

Architecture of Workplaces 1. Lecture 3

INDUSTRY2.0 – mass production

Modern wars – new needs: compulsion and experiments

5. New building materials and new manufacturing processes characterize the development in second half of the nineteenth century.

14. Known as “the architect of Detroit,” Albert Kahn (March 21, 1869 – December 8, 1942) was one of the most prolific architects in US history, with over 60 buildings listed on the National Register of Historic Places. In a career spanning 50 years, Kahn’s body of work contained building types ranging from housing complexes to office buildings to aquariums and styles encompassing Beaux Arts, Georgian and Art Deco. Kahn’s factories for Ford and Packard Motors helped to establish the industrial aesthetic of Detroit and stood in contrast to the similarly inspired Bauhaus movement taking place in Germany. Soon after, Kahn partnered with his brother Julius, an engineer, to develop a new reinforcing technique for concrete beams called the “Kahn Trussed Bar,” which used steel wings bent at 45 degree angles to distribute stresses throughout the beam more evenly than in existing methods. Kahn then used this technology in his designs for the Palms Apartments (1903) and the Packard Automotive Plant (1905), the first use of reinforced concrete in automotive factory design in the country. Kahn also became the architect of choice for Henry Ford, who commissioned the design of many Ford Automotive showrooms and plants across the country, including the Highland Park Ford Plant (1910) and the half-mile long Ford River Rouge Complex (1917), at the time the largest manufacturing complex in the US, with a workforce of 120,000 workers.

His **factories** became known for their **open floor spaces** created by the use of **long span steel trusses and their generous natural lighting and ventilation facilitated by large strip windows and roof monitors**.

Also during this time period, Kahn was tapped to become the official consulting architects for all industrial construction in the Soviet Union during the reign of Joseph Stalin, beginning with his design for the Stalingrad Tractor Plant (1929) and continuing until 1932. During this stint, Kahn’s firm opened a design bureau in Moscow headed by Kahn’s younger brother, Moritz, hiring and training over 4,000 Soviet architects and engineers to design over 500 plants and factories. Kahn continued working until his death on December 8, 1942. His firm continues to operate under his name to this day.

15-16. In the USA 1902 Ernest L. **Ransome obtains the patent for reinforced concrete slab construction**. This is a complete system of formwork, reinforcing and grouting.

The reinforced concrete system in the USA was **developed by the Kahn brothers** (Albert and Julius) **in Detroit**. The “Kahn system” as it was patented, was marketed by the newly formed “Kahncrete” company and its subsidiary “Trussed Concrete Steel Company”, or “Truscon” as it was often known.

Albert Kahn completed a factory for the Packard Motor Company, Detroit (1903), **the first American reinforced concrete building** and the first with **steel windows** imported from England. These elements produced a lighter building than ever before.

The United Shoe Machinery Factory, Ransome, 1903 and the Packard Motor Company in Detroit, Albert Kahn, 1905 were the first examples built with the new system. **The bearing construction skeleton appears for on the facade and gives the proportion of the facade with glazed fields.**

17. Kahn was then commissioned by Henry Ford to build a new four-storey plant in Highland Park Detroit. It was a huge hall of 288,0 x 22,5 meter, grid of 6,0 x 4,5 m, with a **totally free ground floor plan, while the staircases, elevators, toilets were bound together in outer blocks**. The **elevators** served the **transport of raw materials and products on the certain levels**. The parts were transported **from above to bottom to the end assembly using gravitation force**. Assembling first the parts on the upper levels, end assembly on the lower level.

18. Three years later Kahn built the factory to house **the world’s first moving assembly line**. This was for the “Ford model T.” Ford demanded a building with the focus on **open space, adaptability, free areas suitable for production flow lines** where the planned integrated processes, from the arrival of raw materials to the finished product, could all take place on one level. **1913 introduction of the assembly line** (production belt) instead of gravitation transport.

19-20. His next commission was the Ford Rouge plant (1916), a mammoth plant, its **assembly line ran through a series of single storey units**. Here Kahn introduced the use of steel rather than reinforced concrete for its structural framework. After the introduction of the assembly line (production belt) in 1913 the **single-storey halls became the industrial building type**. So by better lighting conditions, a more flexible arrangement of machines and manufacturing process was enabled. **Integrated factory:** raw material production and preparation in the same place

Mass/ series production: huge spaces, organization, automation, integrated workflow - The first integrated factory.

His **factories** became known for their **open floor spaces** created by the use of **long span steel trusses and their generous natural lighting and ventilation facilitated by large strip windows and roof monitors**.

21-22. After the introduction of the **assembly line** (production belt) in 1913 the **single-storey halls became the industrial building type**. So **by better lighting conditions, a more flexible arrangement of machines and manufacturing process** was enabled.

These buildings became known as "Model factories" and their design as the "**Kahn Daylight system**" being based on a **regular grid of column, beam and slab**. Concrete sections were fully exposed and **external wall spaces were glass filled with slender glazing**. Kahn was to develop this design in numerous subsequent factories, all **single storey, all lit from above to enable the floor to be kept clear** for machinery and processes. **Services** such as lavatories and offices were placed at a higher, often **mezzanine level**.

His **factories** became known for their **open floor spaces** created by the use of **long span steel trusses and their generous natural lighting and ventilation facilitated by large strip windows and roof monitors**.

23. Cadillac Place rises 15 stories to a total height of 67 m, with the top floor at 57 m. The building has 31 elevators. It was originally constructed with 110,000 m² and expanded to 130,000 m².

Designed by Albert Kahn, the structure consists of a two-story base with four parallel 15-story wings connecting to a central perpendicular backbone. Kahn used this design **to allow sunlight and natural ventilation** to reach **each of the building's hundreds of individual offices**. The entire building is faced in limestone and is crowned with a two-story Corinthian colonnade. In 1923, it opened as the **second largest office building in the world**.

24. The building was originally designed to house office and retail space, but currently houses only offices. The building was renamed the Albert Kahn Building in 1988.

25-29. A factory based on Ford's principles, semi-finished products on the different floors, a racetrack on the topmost floor to test the new cars.

Lingotto once was an automobile factory built by Fiat. Construction started in 1916 and the building opened in 1923. The design (by young architect Matté Trucco) was unusual in that it had five floors, with raw materials going in at the ground floor, and cars built on a line that went up through the building. Finished cars emerged at rooftop level, where there was a **rooftop test track**. It was the **largest car factory in the world** at that time. For its time, the Lingotto building was avant-garde, influential and impressive — Le Corbusier called it "one of the most impressive sights in industry", and "a guideline for town planning". 80 different models of car were produced there in its lifetime, including the famous Fiat Topolino of 1936.

31-33. Bauhaus was an art school in Germany that combined crafts and the fine arts, and was famous for the approach to design that it publicised and taught. It operated from 1919 to 1933.

The building was designed by the founder of the Bauhaus, Walter Gropius, and commissioned by the city of Dessau. The plans were drafted in Gropius's private office – the Bauhaus did not have its own department of architecture until 1927. The interior fittings were made in the Bauhaus workshops. The city of Dessau financed the project and also provided the building plot.

The design is a further development of an idea that Gropius had previously realised (pre-WWI) with the construction of the Fagus factory in Ahlfeld an der Leine. In both buildings a glass facade on the load-bearing framework allows a view of the interior workings. In the workshop wing in Dessau this provides clear view of the constructive elements. The design does not visually amplify the corners of the building, which creates an impression of transparency. Gropius designed the various sections of the building differently, separating them consistently according to function. He positioned the wings asymmetrically; the form of the complex can thus be grasped only by moving around the building. There is no central view. The main elements of the complex are the glass-fronted, three-storey workshop wing, the likewise three-storey building for the vocational school and the five-storey studio building. The workshop wing and the vocational school are connected by a two-storey bridge which was used for administration purposes. Gropius's private office was also located here until 1928. The workshop wing and the studio building are connected by a one-storey building in which the so-called festive area comprising auditorium, stage and canteen is located. The studio building housed students and junior masters in 28 studio flats, each measuring 20 m².

34-35. Mendelsohn He was commissioned to design several branches of the Schocken Department Store. In the one at Stuttgart (1926) he emphasized the horizontal by using continuous-ribbon windows separated with bands of brick. The rounded staircase at the corner of the asymmetrical structure was cantilevered over the entrance. It constituted an impressive ensemble of modern architecture, and was damaged only lightly in World War II. In 1960, the city of Stuttgart demolished the store, despite international protest.

39-41. The **new construction** techniques followed on from Gropius in Europe, which allowed **glass to be used to full effect**. An important example is the Van Nelle Factory in Rotterdam. The **different volumes of the packing facility and the administrative building** set next to each other, the regular order of the facade are characteristic.

The **glass curtain wall** determine the external appearance. So **the facade entirely of glass shows the structural system**. The interior is articulated by the striking **mushroom slab**.

47-53. Tomáš Baťa built the world's largest shoe manufacturing enterprise out of a tiny family workshop by using production methods and management techniques that were revolutionary in his era, and which still find application today. The Baťa empire had also diversified extensively from its core business in the years since 1894, when Tomáš Baťa opened his first shoe workshop with his two siblings on Zlín's town square.

This visionary businessman set up his shoemaking business in the town of Zlín in the 1890s and revolutionised the footwear industry with the introduction of mass production techniques inspired by Henry Ford.

The success of his business meant that the town grew rapidly in the early 20th century as people flocked from neighbouring regions to staff Baťa's expanding shoe factory.

Tomáš Baťa's profound influence on Zlín stemmed from that fact that he sought to create a "total environment" for his workers. As a result, he built houses, sports centres, and entertainment complexes for his employees. These functionalist buildings are what have shaped the town's current appearance, making it a veritable treasure trove of 20th century architecture.

Most of the buildings were designed by renowned Czech architects František Gahura and Vladimír Karfík with the latter designing Zlín's famous 16-storey skyscraper, which at the time was the tallest building in Central Europe.

Now there were Baťa tanneries, Baťa engineering works, Baťa rubber plants, Baťa chemical refineries, Baťa power stations, Baťa coal mines, even a Baťa film studio. Baťa made bicycles and car tyres, gas masks and children's toys. Everything was produced in highly automated, purpose-built, red-brick factories that employed 30,000 people in Czechoslovakia and thousands more abroad.

These workers enjoyed a standard of living that was the envy of the nation. The company provided housing, healthcare, insurance, education, leisure activities and entertainment—often in breathtakingly modern facilities equipped with the latest high-tech gadgets. Baťa operated railway lines, dug canals, and even built its own airport at Otrokovice, just down the road from the Baťa company headquarters in Zlín (where Tomáš Baťa was mayor).

In an age when social entrepreneurship was unheard of, Tomáš Baťa built not only factories, but also homes, schools and hospitals for his workers... ..as well as the most successful shoe store chain of his day.

54-58. As by the Larkin Building Wright wanted to create a closed, sealed space lit from above.

The main workroom is determined by **white concrete columns forming a forest**. At the top they spread and end in circles, with **skylights** in between. At the corners the walls stop short of the ceiling and so glass tubes continue up, and connect to the skylights.

59-62. Rockefeller Center, a 12-acre (5-hectare) complex of 14 limestone buildings in midtown Manhattan in New York City, designed by a team of architects headed by Henry Hofmeister, H.W. Corbett, and Raymond Hood. The group of skyscrapers was built between 1929 and 1940.

Rockefeller Center is a complex of skyscrapers and theaters in New York City developed by John D. Rockefeller, Jr. in the 1930s and designed by a talented committee of architects and planners. It superbly demonstrates how tall buildings can be seamlessly integrated into the horizontal tangle of the city below.

First conceived in 1927, Rockefeller Center was intended as a **mixed use complex** that would house the Metropolitan Opera and assorted retail establishments. The opera later withdrew, and was replaced with the Radio Corporation of America (RCA) and its fledgling subsidiary, NBC. Rockefeller wanted a sound return on his investment, but he also wanted to build something that could serve the public good. He was passionate about architecture and he felt responsible for contributing to the urban quality of New York.

65-69. Albert Kahn worked on more than 1,000 commissions from Henry Ford and hundreds for other automakers.

Kahn's firm designed a large number of the **army airfield and naval bases** for the United States government. By World War II, Kahn's 600-person office designed the **Willow Run Bomber Plant, Kahn's last building**, located in Ypsilanti, Michigan, where Ford Motor Company mass produced **B-24 Liberator bombers**.

"In 1928 the Soviet Government, after combing the U.S. for a man who could furnish the building brains for Russia's industrialization, offered the job to Kahn. Twenty-five Kahn engineers and architects went to Moscow. They had to start from scratch., Kahn's firm's **Moscow** office built **521 factories between 1930 and 1932** in the Soviet Union.

Also during this time period, Kahn was tapped to become the official consulting architects for all industrial construction in the Soviet Union during the reign of Joseph Stalin, beginning with his design for the Stalingrad Tractor Plant (1929) and continuing until 1932. During this stint, Kahn's firm opened a design bureau in Moscow headed by Kahn's younger brother, Moritz, hiring and training over 4,000 Soviet architects and engineers to design over 500 plants and factories.

By May 1929, Kahn's firm had secured a contract to design and supervise the construction of a tractor factory 650 miles southeast of Moscow. The Stalingrad Tractor Factory was designed by workers in Albert Kahn Associates' office in Detroit, built from prefabricated steel components shipped from the United States, and outfitted with U.S.-manufactured machinery. Truly, the factory was an American import to the Soviet Union.

The Chelyabinsk Tractor plant was a project of the first five-year plan. The plant was founded in 1933. By 1940 the plant had produced 100,000 tractors.

During World War II seven other industrial entities (including most of Leningrad's Kirov Plant and 15,000 of its workers) were either wholly or partially relocated to Chelyabinsk, the resulting enterprise commonly known as "Танкоград" ('Tankograd', or 'Tank City'). The work force increased to 60,000 workers by 1944, from 25,000 during non-military production; during the conflict the works produced 18,000 tanks, and 48,500 tank diesel engines as well as over 17 million units of ammunition. Production included the KV tank from 1941, T-34 tank from 1942, KV-85 tank and IS tanks from 1943, and T-34/85 tank and SU-85 self-propelled field gun from 1944. By 1945 the plant had been awarded the Order of Kutuzov, 1st Class, the Order of Lenin, the Order of the Red Star, and other honours for its efforts in helping to defeat Nazi Germany.

74-83. Every American automaker turned its workforce and facilities to military production during World War II. But no project captured the public's imagination like Willow Run, where Ford Motor Company built one B-24 Liberator airplane every 63 minutes. The plant was the embodiment of America's "Arsenal of Democracy" -- the enormous manufacturing capacity so vital to the Allies' victory.

Kahn's firm designed a large number of the **army airfield and naval bases** for the United States government. By World War II, Kahn's 600-person office designed the **Willow Run Bomber Plant, Kahn's last building**, located in Ypsilanti, Michigan, where Ford Motor Company mass produced **B-24 Liberator bombers**.

The Willow Run plant was first leased, and eventually sold, to General Motors after a fire in August 1953 destroyed their Detroit transmission factory in Livonia, Michigan. The five-million square foot Willow Run plant was closed in 2010 as part of GM's bankruptcy proceedings. Most of the plant was demolished in 2014 but a 175,000 foot portion was offered to the Yankee Air Museum, housed in a hangar until a 2004 fire. After successful fundraising, the Museum reopened in 2017 in the historic building.

85-89. The construction of the new factory started in May 1938 in the new town of "Stadt des KdF-Wagens" (modern-day Wolfsburg), which had been purpose-built for the factory workers. This factory had only produced a handful of cars by the time war started in 1939. None were actually delivered to any holder of the completed saving stamp books, though one Type 1 Cabriolet was presented to Hitler on 20 April 1944 (his 55th birthday).

1939–1944: Wartime production and concentration camp labor

War changed production to military vehicles—the Type 82 Kübelwagen ("Bucket car") utility vehicle (VW's most common wartime model), and the amphibious Schwimmwagen—manufactured for German forces.

As was common with much of the production in Nazi Germany during the war, slave labor was utilized in the Volkswagen plant, e.g. from Arbeitsdorf concentration camp. The company would admit in 1998 that it used 15,000 slaves during the war effort. German historians estimated that 80% of Volkswagen's wartime workforce was slave labor.

90-91. Cold War, the open yet restricted rivalry that developed after World War II between the United States and the Soviet Union and their respective allies. The Cold War was waged on political, economic, and propaganda fronts and had only limited recourse to weapons. The term was first used by the English writer George Orwell in an article published in 1945 to refer to what he predicted would be a nuclear stalemate between "two or three monstrous super-states, each possessed of a weapon by which millions of people can be wiped out in a few seconds."