

Rail Transit Project Delivery in Germany

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Germany

In the past two decades, regions throughout Germany have built dozens of new rail lines and extensions. Compared to other countries, Germany has some of the highest costs per mile for building tunnelled rail, with projects averaging \$509 million per mile. But the country also has some of the lowest costs for building at-grade trams, averaging only \$35 million per mile. For the tunnelled projects, all were 2.5 miles or shorter, and stakeholders noted the increasing frequency of delays, high costs, and budget overruns.¹

Project delivery in Germany is led by operating agencies but in close collaboration with regional transit alliances, which are public bodies that coordinate services and planning among several independent transit operators. Once planning is complete, it is often the individual operating agencies or construction authorities that lead compliance with federal environmental regulations, build the project, and apply for federal funding to cover up to 75 percent of the capital costs for building rail transit. Most German agencies use design-bid-build (DBB) procurements, select contractors based on best value, and use public sector employees to manage projects. The federal government recently allowed for certain "environmentally friendly" projects such as railways to bypass the traditionally long environmental review process and require only Parliamentary approval.²

Table 1: German rail transit projects completed since 2009⁺

Location	Project	Opened	Time to Construct (months)	Length (miles)	Percent Tunned	Cost*	Cost per Mile*
Berlin	U5-U55 connection	12/2020	128	1.4	100	839	615
Berlin	Adlershof II extension	10/2021	17	1.7	0	55	33
Berlin	Tramway Adlershof-Schöneeweide	9/2011		0.9	0	23	27
Berlin	U55	8/2009	166	1.1	100	669	599
Bielefeld	Bielefeld tram Line 2 extension	12/2015		0.8	0	25	31
Bremen	Line 4 Extension	8/2014	42	3.4	0	108	32
Cologne	North-South light rail	12/2015	143	2.5	100	1,832	739
Dusseldorf	Wehrhahn Line	2/2016	99	2.1	100	1,582	751
Freiburg	Line 2 extension from Reutebachgasse to Zähringen	3/2014	32	1.1	0	42	38
Freiburg	Tram 4 extension	12/2020	**	0.6	0	27	44
Hamburg	U4 to HafenCity U	11/2012	63	2.4	100	574	238
Hamburg	U4 to Elbbrücken	12/2018	44	0.8	100	231	287
Hannover	Route 7 extension	12/2014	30	0.9	0	34	36
Karlsruhe	Karlsruhe Combined Solution	12/2021	143	3.1	72	2,408	777
Leipzig	City Tunnel	12/2013	125	2.2	100	1,757	787
Munich	U3 Extension to Moosach	12/2010	74	1.2	100	337	271
Munich	Tram 16 Extension to St. Emmeram	12/2011	18	2.7	0	73	27
Munich	Tram 25/19 Extension to Berg am Laim	12/2016	10	0.8	0	19	24
Nuremberg	U3 Line	6/2008	**	2.1	100	618	293
Nuremberg	Route 4 extension to Am Wegfeld	12/2016	**	1.5	0	69	46
Saarbrücken	Saarbahn Extension to Lebach	10/2014	**	6.5	0	90	14
Ulm	Tram Line 2 between science city and Kuhberg	12/2018	38	5.8	0	336	58

* = 2021 USD in Millions

** = information not available

⁺ = Since there was an excess of German transit projects compared to other countries, we chose the most recent examples since 2009, instead of using examples since 2000.

Governance

Germany is a federal parliamentary democracy. It has a bicameral legislature comprised of the *Bundestag*, which includes representatives elected directly by people, and the *Bundesrat*, whose representatives are appointed by state governments. Germany is a

civil law country.³ The German head of government is the chancellor, elected through a majority vote from the Bundestag and parliaments of 16 states. The chancellor proposes members for the cabinet to preside over a ministry, and they are confirmed by the president. The Federal Ministry of Transport and Digital Infrastructure (BMVI) oversees national transportation policy and funding of large infrastructure projects.

The German **federal government's** primary role in transportation project delivery depends on whether a project is considered federal or non-federal infrastructure. Federal infrastructure includes interstate networks such as motorways, waterways, and railway lines owned by the federal government, such as the European Freight Corridors.⁴ The federal government selects projects and provides funding through a Federal Transport Infrastructure Plan (Bundesverkehrswegeplan, or BVWP) that prioritizes approved state projects every 15 years. Projects are incorporated into this plan based upon several factors, including cost benefit analysis (CBA) and equitable distribution between states.⁵ The BVWP does not include projects for local subways and trams, which are not considered federal infrastructure.

The planning process for non-federal projects, which include most urban public transit infrastructure, predominantly starts at the local level, after which localities develop a CBA and apply for state and federal funding. The federal government contributes up to 75 percent of funding for a new non-federal transit project through the GemeindeVerkehrsFinanzierungsGesetz (GVFG), or the Local Transport Financing Act.⁶

Germany is comprised of 16 **federated states**, which includes 13 states and the three city-states of Berlin, Hamburg, and Bremen. Most are governed by a state-level parliament called a Landtag, led by a minister-president and an appointed cabinet. In the three city-states, the city council functions as a state parliament.⁷ States typically contribute 20 to 30 percent of total funding for a transit project.

States are further divided into **administrative districts** that exist in all but the three urban city-states. Each district has an elected district council and an administrator. According to the Federal Passenger Transport Act (PBefG), districts and independent cities are responsible for coordinating public transport planning activities. Each state also has a state public transport law that postulates that the municipalities and districts are responsible for planning public transport. **Municipalities** are the smallest administrative unit, governed by elected councils and a mayor.⁸ Cities or municipalities play a significant role in planning, often own transit operating companies, and typically contribute 10 to 20 percent of funding for a transit project.

About every five years, cities, municipalities/districts, or regional planning entities publish a Nahverkehrsplan (NVP), or local transport plan. This includes a scan of

current transit conditions as well as goals for minimum service standards, targets to make the service more attractive to users, and plans for transit expansion.⁹ Districts often do not contribute funding to urban transit projects.

Urban regional transit in Germany is organized within **transit alliances**. For each region there can be several large and small transit operators within an alliance. For example, the 36 transit operators in the Berlin/Brandenburg region are coordinated by the Verkehrsverbund Berlin-Brandenburg (VBB).¹⁰ In Hamburg and neighboring counties in the states of Schleswig Holstein and Lower Saxony, Hamburger Verkehrs Verbund (HVV) operates an integrated system of 25 transit operators.¹¹ The main role of a transit alliance is to coordinate schedules and information, set fare policy, and distribute fare revenue. Depending on the region, a transit alliance can also lead or assist in long-term transit planning.¹² Local and state entities have a leading role in the governance of transit alliances in large urban areas except for Nuremberg. Small alliances in rural areas tend to be governed principally by the transit operators, with local governments providing funding and otherwise playing an advisory role.¹³

Transit operators are organized as publicly owned companies that run the services, collect fare revenue, and maintain vehicles and stations, and typically manage capital construction.¹⁴ Their size varies greatly, from an operator running a few bus lines to Berlin's largest operator, BVG, which runs nine underground lines, 22 tram lines, and 1,500 buses.¹⁵ For intercity passenger rail and most regional/urban rail (S-Bahn) services, Deutsche Bahn owns the physical infrastructure while transit agencies tender operations to Deutsche Bahn or other international and private operators.¹⁶

In Germany, transit capital projects are delivered by a transit agency or by the agency or municipality creating a special-purpose delivery vehicle (SPDV) with the sole purpose of building a transit project or program of projects, which is then dissolved when the work is completed. Smaller light rail and tram projects tend to be directly tendered through the agency, while some heavy rail or exceptionally large tram projects (such as the Karlsruhe Combined Solution, in which the city tunneled all of its tram lines) are carried out using SPDVs.¹⁷ Projects have been built using design-build (DB), design-bid-build (DBB), or public-private partnerships (P3s), though DBB is most common.

Project planning and regulation

Germany has a standard federal process for planning local transit projects, with some variation depending on the region and agencies involved. First, a city or locality proposes a project, often in coordination with the transit alliance or rail operator. Next, the local government demonstrates it has a favorable CBA and then the ministry of transport reviews applications and allocates available federal funding. If a project

applies for state funding, it goes through a similar application process through the state ministry of transportation.

Germany has strict environmental protections for building new infrastructure, which are largely set at the federal level and are based on EU directives.¹⁸ The project sponsor must first complete a strategic environmental assessment (SEA), which produces a report that details predicted environmental impacts, including effects on water quality, endangered species, and air and noise pollution, as well as possible alternatives to the project.¹⁹ An SEA must involve input from environmental authorities as well as public outreach.

Project sponsors then complete a spatial impact assessment procedure, which explores whether a project aligns with the area's planning objectives, analyzes the project's environmental impacts, and considers alternatives within the project.²⁰ Projects with significant environmental impacts also require an environmental impact assessment (EIA). While the SEA happens in the planning phase, an EIA is carried out when a project is going through the approvals process and details its impact on humans, animals, plants, water, and "cultural goods."²¹

The community engagement process is also federally regulated. By law, the project sponsor must engage with affected parties and stakeholders, including environmental organizations, citizens, societies, trade associations, and local authorities. Sponsors must solicit input regarding the design, legality, and location of the project.²² However, BMWI recognizes that some members of the public feel they are "inadequately involved," and the ministry's guidance urges sponsors to engage in earlier, broader, and continuous engagement.²³ Some sponsors have voluntarily done more community engagement by hosting open discussions and trying to bring participants together at an early stage by laying out plans physically and posting them online. Interviewees expressed that this type of engagement with the public is currently a best practice and will likely become planning law in the next few years.

Although Germany has rules that limit individual parties' ability to sue transit project sponsors, interviewees said public participation still results in a long planning process.²⁴ Recently, the federal government has tried to accelerate the planning process by passing the Planning Acceleration Act III in 2020. This streamlined the hearing and planning approval process for public transit by simplifying statutory requirements and made recommendations for engaging in enhanced, early, and broad public participation.²⁵

The federal government has recently worked to accelerate the environmental review process by exempting some projects that have no apparent conflicts from the first part

of their environmental review. Also, for “environmentally friendly rail and waterway projects,” the Bundestag can provide approval without environmental review.²⁶

Regulation of heavy rail is dependent upon the railway owner. Federally owned railways and non-German railways operating in Germany (like the French SNCF) are regulated by the Federal Railway Authority. Other non-federally owned railways are regulated by state-level authorities, but states can choose to defer to regulation by the federal government.

German transit follows flexible fire protection guidelines according to the technical rules for the operation and construction of trams, or TRStrab. These are prepared by a joint federal-state technical safety committee and informed by the federal Ministry of Transportation. While TRStrab guidelines are not mandatory, engineers must specify any deviations from the recommendations.²⁷ Fire protections are largely individualized to the specific location, and regulations for air circulation or escape routes are made on a case-by-case basis. Sites are tested by simulation, where project engineers examine the distribution of smoke in underground stations and test flows of people during an evacuation drill.²⁸

Project funding

Transit capital projects are funded by a mix of federal grants as well as state and city contributions and, in some circumstances, funds from the EU, Deutsche Bahn, or bordering municipalities. A typical breakdown of project funding is 60 percent federal, 20 percent state, and 20 percent city (or 30 percent state, 10 percent city).²⁹

The Municipal Transport Financing Act (GVFG) regulates and allocates federal funding for local transport projects. The federal government has a fixed budget divided between federal transport programs (those included on BVWP) and state programs. States can apply for partial funding of transport projects that cost more than €50 million (\$67.5 million).³⁰ The newest iteration of GVFG funds can provide up to 75 percent of the cost for a capital project such as urban transit, increased in 2019 from a previous cap of 60 percent.³¹

For example, the Karlsruhe Combined Solution tram project was 60 percent federally funded, 20 percent state-funded, and 20 percent (plus any costs ineligible for federal funding) city-funded.³² For the Cologne North-South Stadtbahn, 60 percent of funding was federal, 30 percent came from the state and 10 percent was from the city of Cologne.³³ Sometimes two or more states will contribute if a system runs through multiple states, as with HVV in Hamburg and its two bordering states of Lower Saxony and Schleswig-Holstein.

Some German infrastructure projects are eligible for European Regional Development Funds (ERDF) from the EU, though these grants are limited mostly to projects in the five German states that were formerly part of East Germany.³⁴ For example, the Leipzig City Tunnel in the state of Saxony received \$372 million in ERDF, out of a total cost of \$1.6 billion.³⁵

Project construction

Construction of transit projects in Germany is typically managed by the regional rail operator or, in some cases by an SPDV, which is common for the largest projects. In Berlin, the BVG Projekt GmbH is a subsidiary owned entirely by BVG, the largest rail operator in the region. BVG Projekt GmbH was the principal contractor for the U5 connector and is planning to manage more BVG construction projects in the future.³⁶ The Karlsruhe Rail Infrastructure Company is owned by the city of Karlsruhe, and was created to build the Karlsruhe Combined Solution, for which it led planning and construction management.³⁷

Most construction procurements follow a traditional DBB approach, though according to some interviewees, agencies have the option to use DB on projects.³⁸ Construction contractors are typically selected through a two-step process that includes a detailed evaluation of qualifications, experience, and approach, followed by a final selection of qualified bidders based on price.³⁹

According to interviewees, getting permission through the environmental and local permitting processes can take up to 10 years, but once a project has secured the necessary federal and local permits, it is cleared to start construction and will not be impeded as the plan approval supersedes local law. Some interviewees relayed frustration at the increasingly long timelines for approval, but all noted relief that outside forces cannot stop construction once it has started.⁴⁰

While tunneling costs in Germany are higher than the global average, light rail costs are some of the lowest in our database. This is partially because these projects are more analogous to streetcar projects rather than light rail in its own right-of-way. For example, the Freiburg Line 2 extension (\$38 million per mile) and the Bremen Line 4 extension (\$32 million per mile) operate most of their route with mixed traffic on the roadway. The Bielefeld tram extension (\$31 million per mile) runs along farm fields on level ground. These attributes greatly simplify project planning, permitting, and construction, but still cost less than similar projects in the United States.

Takeaways

Germany's use of regional transit alliances provides significant help with coordination and public buy-in for projects. Their structure, board make-up, and authorities for aligning regional transit authorities provide value, particularly in the planning and early stages of project development. When there are many smaller operators, alliances are valuable coordination entities that act as a liaison between federal or state priorities and local needs.

While interviewees complained about long timelines associated with environmental review and permitting, recent attempts have been made to streamline and expedite the process for transit projects. Germany has simplified the planning process, expanded early community engagement, and provided authority to exempt transit and other environmentally beneficial projects from key parts of the federal process.

Germany provides interesting lessons for building at-grade transit, as costs per mile for tram and light rail projects are some of the lowest in our database. This is particularly applicable to the United States, where at-grade buildouts are common. Some of these low costs are related to the simplicity of infrastructure, standardized stations, and routes through existing right-of-way. This should be explored further.

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 - ²⁸ Ullrich Pickert, Julian Park, Maximilian Privik, and Matthias Musa, "Brandschutz in unterirdischen Verkehrsanlagen," DER NAHVERKEHR, November 2019, p. 6-8.; European Commission, "Technical Rules for Trams, Fire Protection in Underground Operating Systems (German designation: TRStrab Brandschutz, Technical Rules for Trams: Fire Protection)," June 24, 2014.
 - ²⁹ Recent policy changes now allow for up to 90 percent federal funding of projects for electrification of a railway line (either by overhead catenary or electric batteries with charging stations) or the

rehabilitation of a disused or freight railway line for passenger transport. In most other cases, like when building a new transit line or extension, the maximum federal funding is 75 percent. See, e.g.: BMVI, "Wir setzen den Schienenverkehr weiter unter Strom," April 3, 2021.

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Eno

Center for Transportation

1629 K Street, NW
Suite 200
Washington, DC 20006

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