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# Big Data Analysen im Asset Management

WIENER LINIEN

ÖVG/FSV-Forum
am 30.Jänner 2019 in der Wirtschaftskammer Wien, AT

# Das Unternehmen

**970 Mio. Fahrgäste**

**1 Mrd. in 2020 erwartet**

**38% Anteil am Modal Split**

**670 km Gleislänge**

**8.700 MitarbeiterInnen**

# Wann sprechen wir von Big Data?

- **Volume:** The quantity of generated and stored data

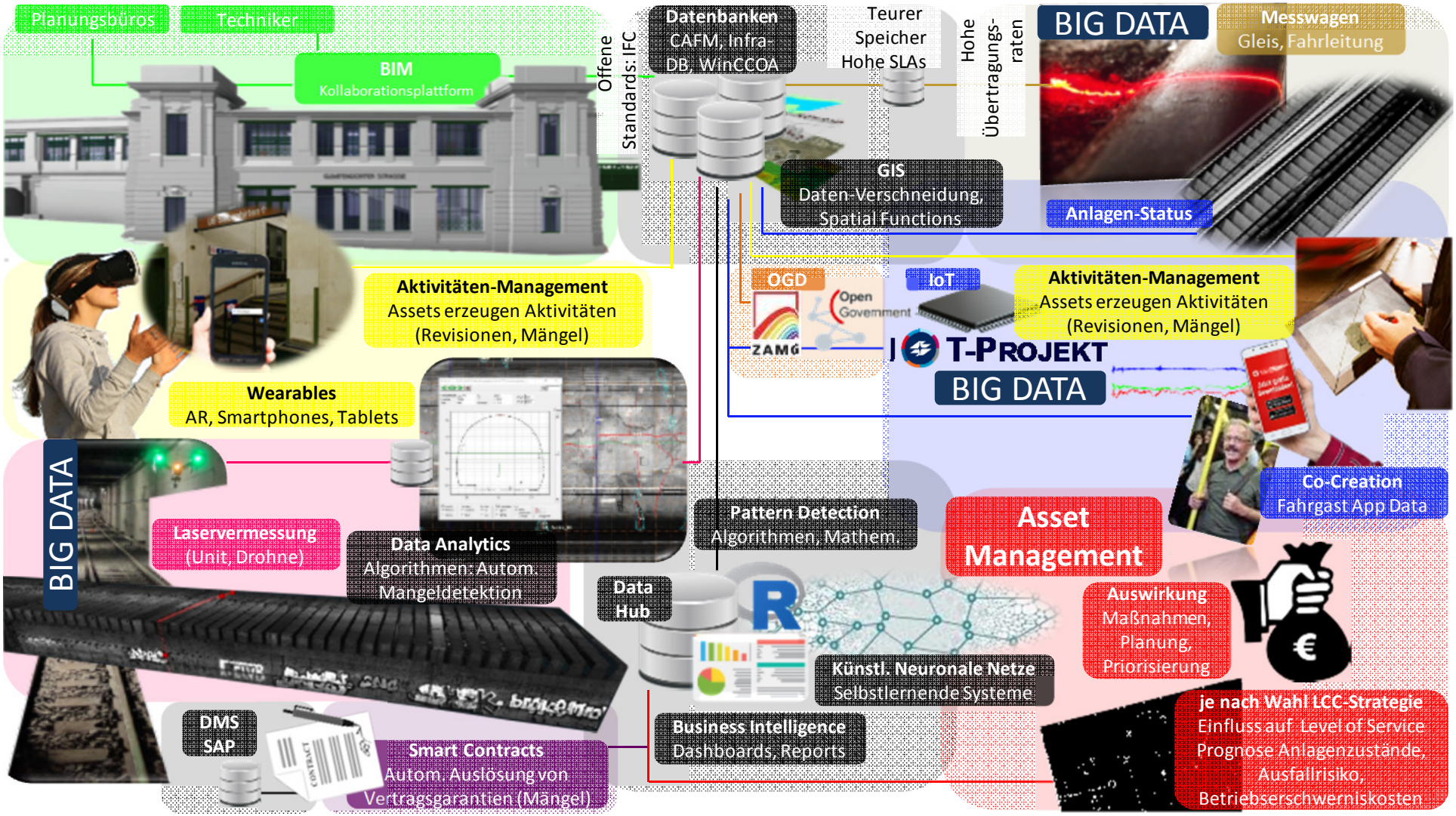
  (e.g. backups need terrabyte of data)

- **Variety:** The type and nature of the data

  (e.g. camera records)

- **Velocity:** The speed at which the data is generated and processed

# Von Big Data zum Asset Management



# Von Big Data in die DB + GIS

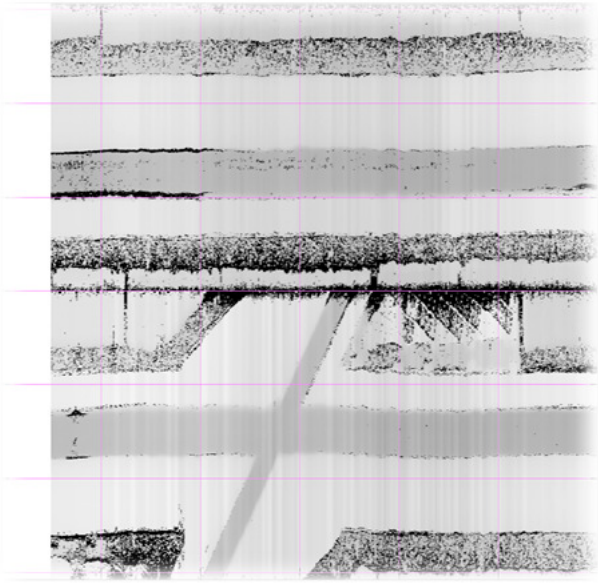
- Forschungsprojekt „Plasma Tram“
- Messeinheit
- Laser Light Section technology

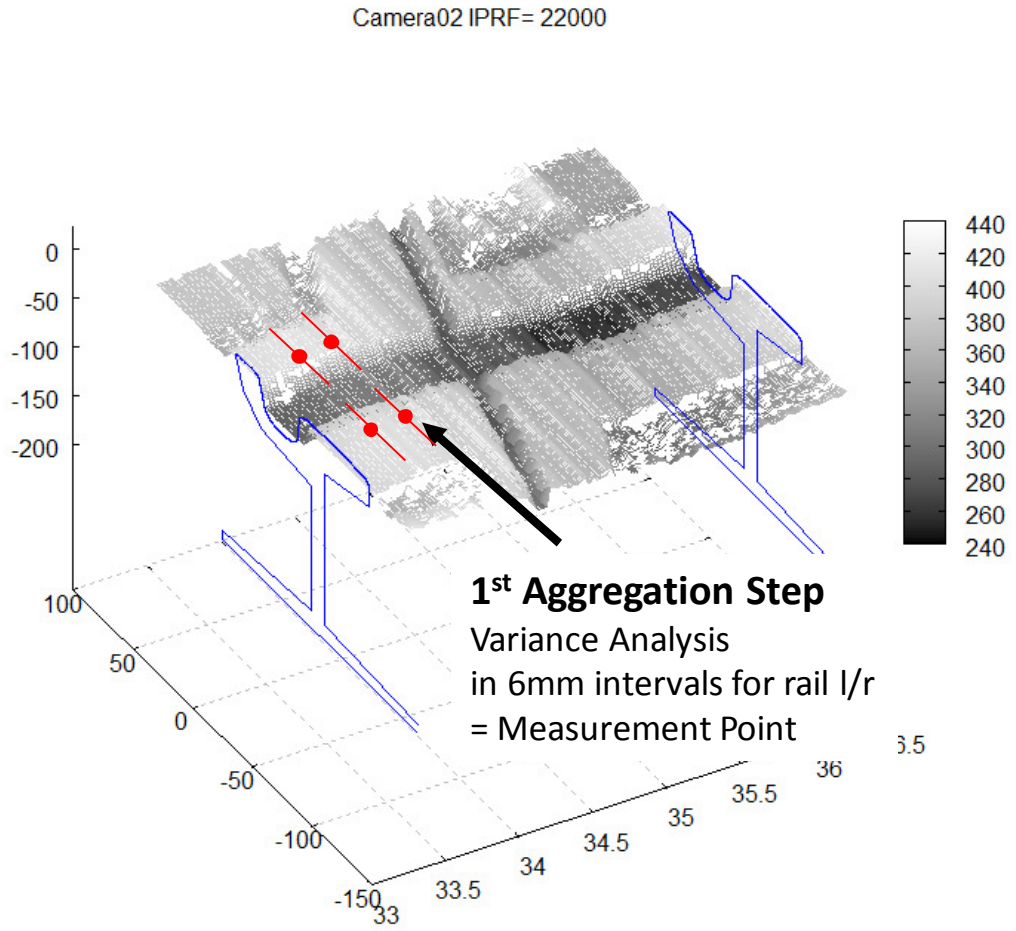
# Von Big Data in die DB + GIS

- Hohe Scan Frequenz in 6mm Intervallen
- Ein Profil alle 6mm

    -> Aggregation zu 1m-Profilen

# Von Big Data in die DB + GIS



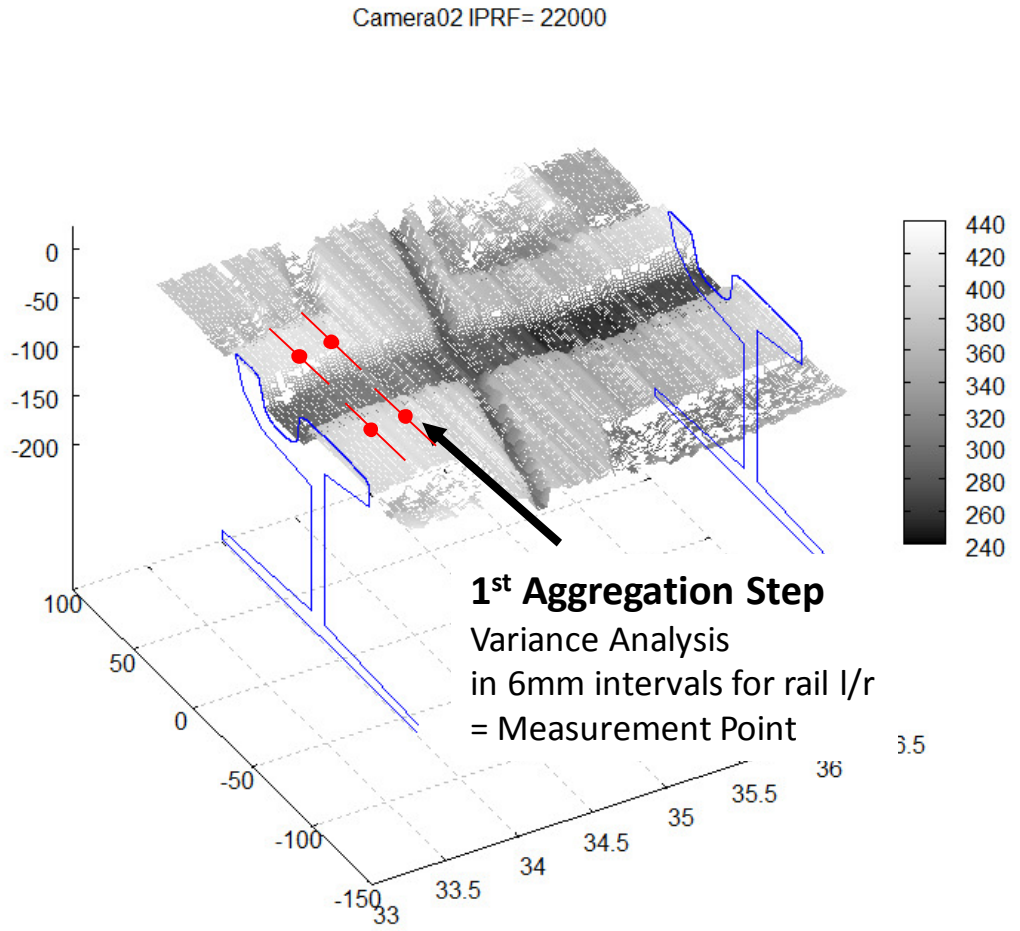



(c) BAMM 2013

# Von Big Data in die DB + GIS

344km of tram track
= 688km tram track l/r
= 688,000m
= 688,000,000mm
= 114,666,666 Measurement Points
**~ 1.8 billion attributes**

**2nd Aggregation Step**
Merge to 1 Measurement Point
per 1 meter
= 688,000 Measurement Points
**~ 11 million attributes**




**1st Aggregation Step**
Variance Analysis
in 6mm intervals for rail l/r
= Measurement Point

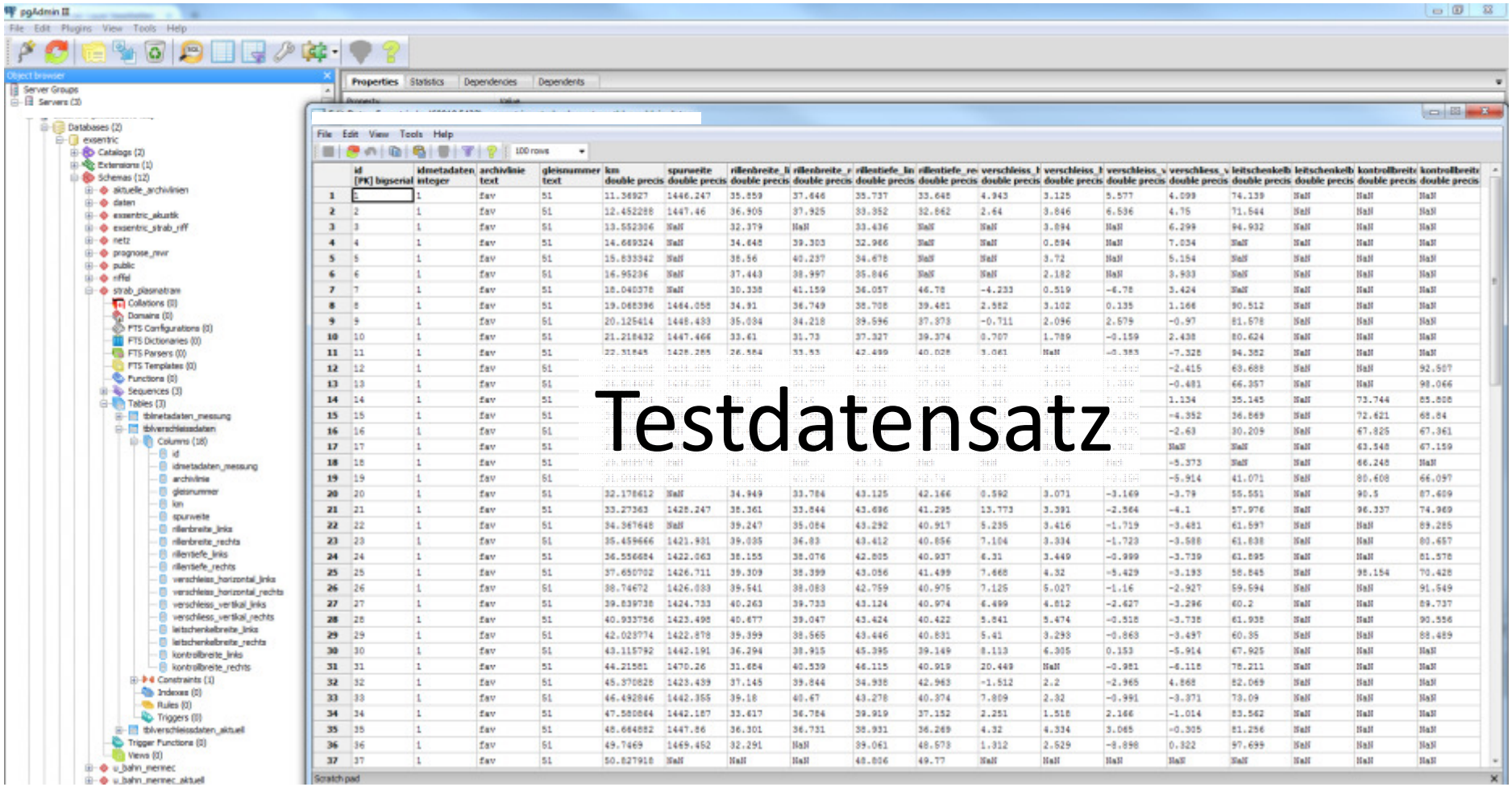
(c) BAMM 2013

# Von Big Data in die DB + GIS

Aggregation notwendig, um Migration in DB + GIS zu ermöglichen

- **Limit** data **by time** (1 set = 688.000 measurement points = 1 run)
- **Merge** attributes (15 values > 1 rating)
- **Seperate** data in modes (subway, tram)
- **Limit** data **by value** (view only poor rating)
- **Reduce** interval (1 measurement point per 6mm > 1m)

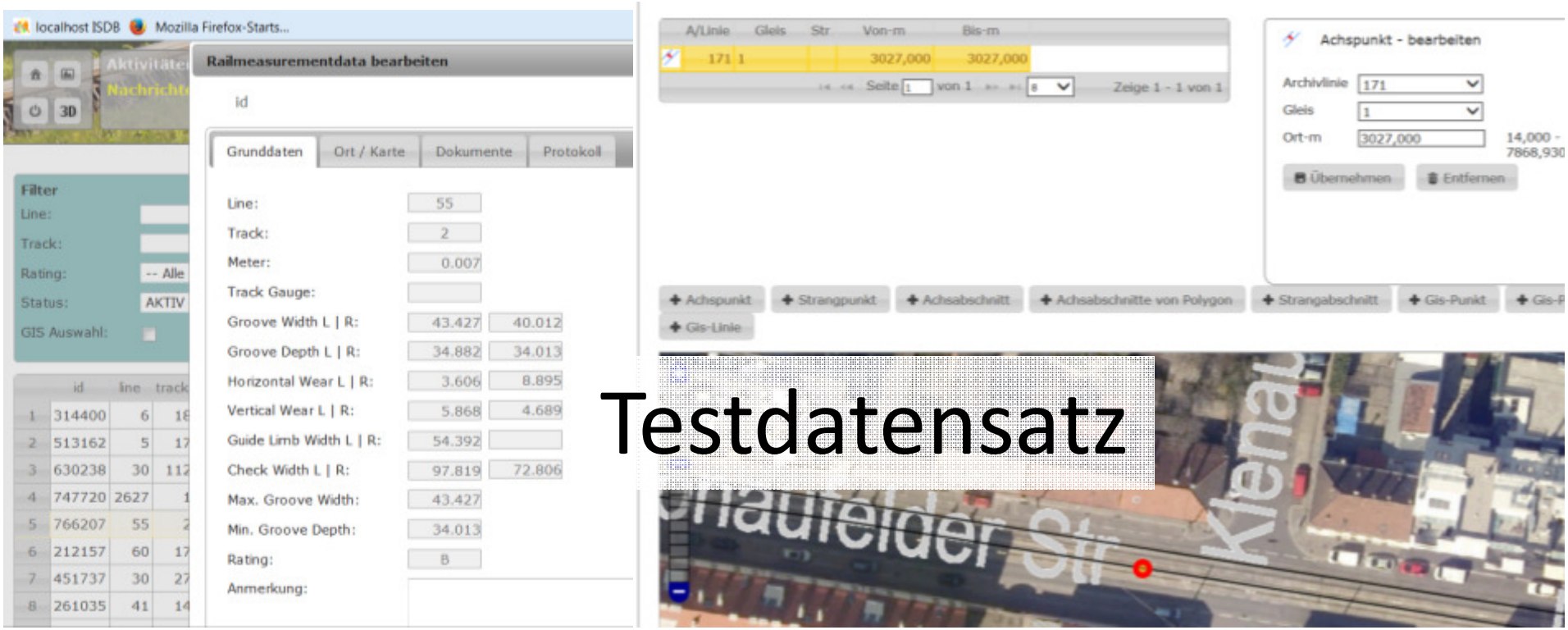
# Von Big Data in die DB + GIS



# Von Big Data in die DB + GIS

| | id | line | track | meter | track gau | groove wic | groove wic | max groov | gr | | | | | | | limb | guide limb | check widt | check widt | rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 828289 | 1 | 1 | 118.21 | 1453.68 | 38.30 | 40.16 | 40.16 | | | | | | | | 73.92 | | | | C1 |
| 2 | 465458 | 1 | 1 | 119.23 | 1445.69 | 37.78 | 44.18 | 44.18 | | | | | | | | 75.32 | | | 86.23 | C1 |
| 3 | 668600 | 1 | 1 | 144.97 | | 39.78 | 47.65 | 47.65 | | | | | | | | 80.61 | | | 93.70 | C1 |
| 4 | 463671 | 1 | 1 | 207.46 | | 28.04 | 44.67 | 44.67 | | | | | | | | | 47.05 | 50.12 | | C1 |
| 5 | 412899 | 1 | 1 | 279.16 | | 38.34 | 39.17 | 39.17 | 30.48 | 27.83 | 27.83 | 18.26 | 4.90 | 12.14 | 8.47 | 71.74 | 47.74 | | | C1 |
| 6 | 369317 | 1 | 1 | 356.74 | | 36.99 | 36.47 | 36.99 | 34.47 | 27.59 | 27.59 | 2.51 | 3.97 | 11.89 | 5.34 | 69.40 | | | 89.63 | C1 |
| 7 | 377486 | 1 | 1 | 357.85 | 1420.09 | 39.89 | 39.31 | 39.89 | 31.72 | 27.59 | 27.59 | 2.84 | 5.81 | 12.35 | 6.75 | 59.73 | | | 89.58 | C1 |
| 8 | 313700 | 1 | 1 | 358.27 | 1420.90 | 37.74 | 36.47 | 37.74 | 31.48 | 26.50 | 26.50 | 3.79 | 3.64 | 13.44 | 7.18 | 64.41 | | | 90.16 | C1 |
| 9 | 553521 | 1 | 1 | 359.11 | 1427.29 | 38.30 | 38.21 | 38.30 | 32.49 | 25.36 | 25.36 | 3.96 | 11.03 | 13.95 | 6.79 | 69.19 | | | | C1 |
| 10 | 185590 | 1 | 1 | 666.83 | 1461.97 | 38.69 | 45.65 | 45.65 | 26.50 | 31.36 | 26.50 | 8.71 | 8.96 | 8.45 | 13.50 | | 90.14 | | 44.49 | C1 |
| 11 | 756932 | 1 | 1 | 720.97 | | 37.38 | 31.00 | 37.38 | 39.73 | 26.93 | 26.93 | 16.73 | 0.33 | 12.90 | -0.25 | 98.98 | 64.99 | | 34.00 | C1 |
| 12 | 708671 | 1 | 1 | 1195.28 | | 38.31 | 36.54 | 38.31 | 26.93 | 32.09 | 26.93 | 1.32 | 5.12 | 7.87 | 12.63 | 60.15 | | 98.46 | 87.82 | C1 |
| 13 | 88534 | 1 | 1 | 1196.38 | | 37.02 | 48.04 | 48.04 | 24.82 | 49.73 | 24.82 | | 4.30 | | 13.82 | 59.51 | | 96.53 | 81.36 | C1 |
| 14 | 440345 | 1 | 1 | 1197.48 | | 36.72 | 41.02 | 41.02 | 25.91 | 42.84 | 25.91 | 1.00 | 3.11 | -3.51 | 13.82 | 62.11 | | 98.83 | 90.93 | C1 |

# Von Big Data in die DB + GIS



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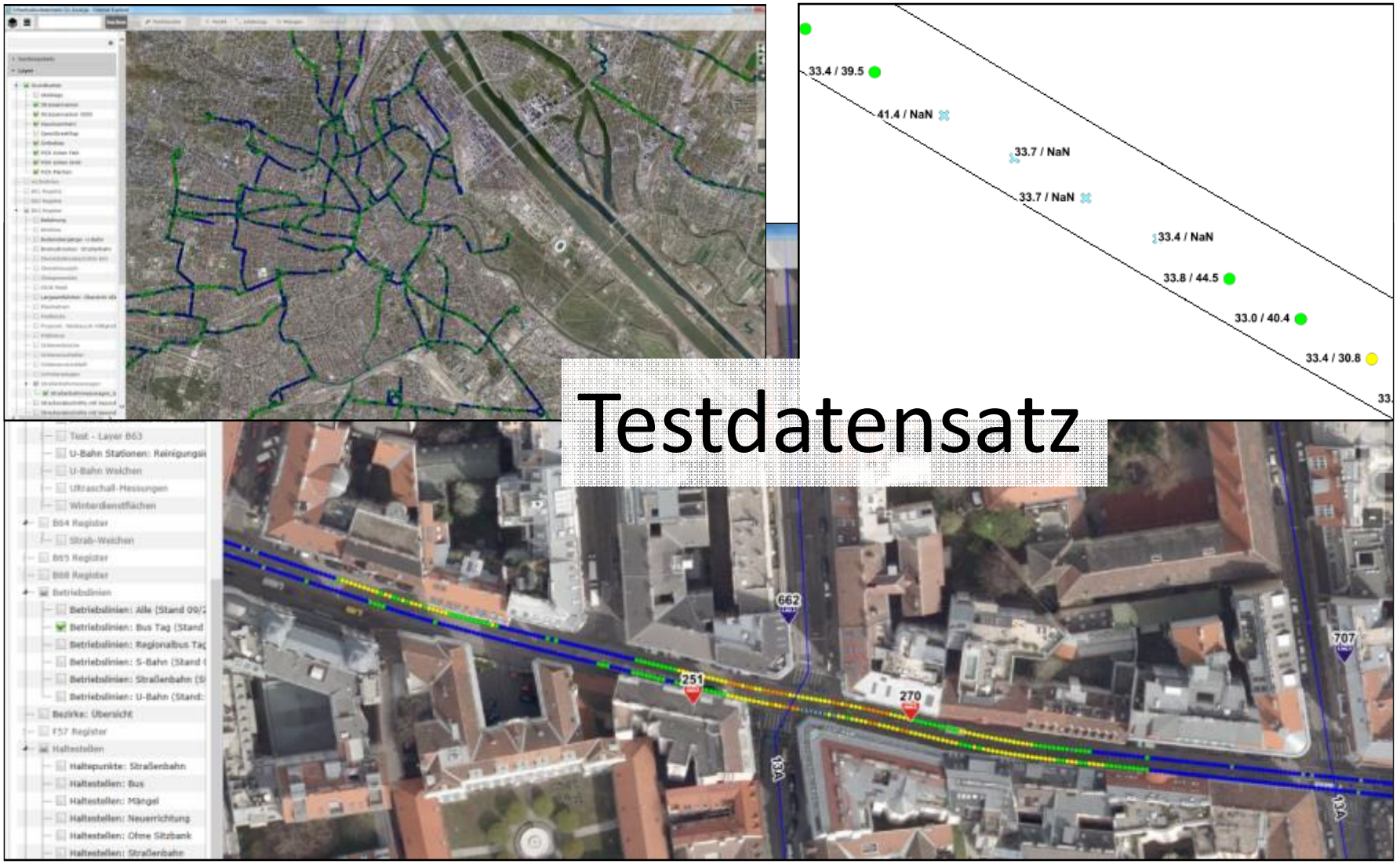

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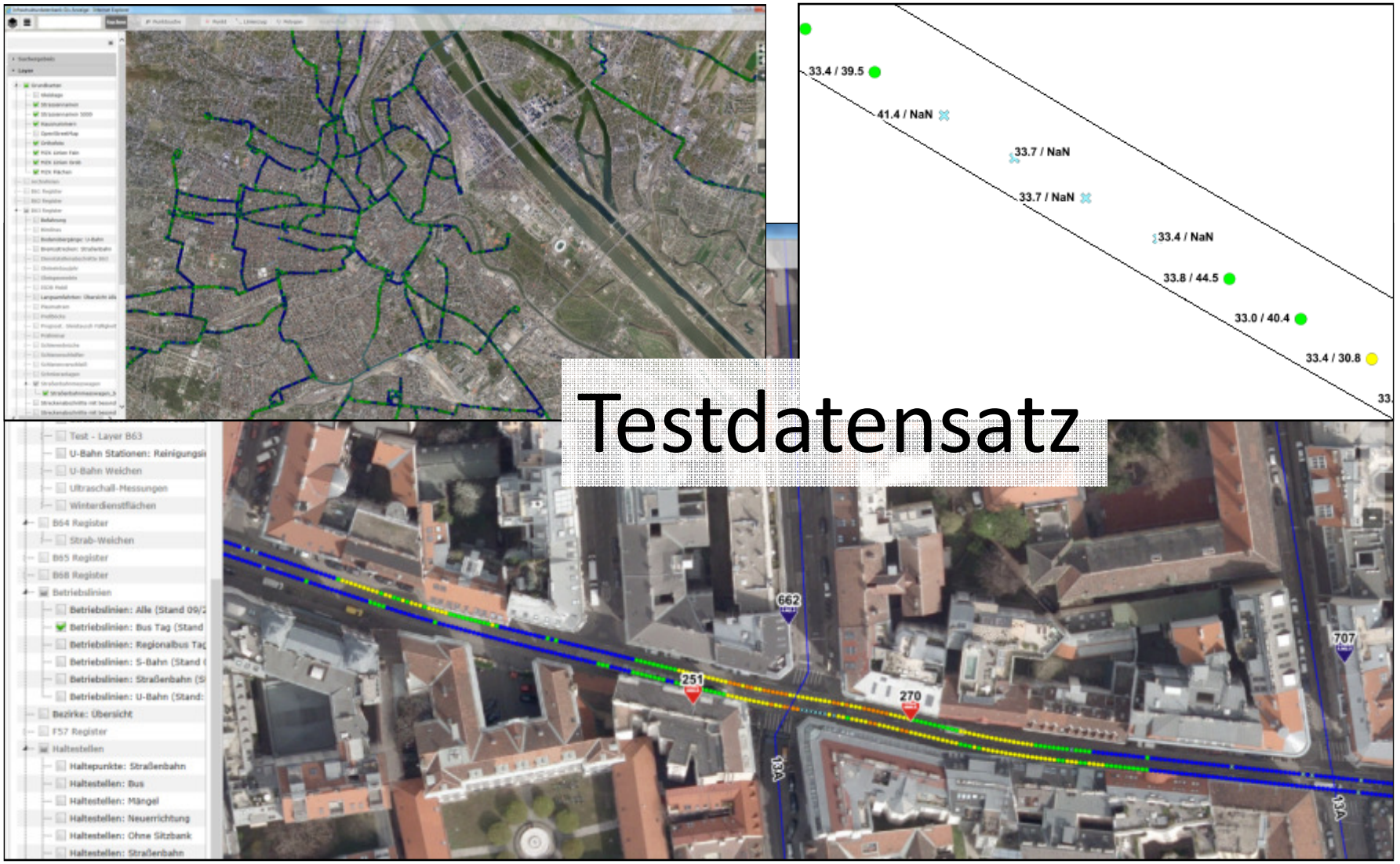
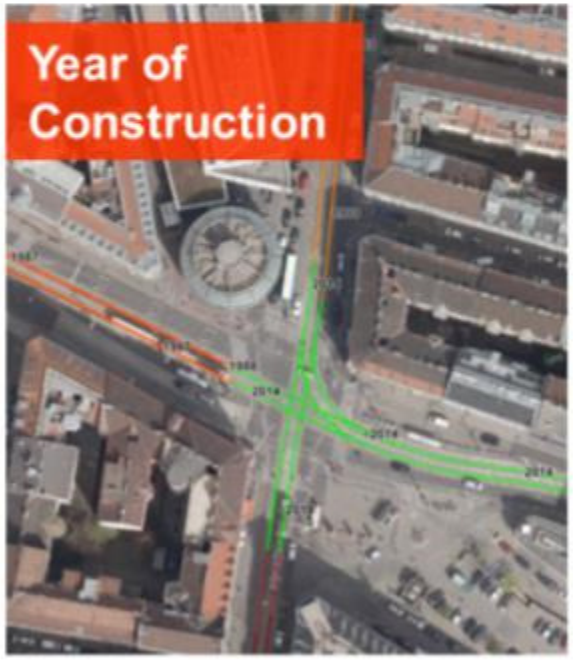
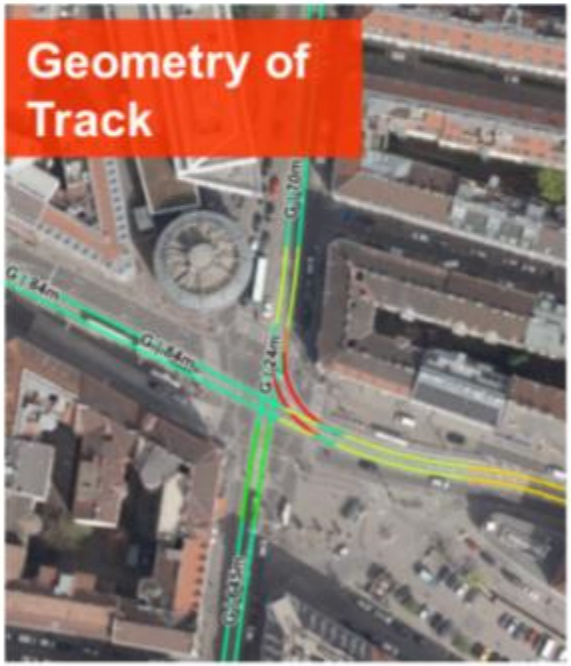


# Von DB + GIS zum Asset Management

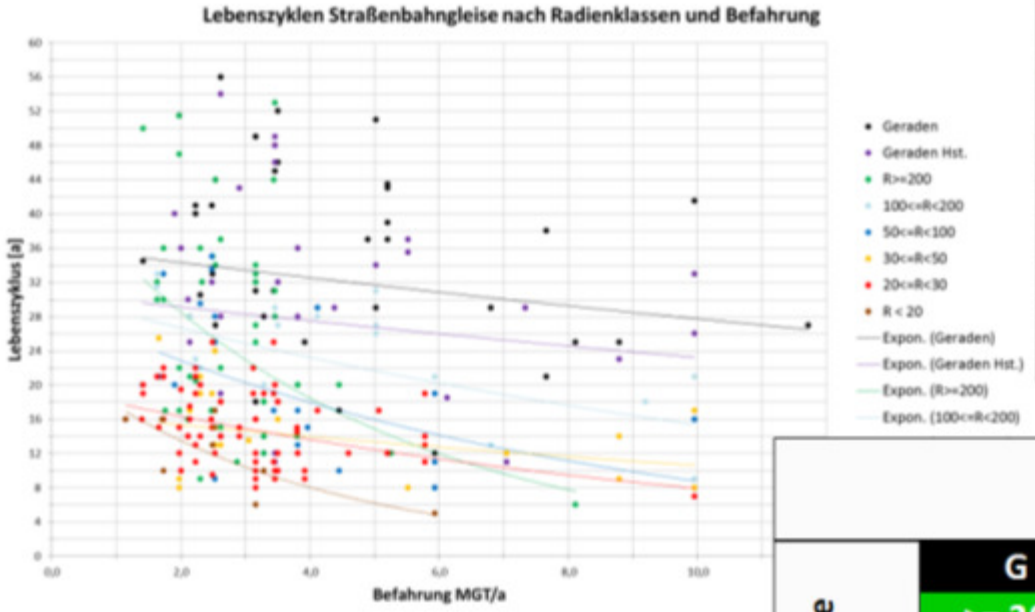
- Fast results within 6 month expected
- Easy understanding for stakeholders
- Minimal effort due to usage of existing data

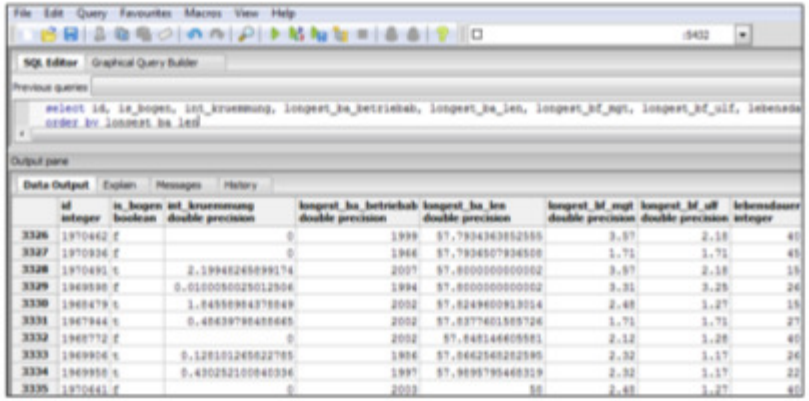




# Von DB + GIS zum Asset Management

## Set lifetime by classification

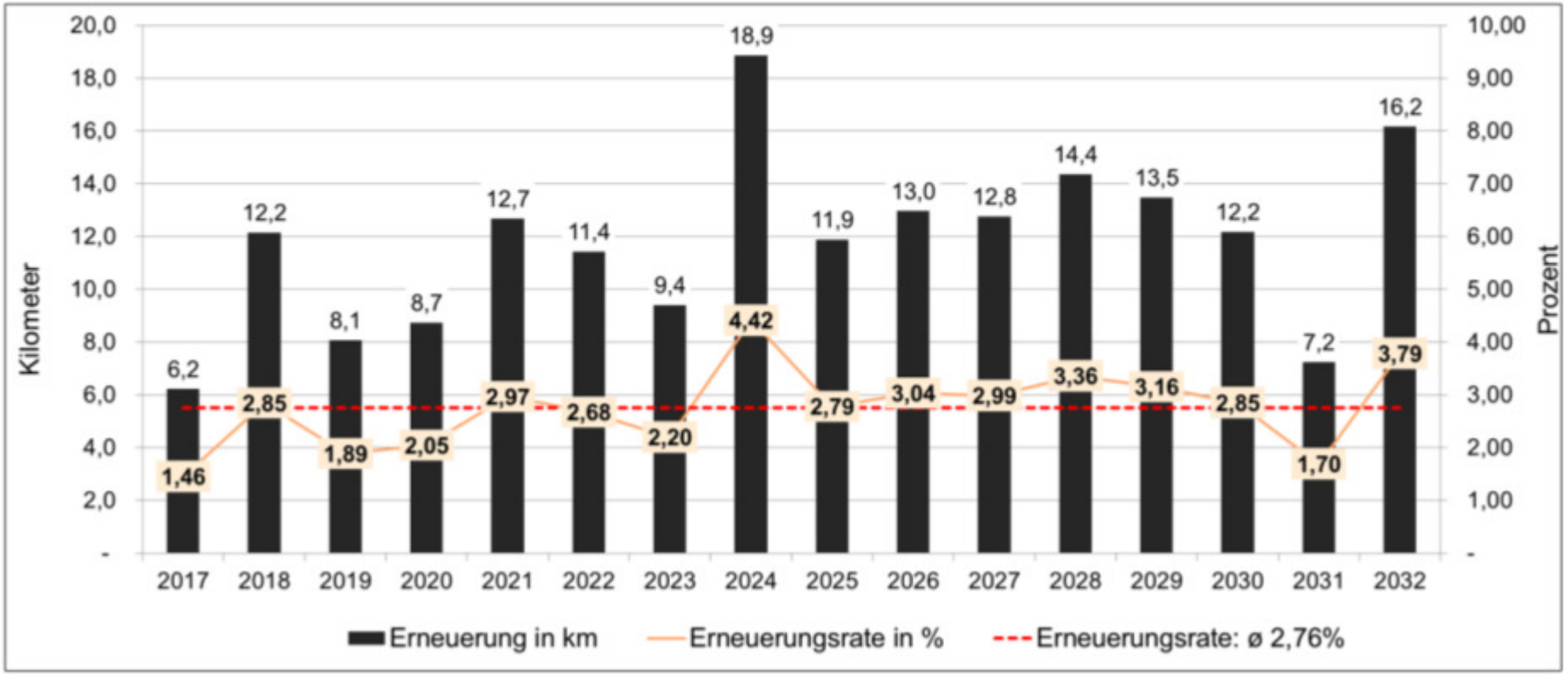


| Gleisgeometrie (Radius) | Befahrung in MGT/Jahr | | | | |
|---|---|---|---|---|---|
| | 0 < 2 | 2 < 4 | 4 < 6 | 6 < 8 | 8 <= 10 |
| G | 45 | 40 | 36 | 30 | 28 |
| >= 200 | 33 | 26 | 23 | 21 | 19 |
| 100 < 200 | 28 | 25 | 22 | 19 | 16 |
| 50 < 100 | 27 | 22 | 15 | 12 | 11 |
| 30 < 50 | 20 | 18 | 14 | 12 | 11 |
| 20 < 30 | 18 | 15 | 12 | 10 | 8 |
| 0 < 20 | 16 | 13 | 8 | | |

# Von DB + GIS zum Asset Management

## Result: Increase of renewal rate to 2.76% on average to hold backlog



# Von DB + GIS zum Asset Management

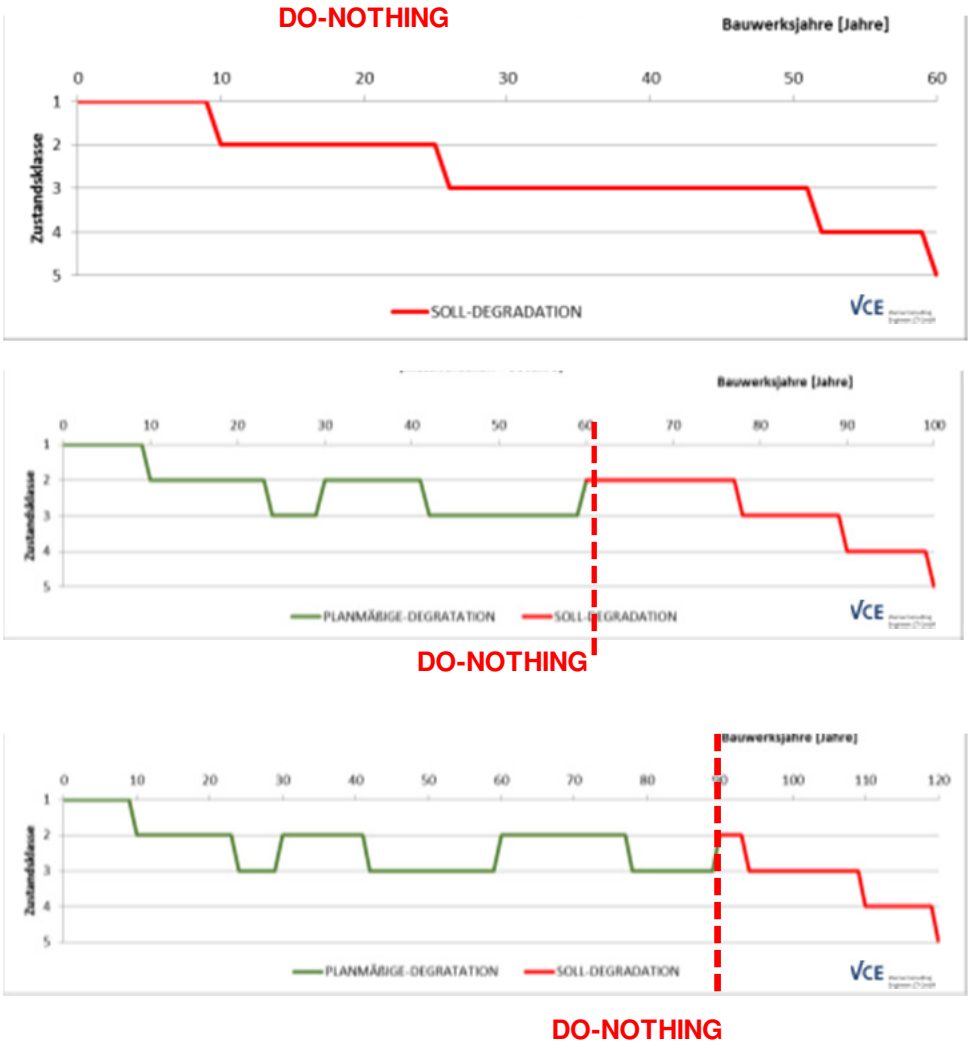
## Forecast: Calculation of the avg. remaining track life-time in 2032 (in 2017 = 11.8 years)

Track length, track geometry, load = const.;

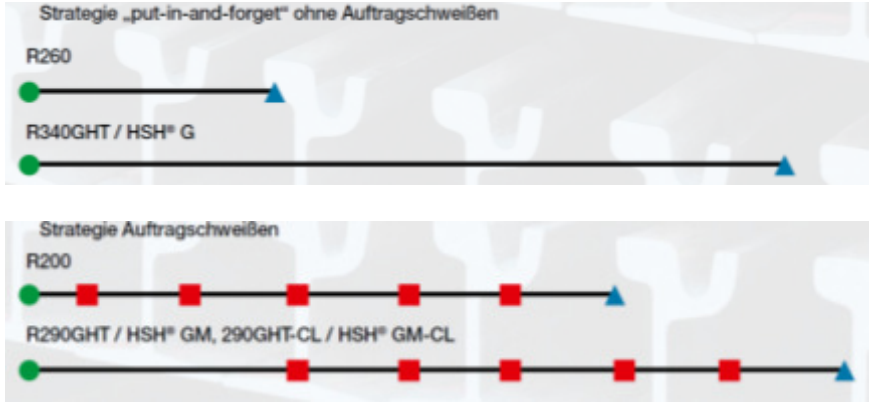
Track with the most negative remaining life-time will replaced first

- at 0% Renewal Rate = 3.23 years
- at 1% Renewal Rate = 6.52 years
- at 3% Renewal Rate = 13.12 years
- at 5% Renewal Rate = 20.88 years

# Von DB + GIS zum Asset Management




IH-Strategien für Bauwerk oder Gleis



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