

excel sheets for beam design Full Version

Excel sheets for beam design have become an indispensable tool for civil and structural engineers aiming to streamline their workflow, improve accuracy, and enhance efficiency in designing beams for various construction projects. With the increasing complexity of structural requirements, utilizing well-structured Excel spreadsheets can significantly reduce manual calculations, minimize errors, and facilitate quick modifications. Whether you are a seasoned engineer or a student, mastering the use of Excel sheets for beam design can elevate your engineering practice to new levels of precision and productivity.

Introduction to Excel Sheets for Beam Design

Designing beams involves calculating various parameters such as bending moments, shear forces, deflections, and reinforcement requirements. Traditionally, these calculations were performed manually or through proprietary software. However, Excel sheets offer a customizable, flexible, and cost-effective alternative. They allow engineers to develop tailored models, automate repetitive calculations, and perform sensitivity analyses easily.

Advantages of Using Excel Sheets for Beam Design

- Cost-effective and accessible to most engineers and students
- Highly customizable to specific project needs
- Facilitate quick updates and modifications
- Enable data visualization through charts and graphs
- Automate complex calculations with formulas and macros

Key Components of an Excel Beam Design Sheet

Designing an effective Excel sheet involves integrating multiple components that work together seamlessly. A comprehensive beam design Excel sheet typically includes the following sections:

Input Data Section

This section captures all the essential parameters required for the design calculations.

- Beam geometry: span length, cross-sectional dimensions (width, height)
- Material properties: concrete grade, steel yield strength

- Loading details: dead loads, live loads, point loads, distributed loads
- Support conditions and boundary constraints

Calculation Modules

Automated calculations based on input data to determine critical parameters.

- Ultimate load calculations
- Bending moment and shear force diagrams
- Maximum bending moment and shear force values
- Design of reinforcement: tension and compression steel
- Deflection checks against permissible limits

Design Checks and Code Compliance

Ensures that the design adheres to relevant codes such as ACI, Eurocode, or IS codes.

- Flexural strength verification
- Shear strength verification
- Serviceability checks (deflections and crack widths)
- Reinforcement detailing and spacing

Output and Visualization

Clear presentation of results for easy interpretation.

- Summary tables with key results
- Graphs illustrating bending moment and shear force distributions
- Reinforcement details and bar schedules

Creating an Efficient Excel Sheet for Beam Design

Developing a reliable and user-friendly Excel sheet requires careful planning and understanding of structural design principles. Here are the essential steps:

Step 1: Define Input Parameters Clearly

Start with a dedicated section for inputs. Use data validation (drop-down lists, sliders) to minimize

input errors. Clearly label all parameters, and consider using cell comments for explanations.

Step 2: Implement Accurate Calculation Formulas

Use established structural engineering formulas, ensuring they are correctly implemented with cell references. For example:

- Bending moment: $M = w L^2 / 8$ (for uniformly distributed load)
- Shear force: $V = w L / 2$

Ensure formulas are dynamic, so changing input data automatically updates all related calculations.

Step 3: Incorporate Design Codes

Embed code-specific parameters and safety factors. Use conditional formatting to flag non-compliant designs.

Step 4: Automate Reinforcement Design

Based on calculated moments and shear forces, develop formulas to determine required reinforcement areas. Use lookup tables for bar sizes and spacing.

Step 5: Add Data Validation and Error Checks

Implement checks to alert the user if inputs are outside reasonable ranges or if design checks fail.

Step 6: Create Visualizations

Use charts to display load diagrams, bending moment distribution, and shear force profiles. Visual aids enhance understanding and presentation quality.

Sample Features of a Beam Design Excel Sheet

To illustrate, here are some features commonly included in advanced Excel sheets for beam design:

- **Load Combination Module:** Allows users to input various load cases and automatically computes the most critical scenarios.
- **Reinforcement Detailing:** Generates reinforcement bar schedules with detailed specifications.
- **Deflection Calculations:** Computes deflections based on material properties and loadings,

ensuring compliance with serviceability limits.

- **Automatic Code Checks:** Flags any design parameters that violate safety or code requirements.
- **Customizable Templates:** Users can modify layouts, add additional parameters, or adapt to different standards easily.

Best Practices for Using Excel Sheets in Beam Design

To maximize the benefits of Excel sheets for beam design, consider the following best practices:

- **Validate Inputs:** Always double-check input data for accuracy.
- **Document Assumptions:** Use comments or a dedicated documentation sheet to record assumptions and formulas used.
- **Regularly Update Formulas:** Keep formulas aligned with current design standards and codes.
- **Perform Sensitivity Analysis:** Test how changes in loads or material properties impact the design.
- **Backup Data:** Save versions frequently to prevent data loss.

Benefits of Using Excel Sheets for Beam Design

Adopting Excel sheets for beam design offers numerous advantages:

- Reduces the likelihood of calculation errors compared to manual work
- Speeds up the design process, especially for repetitive calculations
- Facilitates quick modifications and scenario testing
- Enhances collaboration through easily shareable and modifiable spreadsheets
- Serves as an educational tool for students learning structural design principles

Conclusion

Excel sheets for beam design are powerful tools that blend flexibility, accuracy, and efficiency. By incorporating structured input sections, automated calculations, code compliance checks, and visualization features, engineers can streamline their design process and ensure safer, more reliable structures. Developing or customizing your own Excel spreadsheet tailored to specific project requirements can lead to significant time savings and improved confidence in your designs. Whether used for preliminary assessments or detailed design calculations, mastering Excel-based beam design methods is a valuable skill in the modern structural engineering landscape.

Remember: Always verify your Excel sheet calculations with manual checks or software validation,

especially when working on critical or large-scale projects. Proper documentation and adherence to relevant codes are essential for safe and compliant structural designs.

Excel Sheets for Beam Design: A Comprehensive Guide for Structural Engineers

In the realm of structural engineering, excel sheets for beam design have revolutionized the way engineers approach calculations, analysis, and documentation. These tools provide a streamlined, accurate, and efficient means of performing complex computations, ensuring safety, compliance, and optimization in beam design processes. Whether you're a seasoned professional or a student honing your skills, understanding how to leverage excel sheets for beam design can significantly enhance productivity and precision.

Why Use Excel Sheets for Beam Design?

Before diving into the specifics, it's essential to understand the advantages of utilizing excel sheets in beam design:

- Automation of Calculations: Automate repetitive calculations, minimizing human error.
- Time Efficiency: Reduce manual computation time, allowing more focus on analysis and decision-making.
- Consistency and Accuracy: Standardized formulas ensure consistent application of design codes.
- Data Management: Store and organize data for multiple beams or scenarios for easy comparison.
- Customization: Tailor sheets to specific project requirements, codes, or design preferences.
- Documentation & Reporting: Generate clear reports directly within the sheet for review and approval.

Core Components of an Excel Sheet for Beam Design

A typical excel sheet for beam design encompasses several key sections:

- Input Data Section

This section gathers all the necessary parameters for the design:

- Material Properties:
 - Concrete strength (f'_c)

- Steel yield strength (f_y)
- Geometric Data:
 - Beam span (L)
 - Cross-sectional dimensions (width b , height h)
 - Effective cover
- Loading Data:
 - Dead load
 - Live load
 - Additional loads (imposed, wind, seismic)
- Support Conditions:
 - Simply supported, cantilever, continuous

- Load Calculations

Based on input data, this part computes:

- Total load (w): Sum of dead and live loads
- Factored load (M_u): Using load factors per code (e.g., 1.2 Dead + 1.6 Live)
- Ultimate moment calculation: For different support conditions

- Structural Analysis

Calculates the internal moments and shear forces:

- Bending moment (M) at critical sections
- Shear force (V) at supports and mid-span

- Reinforcement Design

Key calculations determine the required reinforcement:

- Section modulus (S): Based on cross-sectional dimensions
- Required steel area (A_{st}): For bending capacity
- Spacing and size of reinforcement bars: Based on code limits and practical considerations

- Section Check and Code Compliance

Verifies if the design meets the safety and serviceability requirements:

- Flexural capacity (M_n): Ensuring capacity exceeds factored moments
- Shear capacity (V_n): Check against shear forces
- Deflection limits: Ensuring deflections are within permissible limits

- Output and Detailing

Provides summarized results:

- Reinforcement area
- Bar sizes and spacing
- Moment and shear diagrams (optional)
- Summary report for documentation

Developing an Excel Sheet for Beam Design: Step-by-Step Guide

Creating an effective excel sheet for beam design involves systematic planning and implementation. Here's a detailed process:

Step 1: Define Input Parameters

Start by setting up cells for all input data, using clear labels and data validation where applicable. For instance:

- Use dropdowns for support conditions
- Set input cells for material properties and loads
- Implement units (e.g., MPa, mm, kN/m)

Step 2: Establish Calculation Sections

Below the input cells, develop formulas that perform the necessary calculations:

- Compute total loads based on inputs

- Apply relevant code factors to find factored loads
- Use formulas to calculate moments and shear forces

Step 3: Design Checks and Reinforcement Calculations

Implement formulas to determine:

- Required reinforcement area (A_{st}) based on the bending moment, using formulas derived from design codes
- Reinforcement bar sizes and spacing, ensuring compliance with minimum and maximum spacing limits
- Check shear capacity, calculating the shear capacity of the section and comparing it with the applied shear

Step 4: Incorporate Code Limits and Safety Factors

Embed checks within your sheet:

- Ensure reinforcement ratios do not exceed the maximum limit
- Verify deflection limits using empirical formulas or code provisions
- Highlight any non-compliance with conditional formatting or messages

Step 5: Visualize Results with Charts and Diagrams

Enhance clarity by adding:

- Bending moment and shear force diagrams
- Reinforcement detail sketches (if possible)
- Summary tables highlighting key parameters and results

Step 6: Automate and Protect the Sheet

Use Excel functionalities:

- Formulas and functions for automatic calculations
- Data validation for input consistency
- Conditional formatting to flag issues

- Protection to prevent accidental editing of formulas

Advanced Features and Tips for Effective Excel Beam Design Sheets

To maximize the utility of your excel sheets, consider integrating advanced features:

- Incorporate Code-Specific Design Checks

Embed provisions from relevant standards such as ACI, Eurocode, or IS codes, making your sheet adaptable to different jurisdictions.

- Use Macros for Complex Tasks

Develop VBA macros to automate tasks like batch processing multiple beams, generating detailed reports, or creating reinforcement layouts.

- Create User-Friendly Interfaces

Design intuitive input forms or dashboards, making it easier for users to input data and interpret results without delving into complex cell references.

- Link Multiple Sheets

For large projects, link sheets for different beam types, spans, or load cases to facilitate comprehensive analysis.

- Validate with Hand Calculations

Always cross-check your excel outputs with manual calculations or software outputs to ensure accuracy.

Examples of Popular Excel Beam Design Templates

While custom development offers tailored solutions, several pre-made excel templates are available online, including:

- Reinforced Concrete Beam Design Excel Sheets
- Simply Supported Beam Calculator
- Continuous Beam Analysis Templates
- Pre-stressed Beam Design Sheets

These templates often incorporate best practices, code compliance checks, and visualization tools, serving as an excellent starting point for engineers.

Best Practices for Using Excel Sheets in Beam Design

To ensure reliable and efficient use:

- Maintain Clear Documentation: Comment formulas and include instructions within the sheet.
- Regularly Update Code References: Keep formulas aligned with the latest design standards.
- Validate Inputs: Use data validation to prevent invalid entries.
- Perform Sensitivity Analysis: Test how changes in loads or material properties affect the design.
- Back Up Data: Save versions regularly to prevent data loss.

Conclusion

Excel sheets for beam design are indispensable tools that blend computational efficiency with rigorous safety standards. By systematically organizing data, automating calculations, and integrating code checks, these sheets empower structural engineers to produce accurate, consistent, and compliant designs. Whether you develop custom templates or adapt existing ones, mastering excel-based beam design techniques enhances your capability to tackle complex structural challenges with confidence and precision. As technology advances, integrating Excel with other software and automation techniques will further streamline the beam design process, cementing its role as a fundamental asset in structural engineering workflows.

Question What are the key features to consider when designing an Excel sheet for beam analysis? **Answer** Key features include input sections for load data, material properties, geometric details, calculation formulas for bending moments and shear forces, and output summaries such as stress and deflection results. Incorporating charts and automated calculations enhances usability and accuracy. How can I ensure the accuracy of beam design calculations in Excel? To ensure accuracy, use validated formulas based on engineering standards, include input validation to prevent errors, utilize cell references instead of hard-coded values, and cross-verify results with manual calculations or specialized software. Regular testing and peer reviews also improve reliability. Are there any free Excel templates available for beam design calculations? Yes, several free templates are available online on platforms like ExcelTemplate.net, Engineering Toolbox, and GitHub repositories. These templates typically include essential calculations for bending, shear, and

deflection, which can be customized to specific project requirements. Can Excel sheets for beam design incorporate code compliance checks? Yes, advanced Excel sheets can include embedded formulas and conditional formatting to check compliance with building codes such as AISC, Eurocode, or IS codes. This helps ensure that the design adheres to safety and regulatory standards automatically. What are the advantages of using Excel sheets for beam design over manual calculations? Excel sheets automate repetitive calculations, reduce human error, allow quick modifications, and facilitate data visualization through charts. They also enable easy documentation, sharing, and updating of design parameters, increasing efficiency and consistency. How can I customize an Excel sheet for different types of beams (simply supported, continuous, cantilever)? Customization involves adjusting input parameters and formulas to match the boundary conditions and loading scenarios of each beam type. Using modular sheets or sections for different configurations, along with conditional formulas, allows flexibility for various beam types and design requirements.

Related keywords: beam design, structural analysis, reinforcement layout, load calculation, spreadsheet templates, civil engineering, moment calculation, shear force, reinforcement detailing, structural spreadsheet

charlotte and peter fiell

Charlotte and Peter Fiell are renowned figures in the world of design, architecture, and contemporary visual culture. Their collaborative work as authors, researchers, and curators has significantly influenced how we perceive design history and its impact on modern society. With a keen eye for detail and a passion for uncovering the stories behind iconic objects and movements, Charlotte and Peter Fiell have established themselves as authoritative voices in the field. This article delves into their backgrounds, contributions, notable publications, and their lasting influence on design scholarship.

Who Are Charlotte and Peter Fiell?

Background and Career Overview

Charlotte and Peter Fiell are British design historians and authors celebrated for their extensive work on design history and contemporary design trends. Their collaborative efforts have resulted in numerous influential publications that are widely used by students, professionals, and enthusiasts alike.

Charlotte Fiell's academic background is rooted in art and design history, which she has combined

with her keen interest in the cultural aspects of design. Peter Fiell, on the other hand, is recognized for his expertise in design criticism and his ability to contextualize design within broader social and cultural frameworks.

Together, they have spent decades researching, writing, and curating exhibitions that highlight the evolution of design from the early modern period to the present day.

Major Contributions to Design Literature

Key Publications

The Fiells are perhaps best known for their comprehensive and visually engaging books that explore various facets of design. Some of their most influential publications include:

- **Design of the 20th Century** ? A definitive guide that chronicles the development of design over the last hundred years, covering everything from industrial design to graphic arts.
- **1000 Lights** ? An extensive survey of lighting design, showcasing innovations and iconic fixtures from around the world.
- **Furniture Design** ? An in-depth look at the evolution of furniture, highlighting key designers and movements that shaped modern interiors.
- **Design Culture: An Anthology** ? A collection of essays and case studies that examine the cultural significance of design across different eras and regions.

Their books are characterized by their rich visual content, combining high-quality photographs, detailed illustrations, and insightful analysis, making them invaluable resources for understanding the history and significance of design.

Curatorial and Exhibition Work

Beyond their publications, Charlotte and Peter Fiell have curated numerous exhibitions that have traveled worldwide. These exhibitions often serve as visual narratives that bring their written work to life, engaging audiences with immersive experiences.

Some notable exhibitions include:

- Modern Masters: Design in the 20th Century ? Showcasing key works from influential designers.
- Lighting the Future ? Exploring innovations in lighting technology and design.
- Furniture of the 21st Century ? Highlighting contemporary trends and emerging designers.

Their curatorial work emphasizes the importance of storytelling in design and underscores the social, cultural, and technological factors that influence creative practices.

Their Approach to Design History

Interdisciplinary Perspective

Charlotte and Peter Fiell advocate for an interdisciplinary approach to understanding design. They believe that design cannot be studied in isolation but must be contextualized within cultural, political, and technological frameworks.

This perspective allows their work to:

- Connect design movements with historical events.
- Analyze the societal impact of technological innovations.
- Explore the ways design reflects cultural identities.

Visual Emphasis

A hallmark of their publications is the emphasis on visual content. They understand that design is a highly visual discipline, and their books are often praised for their stunning imagery that complements scholarly analysis.

This visual focus:

- Enhances reader engagement.
- Provides a comprehensive understanding of design objects.
- Inspires designers and enthusiasts alike.

Influence and Legacy

Educational Impact

Charlotte and Peter Fiell's work has become standard reading in design education worldwide. Their books are frequently cited in university courses on design history, industrial design, and visual culture.

Their clear explanations and rich visuals make complex subject matter accessible to students and newcomers to the field.

Inspiring Contemporary Designers

Many modern designers cite the Fiells' publications as sources of inspiration. Their detailed case studies and historical insights help emerging designers appreciate the roots of their craft and the evolution of design principles.

Promoting Design Awareness

Through their exhibitions and writings, the Fiells have helped raise public awareness about the importance of design in everyday life. They emphasize that good design is not only functional but also culturally meaningful and aesthetically compelling.

Notable Awards and Recognitions

Over the years, Charlotte and Peter Fiell have received numerous accolades for their contributions to design scholarship and publishing, including:

- Design awards from major institutions.
- Recognition for their influence in curatorial practices.
- Honorary mentions for promoting design literacy worldwide.

Conclusion

Charlotte and Peter Fiell are pivotal figures in the understanding and appreciation of design. Their work bridges scholarly research and popular engagement, making complex design histories accessible and compelling. Whether through their meticulously researched books, inspiring exhibitions, or educational initiatives, they continue to shape the discourse around design's role in culture and society. For anyone interested in the evolution of design or seeking to deepen their appreciation of creative innovation, exploring the work of Charlotte and Peter Fiell offers valuable insights and inspiration.

Keywords: Charlotte and Peter Fiell, design history, design books, design exhibitions, influential designers, contemporary design, visual culture, design education, industrial design, furniture design, lighting design

Charlotte and Peter Fiell are renowned names in the world of design, architecture, and contemporary culture. Their collaborative work as authors, curators, and commentators has significantly shaped how audiences engage with design history and innovation. This dynamic duo's influence extends across numerous publications, exhibitions, and educational initiatives, making them pivotal figures for anyone interested in the evolution of design and its cultural implications. In

this guide, we'll explore their backgrounds, key contributions, notable publications, and the enduring impact they have had on the field of design.

Who Are Charlotte and Peter Fiell?

Charlotte and Peter Fiell are a married couple with a shared passion for design. Their combined expertise spans decades, during which they have authored influential books, curated exhibitions, and contributed to scholarly discussions on design's role in society. Their work often blurs the lines between academic analysis and accessible storytelling, making complex topics approachable for both specialists and general readers.

Backgrounds and Expertise

- Charlotte Fiell: Charlotte has a background rooted in design history and cultural studies. Her focus often emphasizes contemporary design movements and their socio-cultural contexts.

- Peter Fiell: With a robust background in industrial design and architecture, Peter's insights frequently delve into design innovation, craftsmanship, and technological advancements.

Together, their complementary skills allow them to craft comprehensive narratives that contextualize design within broader historical, technological, and cultural frameworks.

Major Contributions and Notable Works

Influential Publications

The Fiell couple has authored and edited numerous books that have become staples in the fields of design and architecture. Some of their most notable publications include:

- "1000 Chairs" (2002): An exhaustive survey of chair design, exploring its evolution from functional object to icon of style and artistic expression.

- "Design of the 20th Century" (1999): A comprehensive overview of the century's most influential designers, movements, and innovations.

- "The Story of Design" (2012): A richly illustrated narrative tracing the history of design from

prehistory to the digital age.

- "Fashion Design": Exploring the trajectory of fashion as an integral aspect of cultural expression and innovation.

- "The FIELL Collection": A series highlighting iconic design pieces, offering insights into their creation and significance.

Curatorial and Exhibition Work

Beyond their writing, Charlotte and Peter Fiell have curated numerous exhibitions showcasing design history and contemporary innovation. Their curatorial approach often emphasizes storytelling, contextualizing objects within cultural and societal shifts.

Educational Impact

Their work has been influential in academic settings, inspiring curricula, lectures, and seminars that introduce students and professionals alike to the richness of design history.

The Fiell Approach to Design

The Fiell duo's methodology combines rigorous research with engaging storytelling. They aim to:

- Make Design Accessible: Simplify complex concepts without sacrificing depth, making design history approachable for a broad audience.

- Highlight Cultural Contexts: Emphasize how design reflects, influences, and responds to societal changes.

- Showcase Innovation: Celebrate the creative process behind iconic objects, emphasizing craftsmanship, technology, and artistic vision.

- Foster Appreciation for Craftsmanship: Recognize the skill and artistry involved in design, encouraging respect for both historical and contemporary designers.

Key Themes in Their Work

- The Evolution of Design

Charlotte and Peter Fiell trace how design has evolved over centuries, influenced by technological advancements, cultural shifts, and economic factors. From early craftsmanship to mass production and digital design, they highlight pivotal moments and figures.

- The Intersection of Art and Function

Their work often explores how functional objects become symbols of aesthetic movement, reflecting societal values and individual identity.

- Sustainability and Future Trends

Recent writings emphasize the importance of sustainable design and innovation in addressing global challenges, positioning the Fiell couple as forward-thinking commentators.

- Design as a Cultural Phenomenon

They argue that design is not merely about objects but is deeply intertwined with cultural narratives, politics, and social change.

Influence and Legacy

Charlotte and Peter Fiell have played a crucial role in elevating the discourse around design, blending scholarly rigor with popular appeal. Their publications are widely used in academic courses, while their exhibitions and public talks inspire a broader appreciation for design's role in shaping human experience.

Key Contributions to the Field

- Bridging Academic and Popular Audiences: Their work makes scholarly insights accessible, fostering a wider appreciation.

- Documenting Design History: Their comprehensive catalogs serve as essential references.

- Encouraging Critical Engagement: They challenge audiences to consider design's impact on society and the environment.

Conclusion: The Enduring Impact of Charlotte and Peter Fiell

In sum, Charlotte and Peter Fiell have established themselves as influential voices in the study and celebration of design. Their collaborative efforts have produced a body of work that is both academically rigorous and broadly accessible, shaping how we understand the history, present, and future of design. Whether through their books, exhibitions, or lectures, they continue to inspire new generations of designers, historians, and enthusiasts to appreciate the artistry, innovation, and cultural significance of design objects and movements.

Their legacy underscores the idea that design is not just about aesthetics but a vital part of human culture—an ongoing dialogue between function, form, and society. As the world faces new challenges and opportunities, the insights and enthusiasm of Charlotte and Peter Fiell remain vital sources of inspiration and knowledge in the ever-evolving landscape of design.

Question Who are Charlotte and Peter Fiell in the design world? Charlotte and Peter Fiell are renowned design historians, authors, and curators known for their influential books and contributions to design education and appreciation. What are some notable works by Charlotte and Peter Fiell? Their notable works include 'Design of the 20th Century', 'Furniture Design', and 'The Story of Graphic Design', which are widely regarded as essential references in the field. How have Charlotte and Peter Fiell influenced design history? Through their comprehensive publications and exhibitions, they have significantly shaped the understanding and appreciation of modern and contemporary design worldwide. Are Charlotte and Peter Fiell involved in any design exhibitions? Yes, they have curated numerous exhibitions on design topics, showcasing their expertise and promoting design awareness in museums and galleries globally. What is the focus of Charlotte and Peter Fiell's writing? Their writing primarily focuses on the history, evolution, and cultural impact of design, covering areas like furniture, graphic design, and industrial design. Have Charlotte and Peter Fiell received any awards for their work? Yes, they have received several awards and honors recognizing their contributions to design scholarship and publishing. Are Charlotte and Peter Fiell involved in teaching or academic work? While primarily known as authors and curators, they have also contributed to academic programs and lectures related to design history. Where can I find the works of Charlotte and Peter Fiell? Their books are available in major bookstores, online retailers, and libraries, and their exhibitions have been held at prominent museums worldwide. What impact have Charlotte and Peter Fiell had on design education? They have influenced design education by providing comprehensive resources and inspiring new generations of designers and historians. Are Charlotte and Peter Fiell still active in the design community? As of the latest information, they

continue to contribute through writing, curating, and participating in design discussions and events.

Related keywords: design, architecture, interior design, furniture, lighting, visual inspiration, design authors, modern design, Scandinavian design, design books

Read the full article online: [charlotte and peter fiell](#)