PORTUGUES DAM: CHALLENGES AND SUCCESS IN FOUNDATION DOCUMENTATION AND TREATMENT

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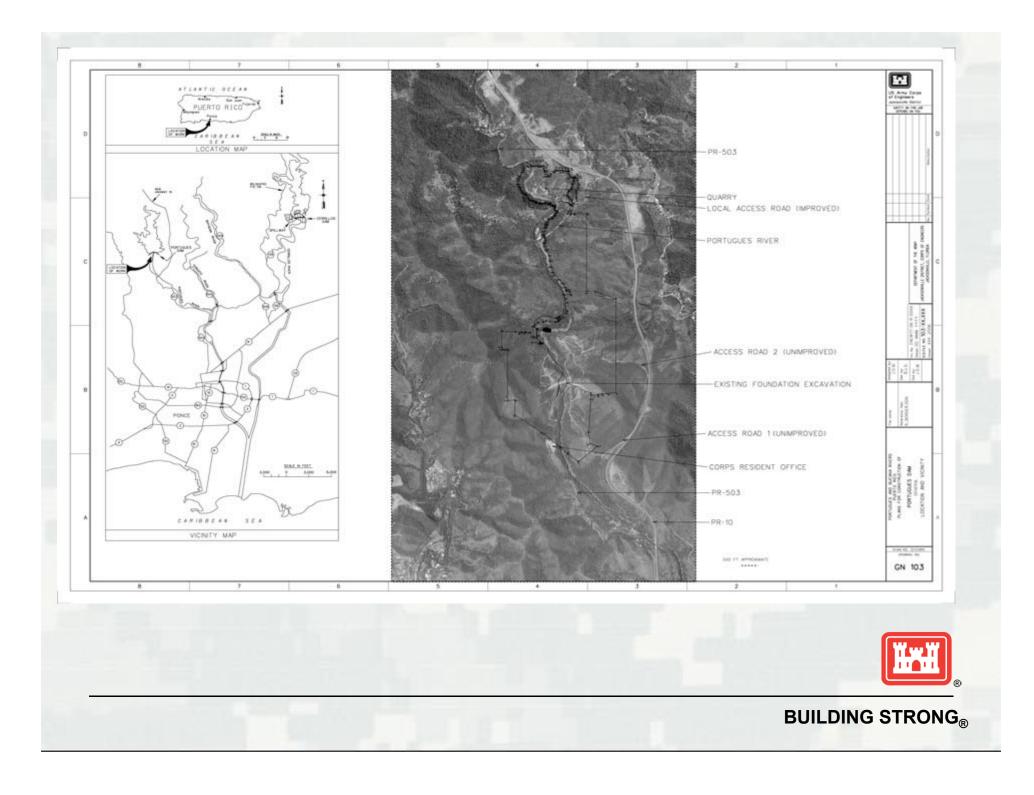


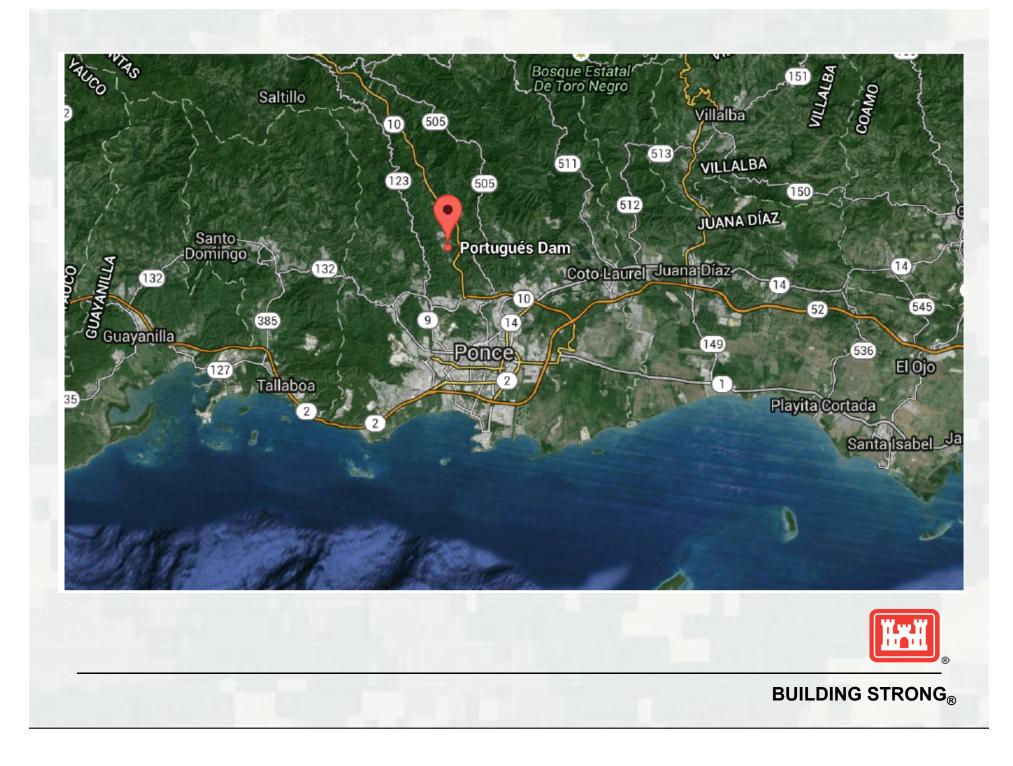
US Army Corps of Engineers BUILDING STRONG JACKSONVILLE DISTRICT



Portugues Dam



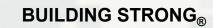


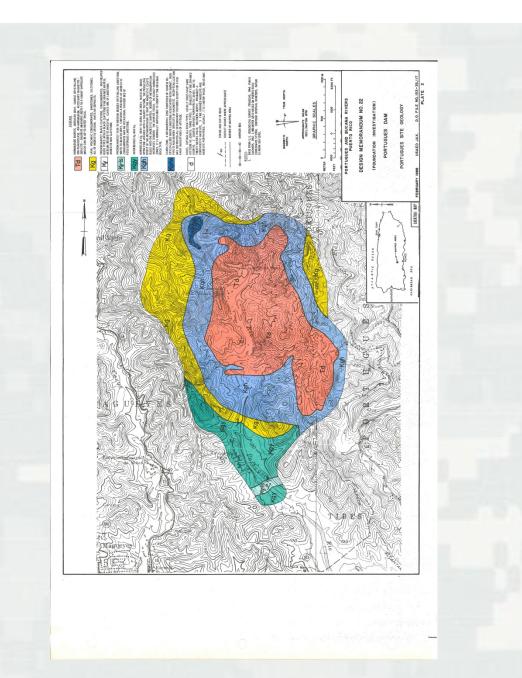


Geologic Features of Importance to be Captured by Mapping

- Meta-sediment Foundation Rock
- Radiating Shears and Dikes
- High Angle Fracture System
- Weathering









Photogrammetric Mapping

- Overlapping series of photos
 - camera and lens calibration consumer grade
 - Perspective for 3D
- Use software to process into 3D image
- Georeferenced with survey control not always necessary
- Sufficient camera resolution allows feature measurements



Field Preparation

Place control points

Layout camera stations

Identify and mark foundation – color coded

BUILDING STRONG®

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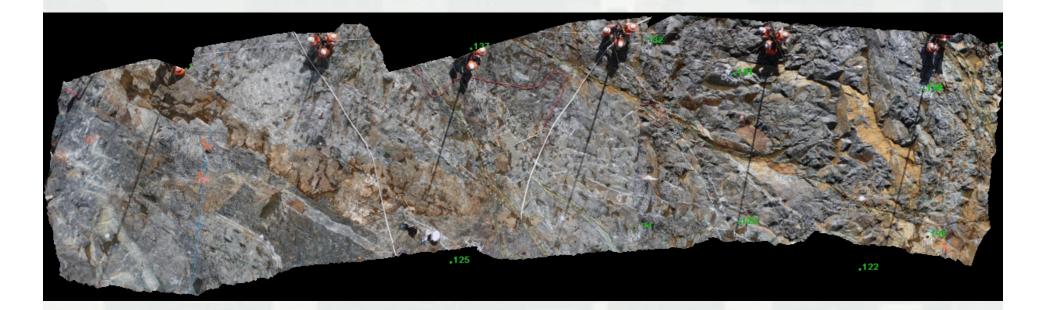
Mapping Process

~7 photos per strip, one hour on this foundation

- Immediately print photos for mapping
- Field descriptions directly on the photos
- QC software measurements dip/dip direction



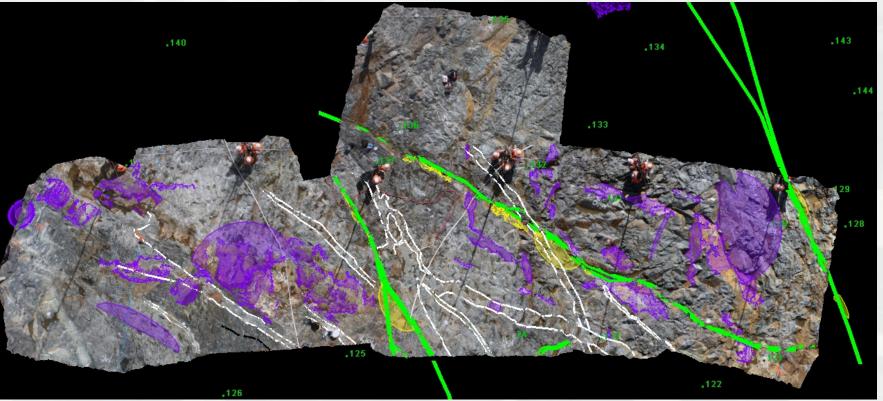
Strip of Photos



- Field mapping base
- Features described from field labeling



Photo Analysis

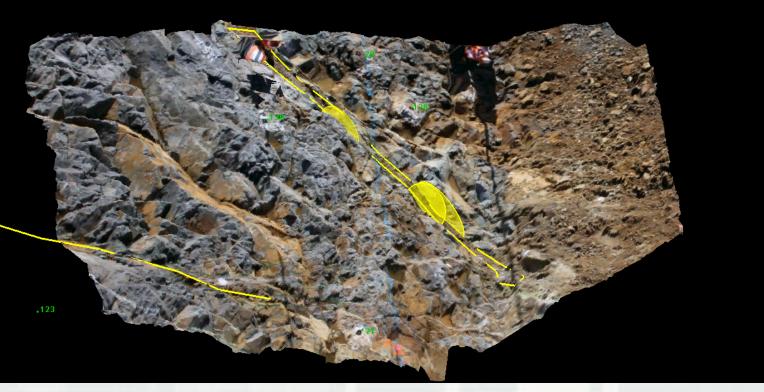


- Fracture length/continuity/orientation
- Digitize features
- Contours/Sections/Volumes
- Document treatment areas



3D Processing and Analysis

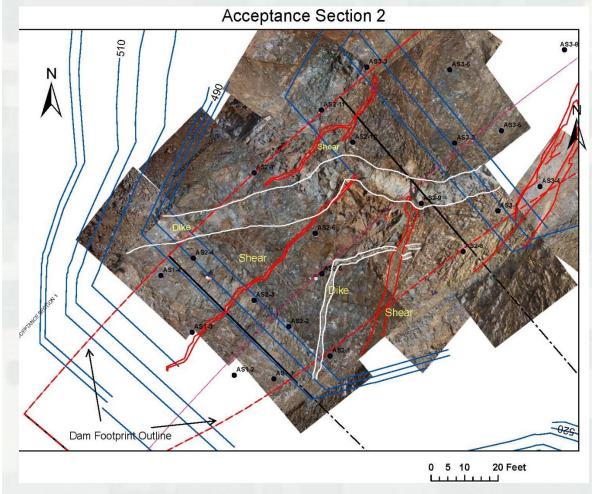
- Software processing photos
- Analysis varies with purpose



Processed photo pair

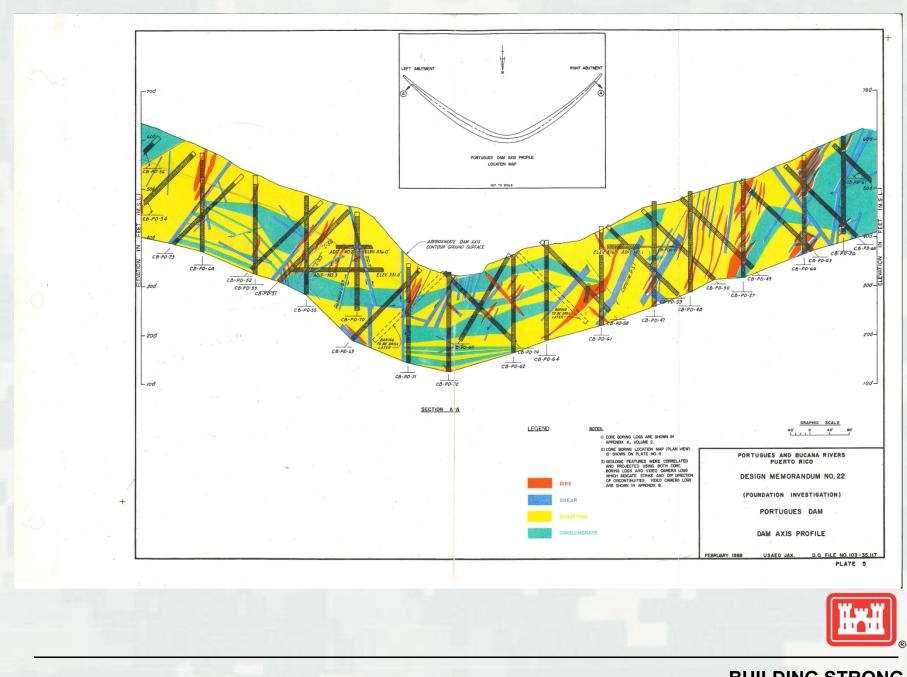


Data Presentation



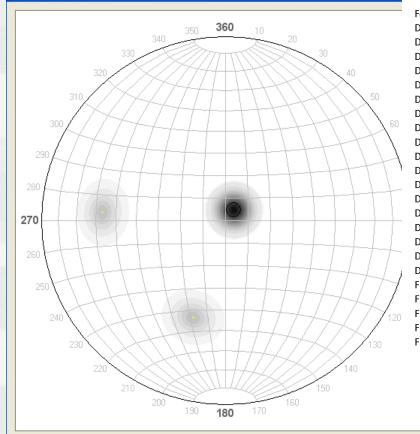
- GIS with numerous presentation possibilities.
- Cross sections projecting shears to boreholes using orientation data.





Data Presentation

Discontinuity Analysis



Feature Type	Center X	Center Y	Center Z	Dip⁰	Direction ^o	Diameter	Max. Chord	Area
Dike Orientation	586182.2	739076.3	486.2	67.7	116.6	1.41	1.41	0.2
Dike Orientation	586144.8	739116.8	484.64	27.4	149.7	1.86	1.86	0.43
Dike Orientation	586171	739092.1	483.93	87	87.8	2.3	2.3	0.28
Dike Orientation	586184	739081.1	483.97	63.3	127.5	3.76	3.76	0.71
Dike Orientation	586169.3	739087	485.43	50.5	290.7	3.85	3.85	3.06
Dike Orientation	586178.3	739087.3	483.14	81.2	93.4	4.71	4.71	1.07
Dike Orientation	586135.8	739123.1	485.19	60.5	161.3	4.91	4.91	1.09
Dike Orientation	586169.4	739093	484.05	68	271	5.45	5.45	2.42
Dike Orientation	586181	739082.2	484.17	43	111.7	5.85	5.85	4.21
Dike Orientation	586170.7	739086.5	485.19	44	299.9	8.28	8.28	3.15
Dike Orientation	586166.4	739073.2	490.31	60.3	293.9	8.33	8.33	1.52
Dike Orientation	586165.8	739111.1	479.95	86.7	301.4	2.73	2.73	1.04
Dike Orientation	586153.5	739118.3	481.03	83	353.3	4.16	4.16	0.64
Dike Orientation	586154.7	739113.2	482.3	65.9	223.2	5.84	5.84	2.97
Dike Orientation	586169.8	739115.6	477.03	82.2	139.5	6.74	6.74	2.69
Dike Orientation	586169.9	739116.4	476.61	87.9	141	8.68	8.68	3.26
Dike Orientation	586180.8	739103.9	476.78	78.9	106.2	9.67	9.67	4.73
Dike Orientation	586149.2	739125.7	480.79	60.6	149.6	10.49	10.49	11.69
Fracture Orientation	586169.5	739084.3	486.11	51.8	118.4	0.79	0.79	0.16
Fracture Orientation	586145.5	739110.1	486.24	78.2	113.6	2.06	2.06	0.35
Fracture Orientation	586156.2	739093.2	488.29	62.5	197.9	2.41	2.41	0.76
Fracture Orientation	586161.5	739081.4	489.33	88.8	120	2.57	2.57	1.16
Fracture Orientation	586164.7	739093.6	484.76	88.3	270.9	2.63	2.63	0.2

Projection

C Equal Angle (Wolff)

Equal Area (Schmidt)

ΟK

Advanced

Stereonet of measured orientations

Foundation Preparation Challenges

- Steep Slopes
- Equipment and Personnel Access
- Safety
- Removal of Weathered Materials



River Valley Foundation



Left Abutment Excavation





Excavated Shear Zone





Right Abutment Fall Protection





Left Abutment Fall Protection



Thank You

