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Case Analysis

Accelerating Construction Schedules with In-Situ Ground Improvement

Market Sector

INDUSTRIAL/COMMERCIAL DEVELOPMENT

Application

IN-SITU COMPACTION

Project Phase

CONSTRUCTION PHASE

DYNAMIC COMPACTION SOLUTIONS

Project Detail

The project entailed the building of the Greeley Civic Centre and surrounding parking and landscaping. According to the geotechnical assessment, Terracon Project number 21165013, the structural design was required to accommodate specific maximum load requirements to ensure stability. These parameters included a maximum capacity of 500 kips for columns, a limit of 10 kips per linear foot for walls, and slab designs rated for a standard 150 psf, with certain reinforced areas capable of supporting up to 250 psf maximum.

Project Objectives

Critical geotechnical objectives included improving the soil's bearing capacity to reduce foundation cost proposals and advancing the planned project schedule through efficient site preparation. The strategy also focused on achieving maximum primary settlement early in the process to mitigate against potential future differential settlement, ensuring the long-term structural integrity of the facility and its surrounding infrastructure.

Verified 20–30% CBR Strength Improvement via HEIC compaction

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Soil Analysis

The site material consisted predominantly of sandy soil, with specific sections characterized by a higher clay content. While the upper soil layers encountered in the boreholes generally comprised clayey to silty sands, they also contained a significant amount of gravel.

Although clayey soils are typically categorized as expansive—exhibiting a potential for shrink-swell movements during moisture changes—geotechnical testing revealed only very low levels of potential movement. Furthermore, while groundwater was detected during the assessment, it was located at depth, and bedrock was similarly encountered only at greater depths.

Site Characterization

Material Description	Approx. Depth to Bottom of Stratum (feet)	Consistency / Density / Hardness
Asphalt pavement in Boring Nos. 4, 5 and 6 only	0.1 to 0.3	-
Topsoil / vegatative layer in Boring N0. 7 only	0.3	-
Clayey sand with varying amounts of gravel	2 to 9	Loose to medium dense
Sand with varying amounts of gravel, silt, and clay	22 to 32	Loose to very dense
Claystone and sandstone bedrock	To the maximum depth of exploration of about 40 feet	Medium hard to very hard

Conventional Test Results

Dynamic Cone Penetration (DCP)
Subsurface conditions exhibited an increase in relative density from loose to medium dense in the upper strata, transitioning to medium dense to dense conditions to an approximate depth of 6 feet. The DCPs indicated fairly high levels of equivalent CBRs to the measured depth of 5 to 6ft, with CBRs averaging between 20% and 30% from around 3ft downwards.

Plate Load Testing
TEST 1 was performed on the surface, while TEST 2 was performed 40” below the compacted surface. The settlement results represented the predicted settlement at 3 ft and 6.3 ft below the surface for TEST 1 and TEST 2, respectively.

The results are summarized as follows:

Pressure Setting in Pounds per Square Fot (psf)	Settlement in inches	
	Test 1	Test 2
2,611 psf (125kPa)	0.014"	0.121"
3,133 psf (150kPa)	0.022"	0.137"
4,177 psf (200kPa)	0.037"	0.172"
5,221 psf (250kPa)	0.058"	0.207"

Based on the requirement of achieving a maximum settlement of 1 inch under a pressure of 2,500 psf, the results indicated that the bearing capacity was achieved and surpassed. A maximum settlement of 0.207” was experienced at 6.3 ft below the compacted surface during one of the tests at a pressure of 5,221 psf. Through a process of extrapolation, the settlement at 2,500 psf for Tests 1 and 2—noting TEST 2 was performed 40” below the compacted surface—resulted in an average of 0.06515”, with a maximum of 0.1175” at depth.

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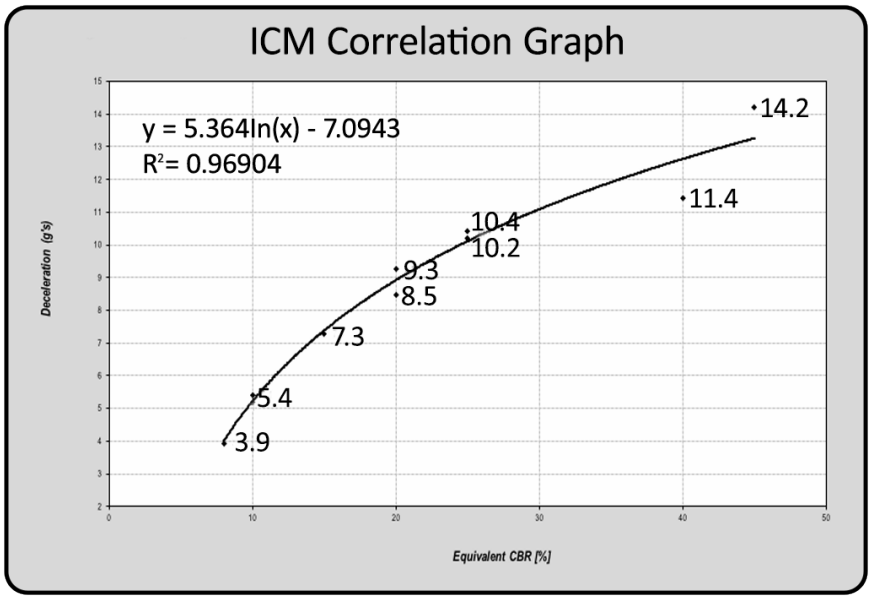
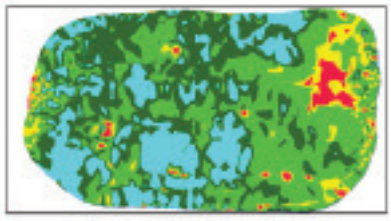
Correlation

Correlations were established between ICM relative stiffness values (derived from impact drum deceleration measurements) and DCP results converted to equivalent CBR values. Linear regression analysis yielded an R^2 value of 0.97, indicating that approximately 97% of the variability in the DCP-derived CBR results is explained by the measured stiffness response.

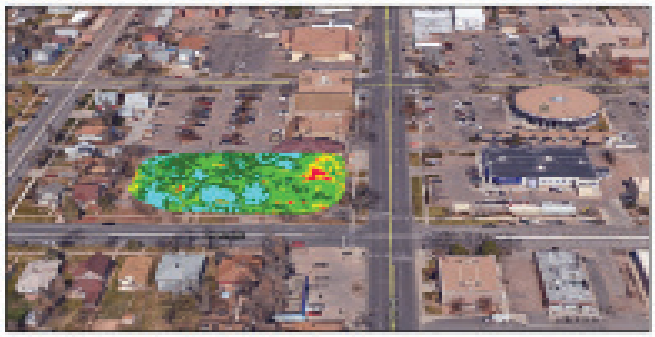


CBR (%)	Color	Value
<10		<5.2
10 - 15		5.2 - 7.38
15 - 20		7.39 - 8.92
20 - 25		8.93 - 10.11
>25		>10.11

Color Coding



General Site Mapping



Overlaid Google Maps

- **Verified 20% to 30% average post-compaction CBR**
- **Digital mapping and physical soil strength showed a 97% verified alignment**
- **Bearing capacity surpassed requirements by over 100%**

Get in touch

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