
# FIRMUS Impact Overview 2023

In collaboration with

SHIBOLET ESG

## Executive Summary:

This impact report examines the potential of FIRMUS's advanced software platform to drive environmental sustainability within the construction industry. FIRMUS's software platform, renowned for its solution-oriented approach, has disrupted the construction sector by automating the analysis of construction drawings. This automation enables the identification of design-related risks and enhances decision-making during the pre-construction phase.

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While the FIRMUS platform itself is not directly responsible for the environmental impact, its utilization indirectly contributes to promoting environmental sustainability within the construction industry.

The report commences by providing a comprehensive overview of the construction industry, emphasising its global scale and the significant environmental implications it poses. It then highlights the specific challenge faced by FIRMUS, underscoring the environmental consequences associated with this challenge. Although today, FIRMUS focuses on helping pre construction teams bid more accurately, save time, avoid mundane tasks and build good relationships with clients, the fact that FIRMUS helps mitigating design risks early allows it to effectively tackle the problem of rework and reduce change orders, waste and emissions. FIRMUS helps mitigate the environmental impact of construction projects while simultaneously reducing time and costs.

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This report is focused on rework and waste. To substantiate the gravity of this problem, pertinent numerical data and statistics are presented. Additionally, it showcases FIRMUS's innovative solution through case studies and impactful performance indicators. Ultimately, the report summarizes the multitude of benefits derived from integrating the FIRMUS platform into the pre-construction phase.

This report has been conducted by Shibolet ESG, a consulting firm, at the behest of FIRMUS.

## Introduction:

The construction industry has increasingly recognized the imperative of incorporating sustainable practices into its operations, aiming to minimize its environmental impact, improve resource efficiency, and promote social responsibility. By embracing sustainable goals, the industry seeks to align itself with environmentally conscious principles. Strategies such as implementing green building certifications, adopting energy-efficient construction methods, and implementing waste reduction strategies exemplify the industry's commitment to sustainability.

However, despite the industry's efforts to promote sustainability, it continues to have a substantial environmental impact, characterized by significant energy consumption, waste generation, and greenhouse gas emissions. Understanding the current environmental impact is crucial in addressing these challenges effectively.

**Recent statistics shed light on the extent of the industry's impact:**

1. **Energy Consumption:** The construction sector account for a significant portion of global energy consumption. In 2019, the construction industry worldwide consumed approximately 40% of the total global energy output [1].

2. **Waste Generation:** Waste generation is another critical sustainability challenge faced by the construction industry. The United Nations Environment Programme (UNEP) reports that construction and demolition waste accounts for about 30% of all waste generated globally, with concrete, asphalt, wood, and metals being the primary contributors [2]. This waste not only strains landfill capacity but also depletes natural resources and contributes to environmental degradation.

3. **Greenhouse Gas Emissions:** The construction industry is a notable source of greenhouse gas emissions, responsible for approximately 11% of energy-related CO2 emissions worldwide in 2020, according to the International Energy Agency (IEA) [3].

Furthermore, the construction industry in the United States contributes significantly to environmental degradation, encompassing resource consumption, waste generation, and emissions. A comprehensive study conducted by the United States Environmental Protection Agency (EPA) in 2018 revealed that the construction and operation of buildings accounted for approximately 39% of total energy use and 68% of total electricity consumption in the country.

*“Moreover, the construction and demolition (C&D) sector generated approximately 600 million tons of C&D debris in the USA in 2018 [4].”*
Industry leaders must acknowledge the presence and impact of a critical issue that significantly contributes to the sustainability challenges faced by the construction industry: rework.

**Rework, an integral and significant problem within the industry, has far-reaching implications that affect project timelines, costs, society and environmental sustainability.** The next section will provide an in-depth examination of the challenges posed by rework and its ramifications for the industry as a whole.

## The Challenge:

FIRMUS was established to address a paramount challenge in the construction industry - Design induced risks. One of those risks is the risk of rework. **Rework refers to the necessity of rectifying or redoing work that has been previously completed but fails to meet the required standards or specifications the project was set out to achieve.**

In construction, rework can arise from various factors, including design errors, discrepancies, scope gaps, poor workmanship, miscommunication, changes in project requirements, or unforeseen site conditions.

The implications of rework in construction are significant, affecting project timelines, costs, and overall quality. It can lead to delays, increased expenses, and disruptions to the construction process. Rework often involves dismantling or removing completed work and redoing it, resulting in time-consuming efforts, heightened expenses, and reduced productivity for the construction team.

### The following statistics emphasize the impact of rework on the construction industry

#### Time and Schedule Impact

The Construction Industry Institute (CII) estimates that rework typically accounts for 5% to 15% of total project duration, contributing to project delays and missed deadlines [1]. Additionally, a study by the National Institute of Standards and Technology (NIST) found that rework can extend project schedules by an average of 10% [2].

#### Cost Impact

Rework can significantly inflate project costs. The CII reports that rework costs typically range from 2% to 20% of the total project cost [1]. Furthermore, the NIST study revealed that rework expenses can amount to 12% to 15% of the total project budget [2].

#### Productivity Impact

Rework affects the productivity of the construction team and can lead to inefficiencies. According to a survey conducted by Dodge Data & Analytics, rework reduces labor productivity by an average of 5% to 10% [3]. This loss in productivity results from the additional time and effort required to rectify errors and redo work.

#### Safety Impact

FIRMUS' proactive approach to preventing rework in the construction industry not only enhances efficiency but also significantly reduces safety risks. Rework in the construction industry poses a significant safety risk, with 39% of injuries occurring during rework, as reported by BBI Services [4].

Another important impact is the environmental impact. In the construction industry, the rework challenge not only has implications for project timelines and costs, but also has environmental consequences: Material Waste, Energy Consumption, Water Usage, Habitat Disruption, Air and Noise Pollution.

Rework in the construction industry has significant environmental impacts, contributing to the overall environmental footprint of construction projects. These impacts can be quantified and include:

1. **Resource Depletion:** Rework often necessitates the removal and replacement of materials, leading to increased resource consumption. It has been estimated that **rework accounts for 4% to 10% of total construction materials used globally** [1]. The extraction and processing of these resources can result in habitat destruction, soil erosion, and water pollution.

2. **Waste Generation:** Rework generates substantial amounts of construction waste, including debris, demolished structures, and discarded materials. Globally, **construction and demolition waste contribute to approximately 35% to 40% of total solid waste generated** [2]. Proper waste management is crucial to mitigate the environmental impacts of rework-related waste.

3. **Energy Consumption:** Rework activities, such as demolition and reconstruction, require additional energy inputs. The energy consumed during rework contributes to the overall energy footprint of the construction industry. Rework has been found to account for approximately 3% to 5% of total energy consumption in the construction sector [3]. This energy consumption primarily relies on non-renewable sources, resulting in greenhouse gas emissions and climate change impacts.

4. **Greenhouse Gas Emissions:** Rework indirectly contributes to greenhouse gas emissions through increased energy consumption and transportation requirements. It has been estimated that **rework accounts for approximately 2% to 5% of total greenhouse gas emissions from the construction industry** [5]. These emissions primarily consist of carbon dioxide (CO2) and contribute to climate change.

5. **Water and Air Pollution:** Rework activities can lead to water and air pollution. During rework, dust, particulate matter, and hazardous chemicals can be released into the air, affecting air quality. Construction waste, if not properly managed, can contaminate water sources through leaching or runoff, causing water pollution. **The construction industry is estimated to contribute to 12% of global freshwater pollution** [6].

## Solution:

Reducing rework through the utilization of advanced software platforms like FIRMUS, allows the construction industry to minimize its environmental impact. By addressing design issues early and improving communication and collaboration, FIRMUS helps optimize resource utilization, reduce material waste, and decrease energy consumption associated with rework. The result is a more environmentally sustainable construction process that aligns with the industry's goals of reducing its ecological footprint. And this process is so effective that customers reported **using 80% of FIRMUS issues** in their reports back to the design teams and clients.

**48-96**
**HOURS (FIRMUS)**

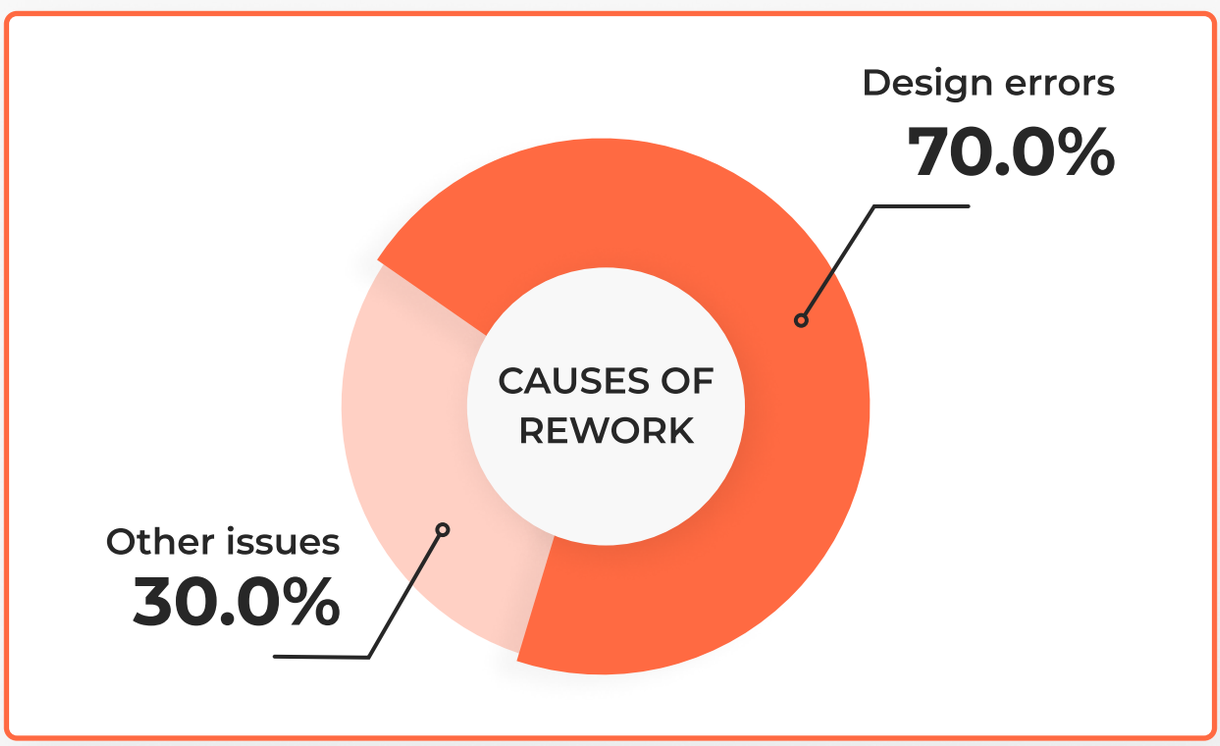
***VS***

**2-3**
**WEEKS (MANUAL)**

On average, FIRMUS identifies a substantial **447 issues in every project**, which, if left unaddressed, could lead to potential rework, resulting in heightened environmental resource consumption, social disruptions, and governance complexities. With FIRMUS' efficient system, manual processing time is significantly reduced to 48-96 hours vs. the typical 2-3 week turnaround for similar projects. This expedites issue resolution and minimizes the project's environmental footprint.

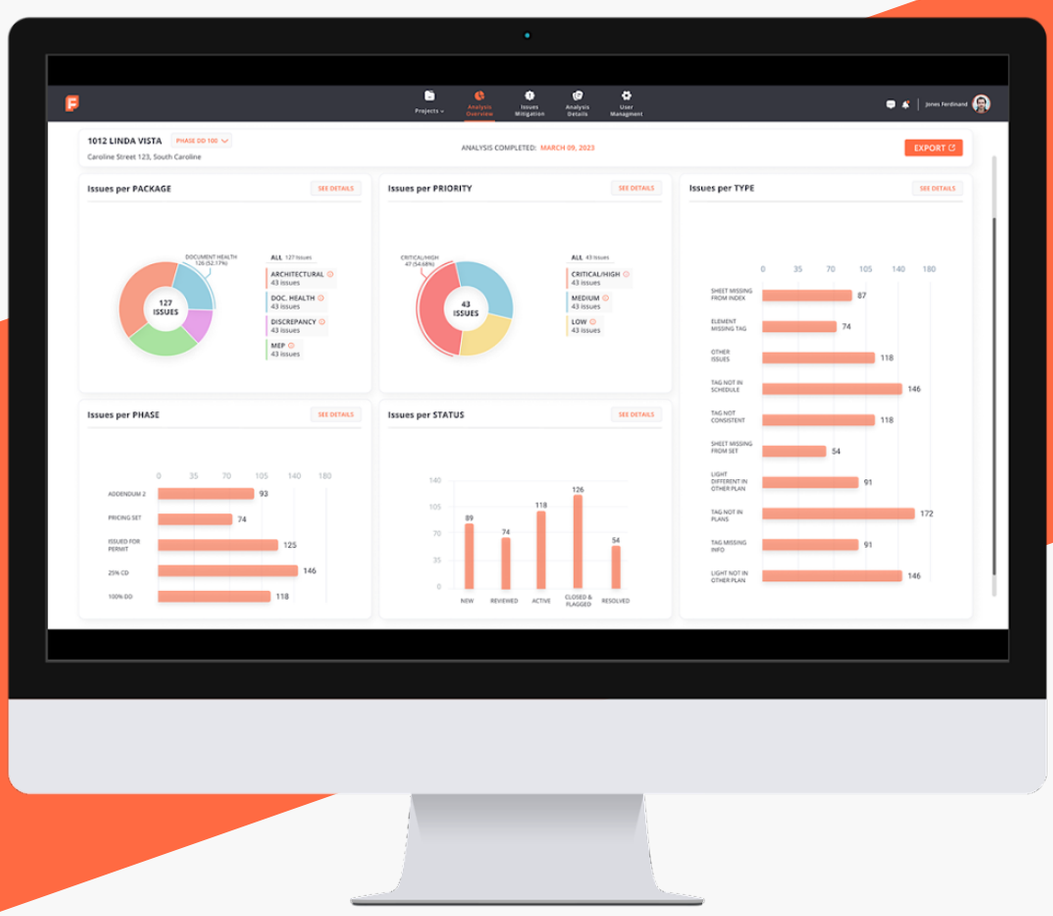
Firmus automatically analyzes drawing sets, identifying design-related risks and enhancing pre-construction decision-making to:

**1. Limit Design Errors:** Design errors can significantly contribute to rework within construction projects. **According to a study conducted by the Construction Industry Institute (CII), design errors account for up to 70% of all rework** [7]. **This statistic emphasizes the importance of comprehensive and accurate design processes to reduce the need for subsequent corrections and modifications.**



**2. Lower Construction Efforts:** Rework represents a substantial portion of construction efforts and can have a significant impact on project productivity. The CII estimates that approximately 30% of all construction efforts are dedicated to rework-related activities [1]. This figure encompasses the time, resources, and labor required to rectify errors, redo work, and ensure compliance with desired project specifications.

FIRMUS automatically identifies design issues, incomplete designs,, discrepancies and scope gaps by utilizing Computer Vision AI, to increase cost predictability, eliminate rework, delays, and related risks. FIRMUS uses easy to understand analytics, dashboards and detailed reports to help improve decision making processes and allow customers to quickly address greatest risks, track design development and manage their team. Their intuitive cloud-based platform, allows project stakeholders to effectively communicate and understand the bigger picture, increasing certainty, helping to build relationships based on trust and establishing a competitive edge.

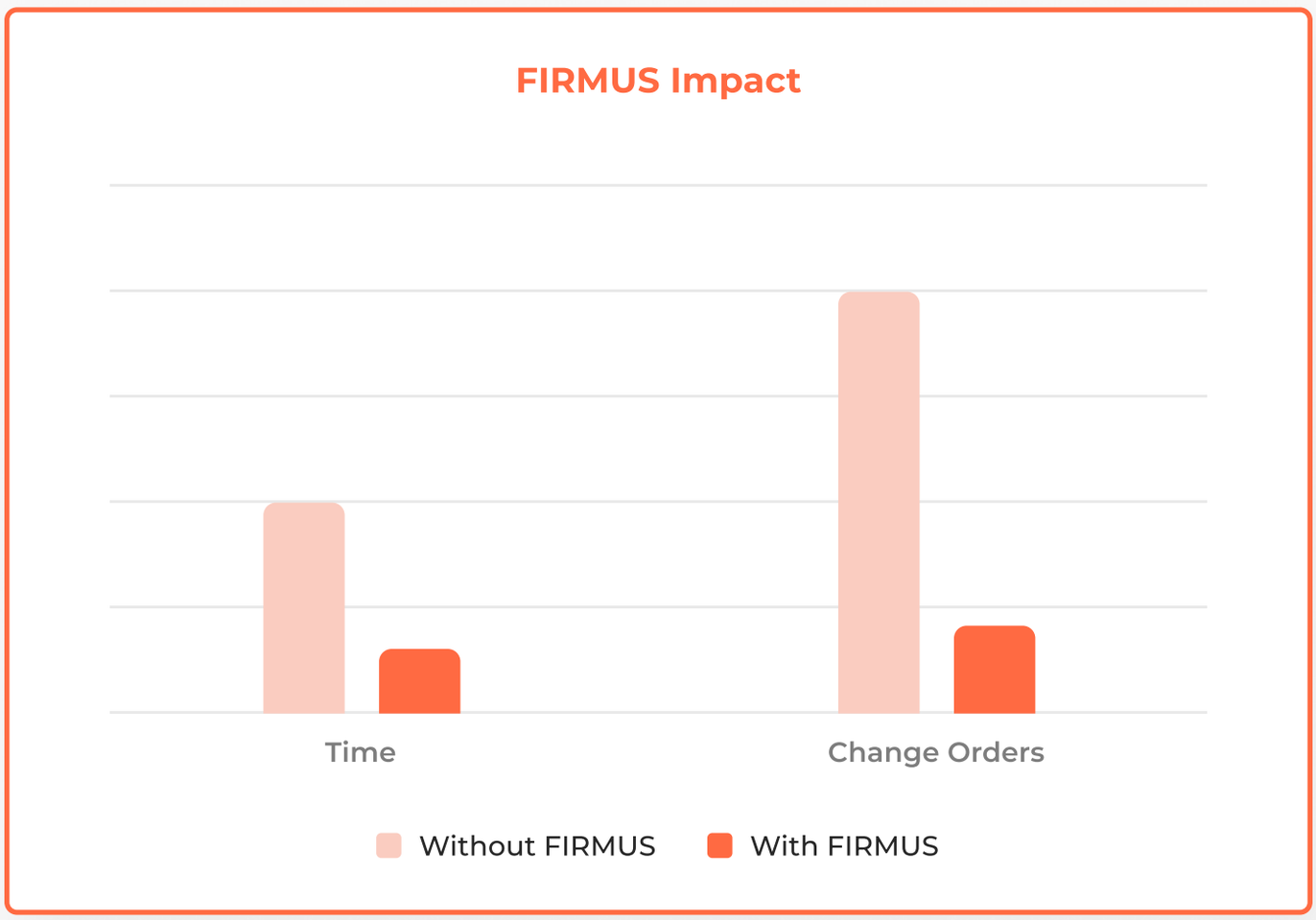


## Advancing Sustainability with FIRMUS:

FIRMUS's advanced software platform revolutionizes pre-construction decision-making and contributes to environmental sustainability by addressing design-related risks and minimizing rework. This proactive approach lowers the construction industry's environmental impact, optimizes resource utilization, and reduces energy consumption and waste generation.

Through FIRMUS's automated analysis of drawing sets, design errors and construction efforts are reduced, aligning with the industry's sustainability goals. By empowering stakeholders to make informed decisions and fostering effective communication, FIRMUS cultivates a culture of efficiency, sustainability, and social responsibility in the construction sector.

Avoiding potential Change Orders and rework has allowed FIRMUS to mitigate negative social and financial impacts on the construction team and the community. Even a single identified issue can result in substantial cost savings. As the construction industry evolves, adopting innovative technologies like FIRMUS is crucial for building a greener and more sustainable future. Collaboratively, we can leave a lasting positive impact on both society and the environment, with FIRMUS leading the way.



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7. G. Ellis, “7 Ways to Reduce Construction Rework,” Autodesk Construction Cloud, 2023.