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Architectural implications of colonial infrastructure
Case study: Dutch East Indies railway network in Java

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ABSTRACT

The Dutch East Indies' colonial infrastructure, particularly Java's railway network and its linkages to sugar fields and mills, changed urban and economic environments. Railways, originally designed for military defense in the 1840s, became economic arteries supporting agro-industrial growth under the Cultuurstelsel (1830) and Agrarian Law (1870), according to historical data. Strategic railway planning promotes resource extraction, urban expansion, and path dependence, sustaining urban centers after colonialism. Synchronic-diachronic and network analysis compare the phased development of railway stations and sugar mills (1830–1942), examining shared architectural influences, materials (from local wood to imported steel), and styles (pragmatic neoclassical to Indies and Art Deco). Railways efficiently transported sugarcane and cargo, while mills incorporated rail lines, creating divided towns and industrial landscapes. Technical adaptations to tropical temperatures and commercial incentives show how colonial exploitation shaped Java's spatial character. This study illuminates how colonial infrastructure, architectural rationalism, and economic imperatives shaped Java's modern landscape, enriching historical studies.

Introduction

Economic activity and urban expansion depend on infrastructure, which includes transportation, telecommunications, water, and sewage (Song 2012). Dionisio Gonzales stated this system underpins urban movement and supports inclusive communities, economic progress, greater health and living standards, active lives, and air quality and livability (Pulido et al. 2018). In the past, infrastructure networks have been used by lawmakers and planners to get private investment for economic and housing growth. (Song 2012).

Qui stated in his studies that railway networks shaped communities during the first industrial revolution. Cities with railway infrastructure, especially big networks, have greater growth and future prospects. Railway networks make public transportation much easier to use and speed up economic growth, which often changes how businesses work in cities. Investment in railways can unite businesses and workers and boost the service industry (Qiu 2023).

Remi Jedwab's Kenya study found that rail networks made it simpler to exploit the country's riches and govern its territory. Setting up colonial railroads altered where European colonies were, which affected where key towns were after

independence. After liberation, European towns and train infrastructure collapsed, but cities created along these lines survived because they were dependent on the routes, making investment easier afterward. Railroads changed transportation in Africa, where trade prices were high, increasing exports, making it simpler for people and enterprises to travel around, and spreading new ideas like new crops. When Brata studied the Dutch East Indies, the Dutch colonial administration established a sophisticated rail system in Java. This made the island easier to reach from around the world and added to the Great Post Road. Java's first railway opened between Semarang and Tanggung in 1867. By the 1930s, Java's train and tram network had exceeded 5,000 km, matching several European networks. This expansion helped establish huge cities in the middle of the country. This connected Java's agricultural and industrial sector, notably sugar fields, to global markets, making it a modern economy by the early 1900s (Brata 2017).

Colonial railway investments, mostly driven by economic motives, shaped Java's urban architecture and space (Ramli, Antariksa, and Santosa 2020; Chanrasari, Nurmiah, and Umar 2018; Sugiharto 2017). Railway networks produced new urban centers or transformed old ones and railway-centric communities with workshops, depots, offices, and housing for European workers (Wijaya and Sari 2020). Jamalpur, a colonial railway town in India, had segregated residential zones and railway-specific institutions to serve a European labor force apart from the local population (Sinha 2015). Java is expected to have distinctive architectural and urban designs reflecting the colonial railway system's operational and sociological needs. This study examines the impact of the colonial railway system's development in Java, particularly sugar plantations, on the economic and demographic framework and the architectural and spatial remnants that survived the period, despite the railway network's diminishing initial benefits. (Brata 2017).

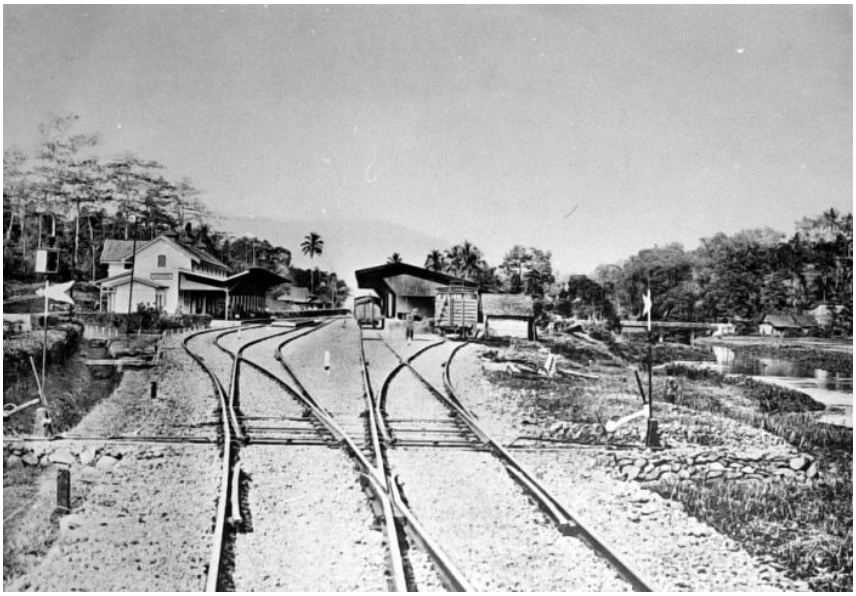

Figure 1. Railwaystation in Tuntang of the Dutch Indies Railway Company, Central-Java, operated 1873
Photo taken around 1910 – 1915
Source https://collectie.wereldmuseum.nl/?query=search=*=TM-10014032

Sugar mills and railway stations were built to meet mutual needs. A robust rail network was needed to deliver sugarcane and refined sugar from plantations to mills and ports, as sugar mills proliferated (Sulistyani 2023; Bosma 2013). Both are substantial, notable edifices that represent industrialization and colonial dominance (Knight 2014). The most evident architectural connection is the direct physical integration of the light rail line with the sugar mill, facilitating the transportation of sugar cane from the field to the mill and sugar to the station or port (Bosma 2013).

The physical interconnectedness of industrial modernity is shown by sugar plants and railway terminals that adapt to local conditions while preserving urban influences.

This study investigates how the architecture of Java's railway stations and sugar factories, key components of the colonial economic and social framework, shaped the modern industrial landscape's visual and spatial identity during the Dutch East Indies period. This study examines how local and imported materials and construction technologies (such as steel roof structures and large steam engines) used in railway stations and sugar factories affect their architectural expression and morphology.

Methods

This research uses network analysis and synchronic-diachronic technique. This combo aims to explain Dutch East Indies colonial infrastructure development and architecture. The synchronic method will examine the structure and function of architecture during a certain time, such as railway station layouts or sugar factory layouts. Architecture will be seen as a process of adaptation to historical forces rather than a result in the diachronic approach (Adiyanto 2020). Nodes (people, organizations, infrastructure) and edges (connections between nodes) are used in network analysis to show system patterns over time. This strategy allows tracking a network's growth, identifying key participants, and understanding interconnection (Buchnea and Elsahn 2022). The integration of these two methodologies establishes a framework for attaining: (1) Clarity of context, longitudinal research, investigation of the same issue throughout time, and relevance to processes, sequences, phases, techniques, or occurrences (pro-appropriateness); (2) Disclosing the impact of interactions among people and organizations on architectural choices, technological transfer, and spatial configurations; (3) Recognizing contextual transformations essential for comprehending architectural development and illustrating how architectural edifices serve as indicators of socio-economic dynamics and political emblems; (4) Promoting the integration of qualitative data from archives and historical narratives with quantitative data from network measurements for enhanced analysis.

Results and discussion

Chronology of the railway network's evolution during the Dutch East Indies period

First Phase: Initial Ideas and Urgent Needs (1840s - 1860s)

The concept of constructing a railway line in Java originated as early as 1840. On August 15, 1840, Colonel JHR. C. van der Wijck proposed the construction of a railway line extending from Surabaya, through Solo and Yogyakarta, to Batavia, primarily for military security purposes (Reitsma 1928). Following the introduction of the Cultivation System (Cultuurstelsel) in 1830, the output of export goods, including sugar and coffee, surged significantly (Cahya and Gery 2023).

Second Phase: Early Railway Network Development and the Role of the Private Sector (1860s–1870s)

The liberal victory in the Netherlands in the 1850s reinforced the notion that industrial activity in the Dutch East Indies would develop with enough opportunities, including railway connections (Cahya and Gery 2023).

In 1862, the Dutch East Indies administration awarded a concession to the private entity Nederlandsch-Indische Spoorweg Maatschappij (NISM) to construct the inaugural railway line in Java (Mohtar 2021). The construction of this route commenced in 1863, linking the city of Semarang to the regions of Surakarta and Yogyakarta (Vorstenlanden (Mohtar 2021; Mirza 2023).

The initial segment of this line, Semarang-Tanggung (25 km), commenced operations on June 17, 1864, and was officially inaugurated on August 10, 1867, signifying the commencement of railway history in the Dutch East Indies (Mirza 2023; Ratnawati 2015). The main goal was to carry agricultural goods from the interior to Semarang for export while boosting indigenous economic growth. 90% of sugar and coal were shipped by rail to the port (Ratnawati 2015).

The Agrarian Law of 1870 encouraged European private investment in plantations, increasing crop distribution needs like mass transportation (Dikrulloh 2024). In 1873, the Batavia-Buitenzorg (Bogor) line opened, followed by the Surabaya-Pasuruan line in 1878 (Handinoto 1999).

Third Phase: Extensive Development and Diversification of Functions (Late 19th to Early 20th Century)

Railways helped regional and residential development in the late 19th century, allowing European migration into the interior for plantation expansion (Dikrulloh 2024). Batavia and Surabaya were connected by train in 1894, allowing two-day travel. The largest Asian network at the time, this program improved transit and movement between key urban areas (Mohtar 2021; Hermawan 2022a).

Private railway companies emerged. Semarang Cheribon Stoomtram Maatschappij (SCS) began building the Semarang-Cirebon line in 1895 and opened it in 1897. The SS opened the Batavia-Bandung Line. The Batavia–Bandung route through Purwakarta began in 1906, reducing travel time and distance. This line was both economic (facilitating agricultural and plantation commodities transit) and military (creating a defensive perimeter) (Mohtar 2021).

The Kalisat-Kalibaru line was constructed in 1903 to connect Banyuwangi to other Javan districts, improve plantation product shipping to Panarukan Port, and stimulate European migration (Dikrulloh 2024).

Phase Four: Innovation and the Depression (1920s–1940s)

SS launched the Eendaagsche Express in 1929 to cut the Batavia-Surabaya trip to 12 hours, followed by the Java Nacht Express in 1936 for nighttime travel. The 1940 installation of ice-block-powered air conditioning in first-class carriages improved passenger comfort (Mohtar 2021). Several construction plans, notably the Garut-Cikajang line extension, were halted by the 1930s Economic Depression (Mirza 2023).

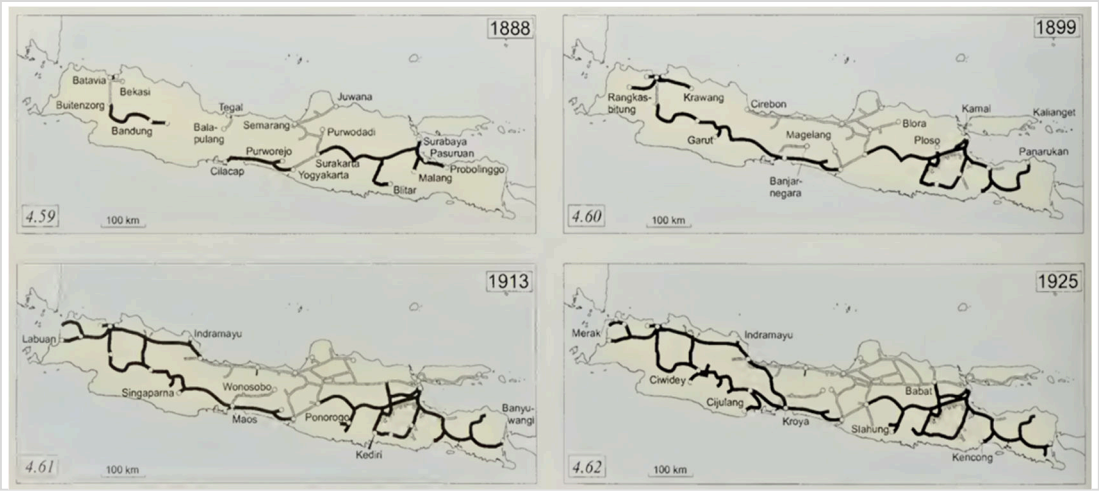

Figure 2. Map of railways evolution in Java (Tagliacozzo and Cribb 2001)

Periodization of the development of sugarcane plantations and sugar factories

First Phase: Initial Foundations (early 19th century to mid-19th century)

Governor General Van Den Bosch introduced forced cultivation in 1830. The main goal was to increase government plantation and agricultural earnings (Cahya and Gery 2023; Tangkilisan 1996). Since 1830, Dutch East Indies sugar and coffee production have tripled or quadrupled, generating 93.664 million guilders in exports from 1865 to 1869 (Cahya and Gery 2023). Despite rapid industrial growth, animal-drawn carts (cattle, buffalo, horses), horse-drawn carriages, and river transit are insufficient. Sugarcane and sugar are transported for weeks to months, spoiling the crop before reaching the mill or port (Cahya and Gery 2023; Mohtar 2021; Hermawan 2022a; Fauzi et al. 2025; Hermawan 2022b). This circumstance demands better transit systems (Cahya and Gery 2023; Mohtar 2021).

Second Phase: Liberalization and Private Domination (late 19th century).

A liberal administration that made major changes replaced the conservative government that supported the Cultuurstelsel in 1860 in 1870 (Tangkilisan 1996). The Agrarian Law (Agrarische Wet) allowed foreign private companies to invest in Dutch East Indies

plantations and agriculture, notably sugar crops (Fauzi, Armiyati, and Jayusman 2025; Cahya and Gery 2023; Tangkilisan 1996). Thus, sugar became a major export after 1870. Private sugar factories can operate without permissions, as under the Cultuurstelsel. In 1900, Java produced 455,229 tons of sugar (Tangkilisan 1996).

Third Phase: Expansion (Early 20th Century)

Java produced 575,397 tons of sugar in 1906 (Tangkilisan 1996). The Cirebon Residency grew 13,151 hectares of sugar cane in 1930, up from 8,648 in 1920 (Fauzi et al. 2025). Advanced agricultural technology and labor management optimized productivity, resulting in a peak period from 1927 to 1928 (Dikrulloh 2024).

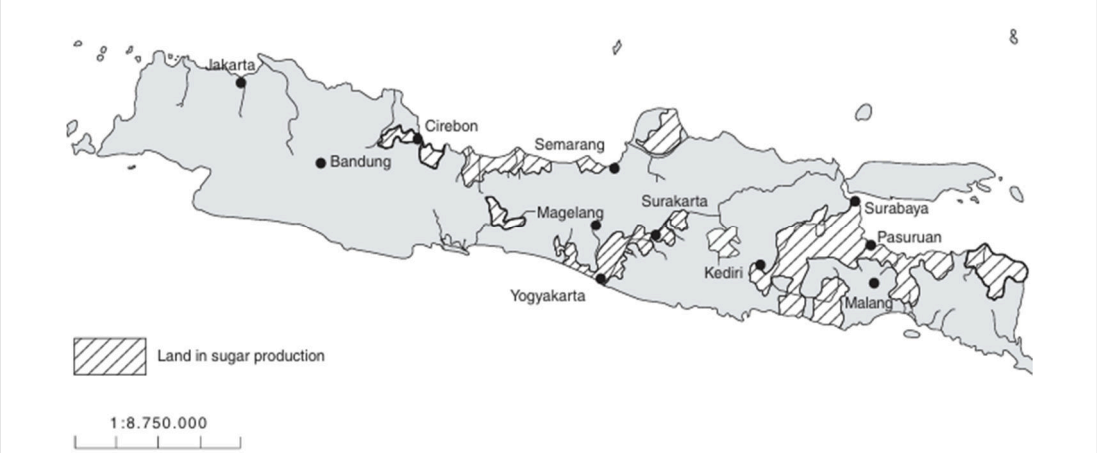

Figure 3. Map of Java's sugar-production regions around 1920 (Bosma 2013)

Phase Four: Challenges and Decline (1930s).

The Dutch East Indies sugar industry collapsed during the worldwide economic downturn (Fauzi et al. 2025).

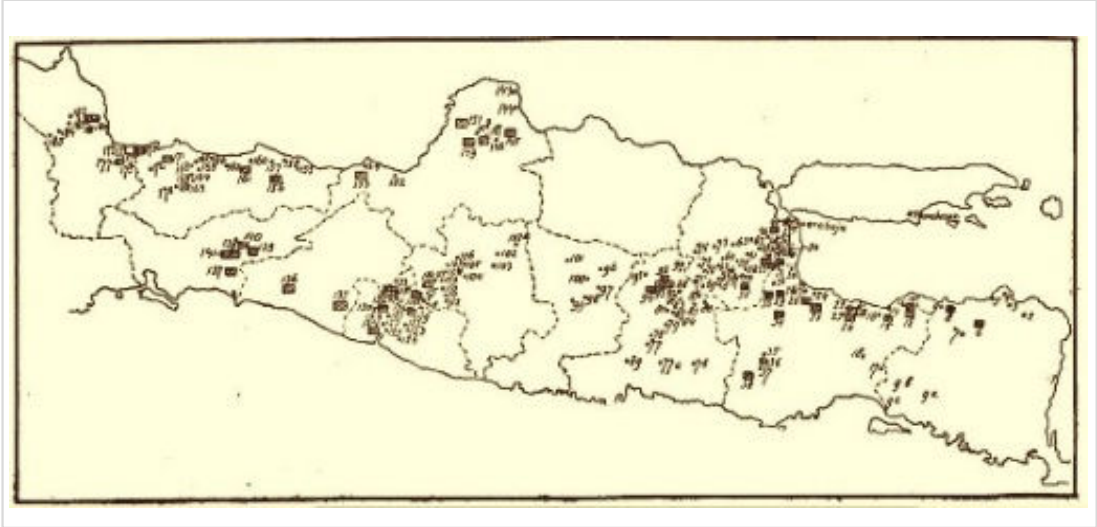

Figure 4. Map of sugar factories on Java around 1932
https://www.willemsmithistorie.nl/images/stories/java/suikerfabriekenJava11021932.jpg

Synthesis

The railway network's development and sugarcane plantations and sugar processing facilities' development have parallels and possible overlaps. Originally built for protection, the railway later served sugar plantations. Thus, a thorough investigation of the railway network's

growth, including stations and sugar mills, and its drivers is necessary.

Analysis of the progression of railway stations and sugar factories in Java

This periodization divides railway stations and sugar mills into three developmental phases: starting (1840–1870), developing (1870–1930), and peaking (1930–1942). This divide was caused by political and economic issues, including the 1830 compulsory cultivation legislation (Cultuurstelsel), the 1870 Dutch East Indies Agrarian legislation (Agrarische Wet), and the 1930 global economic crisis. Therefore, we compare:

Table 1. Comparison of the evolution of the railway network with the sugarcane plantation and sugar industrial network

Period	Driving factor	Railway network	Network of sugarcane plantations and sugar mill
Early Development (1830 – 1870)	Cultivation System implemented by the Dutch East Indies Government around 1830. The production of sugar and coffee grew three to four times from 1830 to 1840 (Cahya and Gery 2023).	The concept of constructing a railway originated in 1840 for defensive objectives, linking Surabaya-Solo-Yogyakarta to Batavia (Reitsma 1928).	The mean sugar yield per bau (0.7 hectare) rose from 33.58 piculs during 1850-1854 to 49.74 piculs in 1865-1870 (Mandere 1928).
Economic Liberalization (Agrarian Law 1870 - Towards the Global Depression 1930)	The Agrarian Law of 1870 initiated economic liberalization and signified the conclusion of the Cultuurstelsel (Fauzi, Armiyati, and Jayusman 2025; Ratnawati 2015; Cahya and Gery 2023). The amount of plantation commodities exports has risen, along with the expansion of extensive plantation fields, particularly in Java (Dikrulloh 2024).	The development of railway lines is being expedited as the primary method for delivering plantation products from the interior to the port (Mirza 2023; Hermawan 2022a; Mohtar 2021). Private railway businesses formed (Fauzi, Armiyati, and Jayusman 2025), alongside those owned by the Dutch East Indies government (Hermawan 2022b).	The quantity of private sugar factories surged significantly. In 1879, there was 14 private sugar enterprises (Fauzi, Armiyati, and Jayusman 2025). Manufacturing facilities implemented contemporary technology. Associations of sugar producers, such as the Vereenigde Javasuikerproducenten (V.I.S.P.), were established to oversee the sector (Mandere 1928).
Great Depression (1930) – beginning of World War II (1942)	The world experienced the Economic Depression, known as the Great Depression, in the early 1930s (Mohtar 2021) Colonial governmental practices intensified in overseeing the production and distribution of plantation commodities (Dikrulloh 2024).	The Garut-Cikajang railway line was inaugurated on August 1, 1930; however, the extension to Pameungpeuk was not executed due to the economic collapse. This was the final line constructed by the SS prior to the recession ceasing the development of additional lines (Hermawan 2022a).	The sugar sector underwent a downturn accompanied by decreasing pricing (Tangkilisan 1996; Mohtar 2021). The measurement system transitioned from bau and pikul to hectares and quintals circa 1927-1928 (Mandere 1928).

Table 1 shows how local and global economic-political concerns affect the growth of railway networks, sugarcane farms, and sugar mills in Java. Foreign influences, global circumstances, and domestic elements, such as sugar cane plantations, affect the railway network's longevity, as do political and economic issues. Given these limitations, what is the train station and sugar factory's architectural design and relationship? This table showed:

Table 2. Comparison between Train Station and Sugar Mill

Indicator	Train Station	Sugar Mill
Early Development Period (1830 – 1880)	The economy was predominantly influenced by the Cultuurstelsel, implemented in 1830.	
The Role of Designer	Before 1900, civil engineers used European technology to design	European engineers and professionals introduced sophisticated steam engine

Indicator	Train Station	Sugar Mill
	stations. The aesthetics of architecture were important to civil engineering. Engineers pioneered through material shortages, building equipment, manpower issues, and site challenges (Sulistyani 2023).	technology, launching the sugar industry. Contractors hired skilled craftsmen and operators. With foundries and specialized workshops, Surabaya became a sugar industry hub (G. Roger Knight 2014).
Design Approach and/or Building Style	Late 19th-century stations have pragmatic, utilitarian, and unadorned engineering (Sulistyani 2022). • Initial variation (1864-1874) features neoclassical style. • Second variant (1875-1890) by Staatsspoorwegen (SS) features uncomplicated neoclassical design, but the roof's adaptation to tropical environment is limited. • The third version (1881-1900) by the Semarang-Joana Stoomtram Maatschappij (SJS) has a timber chalet style with simple eclecticism (Sulistyani 2023).	Coastal sugar mills are simpler and utilitarian, but plantation and upland sugar factories have spectacular facades with many ornamentation (Fauzi Mizan Prabowo Aji, Febela Priyatmono, and Haja Bava Mohidin 2025).
Materiality	Wood is the main material for SJS stations due to its availability and affordability (Sulistyani 2023).	The oldest Yogyakarta sugar factories, PG Padokan, PG Barongan, and PG Sedayu, have wooden roofs (Husna and Ikaputra 2024)
Economic Liberalization Period (1870 - 1930)	The Agrarian Law of 1870 helped private businesses start sugar cane farms, which boosted industrial building construction. . (Husna and Ikaputra 2024)	
The Role of Designer	In the early 20th century, professional architects, including Delft Polytechnic School alumni, became heavily involved in station design. Stations were designed by H. Thomas Karsten, P.A.J. Moojen, J. van Gendt, H. Maclaine Pont, and F.J.L. Ghijsel. Engineers like C.W. Koch and Delft graduate J. van Gendt helped build current functionalist style (Sulistyani 2023).	Due to their higher financial means for plant refurbishment and machinery modernization, venture capital firms and banks have acquired several sugar factories from families (Husna and Ikaputra 2024). Sugar manufacturing technology may be integrated into present production facilities as engineers advance it (G. Roger Knight 2014). The E. Rombouts Technical Bureau restored other sugar facilities and presumably designed a similar exterior (Husna and Ikaputra 2024).
Design Approach and/or Building Style	Architectural variations post-1900 encompass (Sulistyani 2023): • Steel frame stations (1900-1915) for island-type stations, reflecting European architectural trends and efficiency; • Eclectic chalet style single-sided station (1900-1915) for smaller stations, featuring intricately carved wooden roof ornamentation; • Indies style architecture (1900-1915) tailored to tropical climates with eaves (trefoil roofs) and brick walls. H. Thomas Karsten investigated Javanese architecture by installing a tajug roof with a metal structure on Solo Balapan Station's new hall (1924-1927).	The roof span and number of modules (multi-module for short spans, single-module for large spans) depend on roof structure technology (Husna and Ikaputra 2024). Many rebuilt sugar plants, such PG Djatiroto and PG Redjo Agoeng, were Art Deco (Fauzi Mizan Prabowo Aji, Febela Priyatmono, and Haja Bava Mohidin 2025).
Materiality	• Steel frames were increasingly popular for island station buildings and enclosures. Iron and steel imports persisted until the 1920s.	Steel roofing structures are increasingly used in modern or renovated sugar factories, allowing longer roof span (Husna and Ikaputra 2024).However, the Dutch East Indies' iron industry only began in 1920,

Indicator	Train Station	Sugar Mill
	• Wood continues to be used for chalet-style constructions due to its availability. • Brick walls were used in Indies-style architecture for climate adaptability. • Concrete became a significant material in the early 20th century, representing modernism and scientific growth (Sulistyani 2023).	requiring the importation of iron and steel, which influenced the design by including buildable components (Sulistyani 2023). UK and French engineering businesses Fawcett Preston Engineering and Fives Lille manufacture sugar machines (G. Roger Knight 2014).
Great Depression Period (1930 - 1942)	Great economic crisis in 1929	
The Role of Designer	With the rise of modernism, station design during the Great Depression required expert architects. Delft engineers C.W. Koch and J. van Gendt shaped modern functionalist railway station design (Sulistyani 2023).	The present technical bureau continued necessary improvements. To ensure sustainability, manufacturing efficiency and machinery modernization were prioritized (Husna and Ikaputra 2024).
Design Approach and/or Building Style	Art Deco and Nieuwe Bouwen flourished at this time. Art Deco, Nieuwe Bouwen, and modernism were adapted to local conditions (Sulistyani 2023).	Design priorities during this time were maintenance and efficiency above new construction. Several sugar mills that were still operating or being renovated adopted Art Deco styling (Fauzi Mizan Prabowo Aji, Febela Priyatmono, and Haja Bava Mohidin 2025).
Materiality	Architectural beauty incorporates technological and material advances like concrete. Roof installation using metal frames is typical. The architects' materials and architectural changes to address climate change show their flexibility to Java's particular environment (Sulistyani 2023).	Previously, steel roof structure technology concentrated on material efficiency. After 1920, the Dutch East Indies developed its own materials industry, which could reduce imports (Sulistyani 2022).

Comparing the train station and sugar factory shows that political and economic factors shaped their architectural design as the focus shifted from economic growth to infrastructural development, resulting in a more utilitarian approach. The design method prioritized usefulness above architectural beauty. After economic stability, architectural styles and architects' roles influenced rail station and sugar factory architecture. This is thoroughly covered in Sulistyani's study (Sulistyani 2022; 2023).

This development affected material use. Wood and other readily available materials were used throughout development. After development, steel from the Netherlands and Europe was used for railway stations and factories to improve efficiency.

Figure 5. Statiun Semarang (photo taken around 1865) (https://www.rijksmuseum.nl/en/collection)

Figure 6. Station roof S.S. at Tandjong Priok under construction/span 40 meters - length 200 meters (https://www.rijksmuseum.nl/en/collection)

Figure 5 and figure 6 Show how building materials have changed, especially train station roofing from wood to steel.

Steel was advantageous because sugar mills needed steel-based machinery. Iron engines, tracks, and long train lines were needed for train networks. Materials like steel are durable. Tanjung Priok station's massive building remains. (figure 7).

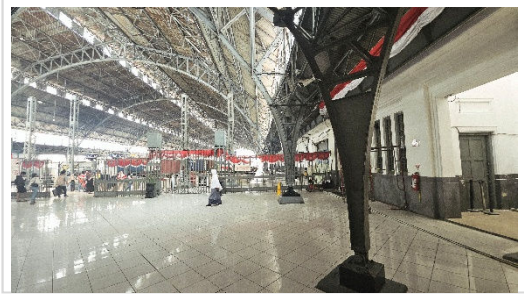

Figure 7. Present state of Tanjung Priok Station (photograph captured on August 3, 2025 by Adhika Atyanta

Steel is ideal because sugar mills need steel processing apparatus. Train networks require locomotives, tracks, and long train lines made of steel. Steel demand in industrial operations, notably sugar processing equipment, requires large areas.

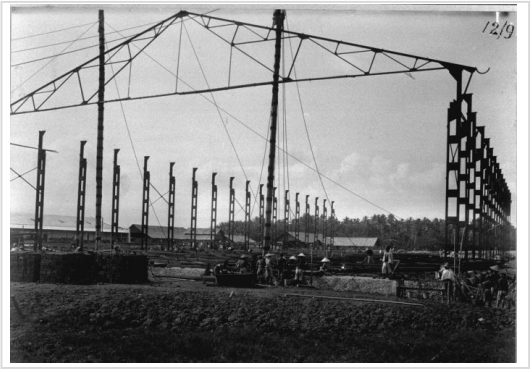

Figure 8. The first truss of the mill house of the sugar factory Poerworedjo Central Java (photo taken around 1909) (https://collectie.wereldmuseum.nl/).

Train stations and enterprises have similar large-scale spatial needs. Using steel building structures is efficient and practical. Thus, iron and steel are necessary and have a large market share. Thus, transporting materials from the Netherlands/Europe to the Dutch East Indies is economically justified by sugar factory profits, railway station construction cost-efficiency, and the benefits of processed goods and individual mobility, particularly within Java.

Figure 9. Rail yard at the north side of the Poerworedjo sugar factory, Central Java (https://collectie.wereldmuseum.nl/)

Spatial development in Java

Sugarcane plantations and sugar mills shaped Java's spatial planning during the Dutch East Indies, especially under the 1830 Cultuurstelsel (Forced Cultivation System). This method ensured Java's coffee, sugar, and indigo exports. Sugar mills were given "kring" (land parcels) for sugarcane and labor. This required the allotment of large areas to sugarcane, often replacing irrigated rice paddies (Knight 2014). For commercial agricultural land distribution, the colonial authority relied on Javanese aristocrats (priyayi and regents).

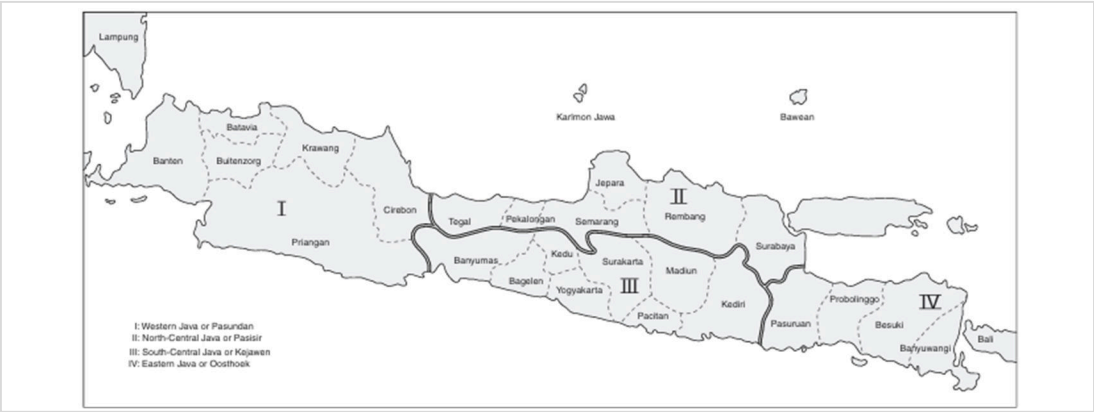

Figure 10. Map administrative divisions (Residencies) of Java around 1920 (Bosma 2013)

After being absorbed into the colonial civil service, regents became the top native authorities (Bosma 2013; Knight 2014) Sugar estates-built railways in the 1870s to move sugar cane from fields to mills (Bosma 2013).

Figure 11. Arrival of Governor-General B.C. de Jonge at the station of the Netherlands Indian Railway Company in Soerakarta, received by Pakoe Boewono X (http://hdl.handle.net/1887.1/item:771716)

The sugarcane fields, sugar mills, and railway network changed Java's environment, changing land use and rural social structures and creating an unmatched industrial infrastructure. This massive, state-directed industrial project made Java the "Oriental Cuba" of the sugar market (Knight 2014).

The Netherlands was late to industrialize compared to other European nations because it lacked basic metallurgical industries like ironworks until the late 19th century. Hoogovens focused on high-quality, low-cost pig iron from 1918 to 1930, not integrated steelmaking. They generated new resources and endured via improvement (Vrieling 1998).

Iron and steel industry network

The Dutch East Indies imported iron and steel (Furnivall 2010). The Dutch East Indies' sugar industry relied on European steam engine producing gear (Husna and Ikaputra 2024). The Dutch metalworking sector is small and dominated by military needs (Zanden and Leeuwen 2011). One source mentions Krupp AG, a major German steelmaker, implying Germany may supply steel (Bosma and Webster 2015). Paris-based Gouin et Cie. supplied metal superstructure for Dutch infrastructure projects including the Moerdijk bridge (Staatsspoorwegen 1868) Many European industrial nations supply steel to the Netherlands. F. J. H. Baijer, the "Surabaya 'Iron King'," commanded De Phoenix and De Volharding, which adapted indigenous technology (Knight 2014).

Figure 12. The entrance gate of 'De Volharding, Royal Factory of Steam and other Machines in 1857 by F.J.H. Baijer' in Surabaya (https://collectie.wereldmuseum.nl/)

In the machinery sector of the Dutch East Indies, firms like N.V. de Bromo (1865), N.V. De Industrie (1878), and CV Vulkaan (1918) in Surabaya were founded to repair and provide machinery for processing plantation products (Machmudi, Abdurakhman, and Fauzi 2024).

Figure 13. Front of the entire site of N.V. De Nederlandsch-Indische Industrie, photo taken 1918 (https://hdl.handle.net/1887.1/item:927437)

Financial advantages

Upon revisiting the Dutch East Indies and analyzing the economic advantages, the subsequent numbers arise: (a) The age from 1830 to 1880 saw a forced cultivation scheme. No exact numbers exist for Dutch East Indies profitability during this time. The 1878–1879 period had 419 million guilders in income from numerous areas (Gordon 2012); (b) The age from 1830 to 1880 saw a forced cultivation scheme. No exact numbers exist for Dutch East Indies profitability during this time. The 1878–1879 period had 419 million guilders in income from numerous areas (Sumardi, Ayu, and Naim 2019); (c) The 1930s to 1940s saw the worldwide economic crisis and World War II. The colonial surplus from foreign commerce had increased before, but it fell to 5,058 million guilders between 1932 and 1935 and 5,835 million guilders by 1942 (Sumardi, Ayu, and Naim 2019).

Conclusions

The sugar industry and the colonial railway network shaped Java's industrial landscape. Civil engineers used pragmatic reasoning and operational considerations in the first architectural design process to ensure efficiency and effectiveness. The inclusion of light rail lines into sugar mills and the creation of rail-focused cities and metropolitan centers showed the operational ramifications.

Imported iron and steel components were needed to support sophisticated sugar processing equipment and assure station coverage. The expensive materials allowed factory production halls and station yards to have large roof spans, demonstrating that industrial productivity and profitability justified the cost of imported materials. As the economy grew, architectural styles changed from Neoclassical to Indies and Art Deco, incorporating tropical climate necessities like extended eaves and reflecting professional architects' influence and symbolizing modernity and colonial authority in Javanese space.

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Author(s) contribution

Johannes Adiyanto contributed to the research concepts preparation, methodologies, investigations, data analysis, visualization, articles drafting and revisions.

Hery Setiawan Purnawali contribute to the research concepts preparation and literature reviews, data analysis, of article drafts preparation and validation.

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