



# SEITENDRUCKVERSUCH

|                    |                                            |             |                              |
|--------------------|--------------------------------------------|-------------|------------------------------|
| Projektbezeichnung | BAB A81 AK Stuttgart - AS Sindelfingen Ost |             |                              |
| Bohrung            | KB BW 50                                   | Formation   | :                            |
| Versuchstiefe      | 10.25 m                                    | Gestein     | :                            |
| Datum              | 25.05.23                                   | Sondentyp   | Ettlinger Seitendruck 101 mm |
| Gerätenummer       | 17/71                                      | Sondenlänge | 490 mm                       |
| Messrichtung       | :                                          |             |                              |
| Bemerkung          | :                                          |             |                              |

| Laststufe | Zeit  | Druck                | Sensor | Sensor | Verformung | Verformung | mittlere   |
|-----------|-------|----------------------|--------|--------|------------|------------|------------|
| A=Anfang  | [Min] |                      | unten  | oben   | unten      | oben       | Verformung |
| E=Ende    |       | [kN/m <sup>2</sup> ] | [mm]   | [mm]   | [mm]       | [mm]       | [mm]       |
| A         | 0     | 50                   | 3.712  | 2.399  | 0.000      | 0.000      | 0.000      |
| E         | 2     | 50                   | 3.754  | 2.435  | 0.042      | 0.036      | 0.039      |
| A         | 3     | 101                  | 3.907  | 2.643  | 0.195      | 0.244      | 0.219      |
| E         | 4     | 101                  | 3.977  | 2.693  | 0.265      | 0.294      | 0.279      |
| A         | 4     | 151                  | 4.070  | 2.837  | 0.358      | 0.438      | 0.398      |
| E         | 5     | 151                  | 4.144  | 2.891  | 0.432      | 0.492      | 0.462      |
| A         | 5     | 199                  | 4.221  | 3.001  | 0.509      | 0.602      | 0.555      |
| E         | 6     | 199                  | 4.273  | 3.033  | 0.561      | 0.634      | 0.597      |
| A         | 7     | 249                  | 4.336  | 3.107  | 0.624      | 0.708      | 0.666      |
| E         | 12    | 249                  | 4.402  | 3.163  | 0.690      | 0.764      | 0.727      |
| A         | 13    | 200                  | 4.402  | 3.161  | 0.690      | 0.762      | 0.726      |
| E         | 14    | 200                  | 4.401  | 3.158  | 0.689      | 0.759      | 0.724      |
| A         | 14    | 150                  | 4.389  | 3.124  | 0.677      | 0.725      | 0.701      |
| E         | 15    | 150                  | 4.386  | 3.118  | 0.674      | 0.719      | 0.696      |
| A         | 16    | 100                  | 4.381  | 3.109  | 0.669      | 0.710      | 0.690      |
| E         | 18    | 100                  | 4.380  | 3.103  | 0.668      | 0.704      | 0.686      |
| A         | 18    | 151                  | 4.380  | 3.104  | 0.668      | 0.705      | 0.686      |
| E         | 19    | 151                  | 4.380  | 3.104  | 0.668      | 0.705      | 0.686      |
| A         | 20    | 200                  | 4.381  | 3.112  | 0.669      | 0.713      | 0.691      |
| E         | 21    | 200                  | 4.381  | 3.115  | 0.669      | 0.716      | 0.693      |
| A         | 22    | 249                  | 4.402  | 3.176  | 0.690      | 0.777      | 0.734      |
| E         | 23    | 249                  | 4.414  | 3.184  | 0.702      | 0.785      | 0.743      |
| A         | 23    | 299                  | 4.449  | 3.233  | 0.737      | 0.834      | 0.786      |
| E         | 24    | 299                  | 4.469  | 3.260  | 0.757      | 0.861      | 0.809      |
| A         | 24    | 349                  | 4.502  | 3.310  | 0.790      | 0.911      | 0.851      |
| E         | 25    | 349                  | 4.553  | 3.334  | 0.841      | 0.935      | 0.888      |
| A         | 26    | 400                  | 4.595  | 3.401  | 0.883      | 1.002      | 0.943      |
| E         | 27    | 400                  | 4.636  | 3.417  | 0.924      | 1.018      | 0.971      |
| A         | 27    | 450                  | 4.669  | 3.468  | 0.957      | 1.069      | 1.013      |
| E         | 28    | 450                  | 4.704  | 3.494  | 0.992      | 1.095      | 1.043      |
| A         | 29    | 500                  | 4.741  | 3.534  | 1.029      | 1.135      | 1.082      |
| E         | 34    | 500                  | 4.810  | 3.575  | 1.098      | 1.176      | 1.137      |
| A         | 34    | 399                  | 4.806  | 3.566  | 1.094      | 1.167      | 1.130      |
| E         | 35    | 399                  | 4.805  | 3.565  | 1.093      | 1.166      | 1.129      |
| A         | 36    | 301                  | 4.801  | 3.541  | 1.089      | 1.142      | 1.115      |
| E         | 37    | 301                  | 4.801  | 3.533  | 1.089      | 1.134      | 1.111      |
| A         | 37    | 200                  | 4.796  | 3.527  | 1.084      | 1.128      | 1.106      |
| E         | 38    | 200                  | 4.796  | 3.520  | 1.084      | 1.121      | 1.103      |
| A         | 39    | 101                  | 4.790  | 3.515  | 1.078      | 1.116      | 1.097      |
| E         | 41    | 101                  | 4.788  | 3.506  | 1.076      | 1.107      | 1.092      |
| A         | 42    | 200                  | 4.788  | 3.507  | 1.076      | 1.108      | 1.092      |
| E         | 43    | 200                  | 4.789  | 3.508  | 1.077      | 1.109      | 1.093      |
| A         | 43    | 299                  | 4.791  | 3.509  | 1.079      | 1.110      | 1.094      |
| E         | 44    | 299                  | 4.791  | 3.510  | 1.079      | 1.111      | 1.095      |



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|                    |                                              |             |                                |
|--------------------|----------------------------------------------|-------------|--------------------------------|
| Projektbezeichnung | : BAB A81 AK Stuttgart - AS Sindelfingen Ost |             |                                |
| Bohrung            | : KB BW 50                                   | Formation   | :                              |
| Versuchstiefe      | : 10.25 m                                    | Gestein     | :                              |
| Datum              | : 25.05.23                                   | Sondentyp   | : Ettlinger Seitendruck 101 mm |
| Gerätenummer       | : 17/71                                      | Sondenlänge | : 490 mm                       |
| Messrichtung       | :                                            |             |                                |
| Bemerkung          | :                                            |             |                                |

| Laststufe | Zeit  | Druck                | Sensor | Sensor | Verformung | Verformung | mittlere   |
|-----------|-------|----------------------|--------|--------|------------|------------|------------|
| A=Anfang  | [Min] |                      | unten  | oben   | unten      | oben       | Verformung |
| E=Ende    |       | [kN/m <sup>2</sup> ] | [mm]   | [mm]   | [mm]       | [mm]       | [mm]       |
| A         | 44    | 400                  | 4.793  | 3.513  | 1.081      | 1.114      | 1.097      |
| E         | 45    | 400                  | 4.794  | 3.525  | 1.082      | 1.126      | 1.104      |
| A         | 46    | 501                  | 4.797  | 3.576  | 1.085      | 1.177      | 1.131      |
| E         | 47    | 501                  | 4.824  | 3.598  | 1.112      | 1.199      | 1.156      |
| A         | 47    | 600                  | 4.879  | 3.671  | 1.167      | 1.272      | 1.219      |
| E         | 48    | 600                  | 4.915  | 3.706  | 1.203      | 1.307      | 1.255      |
| A         | 48    | 701                  | 5.000  | 3.781  | 1.288      | 1.382      | 1.335      |
| E         | 49    | 701                  | 5.049  | 3.806  | 1.337      | 1.407      | 1.372      |
| A         | 50    | 801                  | 5.102  | 3.860  | 1.390      | 1.461      | 1.425      |
| E         | 51    | 801                  | 5.167  | 3.909  | 1.455      | 1.510      | 1.483      |
| A         | 51    | 901                  | 5.248  | 3.966  | 1.536      | 1.567      | 1.551      |
| E         | 56    | 901                  | 5.346  | 4.017  | 1.634      | 1.618      | 1.626      |
| A         | 57    | 701                  | 5.341  | 4.008  | 1.629      | 1.609      | 1.619      |
| E         | 58    | 701                  | 5.338  | 3.997  | 1.626      | 1.598      | 1.612      |
| A         | 58    | 497                  | 5.333  | 3.985  | 1.621      | 1.586      | 1.603      |
| E         | 59    | 497                  | 5.333  | 3.978  | 1.621      | 1.579      | 1.600      |
| A         | 59    | 301                  | 5.328  | 3.975  | 1.616      | 1.576      | 1.596      |
| E         | 60    | 301                  | 5.328  | 3.971  | 1.616      | 1.572      | 1.594      |
| A         | 61    | 199                  | 5.325  | 3.966  | 1.613      | 1.567      | 1.590      |
| E         | 62    | 199                  | 5.325  | 3.951  | 1.613      | 1.552      | 1.582      |
| A         | 63    | 52                   | 5.318  | 3.819  | 1.606      | 1.420      | 1.513      |
| E         | 65    | 52                   | 5.318  | 3.743  | 1.606      | 1.344      | 1.475      |



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| Projektbezeichnung | : BAB A81 AK Stuttgart - AS Sindelfingen Ost |             |                                |
| Bohrung            | : KB BW 50                                   | Formation   | :                              |
| Versuchstiefe      | : 10.25 m                                    | Gestein     | :                              |
| Datum              | : 25.05.23                                   | Sondentyp   | : Ettlinger Seitendruck 101 mm |
| Gerätenummer       | : 17/71                                      | Sondenlänge | : 490 mm                       |
| Messrichtung       | :                                            |             |                                |
| Bemerkung          | :                                            |             |                                |

## MODULI aus der unteren Verformung :

|               | Lastbereich<br>[kN/m <sup>2</sup> ] | Verschiebung<br>[mm] | Ermittelte Moduli bei unterschiedlichen Poissonszahlen |                                |                               |                               |                               |                               |
|---------------|-------------------------------------|----------------------|--------------------------------------------------------|--------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
|               |                                     |                      | Steifemodul in Klammern                                |                                |                               |                               |                               |                               |
|               |                                     |                      | v=0,25<br>[MN/m <sup>2</sup> ]                         | v=0,25<br>[MN/m <sup>2</sup> ] | v=0,3<br>[MN/m <sup>2</sup> ] | v=0,3<br>[MN/m <sup>2</sup> ] | v=0,4<br>[MN/m <sup>2</sup> ] | v=0,4<br>[MN/m <sup>2</sup> ] |
| Belastung     | 50 - 249                            | 0.648                | 30.6                                                   |                                | 30.2                          |                               | 28.1                          |                               |
| Entlastung    | 205 - 145                           | -0.016               | 379.5                                                  | (455.4)                        | 374.1                         | (503.6)                       | 348.0                         | (745.6)                       |
| Belastung     | 100 - 500                           | 0.430                | 92.6                                                   |                                | 91.3                          |                               | 84.9                          |                               |
| Entlastung    | 381 - 221                           | -0.007               | 2205.8                                                 | (2647.0)                       | 2174.5                        | (2927.2)                      | 2022.4                        | (4333.7)                      |
| Belastung     | 101 - 901                           | 0.558                | 142.7                                                  |                                | 140.7                         |                               | 130.8                         |                               |
| Entlastung    | 646 - 307                           | -0.009               | 3972.2                                                 | (4766.7)                       | 3915.8                        | (5271.3)                      | 3641.9                        | (7804.0)                      |
| Erstbelastung | 50 - 249                            | 0.648                | 30.6                                                   |                                | 30.2                          |                               | 28.1                          |                               |
| Erstbelastung | 249 - 500                           | 0.396                | 63.0                                                   |                                | 62.1                          |                               | 57.8                          |                               |
| Erstbelastung | 501 - 901                           | 0.522                | 76.3                                                   |                                | 75.2                          |                               | 69.9                          |                               |
| Wiederbelast. | 100 - 249                           | 0.034                | 436.9                                                  |                                | 430.7                         |                               | 400.6                         |                               |
| Wiederbelast. | 101 - 501                           | 0.036                | 1105.6                                                 |                                | 1089.9                        |                               | 1013.6                        |                               |

## MODULI aus der oberen Verformung :

|               |           |        |        |          |        |          |        |          |
|---------------|-----------|--------|--------|----------|--------|----------|--------|----------|
| Belastung     | 50 - 249  | 0.728  | 27.3   |          | 26.9   |          | 25     |          |
| Entlastung    | 205 - 145 | -0.042 | 141.9  | (170.3)  | 139.9  | (188.3)  | 130.1  | (278.8)  |
| Belastung     | 100 - 500 | 0.472  | 84.4   |          | 83.2   |          | 77.3   |          |
| Entlastung    | 381 - 221 | -0.036 | 436.9  | (524.3)  | 430.7  | (579.8)  | 400.6  | (858.4)  |
| Belastung     | 101 - 901 | 0.511  | 155.8  |          | 153.6  |          | 142.9  |          |
| Entlastung    | 646 - 307 | -0.021 | 1634.0 | (1960.8) | 1610.8 | (2168.4) | 1498.1 | (3210.3) |
| Erstbelastung | 50 - 249  | 0.728  | 27.3   |          | 26.9   |          | 25.0   |          |
| Erstbelastung | 249 - 500 | 0.391  | 63.8   |          | 62.9   |          | 58.5   |          |
| Erstbelastung | 501 - 901 | 0.419  | 95.0   |          | 93.7   |          | 87.1   |          |
| Wiederbelast. | 100 - 249 | 0.081  | 183.4  |          | 180.8  |          | 168.1  |          |
| Wiederbelast. | 101 - 501 | 0.092  | 432.6  |          | 426.5  |          | 396.6  |          |



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| Projektbezeichnung | : BAB A81 AK Stuttgart - AS Sindelfingen Ost |             |                                |
| Bohrung            | : KB BW 50                                   | Formation   | :                              |
| Versuchstiefe      | : 10.25 m                                    | Gestein     | :                              |
| Datum              | : 25.05.23                                   | Sondentyp   | : Ettlinger Seitendruck 101 mm |
| Gerätenummer       | : 17/71                                      | Sondenlänge | : 490 mm                       |
| Messrichtung       | :                                            |             |                                |
| Bemerkung          | :                                            |             |                                |

## MODULI aus der mittleren Verformung :

|               | Lastbereich<br>[kN/m <sup>2</sup> ] | Verschiebung<br>[mm] | Ermittelte Moduli bei unterschiedlichen Poissonzahlen |                                |                               |                               |                               |                               |
|---------------|-------------------------------------|----------------------|-------------------------------------------------------|--------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
|               |                                     |                      | Steifemodul in Klammern                               |                                |                               |                               |                               |                               |
|               |                                     |                      | v=0,25<br>[MN/m <sup>2</sup> ]                        | v=0,25<br>[MN/m <sup>2</sup> ] | v=0,3<br>[MN/m <sup>2</sup> ] | v=0,3<br>[MN/m <sup>2</sup> ] | v=0,4<br>[MN/m <sup>2</sup> ] | v=0,4<br>[MN/m <sup>2</sup> ] |
| Belastung     | 50 - 249                            | 0.688                | 28.9                                                  |                                | 28.4                          |                               | 26.5                          |                               |
| Entlastung    | 205 - 145                           | -0.029               | 206.5                                                 | (247.9)                        | 203.6                         | (274.1)                       | 189.4                         | (405.8)                       |
| Belastung     | 100 - 500                           | 0.451                | 88.3                                                  |                                | 87.0                          |                               | 80.9                          |                               |
| Entlastung    | 381 - 221                           | -0.022               | 729.4                                                 | (875.2)                        | 719.0                         | (967.9)                       | 668.7                         | (1432.9)                      |
| Belastung     | 101 - 901                           | 0.534                | 149.0                                                 |                                | 146.8                         |                               | 136.6                         |                               |
| Entlastung    | 646 - 307                           | -0.015               | 2315.5                                                | (2778.6)                       | 2282.7                        | (3072.8)                      | 2123.0                        | (4549.2)                      |
| Erstbelastung | 50 - 249                            | 0.688                | 28.9                                                  |                                | 28.4                          |                               | 26.5                          |                               |
| Erstbelastung | 249 - 500                           | 0.393                | 63.4                                                  |                                | 62.5                          |                               | 58.2                          |                               |
| Erstbelastung | 501 - 901                           | 0.470                | 84.6                                                  |                                | 83.4                          |                               | 77.6                          |                               |
| Wiederbelast. | 100 - 249                           | 0.057                | 258.3                                                 |                                | 254.7                         |                               | 236.9                         |                               |
| Wiederbelast. | 101 - 501                           | 0.064                | 621.9                                                 |                                | 613.1                         |                               | 570.2                         |                               |

## FORMELN :

Gleichung für die Modulberechnung:

$$E = f \times d \times \frac{\Delta p}{\Delta d}$$

f (für Poissonzahl 0,25)= 0.986

f (für Poissonzahl 0,30)= 0.972

f (für Poissonzahl 0,40)= 0.904

d = 101 mm Anfangsdurchmesser der Versuchsbohrung

delta p = Änderung der Bodenpressung

delta v = Änderung des Durchmessers

Modulberechnungen nach DIN 4094-5



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| Bohrung            | : KB BW 50                                   | Formation   | :                              |
| Versuchstiefe      | : 10.25 m                                    | Gestein     | :                              |
| Datum              | : 25.05.23                                   | Sondentyp   | : Ettlinger Seitendruck 101 mm |
| Gerätenummer       | : 17/71                                      | Sondenlänge | : 490 mm                       |
| Messrichtung       | :                                            |             |                                |
| Bemerkung          | :                                            |             |                                |

