

Requirement Engineering for Upgrading Drilling and Blasting Analysis at ABC Ltd

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Outline

- Background Information
- Overview
- Project Goals
- Agile Requirement Engineering
- Project Phases
- Problems during RE
- Things to Redo during RE
- Learning Opportunity
- Conclusion

Background Information – Drill, Blast & Shovel



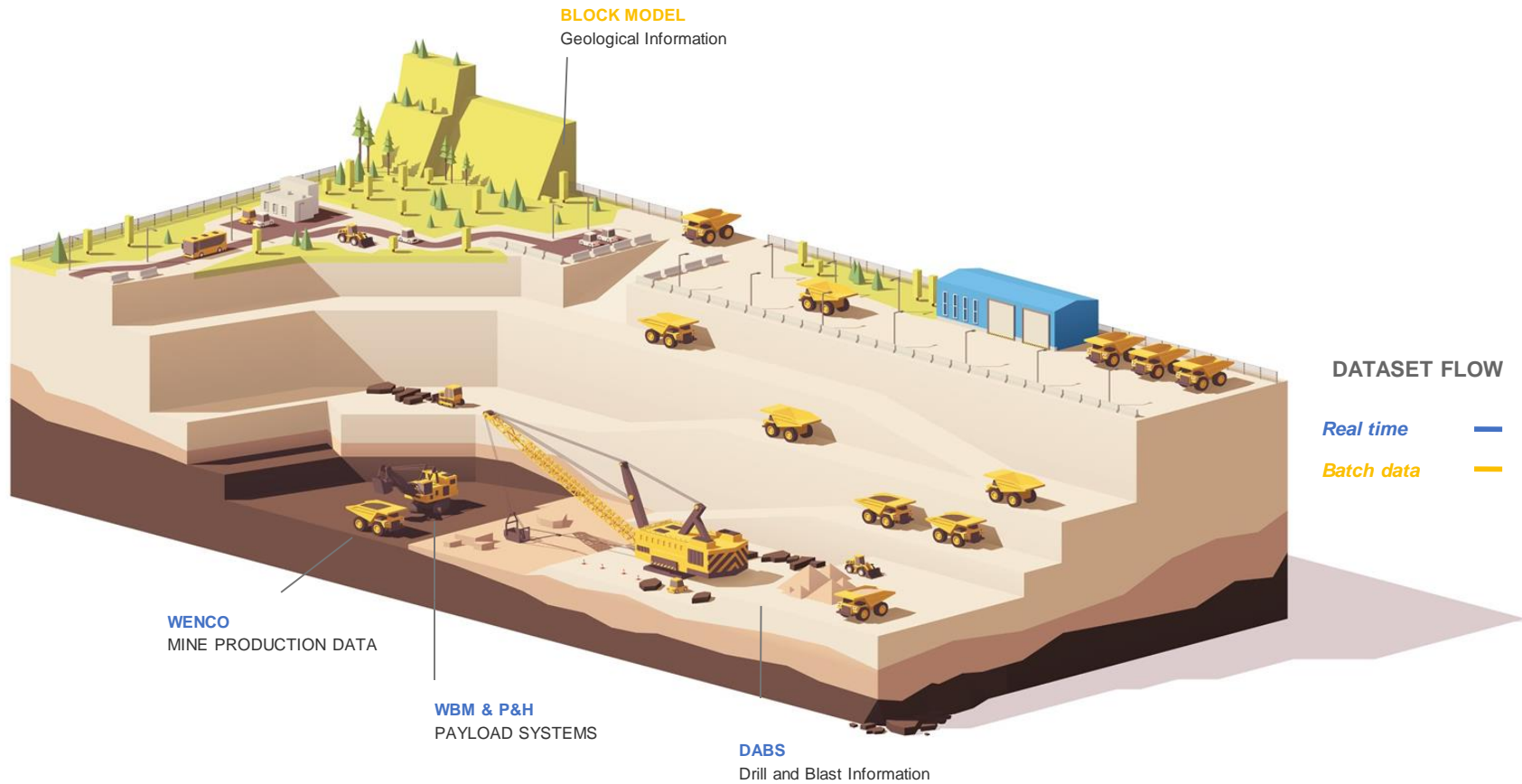
Overview

Drilling and Blasting (D&B) are vital components of any surface mine operation:

- It's a complex process with many variables
- Significant cost of mining is associated with the process
- Lots of information is available within different platforms
- Integration of data in one platform to assist engineers for setting blast parameters
- Informed decision by D&B engineers to reduce variability between different blasting patterns



Overview - (Contd)



Project Goals

Optimize Blasting

By analyzing within a blasted pattern:

- Resultant digability
- Geological properties of the pattern like Blastability Index
- Blasting Parameters like delays, explosive material
- Define Key Performance Indicators (KPIs) for digability, productivity, energy generation and cost

Target for Digability

Add target digability for each blast pattern:

- Lower range is dictated by not affecting shovel productivity
- Upper range is limited by no wasted energy and positive benefits for production

Web Application

Design a platform under which:

- Integrated data from multiple sources can be visualized
- End users can interact through advance User Interface (UI) to define goals for a blast pattern

Agile Requirement Engineering

Design and Execution Plan

- Required flexible and quicker solution
- Constant feedback from the site engineers was required
- Agile design strategy
- Weekly Scrums

Requirement Engineering Phases

- Proof of Concept (POC) (Oct 2018 – Jan 2019)
- Phase 1 (Feb 2019 – March 2019)
- Phase 2 (April 2019)

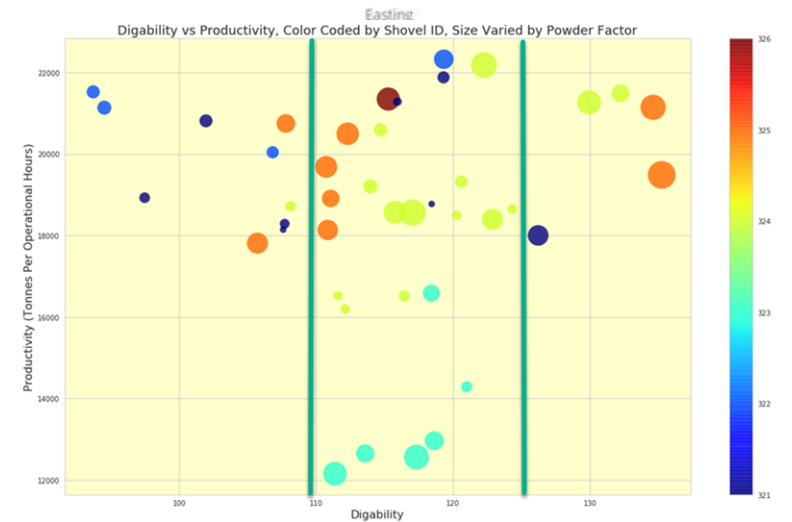
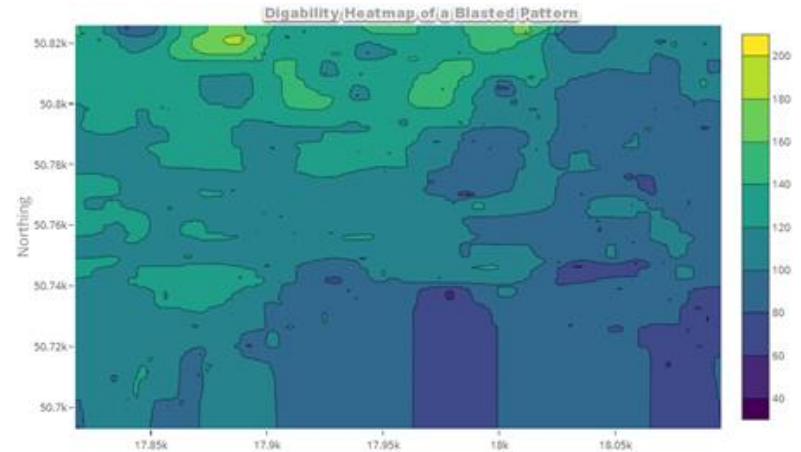
Proof of Concept Phase

Goals

- Understand requirements from the Engineers
- Search for required data in the database
- Automate the integration of data
- Validation of results by end users

Results

- Per pattern analysis:
 - Digability
 - Productivity of the shovel
 - Powder Factor
 - Geological properties
 - Cost
 - Many more insights
- Overall analysis:
 - Average out the per pattern analysis to provide bigger picture to design engineers



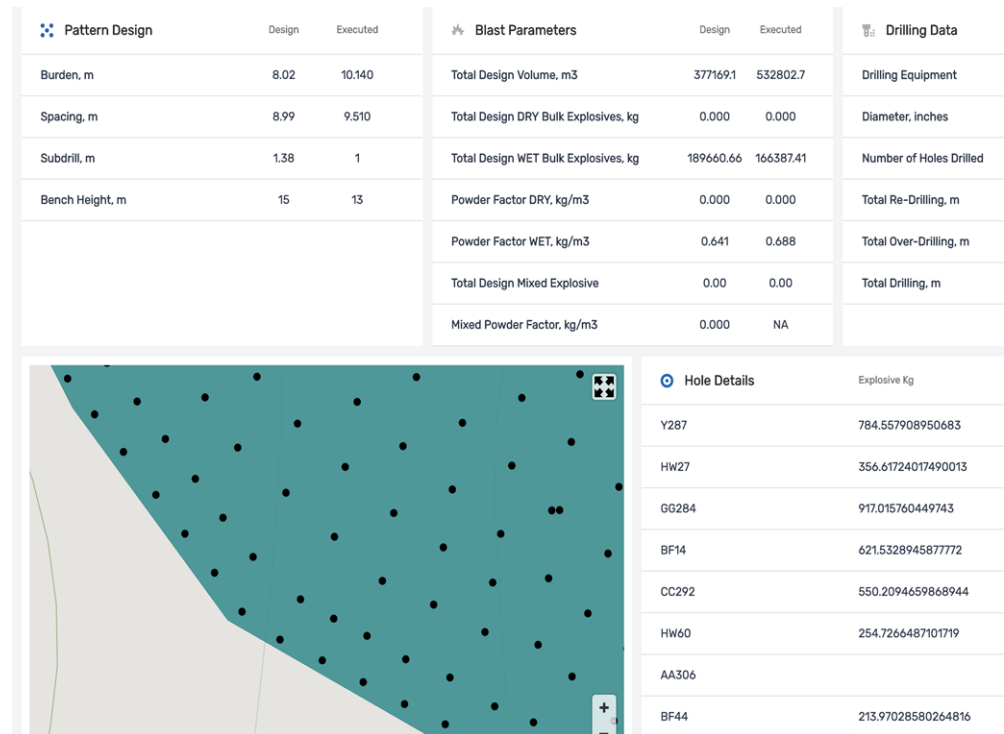
Phase 1

Goals

- Design a web application
- Test the results
- Put the application into production

Results

- Data Integration:
 - Drill and Blast
 - Payload
 - Block Model
- Post Blast KPI report:
 - 40 integrated metrics
- Advance UI:
 - Multi-pattern map view
 - Data visualization on map



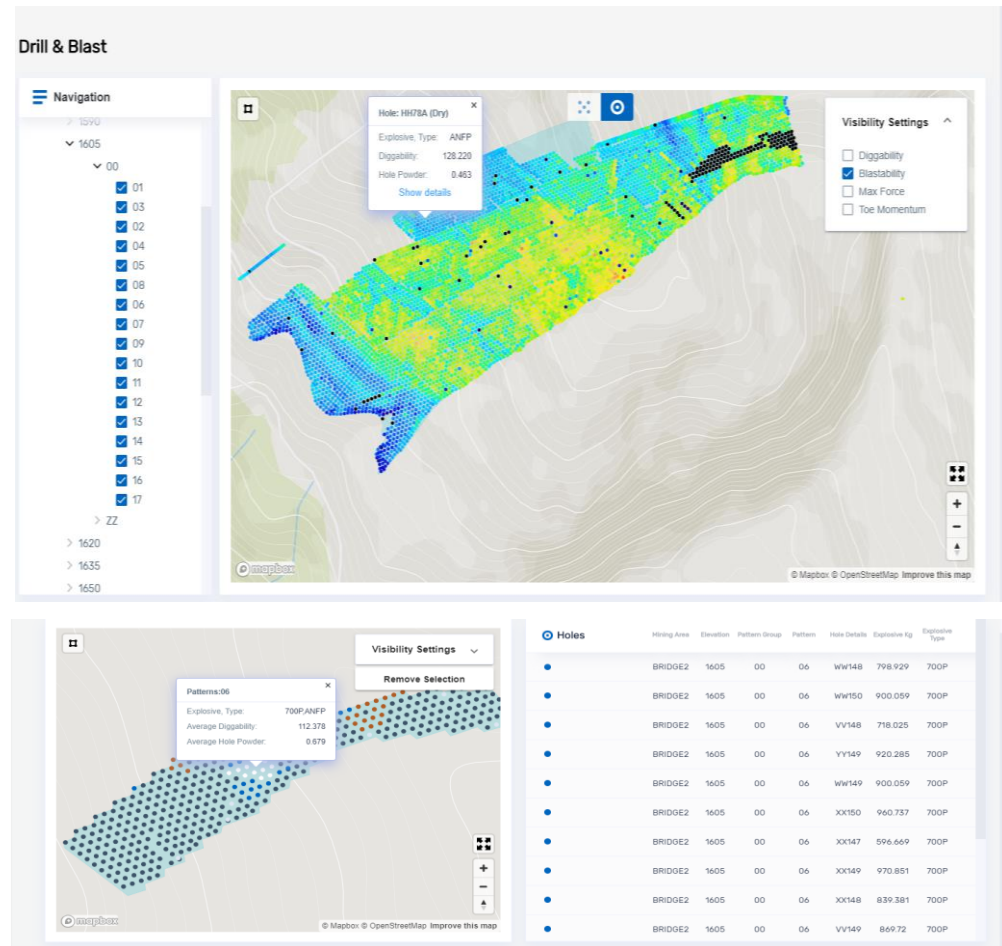
Phase 2

Goals

- Live data ingestion using cloud platform
- Incorporate more KPI features
- Additional advance UI

Results

- Data Pipeline
 - Google cloud platform for data streaming
 - Batch data sharing strategy
- Additional KPI features:
 - 60 integrated metrics
- Additional Advance UI:
 - Heat Maps
 - Aggregate information based on user selected polygon



Problems during Requirement Engineering

Database Entity Relationship

- Lack of Entity Relationship Diagram (ERD)
- Reverse engineer the software and understand the origin of data

Data Integration

- Spatial joining required advance python tools

Data Quality

- Availability of sensor data due to breakdown of sensor
- Data cleaning

Things to Redo during RE process

User Interface

- Data visualization tool - Web Application
- Customization of MapBox
- Selection of blast patterns from drop down to tree structure

Data Collection from Database

- Modify the formula for feature calculation
- Redefine the number of features displayed by default

Learning Opportunity during RE

User Engagement

- Importance of defining the feature definition using business analysis sessions with the end users

User Stories

- Understand the true requirements of end users and transforming them into technical language for software development

Database Complexity

- ERD of database

Conclusion

- Designed a web application to upgrade drilling and blasting analysis at ABC Ltd.
- Three phases to understand RE: POC, Phase1, Phase2
- Understanding the complexity of upgradation through POC
- Constant feedback from end users through Agile RE
- Less effort required related to redoing tasks due to weekly scrums

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THANK YOU
FEEDBACK, COMMENTS & QUESTIONS