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NJARNG Sustainability Newsletter

In collaboration with Rowan University

Clean Cut Quarterly

Image: BIM

Discover how the power of BIM is transcending existing structures. Story on page 6

Image: FacMan

Read how Rowan engineering students are organizing maintenance procedures for a sustainable facility on page 1

Image: Audit

Learn how ASHRAE Level II energy & water audits are performed on page 3

A Managed Facility is a Sustainable Facility

By: Teresa Scronzynski and John Pineda

Rowan University's College of Engineering juniors and seniors take hands-on clinic courses that meet all semester long, where engineering students are given the opportunity to perform research and work on actual projects. In these projects, students are faced with real engineering challenges under the guidance of credentialed engineers to find innovative solutions to engineering related problems. The Facilities Management clinic offered by the Sustainable Facilities Center (SFC) in the Civil and Environmental Engineering Department offers two semesters worth of clinic courses that benefit the maintenance of NJDMAVA facilities. The Facilities Management clinic students learn building systems, such as HVAC, electrical, and plumbing systems to optimize maintenance and repair data from FacilityDude, the computerized maintenance management system used by NJDMAVA and BUILDER SMS, the asset management system which shows building system conditions. SFC staff, clinic professors, and DMAVA personnel lead each clinic group of three and five students each semester through the procedures.

What do we do?

The Facilities Management team begins by pulling system data from the BUILDER SMS records, work order logs, and floor plans of the site to become familiar with the systems in the building. BUILDER SMS information includes the location, ASTM code, description, make and model, serial number, year built and installed, as well as any notes on the system. The team travels to the site to get photographs and information on the equipment, whether it is HVAC, electrical, fire systems, or miscellaneous equipment that may require preventative or scheduled maintenance. This data will be the primary source of information used by the team to develop a facility's maintenance plan. The team uses manufacturer handbooks as well as previously gathered information to learn about essential maintenance for the equipment. Ultimately, the clinic team produces reports on the site. The reports from this clinic cover the Level II Planned Maintenance Plans, which provide precise information about the equipment unique to that facility. For example, the dust and lint in the condenser in a Traulsen refrigerator condenser located at the Toms River Armory must be cleaned once every other month. The interior and exterior of this refrigerator must be cleaned with a warm, soapy cloth and then dried off.

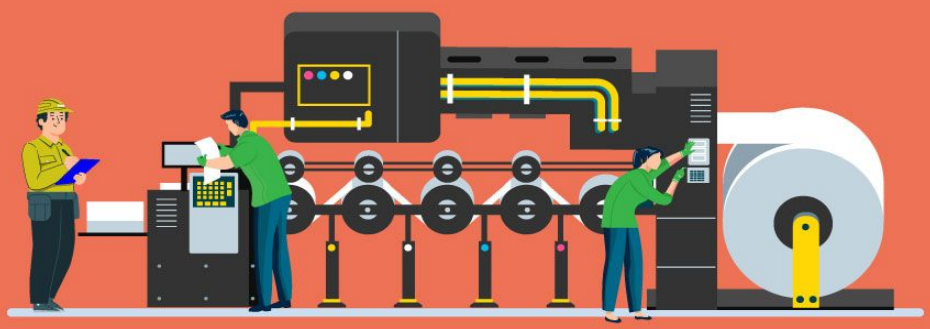

Image: Facility

'Managed Facility' continued on page 2

How can we help?

This clinic's work directly benefits DMAVA in many ways. A document like the one created in the clinic provides the armorer with a concise guide on what needs to be done, how it is done, and when it needs to be done. This information can also be more easily used by entering the maintenance schedule into the FacilityDude system, which can automatically remind the armorers about the work they need to do. Having the maintenance schedule automated will keep systems running as best as possible. The armorers are also more likely to notice issues when they are small, making them easier and less expensive to fix. It gives advance notice of larger potential issues so they can be budgeted for the near future instead of them being a surprise expense. In addition, planned maintenance has been shown to reduce reactive maintenance as it gives the systems the best conditions to run, reducing the number of issues in general.

Facilities Management Clinic Team On Site at West Orange

From DMAVA's perspective

We contacted Justin Costa, the Energy Manager for NJDMAVA to hear about his experiences with this clinic. According to Justin, DMAVA mostly relies on reactive maintenance instead of planned maintenance. This needs change, especially with the addition of photovoltaic (PV) cells to NJDMAVA sites, as they benefit from preventative maintenance. Justin agrees with the benefits of this type of maintenance, saying "...instead of waiting until a boiler fails completely… [we] make sure that our equipment is running properly." The systems that more relate to him as an energy manager are the PV cells. They should be checked periodically to make sure they are running at peak performance to get the most electricity possible for NJDMAVA. While this is not directly related to the systems looked at in this clinic, the principles apply to all systems in the building.

Auditing Towards a Sustainable Future

By: Ryan Bailey, Mason Posner, Bryson Townsend

Junior and senior level students who enroll at the Henry M. Rowan College of Engineering participate in semester-long projects called “clinics” that allow students to work in small teams on real-world projects. At the beginning of each semester, the junior and senior level students get to choose from over 100 projects that they are interested in. Some of these clinic projects are overseen by the Sustainable Facilities Center (SFC), established in 2018 as part of the College of Engineering, responsible for helping both public and private organizations become more sustainable by working to improve and change the environmental, economic, and social impacts of buildings [1].

The SFC clinics are funded by the New Jersey Department of Military and Veterans Affairs (NJDMAVA). These clinics include the NJARNG Energy-BIM-Builder clinic, NJDMAVA Facilities Management clinic, and NJDMAVA Energy Audit clinic. Both undergraduate and graduate students alike are critical to the success and work done by the SFC. Currently, the SFC works with over 150 military buildings covering over 2 million square feet of space in the state of New Jersey [1]. These clinics help maintain and operate the facilities as efficiently as possible by reducing energy use, water use, and pollution.

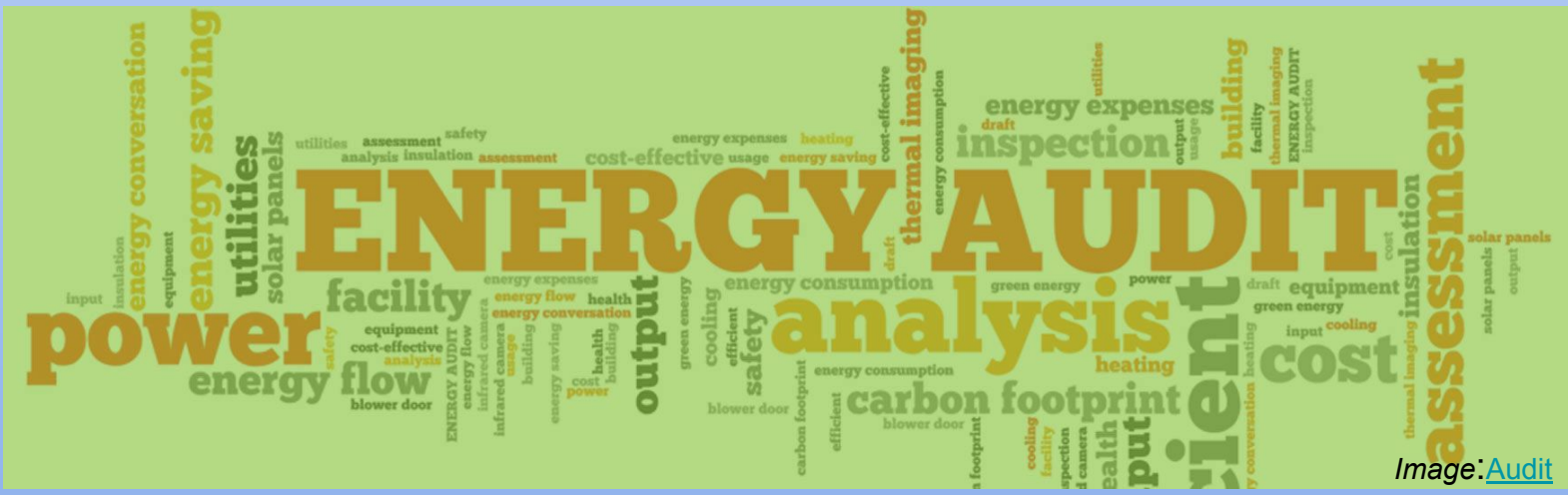

Image: Audit

What is an Energy Audit?

In the case of the energy audit clinic, students are tasked with conducting an ASHRAE level 2 energy audit for an assigned NJARNG building to look for energy conservation measures (ECM) for the building. According to The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) a level 2 energy audit consists of, “a more detailed building survey, including energy consumption and peak demand analysis. A breakdown of energy end uses within the building is developed.” The basic steps of a level 2 audit include; (1) reviewing systems and past energy use from utility bills. (2) Studying the building’s operations, and daily occupant operations. As well as a site visit to collect data on the systems using energy and to collect information from the building. (3) Identifying changes that can be made to building systems to reduce energy consumption or cost. (4) Perform economic and engineering analysis of the proposed changes to fully understand the benefits. (5) Final report on findings and recommendations..

‘Audit’ continued on Page 4

Students are first tasked with conducting a preliminary energy analysis (PEA). This is done by looking through previous electricity and gas bills in order to understand the energy use, and costs of the building, and to create graphs to follow energy trends. Following the PEA is a site visit where students analyze the existing conditions of the different systems in the building. During the site visit, students take note of the different heating systems, plug loads, lighting, and plumbing fixtures in the building. When Mason Posner, one of the undergraduate students currently working on the energy audit clinic, was asked about his experience he said, "it is very interesting to see where different improvements can be made to the current systems of the buildings, from changing something as small as a light bulb or switch, or something as big as a boiler."

The Purpose of Energy Audits

Many companies and organizations today are trying to move toward a greener future and reduce their carbon footprint. The process of updating and renovating different aspects of buildings can be tricky and costly for consumers. Many of them do not have adequate information on their energy use, or where their energy consumption can be decreased. Before any renovation can be done to a building, an energy audit is performed to help the consumers understand where the most energy is being used, how much they are spending, and where their energy consumption can be reduced. By the end of the semester, the clinic will propose energy conservation measures based on their findings and provide a financial analysis of implementing these measures. This includes calculating the return on investment (ROI), savings-to-investment ratio (SIR), and other values. This step of the audit process is one of the most important because it is taking all of the other steps together to complete the audit's end goal of presenting sustainable solutions to reduce energy use. All of this is done to help NJDMAVA save money and reduce its carbon footprint, moving towards a greener future.

What is BIM?

By: Kieran Breen, Abbie Coen, and Youssef Gerges

Rowan University's Sustainable Facilities Center (RU-SFC) offers building information modeling (BIM) to junior and senior-level engineering students as a two-semester project within the scope of NJDMAVA. According to Autodesk, BIM is, "the holistic process of creating and managing information for a building asset." In other words, users can create a three-dimensional digital model of a building asset that allows the user to have greater visibility and decision-making for more sustainable and cost-saving options on architectural, engineering, and construction (AEC) projects.

During the Fall 2022-Spring 2023 academic year, the BIM team is responsible for creating BIM models for the West Orange Readiness Center (RC), the West Orange CSMS #4, the Sea Girt RC, the Riverdale RC, and the Dover RC. Each of these projects will vary in size and complexity, so it is important that the team follows the BIM workflow shown in the figure on the following page. The team utilizes popular engineering programs such as Autodesk ReCap, Autodesk Revit, and Autodesk Viewer in the BIM workflow to create comprehensive 3D models and 2D floor plans.

'BIM' continued on page 5

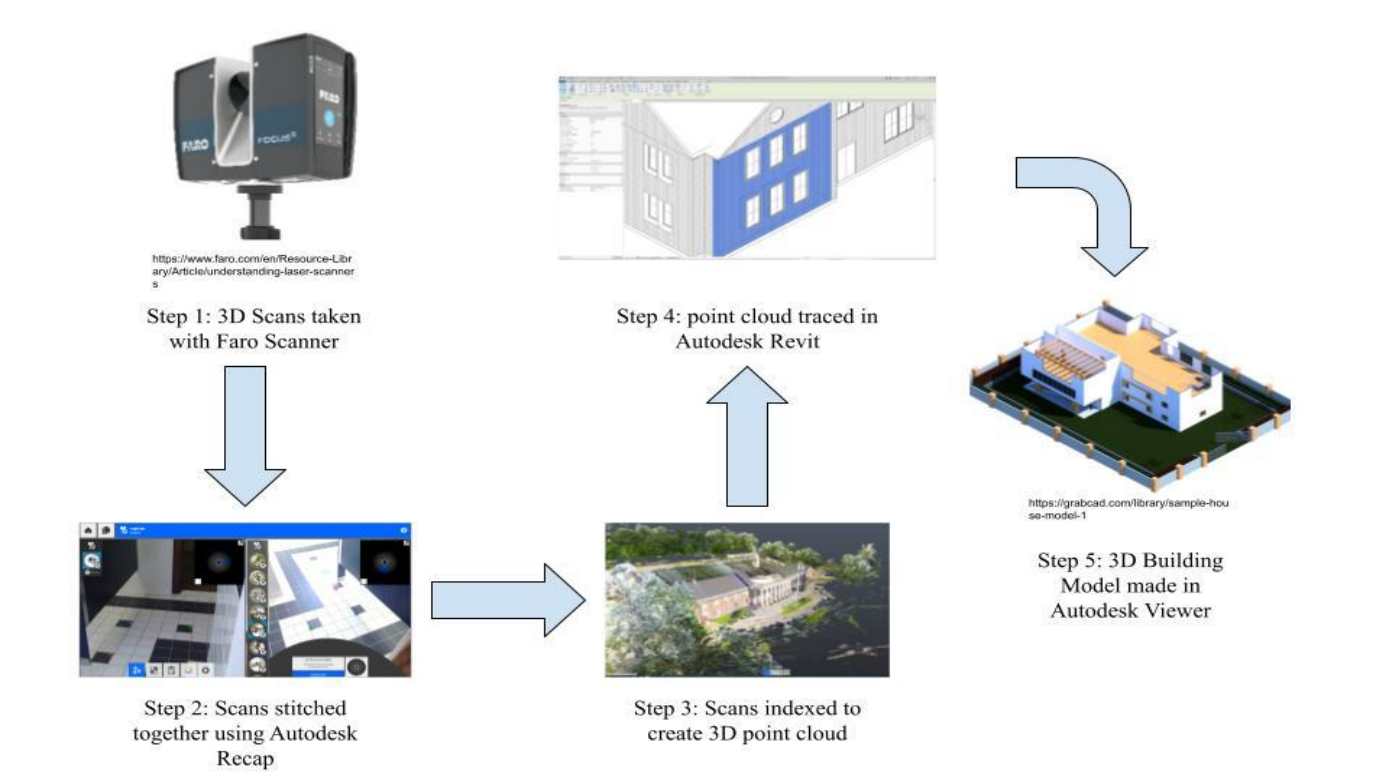

Figure 1: BIM Workflow Diagram

In this upcoming project, Rowan BIM Clinic students plan to help NJDMAVA map out the area for an upcoming project. The upcoming project is in West Orange, New Jersey at the armory. Our team has been stitching FARO 3D Scans of the area view to begin the project to create a giant scan of the entire building. We are stitching these together through AutoDesk Recap Pro, shared on a drive so multiple members can work on it at once. Once all of the scans are stitched and indexed, we will upload the point cloud into Revit to further the modeling process.

Thus far the team has been using Autodesk Recap. This is a program that takes previously taken 3D scans and helps to piece these scans together. 3D scans were taken of NJDMAVA sites. Each scan covers a single area and surrounding walls. For example, most scans cover a single room, but some larger rooms may also need multiple scans. Using Recap's stitch feature these 3D scans are put together into one large file for each building. To stitch the scans together adjacent scans must be put together. This is done by choosing 3 common points within the adjacent scans, as seen in the figure below. This allows Recap software to merge the adjacent scans. Eventually, an entire building together will be stitched and provide an accurate 3D model of the building.

Students have begun uploading the files on Revit, the plan is to use the file from Recap to continue work on the BIM project of creating these 3D models. By the end of the Spring 2023 semester, the goal is to have accurate 3D models available to NJDMAVA. These plans will allow NJDMAVA to more easily schedule planned maintenance, demolish a building or a portion, or add an extension or update a building.

The Power of BIM

By: Adetomiwa Awogbamila, Steven Castlegrant, and Peter Demirjian

Building Information Modeling (BIM) is often used for the design process of architectural, engineering, and construction (AEC) projects. Due to the power of BIM software, it has become the ideal tool in modern technology due to its high detail and collaboration potential. An article on Autodesk's website states, "Using BIM gives you greater visibility, better decision-making, more sustainable options, and cost-savings on AEC projects." BIM is important for existing AEC projects because it is much more powerful and accurate than simply using CAD. A separate article posted to AutoDesk's website states, "When using CAD for building design, you focus on creating drawings. When using BIM, you focus on creating a building model, and then the drawings can be generated from the model. This saves time because you do not have to draw anything twice". When using CAD you are more so creating a floor plan, while using BIM allows you to create a working model from which those floor plans can be pulled and analyzed. In other words, using BIM instead of CAD will mean getting more from doing less.

While Building Information Modeling (BIM) is often used in the construction process, it can also be used on existing buildings to create models displaying the pre-existing systems a building contains. The use of this modern technology allows for a more organized, detailed, and collaborative way to map out the systems of a building with easy access. A completed model can combine information from multiple blueprints/floor plans into one interactive model that can then be broken down into the systems you intend to view. An article by The CAD Room states, "BIM goes way beyond a CAD system, as it can show critical facilities management systems such as electrical containment and mechanical cooling systems as well as roofs and windows. Using automated intelligence, the program can identify and highlight each specific system, allowing you to view all of its components at once as shown in Figure 1.

In the present day, everything is stored on computers where files can be retrieved with a click of a button, and therefore, merging a facility's paper blueprints with a computer model is an ideal way to retain a building's old information, while also providing a simple way to add new information as well. According to an article by Bailey Garner, "It allows automated data extraction to ensure all disciplines work from a single information source; reduces the amount of rework required, by enabling issues to be identified before construction". In today's world where hundreds of people come together to work on a single massive project, BIM allows all of those people to do exactly that, without getting in each other's way. Collaboration is a massive part of the design process, and BIM makes it that much easier. From these models, you can determine a facility's equipment efficiency and energy usage in an attempt to lower the costs of a building's maintenance.

Here are a few examples of the power of BIM and how it is implemented in existing structures. This example is a case study discussed in a magazine, published in 2018, by Dr. James Chariton titled "BIM and Exiting Buildings". This case study features the historic 900-year-old Chapter House - Durham Cathedral, located in Durham, England. It's a world-famous site for visitors. The Chapter House is a large site that is expensive to run and requires £3.3 million annually (Chariton 2018, as cited in Durham World Heritage Site 2015) This case study shows how BIM is implemented in historic buildings for maintenance and preservation. The overall purpose was to "... decrease the renovation and maintenance costs and make the process more efficient and financially sustainable (Chariton 2018, as cited in Kassem, 2015).

'Power' Continued on Page 7

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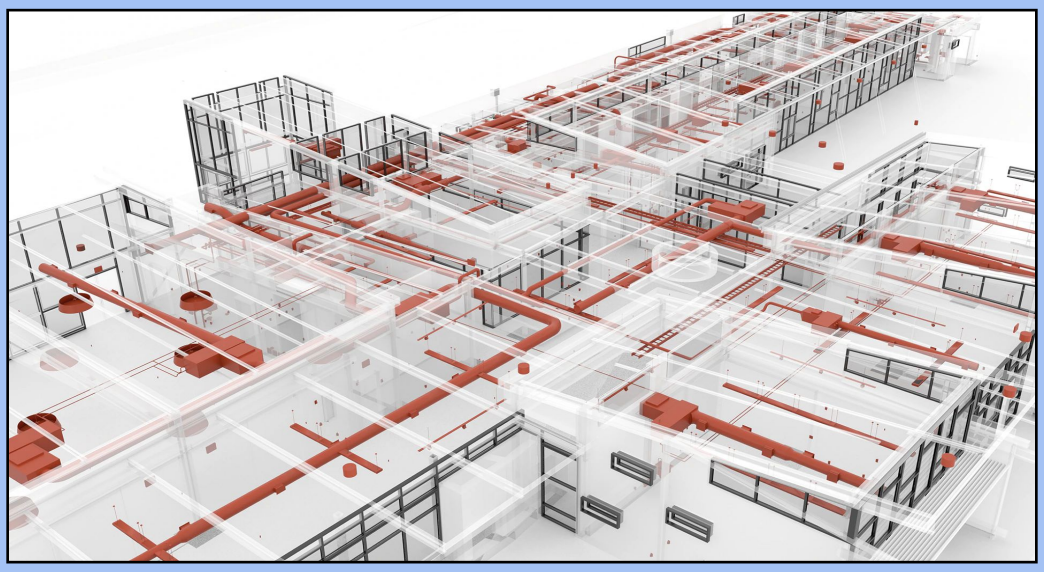

Figure 2: BIM Model Highlighting HVAC System

The magazine discusses how the building was surveyed by BIM Academy using 3D laser scanning technology. The data obtained is used to create 3D point clouds of the Chapter House. The point cloud was then exported to Autodesk Revit to be modeled by BIM Academy, adding model parameters specified to client needs. Several beneficial outcomes result from this study. The magazine states that one benefit is that there is "a central data-rich model available for everyday use, which allows for better-informed decisions…" and another benefit is that it provides "...accurate information of the current state and layout of the building as a single reliable resource" (Chariton 2018). The case study concluded that BIM had a significant impact on the project as it supported and helped develop the facilities management processes of the Chapter House.

Another brief case study involves the use of BIM to aid in the process of expanding the Northeast Water Purification Plant located in the city of Houston, Texas. The article was posted by Tejjy Inc., a BIM automation company in the USA, titled "BIM Came in Handy for Northeast Water Purification Plant Expansion" on the BIM community website on June 24th, 2020. Tejjy inc. utilized Autodesk Revit and AutoCAD to create 3D BIM models of the site to support several project objectives including "... Coordination and shop drawing, Constructability Review (Model Update to reflect changes resulting from Design Changes, RFI Generation & Update)... Coordination of Piping and process equipment, Pre-fabrication & Modularization" and more (Tejjy Inc. 2020). The outcome of Tejjy inc. implementing BIM in the water treatment expansion project allowed "...saved the time and money of the project owner throughout the building lifecycle by developing the perfect design and drawings through BIM. The technology helped to simplify the project workflow using Revit BIM Model for coordination" (Tejjy inc. 2020).

Existing buildings today have been becoming increasingly complex when it comes to the operation and management of facilities, which ends up costing more money, time, and effort in managing a building's stability. With the help of BIM, workers can implement design and construction for information management easing any construction schedule conflicts and space congestions, all while reducing the number of safety risks that workers may encounter. This in turn reduces building costs, allows for the use of efficient energy, and gives an overall better experience in facility management.

Meet the Authors

Teresa Scronzynski & John Pineda

Facilities Management Clinic Team

Teresa is a senior, majoring in civil and environmental engineering. Teresa enjoys playing Dungeons and Dragons and will pursue a career in transportation planning.

John is a senior in the electrical and computer engineering program, who likes coding and would like to write programs for games or project management.

Kieran Breen, Abbie Coen, & Youssef Gerges

Building Information Modeling Clinic Team

Kiernan is in his junior year working towards an electrical and computer engineering degree. He is into hiking and rock climbing. Daniel has a dream to step foot in all 50 states.

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James is a junior in the mechanical engineering program. He enjoys small hikes and is interested in sustainability/maintenance engineering

Adetomiwa Awogbamila, Steven Castlegrant, and Peter Demirjian

Building Information Modeling Clinic Team

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'Meet The Authors' continued on page 9

Meet the Authors

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Building Energy and Water Audit Clinic Team

Ryan is a senior majoring in electrical and computer engineering. He likes sound engineering and recording music. Ryan hopes to build a career in public transit.

Mason is majoring in mechanical engineering and he intends to study mechanical, electrical, and plumbing (MEP) design after graduating.

Bryson is in his senior year working towards a civil and environmental engineering degree. Bryson's interests include fitness, graphic design, and chess.

Learn more about the Rowan University Sustainable Facilities Center **here** or scan our QR code!

SCAN ME

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