



The Sage Report

A Monthly Newsletter of Insights, Projects, and Productivity

Replacement-in-Kind? Not so Fast.

Replacing a failed or aging piece of building equipment often sounds simple: remove the old unit and install another one in its place. In practice, what starts as a “replacement-in-kind” project can quickly become a much larger renovation.

A boiler, chiller, air handling unit, rooftop unit, generator, pump, or electrical panel may have been installed 20, 30, or even 40 years ago. During that time, building codes, energy requirements, refrigerants, controls, electrical standards, and owner expectations have changed. The replacement equipment itself has changed too.

Consider an air handling unit. A modern unit may be larger than the equipment it replaces because of higher-efficiency filters, lower coil velocities, energy recovery, additional access sections, or different fan arrangements. Suddenly, the project needs modifications to ductwork, piping, structural supports, electrical feeders, controls, doors, walls, or roof openings simply to install the equipment.

The same issue occurs with heating and cooling equipment. Older refrigerants are being phased out, and equipment using newer refrigerants may introduce different safety and code requirements. A replacement chiller or heat pump may also have different electrical characteristics that require evaluation of feeders, breakers, transformers, switchgear, and available building capacity.

Then there is the question that is sometimes overlooked until construction: how will the equipment actually get to its final location?

The original equipment may have been installed before walls, roofs, or other building systems were constructed around it. Replacement can require partial equipment disassembly, temporary wall or roof openings, crane access, rigging plans, structural evaluation, or carefully defined removal and installation routes.

Controls add another layer. A modern piece of equipment may not interface easily with a decades-old building automation system. Sensors, valves, actuators, variable frequency drives, control panels, sequences of operation, and network infrastructure may all require modification.

Even a seemingly straightforward equipment replacement can therefore affect multiple disciplines and multiple building systems.

The lesson for owners and design teams is simple: evaluate the entire installation, not just the equipment being replaced. Early investigation of utilities, access, structure, controls, code requirements, and surrounding systems can identify these issues during design, when they can be addressed deliberately, rather than during construction, when they become costly surprises.



Replacement-in-Kind Checklist

- ☐ Verify condition/capacity of systems serving the equipment.
- ☐ Confirm that the replacement equipment meets current building, mechanical, electrical, plumbing, fire, energy codes.
- ☐ Confirm whether refrigerant changes introduce additional safety, ventilation, detection, or piping requirements.
- ☐ Compare the physical dimensions and service clearances of the replacement equipment with the equipment removed.
- ☐ Verify the complete removal and installation path.
- ☐ Determine whether doors, walls, roofs, ceilings, louvers, or other components must be temporarily removed or modified.
- ☐ Identify crane, rigging, hoisting, and staging requirements.
- ☐ Verify structural capacity for equipment, dunnage, housekeeping pads, piping, ductwork, rigging loads.
- ☐ Confirm electrical voltage, phase, MCA, MOCP, starting characteristics, and available system capacity.
- ☐ Evaluate feeders, breakers, disconnects, transformers, switchgear, starters, and VFDs for compatibility.
- ☐ Verify heating water, chilled water, steam, gas, fuel oil, domestic water, compressed air capacities.
- ☐ Confirm piping sizes, pressure requirements, pumping capacity, valves, strainers, expansion provisions, and connection locations.
- ☐ Evaluate duct sizes, airflow, static pressure, filtration, coil velocities, and outside air requirements.
- ☐ Determine whether the equipment can communicate with the building automation or control system.
- ☐ Identify required sensors, actuators, control panels, safeties, alarms, sequences, network modifications.
- ☐ Determine whether hazardous materials may be disturbed during demolition or installation.
- ☐ Evaluate roof penetrations, flashing, warranties, curbs, drainage, and snow conditions for rooftop equipment.
- ☐ Confirm combustion air, ventilation, exhaust, flue, and chimney requirements where applicable.
- ☐ Evaluate noise and vibration requirements and impacts on adjacent occupied spaces.
- ☐ Identify required shutdowns and determine how building operations will be maintained during construction.
- ☐ Determine whether temporary heating, cooling, ventilation, power, water will be required.
- ☐ Consider construction phasing, occupied-space restrictions, contractor access, staging, parking, work-hour limitations.
- ☐ Verify equipment maintainability, including filter replacement, coil cleaning, tube pulling, motor removal, valve access, and future component replacement.
- ☐ Confirm testing, balancing, commissioning, startup, training, and closeout requirements.
- ☐ Develop a complete project cost including architectural, structural, mechanical, plumbing, electrical, controls, abatement, rigging, temporary systems, restoration work.



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Beware of Trusses: Rooftop Equipment Starts With the Structure

Mechanical engineers spend considerable time selecting rooftop units, exhaust fans, heat pumps, condensers, ERVs, and other equipment. One of the first questions, however, has nothing to do with airflow, capacity, or efficiency: **What is holding up the roof?**

The roof cannot be treated as empty real estate. Whether equipment is being added or replaced, the framing needs to be identified and evaluated early. Never assume a replacement unit can simply be placed on the previous curb, or that a small piece of equipment can be added without structural modifications.

Beware of Trusses

Engineered trusses and open-web steel joists are highly efficient structural systems, which can make them challenging during renovations. They were designed for specific loads and load patterns, often with limited reserve capacity for concentrated loads that were never anticipated.

A rooftop unit may introduce several thousand pounds at locations that do not correspond with the original loading. Even smaller fans can create problematic concentrated loads depending on their location relative to panel points, chords, joists, and bearings.

Bottom chords are another concern. Unless specifically designed for added loading, they may support only relatively small concentrated loads, commonly on the order of 50 to 200 pounds. Piping, ductwork, equipment, or supports suspended from them can therefore create structural problems. Concentrated loads should generally be located at or near panel points unless evaluated otherwise.

Reinforcing trusses and joists is possible, but not necessarily simple. Forces are distributed through chords, webs, connections, bridging, and bearings. In difficult cases, supplemental framing may need to transfer equipment loads to girders, walls, or columns extending to structure below. Large roof penetrations create similar concerns. Moving a duct, shaft, or curb opening a few feet during design can sometimes avoid significant structural work.

Steel Beams Are Easier, But They Are Not Free Capacity

Conventional structural steel framing usually provides more reinforcement options. Supplemental beams can often be added, and members can sometimes be strengthened with engineered modifications.

That does not mean the roof has spare capacity. Beams, connections, girders, columns, and the load path to the foundation still need evaluation. Steel may be easier to modify, but it still needs to be checked.

Weight Is Only Part of the Problem

Operating weight is only one consideration. Current codes also address snow, wind, seismic forces, load combinations, and anchorage. ASCE 7-22 includes requirements applicable to rooftop equipment and supports.

Snow can be especially important. Units, curbs, screens, parapets, adjacent roofs, and other obstructions can create snow drifting and loads significantly greater than the uniform roof snow load. The 2025 New York State code update incorporates significant changes associated with the ASCE 7-22 snow-load provisions.

Wind creates lateral and uplift forces that require a complete load path through the curb or support steel into the building structure. Seismic anchorage may also apply.

This is why a true "like-for-like replacement" is much less common structurally than it may appear mechanically.

Get Equipment Selections Early

Give the structural engineer useful information early. Preliminary equipment selections should identify:

- Operating weight and dimensions
- Curb dimensions and point loads, when available
- Location and orientation
- Roof openings and duct penetrations
- Equipment height and wind exposure
- Screens, platforms, dunnage, and associated loads

Do not wait until the equipment schedule is nearly complete. If supplemental beams, truss reinforcement, columns, or equipment relocation are required, that needs to be known while the mechanical layout can still change.

Look Up Before You Lay Out

Structural coordination should begin before the equipment layout and ideally before the proposal is developed. Determine whether structural drawings are available and adequately identify the roof framing. If not, additional field investigation may need to be included in the project scope. During the site visit, identify whether the roof uses steel beams, open-web joists, engineered trusses, wood, or concrete. Determine framing direction, accessibility, and whether there is adequate space to install supplemental framing.

Also look for changes since the original drawings were prepared, including added equipment, supplemental frames, abandoned curbs, infilled openings, or reroofing that may have added dead load. Original drawings do not always represent current conditions.

The lesson is simple:

The structure needs to be part of the mechanical design from the beginning.

Never assume an open area of roof has spare capacity. Never assume replacement equipment is structurally equivalent because it serves the Same function. Never assume a roof opening can simply be cut where the ductwork works best. **And when the you see Engineered trusses or open-web steel joists, pay especially close attention.**

ENGINEERED TRUSSES: LIMITED CAPACITY

- ✗ Designed for specific loads and patterns
- ✗ Limited reserve for concentrated loads
- ✗ Bottom chords typically support only 50-200 lbs concentrated load
- ✗ Modifications can be complex and costly
- ✗ Large openings may interfere with truss webs and members

STEEL BEAMS: MORE FLEXIBILITY

- ✓ Easier to reinforce with supplemental steel
- ✓ Loads can be transferred to beams and columns
- ✓ Openings can often be framed to maintain structural integrity
- ✓ Still requires analysis of beams, connections, and load path

PLAN EARLY. COORDINATE. BUILD IT RIGHT.



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CRIS: A Valuable Research Tool for Engineers Working on Existing Buildings

When starting a renovation project, engineers usually begin with drawings, field observations, record documents, and discussions with the owner. For older buildings in New York, there is another resource worth checking early in the design process: the New York State Cultural Resource Information System, commonly known as CRIS.

CRIS is maintained by the New York State Office of Parks, Recreation and Historic Preservation (OPRHP), which includes the State Historic Preservation Office (SHPO). The web-based geographic information system was developed to inventory and manage information about New York's historic and archaeological resources and to support environmental and historic-preservation reviews required under state and federal law.

CRIS is used by SHPO staff, state and federal agencies, municipalities, preservation professionals, archaeologists, architects, engineers, consultants, property owners, and others involved with projects that may affect cultural resources. Some archaeological and project-review information requires authorized access, but a substantial amount of information can be researched through CRIS using Guest access.

Why Engineers Should Care

CRIS is much more than a database showing whether a building is historic. For engineers working on existing buildings, it can sometimes provide information that is difficult to locate anywhere else.

A building record may identify its construction date, architect, original use, historic use, structural or exterior materials, number of stories, historic designation, and other basic characteristics. Historic resource inventory forms may provide considerably more detail.

CRIS may also contain historic and contemporary photographs. These can help identify previous building configurations, window types, masonry details, roof features, additions, removed structures, and changes that have occurred over time.

The real value, however, can be hidden in the attachments.

Previous surveys, National Register documentation, historic resource reports, maps, photographs, drawings, and other documents may be associated with a property. On some buildings, these records provide information about construction and previous repairs that would otherwise require considerable investigation to reconstruct.

Look Beyond the Building Record

CRIS research should not stop after finding the building.

The surrounding site may fall within a historic district or previously surveyed area. A larger architectural survey may contain detailed information about an entire campus or neighborhood even when the individual building record contains relatively little information.

CRIS also maps archaeological survey areas and cultural-resource information relevant to ground disturbance. This can become important when a project includes underground utilities, foundations, additions, equipment pads, drainage improvements, geothermal systems, duct banks, roads, parking areas, or other excavation. Detailed archaeological information is restricted in some circumstances, but Guest access can still alert the design team that cultural-resource considerations may exist and that additional investigation may be necessary.

Previous SHPO consultation associated with a property can also be valuable. Earlier rehabilitation projects may help establish which architectural features were considered historically significant and how previous modifications were approached.

A Useful First Step in Existing-Building Design

CRIS does not replace field investigation, record drawings, hazardous-material surveys, structural evaluation, or direct consultation with SHPO. It also is not a general environmental database for wetlands, brownfields, petroleum spills, or other environmental conditions.

What it provides is another layer of information about the building and site before design decisions are made.

For engineers working on older New York buildings, particularly state facilities, checking CRIS early can answer questions, identify additional questions that need to be asked, and occasionally uncover drawings, photographs, surveys, or reports that the project team did not know existed.

Best of all, much of this research can be performed simply by entering CRIS as a Guest.

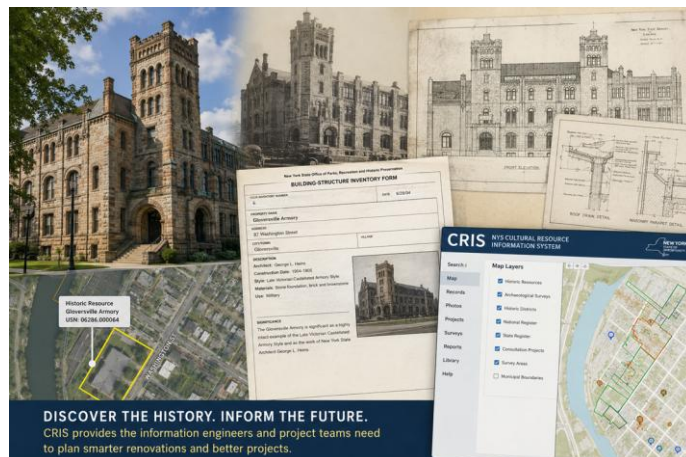
NYS Cultural Resource Information System (CRIS):

<https://cris.parks.ny.gov/>

NYS Office of Parks, Recreation and Historic Preservation, CRIS

Information: <https://parks.ny.gov/preservation/resources/cris>

PRO TIP: Try this **prompt** to have Chat GPT Plus (High Intelligence) run the CRIS query for any building.





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UPCOMING LIVE WEBINARS AND SEMINARS

This month's lists of free live webinars and seminars is below. Each offers at least one PDH and qualifies as a *Course of Learning* – a format that includes traditional classroom-style courses or live webinars with real-time interaction with an instructor. As a reminder, New York State requires that 18 of the 36 total continuing education hours for professional engineers be completed through *Courses of Learning*.

All webinars listed below are free. ASHRAE and ASPE meetings (when listed) are in-person and have a cost of \$50 reimbursed by Sage for Sage employees.

Date	Topic	Host	Credit	Time (ET)	Registration Link
Sep 1	Trusted Resources for Specification Success	Ron Blank	1 AIA HSW / FBPE PDH	12 -1 PM	Register here
Sep 3	Fundamentals of Lateral Earth Pressures	NoonPi	1 PDH	12 -1 PM	Register here
Sep 3	Baseplate Design (ANC206)	Hilti USA	1 NCSEA PDH	12 -1 PM	Register here
Sep 10	Firestop Installation QC	Hilti USA	1 Hilti PDH	12 -1 PM	Register here
Sep 14	Smoke Containment Strategies	Ron Blank	1 AIA HSW	12 -1 PM	Register here
Sep 15	Polyiso Air and Water Barrier	Ron Blank	1 AIA HSW / FBPE PDH	12 -1 PM	Register here
Sep 15	Baseplate Design: AISC Design Guide 1	Hilti USA	1.5 NCSEA PDH	12 -1:30 PM	Register here
Sep 15	Anchorage to Masonry	Hilti USA	1 NCSEA PDH	12 -1 PM	Register here
Sep 15	Post-installed Rebar Design	Hilti USA	1 NCSEA PDH	12 -1 PM	Register here
Sep 16	Commercial Restroom Design Trends	GreenCE	1 AIA HSW / FBPE PDH	12 -1 PM	Register here
Sep 17	Prefabricated Fireproof Columns	GreenCE	1 AIA HSW / FBPE PDH	12 -1 PM	Register here
Sep 17	ACI 318 Shear Concrete Breakout	Hilti USA	1.5 NCSEA PDH	12 -1:30 PM	Register here
Sep 18	Cable Railings in Public Buildings	Ron Blank	1 AIA HSW	12 -1 PM	Register here
Sep 21	Designing Functional Outdoor Living Spaces	Ron Blank	1 AIA HSW / FBPE PDH	12 -1 PM	Register here
Sep 22	LRFD Design for Anchorage into Masonry	Hilti USA	1 NCSEA PDH	12 -1 PM	Register here
Sep 23	Battery Electric Vehicle and Clean Energy	NoonPi	1 PDH	12 -1 PM	Register here
Sep 29	Building Safety: Ballistic, Blast, Storm, Forced Entry	Ron Blank	1 AIA HSW / FBPE PDH	12 -1 PM	Register here
Sep 30	Panelized Aluminum and Steel Railings	Ron Blank	1 AIA HSW / FBPE PDH	12 -1 PM	Register here





Saranac Lake Train Depot Renovation

Saranac Lake, NY

The Saranac Lake Train Depot renovation is a comprehensive historic restoration and building systems modernization project at 42 Depot Street in Saranac Lake, New York. This OGS administered project for NYS DEC involves a one-story, 3,900 square foot historic depot building. The current renovation cost estimate is roughly \$4 million. Construction will begin in late 2026 and continue through 2027.

Sage Engineering is providing overall project coordination, along with HVAC and plumbing engineering design. The broader consultant team includes Architecture+ for architectural design, Jade Stone Engineering for electrical engineering, OSPA Engineering for civil and site design, and Adelaide Environmental Health Associates for hazardous material inspection and abatement design.

This project is far more than a cosmetic renovation. The work combines historic preservation with accessibility upgrades, hazardous material abatement, site and drainage improvements, replacement plumbing and electrical systems, fire alarm replacement, and a major HVAC upgrade. Significant portions of the depot's historic character will be retained and restored, including wood flooring, wainscoting, built-in benches, ticket booth millwork, masonry, radiators, and exterior architectural details.

The architectural scope includes restoration of historic interior finishes, repair and refinishing of hardwood floors, modification and reinstallation of built-in benches, restoration of the ticket booth, replacement of damaged flooring, masonry repointing, attic insulation upgrades, and crawl space improvements. The work also includes two accessible toilet rooms, accessible drinking fountains, improved floor transitions, restored ramps and handrails, and site improvements such as accessible pedestrian routes, bicycle racks, picnic tables, restored pavement, drainage improvements, and lawn restoration.

The HVAC scope is one of the most technically significant portions of the project. An air-to-water heat pump chiller will provide heating and cooling through a glycol hydronic loop serving ten fan coil units. The system includes lead-lag pumps, a buffer tank, expansion tank, glycol feed system, and pre-insulated underground hydronic piping. Several fan coil units are carefully coordinated with the restored built-in bench assemblies and historic interior construction. **See image on right.** The depot's retained boiler and radiator system will continue to provide low-temperature and backup heating, allowing the project to combine modern heat pump technology with the building's historic heating system.

Ventilation will be provided by three attic-mounted energy recovery ventilators connected to retained exterior louver openings. The plumbing scope includes replacement domestic water, hot water, sanitary, waste, and vent piping, along with accessible fixtures, a water heater, hot water recirculation, and backflow prevention. The electrical scope includes conversion to a 208Y/120V, 200A, three-phase service, replacement panelboards, lighting, controls, communications infrastructure, mechanical equipment power, exterior lighting, and a complete addressable fire alarm system.

The Saranac Lake Train Depot project is a strong example of the coordination required to modernize a historic building without losing the features that make it significant. Mechanical, plumbing, electrical, civil, architectural, and hazardous material work must be carefully coordinated within a compact wood-framed structure while preserving historic finishes and maintaining the character of the original depot.

