LAR-IAC

Independent QA/QC
February 7, 2006

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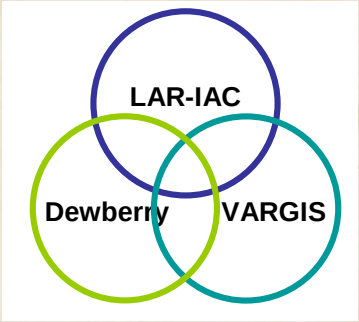
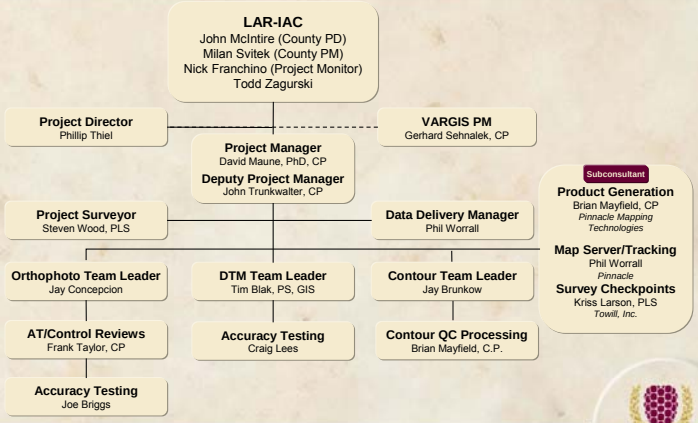
Quality Assurance

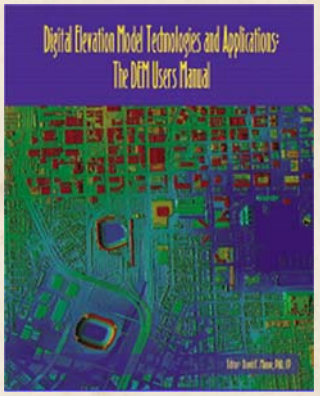
Steps taken to ensure client/user expectations are satisfied or exceeded

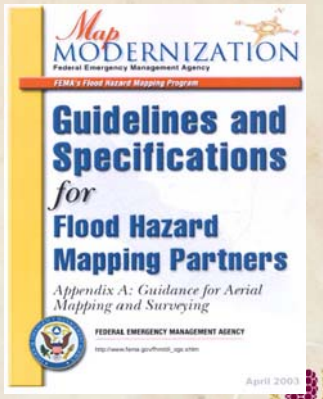


Los Angeles Region – Imagery Acquisition Consortium (LAR-IAC)

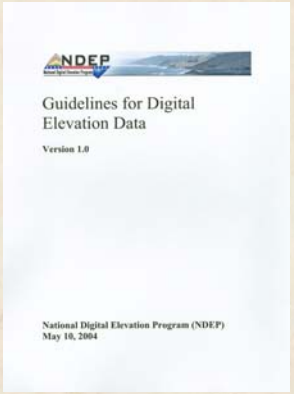


Dewberry specializes in “user requirements”





Dewberry drafted these accuracy guidelines also referenced by LAR-IAC


NDEP

Guidelines for Digital Elevation Data

Version 1.0

National Digital Elevation Program (NDEP)
May 10, 2004


ASPRS Guidelines
Vertical Accuracy Reporting for Lidar Data

Major Responsibilities of Dewberry Team

Dewberry Tasks:

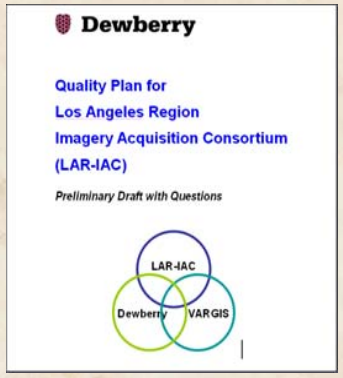
- Project Management
- Quality Plan
- AT/control reports
- Horizontal & vertical accuracy assessments
- Orthophoto QA/QC
- LiDAR DTM QA/QC
- Review of contour QA/QC
- (Optional) survey QA/QC checkpoints

Pinnacle Tasks:

- Map Server
- AT/control reports
- Contour QA/QC
- Completeness reviews
- Product generation
- Product delivery/training

State-of-the-art mapping technologies (e.g., DMC, LiDAR) have revolutionized the mapping industry's approach to QA/QC.

LAR-IAC Quality Plan based on Dewberry's lessons learned in 350+ counties elsewhere


Dewberry

Quality Plan for
Los Angeles Region
Imagery Acquisition Consortium
(LAR-IAC)

Preliminary Draft with Questions

LAR-IAC
Dewberry
VARGIS

- 101 Acceptance Criteria for digital orthophotos, digital terrain models (DTMs), and contours
- Each has characteristics to be tested
- Each characteristic has detailed Measure of Acceptability for pass or failure of product
- Visual inspections require technical expertise & "calibrated eyeballs"

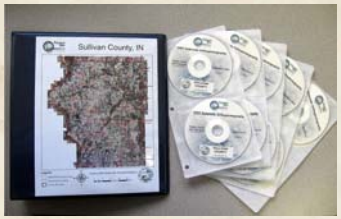
Dewberry/Pinnacle Synergy

Dewberry staff performs QA/QC on all products to detailed Acceptance Criteria

Pinnacle prepares all deliverables, including tailored datasets

Separate countywide deliverables in Indiana similar to cities in L.A. County ("limited areas")

Some L.A. departments/agencies may receive entire countywide datasets, whereas cities will receive "limited area" datasets including buffer areas. Some LAR-IAC project partners may prefer delivery on external hard drives, whereas others may prefer DVDs.



LAR-IAC Project Partners …

Agoura Hills	El Segundo	Palos Verdes Estates
Arcadia	Glendale	Paramount
Beverly Hills	Inglewood	Pasadena
Burbank	La Habra Heights	Redondo Beach
Carson	Lakewood	Santa Clarita
Cerritos	Long Beach	Santa Monica
Covina	Manhattan Beach	Torrance
Culver City	Monrovia	Westlake Village
Diamond Bar	Palmdale	Whittier

Part I — QA/QC of Digital Orthophotos

- Aerial triangulation analyses
- Horizontal accuracy assessments
- Aesthetics QA/QC
- Completeness QA/QC
- Product generation of all countywide and "limited area" deliverables
- Assistance with data installation and training

Example of radiometry too black or too white

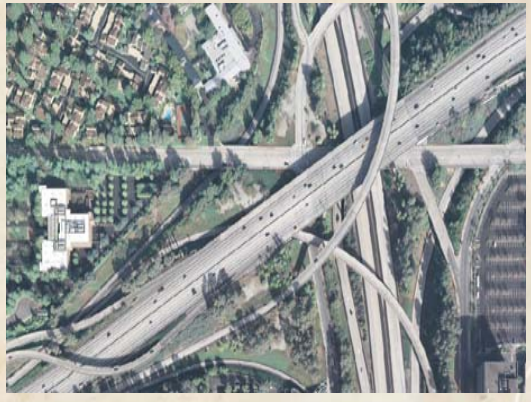
Examples of spectral reflection, speckles and pixelation

Crooked roofline, before and after revised DTM

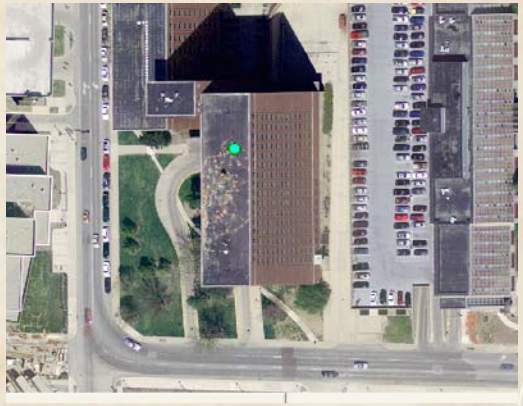
“Hourglass” bridge, before and after breaklines

Seamline errors often difficult to see

Multi-layer bridge decks have special needs



Tall buildings have criteria for limited lean



Use of photo-identifiable QA/QC checkpoints

Accuracy Assessment Spreadsheet

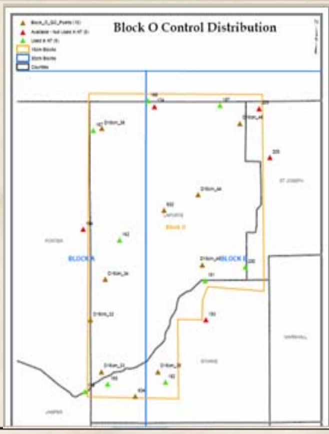
Reference: FGDC's Geospatial Positioning Accuracy Standards
National Standard for Spatial Data Accuracy (NSSDA), FGDC-STD-007.3-1998

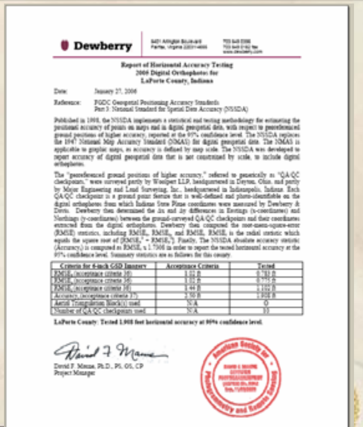
Block O	QA/QC Points as surveyed by Voolpert & Major Engr.			Orthophotos measured by Dewberry		Ortho minus surveyed coordinates		Discrepancies Squared as required for RMSE calculations	
	Indiana SPC West NAD 83(1986)		NAVD 88	Indiana SPC West NAD 83 (1986)		Indiana SPC West NAD 83 (1986)			
Point Number	Northing (y) (US Survey Feet)	Easting (x) (US Survey Feet)	Elevation (z) (Feet)	Northing (y) (US Survey Feet)	Easting (x) (US Survey Feet)	Δy (Northing) (US Survey Feet)	Δx (Easting) (US Survey Feet)	Δy^2 (ft^2)	Δx^2 (ft^2)
504	2,175,759.671	3,026,651.145	700.694	2,175,757.764	3,026,651.944	-1.907	0.799	3.637	0.639
502	2,239,695.867	3,046,894.161	706.309	2,239,695.846	3,046,894.315	-0.021	0.154	0.000	0.024
DRcm_32	2,226,762.329	2,994,705.723	690.411	2,226,762.415	2,994,706.409	0.296	0.706	0.092	0.597
DRcm_33	2,192,123.040	3,002,510.940	666.198	2,192,122.967	3,002,509.579	-0.073	0.639	0.005	0.408
DRcm_34	2,263,732.626	3,005,960.634	730.983	2,263,732.359	3,005,960.646	-0.167	0.212	0.028	0.045
DRcm_36	2,354,388.428	3,002,557.780	695.493	2,354,388.409	3,002,558.192	0.081	0.392	0.004	0.154
DRcm_35	2,192,135.591	3,042,770.822	654.651	2,192,134.640	3,042,772.806	-0.951	1.984	0.904	3.937
DRcm_44	2,340,188.470	3,071,241.748	776.669	2,340,187.462	3,071,242.037	-1.008	0.288	1.016	0.083
DRcm_45	2,263,505.197	3,074,197.271	691.426	2,263,504.936	3,074,197.005	-0.263	-0.266	0.069	0.035
DRcm_46	2,357,871.570	3,100,980.097	701.386	2,357,871.060	3,100,980.569	-0.510	0.472	0.260	0.223
							Sums	6.092	6.134
Point numbers in orange were surveyed by Voolpert				Horizontal Accuracy Acceptance Criteria			MSE	0.601	0.613
Point numbers in gray were surveyed by Major Engineering				RMSEx and RMSEy should = 1.02 ft or less			RMSEx (ft)	0.775	0.783
				RMSEr must = 1.44 ft or less			RMSEr (ft)	per NSSDA	1.102
RESULT: Block O PASSES	7/25/2006			ACCURACYr must = 2.5 ft or less at 95% confidence level			ACCURACYr (ft)	per NSSDA	1.908

Professional Land Surveyor certifies these coordinates

Certified Photogrammetrist certifies these coordinates & accuracy statistics

Horizontal Accuracy Certification

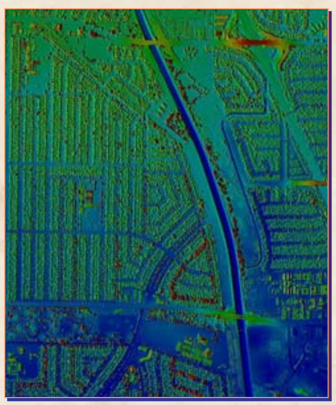


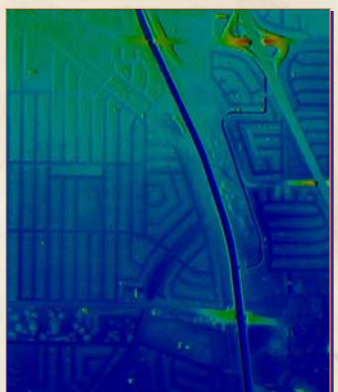


Part II — QA/QC of LiDAR DTMs & breaklines

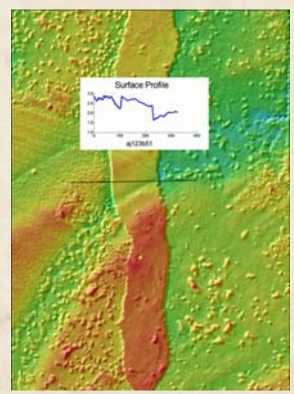
- Vertical accuracy assessments — complies with FEMA, NDEP and ASPRS requirements for LiDAR elevations to be tested in five separate land cover categories
- Qualitative assessments to identify systematic errors in the Digital Terrain Model (DTM)
- Completeness QA/QC
- Product generation of DTM/breakline datasets for all countywide and "limited areas" (cities)

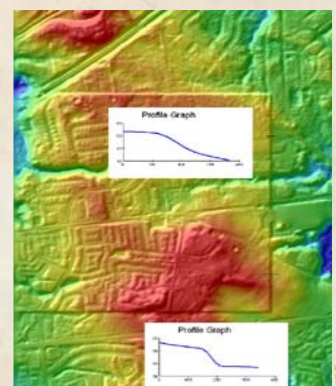
Lidar last return, before/after post-processing



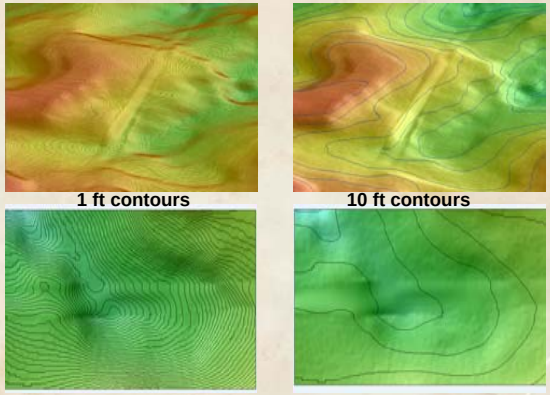


Systematic errors (+ artifacts) in bare-earth DTMs





We then determine if artifacts are significant



It's very rare for DEMs to be found unsuitable for orthorectification

Part III — QA/QC of 2' and 4' contours

- Qualitative QA/QC — both automated and visual QA/QC to determine if contours satisfy Acceptance Criteria
- Completeness QA/QC
- Product generation of all contour datasets for all countywide and "limited areas" (cities)

Questions?