



Roof, Paving and Building Envelope Asset Management and Construction Technology

Prepared for:

RAM USA's Process:



Diagnostics



Forensic Surveys



Prioritized Budgets



***Online
Asset Management***



Design & Engineering



Bid Management



Project Management

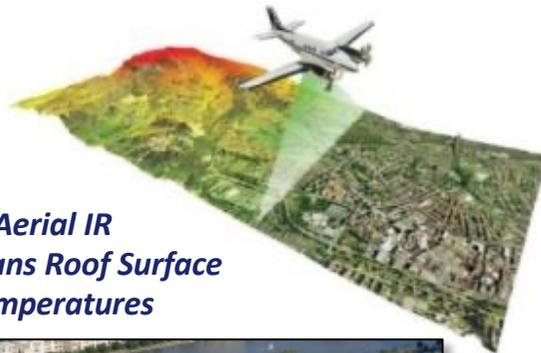


***Warranty Compliance
& Maintenance***

Information

Independent, Complete Condition Baseline Assessment with Objective Options

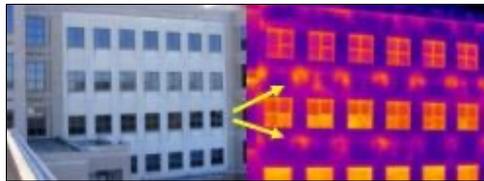
Diagnostic Services



1. Aerial IR Scans Roof Surface Temperatures



2. Blended Moisture Saturation Results



Handheld IR Wall Scans

Visual Surveys



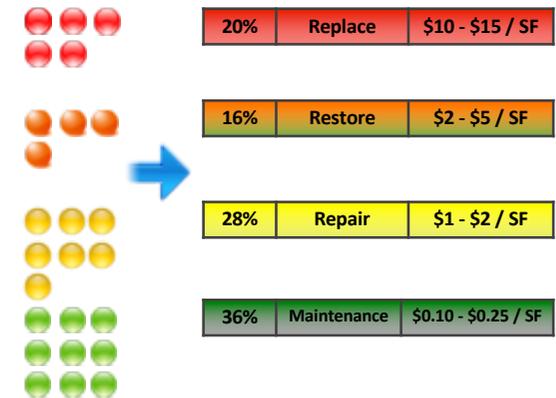
“Boots on the Roof” Forensic Surveys

- Offer Checks & Balances
- Third-Party Review
- Consider All Feasible Options
- Reduce the Number of Roof Replacements



Report = Prioritized 5-Year Plan

- Multi-Year Project Plans with More Accurate Cost Estimating
- Detail Your Entire Portfolio Down to Each Roof Section
- Empowers for Proactive Business Decisions to Select Lowest Lifecycle Costs



**The Right Repair +
The Right Timing =
Best Value**

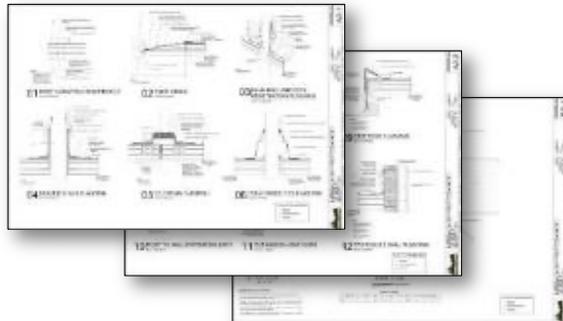
Implementation

Our Expertise Delivers the Highest Value Solutions

Design, Specifications, and Engineering Services



- Failure Mode Analysis
- Customized Recommendations and Details
- Technical /Architectural Drawings & Specs



Bid Management



Program Designed to Provide Accurate Bids on the Widest Array of Options

- Tighter Specifications Create “Apples-to-Apples” Bids & Increased Competition
- “Best Value” Contractor Recommendations and Control Over Contractor Selection
- More Project Control & Less Change Orders



Project Management & Project Monitoring



- On-Site Quality Control Inspections
- Registered Roof Observers (RRO)
- Contract Administration & Project Close Out



Project Monitoring Can Double the Life of a Roof!

Continuation

Customized Maintenance and Asset Management Programs

On-Going Maintenance Plans



- Annual/Semi-Annual Inspections
- Maintenance Programs
- Warranty Compliance Inspections

Maximize Waterproofing
Maximize Durability
Maximize Asset Performance

Did You Know?

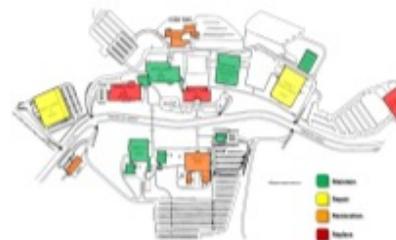
You could fix 6 potential leaks at the same cost as 1 emergency leak.

Asset Management Programs



Actionable Intelligence Empowers Proactive Business Decisions

- Offerings and Expertise to Protect Your Assets
- Programs Tailored to Meet Your Specific Business Goals and Strategies
- Proactive Solutions that Deliver High ROI



RAM Command Online Management



- Centralized Web-Based Management
- Access to Your Entire Property Portfolio
- Proactively Managing Your Assets will Save Budget Dollars

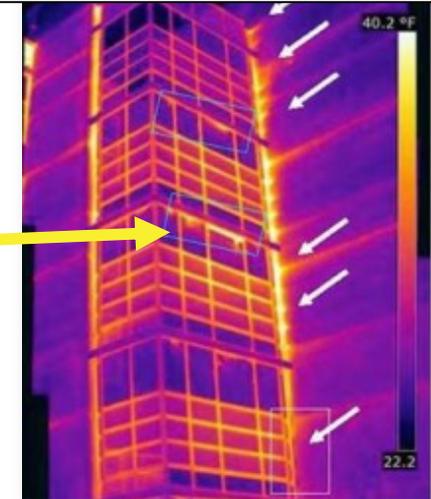
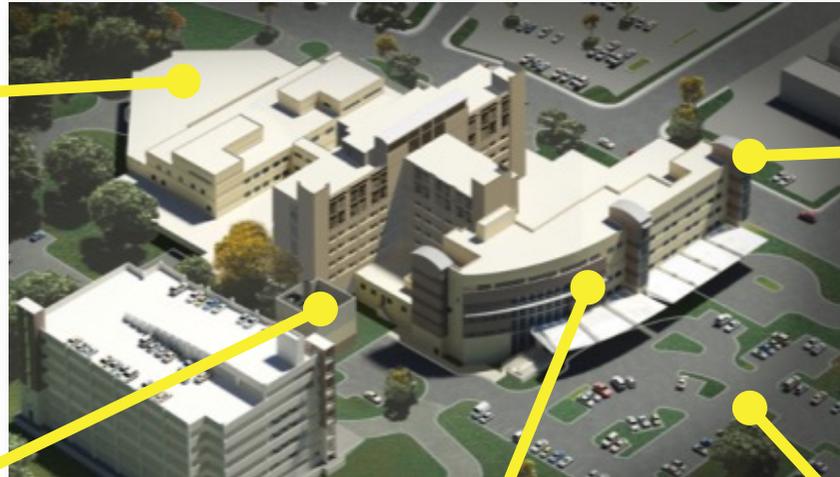


Get Your Hands Around Your Entire Building Portfolio

RAM Construction Technology – Building Envelope and Energy Tools



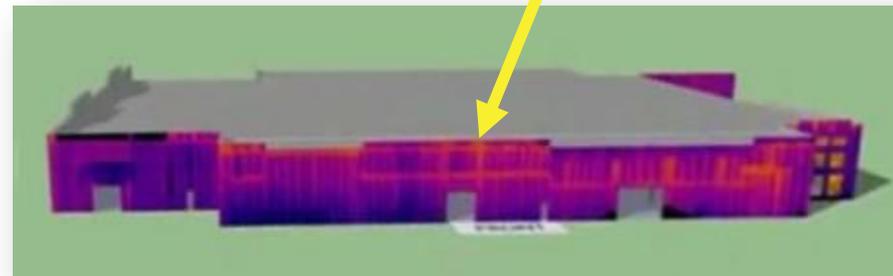
Aerial Roof Moisture/Energy Scans



Envelope Energy Loss Analysis



Aerial Steam Line Scans



Energy/Thermal Performance Modeling



Aerial Parking Lot Scans

RAM Command

Your Solutions Roadmap

WELCOME COMMAND ADMIN HELP LOGOUT

UNITED STATES POSTAL SERVICE

OVERVIEW
IMAGE VIEW
DETAILED VIEW
FISCAL VIEW
EVENT VIEW

Capital Metro Area
Eastern Area
Great Lakes Area
Northeast Area
Pacific Area
Southern Area
Western Area

PROGRAM TOTALS

Program Totals	
Sites	7
Buildings	7
Roof Sections	5
Roofing SF	\$37,677
Total Replacement Value	\$957,700

BREAKDOWN

Number of Roof Sections by Age

21+ yrs	1
16-20 yrs	1
11-15 yrs	1
6-10 yrs	1
0-5 yrs	1

BUDGETING

Expected Expenditures

	2014	2015
Repairs	\$100,000	\$125,000
Restore	\$10,000	\$25,000
Repair	\$10,000	\$5,000
Maintenance	\$1,200	\$6,000
Total	\$543,200	\$169,000

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Your Solutions Roadmap

WELCOME COMMAND ADMIN HELP LOGOUT

UNITED STATES POSTAL SERVICE

Image View: US25 - Arizona - Apache County - Alpine

Display Roof Sections & Points of Interest
Blended (Roof)

OVERVIEW
IMAGE VIEW
DETAILED VIEW
FISCAL VIEW
EVENT VIEW

Capital Metro Area
Eastern Area
Great Lakes Area
Northeast Area
Pacific Area
Southern Area
Western Area

Arizona
Alpine
Section A
Section B
Section C

PROGRAM TOTALS

Program Totals	
Buildings	1
Roof Sections	1
Roofing SF	6,917
Total Replacement Value	\$138,340

BUDGETING

Expected Expenditures

	2014	2015
Repairs	\$138,340	\$0
Restore	\$0	\$0
Repair	\$0	\$0
Maintenance	\$0	\$0
Total	\$138,340	\$0

- Centralized Web-Based Management
- Your Entire Roof Portfolio Right at Your Finger Tips
- Quickly Access and Manage the Health and ROI of Assets

Detailed and Custom Reporting

Image View: Thumbnail Navigation

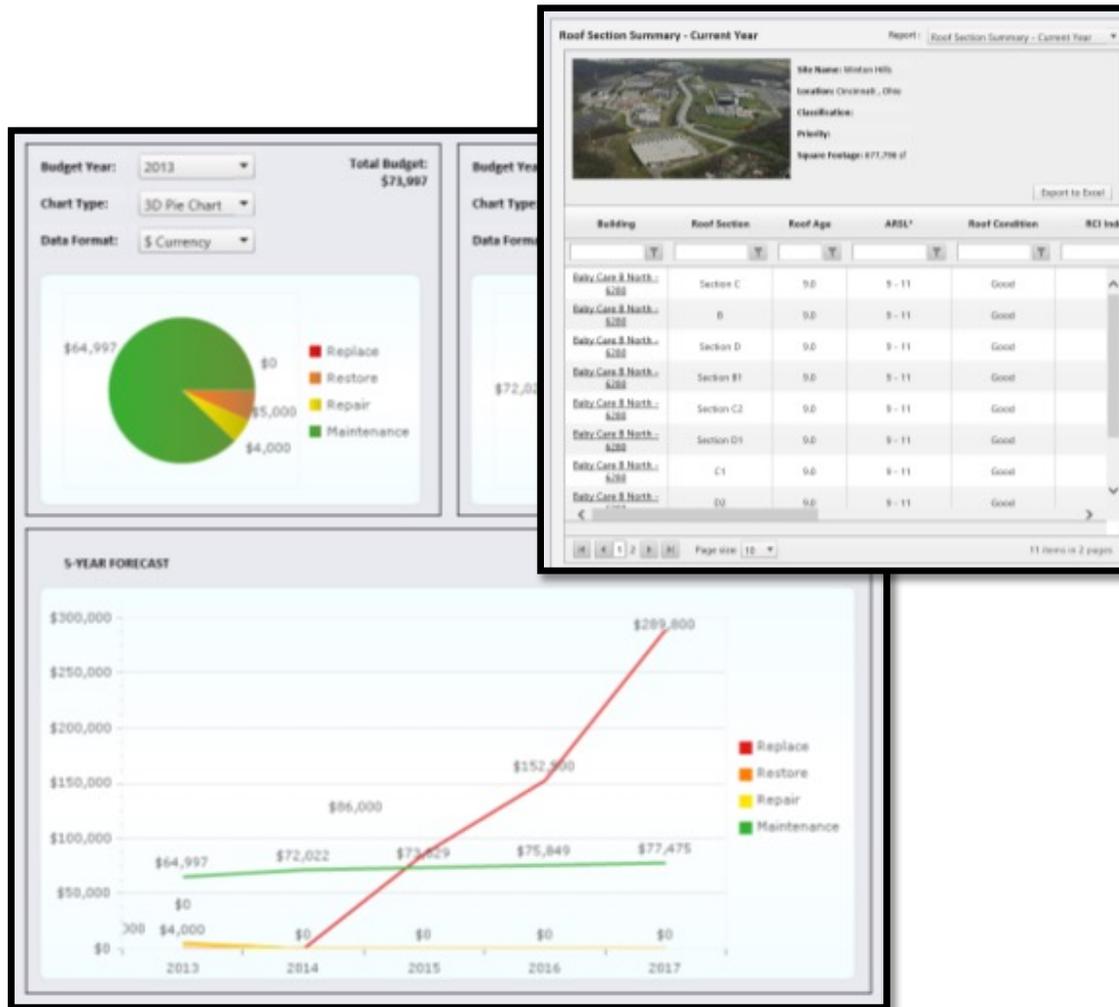


Image View

- OVERVIEW
- IMAGE VIEW**
- DETAILED VIEW
- FISCAL VIEW
- EVENT VIEW

- Capital Metro Area
- Eastern Area
- Great Lakes Area
- Northeast Area
- Pacific Area
- Southern Area
- Western Area

Cincinnati, OH 78,870 sf

Cincinnati, OH 54,085 sf

Cincinnati, OH 63,812 sf

Cincinnati, OH 35,110 sf

Cincinnati, OH 38,101 sf

Cincinnati, OH 25,665 sf

Cincinnati, OH 90,611 sf

Cincinnati, OH 71,632 sf

Cincinnati, OH 8,415 sf

Cincinnati, OH 61,755 sf

Cincinnati, OH 52,215 sf

Cincinnati, OH 12,315 sf

Cincinnati, OH 36,665 sf

Cincinnati, OH 54,350 sf

Cincinnati, OH 11,675 sf

Cincinnati, OH 0 sf

Cincinnati, OH 0 sf

Cincinnati, OH 0 sf

Roof Moisture Analysis

Infrared Analysis – First Phase of Determining Failure Mode



Report Details:

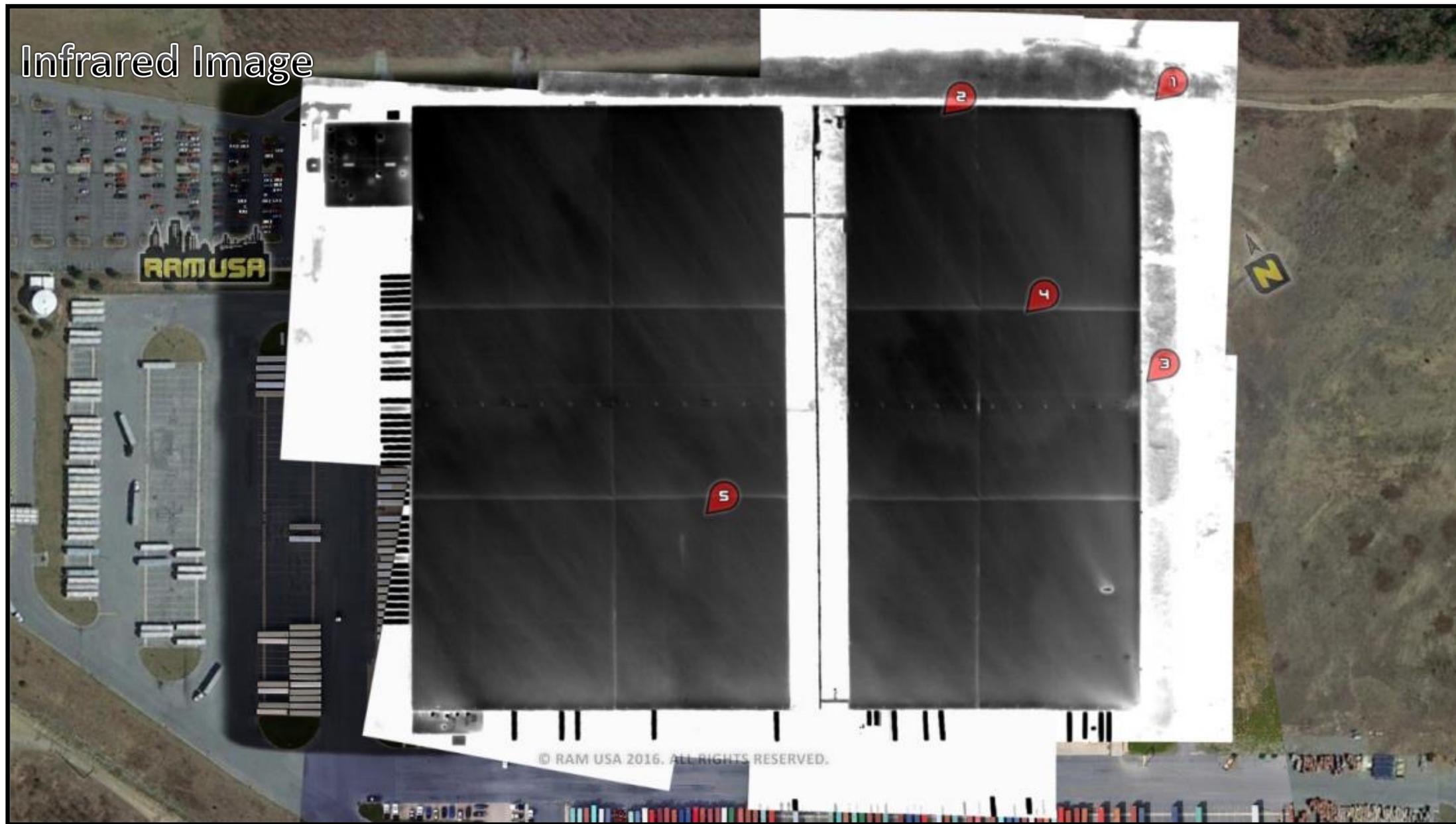
- Tagging
- Types of Failure
- Square Footage
- Criticality
- Observations
- Portfolio Ranking

Color	Moisture	Severity
Yellow	< 30%	Minor
Orange	30% - 65%	Important
Red	> 65%	Critical
Pink	Field Investigation to Confirm	To Be Determined

Visual Image



Infrared Image



Blended Image



Keeping \$2,400,000 out of the landfill!



	RAM USA	
Estimated	RAM Aerial Survey	= \$ 14,000
Replacement Cost	RAM Forensic Survey	= \$ 21,000
= \$7,971,995	RAM Re-Skin	= \$4,898,200
	RAM Total	= <u>\$4,933,200</u>
	RAM Savings	= \$3,038,795

< 0.5% of replacement cost reduces expenditure by 62%

By-Product: Materials Saved

The Most “Sustainable” Action One Can Take is to Keep Good Materials on Buildings



We Estimate that over 350,000 cubic feet of Landfill Space could be Saved by Maintaining the Good Roofing Material on this Project



Visual Image

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Blended Image

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Case Study – Global CPG Client

Global CPG client in OH faced an aging roof portfolio needed to effectively manage the inevitable future capital outlay. Client delegated this responsibility to JLL. JLL hired RAM USA (A Synergy partner) to devise a comprehensive long term capital plan.

Customized Solution

- Global CPG client needed help evaluating the roof structural health across 4 Campuses, 15 Buildings, 300 roof sections totaling 1,550,615 roof sq. ft..
- Modus operandi was to replace roof due to leak, age and appearance.
- Thinking outside of the box JLL engaged RAM USA (A Synergy partner) to conduct innovative aerial infrared site surveys to report on 10 years portfolio assessment and finalize a capital plan.
- Infrared scans are used to locate wet insulation in roofing systems, using forensic data from the images, RAM USA identified roof sections eligible for restoration.



Case Study – Global CPG Client

Global CPG client in OH faced an aging roof portfolio needed to effectively manage the inevitable future capital outlay. Client delegated this responsibility to JLL. JLL hired RAM USA (A Synergy partner) to devise a comprehensive long term capital plan.

Results

- By utilizing state-of-the-art aerial infrared site survey and virtual roof top inspection, RAM USA was able to recommend areas where roof restorations was possible leading to \$8.8 M of cost avoidance
- RAM USA provided 20% lower survey cost due to Synergy preferred pricing = \$25,250 cost savings
- Portfolio Asset Value = \$33,500,000
- Survey cost = \$100,950
- Survey cost = 0.3% of Portfolio Asset Value
- Cost avoidance = \$8,800,000
- Return on Investment on conducting the infrared roofing Survey = 8,717%

Client Profile

Industry: Consumer products

Geography: Ohio

Square footage: 1,550,615

Length of relationship: Three (3) Years

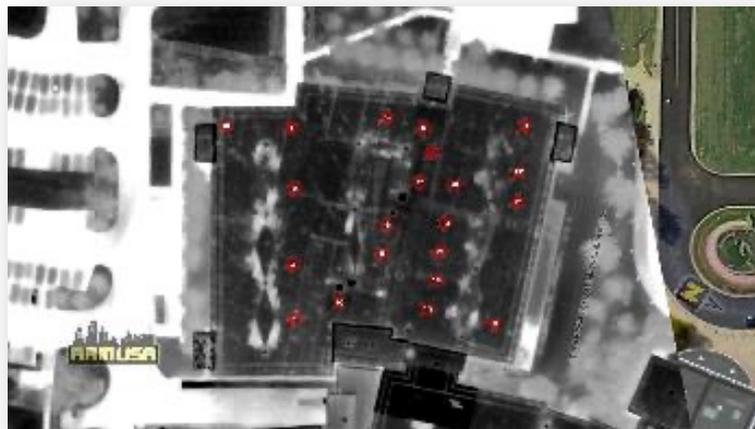
Cost avoidance: \$8.8 Million

Cost Savings: \$25,250

ROI: 8,717%

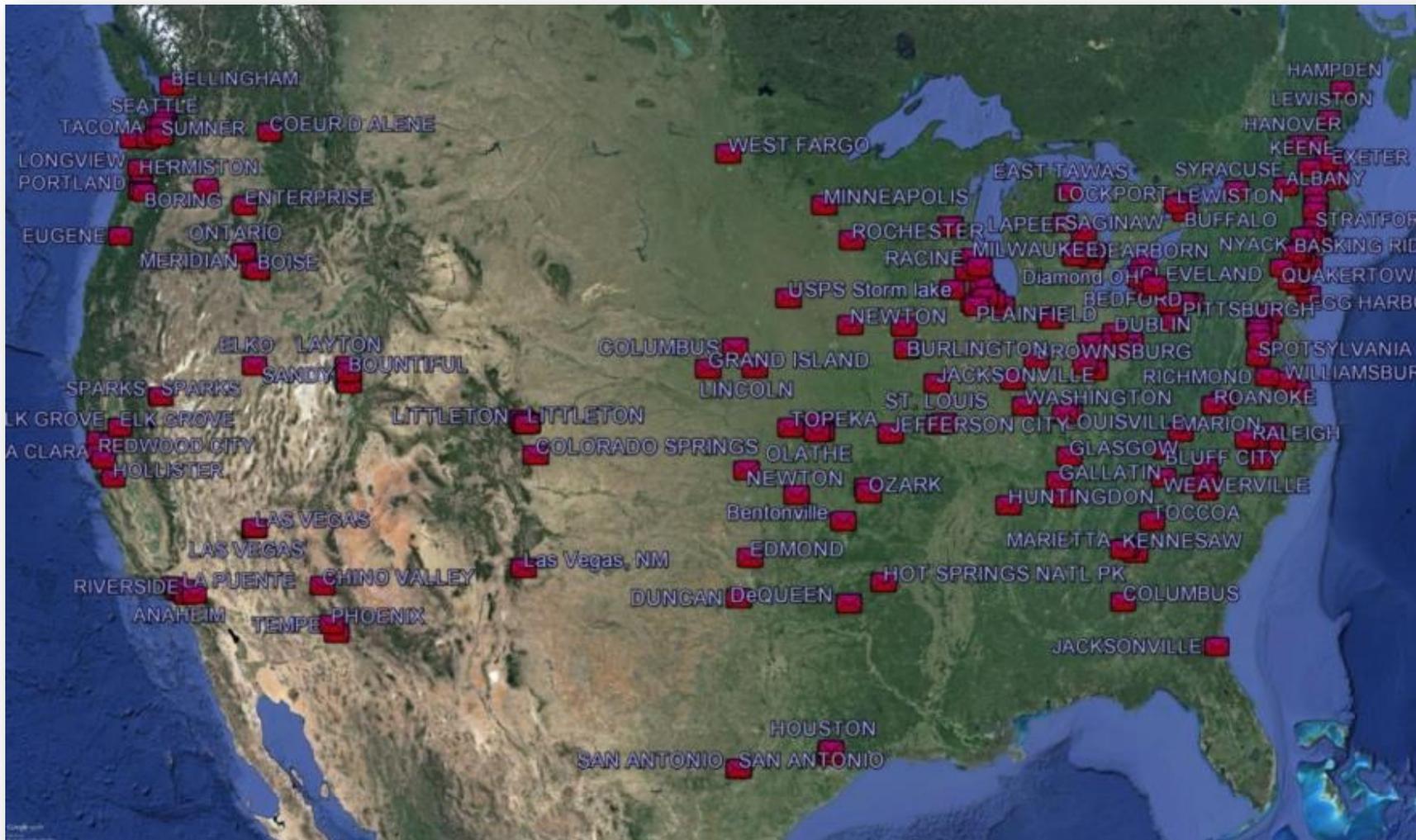
Year completed: 2016

Services provided:
Project Management



Case Study – United States Postal Service

Map of Sites:



Summary– United States Postal Service

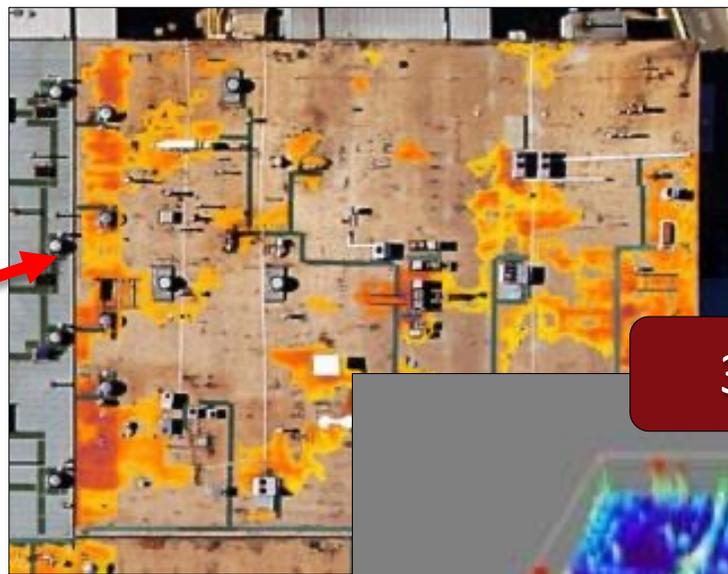
TOTAL SITES REVIEWED	188
REPLACEMENT RECOMMENDED	60
RESTORATION RECOMMENDED	41
RESKIN RECOMMENDED	20
REPAIR RECOMMENDED	46
MAINTAIN RECOMMENDED	21

188 Sites @ **\$1,674,000** Reduced Costs by **\$56,958,318**

Roughly 1.6% of replacement cost reduces expenditure by 56%

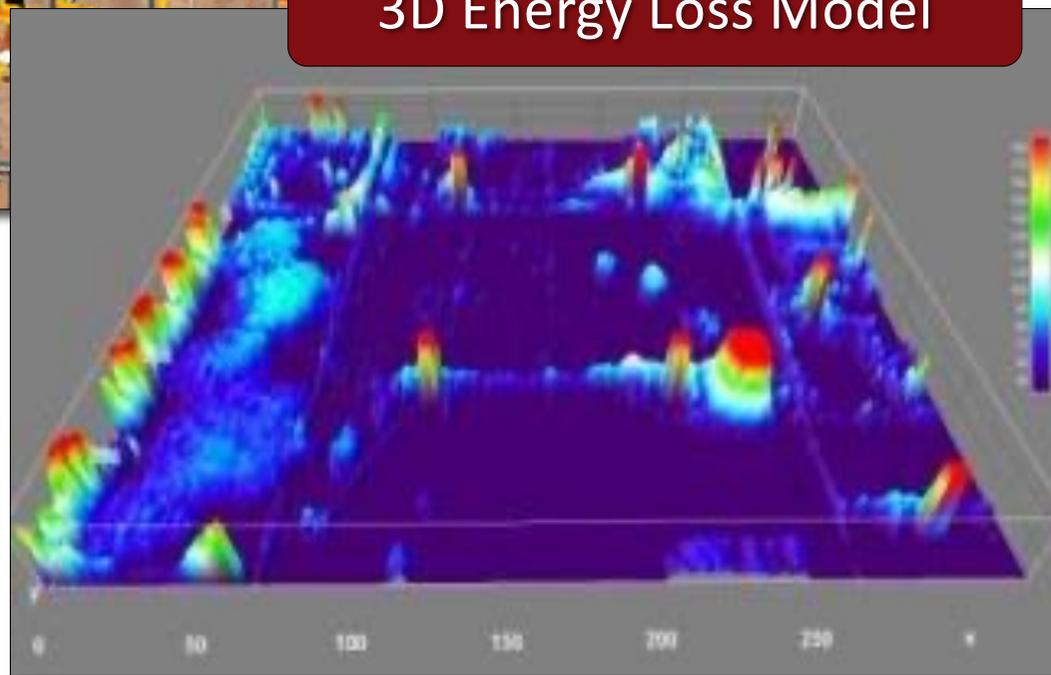
Envelope Energy Loss Analysis

Roof Energy Analysis



*50,000 SF Infrared with
Colorized Moisture*

3D Energy Loss Model

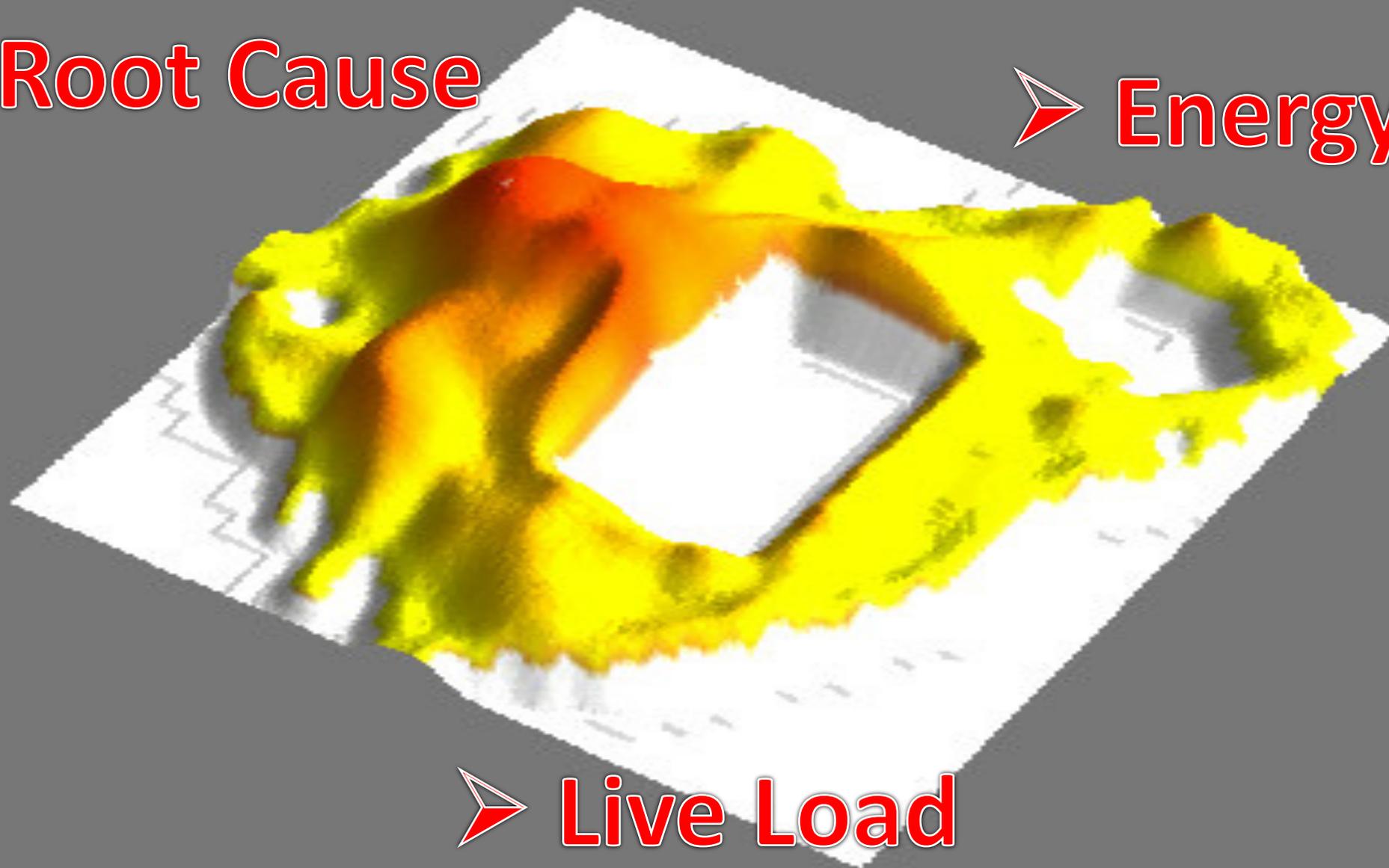


- One 50,000 SF Roof Replacement:
 - Increased R-Value from R2 to R22
 - Significant savings over the lifetime of the Roof

Deeper Analysis

➤ **Root Cause**

➤ **Energy Loss**



➤ **Live Load**

Deeper Analysis



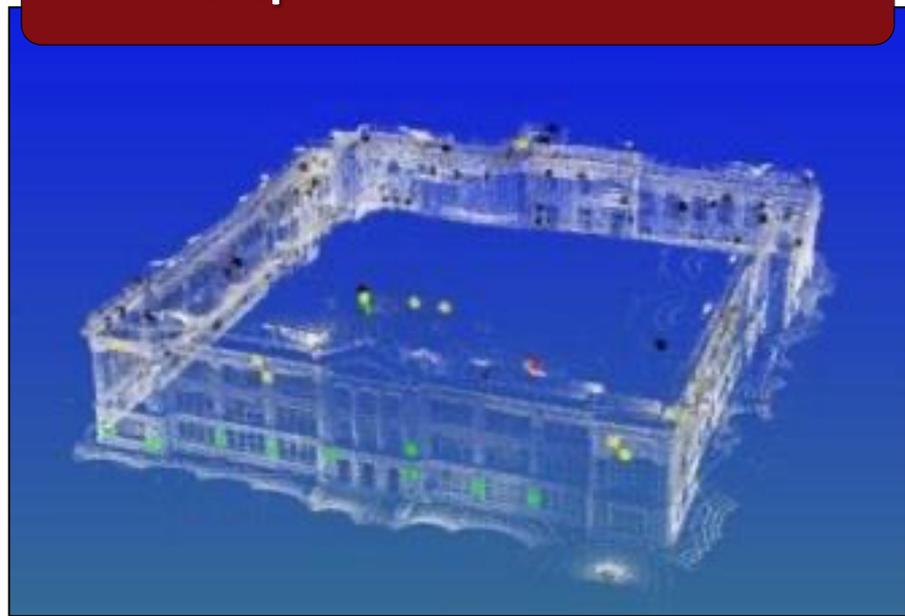
Deeper Analysis



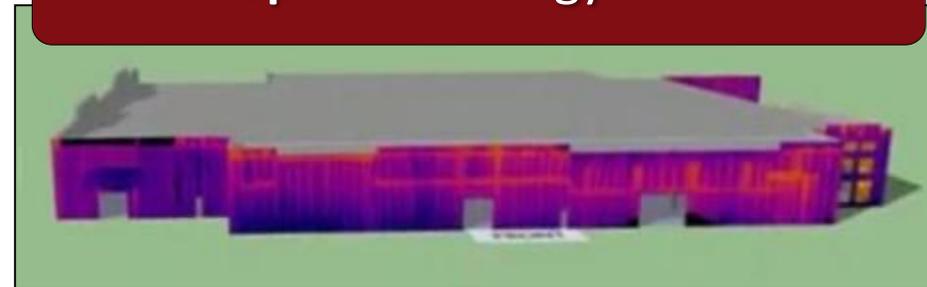
Energy Calcs derived From Thermal Patterns of Moisture Damage

Building Envelope Performance/Energy Analysis

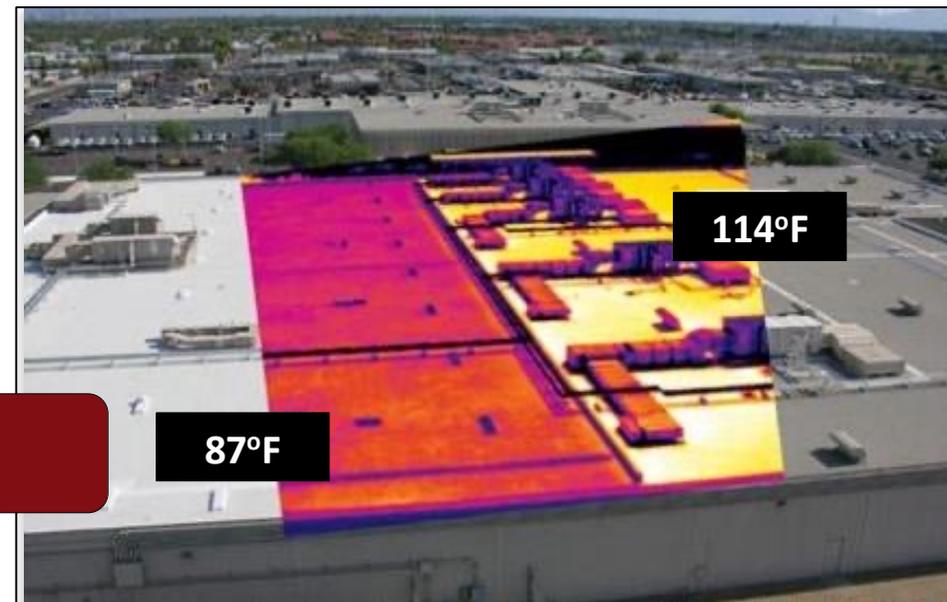
Step 1: 3D Laser Model



Step 2: 3D Energy Model



Step 3: Final Building Energy Costs

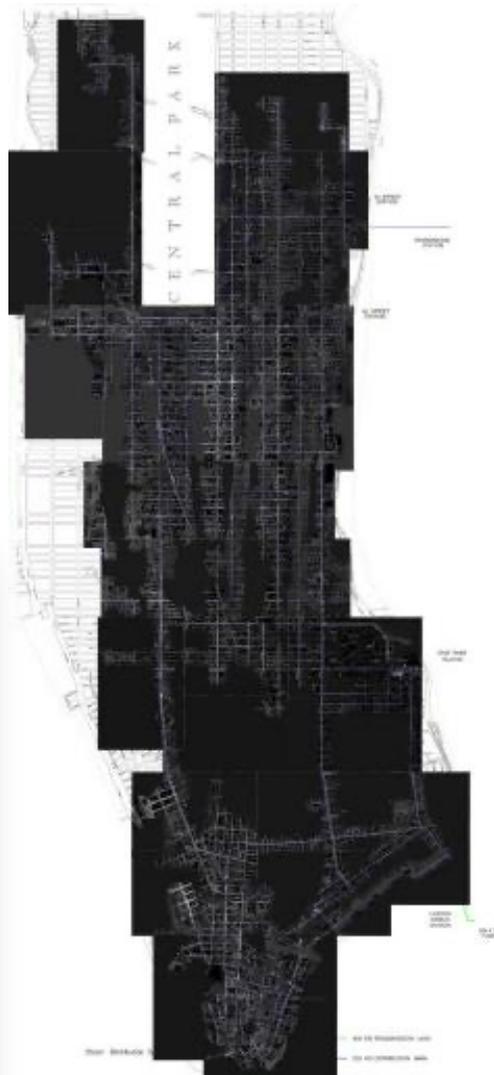


Steam Transmission Analysis

Case Study - City of Manhattan

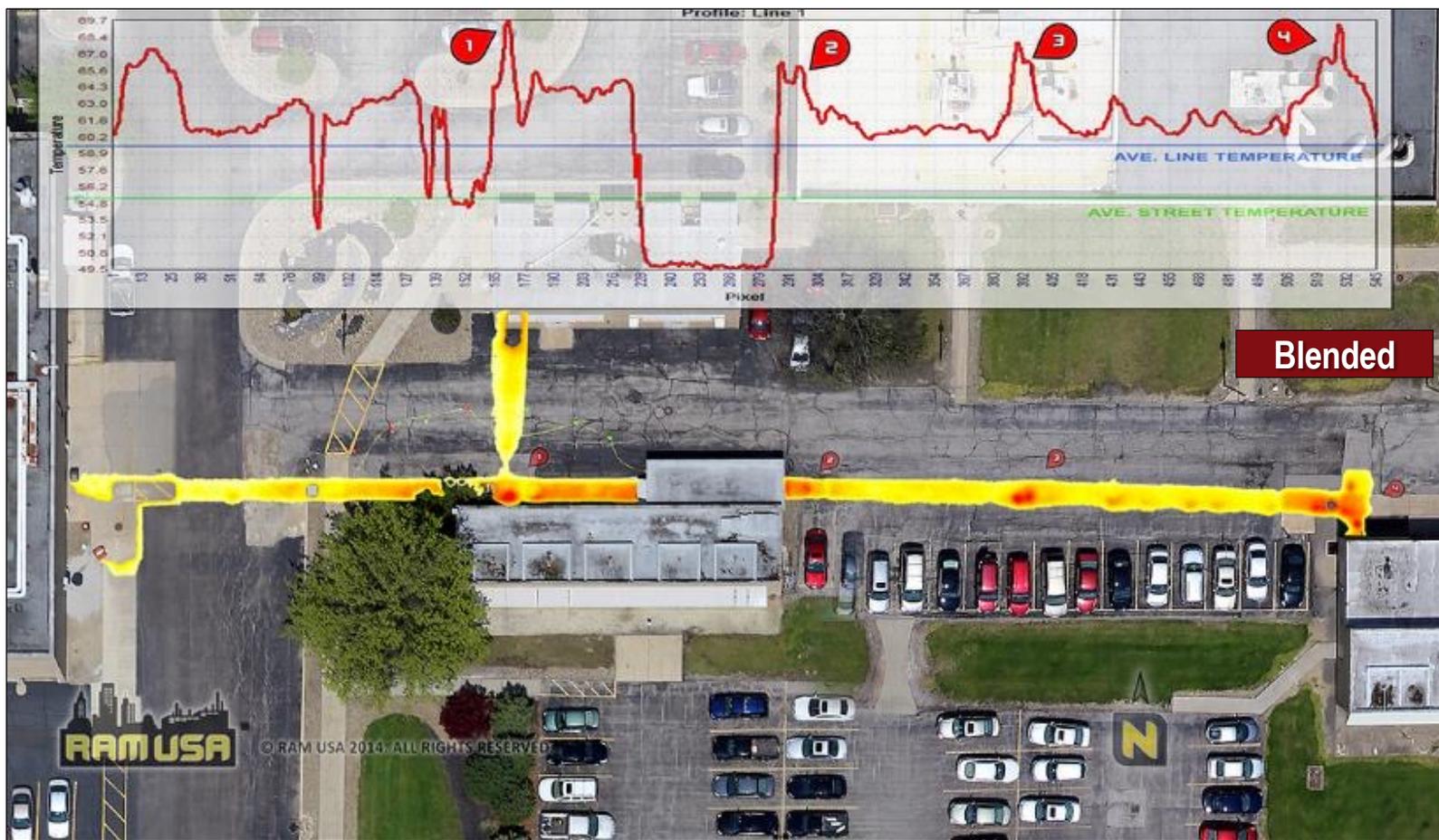
Steam Line Analysis – Aerial Infrared

- Reduce Energy Losses
- Monetize Losses
- Maximize Safety
- Prevent Explosions
- Minimize Business Interruption, Fines, Lawsuit, Litigation



Process of Analysis and Reporting

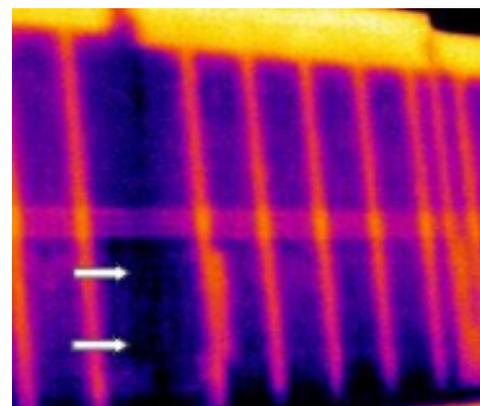
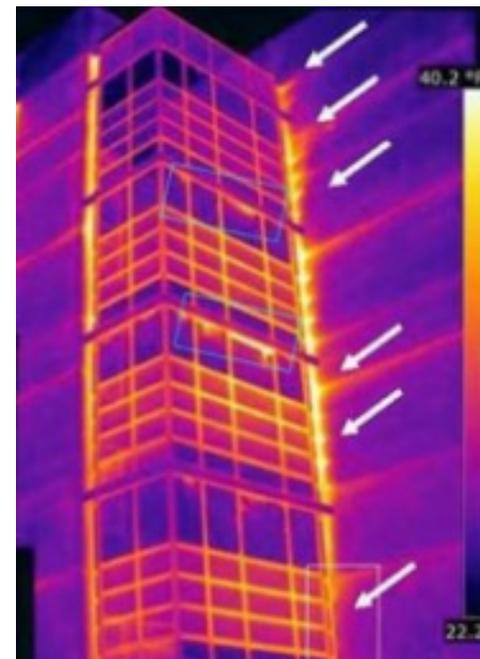
Steam Line Analysis (North Line) – Aerial Infrared



Building Façades & Masonry

Infrared Wall Scans – Identify Escaping Energy

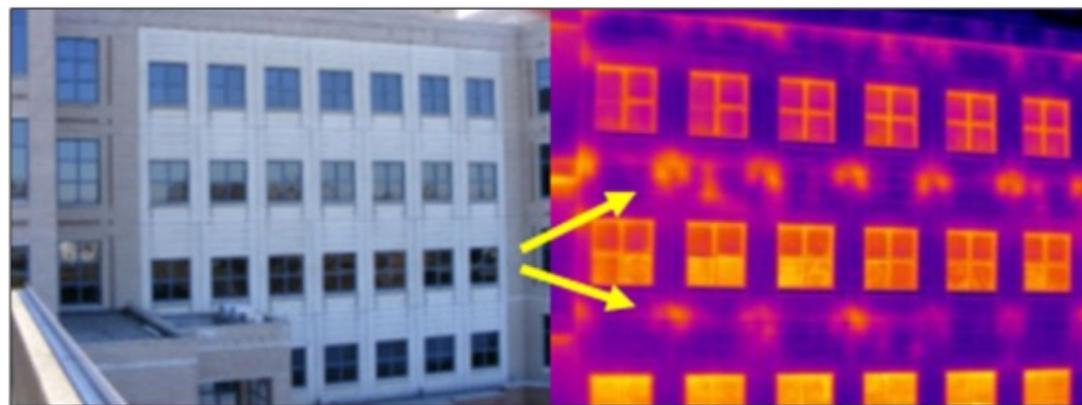
- Early Issue Identification
 - Design
 - Installation
 - Weathering
 - Operations
 - Maintenance
- Air Exfiltration / Infiltration
- Sources of Mold, Mildew, & Moisture
- Increase the Asset's Life
- Reduce Energy Costs
- Eliminate Tenant Issues



Case Study - Infrared Wall Scan & Diagnostics

\$1.25 million new window cost avoidance & significant reduction in energy loss

- Frosting Window Panes
- Infrared Proves Windows Still Performing
- Improper Construction
- Missing Insulation
- Reallocate Resources to Proper Solution



Paved Surface Analysis

Paving Program

Similar to Roofing, Parking Lots are large assets that often appear to be good until they are bad. Also similar to roofing, RAM has developed a method and procedure to quickly, accurately and relatively cheaply assess a single site, a college campus or even a national chain with properties in all 50 states, Canada, Mexico and the Caribbean. Deploying an Aerial Infrared Imaging system, RAM quickly flies to dozens of sites every night and gathers the length, depth and width of every flaw at your site.

Thermal Imaging is a key advantage for RAM. The obvious speed and reach of the flight team allows RAM to assess all your sites quickly. The technology will identify and quantify;

Raveling – Pock Marks or surface erosion.

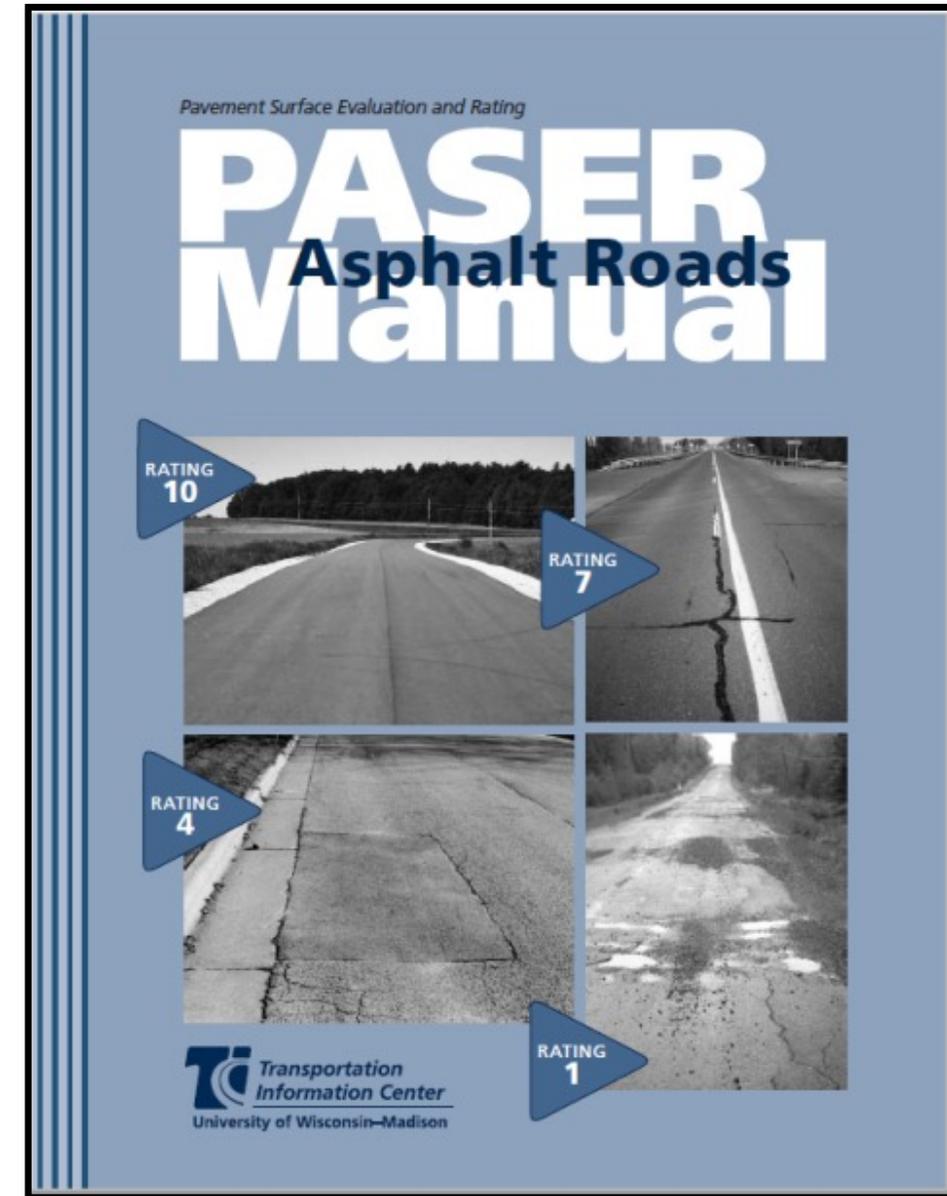
Polishing/Flushing – Traffic wear / Asphalt surfacing.

Alligator Cracks – Cracks forming a series of small blocks.

Pot Holes – Bowl Shaped depressions.

Seal Coating Life – Est. Remaining Service Life

Slippage/Distortion – Flaw between Overlay/Underlying



Paving Program

Objectively Quantify the Quality of each Property

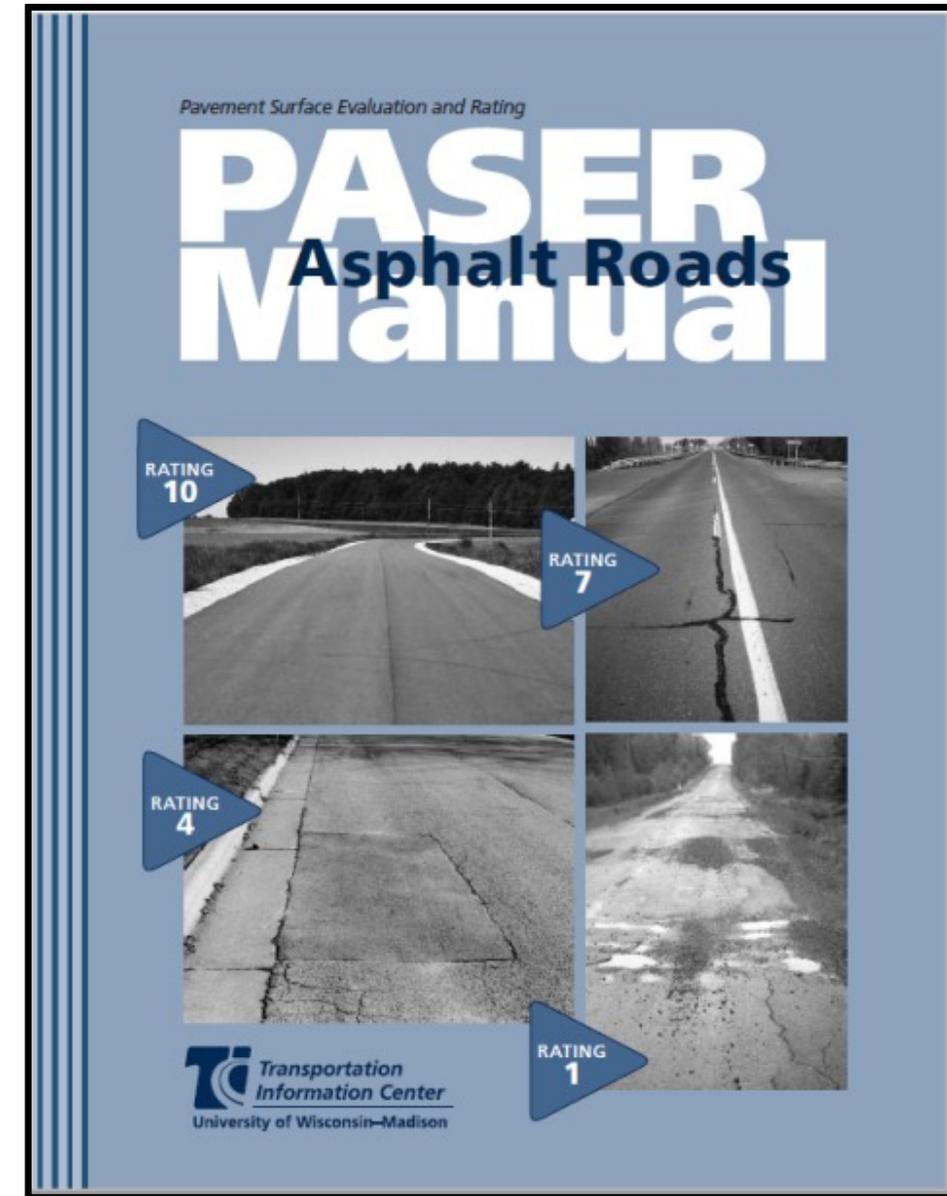
No Action – Score ABOVE 90 on RAM LOC scale

**Maintain – Score between 70 and 90
(Clean and Monitor)**

**Repair – Score between 50 and 70
(Minor Repairs and or Minor Restoration)**

**Restore – Score between 40 and 50
(Moderate Repair or Complete Restoration)**

Replace – Score below 40.



Level 4 – High Contrast RAM USA Proprietary Analysis

Reporting Details:

- **TAG** Each Anomaly
- **TYPING** of Failures
- **Square Footage** Calculated
- Criticality **SCORING**
- Portfolio **RANKING**
- Portfolio Ranking
 - For Visual Inspection
 - For Budgeting

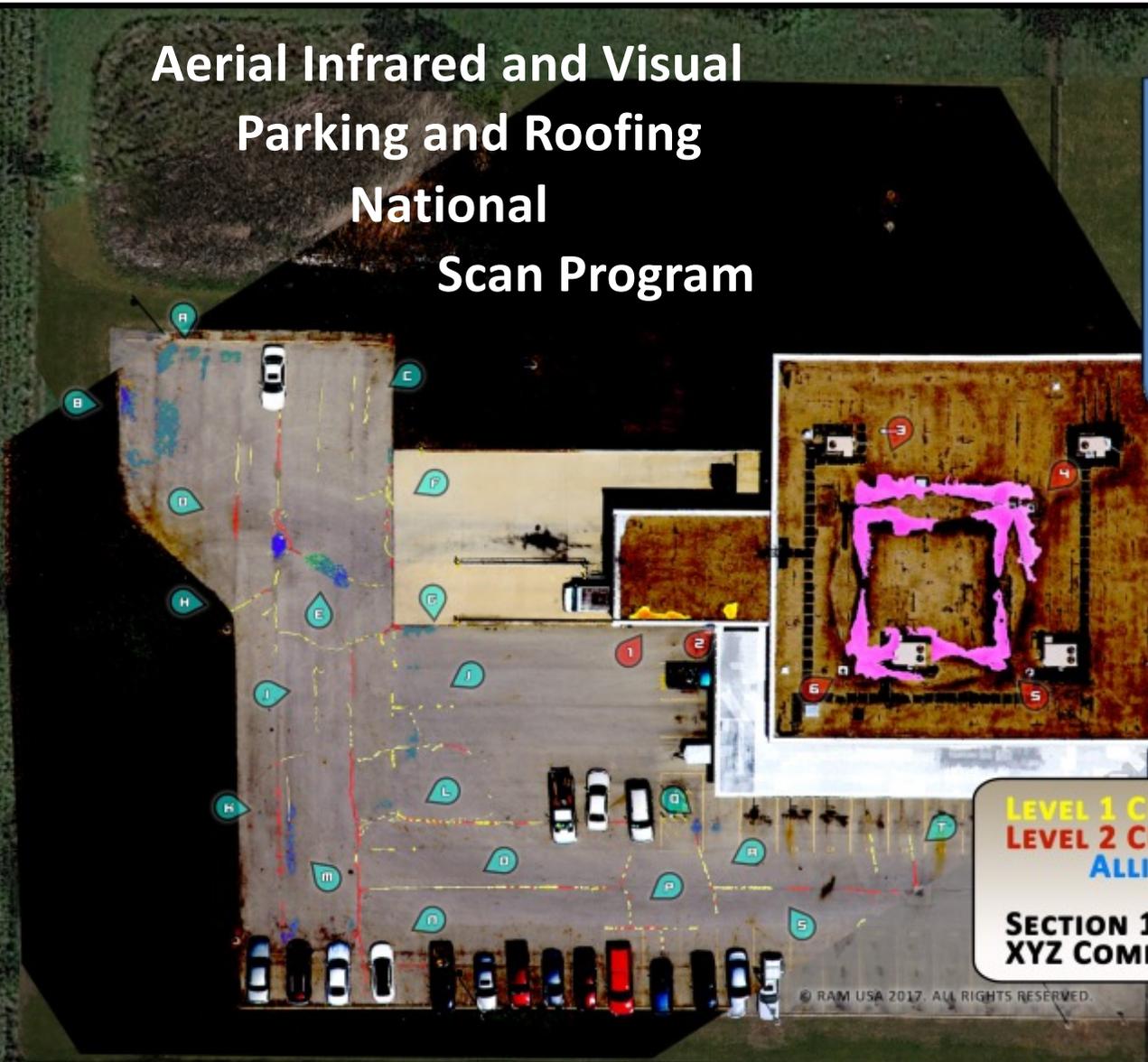


Level 4 – High Contrast RAM USA Proprietary Analysis



Aerial Infrared and Visual Parking and Roofing National Scan Program

- REPORTING DETAILS**
- TAG** EACH ANOMALY
 - TYPING** OF FAILURES
 - SQUARE FOOT** CALCULATIONS
 - CRITICALITY SCORING**
 - PORTFOLIO RANKING**
 - EFFICIENT VISUAL INSPECTONS**
 - BEST BUDGETING**

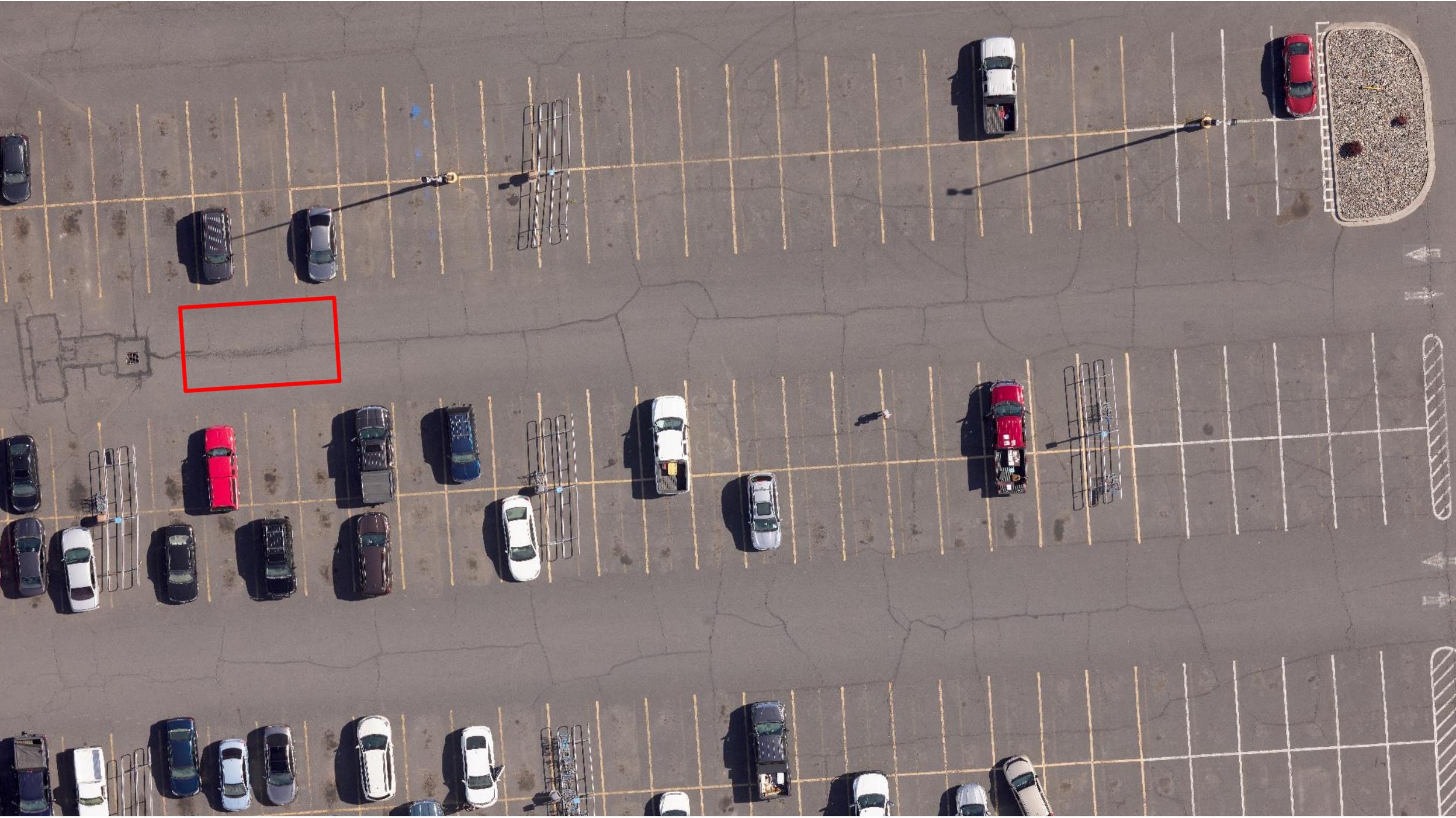


LEVEL 1 CRACKS = 347.5 FEET
LEVEL 2 CRACKS = 117.5 FEET
ALLIGATOR = 149.4 SQ. FT.

SECTION 1A SCORE = RAM LOC 41
XYZ COMPANY RANK = 107 OF 618



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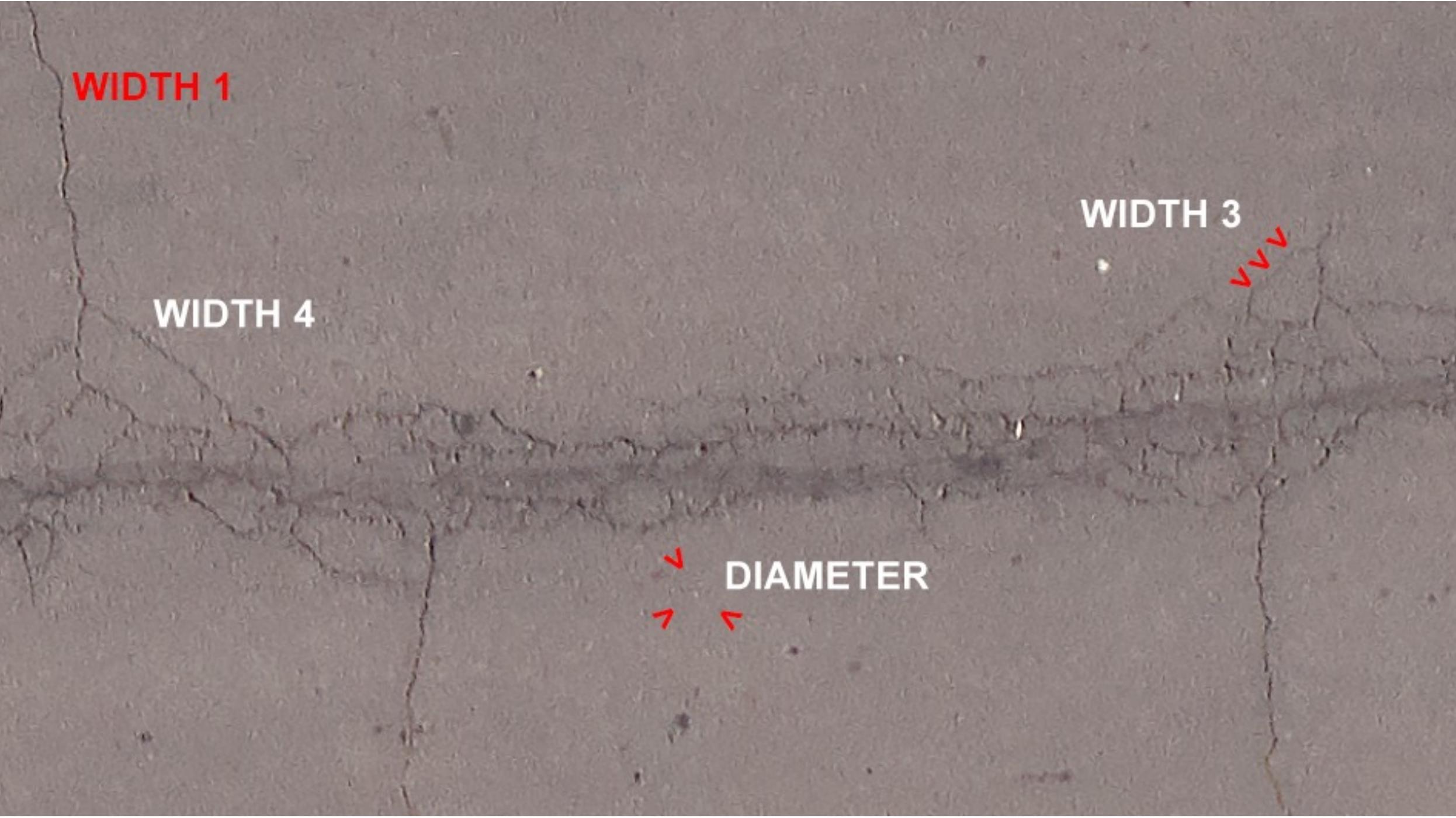


WIDTH 1

WIDTH 3

WIDTH 4

DIAMETER



Level 1 – ROOF & PAVE Analysis; BLENDED and SCORING IMAGE





Aerial Paved Surface Scan

Scoring Tables – Harrison

Sorted by Location			Sorted by Area			Sorted by Score		
Apron 1	9.7	7,636	Lot 9	6.8	271,750	Drive 23	1.3	9,667
Apron 2	9.6	7,700	Lot 3	2.2	264,700	Drive 21	1.3	21,663
Apron 3	7.3	6,500	Lot 4	4.6	93,600	Drive 16	1.8	33,225
Apron 4	7.7	1,600	Lot 1	5.7	71,450	Lot 2	1.9	68,000
Dock 1	9.8	13,000	Lot 2	1.9	68,000	Lot 3	2.2	264,700
Dock 2	6.4	53,700	Dock 2	6.4	53,700	Dock 6	2.9	27,400
Dock 3	3.6	21,600	Lot 5	5.6	51,500	Dock 9	2.9	3,447
Dock 4	4.6	31,400	Lot 8	6.6	49,700	Dock 3	3.6	21,600
Dock 5	6.6	34,000	Drive 9	7.0	41,530	Drive 4	3.6	15,740
			Dock 5	6.6	34,000	Dock 7	3.9	23,850
			Drive 16	1.8	33,225	Dock 8	4.1	6,600
			Drive 14	4.4	32,328	Drive 15	4.4	21,741
			Dock 4	4.6	31,400	Drive 14	4.4	32,328
			Lot 11	4.9	29,700	Drive 24	4.4	4,870
			Dock 6	2.9	27,400	Lot 6	4.4	17,400
			Dock 7	3.9	23,850	Dock 3	4.6	6,800
			Drive 15	4.4	21,741	Dock 4	4.6	31,400
			Drive 21	1.3	21,663	Drive 7	4.6	18,760
			Drive 8	9.6	21,620	Lot 4	4.6	93,600
			Dock 3	3.6	21,600	Lot 11	4.9	29,700
			Drive 2	7.3	20,750	Drive 22	5.0	5,740
			Drive 7	4.6	18,760	Lot 5	5.6	51,500
			Drive 11	9.6	18,100	Lot 1	5.7	71,450
			Lot 7	5.7	17,500	Lot 7	5.7	17,500
			Lot 6	4.4	17,400	Drive 1	5.9	9,000
			Drive 19	9.6	16,358	Dock 2	6.4	53,700
			Drive 4	3.6	15,740	Dock 5	6.6	34,000
			Drive 13	9.8	13,900	Lot 8	6.6	49,700
			Lot 10	9.6	13,300	Lot 9	6.8	271,750
			Dock 1	9.8	13,000	Drive 9	7.0	41,530
			Drive 6	8.8	9,770	Apron 3	7.3	6,500
			Drive 23	1.3	9,667	Drive 2	7.3	20,750
			Drive 12	7.7	9,513	Apron 4	7.7	1,600
			Drive 1	5.9	9,000	Drive 12	7.7	9,513
			Drive 10	9.8	8,445	Drive 5	8.8	9,770
			Apron 2	9.6	7,700	Drive 20	8.8	1,857
			Apron 1	9.7	7,636	Drive 5	8.9	7,200
			Drive 5	8.9	7,200	Apron 2	9.6	7,700
			Drive 3	4.6	6,800	Lot 10	9.6	13,300
			Dock 8	4.1	6,600	Drive 8	9.6	21,620
			Apron 3	7.3	6,500	Drive 19	9.6	16,358
			Drive 17	9.7	6,248	Drive 11	9.6	18,100
			Drive 22	5.0	5,740	Drive 17	9.7	6,248
			Drive 24	4.4	4,870	Apron 1	9.7	7,636
			Lot 8	6.6	49,700	Dock 1	9.8	13,000
			Lot 9	6.8	271,750	Drive 13	9.8	13,900
			Lot 10	9.6	13,300	Drive 10	9.8	8,445
			Lot 11	4.9	29,700	Apron 4	7.7	1,600



Aerial Paved Surface Scan

Surface Distress Detailed Description

Concrete Surface Distress		
Surface rating	Visible distress*	General condition/treatment measures
10 Excellent	None.	New pavement. No maintenance required.
9 Excellent	Traffic wear in wheelpath. Slight map cracking or pop-outs.	Recent concrete overlay or joint rehabilitation. Like new condition. No maintenance required.
8 Very Good	Pop-outs, map cracking, or minor surface defects. Slight surface scaling. Partial loss of joint sealant. Isolated meander cracks, tight or well sealed. Isolated cracks at manholes, tight or well sealed.	More surface wear or slight defects. Little or no maintenance required.
7 Good	More extensive surface scaling. Some open joints. Isolated transverse or longitudinal cracks, tight or well sealed. Some manhole displacement and cracking. First utility patch, in good condition. First noticeable settlement or heave area.	First sign of transverse cracks (all tight); first utility patch. More extensive surface scaling. Seal open joints and other routine maintenance.
6 Good	Moderate scaling in several locations. A few isolated surface spalls. Shallow reinforcement causing cracks. Several corner cracks, tight or well sealed. Longitudinal or transverse joints and more frequent transverse cracks.	First signs of shallow reinforcement or corner cracking. Needs general joint and crack sealing.
5 Fair	Moderate to severe polishing or scaling of the surface. High reinforcing steel causing surface spalling. Some joints and cracks have begun spalling. First signs of joint or crack faulting. Multiple corner cracks with broken pieces. Moderate settlement or frost heave areas. Patching showing distress.	First signs of joint or crack spalling or faulting. Grind to repair surface defects. Some partial depth patching or joint repairs.
4 Fair	Severe polishing, scaling, map cracking, or spalling over 50% of the area. Joints and cracks show moderate to severe spalling. Pumping and faulting of joints (1/2") with fair ride. Several slabs have multiple transverse or meander cracks with moderate spalling. Spalled area broken into several pieces. Corner cracks with missing pieces or patches. Pavement blowups.	Needs some full depth repairs, grinding, and/or asphalt overlay to correct surface defects.
3 Poor	Most joints and cracks are open, with multiple parallel cracks, severe spalling, or faulting. D-cracking is evident. Severe faulting (1") giving poor ride. Extensive patching in fair to poor condition. Many transverse and meander cracks, open and severely spalled.	Needs extensive full depth patching plus some full slab replacement.
2 Very Poor	Extensive slab cracking, severely spalled and patched. Joints failed. Patching in very poor condition. Severe and extensive settlements or frost heaves.	Recycle and/or rebuild pavement.
1 Failed	Restricted speed. Extensive potholes. Almost total loss of pavement integrity.	Total reconstruction.

Level 1 – PAVE Analysis; Report Tables

Ohio Turnpike – 55 Building Portfolio from State Line to State Line

- Developed an Asset Management Program
 - All data was input in online program
 - RAM Command
- Aerial Infrared Scans
- Visual Roof Surveys
- Design Specifications and Project Management



CASE STUDY

Seven Site Analysis Comparison

RAM USA – Collected in 78 mins, processed in 5 hours. Current Capacity = 50-100 sites per day

	Carmel		Colerain		Ferguson		Harrison		Kemper		Moriah		Ridge	
Coating	1.5		1		2.25		2		2		2		5.75	
Cracks Filled	5		9.5		5		7.5		4		8		3	
Cracks size	3.25		8.5		3.25		6		2.5		6.75		5	
Lon Cracks	3.5	3.5	8	8	3.5	3.5	7	7	2.25	2.25	7.75	7.75	7.8	7.8
block Cracks	4.25	4.25	8.95	8.95	3.75	3.75	6.75	6.75	3	3	5.75	5.75	5.25	5.25
Raveling	3.5	3.5	7.5	7.5	3	3	6.75	6.75	2.25	2.25	6.75	6.75	8.75	8.75
Alligator	2.5	2.5	8.75	8.75	2.25	2.25	7.75	7.75	3	3	8.75	8.75	8.5	8.5
Other														
RAM Score	3.357143		7.457143		3.285714		6.25		2.714286		6.535714		6.292857	
Paser		3.4375		8.3		3.125		7.0625		2.625		7.25		7.575
RAM Rank	5	5	1	1	6	6	4	4	7	7	2	3	3	2
Atlas 10 Score	32		89		61		76		29		65		65	
Atlas 10 Rank		6		1		5		2		7		3		3

Atlas 10 – Collected in 8 days, processed in 15 hours. Current Capacity = 1.5-4 sites per day

Case Study – State of Tennessee

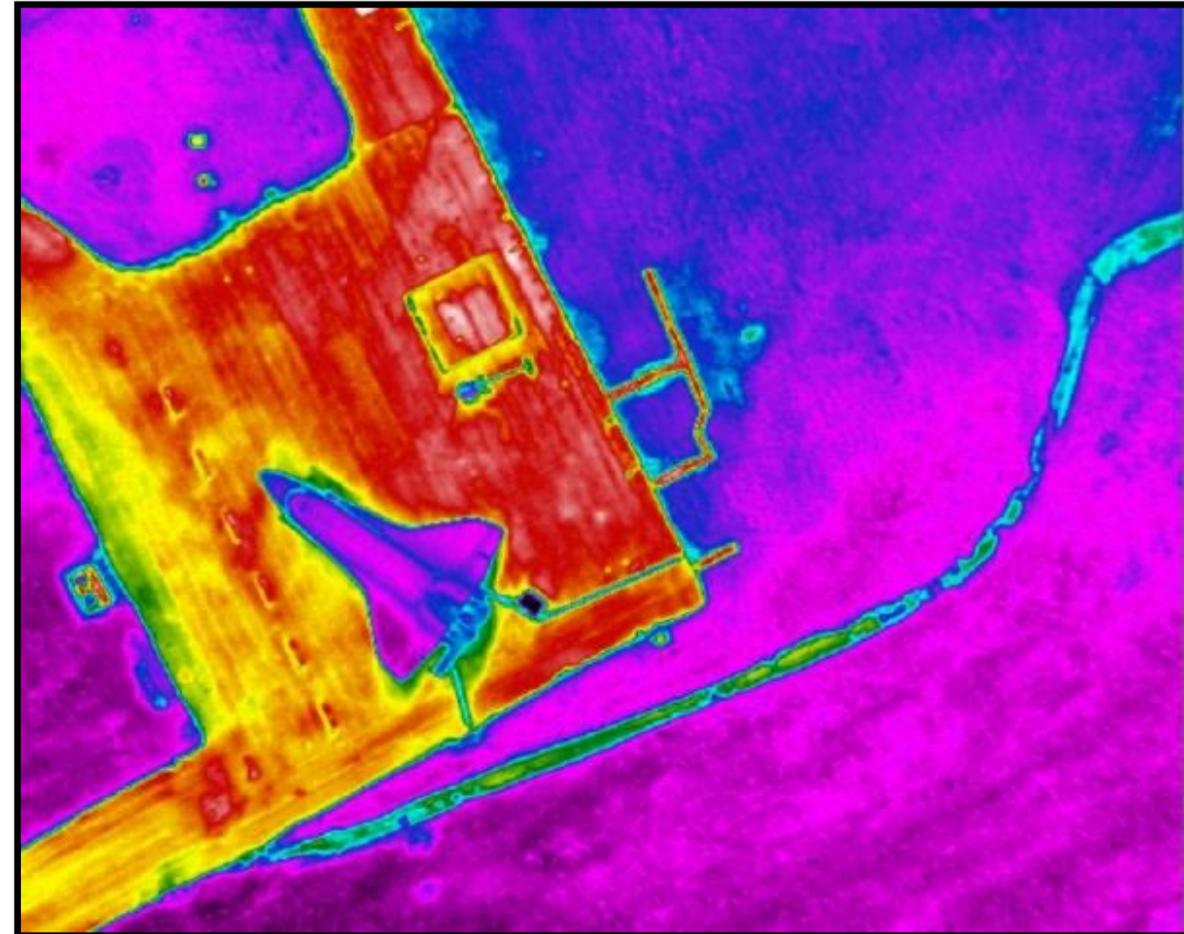
The JLL team in Tennessee was in a competitive bid to increase their business with the State of Tennessee. JLL hired RAM USA (a Synergy Partner) to perform aerial infrared diagnostics on steam lines and roofs. This would allow JLL to offer the state a more comprehensive approach to managing their portfolio of buildings. Winning this business will allow JLL to expand its managed portfolio to additional general government buildings and higher education campuses that choose to participate in the new contract.

Customized Solution

- There were three bidders invited to the RFP.
- While performing a site survey at the University of Memphis campus the JLL team observed an active underground steam line leak from the central steam plant. JLL recalled that the JLL Synergy Partner - RAM USA has a steam line analysis system using Aerial Infrared Technology.
- JLL contracted with RAM USA to fly the entire University of Memphis campus to perform an Aerial Infrared Steam Line Scan. RAM USA would also capture data on the campus roofs to detect for moisture in the insulation and potential roof issues.



- Geo-Referenced Polygons
 - Surfaces; Paved, Landscaped...
 - Roof Areas
 - Building Footprint
 - Administrative Boundaries



Paved Surfaces Ranked

Gas and Electric Line Measured

Solar Array Measured

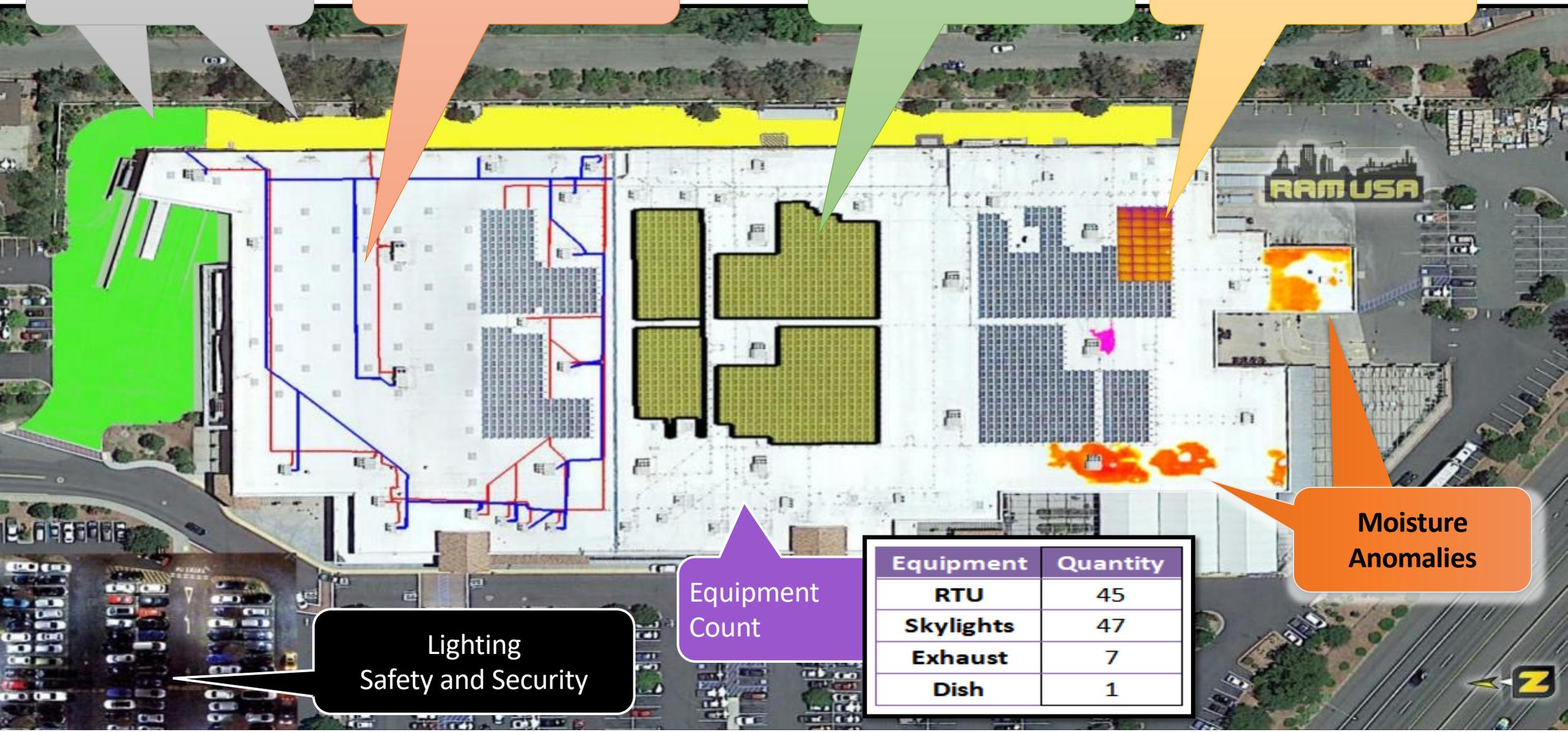
Solar Array Anomalies

Equipment Count

Lighting Safety and Security

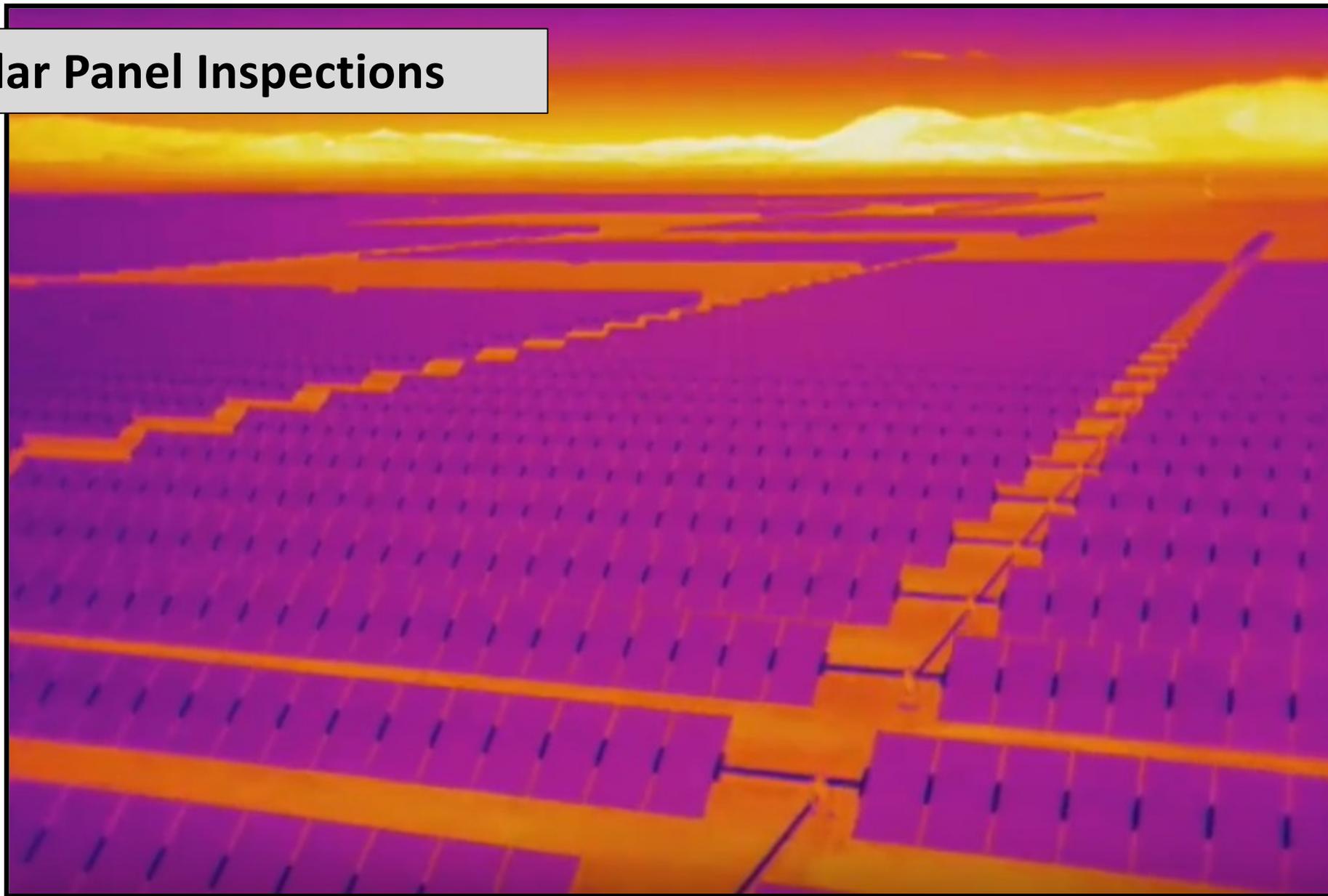
Moisture Anomalies

Equipment	Quantity
RTU	45
Skylights	47
Exhaust	7
Dish	1

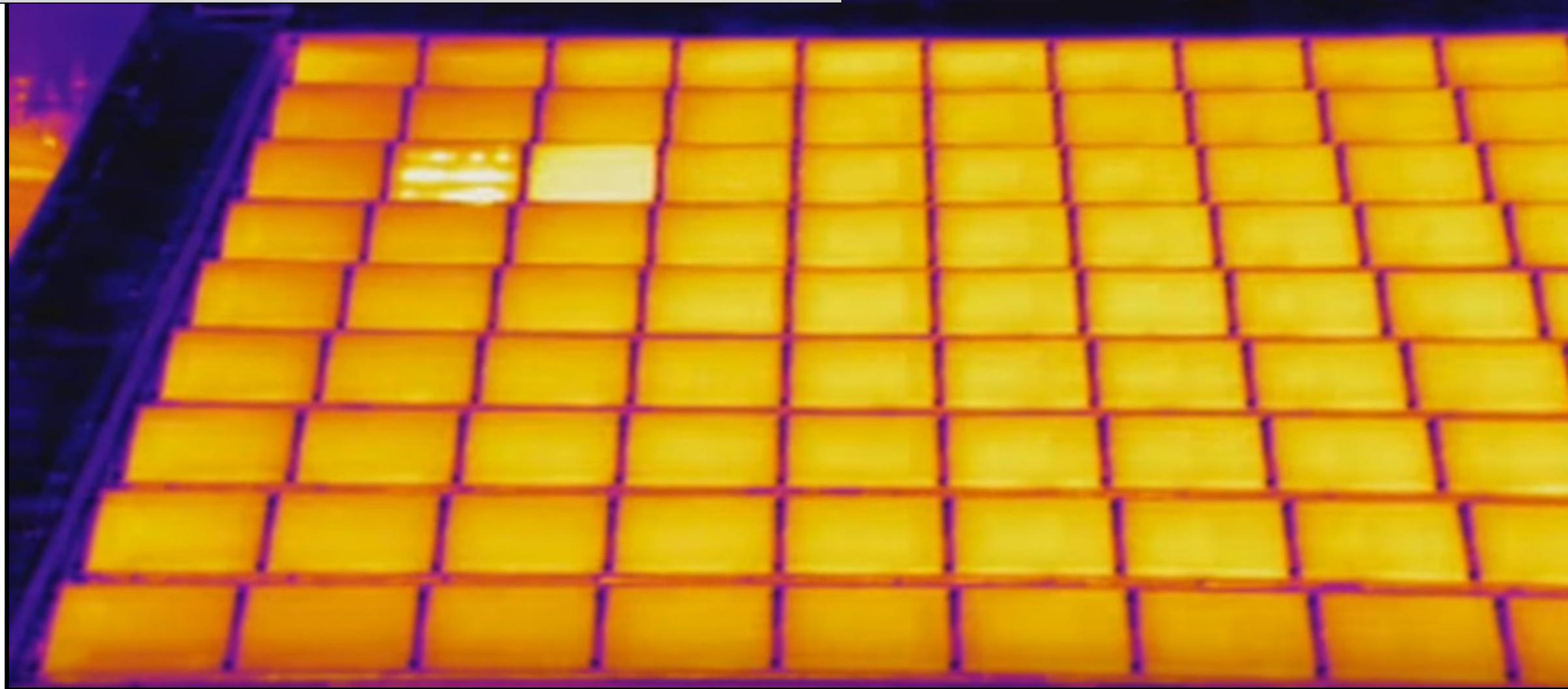


Solar Equipment Analysis

Aerial Infrared Solar Panel Inspections



Aerial Infrared Solar Panel Inspections



Property Lighting Analysis

Property Lighting

Safety

Protect Clients

Avoid Lawsuits

Energy Efficiency





**Objective Analysis
bases on the standards
and legal requirements.**

See your property from
a better vantage



Proprietary Analysis
 Standardized process
 enables owners to
 compare facilities and
 take quick action at
 significant savings.



Property Analysis

Site Positioning and Landscaping



Property Area	14.35 Acres
Arborvitae	61
Sugar Maple	12
River Birch	9
Grass	1.29 Acres
Mulch	.25 Acres



Current
High Resolution
Visual of Property
(Nadir)



Current
High Resolution
Visual of Property
(Obliques – Four Directions)



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Innovation

