



Automation of Bar Bending Schedule Software for Building

Gowrish G Kamath¹, K P Venkatesh², Keerthan Hebbar³, P Vikhyath Shenoy⁴,

Mr. Dinesh Ramakrishna Bhagwat⁵

Final year student, Dept. of CSE, Mangalore Institute of Technology & Engineering, Moodabidri, India¹⁻⁴

Dept. of CSE, Mangalore Institute of Technology & Engineering, Moodabidri, India⁵

Abstract: Bar Bending Schedule (BBS) is basically the representation of bend shapes and cut length of bars as per structure drawings. BBS is prepared from construction drawings. For each member separate BBS is prepared because bars are bent in various shapes depending on the shape of member. "BBS", the word BBS Plays a significant role in any construction of High rise buildings. It helps to quote for tender the cost incurred by steel. Finding the cutting length and bending length in reinforcement detailing improves the quality of construction and minimize the wastage of steel, so this makes an economic construction. This increases faster construction and reduces the total construction cost for site engineers, It becomes easy to verify the cutting length and bending length of the reinforcement before placing the concrete. The calculation process requires meticulous calculations and analysis to ensure structural integrity, safety, and durability. This paper presents a review of the latest research and developments in automation applied to the BBS Software.

The paper first highlights the importance of Software infrastructure and the challenges associated with their design process, including complex calculations, iterative analysis, and adherence to design codes and standards. Then, it discusses the role of automation in addressing these challenges and improving the efficiency and accuracy of the calculation.

The benefits of automation in Software are discussed, including reduced human error, improved accuracy, increased productivity, and enhanced design optimization.

The paper also discusses the limitations and challenges of automation in Software, including the need for reliable input data.

Finally, the paper identifies future research directions and potential areas of improvement in automation for BBS Software. These include the development of more advanced AI models, integration of automation with emerging technologies like Buildings and addressing the challenges related to data reliability and ethical concerns.

In conclusion, automation has emerged as a promising approach to improve the design of Software, making the process more efficient, accurate, and optimized. However, further research is needed to overcome the challenges and limitations associated with automation, and to ensure its ethical and responsible use in Bar Bending Schedule. The findings of this review paper can serve as a reference for researchers, practitioners, and policymakers interested in the application of automation in the BBS Software.

Key Points: BBS(Bar Bending Schedule), CAD(Computer-Aided Design)

I. INTRODUCTION

Bar bending schedule is an important structural working document that rightly gives the disposition, bending shape, total length, and quantity of all the reinforcements that have been provided in a structural drawing. It is often provided in a separate sheet (usually A4 paper) from the structural drawing. The bar marks from structural detailing drawing are directly transferred to the bar bending schedule. The design of different structures requires careful consideration of various factors such as structural stability, load-bearing capacity, durability, and aesthetics, among others. Traditional methods of designing Software involve manual calculations, which can be time-consuming, labor-intensive, and prone to human errors. However, with the advent of automation in the field of engineering and construction, the design process of Bar Bending has been revolutionized.



Automation has emerged as a promising approach to streamline and optimize the design of Software, making it more efficient, accurate, and cost-effective. Automation in the design of Structures involves the use of computer-aided design (CAD) software, numerical simulations, and advanced algorithms to generate optimal design solutions. This paper aims to highlight the significance of automation in Existing Software and its potential benefits for the field of civil engineering. The use of automation in this Software has several advantages. Firstly, it allows engineers to Calculate with high precision and accuracy, minimizing the risk of human errors.

Secondly, automation in the Software enhances the efficiency of the calculation. Manual calculations can be time-consuming and labor-intensive, whereas automation enables engineers to generate design alternatives quickly and compare them based on different criteria such as cost, aesthetics, and sustainability. This allows for iterative optimization, resulting in more economical and sustainable designs.

Thirdly, automation in the Software facilitates innovation and creativity in design. The shape of each and every bar is to be derived exactly for cutting from working drawings. With increasing cost of steel, it has become necessary to minimize the wastage. This opens up new opportunities for innovative that may not be feasible with traditional manual methods.

Furthermore, Software takes care of all these aspects, for preparation of Bar Bending Schedules and Quantity Estimation of Reinforcement steel. Bar bending schedule Software is not Excel or any spreadsheet based, neither it runs under any CAD package. It is complete standalone software. Program eliminates time-consuming work of calculating the cut length of bars. BBS sheets generated can be printed through this package directly. Outputs of this software can also be read in any CAD package.

II. LITERATURE REVIEW

In [1] "Bar-Be-Que Bar Bending Schedule Software" by Ensoft India is a specialized tool designed for civil engineers and construction professionals to facilitate the creation of detailed bar bending schedules (BBS) for reinforced concrete structures. This software offers a user-friendly interface and powerful features to streamline the process of generating BBS. Users can input project specifications, structural design requirements, and reinforcement details into the software. Bar-Be-Que then automates the calculation of the quantity and specifications of reinforcement bars needed for various concrete elements such as beams, columns, slabs, and footings. The software provides comprehensive information including bar sizes, lengths, shapes, bending angles, and placement details within the concrete structures. With its intuitive interface and efficient calculations, Bar-Be-Que simplifies the creation of BBS, enabling engineers and construction professionals to improve productivity and accuracy in their projects. Additionally, the software may offer customization options, integration with other construction software tools, and support for industry standards and codes, further enhancing its utility and effectiveness in the construction industry.

In [2] "Rebar CAD Bar Bending Schedule Software" by CADS India is a specialized tool designed for civil engineers and construction professionals to efficiently create detailed bar bending schedules (BBS) within a CAD environment. This software integrates seamlessly with CAD platforms, such as AutoCAD or Revit, allowing users to leverage familiar interfaces and workflows while generating BBS. The software enables users to input project specifications, structural design requirements, and reinforcement details directly within the CAD environment. It then automates the process of calculating the quantity and specifications of reinforcement bars required for various concrete elements like beams, columns, slabs, and footings. The software provides comprehensive information, including bar sizes, lengths, shapes, bending angles, and placement details within the concrete structures, all within the CAD environment. With its seamless integration with CAD software, Rebar CAD by CADS India enhances productivity, accuracy, and efficiency in the creation of BBS, enabling engineers and construction professionals to streamline their workflows and effectively manage reinforcement detailing in construction projects. Additionally, the software may offer advanced features such as customization options, reporting tools, and support for industry standards and codes, further enhancing its utility in the construction industry.

In [3] "RGS REBAR Bar Bending Schedule" by Viskartech is a specialized software solution tailored for the creation of detailed bar bending schedules (BBS) in the context of civil engineering and construction projects. This software streamlines the process of generating BBS by automating various tasks and calculations involved in reinforcement detailing. Users can input project specifications, structural design requirements, and reinforcement details into the software, which then utilizes advanced algorithms to calculate the quantity and specifications of reinforcement bars needed for different concrete elements such as beams, columns, slabs, and footings. The software provides comprehensive information including bar sizes, lengths, shapes, bending angles, and placement details within the concrete structures.



With its user-friendly interface and intuitive features, RGS REBAR simplifies the creation of BBS, enabling engineers and construction professionals to improve efficiency, accuracy, and productivity in their projects. Additionally, the software may offer customization options, integration with other construction software tools, and support for industry standards and codes, further enhancing its utility and effectiveness in the construction industry.

In [4] "Reinforcement-BBS" by Sq-Feet is a specialized software tool developed by Sq-Feet Technologies for generating detailed bar bending schedules (BBS) in civil engineering and construction projects. This user-friendly software automates calculations based on input parameters, including project specifications and reinforcement details, to accurately determine the quantity and specifications of reinforcement bars required for various concrete elements such as beams, columns, slabs, and footings. With its efficient calculation capabilities, Reinforcement-BBS streamlines the BBS generation process, improving productivity and accuracy for engineers and construction professionals.

In [5] "Bar Bending Schedule by Bend Plus" is a software solution tailored to assist civil engineers and construction professionals in creating comprehensive bar bending schedules (BBS) for reinforced concrete structures. This tool simplifies the process by automating calculations based on input parameters such as project specifications, structural design requirements, and reinforcement details. Users can input data regarding bar sizes, lengths, shapes, bending angles, and placement within concrete elements like beams, columns, slabs, and footings. The software then generates detailed schedules outlining the quantity and specifications of reinforcement bars required for each element, facilitating accurate and efficient construction planning and execution. With its user-friendly interface and advanced features, Bar Bending Schedule by Bend Plus enhances productivity and accuracy in construction projects, making it a valuable tool for engineers and construction professionals.

In [6] The "Bar Bending and Quantity Estimation Software" offered by IndiaMart is a comprehensive tool designed to streamline the planning and management processes in civil engineering and construction projects. Combining the functionalities of bar bending schedule (BBS) generation and quantity estimation, this software empowers users to create detailed plans for reinforcing steel bars used in concrete structures while accurately estimating the quantities of various construction materials required. By allowing users to input project parameters and design specifications, the software calculates the specifications of reinforcement bars and provides detailed information such as bar size, length, shape, bending angles, and placement within concrete elements. Additionally, it offers tools for estimating material quantities such as concrete, bricks, and steel, aiding in effective project planning and budgeting. Overall, the software enhances efficiency, accuracy, and resource management, thereby contributing to the successful execution of construction projects.

In [7] The "Bar Bending Schedule Program in Microsoft Excel" by software.infomer is a specialized tool designed to assist civil engineers and construction professionals in generating detailed bar bending schedules (BBS) using the familiar interface of Microsoft Excel. This program offers a user-friendly approach to creating BBS, allowing users to input project specifications, structural design requirements, and reinforcement details directly into Excel sheets. Leveraging Excel's computational capabilities, the program calculates the quantity and specifications of reinforcement bars needed for various concrete elements such as beams, columns, slabs, and footings. It provides comprehensive information including bar sizes, lengths, shapes, bending angles, and placement details within the concrete structures. By utilizing Excel's features, users can customize and format BBS according to their preferences, facilitating easier interpretation and sharing of information with project stakeholders. Overall, the Bar Bending Schedule Program in Microsoft Excel by software.infomer offers a convenient and efficient solution for creating accurate BBS, enhancing productivity and accuracy in construction projects.

In [8] "Bar Bending Schedule Rebar BBS 5.2.3 by Soft112" is a specialized software tool designed to facilitate the creation of detailed bar bending schedules (BBS) for reinforced concrete structures. This software offers a user-friendly interface and powerful features to streamline the process of generating BBS. Users can input project specifications, structural design requirements, and reinforcement details into the software. Bar Bending Schedule Rebar BBS 5.2.3 then automates the calculation of the quantity and specifications of reinforcement bars needed for various concrete elements such as beams, columns, slabs, and footings.

The software provides comprehensive information including bar sizes, lengths, shapes, bending angles, and placement details within the concrete structures. With its intuitive interface and efficient calculations, Bar Bending Schedule Rebar BBS 5.2.3 simplifies the creation of BBS, enabling engineers and construction professionals to improve productivity and accuracy in their projects. Additionally, the software may offer customization options, integration with other construction software tools, and support for industry standards and codes, further enhancing its utility and effectiveness in the construction industry.



III. SCOPE AND METHODOLOGY

Aim of the Project

To save time in Calculating the quantity of steel in construction and to input necessary parameters , and to generate total quantity of steel automatically.

Existing Software

“Barbeque Software For Bar Bending Schedules” by Ensoft [1]

Bar-Be-Que is a comprehensive software solution designed for bar bending scheduling in building construction projects. One of its standout features is the standalone option for manual data entry of each bar, where dimensions of each bar are inputted in a tabular form. This user-friendly interface simplifies the process of entering detailed information about reinforcement bars, including their diameters, lengths, and spacing.

The program's advanced capabilities include generating a Bar Bending Schedule (BBS) Drawing with a to-the-scale graphical sketch of each bar. This feature aids in visualizing the placement and configuration of reinforcement bars within the component or structure. The graphical representation is invaluable for understanding the spatial arrangement of bars and ensuring accurate implementation in construction.

Bar-Be-Que supports various bar shape codes, such as those specified in the latest IS 2502 or BS 8666 codes, providing flexibility to adhere to regional or project-specific standards. Additionally, the software automates the calculation of bar lengths according to code requirements, eliminating the time-consuming manual calculations traditionally associated with bar bending scheduling.

Furthermore, Bar-Be-Que offers customizable options for deductions in bar lengths due to bending, allowing users to implement deductions according to IS or BS codes or based on specific site practices. This flexibility ensures that the generated BBS accurately reflects the required bar lengths for construction.

Another noteworthy feature of Bar-Be-Que is its ability to provide a diameter-wise breakup of reinforcement quantities as a summary. This summary is invaluable for procurement and inventory management, enabling stakeholders to efficiently plan and manage the procurement of reinforcement materials based on specific diameter requirements.

Overall, Bar-Be-Que streamlines the bar bending scheduling process by providing a user-friendly interface, automated calculations, graphical visualization, and customizable options to meet the diverse needs of building construction projects. Its comprehensive features make it an indispensable tool for efficiently managing reinforcement detailing and scheduling in construction projects.

“Bend Plus Software For Bending the Steel” [2] Bend Plus rebar software - the ultimate solution for rebar order entry and fabrication. Bend Plus software is designed to streamline the process, increase efficiency and accuracy, and reduce costs. With advanced algorithms and mathematical models, Bend Plus ensures the accuracy of the final product and automates the process of creating detailed bar bending schedules and cutting lists.

Bend Plus software helps minimize rebar waste and labor costs, resulting in cost savings for your company. Bend Plus is a specialized software solution designed for bending steel reinforcement bars, commonly used in construction projects. This software offers a comprehensive suite of features tailored to streamline the rebar order entry and fabrication process. Bend Plus aims to enhance efficiency, accuracy, and cost-effectiveness in handling rebar-related tasks.

One of the key features of Bend Plus is its advanced algorithms and mathematical models, which ensure the accuracy of the final product. By leveraging these algorithms, the software automates the process of creating detailed bar bending schedules and cutting lists. This automation not only saves time but also reduces the likelihood of errors that may occur during manual calculations.

Moreover, Bend Plus is designed to minimize rebar waste and labor costs. By optimizing the cutting and bending of reinforcement bars, the software helps companies reduce material wastage and optimize labor resources. This results in significant cost savings for construction companies, making Bend Plus a valuable tool for improving profitability and competitiveness in the industry.



Overall, Bend Plus offers a user-friendly interface and powerful features tailored specifically for rebar order entry and fabrication. By streamlining processes, increasing accuracy, and reducing costs, Bend Plus is positioned as an essential solution for companies involved in steel reinforcement fabrication for construction projects.

Proposed system:

Bar Bending Schedule is a specialized software designed for creating reinforcement detailing and bar bending schedules. It simplifies the process by requiring minimal inputs, such as component dimensions and reinforcement specifications, and then automatically generates detailed bar bending schedules based on this information. Its intuitive interface and automation capabilities help save time and reduce the potential for errors, making it an ideal solution for efficiently producing accurate bar bending schedules with minimal input requirements.

Using specialized Bar Bending Schedule (BBS) software offers several advantages over the traditional Excel-based method for bar bending purposes in construction. Firstly, BBS software streamlines the entire bar bending scheduling process through automation, significantly reducing the time and effort required for data entry and calculations compared to the manual processes in Excel.

BBS software is specifically designed to handle the complexity of large-scale construction projects, offering advanced features for managing intricate reinforcement detailing and generating accurate schedules. Moreover, BBS software provides advanced visualization capabilities, allowing users to create detailed 3D models and drawings of reinforcement layouts for better visualization and understanding of the project. Additionally, BBS software often integrates seamlessly with other construction management tools and Building Information

Modeling (BIM) platforms, facilitating efficient data exchange and collaboration among project stakeholders. Furthermore, BBS software ensures compliance with industry standards and codes for reinforcement detailing, minimizing the risk of errors and ensuring regulatory compliance compared to the manual verification required in Excel. Overall, the advantages of using BBS software include increased efficiency, accuracy, visualization capabilities, integration, and compliance with industry standards, making it a superior choice for bar bending purposes in construction compared to the traditional Excel-based method.

IV. DESIGN AND IMPLEMENTATION

Preparation of Reinforcement Bar Bending Schedules for RCC work at construction sites is the most tedious and time-consuming task. The shape of each and every bar is to be derived exactly for cutting from working drawings. With increasing cost of steel, it has become necessary to minimize the wastage.

Bar Bending Schedule software takes care of all these aspects, for preparation of bar bending schedules and quantity estimation software. Bar Bending Schedule software is not Excel or any spreadsheet based, neither it runs under any CAD package. It is a standalone software, which generates to-the-scale graphical sketch of each bar. Program eliminates time-consuming work of calculating the cut length of bars. BBS sheets generated can be printed through this package directly. Outputs of this software can also be read in any AutoCAD compatible package.

Bar Bending Schedule has a option for manual data entry. The dimensions of each bar are entered in a tabular form. Formulas for calculating the cut length after deducting bending allowances for various shapes of bars, are stored in the program, as per IS 2502 and BS 8666 codes.

Program generate the Bar Bending Schedule (BBS) sheets with to-the-scale graphical sketch of each bar. Bar Shape Code can be as per latest IS 2502 or BS 8666 code. Program eliminates time-consuming work of calculating the length of bars after deductions. Diameters wise break up of rebar quantities is printed in the summary.

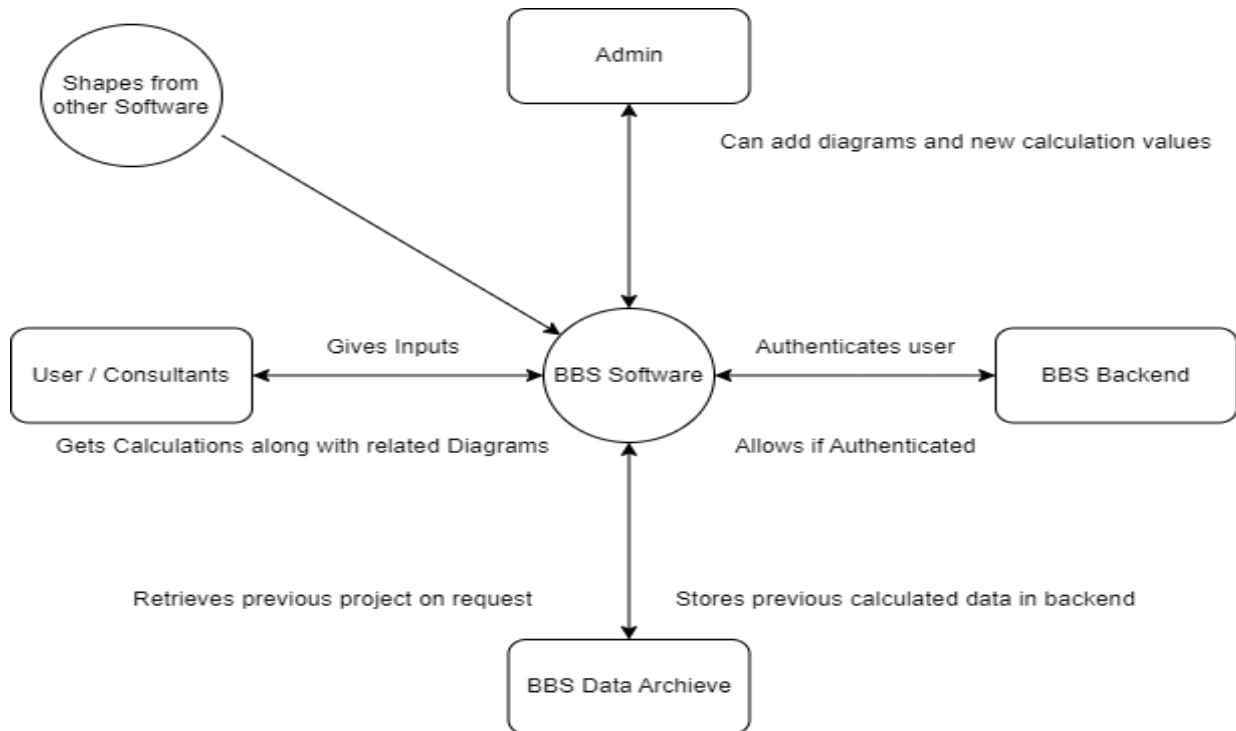


Fig 1. Represents the working of BBS software

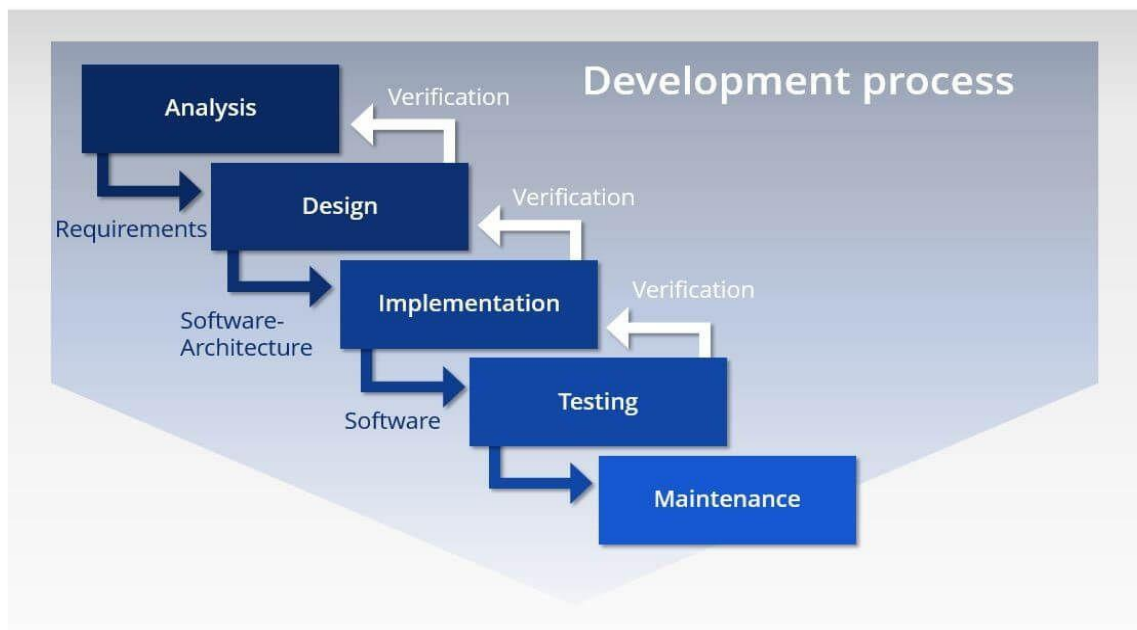


Fig 2. Represents the flow of SDLC of a Software

The Software Development Life Cycle (SDLC) for "BBS" software, designed for reinforced steel detailing, follows a systematic approach to ensure its effectiveness and efficiency. The process commences with meticulous planning and requirements gathering, where the needs of civil engineers, contractors, and stakeholders are identified and detailed requirements such as rebar bending schedules and material optimization algorithms are specified. Subsequently, the software undergoes a thorough design phase, encompassing the creation of a robust system architecture and an intuitive user interface, featuring functionalities like real-time visualization and easy data input. In the development stage, coding adheres to best practices, implementing algorithms for rebar optimization and ensuring scalability, while unit testing



ensures the functionality of individual components. Comprehensive testing, including integration, functional, and performance testing, ensures the seamless operation and reliability of "BBS" under diverse conditions. Upon completion, deployment involves meticulous installation, configuration, and user training to enable engineers and contractors to effectively utilize the software. Continuous maintenance and support, including regular updates and user assistance, ensure "BBS" remains responsive to industry needs, fostering efficient reinforced steel design practices.

V. RESULT AND CONCLUSION

Result: The outcome of the project will be a industry ready software which will be using latest Tech Stack and techniques for accurate and quick calculation and can be used by different civil consultancy agency and various civil engineers. Generating Bar Lengths with very few inputs for standard objects like various types of Beams, Columns, Staircases, and Foundations etc. This software is not Excel or any spreadsheet based neither it runs through any CAD package. It is simple to operate and there is no need of thorough knowledge of a CAD package.

Conclusion: In this paper, we have presented a comprehensive review of the state-of-the-art in automation of BBS Software. Our analysis and findings indicate that automation has significantly impacted the , resulting in increased efficiency, accuracy, and productivity.

One of the key advantages of automation of this Software is the ability to optimize various design parameters, such as dimensions, reinforcement details, and loadings, to achieve an optimal design that meets structural requirements while minimizing construction costs. Automation tools, such as computer-aided design (CAD) software, finite element analysis (FEA) software, and machine learning algorithms, have been utilized to automate repetitive and time-consuming tasks, such as structural analysis, member sizing, and detailing, leading to faster and more reliable designs.

Automation has also facilitated better collaboration among different stakeholders involved in the design process, including contractors, and owners. By providing a unified platform for design and analysis, automation tools have improved communication, reduced errors, and increased transparency, leading to more efficient coordination and smoother project execution.

In conclusion, automation has emerged as a powerful tool in the designing the Software, providing numerous benefits such as increased efficiency, accuracy, and productivity. While there are challenges to be addressed. As technology continues to advance, it is expected that automation will play an even more significant role in the future of Construction, leading to safer, more economical, and sustainable building structures. Further research and development in this field are warranted to continuously enhance the capabilities of automation tools and ensure their widespread adoption in the bridge engineering industry.

REFERENCES

- [1] "Bar-Be-Que Bar Bending Schedule Software" by Ensoft India <https://ensoftindia.com/products/barbeque/index.html>
- [2] Rebar CAD Bar Bending Schedule Software" by CADs India <https://www.cadsindia.com/rebarcad/bar-bending-schedules/>
- [3] "RGS REBAR Bar Bending Schedule" by Viskartech <https://www.viskartech.com/global/products/rgsrebar/demo/>
- [4] "Reinforcement-BBS" by Sq-Feet <https://www.sq-feet.com/reinforcement-bbs>
- [5] "Bar Bending Schedule" by Bend Plus <https://bendplus.com/bar-bending-schedule-software/>
- [6] "Bar Bending and Quantity Estimation Software" offered by IndiaMart <https://www.indiamart.com/proddetail/bar-bending-schedule-and-quantity-estimation-software-21141483630.html>
- [7] The "Bar Bending Schedule Program in Microsoft Excel" by software.informer <https://bar-bending-schedule-program-in-microsof.software.informer.com/>
- [8] "Bar Bending Schedule Rebar BBS 5.2.3"by Soft112 <https://bar-bending-schedule-rebar-weight-calculator.soft112.com/>