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## A GUIDE TO THE CHARLES A. ELLIS PAPERS

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## **Descriptive Summary**

<b>Creator:</b>	Ellis, Charles Alton, 1876-1949
<b>Title:</b>	The Charles A. Ellis Papers
<b>Dates:</b>	1911-1946 [bulk 1928-1938]
<b>Abstract:</b>	Correspondence, writings, printed material, photographs, organization chart, financial estimates, and biographical information relating to the professional career of structural engineer Charles A. Ellis. The primary focus of the papers is on Ellis' design of the Golden Gate Bridge.
<b>Quantity:</b>	0.4 cubic ft.
<b>Repository:</b>	Archives and Special Collections, Purdue University Libraries
<b>Acquisition:</b>	Gift of Dr. Lewis B. McCammon, 1997
<b>Preferred Citation:</b>	The Charles A. Ellis Papers, Archives and Special Collections, Purdue University Libraries
<b>Processed by:</b>	Sammie Morris, July 2004
<b>Location:</b>	Aisle 10

## **Restrictions**

**Access:** Collection is open for research.

## **Related Materials**

A supplementary collection of items relating to Charles Ellis and the Golden Gate Bridge is also available, including photocopies of Ellis' architectural drawings for the design of the Golden Gate Bridge.

## Biographical Sketch

Educator, structural engineer, and mathematician Charles Alton Ellis (1876-1949) was born in 1876 in Parkman, Maine. Ellis was an expert in bridge design, co-designing the Montreal Harbor Bridge and designing the structure of the Golden Gate Bridge almost single-handedly. Ellis took four years of mathematics and higher mechanics at Wesleyan University, where he received his A.B. degree in 1900. Upon graduation from Wesleyan, he worked at various engineering jobs, joining the staff of the American Bridge Company in 1902. It was in this position that Ellis received recognition for his calculus expertise when he calculated the stresses of the subway tubes under the Hudson River. He remained with the American Bridge Company until 1908, when he joined the faculty of the University of Michigan. Ellis remained as Assistant Professor of Civil Engineering at Michigan until 1912. He spent the following two years as a designing engineer for the Dominion Bridge Company. In 1914, he joined the faculty of the University of Illinois as Assistant Professor of Civil Engineering, and was promoted to Professor of Structural and Bridge Engineering the following year. He continued in this position until 1921, when he accepted a position as Vice President in charge of bridge design and construction supervision for the Strauss Engineering Corporation of Chicago.

In 1922, Ellis received his C.E. degree from the University of Illinois. That same year, Joseph Strauss hired him to create a design for the Golden Gate Bridge. Ellis' job was to draw up new plans for Strauss and his team, as Strauss' own design had been rejected. In 1929, Strauss was officially selected as the bridge's chief engineer, with Leon S. Moisseiff, O.H. Amman, and Charles Derleth, Jr. as consulting engineers. Leon Moisseiff had developed a new theory of suspension bridge design, but it was Ellis' job to apply Moisseiff's theory in practice. In March 1930, under Strauss' authority, Charles Ellis began the preliminary design and estimate for the bridge, completing the overall design in four months. In June, Ellis' design was reviewed by the three consulting engineers. The Bridge District Board of Directors reviewed and enthusiastically accepted his design in August. Strauss, meanwhile, had turned in his Engineer's Report to the directors, and the report was not received favorably. Strauss believed that Ellis was responsible for the dissatisfaction on the part of the directors when Ellis refused to comment on the report to the directors.

In September, Ellis gave the keynote address at the first West Coast meeting of the National Academy of Sciences in Berkeley, California. His speech was about the theory behind the design of the Golden Gate Bridge. In November, Ellis began computing thousands of calculations for the bridge, including suspension ropes, floor beams, and cables. Ellis wrote the specifications for all ten bridge construction contracts, which included everything from cable wire to concrete for the anchorages. He supervised the test boring and siting, which involved the complicated process of locating firm footing on the Marin shore. Working twelve to fourteen hours per day, Ellis personally made all the computations and the entire design for the bridge. In October 1931, Strauss began pressuring Ellis to finish his work. Ellis felt that he needed to take the time needed to ensure his calculations were correct for the safe design of the bridge. In November,

voters approved a bond issue providing funding for the Golden Gate Bridge. The following month, Strauss ordered Ellis to go on vacation. Three days before his vacation ended, in December 1931, Strauss instructed Ellis that he would no longer be needed for the project. Strauss stated in his letter that the design for the bridge was “nothing unusual and did not require all the time, study, and expense which [Ellis] thought necessary for it.” Ellis was replaced by Clifford Paine, a former student of his who had no knowledge of suspension bridges, and all mention of Ellis was removed from the bridge materials. Construction began on the bridge in early 1933, and it formally opened in 1937. Heralded as a beautiful monument, in addition to serving as the West Coast entrance to America, the bridge opened with great fanfare. On the South Tower, a plaque honoring Strauss, his assistants, consultants, district directors, and others was unveiled. Although the bridge design was almost single-handedly his own, Ellis was never properly credited for his contributions to the project, and the plaque bore no mention of his name.

After Ellis ceased work on the Golden Gate Bridge project in 1931, he took up private practice as a consulting engineer in Chicago, serving as an advisor to the PWA on suspension and cantilever bridge applications for loans and grants. In September 1934, he joined the faculty of Purdue University as Professor of Structural Engineering. He remained at Purdue until his retirement in 1946. Ellis was the author of the standard textbook on framed structures, in addition to writing numerous articles on bridge design and related subjects. He was a member of the American Society of Civil Engineers, the American Concrete Institute, and the American Railway Engineering Association. In addition to his professional memberships, he was a member of the Sigma Xi, Tau Beta Pi, Chi Epsilon, and Delta Kappa Epsilon fraternal organizations. He died on August 22, 1949, in an Evanston, Illinois hospital, just twelve years following the completion of the Golden Gate Bridge. In 1994, the American Society of Civil Engineers named the Golden Gate Bridge one of the “Seven Wonders of the Modern World.”

## **Scope and Content Note**

The Charles A. Ellis Papers (1911-1946; 0.4 cubic ft.) document the professional career of structural engineer Charles A. Ellis. Types of materials in the collection include correspondence, writings, printed material, photographs, organization chart, financial estimates, and information on professional achievements. Although some biographical information and a small number of personal photographs are included in the collection, the papers primarily document Ellis' involvement with the design of the Golden Gate Bridge in San Francisco.

The Papers are divided into three series:

### **1. Golden Gate Bridge, 1929-1938**

The series documents the design and initial construction of the Golden Gate Bridge. Includes correspondence, financial estimates, letterhead, organization chart, newspaper clippings, and an article written by Ellis on the method he devised for his calculations.

### **2. Professional Career, 1919-1945**

The series documents certain aspects of the professional career of Charles Ellis. Includes a summary of Ellis' professional experience, correspondence, transcripts for speeches made by Ellis, printed material, and a newspaper clipping of Ellis endorsing a Howard radio. Notably missing are Ellis' faculty papers from his tenure at the University of Michigan, University of Illinois, and Purdue University.

### **3. Photographs, 1911-1946**

The series includes six photographs of work on the Golden Gate Bridge, Charles Ellis with friends in Rocky Hill, Connecticut, and Ellis's retirement dinner at Purdue University.

Within each series, items are arranged chronologically by type of material. All materials have been housed in polyester sleeves, acid-free folders, and acid-free boxes. All newsprint has been photocopied and in most cases original newspaper clippings have been discarded. Some newspaper clippings containing images of people, or front pages of newspapers, have been preserved for display purposes, with photocopies made available for researchers.

# INVENTORY

## **SERIES ONE: GOLDEN GATE BRIDGE, 1929-1938**

### **Golden Gate Bridge Project Files, 1930-1938; n.d.**

Set of Correspondence Regarding Ellis' Work and Progress on the Golden Gate Bridge,  
March 1930-June 1938; n.d.

Ammann, O. H.  
Cameron, George T.  
Cone, Russell G.  
Derleth, Charles, Jr.  
Harlan, George H.  
Keesling, Francis V.  
Moisseiff, Leon S.  
Paine, Clifford E.  
Reed, James  
Strauss, Joseph B.

Summary of Estimates by Contracts for the Golden Gate Bridge, June 12, 1931 [includes  
annotations, presumably by Ellis]

Letterhead, Golden Gate Bridge and Highway District, ca. 1930s [lists Charles Ellis as  
Designing Engineer]

Organization Chart for the Golden Gate Bridge Project, 1930 [**Oversized Box**]

### **Newspaper Clippings on the Golden Gate Bridge, 1929-1930; ca. 1930s**

Front page of *The San Francisco Call and Post*, Wednesday, August 28, 1929

“Young, Aides Map Policies—San Francisco to Marin Bridge Project”

“Engineers Scan Data for Span” [includes images of Golden Gate Bridge sketch  
and people involved in the design and planning of the bridge]

*The San Francisco Examiner*, September 11, 1929

“Gate Bridge Survey Starts” [includes image of Ellis and Captain F. A. Savage,  
with sketch of Golden Gate Bridge]

Unidentified San Francisco newspaper, ca. early 1930s

“Borings Will Begin Soon for Bridge: Golden Gate Pier Base Soundings Found to  
Be Satisfactory”

Unidentified San Francisco newspaper, ca. early 1930s

“Golden Gate Bridge Plans Bring Span Experts Here,” by Sam Ewing

*The San Francisco News*, Thursday, February 13, 1930

“Work on Gate Span to Begin Late in 1930” [includes images of experts working  
on the bridge design and planning]

Unidentified newspaper section promoting bond issue for bridge funding, ca. early 1930s  
Special Newspaper Section [includes numerous images]

“Bridging Famed Golden Gate: An Economic Necessity” [**Oversized  
Box**]

**Writings by Charles Ellis, 1934-1935**

Reprint of article by Charles Ellis, "Williot Equations for Statically Indeterminate Structures," American Society of Civil Engineers, Paper No. 1904, reprinted from *Transactions*, vol. 100, 1935, p. 580

Correspondence regarding Ellis' article on Williot Equations and Charles Clarahen's accusation that Ellis was taking credit for work he did designing the towers for the Golden Gate Bridge

Charles Clarahen, Jr. to "Wyly," January 21, [1934]

Henry B. Ward, Secretary of the American Association for the Advancement of Science, February 24, 1934

Sydney Wilmot, Manager of Publications, American Society of Civil Engineers, correspondence with Charles Ellis and Charles Clarahen, Jr., April-June 1934

Leon S. Moisseiff, June 5, 1934

Leon S. Moisseiff, February 7, 1935



## **SERIES TWO: PROFESSIONAL CAREER, 1919-1945**

### **Biographical Information, ca. 1940s**

Summary of professional experience of Charles Ellis, 1900-1944, n.d.

### **Correspondence, Miscellaneous, 1919-1945**

#### Incoming Correspondence, 1919-1945

Chartz [?], A. W., Office of the Dean, University of Illinois, College of Education, Urbana, August 11, 1919

Regarding Ellis' article on teaching of reinforced concrete theory

Elliott, Edward C., President of Purdue University, November 30, 1934

Regarding Ellis' remarks at the dinner of the Central Association of Science and Mathematics Teachers in Indianapolis

Includes transcript of Ellis' remarks on "Mathematics and Engineering Education"

Flerieineg [?], R., American Bridge Company, July 9, 1928

Regarding Ellis' paper on structural problems facing engineers

Hockema, F.C., Assistant to the President of Purdue University, April 12, 1937

Comments on seeing the Golden Gate Bridge and Ellis' part in its design

Hogan, John P., President of the American Society of Civil Engineers, October 16, 1940

Commending Purdue's Student Chapter of the ASCE for its activities

Jones, Jonathan, Chief Engineer of Bethlehem Steel Company, to Sydney Wilmot, ASCE Publications Committee, July 16, 1945

Regarding paper by J.A. Van den Brook on economical design of steel structures through consideration of plasticity

Koenemann, Edw. D., Auditor of Vanderburgh County, Evansville, Indiana, April 12, 1937

Appreciation letter for Ellis' consulting engineer services on two bridges

Reply to Koenemann's letter by Andrey A. Potter, Purdue

University

Letter from Edward C. Elliott to Potter regarding Koenemann's letter

Orr, Nolan B., Engineering Supervisor in charge of structural steel design, State Highway Commission of Indiana, February 21, 1935

Regarding Ellis' lecture on suspension bridges

Richards, C. R., Dean and Director, College of Engineering and Engineering Experiment Station, University of Illinois Urbana-Champaign, June 4, 1921

Regarding Ellis' resignation as Professor of Structural Engineering

Sherwin, Stuart P., University of Illinois, January 19, 1920

Regarding treatise by Ellis on mathematics

Smythe, J. V., Engineer of Bridges, State Highway Commission of Indiana, to A. W. Rohlwing of the Portland Cement Association, June 5, 1937

Thanking them for sponsoring Ellis' lecture series

Ellis' reply to Smythe thanking him for his letter  
Sparks, John, Strauss Engineering Corporation, August 31, 1929  
Regarding article by Clifford E. Paine on the Hackensack River Bridge  
Article, "Analysis of Dynamic Stresses in Hackensack Bascule" by  
C.E. Paine, *Engineering News-Record*, August 29, 1929  
Reply to Article by the Board of Consulting Engineers and  
Editorial by the *Engineering News-Record*  
"Investigating Board's Discussion of Counterweight Tower  
Action" (collapse of Hackensack River bridge)  
"Dynamic Analysis" (analysis of the counterweight system  
of the bridge)

**Speeches, n.d.**

Speech on suspension bridges by Charles Ellis for the AIEE, n.d.

Speech on diplomatic engineers by Charles Ellis, n.d.

**Newspaper Clippings, ca. 1930s**

Advertisement of Charles Ellis endorsing the Howard precision screen grid radio,  
newspaper source unknown, ca. 1930s [includes image of Charles Ellis]

## **SERIES THREE: PHOTOGRAPHIC MATERIALS, 1911-1946**

### **Photographs, 1911-1946**

Golden Gate Bridge Photographs, ca. 1930s

Construction on the Golden Gate Bridge, ca. early 1930s

Boat with crane, workers, and cables

Personal Photographs, 1911; 1946

Miss Ney's [?] House, Rocky Hill, Connecticut: Charles Ellis, Miss Ney [?],  
Palmer Rizy, and Dog Jack, ca. 1911

Rocky Hill, Connecticut: Charles Ellis, Kummel [?], Miss Ney, Rizy and Palmer,  
1911

Charles Ellis Retirement Dinner, Purdue Memorial Union, June 1946

Charles Ellis and Marion Todd at Retirement Dinner

Group Photograph of Retirement Dinner Attendants

## **APPENDICES:**

### **A Select List of Publications by Charles Ellis**

#### **Books:**

*Essentials in the Theory of Framed Structures*. NY: McGraw-Hill Book Company, 1922.

Associate Editor for the six volume set: *Structural Engineers—Handbook Library*, authored by Hool and Kinne, McGraw-Hill.

#### **Articles:**

“Graphical Calculus,” *Journal of Western Society of Engineers*, April 1917.

“Reinforced Concrete Theory Without the Use of Formulas,” *Bulletin of the Society for the Promotion of Engineering Education*, vol. VIII, Nos. 8-9, 1918.

“Analysis of the Continuous Three Column Foundation,” *Engineering News-Record*, October 7, 1920.

“A Short Method for Swing Bridge Calculation,” *Engineering News-Record*, June 9, 1921.

“Suspension Bridges Under the Action of Lateral Forces,” *Transactions, American Society of Civil Engineers*, 1933.

“Simplified Analysis of Indeterminate Frames,” *Engineering News-Record*, 1934.

“Williot Equations for Statically Indeterminate Structures,” *Transactions, American Society of Civil Engineers*, 1935.

“Two-Hinged Rectangular Arch with Variable Moment of Inertia,” *Engineering Bulletin* #79, Purdue Engineering Experiment Station, Vol. XXV, No. 1a, February 1941.

“Designing Reinforced-Concrete Beams with Variable Moments of Inertia,” *Engineering News-Record*, November 6, 1941.

“Analysis of Statically Indeterminate Trussed Structures,” *Transactions, American Society of Civil Engineers*, 1942.

“Characteristic Redundants Used in Analyzing Statically Indeterminate Structures,” *Proceedings, American Society of Civil Engineers*, September 1944.

## **APPENDICES:**

### **Other Repositories with Collections Relating to the Golden Gate Bridge:**

California State Archives

[http://www.ss.ca.gov/archives/archives\\_about.htm](http://www.ss.ca.gov/archives/archives_about.htm)

California State Library, California History Section

[http://www.library.ca.gov/html/CalHist/cal\\_index.cfm](http://www.library.ca.gov/html/CalHist/cal_index.cfm)

Stanford University Libraries, Department of Special Collections

<http://www-sul.stanford.edu/depts/spc/spc.html>

University of California, Berkeley (The Bancroft Library and the Environmental Design Archives) <http://www.lib.berkeley.edu/>

University of Pennsylvania, The Architectural Archives

<http://www.design.upenn.edu/archives/archives/index2.htm>

The Joint Archives of Holland Historical Resource Center, Michigan (Clifford E. Paine Papers) <http://www.hope.edu/resources/arc/>

The University of Illinois also has copies of the engineering drawings and engineering report.

The Library of Congress has photographs of the bridge design. The final engineering drawings, dated August 1930, are signed by Charles A. Ellis. On the drawings, Ellis is listed as Vice-President of Strauss Engineering Corporation.

The archives of Amman & Whitney (papers of O.H. Amman on the Golden Gate Bridge; includes 28-volume set of engineers' reports, correspondence, memos, etc.)

## **APPENDICES:**

### **Additional individuals involved in the creation of the Golden Gate Bridge:**

Joseph B. Strauss (Head of the project/chief engineer)  
Michael M. O'Shaughnessy  
Leon S. Moisseiff (created theory for the suspension bridge design)  
O. H. Amman  
Charles Derleth, Jr.  
Irving Morrow (architect)  
Clifford Paine  
Russell B. Cone

### **Select bibliography on the Charles Ellis and the Golden Gate Bridge:**

*Credit Where Credit Was Due: Charles Ellis, a Purdue Civil Engineering Professor from 1934-1946, is Finally Recognized as the True Designer of the Golden Gate Bridge* by William Meiners. *Purdue Engineering Extrapolations*, Purdue University Schools of Engineering, Summer 2001, p. 6-11.

*The Gate: The True Story of the Design and Construction of the Golden Gate Bridge* by John Van Der Zee. Backinprint.com, 2000.

*Engineers of Dreams: Great Bridge Builders and the Spanning of America* by Henry Petroski. Vintage Books USA, 1996.

"The Case of the Missing Engineer," John van der Zee and Russ Cone, *San Francisco Examiner Image*, May 31, 1992. Reprinted by the Society of Civil Engineers.

*Building Big: Bridges* [video]. PBS. Order via WGBH Boston Video.

"Memoir Abstracts," [obituary of Charles Ellis], *Transactions of the American Society of Civil Engineers*, 1970, pp.1155-1156.

PBS Chronological Timeline on the Building of the Golden Gate Bridge:  
<http://www.pbs.org/wgbh/amex/goldengate/timeline/index.html>

Golden Gate Bridge Website:  
<http://www.goldengatebridge.com>