



# SEITENDRUCKVERSUCH

|                    |                            |             |                                |
|--------------------|----------------------------|-------------|--------------------------------|
| Projektbezeichnung | : Rhein-Main-Link, PFA HE3 |             |                                |
| Bohrung            | : P07-Roc-BK-0016          | Formation   | :                              |
| Versuchstiefe      | : 9.50 m                   | Gestein     | :                              |
| Datum              | : 19.09.24                 | Sondentyp   | : Ettlinger Seitendruck 146 mm |
| Gerätenummer       | : 14/40                    | 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     | 150                  | 2.205  | 3.513  | 0.000      | 0.000      | 0.000      |
| E         | 3     | 150                  | 2.506  | 4.122  | 0.301      | 0.609      | 0.455      |
| A         | 4     | 251                  | 2.892  | 4.598  | 0.687      | 1.085      | 0.886      |
| E         | 5     | 251                  | 3.028  | 4.855  | 0.823      | 1.342      | 1.083      |
| A         | 6     | 499                  | 4.036  | 6.339  | 1.831      | 2.826      | 2.328      |
| E         | 11    | 499                  | 4.285  | 6.958  | 2.080      | 3.445      | 2.763      |
| A         | 11    | 251                  | 4.269  | 6.944  | 2.064      | 3.431      | 2.748      |
| E         | 12    | 251                  | 4.262  | 6.944  | 2.057      | 3.431      | 2.744      |
| A         | 12    | 151                  | 4.248  | 6.808  | 2.043      | 3.295      | 2.669      |
| E         | 15    | 151                  | 4.246  | 6.790  | 2.041      | 3.277      | 2.659      |
| A         | 15    | 249                  | 4.247  | 6.792  | 2.042      | 3.279      | 2.661      |
| E         | 16    | 249                  | 4.247  | 6.792  | 2.042      | 3.279      | 2.661      |
| A         | 17    | 500                  | 4.287  | 6.936  | 2.082      | 3.423      | 2.752      |
| E         | 18    | 500                  | 4.339  | 7.039  | 2.134      | 3.526      | 2.830      |
| A         | 18    | 749                  | 5.074  | 8.069  | 2.869      | 4.556      | 3.713      |
| E         | 19    | 749                  | 5.251  | 8.349  | 3.046      | 4.836      | 3.941      |
| A         | 19    | 999                  | 6.166  | 9.688  | 3.961      | 6.175      | 5.068      |
| E         | 20    | 999                  | 6.423  | 10.083 | 4.218      | 6.570      | 5.394      |
| A         | 21    | 1250                 | 7.433  | 11.463 | 5.228      | 7.950      | 6.589      |
| E         | 26    | 1250                 | 7.996  | 12.327 | 5.791      | 8.814      | 7.303      |
| A         | 26    | 751                  | 7.975  | 12.311 | 5.770      | 8.798      | 7.284      |
| E         | 27    | 751                  | 7.975  | 12.307 | 5.770      | 8.794      | 7.282      |
| A         | 28    | 250                  | 7.545  | 11.657 | 5.340      | 8.144      | 6.742      |
| E         | 29    | 250                  | 7.483  | 11.547 | 5.278      | 8.034      | 6.656      |
| A         | 30    | 152                  | 7.165  | 11.260 | 4.960      | 7.747      | 6.353      |
| E         | 33    | 152                  | 7.139  | 11.188 | 4.934      | 7.675      | 6.304      |
| A         | 34    | 251                  | 7.164  | 11.204 | 4.959      | 7.691      | 6.325      |
| E         | 35    | 251                  | 7.166  | 11.204 | 4.961      | 7.691      | 6.326      |
| A         | 36    | 750                  | 7.462  | 11.584 | 5.257      | 8.071      | 6.664      |
| E         | 37    | 750                  | 7.522  | 11.687 | 5.317      | 8.174      | 6.746      |
| A         | 37    | 1251                 | 8.293  | 12.745 | 6.088      | 9.232      | 7.660      |
| E         | 38    | 1251                 | 8.449  | 12.969 | 6.244      | 9.456      | 7.850      |
| A         | 38    | 1502                 | 9.150  | 14.000 | 6.945      | 10.487     | 8.716      |
| E         | 39    | 1502                 | 9.597  | 14.495 | 7.392      | 10.982     | 9.187      |
| A         | 40    | 1751                 | 10.870 | 16.284 | 8.665      | 12.771     | 10.718     |
| E         | 41    | 1751                 | 11.505 | 16.953 | 9.300      | 13.440     | 11.370     |
| A         | 41    | 1998                 | 12.933 | 18.705 | 10.728     | 15.192     | 12.960     |
| E         | 46    | 1998                 | 14.729 | 20.559 | 12.524     | 17.046     | 14.785     |
| A         | 46    | 1253                 | 14.703 | 20.495 | 12.498     | 16.982     | 14.740     |
| E         | 47    | 1253                 | 14.701 | 20.464 | 12.496     | 16.951     | 14.724     |
| A         | 48    | 254                  | 13.573 | 19.172 | 11.368     | 15.659     | 13.514     |
| E         | 49    | 254                  | 13.430 | 18.994 | 11.225     | 15.481     | 13.353     |
| A         | 49    | 151                  | 13.169 | 18.786 | 10.964     | 15.273     | 13.119     |
| E         | 52    | 151                  | 12.941 | 18.497 | 10.736     | 14.984     | 12.860     |



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| Bohrung            | : P07-Roc-BK-0016          | Formation   | :                              |
| Versuchstiefe      | : 9.50 m                   | Gestein     | :                              |
| Datum              | : 19.09.24                 | Sondentyp   | : Ettlinger Seitendruck 146 mm |
| Gerätenummer       | : 14/40                    | Sondenlänge | : 490 mm                       |
| Messrichtung       | :                          |             |                                |
| Bemerkung          | :                          |             |                                |

## MODULI aus der unteren 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     | 150 - 499                           | 1.779                | 27.5                                                  |                                | 27.2                          |                               | 25.8                          |                               |
| Entlastung    | 395 - 256                           | -0.013               | 1515.4                                                | (1818.4)                       | 1498.0                        | (2016.5)                      | 1417.5                        | (3037.5)                      |
| Belastung     | 151 - 1250                          | 3.750                | 41.1                                                  |                                | 40.6                          |                               | 38.4                          |                               |
| Entlastung    | 921 - 482                           | -0.271               | 226.8                                                 | (272.2)                        | 224.2                         | (301.8)                       | 212.2                         | (454.7)                       |
| Belastung     | 152 - 1998                          | 7.590                | 34.1                                                  |                                | 33.7                          |                               | 31.9                          |                               |
| Entlastung    | 1444 - 705                          | -0.704               | 147.0                                                 | (176.4)                        | 145.4                         | (195.7)                       | 137.5                         | (294.7)                       |
| Erstbelastung | 150 - 499                           | 1.779                | 27.5                                                  |                                | 27.2                          |                               | 25.8                          |                               |
| Erstbelastung | 500 - 1250                          | 3.657                | 28.7                                                  |                                | 28.4                          |                               | 26.9                          |                               |
| Erstbelastung | 1251 - 1998                         | 6.280                | 16.7                                                  |                                | 16.5                          |                               | 15.6                          |                               |
| Wiederbelast. | 151 - 500                           | 0.093                | 526.0                                                 |                                | 519.9                         |                               | 492.0                         |                               |
| Wiederbelast. | 152 - 1251                          | 1.310                | 117.5                                                 |                                | 116.2                         |                               | 109.9                         |                               |

## MODULI aus der oberen Verformung :

|               |             |        |        |          |       |          |        |          |
|---------------|-------------|--------|--------|----------|-------|----------|--------|----------|
| Belastung     | 150 - 499   | 2.836  | 17.3   |          | 17.1  |          | 16.2   |          |
| Entlastung    | 395 - 256   | -0.008 | 2489.5 | (2987.4) | 2461  | (3312.9) | 2328.7 | (4990.1) |
| Belastung     | 151 - 1250  | 5.537  | 27.8   |          | 27.5  |          | 26     |          |
| Entlastung    | 921 - 482   | -0.415 | 148.3  | (178.0)  | 146.6 | (197.4)  | 138.8  | (297.3)  |
| Belastung     | 152 - 1998  | 9.371  | 27.6   |          | 27.3  |          | 25.8   |          |
| Entlastung    | 1444 - 705  | -0.831 | 124.7  | (149.6)  | 123.2 | (165.9)  | 116.6  | (249.9)  |
| Erstbelastung | 150 - 499   | 2.836  | 17.3   |          | 17.1  |          | 16.2   |          |
| Erstbelastung | 500 - 1250  | 5.288  | 19.9   |          | 19.6  |          | 18.6   |          |
| Erstbelastung | 1251 - 1998 | 7.590  | 13.8   |          | 13.6  |          | 12.9   |          |
| Wiederbelast. | 151 - 500   | 0.249  | 196.4  |          | 194.2 |          | 183.8  |          |
| Wiederbelast. | 152 - 1251  | 1.781  | 86.4   |          | 85.4  |          | 80.8   |          |



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| Datum              | : 19.09.24                 | Sondentyp   | : Ettlinger Seitendruck 146 mm |
| Gerätenummer       | : 14/40                    | 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     | 150 - 499                           | 2.307                | 21.2                                                  |                                | 21.0                          |                               | 19.9                          |                               |
| Entlastung    | 395 - 256                           | -0.010               | 1884.0                                                | (2260.7)                       | 1862.4                        | (2507.0)                      | 1762.3                        | (3776.3)                      |
| Belastung     | 151 - 1250                          | 4.643                | 33.2                                                  |                                | 32.8                          |                               | 31.0                          |                               |
| Entlastung    | 921 - 482                           | -0.343               | 179.4                                                 | (215.2)                        | 177.3                         | (238.7)                       | 167.8                         | (359.5)                       |
| Belastung     | 152 - 1998                          | 8.481                | 30.5                                                  |                                | 30.2                          |                               | 28.5                          |                               |
| Entlastung    | 1444 - 705                          | -0.767               | 134.9                                                 | (161.9)                        | 133.4                         | (179.6)                       | 126.2                         | (270.5)                       |
| Erstbelastung | 150 - 499                           | 2.307                | 21.2                                                  |                                | 21.0                          |                               | 19.9                          |                               |
| Erstbelastung | 500 - 1250                          | 4.473                | 23.5                                                  |                                | 23.2                          |                               | 22.0                          |                               |
| Erstbelastung | 1251 - 1998                         | 6.935                | 15.1                                                  |                                | 14.9                          |                               | 14.1                          |                               |
| Wiederbelast. | 151 - 500                           | 0.171                | 286.1                                                 |                                | 282.8                         |                               | 267.6                         |                               |
| Wiederbelast. | 152 - 1251                          | 1.546                | 99.6                                                  |                                | 98.5                          |                               | 93.2                          |                               |

## FORMELN :

Gleichung für die Modulberechnung:

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

f (für Poissonzahl 0,25)= 0.960

f (für Poissonzahl 0,30)= 0.949

f (für Poissonzahl 0,40)= 0.898

d = 146 mm Anfangsdurchmesser der Versuchsbohrung

delta p = Änderung der Bodenpressung

delta v = Änderung des Durchmessers

Modulberechnungen nach DIN 22476-7



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