



# Ingenieure 22



## Stuttgart 21 – List of Flaws & Gaps

[A working paper of Ingenieure22 with a selection of defects, risks and criticisms](#)  
(As of 04.07.2018)

### Foreword

Stuttgart 21 should really be a "lighthouse project". Therefore it must come as a great disappointment to the protagonists, if today this project - which has still not once been completely planned and approved and which is structurally still in its early stages - is accused of such a complete list of deficiencies.

Already in 1998, the former CEO of Deutsche Bahn Johannes Ludewig stopped the Stuttgart 21 project and referred to it as "simply too big and too expensive for the Deutsche Bahn". But then politics intervened, because it was realised that through the construction of an underground railway, there would be a chance to build properties in the centre of Stuttgart, in place of the existing railway lines. To justify this, supporters of the project established the objectively false assertion that the terminus station had reached its absolute performance limits. And they went so far as to make the dubious assertion that Stuttgart 21 could perform twice as well as the existing terminus station. The state of Baden-Württemberg, the region and the city of Stuttgart lured the railway into continuing the planning work on Stuttgart 21: A highly overpriced transport contract was concluded, the airport link was subsidised, and already in 2001 the city of Stuttgart bought the track areas from the Deutsche Bahn and waived any interest payments until at least 2019. And so it was that those at the head of the rail company also tossed their reservations (which were more than justified from today's perspective) over board, and took over the implementation responsibility for Stuttgart 21. Instead of an open, unbiased and reliable examination, it was decided far too early (virtually irrevocably) to build the underground railway, with tunneling systems totaling 60km, in the most difficult geological environment.

Criticism and warnings were given very early on by authoritative figures. For example, already in 1992 a recognised rail expert branded it "almost criminal" to want to create an unbalanced railway with a track gradient of 15 per thousand. Although the risks associated with the fire safety of underground railway systems were addressed early on, especially after the cable car disaster of Kaprun in 2000, the fire safety regulations, according to today's customary international standards, were neglected in the planning. The necessary safety precautions threaten to lead Stuttgart 21 to serious operational constraints and to reduce the efficiency of the railway even further. As well as this, experts had already pointed out (on the basis of experience and serious calculations), that only 8 platform lines would never be sufficient, even for today's requirements, to reach an adequate efficiency for a through station, and with that it was devoid of any future viability. Model approval for the construction of the through station is still also missing today due to static equilibrium and geological problems.

This diverse criticism can be found again in the following list in the shape of deficiencies. The project is urgently deficient in the areas of safety and fire protection, track gradient, efficiency, static equilibrium and geology and not least due to incomplete planning, constant schedule changes and permanently rising costs. In almost every case the policy refers back to the lapidary statement that, "Stuttgart 21 is a cost-effective project of the Deutsche Bahn and it will be built". The Bahn must once again correct costs and construction periods from the top. For years, both the Bahn and politics have refused to take part in the technical discussion about the basic conceptual deficiencies. Thus it is even more important to voice and make public the deficiencies of the project through civic involvement, as clearly and as early as possible. With the following list of deficiencies, we want to illustrate that this major project does not satisfy the standards of quality German engineering in any way.

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<b>A. Decreased performance of the railway junction Stuttgart</b>	
A1: Promised service unachievable	
• Statement of the Deutsche Bahn (DB) 1996: double the performance of S21 relative to the terminus station	
• Arbitration 2010: 50% increase in performance was promised.	
• Today we know: <b>40% performance reduction (!) compared to the terminus station</b> , no reserves for the S-Bahn, in peak hours chaos is inevitable.	
• The project Stuttgart 21 was advertised for many years with <b>double performance</b> . This statement was even included in the application for funding by the European Commission and was the official announcement at the time of the loan contract (2009), mediation (2010), and the referendum (2011). In 2013, these untenable promises were implicitly withdrawn.	

- Unusable simulations and service comparisons: Prof. Martin 2005: Unsuitable examination room, unequal premises, scientifically controversial methodology Stress test 2011: Non-compliance of railway-owned premises, numerous methodological violations, lack of transparency, non-compliance with traditional train sequences, minimum distances, and buffer times. Rail traffic under "stress" was not really tested (e.g., delays of over 5 minutes were not considered).
- Comparison with existing terminus station (zero variant) has never taken place; it is a serious legal planning defect.
- **Second opinion:** Terminus station manages 50 trains without expansion, even 56 with signal-technical training, methodological correctness confirmed by state-owned NVBW [16], traditional train sequences, buffers are complied with.
- Safety requirements due to excessive track inclination and fire protection will lead to further reduction of efficiency and further reduced operating quality.
- Questions of practical operation are not asked: flexibility and redundancy (for example, no alternatives for signal and switch faults, part closures or accidents, or planned construction and renovation work). The failure of only one access can cripple half the station because mutual usability of the tracks is very limited.

## A2: Performance dismantling

The **decreased performance** of the planned 8-track underground station S21 was prepared by **VGH Mannheim** in 2006 with **only 32 to 35 trains per hour** confirmed; everything else is not binding! [1]. The **planned performance dismantling** of the existing railway transport system of the Stuttgart main station of **to date 50 trains per hour on a future 32 to 35 trains** was thus confirmed!, compared to 50 trains per hour at the current terminus. The demolition was planned from the beginning [2]. A bottleneck was created by Stuttgart 21 on the European Magistrale [3].

## A3: Decommissioning of existing trackage still unsettled

The decommissioning of the tracks in the railway terminus is in dispute [4]. Claim for continued operation is applicable; judgment is currently pending. Due to the claim by private railways for continued operation of existing systems the city development by S-21 is questionable (to date it has been explicitly omitted in the approval process).

### A4. Lack of timetable robustness in case of disruptions

#### A4.1: When the tunnels are closed, not all tracks can be used

- Additional tracks are already required to stop delays. 8 tracks are only enough for uninterrupted ideal operation.
- The possibility of transportation with the switch zones is limited; you cannot reach all tracks from all tunnels. In case a tunnel cannot be used, only 5 tracks are available for the affected route, in extreme cases only 2 tracks.

#### A4.2: No alternative for S-Bahn trains

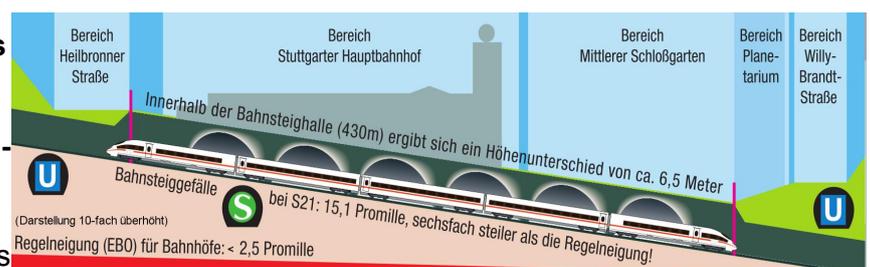
- In the event of an S-Bahn main line disruption, there is no sufficient alternative. A plan to connect the S-Bahn to the Gäubahn is no longer scheduled. Adding the S-Bahn trains to long-distance traffic in the inflow tunnel will lead to considerable traffic restrictions.
- Switch points are missing in the inflow stations.
- The Mittnachtstraße can be used as a terminus at best if the main line is disrupted, and has no direct connection to local public transport.

## B Reduced safety

### B1: Sixfold canted track gradient

- **The slope of the tracks** in the S21 underground station of **over 15 ‰ is 6 times higher** than permissible pursuant to EBO §7 (<2.5 ‰) approved by the Federal Railway Authority **without the legally prescribed "proof of the same safety"**.

- Due to human or technical failure, this gradient can result in **unintentional rolling of the train**, as sometimes happens at Cologne main station with its much smaller track gradient of only 3.68‰, including with injury to people. This was erroneously disregarded in the plan approval of the S-21 project.



- The Cologne main station is so far the only big city station in Germany with a track inclination in the station of more than 2.5‰. In the period of 2010-2014, 23 such roll away occurrences were documented, eight

of them with injuries to people [5]. More known roll away cases are not recorded in this; it must also be assumed there is a high number of unreported cases.

- The existing railway terminus Stuttgart, however, is constructed completely horizontally in the EEO; unexpected rolling of a train is thus excluded.

## B2: Inadequate fire protection

- **Fire protection of the underground station unfit;** escape and rescue routes insufficient and much too long (up to 400 m); **a rapid evacuation** of the underground station hall in the event of a fire or disaster is not possible. The emergency stairs that are now planned at the ends of the platforms with the possibility of exiting via bottom flaps are not suitable to allow large crowds to escape.

- Smoke in the underground station hall in a serious fire incident cannot be controlled; smoke spreads faster than the fleeing people, who can only escape by going up the stairs - into smoke-filled areas. Mobility impaired people have no chance to escape. The escape and smoke-spreading simulations presented by the railway are "embellished" by inaccurate assumptions and conditions and therefore unrealistic.

- **De-smoking the underground station hall is not guaranteed.** Provided blowing of air from the tunnels to direct the smoke through openings in the light openings is insufficient and leads to the smoke mixing in the escape areas - people escaping will be exposed to toxic smoke [6].

- **Fire protection plan in the airport station unfit;** escape from the underground station area 27 m below ground is extremely difficult; the escape and smoke-spreading simulations provided by the railway are "embellished" by inaccurate assumptions and conditions.

- **De-smoking the tunnel is not effectively possible;** the rescue tunnels are 500 m too far away for an effective escape; in the case of a serious fire incident in the tunnel many dead and injured people are expected. **Simulations** to evacuate and spread smoke in the tunnels **cannot reach the public** [7].

- After a serious fire in one of the inflow tunnels, it will remain closed for repair for a long time. This leads to the collapse of the entire Stuttgart railway junction; only eight tracks are left accessible only from one side of a terminus which is now barely navigable because of excessive track inclination (see Point B1) and the track plan.

- Endangering passengers and staff due to a train fire in the tunnel is not excluded by the railway, which has declared such an event to be "unlikely", claiming "the remaining risks are deemed acceptable [8]. and "the inevitable remaining residual risk has to be accepted as a general life risk. This is not a safety precaution, but an irresponsible infringement of universal human rights and incompatible with Art. 8 of the "right to life and physical integrity" Basic Law. This inhumane approach is a violation against Art. 2 of the Basic Law "Right to Life and Physical Intactness".

- Congestion in the tunnel: escape and rescue routes in the tunnels are too narrow for safe escape and the distances of the rescue tunnel at 500 m are far too long

- In contrast, the existing **aboveground terminus** does not need a kilometre long tunnel and **therefore poses no such risk.**

## B3: Limitations and lack of escape options for disabled people

- Disabled people can only access the platforms via a lift on each cross-piece; there is no ramp access to the platforms.

- The transport capacity of the lifts is far too low; in the case of a failure of a lift access to the platform is considerably more difficult for disabled people.

- The minimum measurements as per building regulations and the permissible tilt for wheelchairs are not met on the platforms.

- 15‰ (!) platform tilt (default in EBO: less than 2.5 ‰) complicates wheelchair use!

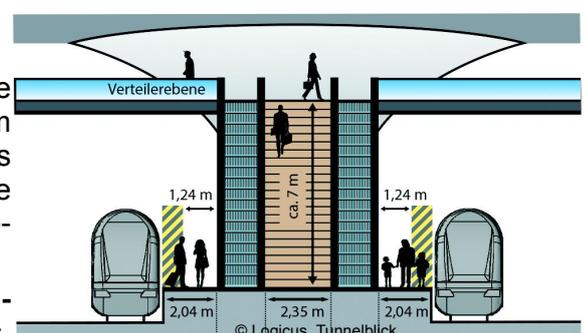
- Access from the platform to the train is not possible for disabled people because there are no lifts.

- In the event of a fire or disaster there is no means of evacuation for disabled people from the underground station hall and certainly not from the tunnel! Planned waiting rooms on the platform are insufficient and much too far away.

## B4: Narrowness on platforms and entrances

- **Bottleneck platform:** Distance from the platform edge to the stairs is **only 2.04 m**, deducting 80 cm of security strips from this, only 1.24 m (!) remain. Passage width on the stairways with the largest flow of people-density and the approved escape staircases. Considerable obstacles at these bottlenecks are foreseeable

- Number and width of **access stairs** to the platforms are **insufficient** to cope with the flow of people! There are four stairs,



each with 2.35m foot width on 420 m length of platform, as well as four escalators up and three down.

- The measures provided for traffic areas on the platforms and more particularly at the entrances are inadequate for high passenger flows in peak hours and lead to undue crowding. The "high comfort with an international model function" advertised in the DB's promotional brochures is completely wrong [9].
- There is only one escalator from each platform to the S-Bahn, which only runs in one direction and can only be changed as needed. If you need to go the other direction, you have to wait a very long time at peak times, because the flow of people prevents it from being switched around, or you have to climb up the stairs with your luggage.

## C Building risks

### C1: Risk of swelling anhydride / building damage due to uplift

- The total **62 km intake tunnel** for the S-21 underground station goes on long stretches through powerful **unleached anhydride layers**, a type of rock that **swells on contact with water** thus occupying 1.6 times the space. The problems caused by **huge pressures** can push the tunnel walls and make long-term restructuring necessary, see the Wagenburg tunnel in Stuttgart, Engelberg motorway tunnel in Leonberg, and others.[10].
- Risk of damage to buildings due to uplift caused by swelling anhydride underground contact if water enters as a result of the tunnelling.

Damage examples: Staufen, Leonberg, Böblingen, Rudersberg, and many more

- Both tubes in the Filderstadt tunnel are right under the television tower where they go through anhydride. There is a risk that the **TV tower** could lose stability due to the onset of swelling in the ground.
- Risk of damage to buildings due to drops caused by tunnelling work. In order to keep such damage low, the railway must carry out very expensive uplift grouting in the steep Kernerviertel under all buildings above Willy-Brandt street up to Sängerkirch street, with whose aid the buildings should first be raised several cm to then be lowered again after the tunnel advancement.

### C2: Unsafe underground / risk of floating

- The S-21 construction pits in Nesenbachtal are on partially muddy underground of uncertain viability and therefore require a costly special foundation with deep foundation piles into the ground gypsum layers, whereby an unwanted rise of the underlying mineral water cannot be excluded.
- Despite its heavy weight, the S-21 underground station can float at a high groundwater level, whereby severe structural damage may occur. To avoid this, there are emergency flood openings in order to flood the underground station hall at a specified ground water level if there is excess. This means no rail operations in the S-21 underground station for a long time.

### C3: Danger of sinkholes and landslides

- Danger of landslides in the steep Kernerviertel and on the Kriegsberg, triggered by construction-related sinking of the groundwater level at the foot of the slope, as well as due to the introduction of water from the GWM blue tubes underground. These areas are in danger of landslides due to geological reasons.
- The underground in Stuttgart has countless sinkholes as a result of local anhydride leachates, which can burst up to the surface suddenly and unexpectedly. In the area of the S-21 pits, several of these older filled up sinkholes have been documented. There is still the risk of a sinkhole.

### C4: Risk of ground water and mineral water

- Risk of the occurrence of mineral water in Stuttgart, the second largest in Europe, due to the deep groundwater lowering for the S-21 pits and the incision of the protective base plaster layers. • Risk of groundwater due to introducing the pit water as "**rusty water**" in the underground, due to steel pipes **without corrosion** protection by the GWM (blue pipes).
- The sinking and infiltration plan underlying the **ground water flow model** is **doubtable**; the prognosis is **questionable**. The criticism extends from purely quantitative deficiencies to methodological and basic scientific inadequacies.
- Comprehensive support of the mineral and medicinal springs do not work with the plan established by the infiltration concept according to our own findings, because of concern of the dangers of the mineral and medicinal springs.
- According to the admission of the model operator [11], the boundary conditions (both the DB model as well as the test model of the land surveyor) are not empirically verifiable over the whole model limits. Both models have only imperfect knowledge of the real system.
- Strongly increased quantities of ground water are already evident (**10x groundwater rush** at the Stuttgart-Wangen interim access!).

## D Incalculable cost risks

### D1: Multiplied construction costs / costs obfuscation

- Framework Agreement 1995 on the construction of Stuttgart21 between the DB, state and federal governments **2.5 € billion**
- In the financing agreement of 2009, **the total cost** was established at **€ 4.526 billion**. This was the basis of the 2001 referendum for "Stuttgart 21" ["The cost cap applies"].
- In December 2012, a year after the referendum, the DB granted a cost increase of over 50% to € 6.8 billion, almost three times more than originally stated. The financing of the additional costs remains unclear. The exit clause provided in the 2009 finance contract in the event that the cost cap was exceeded remains unused.
- Laying the rail requires additional costs of approx. € 200 million, of which 70% is from public GVFG funds (municipal traffic financing law) in addition to the financing contract
- In early June 2016, the DB announced further cost increases by € 624 million known. In fact, further substantial cost increases are to be expected; estimates are at € 9.8 billion when completed in 2021 [12].

### D2: Operating profitability of Stuttgart21 unachievable

- A Supervisory Board resolution of 2001 demands that the "cost-effectiveness and cost control must be on a reliable data basis on completed planning approval".
- The DB disregarded this resolution and started construction before the necessary numbers and plan approvals were available.
- DB CEO Grube said in 2010 that if construction costs exceeded € 4.8 billion the "Stuttgart 21" project would not be profitable and he would "pull the ripcord"! He did not do that.
- The additional cost increases by the railway in December 2012 from € 2.3 billion to € 6.8 billion results in a **"negative interest rate" of 0.3%**; the S-21 project is therefore clearly **not profitable** [13].

### D3: Breach of efficiency principle and Group Policy

- Projects may only be started with **proven profitability** of a benefit-cost ratio significantly greater than 1.0. This has not been demonstrated.
- The implementation agreement of 2001 provides **ongoing project validation** through proof of economic viability based on reliable cost accounting on the basis of the complete plan approvals, and project phasing where applicable.
- The Group Policy in the annual report of the Deutsche Bahn AG of 2001 calls for large-scale projects for the sake of minimising risk to **only begin when all plan approvals are fully available** [14].

With the start of construction in February 2010, the DB violated all standards!

### D4: Delay costs

- Delays in completion and commissioning result in more significant cost increases as "delay costs", including prolonged maintenance costs for construction facilities, ongoing personnel and space costs for the DB site management, compensation claims from companies and third parties due to scheduling overruns, and much more. DB AG anticipates at present € 30 million per month, i.e. € 360 million per year. If the expected date of construction is delayed by three years, this alone makes **additional costs of over one billion €!**
- The track areas acquired by the City of Stuttgart in 2001 will have to be discontinued and handed over by 2020 at the latest after all track systems have been cleared. If the handover is delayed, which is already foreseeable today, the railways will have to pay 25.5 million on default interest to the city of Stuttgart every year. An expected handover in 2027, 2 years after a possible start-up of the S21 in 2025 would mean default interest amounting to € 178 million in total.

## E Unresolved airport and S-Bahn train connections / traffic problems with public transport

### E1: Mixed traffic and one-track Filderstadt route

- The DB is planning mixed traffic of regional / long distance trains and S-Bahn trains in only a 2-track stretch from Stuttgart-Rohr to the airport, that until now has only been used by the S-Bahn. This mixed traffic on only 2 tracks with 3 S-Bahn stops is **very vulnerable to faults and delays**.
- The equal level crossing of the trains at the entrance to the airport terminal station exacerbates this risk even further. In the rush hour in particular, there are often disturbances that affect the entire Stuttgart rail network and cause chaos due to delays with numerous cancellations. The resulting infrastructural conflicts will severely disrupt the S-Bahn timings.
- The proposal by the DB will exclude reinforcing the S-Bahn traffic on this route compared from today in the long-term.

- The regional and mainline services will also be permanently limited to two trains per hour in each direction.
- The huge criticism by a variety of experts as well as constructive suggestions worked out in the Filderstadt discussion were and are ignored.
- The DB plan is the worst of all the alternative solutions. The subsequent compromise of a "third track" also does not change anything.

## **E2: Ministerial permission to use the S-Bahn tunnel for passenger trains**

• In 2010, the Federal Department of Transportation granted temporary exemption until 2035 to also use the existing Filderstadt S-Bahn line for passenger trains to the airport, which is actually not permitted because of the tunnel built for the smaller structure gauge of the S-Bahn trains. What happens next remains to be seen.

## **E3: S-Bahn and city railway impaired by S-21 over the years**

"No traffic delays on ongoing operations" was stated before the start of construction. The experienced reality since then has been very different:

- Commuters experience chaos in the S-Bahn daily. The S-Bahn line is in critical condition according to traffic consulting company SMA commissioned by the railway.
- The impediments to rail due to the S21 construction was originally only supposed to last for a few days or weekends. The meanwhile 14th (!) amendment of plan for the underground station section (PFA 1.1) already requires track closures: The section Staatsgalerie <> Charlottenplatz was interrupted from Pentecost 2016 to the beginning of December 2017. As of December 2017, the section Staatsgalerie <> Hbf is and will be interrupted for two, three or more years [15]
- Traffic problems in the construction streets on the railway premises impair road traffic.
- Excessive construction truck traffic in North Bahnhofsviertel does not meet the standard of planning approval. The construction situation in Wolfram street is totally unsatisfactory.

## **E4: Problems during trial operation and commissioning**

- Trial operation requires switching between old and new routes. This is not possible in some places or structurally not intended.
- The conversion of the S-Bahn ramp requires closing the main line.
- A possibility of travelling from Mitternachtstraße to the terminus station is not scheduled.

## **F Contractual and implementation issues**

### **F1: Construction time overruns - completion delayed by years**

The completion and initial operation established in the financing contract for S-21 will be delayed for years! It was originally scheduled for 2011 then postponed to December 2019, later to 2021; the railways have now granted a further 2 years delay to 2025. But even that will not be enough. Further delays are expected. This results in an extraordinary right of termination for land and city as a contract and financing partner.

### **F2: Plan approvals not completed**

After 17 years of planning and 8 years after the start of construction [2.2.2010]:

- PFA 1.1: Groundwater management: the seventh plan amendment was approved without resolving the threat of groundwater and mineral water.
- PFA 1.2: There are still many unanswered questions about the Filderstadt tunnel such as: fire protection, regulating the compensation and assumptions of liability for damages, and much more
- PFA 1.3: Filderstadt section: There are no plan approvals; considerable planning deficiencies.
- PFA 1.4: Section airport to Wendlingen: Bottleneck at the Wendlinger curve, no spare capacity for the future. Replanning required!
- PFA 1.5: Feuerbach feed: no connection to the Gäubahn. Railway ignored the promises of "mediation". The location of smoke extraction construction (Killesberg or Wartberg) is unclear.
- PFA 1.6b: Railway yard Untertürkheim: There is no planning approval, discussion is still pending, 4 years after delivery of the opinions! The DB wants to submit new planning.

## **G Environment and climate threatened by S-21**

### **G1: Increased energy expenditure and significant CO<sub>2</sub> release by S-21**

- Significant increase in consumption of drive energy of leaving trains due to the depth of the station (stop-

ping at the deepest point) compared to the previous terminus station.

- Increased consumption of drive energy on the new construction line Wendlingen-Ulm with many hills and slopes, additional total difference of 294 m between Stuttgart and Ulm (Crossing the Swabian Alb with the proposed high-speed railway line Wendlingen–Ulm Albquerung NBS at 750 mNN instead of now at 590 mNN, plus tracks leading up to the Filder plain / Stuttgart Airport ascent 159 m).
- Significant electrical additional requirements of about 40 escalators and lifts as well as lighting and ventilation at Stuttgart 21 compared to current terminus station (high subsequent and operation costs).
- Substantial **CO<sub>2</sub> release** in the operation of Stuttgart21 because of the much higher energy consumption compared to the current railway terminus.
- Total release of up to 5.7 million tonnes of CO<sub>2</sub> greenhouse gas during the construction of Stuttgart 21 through cement production, use of construction machinery, construction-related lorry tours and additional motor traffic: [[http://ingenieure22.de/cms/images/publikat/flyer/Treibhausgasemissionen\\_Stuttgart21.pdf](http://ingenieure22.de/cms/images/publikat/flyer/Treibhausgasemissionen_Stuttgart21.pdf)].
- Reducing CO<sub>2</sub> depletion by approx. 3,750 t CO<sub>2</sub> annually due to the 1,500 felled park trees for S-21. S-21 also does not answer to anything in terms of climate change.

## G2: Inner city recreation areas destroyed by S-21

- The Middle Castle Gardens as an inner city recreation area and important climate island with its 289 large, old trees and rare endangered species such as bats and hermit beetles was sacrificed for S-21 and irrevocably destroyed.
- The same thing happened in Rosenstein Park, which is strictly protected as an FFH area under EU law.

## G3: Increased risk of inner city flooding due to S-21

- All main sewers in the inner city are cut by the underground station trough and must be shifted at high construction costs and led under the trough as a culvert. Result: Reduced drainage performance with risk of flooding in heavy rain for the inner city, as well as ongoing costs of about 500,000 euros a year for the city of Stuttgart for cleaning and maintenance.
- The wall extending transverse to the valley over the S-21 underground station acts as a dam - in heavy rain a 2m deep reservoir forms where flooding is a danger in the Klett-Passage!

Note: footnotes (cross-references) to exclusively German-language documents

[1] judgment of the VGH v 6.4.2006, AZ. 5 S 848/05, para. 59

[2] dismissal of OSTA Haussler AZ 1JS59875 / 11

[3] Dr. Engelhardt: "Leistungsrückbau", "Performance dismantling", or. "Was leistet Stuttgart 21 wirklich" "What is Stuttgart 21 really achieving")

[4] §§ 11, 23 General Railway Act

[5] Information of BMVI v. 07.15.2015 / BT printed matter 18/5562

[6] Opinion GRUNER AG/Basel v. 20.9.12

[7] section 5 and 7 memo on the meeting on AK fire protection on 22.01.2014

[8] HBI study section 18.2 p 127

[9] Engelhardt: "Criticism of the Deutsche Bahn AG evacuation simulations, undersizing of pedestrian and railway tracks" and Wössner "Critical review of pedestrian flow analysis at Stuttgart 21"

[10] Dr. Jakob Sierig: "Geohazards in tunnel construction" in mediation Nov. 2010": [www.schlichtung-s21.de/](http://www.schlichtung-s21.de/)

[11] hearing for the 7th PÄ PFA 1.1

[12] Vieregg & Rössler report December 2015

[13] Draft decision to the DB Supervisory Board meeting on 5.03.2013

[14] p. 34 of the Annual Report 2001

[15] Information of SSB from May 2018

[16] [NVBW](http://www.nvbw.de/) (Nahverkehrsgesellschaft Baden-Württemberg, 2011)



© Photo: DB Turmforum - Stuttgart

The policy says there is no alternative to Stuttgart 21, but there is one: Here it is and in fact it is much cheaper:

Terminus station design  
with solar roof  
[www.umstieg-21.de/](http://www.umstieg-21.de/)

This document was first assembled in January 2014 and constantly actualized in cooperation with Ingenieure22 ([www.ingenieure22.de](http://www.ingenieure22.de)).

For further questions please ask [info@ingenieure22.de](mailto:info@ingenieure22.de)