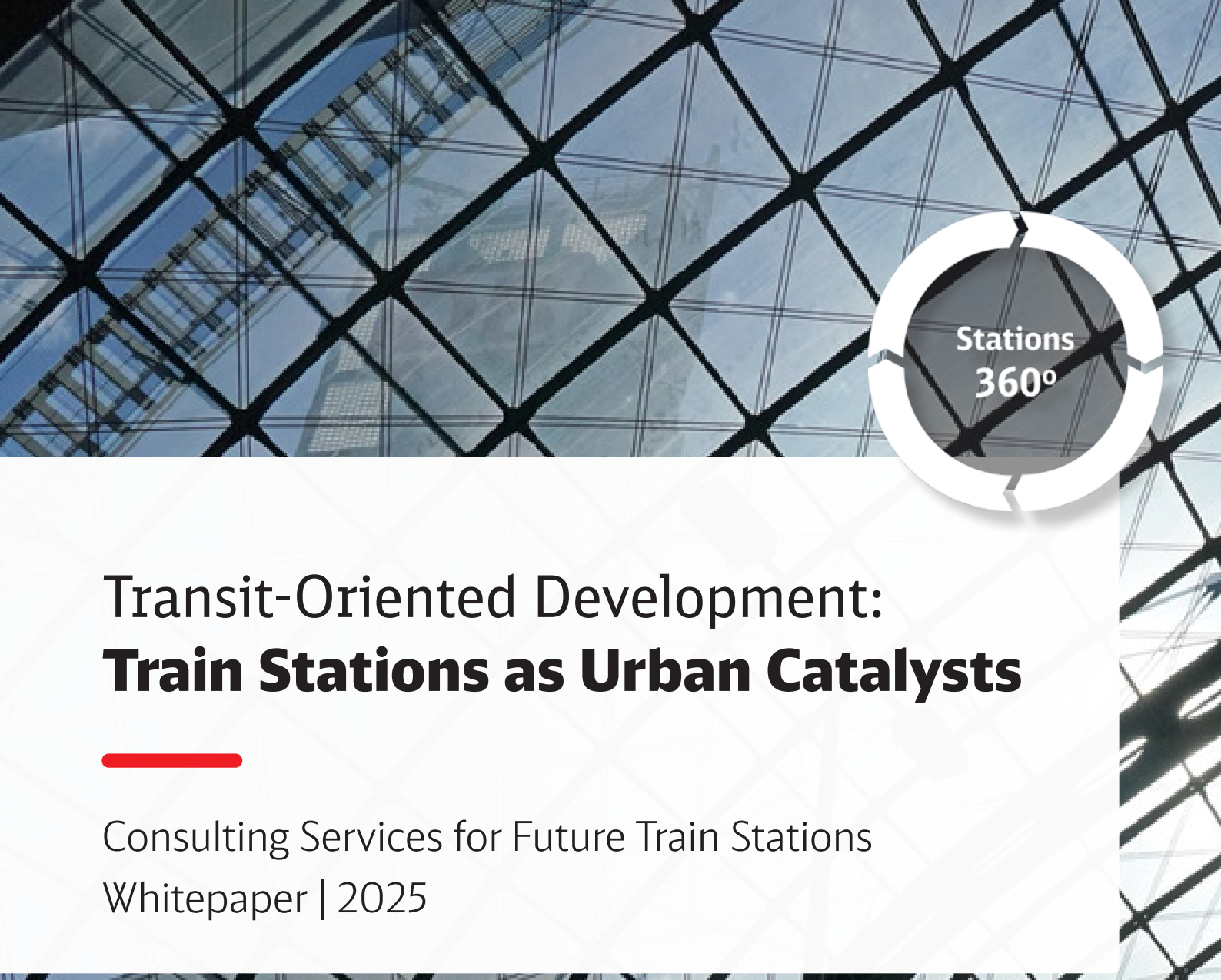

Transit-Oriented Development: **Train Stations as Urban Catalysts**

Consulting Services for Future Train Stations

Whitepaper | 2025

DB Engineering & Consulting

inno2grid

[1] *Source: xcjvüawsrbsfd*

Table of Content

Abbreviations

COE	Certificate of Entitlement
CPTM	Companhia Paulista de Trens Metropolitanos
DB	Deutsche Bahn
DB E&C	DB Engineering & Consulting
DB E.C.O.	DB Engineering, Consulting & Operations
DB InfraGO	DB's infrastructure division
ERP 2.0	Electronic Road Pricing
GIS	Geographic Information System
HDB	Housing & Development Board
HSR	High-Speed Rail
i2g	inno2grid
LTA	Land Transport Authority
LVC	Land-Value Capture
MRT	Mass Rapid Transit
MTR	Mass Transit Railway
S-Bahn	Stadtschnellbahn (urban rail railway)
SDG	Sustainable Development Goals
TOD	Transit-Oriented Development
U-Bahn	Untergrundbahn (underground railway)
URA	Urban Redevelopment Authority

What to expect

As urban environments continue to evolve, the role of train stations is becoming increasingly central to sustainable city development. Rather than viewing stations as simple transit points, there's growing recognition of their potential as integrated community hubs that support both connectivity and local development.
This whitepaper examines how Transit-Oriented Development (TOD) is reshaping the role of stations and presents a practical framework for implementation. The focus extends beyond efficient passenger movement to explore how stations can become places that strengthen communities, support local economies, and contribute to more sustainable urban environments.

The whitepaper covers:

- **Understanding Stations as Development Catalysts**
  Explore how TOD principles can transform transit infrastructure into multifaceted urban centers. The paper examines the practical ways stations can enhance mobility while strengthening economic activity and supporting regional sustainability goals.

- **Learning from International Experience:**
  Insightful international case studies from cities like Berlin, Singapore, and Tokyo demonstrate how TOD strategies have successfully integrated stations with urban planning.

- **Applying the Stations 360° Framework**
  The paper introduces a structured approach that combines digital innovations with sustainable design principles. This framework addresses passenger experience, business development opportunities, infrastructure flexibility, and energy efficiency in an integrated way.
  This whitepaper provides urban planners, transit authorities, and community leaders with practical insights and approaches for reimagining train stations. The content demonstrates how stations can evolve beyond their traditional transport function to become valuable assets that improve urban environments and support community needs.

1. Transit-Oriented Development (TOD)
In the Station Context

In today‘s evolving urban environments, stations play a pivotal role in enhancing mobility, reducing carbon footprints, and increasing accessibility, making them central to global sustainability efforts. Transit-Oriented Development (TOD) has emerged as a transformative approach in urban planning, offering a strategic framework to reshape the relationship between cities and their rail infrastructure.

At its core, TOD is about rethinking the interface between public transport systems—especially rail—and the urban environment. Rather than treating stations as simple infrastructural nodes, TOD reframes them as central elements in the spatial, economic, and social organization of cities.

This whitepaper provides insights into international TOD best practices, from Berlin‘s connectivity renaissance to Singapore‘s pioneering car-lite urban planning. Each showcase how curated transport and land use integration elevate public transport systems and redefine urban landscapes.

Understanding Transit-Oriented Development

TOD represents a strategic urban planning approach that integrates public transportation infrastructure with high-density, mixed-use development within a close radius of stations. This creates vibrant, walkable communities that combine residential, commercial, and retail functions, allowing daily needs to be met within walking or cycling distance while preventing urban fragmentation.

Successful TOD implementation is comprehensively structured around the „6 Ds“ framework:

- **Density:**
  Concentrating higher-density development around transit stations creates compact, high-ridership areas that support a self-sustaining ecosystem. This critical mass of people living, working, and shopping near stations increases transit viability and creates a sense of place.

- **Diversity:**
  Incorporating a mix of land uses—residential, commercial, retail, cultural, and recreational—ensures stations become 24-hour destinations rather than single-purpose commuter facilities. This diversity extends to housing types, creating inclusive communities that serve various income levels and household sizes.

- **Design:**
  Implementing pedestrian-friendly urban design with human-scaled buildings, active street frontages, and quality public spaces transforms stations into welcoming environments. Key design elements include reduced setbacks, street-facing entrances, and transparent facades that create visual interest at eye level.

- **Distance:**
  Ensuring key destinations are within comfortable walking distance (generally 5-10 minutes) from stations maximizes accessibility. This includes thoughtful placement of building entrances, creation of direct pathways, and elimination of barriers that extend perceived walking distances.

- **Destination Accessibility:**
  Extending beyond immediate station areas, this principle focuses on connecting TOD zones to the broader regional network of employment centers, educational institutions, healthcare facilities, and cultural attractions. High-quality transit service ensures that these key destinations throughout the metropolitan area are accessible without requiring private vehicle ownership.

- **Demand Management:**
  Implementing policies and programs that discourage unnecessary car usage while promoting sustainable transport alternatives. Strategies include reduced par

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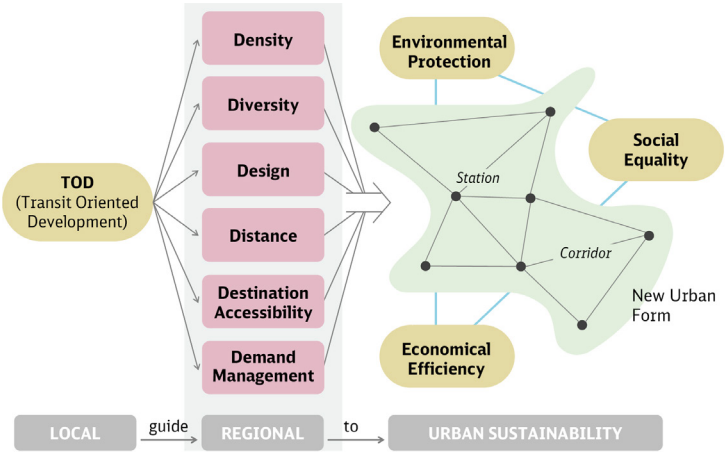
- **Demand Management:**
  Implementing policies and programs that discourage unnecessary car usage while promoting sustainable transport alternatives. Strategies include reduced parking requirements, shared parking facilities, unbundled parking costs (separating parking expenses from housing costs), workplace travel planning, and incentives for transit use, carpooling, cycling, and walking.



[2] ***Source: Was schreiben wir hier rein?***

Stations as Mobility Hubs: Seamless Passenger Intermodality

Within the TOD framework, stations transcend their traditional role as mere access points to rail networks, evolving into multifaceted urban assets that serve as comprehensive mobility hubs, facilitating seamless transitions between different transport modes and catering to diverse passenger needs.

Beyond simply hosting rail platforms, these hubs:

- **Facilitate intuitive intermodal transfers through** thoughtful spatial organization and clear sightlines

- **Offer real-time multi-modal information systems** that help passengers make informed travel decisions

- **Provide dedicated infrastructure for emerging mobility** options like e-scooters, ride-sharing, and autonomous vehicles

- **Feature synchronized scheduling** that minimizes transfer times between different transport modes

- **Incorporate universal design principles** ensuring accessibility for all users regardless of age or abilit

Stations as Social and Commercial Hubs: Placemaking at the Heart of Urban Life

Stations in successful TOD implementations serve as vibrant urban hubs that merge mobility with commerce, culture, and social interaction. Successful station environments prioritize placemaking, transforming transit hubs into welcoming spaces where passengers and visitors can shop, dine, meet, and engage with the city. Integrating retail, dining, office spaces, cultural venues, and public gathering areas turns stations into active city centers, accommodating both daily commuters and leisure visitors. Architectural and urban design (e.g., size of roads, access for pedestrians and non-motorized vehicles, planning requirements for density, and required usage of adjacent development) plays a crucial role, with emphasis on natural light, open spaces, and high-quality materials contributing to a sense of well-being. Interactive public spaces, green areas, and elements reflecting local character create a unique identity, making stations not just transit points but destinations in their own right.

Stations as Value Catalysts: The MTR Model

In the realm of urban development, transit stations serve as potent catalysts for economic growth and community enrichment. Hong Kong's MTR Corporation stands as a prime example of effective TOD execution, with its innovative „Rail Property" model. Since the 1970s, this model has strategically leveraged land within a 500-meter radius of stations,

[3] ***Source:Deutsche Bahn AG***

[4] ***Source: Deutsche Bahn AG***

transforming these areas into thriving economic centers. With annual returns of approximately 9% over the past five years, MTR has transformed station areas into economic powerhouses. The model works through a systematic process:

1. Strategic Land Selection:
MTR collaborates with the government to identify prime land.

2. Secure Development Rights:
Acquires rights at pre-set values to open development opportunities.

3. Competitive Bidding:
Awards development rights to developers through a structured bidding process.

4. Profit Sharing and Management:
Engages in profit-sharing while managing construction and leasing.

Since 1995, this approach has created approximately 100,000 new residential units, increased ridership, and attracted businesses to station areas. Studies show that well-designed stations attract an additional 35,000 passengers on weekdays, boosting both fare revenues and local commerce.

Stations as Space Optimizers: Leveraging Reduced Parking

Developments nearby often reduce the need for expansive parking spaces, thereby maximizing useful space. Exemplifying this advantage, the city of Hamburg has revised local planning regulations to replace fixed parking space requirements with mobility proofs. This encourages the use of public transport and pedestrian pathways, reinforcing the station's role as a connector within urban areas.

Stations as Growth Catalysts: Connectivity as Economic Fuel

Smaller communities can also leverage TOD principles effectively, as demonstrated by Montabaur Station in Germany. Despite serving a town of just 14,000 inhabitants, this station on the Cologne-Frankfurt high-speed rail line has catalyzed impressive economic growth.

The station was conceived in the 1990s as the nucleus of a new urban quarter spanning 51 hectares, designed to accommodate 4,000 residents and 2,000 workers through mixed-use development. The ICE-Park business park, a significant component of this development, attracted over 30 companies by 2006, creating approximately 600 jobs. Notably, United Internet chose Montabaur as its headquarters, further solidifying the area's economic relevance.

[5] ***Source:<Keine Daten von Verknüpfung>***

A 2010 study by the University of Hamburg and the London School of Economics found that between 2002 and 2006, the station's presence contributed to an additional 2.7% economic growth in its catchment area. This success demonstrates how strategic connectivity can drive long-term economic development even in smaller urban settings.

Stations as Drivers of Sustainability

New stations serve as powerful catalysts for sustainable mobility, reshaping urban landscapes by promoting low-impact travel options:

- **Reduced Emissions:** Trains produce significantly lower emissions per passenger; for example, the London-to-Paris rail journey emits just 8.3 kg of CO2 per passenger compared to 48 kg from cars or 122 kg from planes.
- **Improved Air Quality:** Fewer cars on the road decrease pollutants like nitrogen oxides and particulate matter.
- **Limited Urban Sprawl:** Concentrated development around stations preserves natural landscapes.
- **Active Transportation:** Pedestrian-friendly designs and bike-sharing hubs foster walking and cycling.

Successful implementations like Stockholm Central Station (featuring a green roof that supports biodiversity) and London's King's Cross Station (generating approximately 10% of its energy from solar panels) demonstrate how stations can become sustainability hubs through thoughtful design.

The Case of 'Bad' TOD: Transit Adjacent Development

While TOD has demonstrated numerous benefits, it is crucial to approach it with a holistic perspective to fully realize its potential. Not all developments near transit stations align with these principles, often resulting in what is termed Transit Adjacent Development (TAD). TAD refers to developments located near transit stations that capitalize on their proximity to transit but do not integrate design elements that optimize transit use. Effects include:

- **Reduced Transit Ridership:** Without intentional design elements that encourage public transit usage, TAD developments may see limited patronage of the transit systems. The presence of convenient parking options can lead individuals to continue favoring personal vehicles over public transport.
- **Sustained Car Dependency:** TAD generally lacks the features that attract walking and cycling, thereby perpetuating higher car usage. This reliance contributes to traffic congestion and exacerbates environmental challenges.
- **Inefficient Land Use:** Developments characterized by TAD may not utilize land as effectively as TOD, often contributing to urban sprawl. This sprawl can lead to the loss of valuable green spaces that are crucial for urban sustainability.
- **Unrealized Economic Potential:** Without the density and vibrancy that characterize TOD, TAD fails to stimulate local economies to the same degree. The lack of mixed-use spaces and pedestrian-friendly environments may diminish business opportunities and economic vitality.
- **Lower Quality of Life:** The absence of walkability and integrated mixed-use development in TAD areas can result in a less dynamic community environment. Residents might experience reduced convenience, lower levels of social interaction, and an overall decline in the vibrancy of their neighborhood.7

Emphasizing the holistic application of TOD principles ensures more sustainable, integrated, and vibrant urban environments. By recognizing and addressing the limitations of TAD, planners and developers can better harness the potential of transit stations to create thriving communities.

Lessons learned: Recommendations for City Development

To maximize TOD benefits, cities should consider:

1. Regulatory Adaptation:
Adjust planning regulations to encourage TOD initiatives, such as Hamburg's innovative shift from fixed parking man-

dates to a „proof of mobility“ approach. Additionally, explore other regulatory adaptations like mixed-use incentives and height adjustments near transit zones to better support TOD.

2. Value Capture Mechanisms:
Establish KPIs to assess TOD effectiveness in areas like land value uplift, modal shift, job creation, and emissions reduction. Use data to adapt strategies and secure continued investment.

3. Joint Development Models:
Establishing partnerships between public entities and private developers to share risks and rewards.

4. Environmental Integration:
Incorporate green design principles, sustainable materials, and renewable energy sources in TOD planning. Emphasize the addition of urban green spaces and energy-efficient building designs to address potential environmental challenges and enhance community resilience.

5. Integrated Mobility Strategies:
Ensure coordination between urban development and all mobility providers—including public transport operators, micromobility providers, and shared mobility services. Encourage joint planning for scheduling, ticketing (e.g., Mobility-as-a-Service platforms), and infrastructure to improve user experience and ridership.

6. Stakeholder Engagement and Social Inclusion:
Foster early and continuous engagement with residents, businesses, and civil society. Incorporate community feedback into TOD plans to ensure social inclusiveness, mitigate gentrification risks, and build long-term public support.

7. Leverage Smart City Technologies:
Utilize digital tools (e.g., real-time data platforms, smart energy grids, digital twins) to enhance station planning, optimize operations, and support user-centric mobility solutions within TOD areas.

Well-executed TOD principles can transform station areas into vibrant centers of activity, creating lasting economic value and enhancing quality of life for residents. In the following chapter, we explore a diverse array of international TOD success stories that offer valuable insights for practitioners.

2. TOD in Action:
International Perspectives

Berlin Central Station: A Hub of Connectivity and Urban Renewal

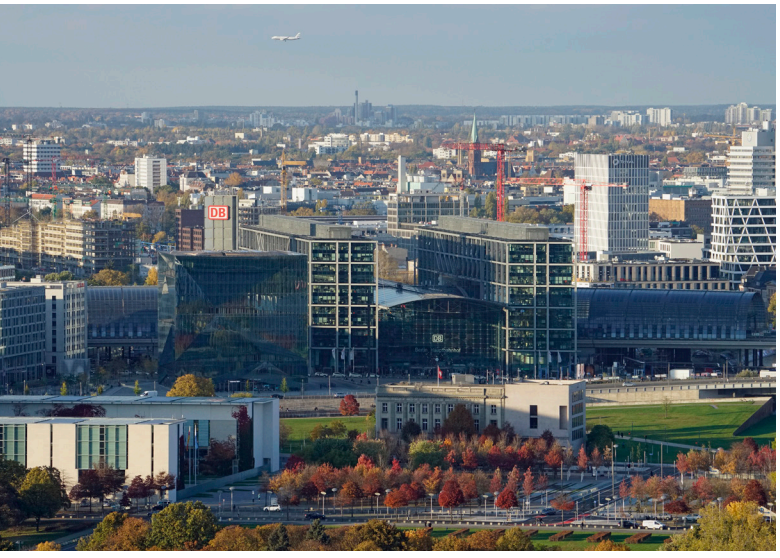
Berlin Central Station (Berlin Hauptbahnhof), serves as a key example of TOD in practice. It is the world's largest intersection station, centrally located in Berlin, the capital of Germany.

About Berlin Central Station

Constructed between 1997 and 2006, the station handles approximately 350,000 passengers per day. With a built-up area covering 60,000 square meters across all floors, the project's estimated cost was around 975 million euros. Designed by architects from gmp Hamburg and Schlaich, Bergmann und Partner, the station's architecture emphasizes functionality and aesthetics, contributing to its role as a key urban landmark.

Berlin Hbf features two main levels for train services: the lower level, situated 25 meters below ground, with 4 platforms and 8 tracks, and the upper level, 15 meters above ground, with 3 platforms and 6 tracks. Between these two levels lies a three-level shopping centre encompassing 15,000 square meters of retail and service space. Additionally, two high-rise buildings above the tracks provide 45,000 square meters of office space.

Berlin Central Station is located at a strategic point within Berlin. It was officially opened in 2006, on the site of the historic Lehrter Bahnhof. The station's development was part of a broader initiative to renew and modernize Berlin following the reunification of Germany. As the largest railway station in Europe by area, Berlin Central Station plays a significant role in both the German and European railway networks. It serves as a central hub for long-distance, regional, and local train services, seamlessly connecting with Berlin's public transport system, which includes U-Bahn (subway), S-Bahn (urban rail), trams, and buses. Since its opening, connection times have decreased significantly, while services and overall capacity have improved.



[6] ***Source:Deutsche Bahn AG / Volker Emersleben***

[7] ***Source:Deutsche Bahn AG***

The Impact of TOD in Practice
Berlin Central Station showcases how effective TOD can transform a previously underutilized area into a vibrant urban hub. Before the station‘s completion, the surrounding area suffered from a lack of infrastructure investment, resulting in low commercial viability and limited residential attractiveness. This resulted in an area that was perceived as „dead“ and isolated from the thriving
parts of Berlin.

Strategic TOD principles were implemented to unlock the area’s full potential. By integrating mobility with urban planning, the area began to attract development and investment, transforming it into a dynamic and appealing urban quarter. Extensive developments adjacent to the station, guided by a master plan from O. M. Ungers in 1994, cover a building area of 350,000 square meters with a total floor space of 255,000 square meters. These projects include hotels, offices, catering, commerce, and housing, creating a dynamic urban district that serves both the transit needs and the daily lives of residents and visitors.

A new city quarter, Europacity, has been developed on approximately 61 hectares of land surrounding the station. This development is centrally located near major political and cultural institutions and is characterized by variety of functions.
For example, the urban design places particular emphasis on a pedestrian-friendly environment that prioritises safety and accessibility.

Additionally, the proximity to Berlin‘s main railway station provides excellent access to various modes of transport.

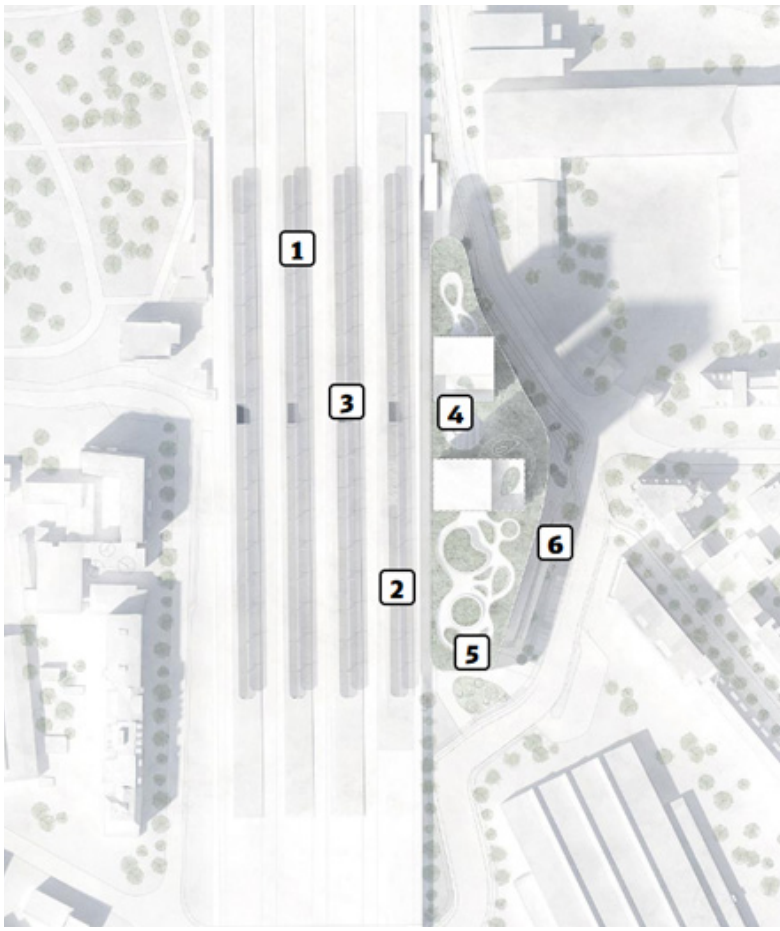
This variety of functions enhances the station’s role by creating a dynamic urban district that serves both the transit needs and the daily lives of residents and visitors. This transformation underscores the power of integrated urban planning and mobility solutions in fostering sustainable and vibrant urban development. Europacity and the further surrounding areas continue to evolve, showcasing the ongoing benefits of TOD in creating livable, access-ible, and attractive urban spaces.

[8] ***Source:<Keine überschneidende Verknüpfung>***

Hamburg Diebsteich – Relocating a Station for Future Growth

The Diebsteich development initiative in Hamburg exemplifies the strategic implementation of Transit-Oriented Development (TOD) principles in contemporary urban transformation. At its core lies the relocation of Hamburg-Altona station, one of Germany's most significant rail terminals and Hamburg's second-largest long-distance station after Hamburg Central Station. Serving approximately 150,000 passengers daily through regional, long-distance, and S-Bahn connections, Hamburg-Altona functions as a critical terminus for services from across northern Germany and Denmark.

The decision to relocate the Hamburg-Altona station carries historical significance as the third such move in the station's history. Originally situated at Platz der Republik park, the station first moved to its current Altona location in 1844. The upcoming 2027 relocation to Diebsteich represents a strategic response to evolving urban dynamics and modern mobility requirements, building upon this legacy of adaptation. February 2025 marked a significant milestone with the opening of the new S-Bahn station Diebsteich, which now serves as a crucial node in Hamburg's transportation network. The station handles approximately 12,500 daily passengers across lines two major lines. In addition, the new Hamburg-Altona station's design incorporates six tracks for regional and long-distance services, complemented by two dedicated S-Bahn tracks, all designed with comprehensive accessibility in mind.



[10] ***Source:<Keine überschneidende Verknüpfung>***

[9] ***Source:<Keine Daten von Verknüpfung>***

The project's scope extends well beyond transportation infrastructure. The development plan encompasses a thoughtfully curated mix of urban functions, including modern office complexes, retail establishments, and hospitality facilities. Cultural and recreational amenities, including a football stadium and concert hall, are integrated into the master plan, positioning Diebsteich as an emerging social and cultural hub. The relocation has also unlocked valuable urban space in Altona, enabling the development of 1,900 new residential units, with a significant portion designated for public housing. These new residential units will remain connected to the transport network through the remaining Hamburg-Altona S-Bahn station. Environmental sustainability remains fundamental, exemplified by a five-hectare green corridor connecting the city quarter Altona to Hamburg's main river, the Elbe.

Singapore: A Global Leader in TOD

Singapore stands as a global exemplar of TOD, leveraging a government-driven approach to integrate urban planning with efficient public transportation. With a population exceeding 5.6 million on a land-scarce island, Singapore faces high urban density and space constraints, necessitating a sustainable, car-lite development model.

Since the 1980s, Singapore has prioritized TOD as a key pillar of its growth strategy, launching the Mass Rapid Transit (MRT) system in 1987. Over the decades, the MRT network has evolved into a densely connected system, serving as the backbone of urban development. By strategically placing MRT stations within new town centers and commercial hubs, Singapore ensures that high-density housing, workplaces, and public amenities flourish around transit nodes. This minimizes car dependency, enhances public transport accessibility, and contributes to a highly livable urban environment.

Core TOD Strategies in Singapore

To successfully integrate transit with urban development, Singapore follows different key TOD strategies that ensure seamless connectivity and economic sustainability. These strategies harmonize transit infrastructure, land use, and community development to create a thriving, accessible city.

Long-Term Integrated Planning

Singapore's urban planning framework is structured into three levels:

- **A Long-Term Plan**
  (formerly the Concept Plan) sets overarching national objectives.
- **The Master Plan**
  translates these objectives into zoning and land-use guidelines.
- **Detailed Local Plans**
  provide area-specific development strategies.

This hierarchical planning structure optimizes land use, supports economic growth, and accommodates population increases. Key agencies, including the Urban Redevelopment Authority (URA), Land Transport Authority (LTA), and Housing & Development Board (HDB), collaborate to synchronize transit expansion with urban development. For example, when a new MRT line is planned, zoning regulations are adjusted to increase plot ratios (allowing for higher-density construction) and enable mixed-use developments in station precincts. This proactive approach ensures that transit corridors are fully leveraged to support sustainable urban growth.

[11] Source:<Keine überschneidende Verknüpfung>

Mixed-Use Developments

Singapore prioritizes integrated neighborhoods that blend residential, commercial, and recreational spaces, reducing the need for long commutes and promoting walkability.

Tampines and Jurong East are prime examples of self-sufficient communities where MRT stations serve as central hubs. These areas combine workplaces, retail centers, and public amenities, ensuring that residents can access daily needs within a short walk or train ride. This reduces congestion, encourages active mobility, and fosters stronger local economies.

Integrated Transport Hubs

MRT stations in Singapore are designed as multimodal hubs, seamlessly connecting different transport modes to enhance commuter convenience. Many major stations include:

- **Integrated rail services**
  (MRT, LRT, and regional rail connections)
- **Bus interchanges located within or adjacent to MRT stations**
  (e.g., Woodlands MRT station features an underground bus interchange to facilitate direct transfers)
- **Pedestrian networks and last-mile solutions, such as**
  sheltered walkways and underground links,
  ensuring uninterrupted connectivity between transit and nearby commercial or residential spaces.

By co-locating these services, Singapore maximizes efficiency and ensures seamless mobility across its public transport network.

Pedestrian & Cycling Infrastructure
Walkability and cycling are integral to Singapore's car-lite urban strategy. The government has invested in extensive pedestrian and cycling infrastructure, ensuring that first- and last-mile connectivity is convenient and safe.

- Dedicated cycling paths, such as those in Tampines (Singapore's first cycling town), were introduced in 2010 to promote sustainable travel options.
- Continuous sheltered walkways in both downtown and residential areas enhance pedestrian comfort, ensurin all-weather accessibility for daily commuters.

Sustainable & Resilient Urban Design
Singapore integrates sustainability and climate resilience into its TOD framework, as reflected in the 2019 Master Plan. The city's transit-integrated design emphasizes:

- **Green spaces and energy-efficient infrastructure,** improving air quality and urban biodiversity.
- **Flood mitigation measures,** such as elevated platform levels and widened drainage systems, protecting key transit nodes from climate risks.
- **Low-carbon urban design,** incorporating eco-friendly building materials and renewable energy solutions in transit developments.

By embedding sustainability at every level of urban planning, Singapore ensures that its transit infrastructure supports long-term resilience and environmental responsibility.

[12] Source:<Keine überschneidende Verknüpfung>

Community Engagement
Public involvement is a critical aspect of Singapore's TOD model. The government actively engages communities in planning processes, ensuring that transit-oriented developments reflect local needs and aspirations.

Through initiatives like public consultations, digital feedback platforms, and participatory urban design workshops, Singapore fosters a sense of ownership and inclusivity among residents. This ensures that TOD benefits all social groups while reinforcing the city's vision for an accessible and community-driven transit system.

Policy & Demand Management Innovations
Singapore complements its TOD strategies with progressive policies that enhance transit efficiency, manage car dependency, and ensure financial sustainability.

Land Value Capture & Rail + Property Model
Singapore strategically leverages its land ownership model to fund transit development, ensuring TOD remains economically viable. The government:

- **Leases land near transit hubs to private developers,** generating revenue for future transit investments.
- **Uses lease revenue to expand MRT infrastructure** (e.g., proceeds from Marina Bay land sales were used to finance the Downtown MRT Line).
- **Develops public housing near MRT stations,** allowing the HDB to capture rising land values and subsidize affordable housing projects.

Car Ownership Control & Congestion Pricing
To discourage excessive car use and prioritize public transit, Singapore has implemented:

- **The Certificate of Entitlement (COE) system,** which caps private vehicle growth through an auction-based permit system.
- **Electronic Road Pricing (ERP 2.0), a world-first satellite-based tolling system,** that dynamically adjusts road pricing to discourage congestion during peak hours.

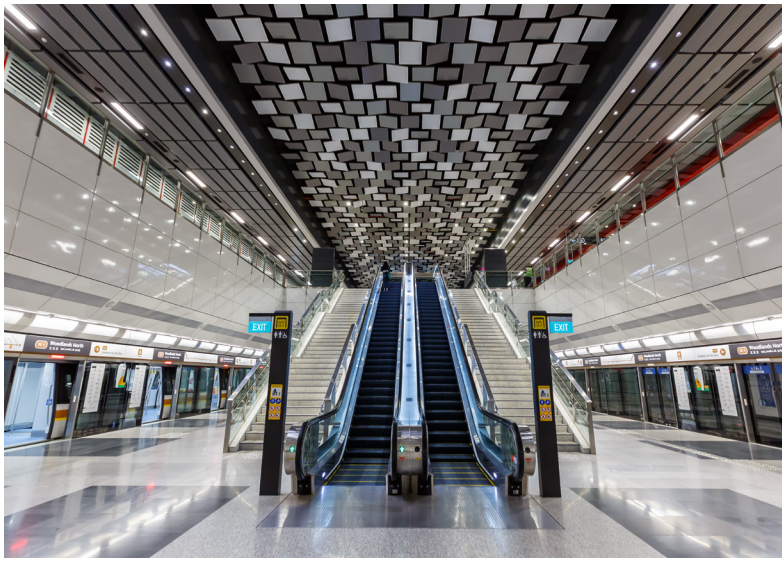
Smart Mobility & Digitalization
Singapore integrates cutting-edge technologies into its transit infrastructure to optimize mobility and enhance the commuter experience:

- **Contactless fare systems** (EZ-Link / SimplyGo) simplify transit payments.
- **AI-driven real-time transit tracking and fleet management** improve service reliability.
- **GIS-based urban planning tools** optimize station catchment areas and feeder bus services, ensuring efficient multimodal integration.

Impact Assessment: Measuring TOD Success in Singapore
Singapore's TOD model has transformed mobility, economic growth, and environmental sustainability.

- MRT ridership reached 3.5 million daily rides in 2019 (pre-pandemic).
- 67% of peak-hour commuting trips rely on public transport, while car use has declined to the low 30% range.
- Property values near MRT stations have surged, with HDB flats and private condos commanding price premiums.
- The rise of business hubs like Jurong East and Paya Lebar has decentralized economic activity, reducing congestion in the core.
- Car ownership remains low at ~35% of households, an exceptionally low figure for a high-income nation.
- Sustainable transport policies have reduced per-capita transport emissions, reinforcing Singapore's climate goals.

Singapore's government-led TOD model stands as a global benchmark in urban mobility, financial sustainability, and integrated land-use planning. By balancing density, accessibility, and economic resilience, the city has created a scalable, future-proof transit system that other cities can learn from.



[13] ***Source:© Markus Mainka (www.aviation-stock.de)***

Munich: From Industry to Innovation - Development and Munich's Urban Evolution

The development plan at Friedenstraße exemplifies how TOD can drive urban transformation, sustainability, and connectivity.

The primary goals of the development plan include transforming the area into a mixed-use urban district, ensuring sustainable and high-quality urban design, and enhancing mobility and connectivity throughout the district.

Located in the Werksviertel area of Munich, this redevelopment project aims to convert a traditional commercial and industrial zone into a vibrant and modern mixed-use urban district. The project includes a variety of spaces such as residential areas, offices, a concert hall, hotels, gastronomic venues, social infrastructure, and sports facilities.

The district plans to provide a future-oriented environment for living and working. It emphasizes diverse, community-oriented architecture, integrated green spaces, and high-quality open-space design. These elements collectively create a visually appealing and functional urban landscape.

Being designated as a core urban area in zoning plans, the MBS Development supports high-density, sustainable, and innovative urban growth in Munich. The project focuses on short travel distances to enhance walkability and connectivity, integrating various modes of transportation to facilitate easy movement and access. It promotes a balanced work-life environment and creates an integrated urban community that meets the needs of modern convenience and sustainability.

The MBS Development shows how TOD can transform urban spaces by improving accessibility and promoting comprehensive urban development. This project illustrates the potential of TOD to create efficient, modern, and livable urban environments that foster economic growth and community well-being, directly linked to Munich East to be refurbished and expanded rail station facility and modern transportation hub providing commuter services for S-Bahn train 1st and 2nd trunk rapid cross rail services, regional and intercity connections and transit urban and city connections via trams and bus services.

[14] ***Source:Deutsche Bahn AG / Uwe Miethe***

[15] ***Source:Deutsche Bahn AG / Uwe Miethe***

Tokyo - Shibuya Station: A Model for Sustainable Urban Hubs

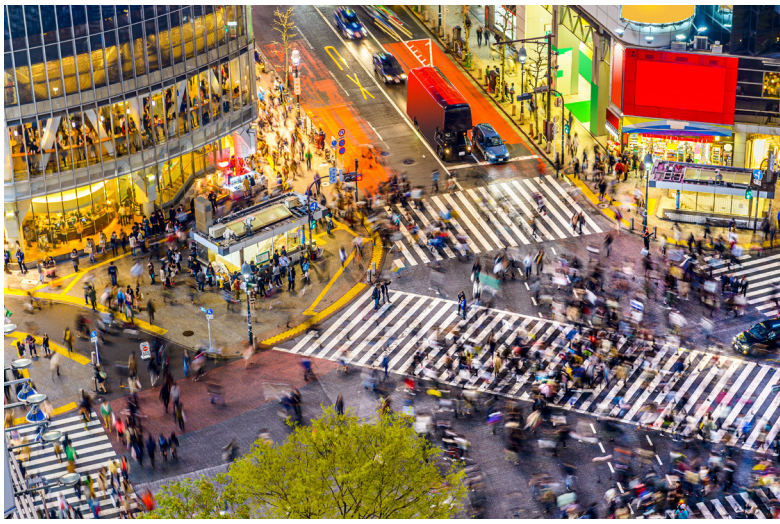
Shibuya Station, a major hub in Tokyo, is undergoing significant redevelopment, described as a „once-in-a-century" project, with completion targeted for 2027.

Shibuya Station, one of the busiest railway hubs in Japan, serves over 2 million passengers daily and is central to Tokyo's transportation network. The redevelopment, led by JR East, Tokyo Corporation, and Shibuya Ward, encompasses multiple projects under the Greater Shibuya initiative, aiming to integrate work, living, and play with a focus on digital and sustainable initiatives. Key developments include Shibuya Hikarie, a 43-story skyscraper completed in 2012, and ongoing projects like Shibuya Stream, which opened in 2018, enhancing commercial and pedestrian spaces.

Shibuya Hikarie, completed in 2012, is a 183-meter-tall skyscraper with LED lights, offering shopping, office, and entertainment facilities, connected to the station via underground and aboveground passageways. Shibuya Stream, part of the south area development, opened in 2018, featuring a 600-meter walkway along the restored Shibuya River, adding green spaces and enhancing the urban environment. Other projects, such as the Shibuya 2 Chome Project, span multiple blocks east of the station, contributing to the area's transformation into a mixed-use hub.
The Shibuya City Urban Development Master Plan, unveiled in 2019, calls for dynamic public areas and green spaces, doubling as safe havens during natural disasters, and nurturing diverse lifestyles and cultures while encouraging new businesses. These efforts aim to create pedestrian-friendly environments, with walker decks and traffic reorganization enhancing connectivity, positioning Shibuya as an international tourist and cultural city.

Research indicates that land prices in Shibuya Ward increased by 9% between the fourth quarter of fiscal 2018 and 2019, surpassing Minato Ward to become Tokyo's most expensive sub-market, with rents reaching ¥5,136 per square meter, a record high. This growth is attributed to the influx of tech and media companies, likely boosting employment and retail sales. The redevelopment's focus on commercial facilities and office spaces suggests increased economic activity, potentially attracting more businesses and residents.

The area's attractiveness, enhanced by landmarks like the scramble crossing and Hachiko statue, draws tourists, contributing to population density, estimated at over 15,000 people per square kilometer. The development's pedestrian-friendly design likely encourages residential growth, supporting a vibrant urban community.



[16] ***Source:<Keine überschneidende Verknüpfung>***

[17] ***Source:<Keine überschneidende Verknüpfung>***

São Paulo‘s CPTM Lines: Boosting Urban Activity through Strategic TOD

CCR Rail Concessions in São Paulo State has implemented TOD strategies on the CPTM Lines 8 and 9 to enhance station connectivity with local land use and integrate rail infrastructure within the urban context. This case study, from the perspective of DB E.C.O. Group, focuses on how these efforts have turned rail stations into activity hubs with retail opportunities and improved the overall urban connectivity and functionality.

The TOD initiatives on the CPTM Lines 8 and 9 involve significant investments in both tariff and non-tariff business opportunities to foster development around the stations. By improving the relationship between stations and their neighborhoods, these initiatives aim to enhance connectivity and functionality. Key efforts include identifying land-use opportunities, raising awareness, and ensuring better accessibility to the stations.

Improving Station Connectivity with Local Land Use: Effective TOD requires improved integration between rail stations and the surrounding land use. Our consultancy work with CCR Rail Concessions has shown that seamless connectivity between stations and local neighborhoods enhances the overall accessibility and utility of the transit system.

Integration of Rail Infrastructure with Urban Context: Integrating rail infrastructure within the local urban context is essential for maximizing the benefits of TOD. This involves developing rail stations as activity hubs that offer retail and commercial opportunities, thus turning them into central points of community engagement and economic activity.

Enhanced Accessibility and Awareness: Identifying appropriate land-use opportunities and enhancing awareness about the benefits of TOD significantly improve accessibility. This approach ensures that transit stations are easily accessible and effectively utilized, promoting greater use of public transportation.

The TOD initiatives on São Paulo’s CPTM Lines 8 and 9, supported by DB E.C.O. Group, showcase how strategic investments and planning can transform rail stations into vibrant activity hubs. By improving station connectivity with local land use and integrating rail infrastructure within the urban context, these projects successfully enhance accessibility and promote integrated urban development. This case study highlights the importance of identifying land-use opportunities and raising awareness to create sustainable, prosperous urban environments.

[18] ***Source:<Keine überschneidende Verknüpfung>***

Metrolinx (Toronto) - A Public Sector-Led TOD Strategy

Metrolinx, Ontario's regional transit authority, has pioneered a „Transit-Oriented Communities" approach to enhance the integration of high-density, mixed-use development around GO Transit stations. This strategy is exemplified by the re-development of Union Station in downtown Toronto, which has become a commercial, residential, and business hub. This case study, from the perspective of DB E.C.O. Group, examines Metrolinx's public sector-led TOD strategy and its impact on urban development and transit operations.

Union Station Redevelopment

The redevelopment of Union Station in Toronto is a prime example of how TOD can transform a transit hub into a dynamic urban center. By partnering with developers, Metrolinx has facilitated the creation of a station-centric development model that attracts private investment and enhances transit ridership. The station area now features a blend of commercial spaces, residential buildings, and business offices, showcasing the potential of TOD to create vibrant, accessible communities.

Public Sector Leadership in TOD: Public agencies, such as Metrolinx, can effectively lead TOD efforts by establishing clear zoning guidelines and providing development incentives around transit stations. Our work with Metrolinx illustrates that proactive public sector involvement is crucial for guiding and sustaining TOD projects.

Sustaining Transit Operations Through Revenue: Long-term revenue streams from station-area leasing and commercial partnerships are essential for sustaining transit operations. The Union Station redevelopment demonstrates how strategic TOD can generate substantial economic benefits, which in turn support the ongoing costs of maintaining and expanding transit services.

Metrolinx's TOD strategy, supported by DB E.C.O. Group, serves as a compelling example of how public sector-led initiatives can improve accessibility and promote integrated urban development. By focusing on high-density, mixed-use development around transit stations, Metrolinx has successfully transformed Union Station into a bustling urban hub. This case study highlights the importance of leadership and strategic planning in the public sector in order to realise the full potential of TOD to create sustainable and prosperous communities.

[19] ***Source:<Keine Daten von Verknüpfung>***

3. Stations 360°

A sustainable platform for digital enabled, multimodal Mobility

[20] ***Source:<Keine Daten von Verknüpfung>***

As the world moves towards more sustainable and efficient means of transportation, train stations are evolving beyond mere points of transit. They are becoming vibrant landmarks that reflect the cultural heritage of their surroundings and serve as inclusive social hubs. Stations 360° embodies this vision by delivering customized consulting services that set new global standards for train stations and mobility hubs.

Our future train station is a dynamic and lively landmark, showcasing the cultural heritage of the neighborhood. It is not only a transportation hub but also a safe and inclusive social hub, a meeting point welcoming people of all ages and diverse backgrounds.

The stations offer a smooth and efficient experience, seamlessly integrating various modes of transport and services including freight transportation. Powered by advanced technologies, including automation and artificial intelligence, the stations utilize the Digital Twin technology to enable real-time monitoring and predictive analytics. This allows operators to optimize energy usage, reduce emissions, and minimize resource consumption.

We prioritize zoning around the stations to ensure seamless integration of multimodal transportation and services, while minimizing disruptions to existing train station services during the modernization process. In addition, we make use of TOD (Transit Oriented Development) principles to foster regional development though a mix-use space with station surrounded by residential, commercial, shopping malls and service areas.
Travelers always have optimal mobility choices – whether it is for travelling to another part of the country or

maybe just reaching the other end of the city. A mindful multimodal infrastructure design is in place to facilitate reaching the destination in the shortest time, paying an affordable ticket, with a well-planned trip. The stations offer a seamless mobility also for the first and last-mile connections. This enables people to conveniently use bikes, on-demand transportation services, pedestrian paths, or other personal mobility choices.

[21] ***Source:<Keine überschneidende Verknüpfung>***

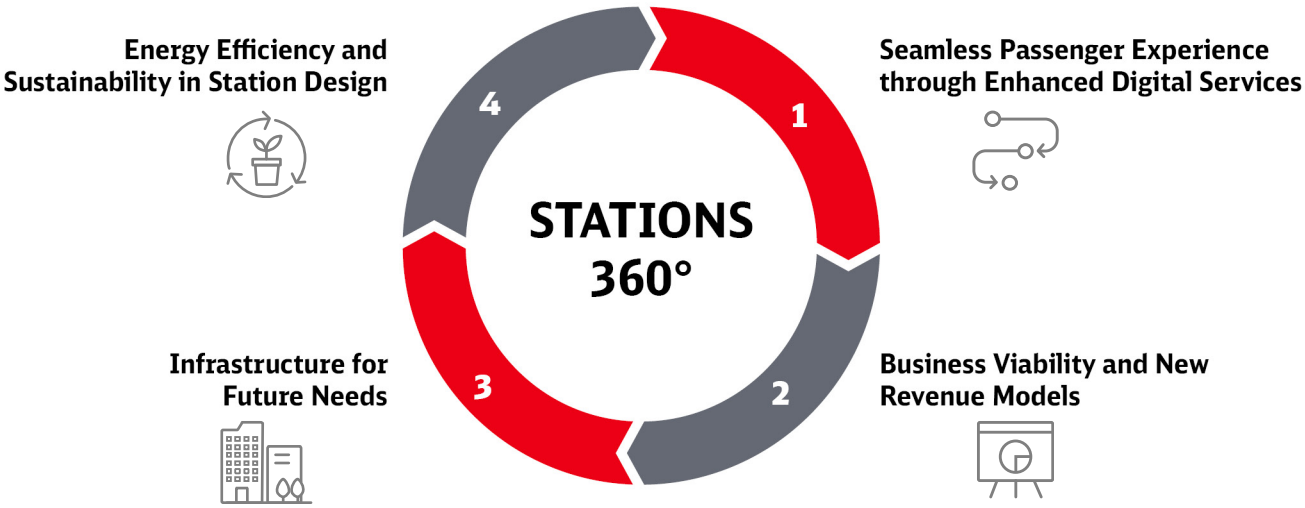
The state-of-the-art stations' infrastructure has a significant economic impact on the surrounding area. By providing retail spaces, health centers, co-working spaces, and daycare

facilities for working parents, the station creates jobs, attracts businesses, and stimulates local economic growth. As a results, the stations can transform the cities, enable higher revenues to the public authorities and rail operators from the LVC (land-value capture) and generating more ridership to the system with the increasing number of travelers, people moving to the surroundings of stations and tourists.

Our future train station operates on a prosumer model that generates more energy than it consumes and contribute to the achievement of several UN SDG's (United Nations Sustainable Development Goals).

The train station's construction is a great example of modern, practical, and aesthetic infrastructure design. It represents our decades of experience building great projects that have been well-planned transit hubs integrated into a fully functioning transport network. It symbolizes our forward-thinking vision for the future and making use of our past experiences.

Our future stations' success relies on a collaborative effort involving city and government authorities, transport operators, station and railways owners, developers, and local communities. With mobility as its primary function, our train stations designed to be a public space for the people, by the people.



[22] ***Source:<Keine überschneidende Verknüpfung>***

Core Components of Stations 360°
The Stations 360° framework consists of four complementary components that together form a comprehensive approach to modern railway station development:

1. **Seamless Passenger Experience:**
Focuses on creating intuitive journeys through digital services and smart technologies that respond to passenger needs and optimize station operations.

2. **Business Viability:**
Explores sustainable financial models and revenue opportunities beyond traditional ticket sales, positioning stations as community hubs with diverse offerings.

3. **Future-Ready Infrastructure:**
Addresses the physical design and technical requirements for adaptable stations that can evolve with changing urban needs and transportation patterns.

4. **Energy Efficiency and Sustainability:**
Encompasses resource-conscious design principles and systems that reduce environmental impact while improving operational efficiency.

[23] ***Source:<Keine überschneidende Verknüpfung>***

The Expertise behind Stations 360°
As part of DB E.C.O. Group, **DB Engineering & Consulting (DB E&C)** plays a key role in shaping sustainable and efficient rail infrastructure worldwide. DB E.C.O. Group unites Deutsche Bahn's expertise in engineering, construction, operations, and environmental solutions, ensuring integrated, future-proof mobility. With a strong commitment to quality, safety, and innovation, DB E&C delivers cutting-edge infrastructure solutions, supporting projects from concept to completion.
inno2grid, also part of DB E.C.O. Group, specializes in integrating energy management and mobility solutions. Through cutting-edge technologies and sustainable practices, inno2grid transforms transportation hubs into smart, efficient, and environmentally friendly spaces.

Stations 360° adapts and applies the principles and methodologies of the Future Station initiative on a global scale. This integrative approach ensures that train stations worldwide are optimized for transit and serve as catalysts for regional development and community engagement.

As we look ahead to a more interconnected and sustainable future, train stations will play a pivotal role in urban development. By integrating TOD principles with advanced digital and sustainability solutions, these stations can transform into vibrant, multi-functional spaces that enhance mobility, stimulate economic growth, and elevate the quality of urban life.

Stations 360° drives this transformation through comprehensive consulting services, leveraging the expertise of DB E&C and inno2grid. By adopting state-of-the-art technologies and sustainable practices, Stations 360° creates next-generation mobility hubs that are efficient, sustain-able, community-centric, and user-friendly.

To realize these ambitious goals, we invite stakeholders, urban planners, transit authorities, and community leaders to collaborate with us. Together, we can reimagine train stations as the heart of future cities, driving regional development and providing unparalleled user experiences.

Join us in this transformative journey to build the train stations of tomorrow. Let's shape a sustainable, connected, and prosperous future.

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