Geographical Information Systems Pipeline Route Optimization (GISPRO)

A qualitative approach to pipeline scoping

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Overview

- What is GISPRO?
- Business Case Overview
- Raster Basics
- Pipeline Routing Business Rules
- Least-Cost Path
- Analyzing Results
- Case Study
- Q&A
GISRPO...

... is a qualitative tool that enables early phase cost estimates for pipeline opportunities up to 6x faster than traditional methods and identifies optimal routing.
GISPRO Architecture
Business Case

Status Quo
• Time Intensive
• Not Standardized
• Not Repeatable

GISPRO
• Low Effort
• Comprehensive
• Standardized
• Repeatable
Raster Basics

Digital Elevation Model (DEM)
Derived Surface (% Slope)
Raster Basics

Reclassify "Discrete Cost Surface"

"Good"

1

9

"Bad"
Establishing Business Rules
Establishing Business Rules

Avoid Steep Slopes

Minimize Crossings

Avoid Sensitive Areas

Maximize Existing Infrastructure

How steep is “steep”?

Crossing Distance?

Avoid or Minimize?

What Type?
Establishing Business Rules

Pipeline Routing Forum

- 2 Days
- 2 Developers
- 1 Spatial Decision Support Specialist
- 7 Engineers
- 2 GIS Specialists
GISPRO Architecture (revised)
Least-Cost Path

Discrete Cost Surface

% Slope

Least-Cost Path

“Scenario 1”
Least-Cost Path

Discrete Cost Surface 1

Discrete Cost Surface 2

Total Accumulative Cost

% Slope

Earthquake Zone

Least-Cost Path
Least-Cost Path

Total Accumulative Cost

Least-Cost Path

“Scenario 2”
Least-Cost Path

% Slope

Weights of Influence

Earthquake Zone

Weighted Cost Surface

× .90 =

× .10 =
Least-Cost Path

Total Accumulative Cost Surface

Least-Cost Path

“Scenario 3”
Least-Cost Path

Scenario 1  Scenario 2  Scenario 3
Analyzing Results

Scenario 1
- 52 miles

Scenario 2
- 63 miles

Scenario 3
- 65 miles
Analyzing Results

San Andreas Fault

Geohazards
Vegetation Density
Population Density
Class Location
Terrain Conditions

Scenario 1
Analyzing Results

Constructability

- Small Mts.
- Hilly
- Level

Productivity

- Blasting or Drilling
- Fragmented Rock or Boulders
- No rock

- Productivity
A Case Study – Idaho Reroute

The Business Rules

- **Avoid**
  - Tribal lands
  - National Forests
  - National grass lands
- **Minimize**
  - River Crossings
  - Road Crossings
  - Urban Areas
A Case Study – Pocatello Reroute

Manual Method

GISPRO

6.75x Faster

3 Days

0.44 Days

27 Man Hours

4 Man Hours

2.5 Days Saved
Potential Savings

Days Saved w/ GISPRO

Traditional

7 Man Weeks - OR -
~ $25 – $35,000 in Savings

Pipeline Length (miles)

GISPRO
Future Enhancements

ArcGIS Server Integration

Process Integration

Cost Model Integration

Offshore Model
Offshore Analysis

Mock Scenario 1

Mock Scenario 2
Questions?