
**Fritz Leonhardt’s Contribution to the Construction of New Main Station of Munich (1939-1942)**

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**ABSTRACT:** Fritz Leonhardt (1909–1999) is one of the best known constructing engineers of the 20th century. He was not only an outstanding representative of his profession, but his vita is as well interesting as his role in the Weimar Republic, under the Nazi dictatorship, and as an influential figure of the Federal Republic of Germany. In this paper, Leonhardt’s role in the national socialist system with its major building projects is investigated and put into its historical context. Fritz Leonhardt’s contributions to the replanning of the city of Munich by Hermann Giesler from 1939 to 1943 will be explained in their technical aspects of the light weight structure. From a historical point of view, the personal networks created by Leonhardt during this time are of special interest: his contacts to architects like Paul Bonatz, Gerd Lohmer, and engineers like Otto Graf in Stuttgart were formative for his rapid advancement in post-war Germany.

**EXPERIENCE**

Immediately after young Fritz Leonhardt graduated as a civil engineer at the TH Stuttgart, he faced one of the major problems threatening his profession: its cardinal interdependence with the economic situation. This was in 1931. The Weimar Republic’s turbulences resulting from the worldwide economic crisis impeded Leonhardt from finding an appropriate employment. He was lucky, though, entering a students’ exchange programme at Purdue-University in West Lafayette, Indiana, in 1932-33 supported by a scholarship from the TH Stuttgart.

A natural self-confidence made Leonhardt approach the leading American engineer Othmar H. Ammann in New York to obtain the permission to visit the George-Washington Bridge under construction. Suspension bridges, like this one, fascinated the young engineer. At that time Fritz Leonhardt stayed in Bethlehem, Pennsylvania, with his uncle Otto Nissler, himself civil engineer, before he was officially enrolled at Purdue University with a modest scholarship from the Institut of International Education. There, he built up a close contact with Prof. Solomon C. Hollister, who, even during the war, offered him an academic exchange and information on the latest technical developments in North America. Still after the end of this term he took advantage of travelling. On his round trip through the USA and Mexico, he visited research facilities and construction sites such as the Golden Gate Bridge or the Hoover Dam. The letters to his parents show how deeply Fritz Leonhardt was impressed by the openness and warmly friendliness of the American engineers (saai KA a). Yet, at the same time, he depicted the social injustices in those years of economic depression. He also showed interest in the changes which Germany was undergoing after the accession to the power of the NSDAP. He had to answer the questions of his American fellow students and in doing so he voiced scepticism towards the anti-semitic position of Germany’s new regime.

**BEGINNINGS AT THE REICHSAUTOBAHN**

His critical attitude, however, changed very quickly after his return to Germany in October 1933. Fritz Leonhardt found his first fixed employment within the Oberste Bauleitung der Reichsautobahnen (OBR) (chief construction management of the Reichsautobahn), in Stuttgart, and a first furtherer in Karl Schaechterle, a renowned bridge builder of the Deutsche Reichsbahn (German Railways), which served as a model for the Reichsautobahn organization (Windisch-Hojnacki 1989, p. 53).
Leonhardt was thrilled by the professional opportunities, which suddenly appeared to him as a young engineer. His employer, Fritz Todt, Generalinspektor für das deutsche Straßenwesen (general manager of German highways), himself engineer aimed at sustaining the reputation of the engineering profession. The Reichsautobahn allowed engineers for the first time to reach high positions in the civil service, which beforehand were reserved for holders of a university degree. In Leonhardt’s and many of his colleagues’ eyes, the National-Socialist government did appear to save them not only from unemployment – at the end of the Weimar Republic more than 6 million people were unemployed, among them a disproportionate number of engineers. It even seemed as if it broke down socio-political barriers and technical professions gained increasing reputation through National-Socialistic policy (Ludwig 1974, p. 69).

Overwhelmed by the new perspectives and deprived of the outsider’s look, Leonhardt quickly became attracted by the National-Socialist propaganda. We observe this interest in several letters, which he sent to the USA, especially in a circular from November 1933 in which he enthusiastically praises the socio-political success and the results on the job market (saai KA b). He decisively rejected any criticism on Hitler’s foreign policy and he replied to the reproach of anti-Semitism with official phrases from the Nazi propaganda. While, at that time, he did not become a member of the NSDAP, he joined the Stuttgart Horse Riding Club of the SA, in order to live up to the expectation of his authorities.

One of Leonhardt’s early works as engineer with the OBR Stuttgart is particularly remarkable: a fly-over across the A 8 (Autobahn Stuttgart – Ulm) near Jungingen. Leonhardt designed a light steel structure. On top of three slender and rigid steel frames, lies a light steel deck of 40 cm depth. The road deck consists of longitudinal L-sections (300 mm x 7 mm) of 40 cm, stiffened by closely spaced transverse sections, creating a supporting grid. The deck receives 6 to 7 cm asphalt paving. Because of the slimness of this construction, it was called “Zündhölzlesbrücke (matchstick bridge)” (Leonhardt 1984, p. 55) (fig. 1).

At this time, Leonhardt dealt intensively with weight reduction of road decks for steel bridges, a question which bothered bridge builders just as well outside Germany. In letters, he discussed developments in the USA with his uncle Otto Nissler (saai KA c). In his doctoral thesis entitled “Simplified calculation of side-supported beam grids”, submitted to Emil Mörsch in Stuttgart in 1937, Leonhardt developed a method for dimensioning such road decks with the aid of model statics. From this ensued later cellular steel flooring and lightweight decks, which were published several times, e. g. in 1940 in his article “Lightweight Construction – a Requirement of our Times” (Leonhardt 1940).

In 1935 Fritz Todt called Schaechterle to the Reichsverkehrsministerium (RVM) (Ministry for Traffic) in Berlin, where he would lead, together with Gottwald Schaper, the bridge department. Schaechterle took Leonhardt along and assigned to him the coordination of engineering works – in particular bridge design – with the artistic advisors Paul Bonatz and Alwin Seifert. Since Adolf Hitler had expressed his dissatisfaction with the first Autobahn bridges, Fritz Todt declared engineering construction to be a cultural task equal to architecture. Todt
brought the two architects as artistic consultants to the ministry, to enable appropriate designs. Furthermore, in 1936, he established regular courses for civil engineers at the Reichsschule der Deutschen Technik Plassenburg (German Technical College Plassenburg) near Kulmbach, to – as it was officially stated – inspire all engineers in his ministry with the cultural dimension of their work. From 28 November till 6 December 1937 Fritz Leonhardt was delegated to the tenth Reichsschulungskurs for highway engineers at the Plassenburg (BA Berlin a). He visited lectures by the architect Friedrich Tamms, the landscape architect Alwin Seifert, and joined plant life excursions with Baron von Krueederer. But the program also included themes like „Geschichte der Ostpolitik“ (Eastern policy history), to focus the engineers upon the aims of the regime they were serving (BA Berlin b).

Leonhardt’s intensive involvement with questions concerning the aesthetic treatment of civil engineering works is documented by the book “Design of Bridges”, published in 1937 together with Karl Schaechterle (Schaechterle; Leonhardt 1937). Leonhardt’s handwritten note in the cover of his own copy tells us „I wrote it in 1936 practically myself“. Therein design principles of bridge construction are developed methodically, with the introduction of prototypes for Autobahn bridges – from the smallest fly-over to monumental valley crossings. Large bridges in steel are shown as well as standard bridges with slender reinforced concrete girders between simple, stone-faced abutments (Schaechterle; Leonhardt 1937, p. 79, p. 108). This publication also shows the closeness of the two engineers, Schaechterle and Leonhardt, to the Stuttgarter Schule (School of Stuttgart), represented by Paul Bonatz. The clear simplicity, even frugality of construction, combined with precise detailing followed conservative modern tradition. Typecasting and standardization of buildings, however, were developed in the 1920’s and 1930’s.

As a whole, the book bears witness to the close cooperation of Karl Schaechterle and Fritz Leonhardt. Nevertheless, the young engineer sought independent tasks and negotiated his transfer to the private enterprise MAN Werke Gustavsburg (saai KA d). In order to retain him, the Reichsautobahn offered him a special project in 1938, which he had been interested in for some time. In January 1938 Fritz Todt entrusted Fritz Leonhardt – only 29 years old and not a civil servant – with the construction management of the Rhine bridge Cologne-Rodenkirchen, the first suspension bridge of the Reichsautobahn system (Leonhardt 1939). Steelworks were in the hands of the Dortmund company August Klönne. Paul Bonatz worked as the artistic adviser, in whose office the young architect Gerd Lohmer designed the plans for the stone-faced abutments. After the outbreak of war, the construction of the Cologne-Rodenkirchen bridge continued, because this project, as a matter of prestige, was not affected by the general building freeze. Fritz Leonhardt was called to the army but was sent back to the site only two days later. On 20 September 1941 the Cologne-Rodenkirchen Bridge was inaugurated in the presence of Fritz Todt (fig. 2).

Figure 2: Fritz Leonhardt 1938–41, Rhein bridge Rodenkirchen; (saai Karlsruhe)

PLANNING FOR MUNICH

At that time Fritz Leonhardt did not stay longer in Cologne; he was called to Munich before the completion of the Rodenkirchen bridge.

Constellation of the Personal

In May 1939, August Klönne’s firm with Paul Bonatz as the consulting architect – Leonhardt worked with both in Rodenkirchen – won the competition of the domed hall of the Munich Central Station announced for steelwork companies only (StA MÜ a). This was the biggest single project of the city planning measures by Hermann Giesler for Munich. Hitler had appointed Giesler on 21 December 1938 as Generalbaurat für die Hauptstadt der Bewegung (General Director of Buildings for the Capital of the Movement) (Früchtel 2008, p. 145). After
winning the competition, Paul Bonatz was nominated head of the Planungsbüro für den Neuen Hauptbahnhof (Planning Bureau New Central Station) and the companies August Klönne and Krupp established the Stahlbau-Gemeinschaft Klönne-Krupp, München. At the end of September, Giesler himself turned to Fritz Todt with the request, “for the planning of the steel cupola […] to have Professor Bonatz assisted by Regierungsbaumeister Dr. Ing. Fritz Leonhardt as consulting engineer.” (BA Berlin c) Todt agreed remarking that “Herr Leonhardt is one of the best bridge designers and likely the best structural engineer among the staff of the Obersten Bauleitungen.” Leonhardt should help with the design, “besides his official function” of construction supervision of the suspension bridge Rodenkirchen. Todt also counseled to give Leonhardt “sufficient staff, to reduce his work to supervision”. (BA Berlin d) To cope with his many duties, Leonhardt established his first consulting office Ingenieurbüro Dr. Ing. Fritz Leonhardt in the Galeriestraße in Munich at the end of 1939. It was associated with the Planungsbüro für den Neuen Hauptbahnhof under Generalbaurat Hermann Giesler (Rasp 1981, S. 111).

Terms of Reference and Previous Plans

A sketch by Hitler dated 22 March 1939, served as the basis for the competition for the Munich Central Station: a flat dome rests on a ring of supporting buildings; a columnar portico emphasizes the projecting entrance. A circular ribbon window and a lantern illuminate the giant cupola (HStA MÜ a). Hitler very specifically wanted a distinction between the Munich Central Station as a “monument of our century’s technology”, in contrast to the Halle des Volkes (People’s Hall) in Berlin, designed by Albert Speer as a massive dome (saai KA e, p. 2). This position of Hitler made a steel construction possible and led to the association of engineer Fritz Leonhardt. The Sonderbaubehörde zum Ausbau der Hauptstadt der Bewegung (The Special Office for the Development of Munich as “Capital of the Movement”) under Giesler’s predecessor Hermann Alker had introduced the cupola theme in 1937.

As a consequence to Hitler’s criticism (saai KA f, p. 10), Giesler – after his appointment – changed the infrastructure of the central station. In Giesler’s plans, the station at the end of a monumental avenue is no longer bypassed on one side. By lowering the tracks, he can pass the streets around the station as an express way exchange. The dome – as designed by the Sonderbaubehörde – is no longer only an entrance hall, but now includes the tracks and platforms in reaching a gigantic size (Landeshauptstadt München 2004, p. 97–98). It constitutes the urban focus at the end of the avenue, between the Denkmal der Partei (Monument of the Party) and the New Central Station, thereby being, similar to Albert Speer’s Halle des Volkes in Berlin. It appeared as a significant element in the remodeling of Munich as “Capital of the Movement” (fig. 3).

Figure 3: Planungsbüro für den Neuen Hauptbahnhof 1942, New Central Station Munich; (Giesler 1977, p.160)

The New Central Station

The winning competition entry by Klönne-Bonatz envisaged a twelve-part ribbed dome over the tracks and platforms. The new entrance hall surrounds the circular plan of the dome and opens via a high, open arcade to the street. To accentuate the direction of the grand axis, Bonatz pulls the porch forward, the canopy resting on slim supports. A continuous ribbon window and a slightly conical lantern illuminate the domed hall over the tracks. The competition design captivates by its reduced architectonic language and anticipates post-war architecture with the its delicate glazing profiles of the clerestory windows. The giant dome, sketched by Hitler, receives a folded sheet metal roof in the design by Bonatz of June 1939. In November 1939 – meanwhile Leonhardt participated in the planning – we can clearly see the bearing rib-structure in a perspective rendering, dated Bonatz 9 Nov 39 (StA MÜ b) (fig. 4).
This drawing expresses the true-size relationships and the domination of the building also shown by monumental city planning models. Two of such models are still kept in the Munich Stadtmuseum (StM MÜ a).

Since the construction of the steel dome was to demonstrate the know-how of German engineering, Fritz Leonhardt can dictate the technical materials: “Aluminum for profiled dome roofing, aluminum for windows and other elements, glass and glass mosaic for translucent and wall surfaces.” (Giesler 1977, p. 174) Leonhardt planned to span the 265 meters with a ribbed dome in steel. Between the ribs of box profiles (2500 mm × 2000 mm) is a double roof, outside of folded, inside of corrugated aluminum sheets, reinforced by six horizontal ring beams and lattice rafters (600 mm × 4900 mm) (fig. 5).

The use of aluminum was to minimize the deadweight to be carried by the steel structure (StA MÜ c). The structural calculations of the system, consisting of 384 equations and 384 unknowns, were a challenge to engineers and mathematicians, and meant work for months; they were examined with the help of structural models (Andrä 1999, p. 494). For this, Leonhardt commissioned a 1 : 50 model “with riveted hollow sections of thin sheet metal to scale” for the Stuttgart Materialprüfungsanstalt (Materials Testing Institute) under Otto Graf (Leonhardt 1984, p. 91). Nothing of it remained. The structural calculations made by Leonhardt and his assistants in 1942 are all preserved and prove that, in the middle of the war, detail planning proceeded at full speed and technical questions, such as compensation for thermal influences, were studied (LAP a).

Context

In retrospect Leonhardt said that he and his team “conducted megalomaniac planning, at least surmising, that it would not be put into practice” (Leonhardt 1984, p. 92). Nevertheless, he was intrigued by the construction of a steel cupola with a 265 m diameter (Früchtel 2008, p. 185). At the same time Albert Speer was planning his Halle des Volkes, competing with a span of 250 m. In his recollections which we have to consider critically Giesler mentioned an anecdote that Speer had asked him to stay below the span of Berlin; his dome should be the biggest of all the cities, chosen for reshaping by the National Socialists (Giesler 1977, p. 176). The size of the Munich dome needed not shun competition of historic examples, as a comparative drawing of the largest buildings of the world show, e. g. the Cheops Pyramid, the Eiffel Tower in Paris or St. Peter’s dome in Rome. With 42 m span the latter only reached a fifth of the Munich station diameter (fig. 6).

Speer’s dome, planned to be built in massive construction, also exceeded with its 250 m all previous dimensions. The Jahrhunderthalle (Century Hall) in Breslau (1913) had a 65 m diameter dome of radial, reinforced concrete beams. In the 1920’s the largest domical constructions were shells, such as the Großmarkthalle (main market hall) in Leipzig, built by the firm of Dyckerhoff & Widmann as an ellipsoidal eight-sided open shell of 74 m span (Schönemann 1987, p. 8). The jump in scale to the domes spanning 250 and 265 m for Berlin and Munich reveals the delusion of grandeur by National Socialist representative architecture. Interestingly, Speer’s engineers in Berlin could not fulfill the expectations of massive solidity and finally provided a steel cupola from which a massive shell should be suspended (Kunze 2001, S. 63). Due to the war both cupola projects were abandoned. Only 20 years later, 200 m spans were realized (Heinle; Schlaich 1996, p. 158).

Further Projects
In the course of Munich’s large scale planning from 1939 to 1943, Leonhardt’s newly founded office attracted numerous other projects, apart from the challenging dome construction. Leonhardt’s range of duties included structural design for the Denkmal der Partei (Monument of the Party), as well as numerous structural studies in traffic engineering, e. g. the development of prefab concrete tracks for the newly planned subway in Munich [LAP b–d].

Railroad planning by the Reichsverkehrsministerium envisaged the upgrading of the Eastern Station. Differing from the huge domed hall of the New Central Station, the Eastern Station has a rectangular hall alongside the tracks. Platforms and tracks get light from clerestory ribbons of parallel roofs with steel box-girders, supported by columns on the service platforms. For this purpose Leonhardt’s office prepared designs of platform roofing in the years 1940 and 1941, detailed down to 1 : 20 scale (saai KA g). This design surprises by the simplicity of steel Tees for cantilever supports with glazed clerestories. Leonhardt himself noted, that the later reconstruction of the Stuttgart platform roofing recalled this design (Leonhardt 1984, p. 91).

In the fall of 1940, after Hermann Giesler was commissioned by Hitler with the replanning of the city of Linz – in addition to Munich – Leonhardt got new tasks in this town (Früchtel 2008, p. 286, p. 296, fig. 291). A suspension bridge over the Danube was to be built; in model photos it resembles the Rodenkirchen bridge. Furthermore, Leonhardt thought of a light steel lattice as roof structure for a flat-roofed exhibition hall. Leonhardt used models to study the joints of steel pipes in space (saai KA h). The question of multi-directional joining was solved by a screw connection.

Beyond Munich, Leonhardt also solicited projects: apart from Munich and Linz, Hamburg was a further main focus of National Socialist town planning. The architect Konstanty Gutschow was to create – according to Hitler’s wishes – in Hamburg a “Gate to the World” a “powerful, eternal symbol of German strength” (StA H a). Since in March 1937 several steel construction firms had been preparing designs for a 700 m span suspension bridge. As early as in January 1938, the public admired a large winner-model of the bridge by the Maschinenfabrik Augsburg-Nürnberg (MAN) at the first German Architecture and Crafts Exhibition in Munich. This concept of a bridge with heavy stone pylons contradicted the design principles Fritz Leonhardt had formulated together with his superior Schaechterle in the book “The Design of Bridges”. Regarding pylons of suspension bridges we read: “Slender steel pylons fit better the lacy system of carrying cables and suspensions than stone portals.” (Schaechterle; Leonhardt 1937, p. 61) Thereof since February 1938, Leonhardt had been preparing an alternate: a suspension bridge with high, slender steel pylons (fig. 7). In his design for Hamburg Leonhardt not only included insights from the supervision of Cologne-Rodenkirchen, but also considered current developments in American bridge building. But Hitler had insisted on a monumental bridge with stone pylons. That is why Leonhardt elaborated a suspension bridge with slightly reinforced hollow piers, to be faced with granite (saai KA i, j). Design drawings and model photos carry his later remark “Leo corrupted by Hitler’s stone tic” (fig. 8).

Through his contacts with Konstanty Gutschow in Hamburg, Leonhardt was also commissioned, apart from the Elbe bridge, with the structural calculations and facade study for the Gauhochhaus (state skyscraper), which
at the Gate to the West should dwarf America’s tall buildings. In this project, architect and engineer endeavor to find a structural solution with an American style steel skeleton.

CONCLUSION

Leonhardt’s early work of the years from 1934 to 1943 consists – with a few exceptions – of bridges and steel structures. Profiting from his experience during a study visit to the USA and his own innovations in materials technology by cooperation with the MPA in Stuttgart, he earned the reputation of a specialist for suspension bridges with the Reichsautobahn. He kept close contact with the USA, pursuing international developments until the war by communicating with his uncle Otto Nissler and Prof. Solomon C. Hollister of Purdue University. Leonhardt cleverly exploited his connections with the Reichsverkehrsministerium. Paul Bonatz and Fritz Todt became his patrons after Karl Schaechterle; it was them who connected him to Hermann Giesler in Munich. Taking his proposals for the Hamburg Elbe bridge into consideration, Leonhardt participated in three of five “Führerstadtplanungen” (city replanning designated by the “Führer”): Hamburg, Munich and Linz. In order to be allowed to build under National Socialist dictatorship, it was unavoidable for Leonhardt to become a party member. In November 1939, when he became independent as a consulting engineer, he joined the NSDAP. Like the first suspension bridge of the Reichsautobahn and the high Elbe bridge, the projects with Leonhardt’s participation in Munich aspired to huge prestige. They were to demonstrate the capability of German steel construction, and were defined by Hitler himself as monuments of technology. For this reason they differed from the heaviness of masonry architecture, as Albert Speer planned it for representative buildings in Berlin and Nuremberg. Although Leonhardt’s thriftiness made him fight exorbitance and waste of materials, so that his engineering structures retain constructive simplicity, one has still to consider that they were serving a regime, which aspired to world supremacy. Civil engineering was another means towards that purpose.

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