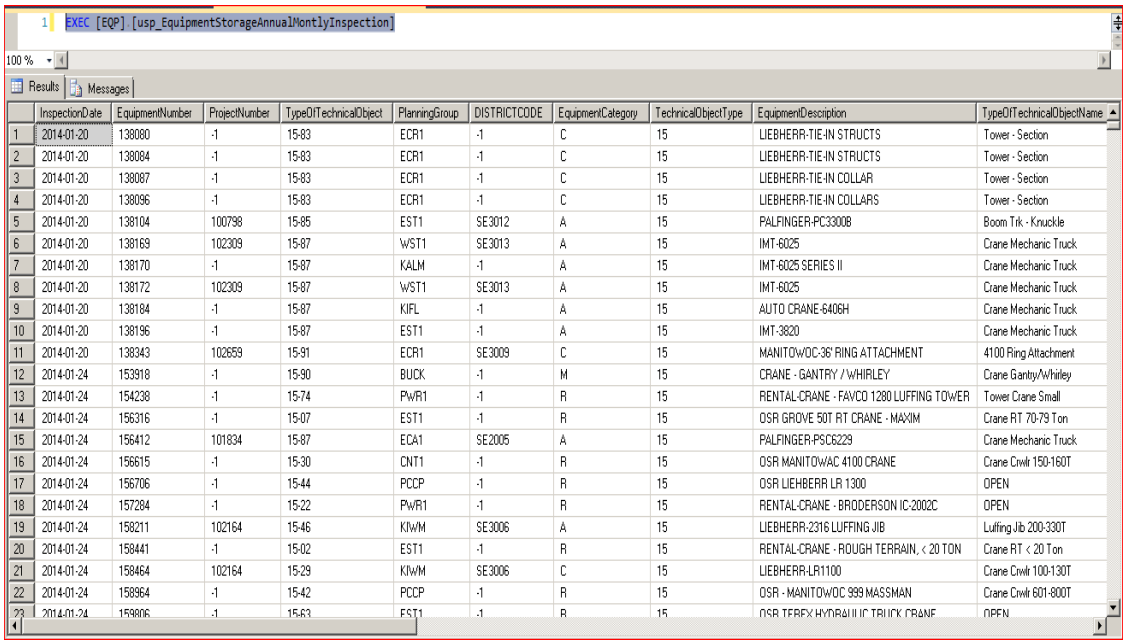
```
USE [ODSRPT]
GO

/****** Object:  StoredProcedure [EQP].[usp_EquipmentStorageAnnualMontlyInspection]    Script Date: 10/4/2015 1:17:03 PM ******/
SET ANSI_NULLS ON
GO

SET QUOTED_IDENTIFIER ON
GO

CREATE   PROCEDURE [EQP].[usp_EquipmentStorageAnnualMontlyInspection]

AS
BEGIN

IF OBJECT_ID(N'tempdb..#Storage') IS NOT NULL
BEGIN
    DROP TABLE #Storage
END
IF OBJECT_ID(N'tempdb..#Strg_MBI_CRN_Img') IS NOT NULL
BEGIN
    DROP TABLE #Strg_MBI_CRN_Img
END

IF OBJECT_ID(N'tempdb..#Pre_Counter') IS NOT NULL
BEGIN
    DROP TABLE #Pre_Counter
END

IF OBJECT_ID(N'tempdb..#Finaltempp') IS NOT NULL
BEGIN
    DROP TABLE #Finaltempp
END
```

Connected. (1/1) KNEODSSWC001 (12.0 RTM)

Figure 24: Code behind the Stored Procedure

Actual code in Stored Procedure

Result Set of the stored procedure:



```
EXEC [EQP].[usp_EquipmentStorageAnnualMontlyInspection]
```

Results | Messages

	InspectionDate	EquipmentNumber	ProjectNumber	TypeOfTechnicalObject	PlanningGroup	DISTRICTCODE	EquipmentCategory	TechnicalObjectType	EquipmentDescription	TypeOfTechnicalObjectName
1	2014-01-20	138080	-1	15-83	ECR1	-1	C	15	LIEBHERR-TIE-IN STRUCTS	Tower - Section
2	2014-01-20	138084	-1	15-83	ECR1	-1	C	15	LIEBHERR-TIE-IN STRUCTS	Tower - Section
3	2014-01-20	138087	-1	15-83	ECR1	-1	C	15	LIEBHERR-TIE-IN COLLAR	Tower - Section
4	2014-01-20	138096	-1	15-83	ECR1	-1	C	15	LIEBHERR-TIE-IN COLLARS	Tower - Section
5	2014-01-20	138104	100798	15-85	EST1	SE3012	A	15	PALFINGER-PC33008	Boom Trk - Knuckle
6	2014-01-20	138169	102309	15-87	WST1	SE3013	A	15	IMT-6025	Crane Mechanic Truck
7	2014-01-20	138170	-1	15-87	KALM	-1	A	15	IMT-6025 SERIES II	Crane Mechanic Truck
8	2014-01-20	138172	102309	15-87	WST1	SE3013	A	15	IMT-6025	Crane Mechanic Truck
9	2014-01-20	138184	-1	15-87	KIFL	-1	A	15	AUTO CRANE-6406H	Crane Mechanic Truck
10	2014-01-20	138196	-1	15-87	EST1	-1	A	15	IMT-3820	Crane Mechanic Truck
11	2014-01-20	138343	102659	15-91	ECR1	SE3009	C	15	MANITOWOC-36' RING ATTACHMENT	4100 Ring Attachment
12	2014-01-24	153918	-1	15-90	BUCK	-1	M	15	CRANE - GANTRY / WHIRLEY	Crane Gantry/Whirley
13	2014-01-24	154238	-1	15-74	PWR1	-1	R	15	RENTAL-CRANE - FAVCO 1280 LUFFING TOWER	Tower Crane Small
14	2014-01-24	156316	-1	15-07	EST1	-1	R	15	OSR GROVE 50T RT CRANE - MAXIM	Crane RT 70-79 Ton
15	2014-01-24	156412	101834	15-87	ECA1	SE2005	A	15	PALFINGER-PSC6229	Crane Mechanic Truck
16	2014-01-24	156615	-1	15-30	CNT1	-1	R	15	OSR MANITOWAC 4100 CRANE	Crane Crwlr 150-160T
17	2014-01-24	156706	-1	15-44	PCCP	-1	R	15	OSR LIEHBERR LR 1300	OPEN
18	2014-01-24	157284	-1	15-22	PWR1	-1	R	15	RENTAL-CRANE - BRODERSON IC-2002C	OPEN
19	2014-01-24	158211	102164	15-46	KIWM	SE3006	A	15	LIEBHERR-2316 LUFFING JIB	Luffing Jib 200-330T
20	2014-01-24	158441	-1	15-02	EST1	-1	R	15	RENTAL-CRANE - ROUGH TERRAIN, < 20 TON	Crane RT < 20 Ton
21	2014-01-24	158464	102164	15-29	KIWM	SE3006	C	15	LIEBHERR-LR1100	Crane Crwlr 100-130T
22	2014-01-24	158964	-1	15-42	PCCP	-1	R	15	OSR - MANITOWOC 999 MASSMAN	Crane Crwlr 601-800T
23	2014-01-24	159806	-1	15-63	EST1	-1	R	15	OSR TEREX HYDRAULIC TRUCK CRANE	OPEN

Figure 25: Result Set of Stored Procedure

Data Analysis

The data analysis is performed using Objective evaluation.

Objective Evaluation:

1. Reducing the time for collecting information which is a manual process by automating the same.

   Now the report is available in Regional Manager's dashboard. Whenever Regional Manager wants find the non-compliant He can just run the report at any point of time without creating an IT Request and with no further waiting.

   Figure 26 illustrates the report embedded in the Regional manager's dashboard.

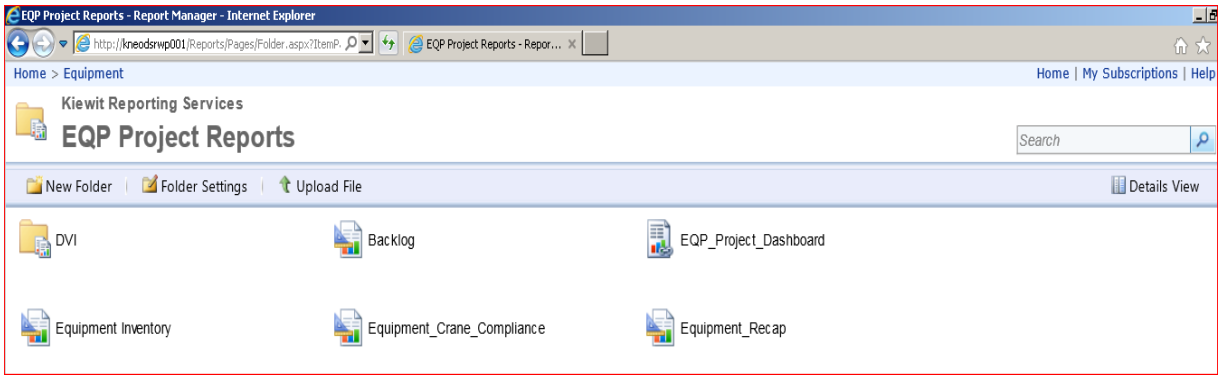


Figure 26: SSRS Report in Regional Managers Dashboard

When Regional Manager clicks the Equipment_Crane_Compliance then he will be able to select the parameters of his region.

Step 1

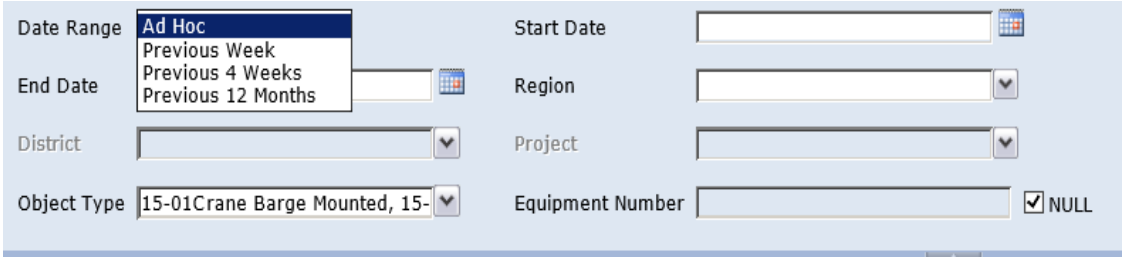


Figure 27: Illustration of the Date Range Input Parameters Selection

Step 2

Depending on the selected date range the Start Date and End Date will be auto populated in its drop downs. If Date Rage is selected as Ad hoc then he need to select the Start Date and End Date manually.

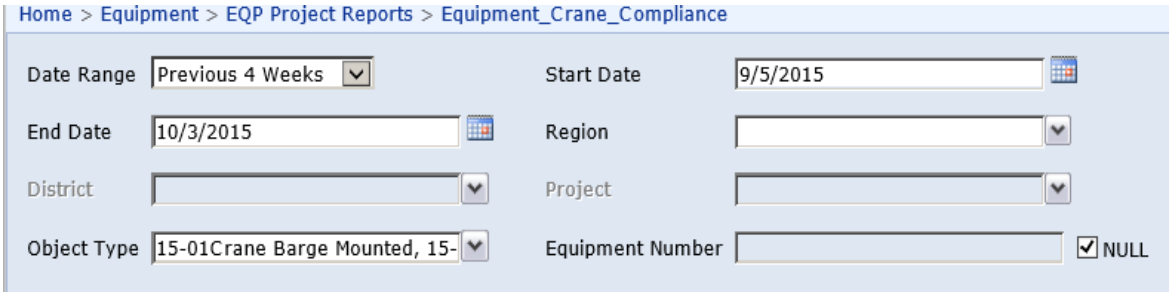


Figure 28: Illustration of the Cascaded Input Parameters for the Start Date and End Date Parameters

Step 3

Respective regional managers can select their regions and also the other regions if required.

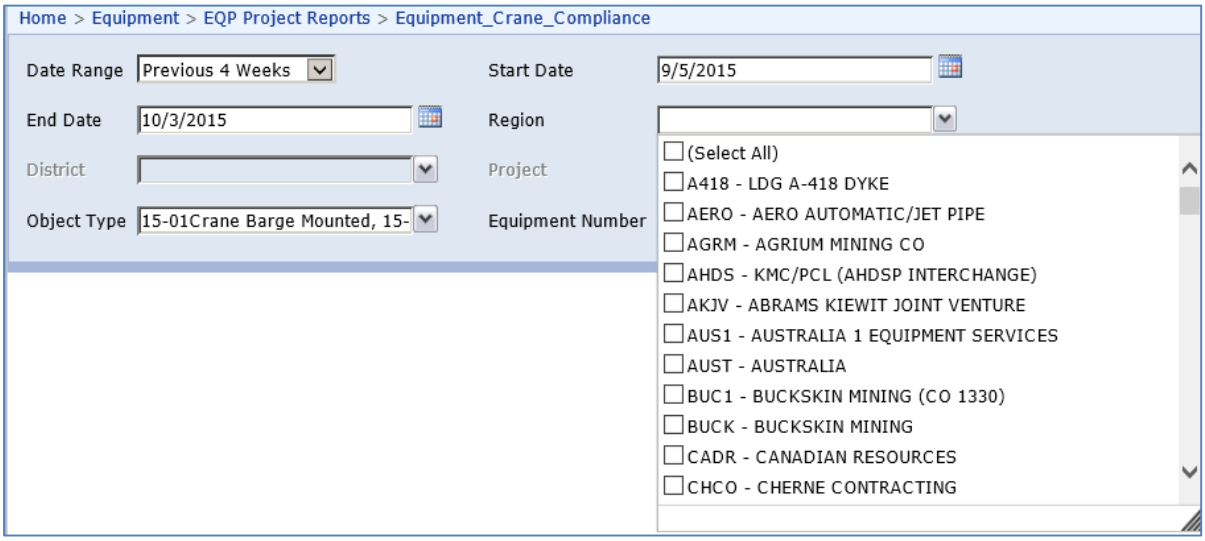


Figure 29: Illustration of Required Selection of Regions Parameters

Step 4

Based on the regions selected the underlying districts will be auto populated from the backend. Also the Object Types will be auto populated based on all the type of the cranes present in that region. If he looks for a

particular type of crane then he need to deselect all and then select the required cranes. In most of the cases the leave it default which looks as the screen below.

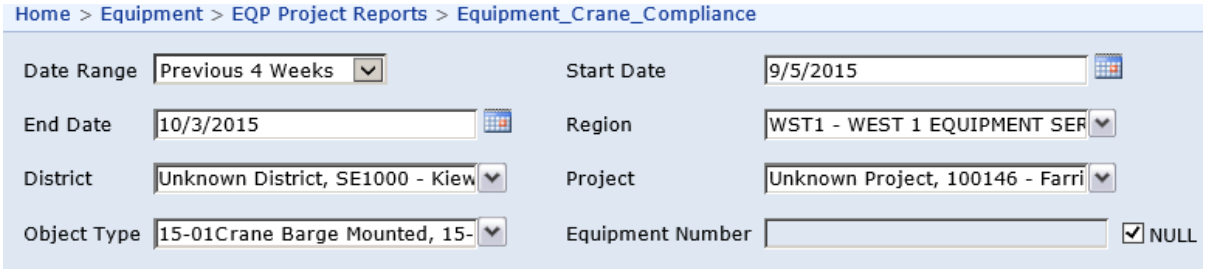


Figure 30: Illustration of the Auto Populated Input Parameters for District and Object Type for the Selected Region

The new step will be viewing the report by clicking the View Report button.

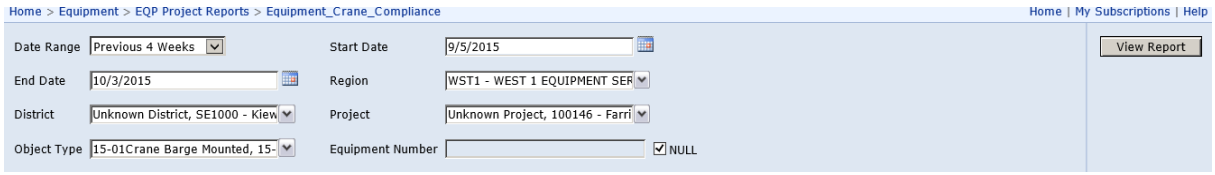


Figure 31: Illustration of the View Report Button after the Required Selection of Input Parameters

The result will be as below screen shot. Figure 32 illustrates result of the Crane Compliance Report with all business rules displaying a compliant and non-compliant crane.

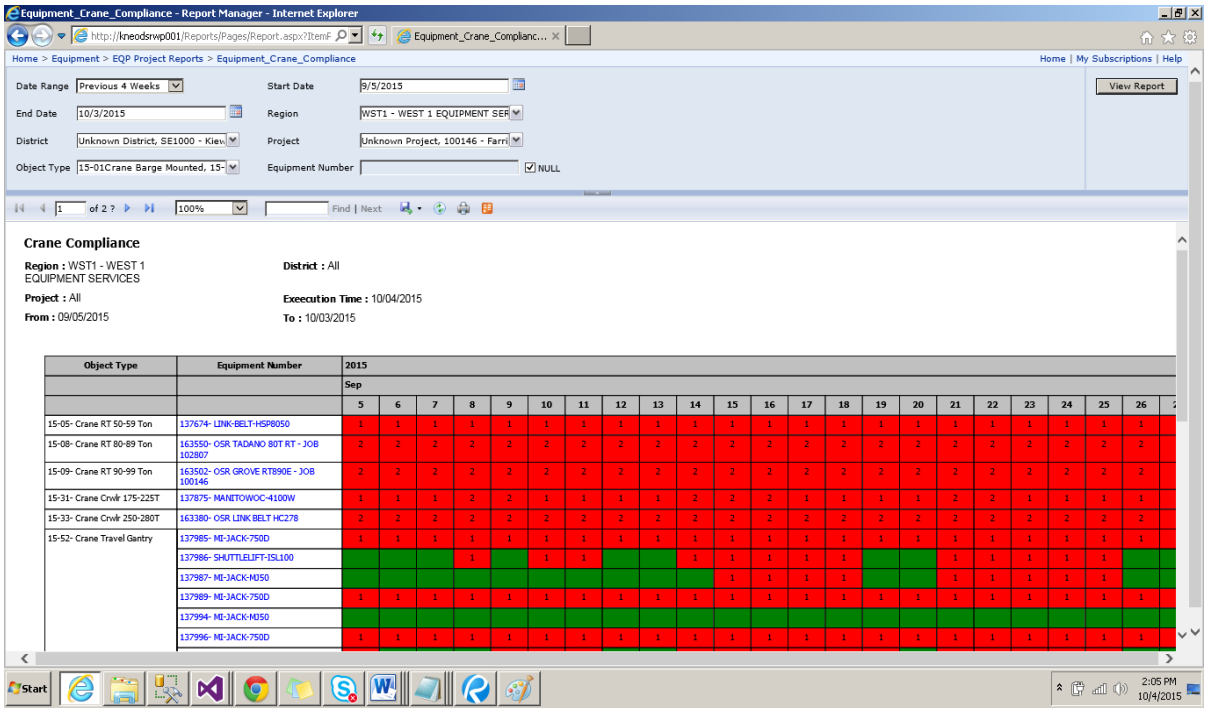


Figure 32: Illustration of the Crane Compliance Report

In Figure 32 the cells will be:

Green–That crane is compliant at that date for example 137986-SHUTTLELIFT-ISL100

Equipment is compliant on September 9th and was non-compliant again from 10th.

Red–NON-Compliant Cranes

The count 1,2,3,4 in the Red indicates the exceptions for that piece of crane on that day.

For Example 137674- LINK-BELT-HSP8050 is having the exception as 1 on September 5th. If manger wants to look at what type of exception it made then he need to click on the cell of September 5th on the corresponding row of that equipment.

Then it will direct us to other page indication the type of error.

CRANE COMPLIANCE

Region : WST1 - WST1- WEST 1 EQUIPMENT SERVICES
District : - Northwest
Project : 110052 - Northwest District OH Co 1036 Plant 0118
Inspection Date : 9/5/2015
Equipment Number : 137674

Object Type	Equipment Number	In Storage	Hour Meter Difference	DVI Received	Monthly Inspection Date	Annual Inspection Date
15-05- Crane RT 50-59 Ton	137674- LINK-BELT-HSP8050		0	No	1/1/1990	3/5/2015

Figure 33: Illustration of the Details Information of Crane Compliance Report if the Particular Cell is Clicked.

This indicates that the monthly inspection was due for this crane and it's been never done.

Yellow–Warning that next inspection needs to be done. It can be either MBI or CRN. For example this equipment 138331- IMT-2020 requires a next monthly inspection need to be done. This yellow glows for 5 days and becomes red indicating that the inspection is due. So for this equipment it was showing up the warning from 10th September to 14th September and then becomes red from 15th September indicating that monthly inspection is due.

Similarly it glows yellow for last month in case of Annual inspection CRN and then changes to red in CRN is not done by the last month.

Crane Compliance

Region : All
District : All
Project : All
Exeecution Time : 10/04/2015
From : 09/05/2015
To : 10/03/2015

Object Type	Equipment Number	2015															
		Sep															
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
15-87- Crane Mechanic Truck	138331- IMT-2020						1	1	1	1	1	1	1	1	1	1	1

Figure 34: Illustration of the 5 Days Warning Period Shown in Yellow for Crane Compliance Report

This clearly proves that our objective in making the process automated was satisfied.

2. Reducing the time required for processing a report to less than 1 minute.

For tracking the time of we created a graphs and analytical report that uses the server to retrieve the information about the report execution time and the parameters and for the date ranges selected.

In a random time taken for report execution is only 3 sec to get the results to Regional Manager.

On an average the report execution time is less than 30 sec.

Figure 35 illustrates the number of execution times and average time of execution of implemented report.

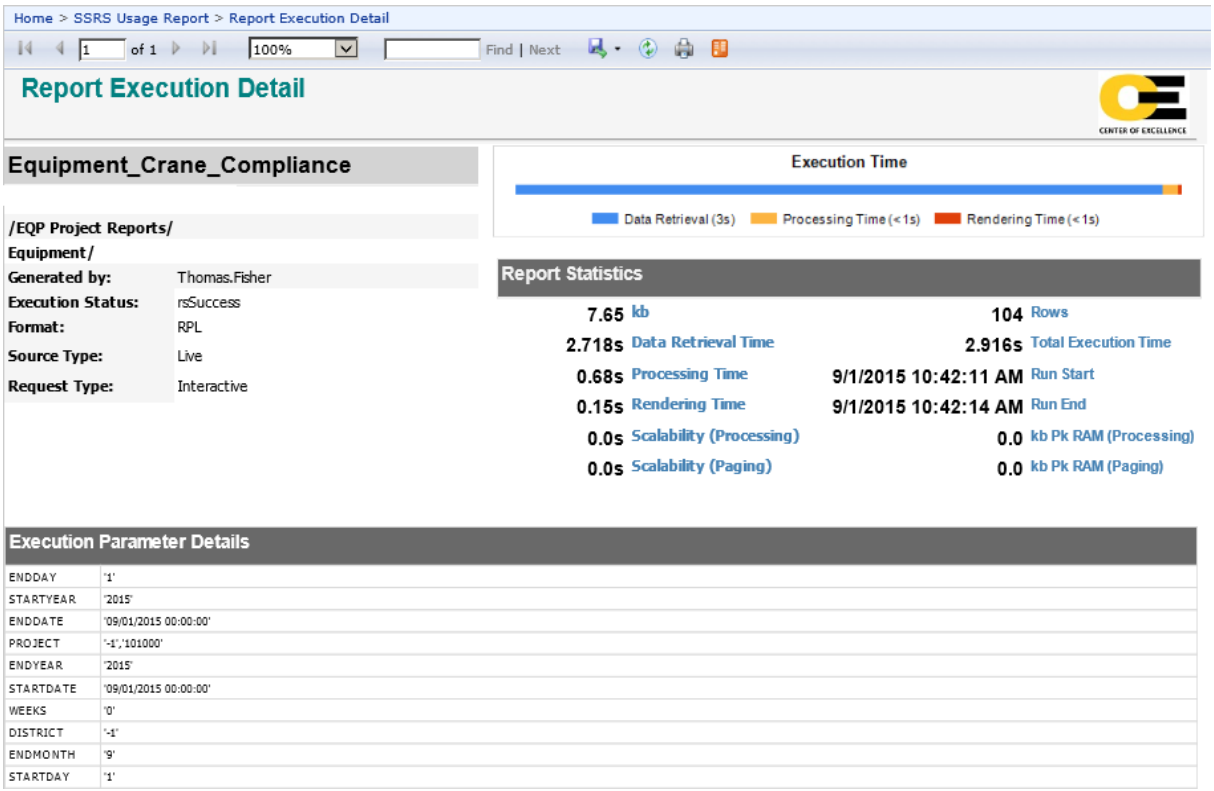


Figure 35: Equipment Crane Compliance Execution Detail

On an average the reporting is taking less than seconds. Figure 36 gives the statistical display of the report usage. It also gives the information of the report status of success and failures.

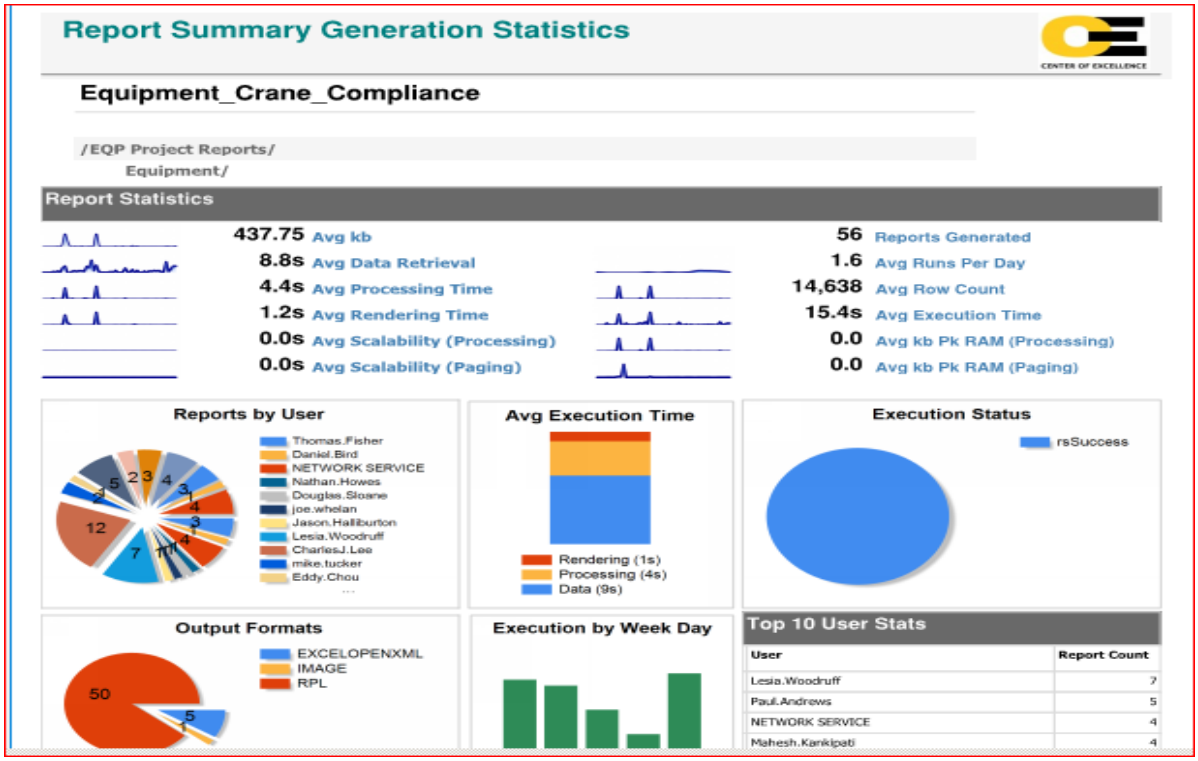


Figure 36: Equipment Crane Compliance Report Statistics

3. To create an environment where users can generate customized reports.

   Now users and analyst can browse the data in the server by using the Excel Pivot and making this as Self Service enabled.

   Figure 37 illustrates the power pivot excel worksheet tool for enabling the self-service model.

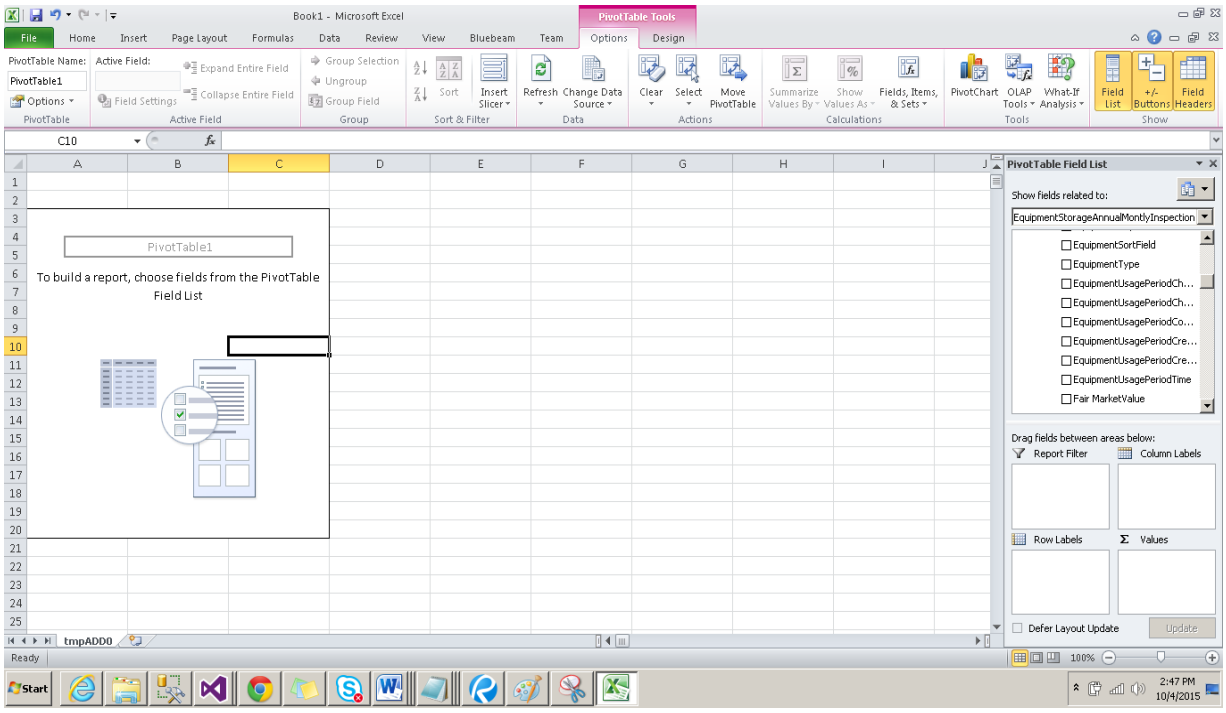


Figure 37: Equipment Crane Compliance in Self Service Mode

Summary

This chapter helps us in evaluation the objectives and the performance of new crane compliance using SSAS Tabular model implementation.

Chapter 5: Results, Conclusion, and Recommendations

Introduction

This chapter focuses on providing the final result of the project. Subsequently, the project questions posed before conducting this study are answered briefly. Possible recommendations are made based on the result and conclusion for further possible improvement opportunities.

Results

The implementation of Crane Compliance was successfully completed using SSAS Tabular model and SSRS Reporting and the report execution time is less than 10 sec on an average and the process was automated.

- What is the need for SSAS Tabular Model Crane Compliance? What are its benefits?
    - It will be very handy for Regional Managers and can be run at any time required.
    - Now regional managers can save their time in applying the business logic to the data they get in excel.
    - Business users at the time of site visits can access the tool.
    - The report data is automated so there will be fewer chances of errors.
- What are the benefits of automating the compliance checks?
    - Now, Regional Manager doesn’t need to raise an IT Request and wait for a week to make a decision on the cranes that were assigned to his region. It was made more pictorial and can be run at any time of a day.

- What is the need of making this tool as self-service?
    - Self Service helps analysts to look at the required data eliminating other non-required information.
    - Accessible in an understandable excel pivot without actual writing query on backend.
- What are the stages/ phases of Implementation and Testing?

  This was implemented in stages and in a defined order.
    - Architectural design
    - Defining views and stored procedures on replicated SAP tables.
    - Tabular Model Implementation.
    - SSRS Reporting Implementation.
    - Tabular Model daily Refreshing schedule.

  At end of each stage there was unit testing and FUT performed.
- What are the acceptable date ranges for this tool to work effectively?

  The Tool is dynamic and it works for all the date ranges like previous week, previous 4 weeks and previous 12 months and also for any required date ranges.
- What are the security levels for accessing the tool?

  This tool is made available only for the Regional Managers and to business users and analysts. This security was achieved at different level. This was made available to Regional Manager by make this URL embedded in their dashboard,

For analysts and business users it was defined in the SSRS security.

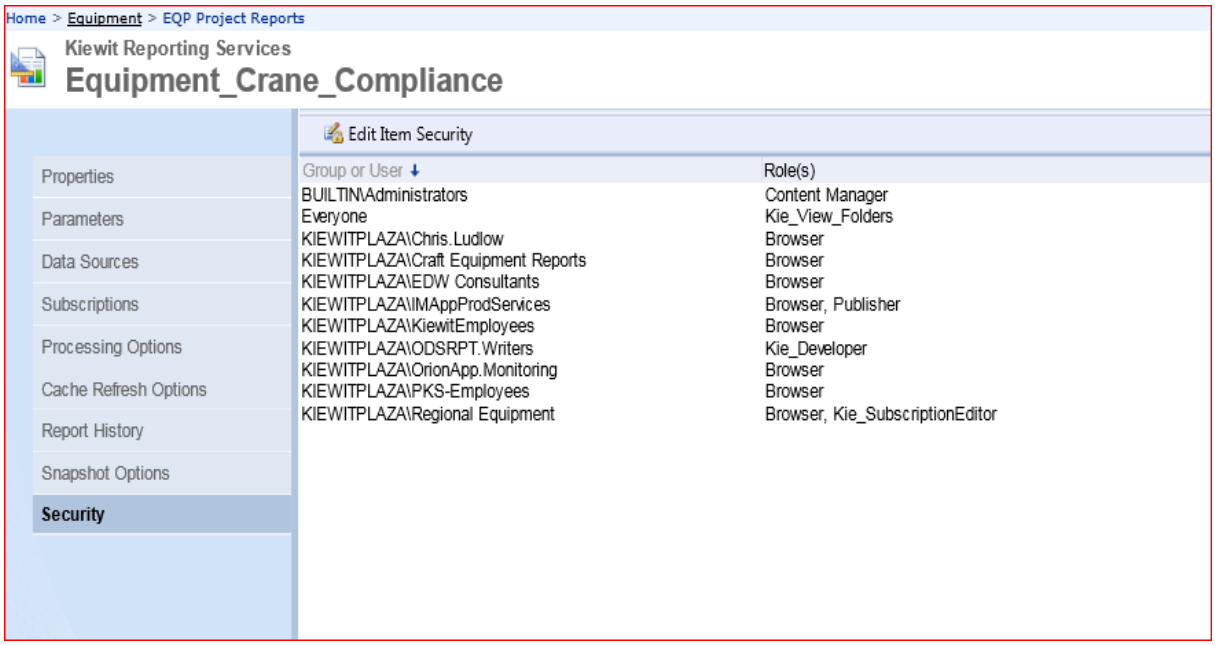


Figure 38: Equipment Crane Compliance Report Security

Conclusion

The implementation of Crane Compliance is a prestigious project which generates and saves Regions budget in turn saving XYZ Corp from huge liabilities. The Self Service is a good feature that helps analyst to dig into further requirements taking into account the present model as the base. Now the automation process helps Regional Managers to take quick decision by just seeing the report.

The Scrum model that was implemented in the Crane Compliance Using SSAS Tabular project resulted in a Complex, flexible and a robust tool. Additional requirements and changes in the specifications changes were handled in the final deployed project.

The final tool seems to be user friendly and very handy for all the users who use this tool. The self-service is really very flexible way of helping self in quest of data digging.

Recommendations

The recommendations would be

1. Further changes should be able to be tracked using the Team Foundation Server (TFS).
2. The Security level can be increased based on the user requirements by providing condition at the DAX Filters in the Manage Roles.

References

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Russo, M., & Ferrari, A. (2012). *Microsoft SQL server 2012 analysis services: The BISM Tabular Model*. Sebastopol, CA: O'Reilly Media.

Turley, P. (2013, July 17). *SSAS tabular models: The good, the bad, the ugly & the beautiful.* C. Lussier, Ed. Retrieved October 5, 2015, from http://social.technet.microsoft.com/wiki/contents/articles/18568.ssas-tabular-models-the-good-the-bad-the-ugly-the-beautiful.aspx#Overview.