TECHNICAL ASSURANCE, INC.

TECHNICAL ASSURANCE
HIGH PERFORMANCE BUILDING ENCLOSURE EXPERTS

SERVICES OVERVIEW

Building System Asset Management

Technical Assurance's ON-PNT® allows facility owners the ability to manage building system inventory, condition assessments and ongoing building system data within one central location. This technology provides for robust GIS mapping and automated reporting metrics for simple data consumption.

Roof Consulting

We are your partner for total roof management. With a team of highly trained roofing specialists, we deliver comprehensive solutions for the assessment, design and implementation of roofing projects of any scope and size. Our programmatic approach to roof management ensures that your roofing investment is optimized to extend the service life of the roof system and to reduce the total cost of ownership.

Façade Consulting

We offer vertical façade management services including masonry and concrete exterior walls, curtain walls, balconies, exterior insulation finishes, fenestrations (doors, windows and skylights) and structural consulting to diagnose the cause of structural distress. We design repairs and restorative solutions that protect the structural integrity and aesthetic design of the building enclosure.

Parking Garage Consulting

Technical Assurance provides comprehensive consulting services for both the restoration of existing parking areas and the construction of new structures. Our deep understand of the requirements for keeping your parking areas highly maintained and safe will help you operate with a low cost of ownership and extend the life of these necessary and valuable assets.

Exterior Hardscapes Consulting

Your exterior hardscapes serve as a first impression and welcome visitors to your facility. Regular maintenance of these areas will increase perceived value of your facility and improve safety. Technical Assurance provides functional design consulting, durability recommendations and due diligence studies, as well as including your exterior hardscapes into your building system asset management program.

Building Enclosure Commissioning

The Technical Assurance full-service Building Enclosure Commissioning Group specializes in providing data-driven, quality improvement suggestions to new construction building design and performs functional testing during construction. Building enclosures directly affect the longevity and energy efficiency of a building. With a systematic approach to quality assurance, our Commissioning process improves the performance, safety and efficiency of a building and ensures that a project meets specific quality requirements outlined by the Owner.

TECHNICAL ASSURANCE, INC.

Technical Assurance, Inc. is a Cleveland-based, nationally-recognized building consulting firm founded in 1993. Technical Assurance, Inc.'s current staff of professionals manages building enclosure consulting and design for assignments of any size or scope. We are frequently asked to provide expert testimony and legal counsel consulting following forensic investigation. To-date, we have successfully delivered program solutions across 45 different states.

Our practice includes a considerable focus on solving a variety of building system deficiencies. Areas of expertise include roofs, façades, fenestrations (doors, windows and skylights), below-grade structures, parking areas and multi-level parking structures. In addition, a number of Technical Assurance clients engage the company to comprehensively manage their physical assets programmatically. These kinds of assignments generally include predictive and preventative maintenance, capital budget integration and even client staff training. We also have a full-service Commissioning Group to improve new construction building design and perform functional testing of the system during construction. Our Commissioning Group also provides Building Retro-Commissioning to improve existing building enclosure performance and energy loss.

Technical Assurance's success is due to our ability to lead the planning, design and implementation process for projects of any type, with a history of delivering projects on time and within budget. Our staff is committed to design excellence and client service with a team approach. Each program is approached individually, without preconceptions, and designed to serve the needs of the particular client – always with the goal of achieving excellence in delivery.

The professionals at Technical Assurance, Inc. have substantial critical facility industry experience. We have an extensive staff of consultants, engineers, field technicians, project and construction managers, database managers, GIS consultants, technical staff and office support. We maintain in-house capabilities to provide asset management and produce design drawings and project specs with complete cost estimating and budget preparation. Additionally, we continue to serve our clients with bidding services and construction administration during the entire course of the task, project or program. Our services are sought primarily by those clients who value their building assets as "critical" in running their daily operations.

5 STEPS TO SUSTAINABILITY

Technical Assurance's unique 5 Steps to Sustainability process ensures thorough, superior results in program assessment, planning, design and management. Our process-driven approach allows our team to systematically lead all phases of building envelope programs – providing a framework for collaboration and creative solutions.

Discover

Development of Owners Facilities Requirement (OFR), inspect, test, explore, excavate, evaluate and observe existing facilities and parking structures to develop an accurate condition assessment. This step frequently involves forensic investigation for facilities problems.

Plan

Prepare and develop repair programs and capital plans along with work schedule priorities based on discovery phase findings.

Solve

Meet with the Owner's Team and develop design (construction documents, plans and specifications) solutions for all building and parking conditions requiring repair, restoration and/or remediation.

Manage

Manage and administer the construction process to ensure cost control, energy savings, quality assurance requirements and compliance with construction documents.

Sustain

Implement and monitor preventive maintenance programs based on long-range component life-cycle forecast to reduce total cost of ownership.

GEOGRAPHICAL COVERAGE

Technical Assurance has the capacity to provide national building enclosure consulting services. Our project-related field teams span across the United States, and we are continuously recruiting top talent in different markets in order to efficiently staff client program needs. We have successfully delivered roofing and building envelope projects across all 50 U.S. states and in Canada.

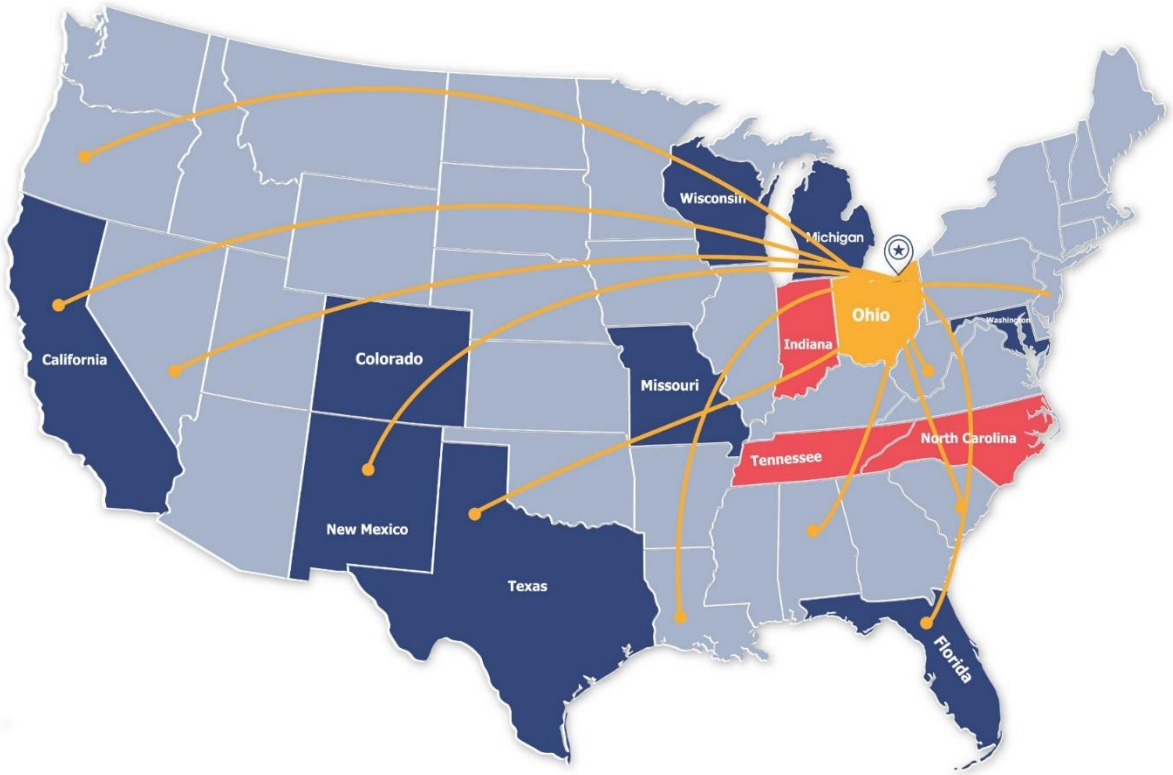
Office Locations

Headquarters Office: 38112 Second Street, Willoughby, OH 44094

Raleigh, NC Office: 301 Kilmayne Drive, Suite 204, Cary, NC 27511

Knoxville, TN Office: 10426 Jackson Oaks Way, Suite 103, Knoxville, TN 37922

Indianapolis, IN Office: 160 West Carmel Drive, Suite 244, Carmel, IN 46032



We Run to Trouble of the service is on us. At Technical Assurance, we pride ourselves on having complete transparency with our clients, and open and honest communication. These guiding principles have set the foundation for us to address our client needs on a national level.

PROJECT EXPERIENCE

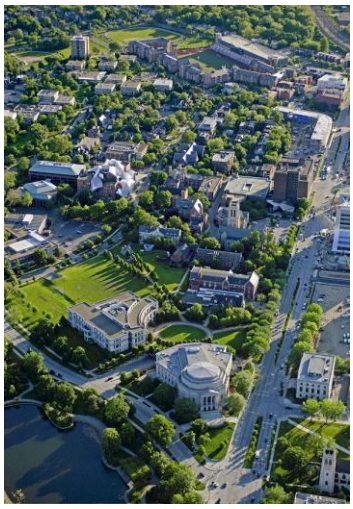
CASE WESTERN RESERVE UNIVERSITY

Client: Case Western Reserve University

Assignment: Roof Sustainability Program

Size: 1.7 million SF

Project Complete: Ongoing (every year)



Technical Assurance has been working with Case Western Reserve University (CWRU) since 2003. In 2013, we were contracted by CWRU to provide a thorough roof assessment for their entire campus, including all academic and residential housing buildings. The university had been experiencing some premature roof failures and needed to gain control of this expansive facility system asset that requires so many capital renewals over the life of a building. To avoid or at least minimize future "surprises," administration decided to contract an enclosure consultant to conduct a thorough conditions assessments beginning with the major systems, roofs and facades. Following the assessment, Technical Assurance worked with the university to implement a campus-wide Roof Asset Management Program (RAMP) on 1.7 million square feet of roofs. This program includes roof maintenance, reporting, emergency and non-emergency leak responses, large roof replacements and construction management.

RAMP has extended the useful service life of their roof portfolio from 5 to 12 years, affording the university over $7 million in total cost of ownership savings over the remaining service life of their roof assets with ongoing repairs and preventative maintenance.

As part of the university's 10-year capital plan, CWRU is focusing on buying down their deferred roof maintenance. As a result, the university's capital roof plan will increase spending over the next few years in order to implement a regular replacement program, which will ultimately save the university millions of dollars on their roof portfolio.

Each year, CWRU replaces failed roof sections on the prioritized buildings/roofs. The number of replacements varies each year based on budget and needs. Technical Assurance designs each of the roof replacements, managed the bid process, served as on-site project management, construction administration and provided quality observation throughout each replacement.

DUKE UNIVERSITY

Client: Duke University Perkins Library

Assignment: Façade Evaluation and Restoration

In 2020, Technical Assurance performed a facade evaluation on the Perkins Library for Duke University in North Carolina. The project included the inspection, testing and planning for the remediation of chronic water infiltration associated with the façade, which is comprised of Duke stone and limestone. The Duke stone is the primary façade component and limestone is found at window surrounds, water tables, spandrels, finials and copings.

The Duke stone is unique to the Duke Forest and quarry and is used on the roughly 100 buildings on the Duke University and Health System campuses. The stone's color is unique and ranges in color that includes deep blues, rich browns, dusty grays and fiery ochres. The University purchased the quarry so that the stone would become a unique architectural common thread on the campus.

The walls of Perkins Library are a barrier system, which means that its function is to prevent the vast majority of water from infiltrating the wall. Whatever water does infiltrate the exterior face, the mass of the full wythe Duke stone wall absorbs it and holds it until the wall dries out. The entire façade of the buildings constructed in 1928, 1948 and 1968 were evaluated with a particular focus on developing a remediation plan for the north elevation which was primarily part of the 1968 addition.

Given the uniqueness of the Duke Stone and the common issues that the University is experiencing across the University, the goal was to develop a systematic and successful remediation program for the Duke stone façade that will not only be used on Perkins Library but can be implemented at all Duke stone clad buildings on the campus.

Technical Assurance developed an approach that will use conventional restoration methods with specialized mortar that is designed for historical restoration. This plan was developed in the fall of 2020. So far in 2021, our team designed the repair and restoration measures necessary to stop the chronic water infiltration. We developed specifications and construction documents. The bidding phase of the project was just completed. Following the bid phase, Technical Assurance provided quality observation throughout the construction of the remediation/restoration work.

WEST VIRGINIA UNIVERSITY

Client: West Virginia University

Assignment: Full Building Envelope

Size: 17 buildings on 2 campuses

Project Complete: Varies

Reference: Brian Gillespie, Construction Manager, Planning Design Construction & Scheduling

304-293-4155

Brian.Gillespie@mail.wvu.edu

Technical Assurance, Inc. was awarded a 3-year IDIQ contract with West Virginia University for comprehensive building envelope consulting services, including roofs, facades, waterproofing and forensic investigations. Although each assignment can vary, Technical Assurance has been asked to assess, cost estimate, design, bid phase manage, and construction phase administer, manage, observe and closed-out a number of projects at WVU.

In addition, Technical Assurance has been tasked with providing consulting services for façade evaluation projects, waterproofing and building enclosure forensic investigation at the university. Below is just a sample of façade/building envelope projects completed for the university:

Beckley Campus RCB Learning Center Sub-Grade Waterproofing:
Technical Assurance was retained to provide inspection, testing and planning in regard to sub-grade waterproofing failures at the RCB Learning Center. Our team discovered many design issues that were causing the chronic water infiltration. After investigation, we worked with the university on the design, bid, project management, field testing and quality observation of the repair project.

Mineral Resource Building Re-Caulk & Replace Seals on Exterior Windows
Technical Assurance provided design, bidding and construction phase services to the University to re-caulk and replace seals on the exterior windows of the building. The scope included developing design and construction documents, managing the bid process on behalf of the University, contractor submittal and shop drawing review, construction administration, and period technical site visits during construction.

Benedum Center Façade Restoration and Waterproofing Repair Project
Following an assessment of the facility, Technical Assurance provided design, bidding, construction administration, project management and quality observation on the $150,000 restoration and repair project. Repair & remediation items included sealants joint replacement around windows and glass doors, masonry repair from deterioration and cracking, repairing surface corrosion, tuckpointing, and restoration to the failed chimney.

University of Alabama at Birmingham

Assignment: ON-PNT Assessments and Forensic Leak Investigation

Size: Approx. 1.2 million square feet in roof assets and 1.16 in façade assets

Project Complete: 2022

In 2021, Technical Assurance was engaged by University of Alabama at Birmingham (UAB) to provide roof and façade campus-wide assessments of their roofs and facades. Overall, the client requested 1.2 million square feet of roofing assets to be requested.

The university then engaged Technical Assurance to perform façade assessments on 12 of the aforementioned 20 buildings with a combined total 1.16 million square feet. This data was also imported into ON-PNT.

Along with the ON-PNT assessments, Technical Assurance performed forensic leak investigations on 3 buildings. One dormitory was experiencing an interior leak and recommendations were provided on remediation. A second building was determined that the leakage was intruding from the perimeter of the building. The evidence lent itself to the construction of the perimeter edge detailing, specifically as it relates to the termination of the membrane flashing behind the perimeter edge sheet metal fascia. Finally, the third building was a dormitory that had reports of leakage and recommendations were made on how to proceed going forward.

The university has plans to repair and fix parts of campus and will use Technical Assurance going forward.

OHIO STATE UNIVERSITY

Assignment: Postle Hall Partial Replacement BECx Services

Size: 130,000 SF

Project Cost: $95 million

Project Complete: Est. 2020

Technical Assurance was engaged Engineering Economics, Inc. (EEI) to provide building enclosure commissioning services on the OSU Postle Hall project. EEI is the commissioning agent of record.

Postle Hall houses The College of Dentistry. The project includes a new building up to 130,000 GSF and will renovate portions of the east and west sections of Postle Hall. Demolition of the southern portion of the eastern wing is required for the new construction. The new addition will include programming for an Ambulatory Care Center, Pre-Doc Clinics, Faculty Practice Clinic, Radiology Clinic, Sterilization, Simulation labs, small commercial space and facility support space. It is the goal to register the project with the USGBC and achieve LEED silver certification.

Technical Assurance is providing the following services:

- Design and CD phase BECx services, which includes design review and specification development at the CD phase.
- Construction Phase – shop drawing and submittal review, mock-up testing and part-time construction observation during critical installations.
- Below-grade waterproofing inspecting/testing
- Performance Testing: IR Scans of Roof systems, water penetration testing, water spray testing, air infiltration testing, flood test of cementitious crystalline waterproofing and envelope water penetration testing

The project is currently in the construction phase.

MILTON & TAMAR MALTZ PERFORMING ARTS CENTER – PHASE II

Client: Heapy

Owner: Case Western Reserve University

Assignment: Building Envelope Consultant/Building Enclosure Commissioning

Project Size: +/- 65,000 GSF Addition

Project Completion: Fall 2021

The CWRU Maltz Performing Arts Center Phase 2 project consisted of the demolition of a portion of the existing facility and construction of a new +/- 65,000 GSF building addition programmed for a 250-seat proscenium theater, 100 seat studio theater, rehearsal studios, workshops, classrooms, offices, to house CWRU Theater, Music and Dance departments, and common spaces to support the historic building. The client and design team had a goal to achieve LEED Silver.

Technical Assurance partnered with Heapy to provide commissioning services on Phase 2, with our team focusing on the building envelope. Our team was engaged during the pre-design phase and continued through construction. Services included:

- Pre-design – OPR development, programming and focus on factors influencing enclosure design, construction, durability and performance.
- Design and CD Phase – Drawing and specification review, specification development, technical assistance during the development of the basis of design and establishment of performance requirements
- Construction Phase – Shop drawing and technical submittal review, periodic technical quality observation (QO) visits to observe typical construction installations pertaining to the building enclosure and reporting
- Occupancy and Operations – 10-month post occupancy review and report
- Performance Testing

ASTM D4541 Adhesion of Weather Barrier Coatings

ASTM C1060 Building Insulation Infrared Scanning

ASTM C1153 Roof Insulation Infrared Scanning

ASTM E783 Air Leakage Through Installed Exterior Windows and Doors

ASTM E1105 Water Penetration Testing on Exterior Window, Skylights, Curtain Wall Under Air Pressure

ASTM E1186 Air Leakage Through Air Barrier Systems

AAMA 501.2 Water Hose Testing of Window Systems

ON-PNT®

ENTERPRISE BUILDING SYSTEM MANAGEMENT SYSTEM

OVERVIEW

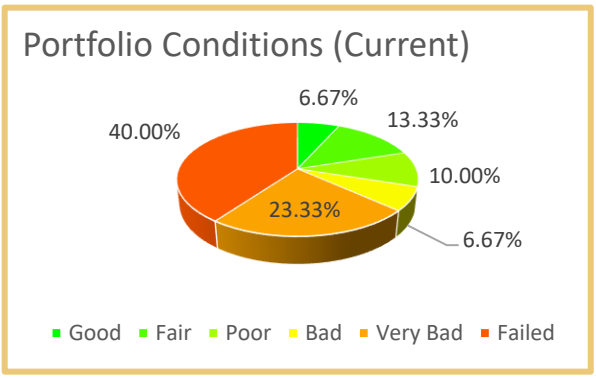
Building System Asset Management Made Simple.

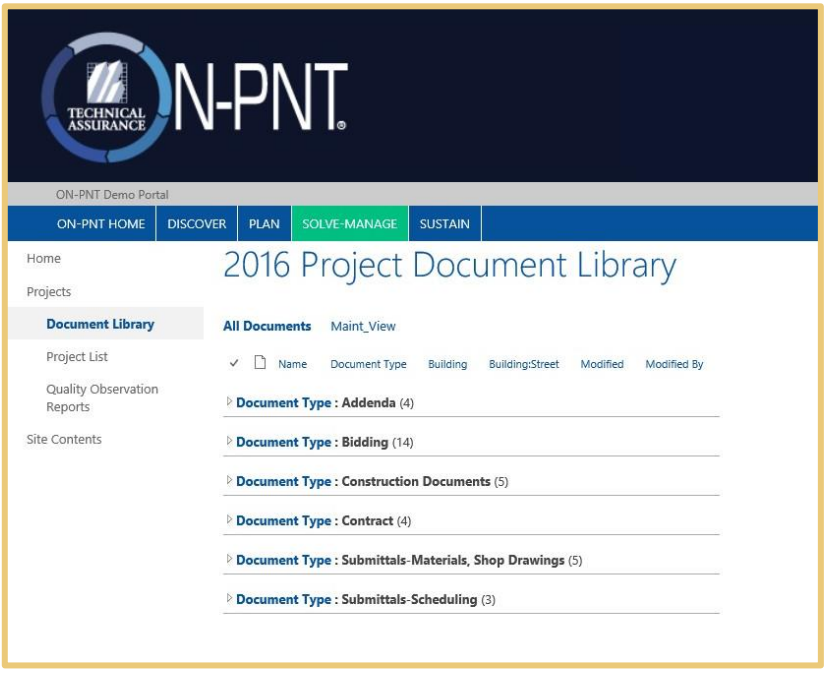
Enable a More Efficient Field Crew | Data Collection
- GIS HTML5 mobile app
- Increases efficiency and effectiveness
- App syncs with web portal every night

Brings Database to the Field & the Field to the Database | Dynamic Mapping
- GIS integrated database
- Easily visualize the condition of roof assets
- Analyze effects of repairs and maintenance

Analysis & Reporting: Performance, Metrics & Goals | Data Consumption
- High level executive summary metrics (KPIs)
- Scorecard review of building conditions
- Custom reports & charts
- Triage scores
- Constrained budget analysis tool
- GIS mapping

Simplified Management
- Robust project management tool
- Document & task management
- Schedule & cost management
- Data repository
- Warranty management & reminders





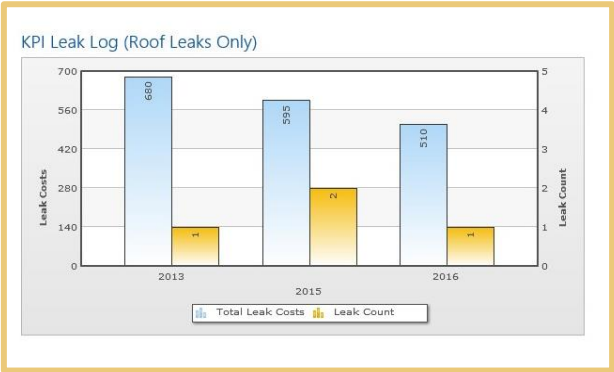
OVERVIEW

The ON-PNT® Enterprise Solution is a GIS (Geographic Information System) enabled database and web portal technology solution for **Building System Management, Design Services and Bid Management, Construction Management and Sustainable Maintenance Management**. ON-PNT® allows facility owners the ability to manage building system inventory, condition assessments, repairs and ongoing building system data within one central location. This cutting edge technology provides robust GIS mapping and automated reporting metrics for simplified data consumption.

ON-PNT® is fully customizable per client. In fact, we build a unique ON-PNT® Portal for each client program. This means we incorporate each client's unique program nomenclature, ID system, special acronyms, custom metrics, etc.

ON-PNT® is based on two open market platform solutions, ESRI ArcGIS Server and Microsoft SharePoint Portal. Technical Assurance has greatly customized and enhanced these open market platforms and has developed a unique 5 Steps to Sustainability ™ Process to drive and manage this solution, which is trademarked as ON-PNT®. Deploying ESRI and Microsoft platforms ensures that our solution meets the most current security, browsing and up-to-date software enhancements on the market today.

A critical feature of ON-PNT® is the Score Card or Key Performance Indicators (KPIs). If definable goals, benchmarks and objectives cannot be met or tracked within an asset management program, how can we determine if and when adjustments and improvements are needed? The point of the KPIs is not to hit specific numbers, but rather to track trending goals and metrics. Done properly, **the asset management program should reduce emergency roof leak expenditures and the quantity of work orders, improve average building system life cycle and lower total cost of asset ownership.** These goals are measurable and therefore should be used for program accountability. ON-PNT® maintains these KPIs as our Score Card.

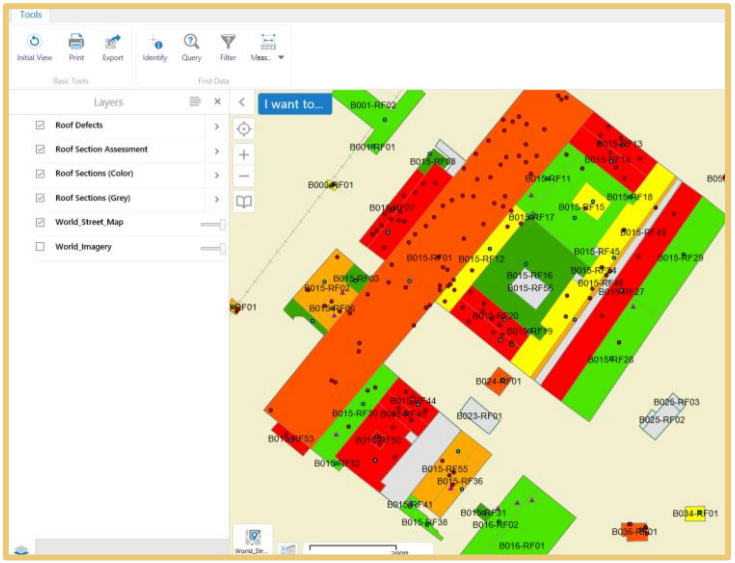


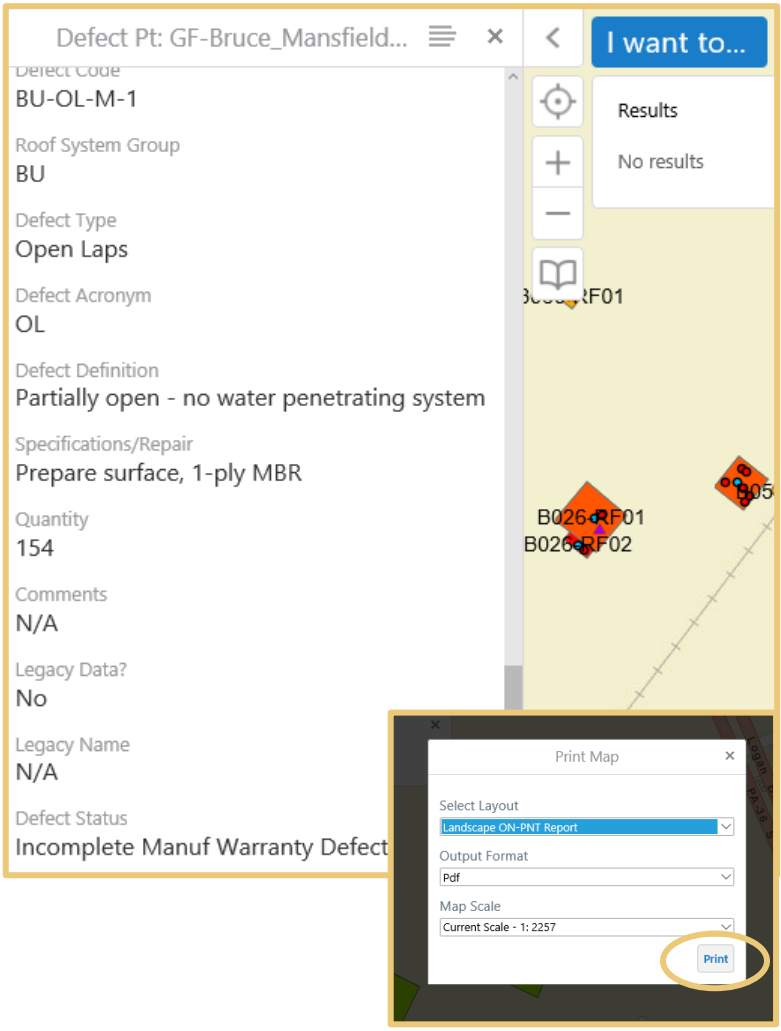
OVERVIEW

The ON-PNT® system provides **repeatable and objective analysis** using established facilities asset management (FAM) standards. The database is modeled using the following engineering standards:

- "Asset Lifecycle Model for Total Cost of Ownership", IFMA/APPA
- ASTM E917-05 Measuring Life-Cycle Costs of Buildings and Building Systems
- ASTM E1057-06 Measuring Internal Rate of Return and Adjusted Internal Rate of Return for Investments in Buildings and Building Systems
- ASTM E1121–12 Measuring Payback for Investments in Buildings and Building Systems
- ASTM E1765-11 Standard Practice for Applying Analytical Hierarchy Process (AHP) to Multi-Attribute Decision Analysis of investments related to Buildings and Building Systems

Using these standards to work within the structure of our database, we ensure consistent findings and reporting with our Asset Management solution. The standards also allow us to bring in unique characteristics and attributes important to our clients from a non-monetary perspective.

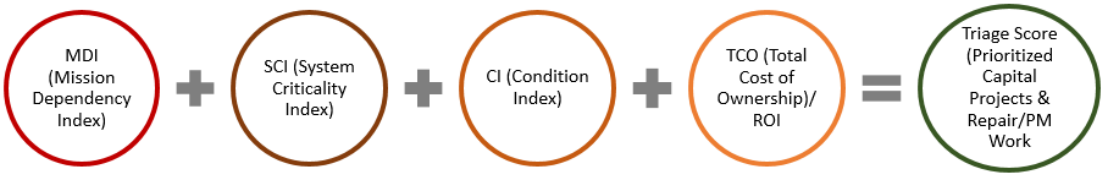




OVERVIEW

RECOMMENDATIONS & BUDGETING

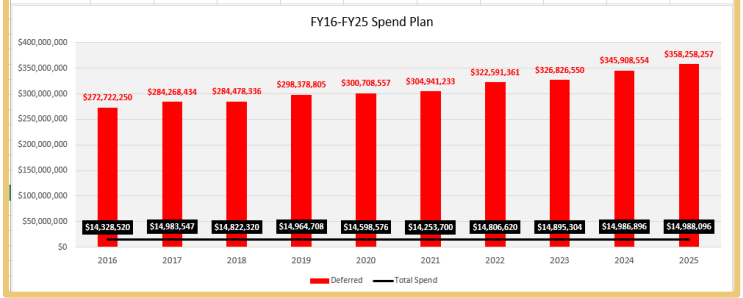
ON-PNT® includes a built-in Business Intelligence for Capital and O&M budgeting and planning, along with work schedule priorities based on discovery phase findings. The automated budgeting reports include scientific methodology for ranking capital replacements and repair projects. The ON-PNT® Triage budget report and project analyzer tool is based upon the building or building system Condition Index (CI), Mission Dependency Index (MDI), System Component Index (SCI) and Total Cost of Ownership (TCO).



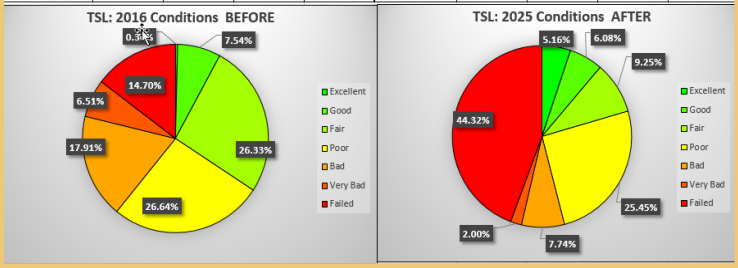
ON-PNT® lets you generate ad-hoc Triage Budget Plans based upon set budget constraints. You can also set your organization's inflationary rate and/or cost of capital or value of cash percentage rate. Once constraints and other rates are set, you can easily generate Triage Budget Plan and/or special Spend Plan and Deferred Maintenance Reports.

10-Year Spend: $15 million/Year

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total Spend	$14,328,520	$14,983,547	$14,822,320	$14,964,708	$14,598,576	$14,253,700	$14,806,620	$14,895,304	$14,986,896	$14,988,096
Total TSL Budget	$272,722,250	$26,529,731	$15,032,222	$28,865,177	$16,928,328	$18,486,376	$32,456,748	$19,130,493	$34,068,900	$27,337,799
Deferred	$272,722,250	$284,268,434	$284,478,336	$298,378,805	$300,708,557	$304,941,233	$322,591,361	$326,826,550	$345,908,554	$358,258,257

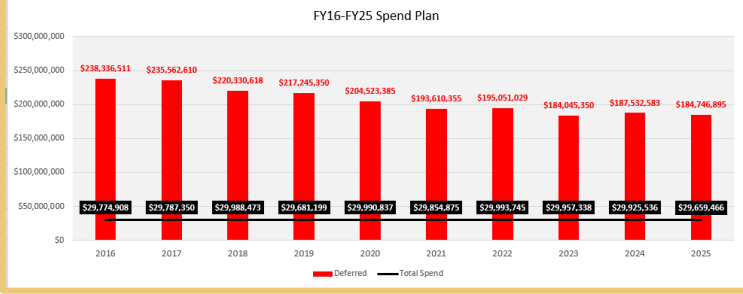


Condition-2016	Count	%	SF	CRV	Condition-2025	Count	%	SF	CRV
Excellent	19	0.36%	141,501	$5,215,598	Excellent	269	5.16%	965,418	$39,233,204
Good	393	7.54%	1,519,097	$60,841,379	Good	317	6.08%	1,007,499	$39,538,528
Fair	1372	26.33%	4,886,607	$203,565,215	Fair	482	9.25%	2,017,074	$80,994,536
Poor	1388	26.64%	5,305,070	$219,412,653	Poor	1326	25.45%	3,787,815	$169,022,567
Bad	933	17.91%	3,251,802	$128,076,573	Bad	403	7.74%	1,550,015	$65,712,988
Very Bad	339	6.51%	1,337,673	$51,012,639	Very Bad	104	2.00%	496,605	$19,251,090
Failed	766	14.70%	3,163,517	$112,813,771	Failed	2309	44.32%	9,780,841	$367,184,915
	5210	100.00%	19,605,267	$780,937,828		5210	100.00%	19,605,267	$780,937,828

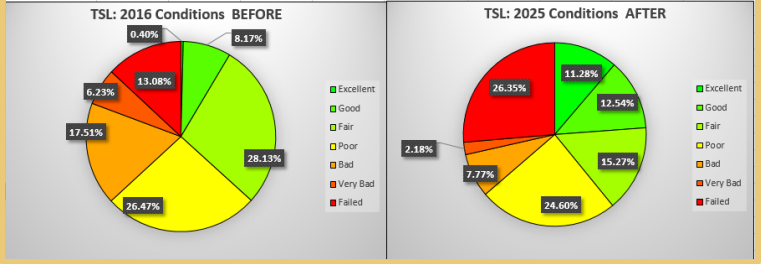


10-Year Spend: $30 million/Year

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total Spend	$29,774,908	$29,787,350	$29,988,473	$29,681,199	$29,990,837	$29,854,875	$29,993,745	$29,957,338	$29,925,536	$29,659,466
Total TSL Budget	$238,336,511	$27,001,006	$14,555,359	$26,903,204	$16,959,235	$17,622,856	$31,295,549	$18,988,066	$33,444,571	$27,139,848
Deferred	$238,336,511	$235,562,610	$220,330,618	$217,245,350	$204,523,385	$193,610,355	$195,051,029	$184,045,350	$187,532,583	$184,746,895



Condition-2016	Count	%	SF	CRV	Condition-2025	Count	%	SF	CRV
Excellent	20	0.40%	264,957	$9,900,754	Excellent	563	11.28%	1,887,177	$78,736,089
Good	408	8.17%	1,574,667	$63,700,151	Good	626	12.54%	2,188,687	$84,679,447
Fair	1404	28.13%	5,106,632	$210,494,982	Fair	762	15.27%	3,352,259	$131,195,586
Poor	1321	26.47%	4,972,542	$205,112,767	Poor	1228	24.60%	3,440,155	$152,941,882
Bad	874	17.51%	3,203,298	$125,852,664	Bad	388	7.77%	1,440,571	$61,339,598
Very Bad	311	6.23%	1,248,197	$47,475,983	Very Bad	109	2.18%	488,327	$18,441,678
Failed	653	13.08%	2,327,875	$85,563,876	Failed	1315	26.35%	5,900,992	$220,766,897
	4991	100.00%	18,698,168	$748,101,177		4991	100.00%	18,698,168	$748,101,177



Request a Consultation

We would love to talk with you about your facility needs.
Connect with us on our website to request a consultation.

Or Contact:

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TECHNICAL ASSURANCE
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