

**Anhang zu:**

**Potenzialuntersuchung  
zum Einsatz von  
Asphalteinlagen**

von

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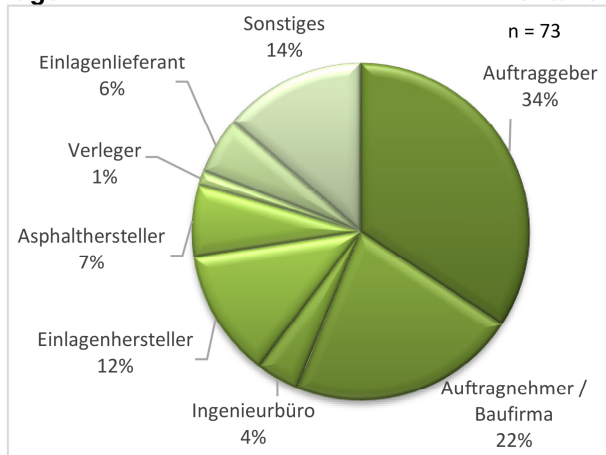
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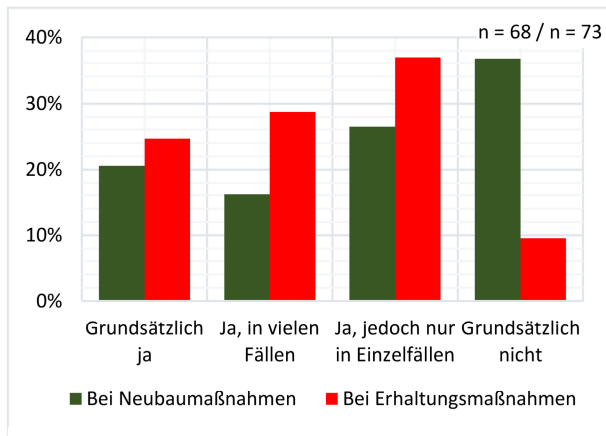
# Anhang 1 - Ergebnisse Experten-umfrage

## In welcher Funktion kommen Sie mit Asphaltteinlagen in Kontakt?



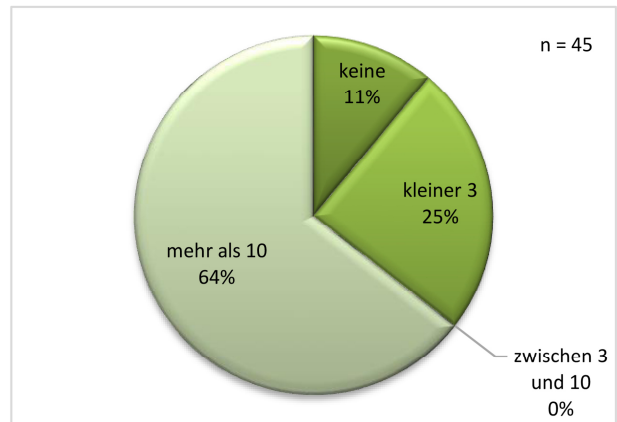
Akteursgruppen

## Sind Sie der Meinung, dass der Einsatz von Asphaltteinlagen die Nutzungsdauer von Asphaltbefestigungen verlängern kann?

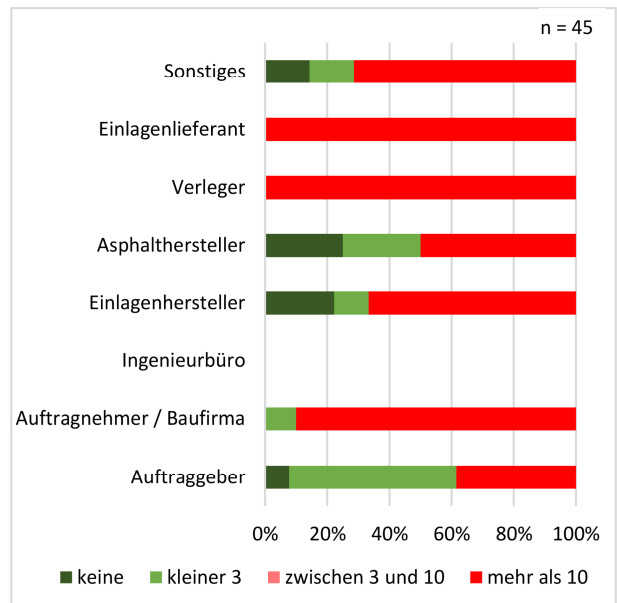


Meinung aller Teilnehmer zur Nutzungsdauerverlängernden Wirkung von Asphaltteinlagen

## Wie viele Projekte in denen Asphaltteinlagen zum Einsatz kamen haben Sie bisher betreut?

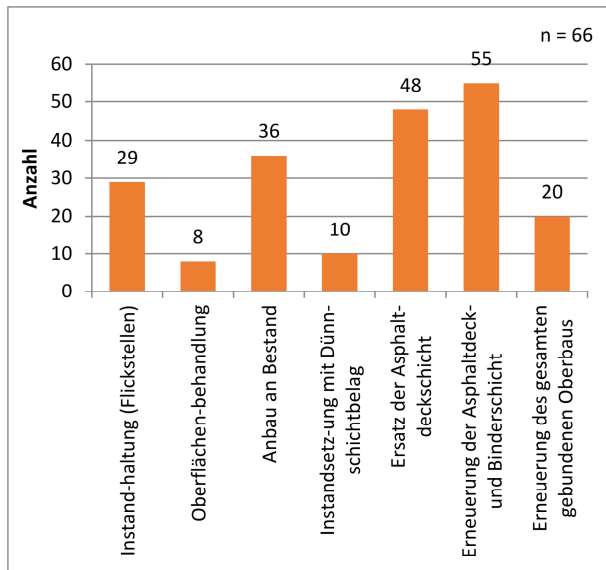


Anzahl betreuter Projekte der Umfrageteilnehmer



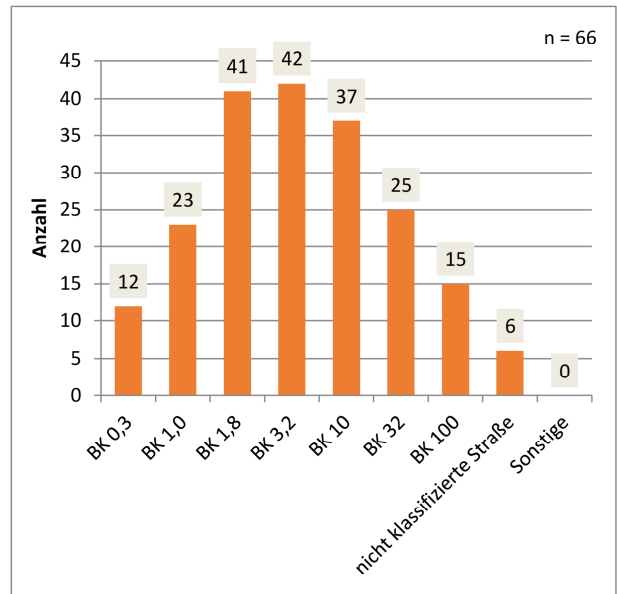
Betreute Projekte nach Akteursgruppen

**Bei welchen Maßnahmen haben Sie bisher Asphalt-einlagen eingesetzt?**



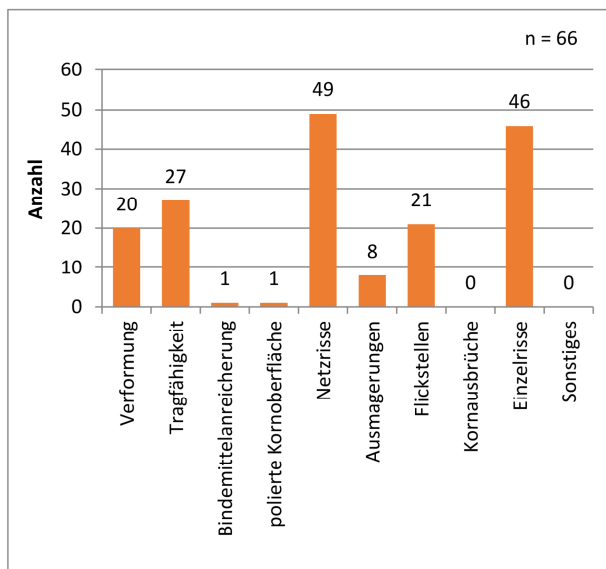
Anzahl und Art der Maßnahmen bei denen Asphalt-einlagen eingesetzt wurden

**In welchem Anwendungsbereich (Belastungs-klassen gemäß RStO) arbeiten Sie mit Asphalt-einlagen?**



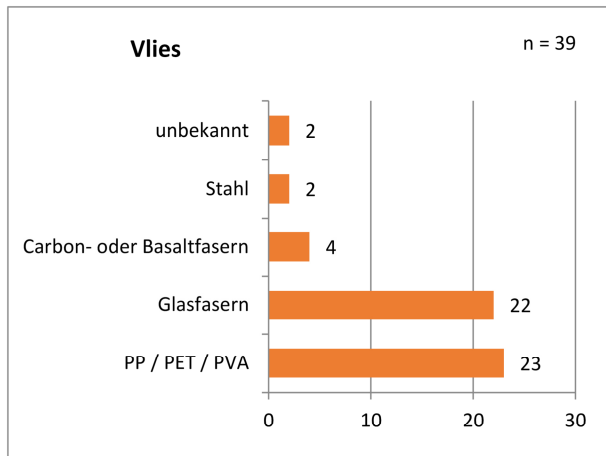
Anwendungsbereich von Asphalt-einlagen nach Belastungs-klassen

**Welche Erscheinungsbilder (vgl. ZTV BEA-StB Tabelle 4.) der bestehenden Befestigungen waren ursächlich für die Entscheidung des Einsatzes einer Asphalt-einlage?**

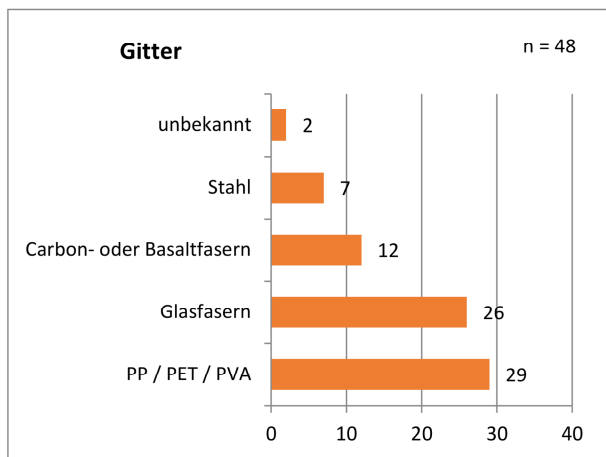


Anzahl und Grund des Einsatzes von Asphalt-einlagen

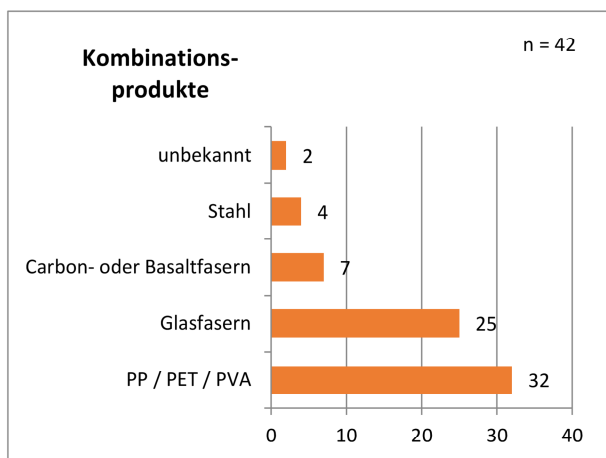
**Welche Art und welche Materialien von Asphalt-einlagen haben Sie bereits verwendet?**



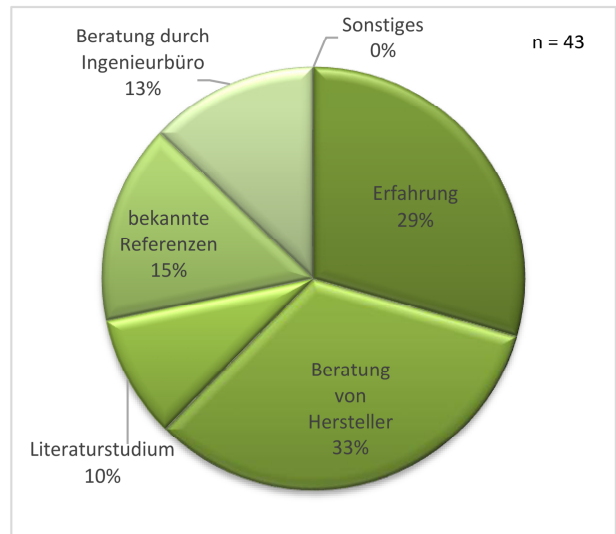
Materialien von verwendeten Vlieseinlagen



Materialien von verwendeten Gittereinlagen

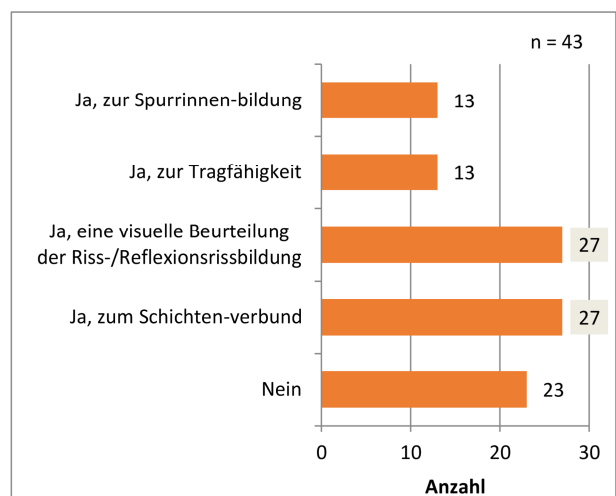


Materialien von Verwendeten Kombinationsprodukten



Gründe für den Einsatz von Asphalteinlagen

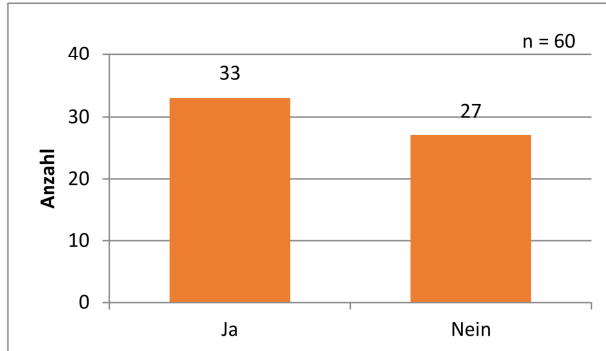
**Liegen Ihnen eigene Untersuchungsergebnisse zu den Eigenschaften der Befestigung mit Asphalteinlage vor?**



Vorhandene Untersuchungsergebnisse von Strecken mit Asphalteinlagen

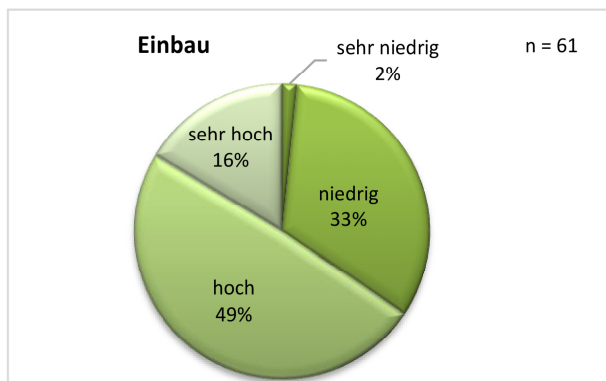
**Aus welchem Grund haben Sie sich für die Einlagen entschieden?**

**Gibt es Referenzbefestigungen ohne Asphalt- einlage mit gleichen Verkehrs- und Umgebungs- einflüssen?**

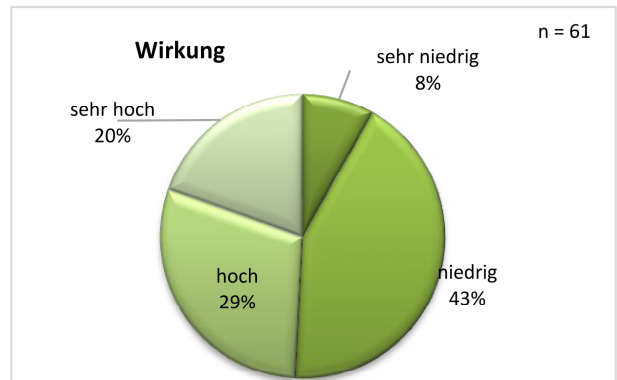


Vorhandene Referenzbefestigungen mit Asphalt einlagen

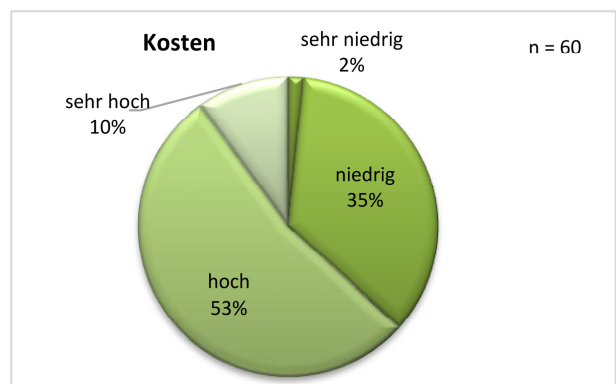
**Wie waren Ihre Erwartungen vor Einbau der As- phalteinlagen, im Hinblick auf Einbau, Kosten und Wirkung?**



Erwartung im Hinblick auf den Einbau von Asphalt einlagen

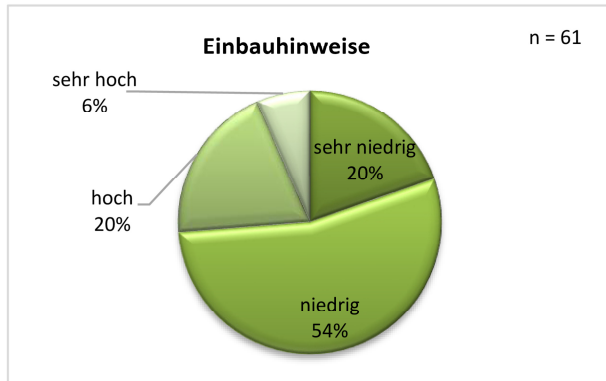


Erwartungen im Hinblick auf die Wirkung von Asphalt einlagen

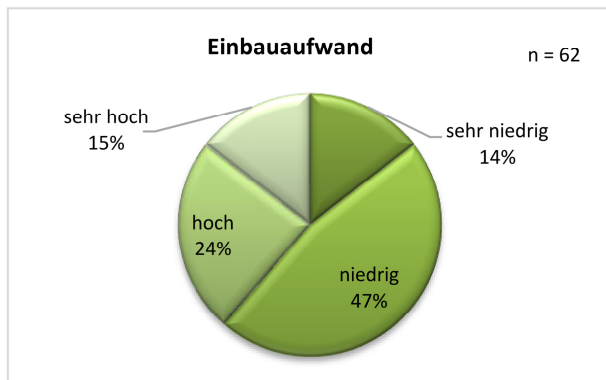


Erwartungen im Hinblick auf die Kosten von Asphalt einlagen

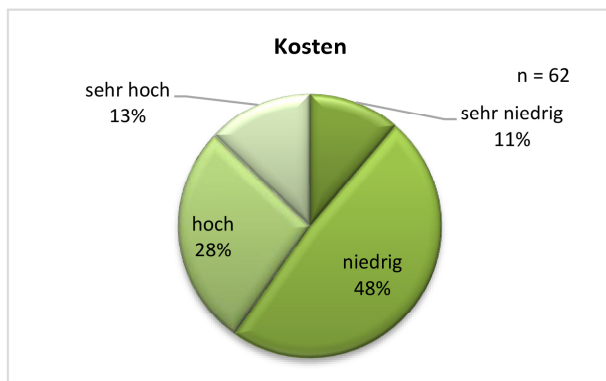
**Wie zufrieden sind Sie mit der Verwendbarkeit und der Wirkung von Asphalteinlagen im Hinblick auf Einbauhinweise, Einbauaufwand, Kosten und Wirkung?**



Zufriedenheit im Hinblick auf die Einbauhinweise für Asphalteinlagen



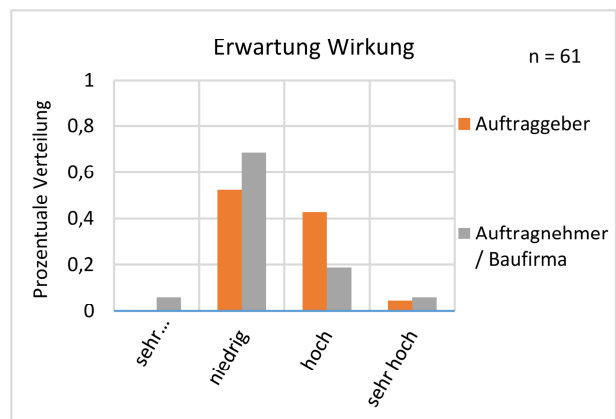
Zufriedenheit im Hinblick auf den Einbauaufwand von Asphalteinlagen



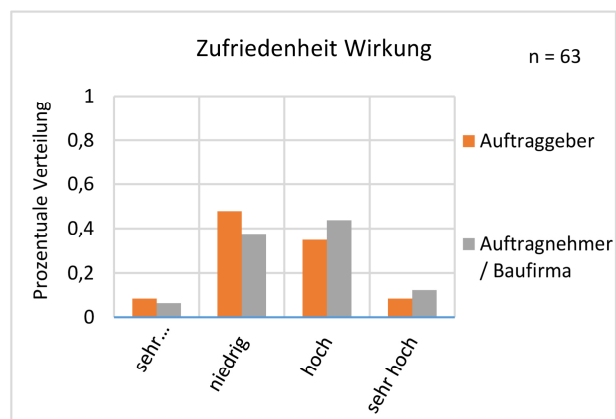
Zufriedenheit im Hinblick auf die Kosten von Asphalteinlagen



Zufriedenheit im Hinblick auf die Wirkung von Asphalteinlagen

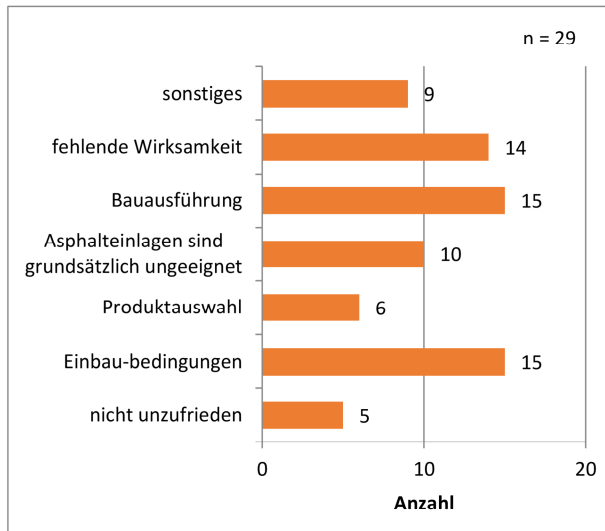


Vergleich der Erwartungen von Auftraggebern und Auftragnehmern mit der Wirkung von Asphalteinlagen



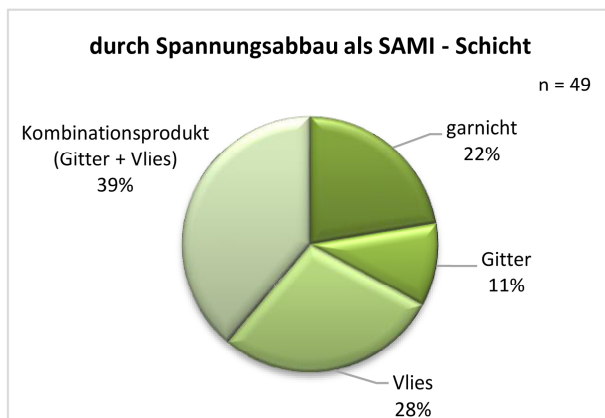
Vergleich der Zufriedenheit von Auftraggebern und Auftragnehmern mit der Wirkung von Asphalteinlagen

Falls sie unzufrieden sind, aus welchen Gründen sind Sie unzufrieden?

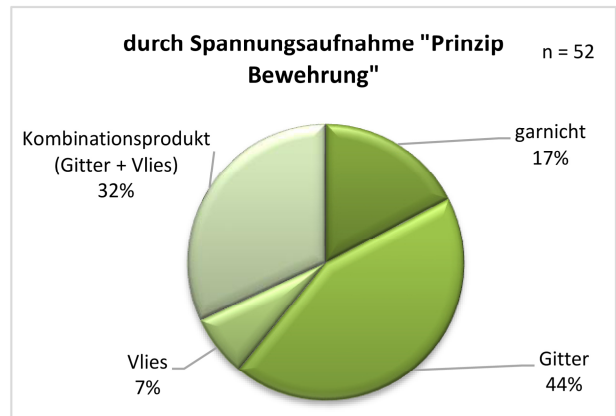


Gründe für die Unzufriedenheit mit Asphalteinlagen

Wie verhindern Asphalteinlagen die Reflexionsrissbildung aus der Unterlage?

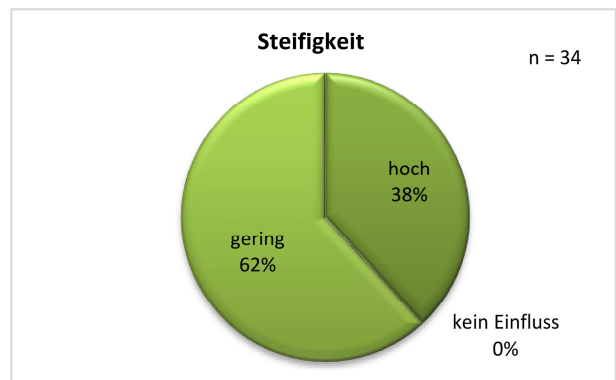


Wird die Reflexionsrissbildung durch Spannungsabbau als SAMI-Schicht verhindert

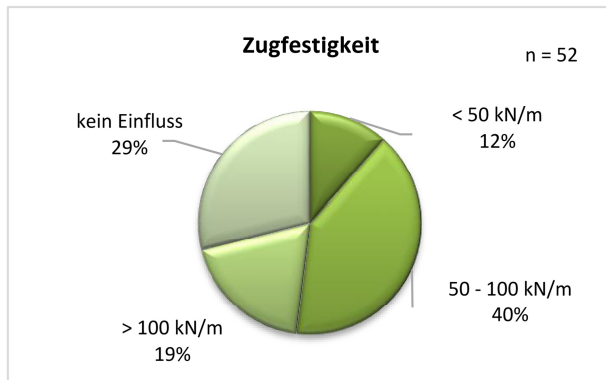


Wird die Reflexionsrissbildung durch Spannungsaufnahme "Prinzip Bewehrung" verhindert

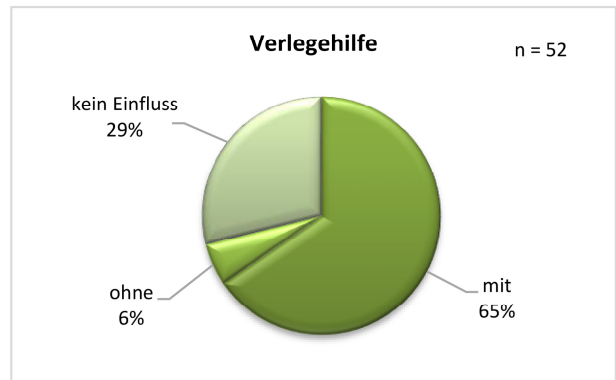
Welche Eigenschaften eines Asphaltgitters würden Sie bei einem Einsatz zur Vermeidung der Reflexionsrissbildung bei Überbauung mit einer 4 cm dicken Asphaltdeckschicht bevorzugen?



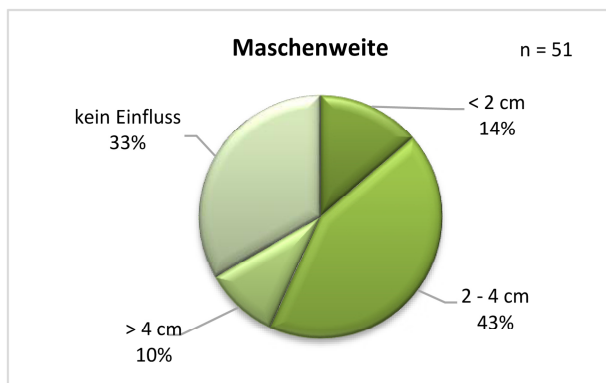
Bevorzugte Steifigkeit einer Asphalteinlage



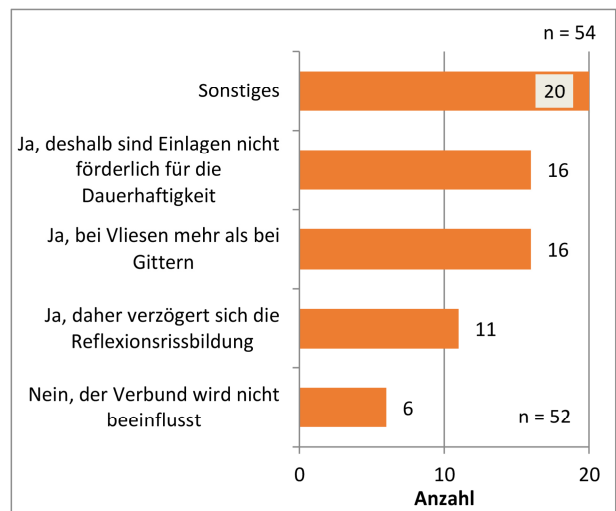
Bevorzugte Zugfestigkeit einer Asphalteinlage



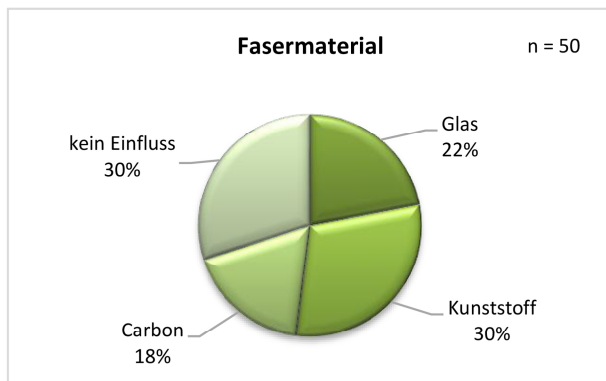
Bevorzugte Ausführung (mit oder ohne) Verlegehilfe einer Asphalteinlage



Bevorzugte Maschenweite einer Asphalteinlage

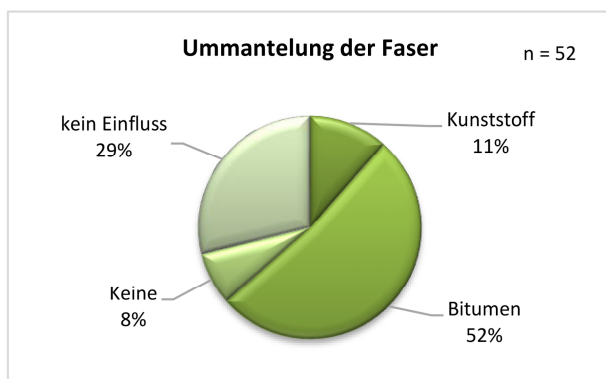


Einfluss von Asphalteinlagen auf den Verbund zwischen Asphaltschichten

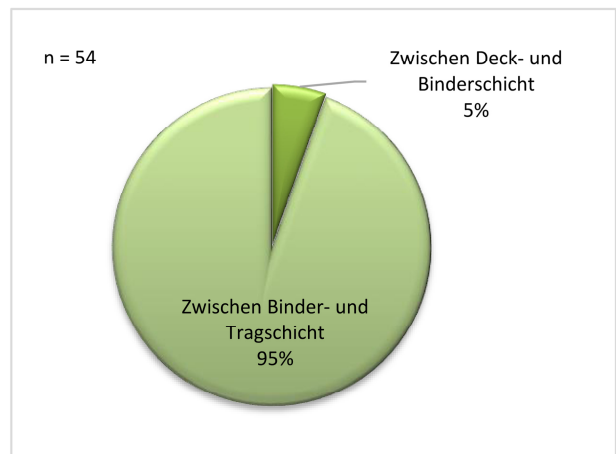


Bevorzugtes Fasermaterial einer Asphalteinlage

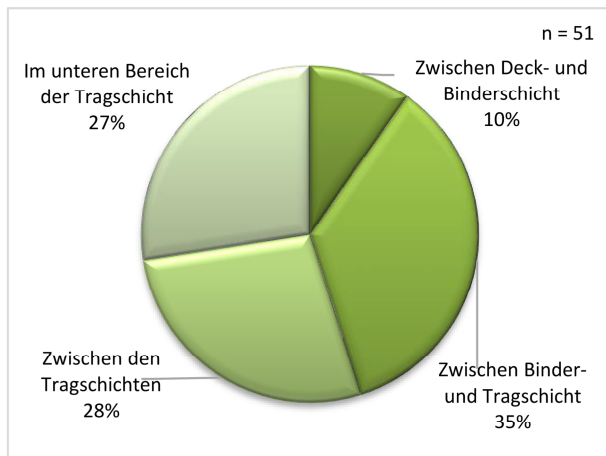
**An welcher Stelle in der Asphaltbefestigung macht Ihrer Meinung nach der Einsatz einer Asphalteinlage zur Verlängerung der Nutzungsdauer einer neu gebauten Befestigung Sinn?**



Bevorzugte Faserummantelung einer Asphalteinlage

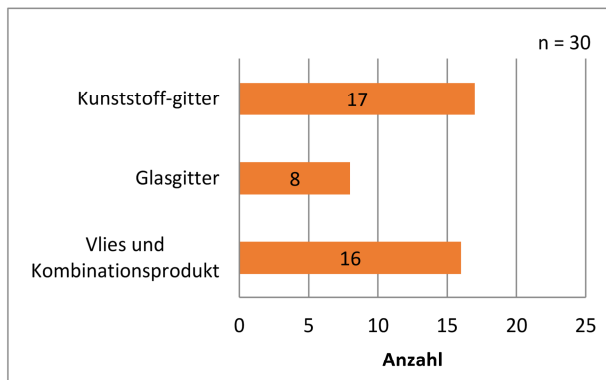


Stelle des Einsatzes einer Asphalteinlage zur Verhinderung der Reflexionsrissbildung

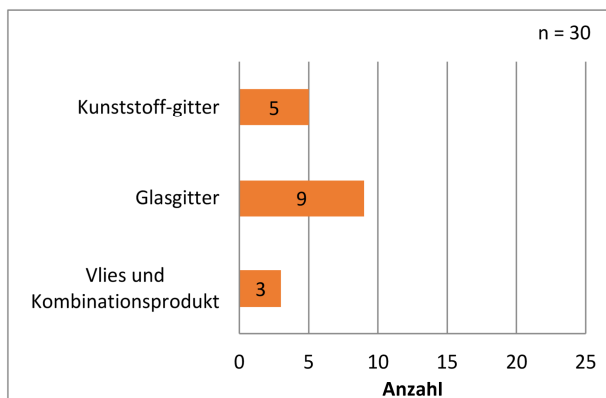


Stelle des Einsatzes einer Asphalteinlage zur Verlängerung der Nutzungsdauer

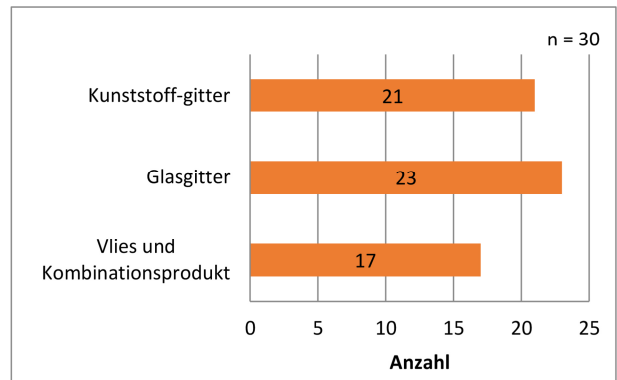
**Wie lassen sich Asphaltbefestigungen mit verschiedenen Asphalteinlagen Ihrer Meinung nach rückbauen und wiederverwerten?**



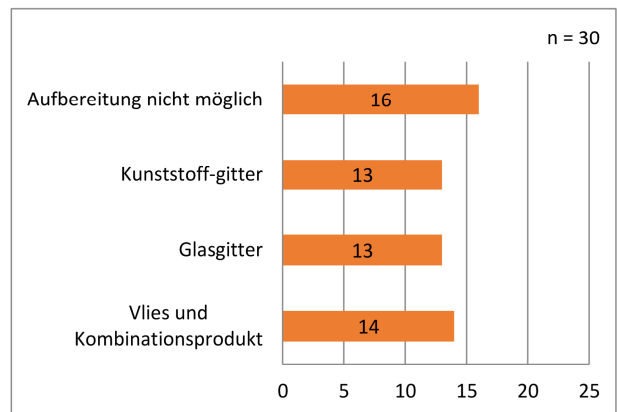
Rückbau durch Fräsen nicht möglich



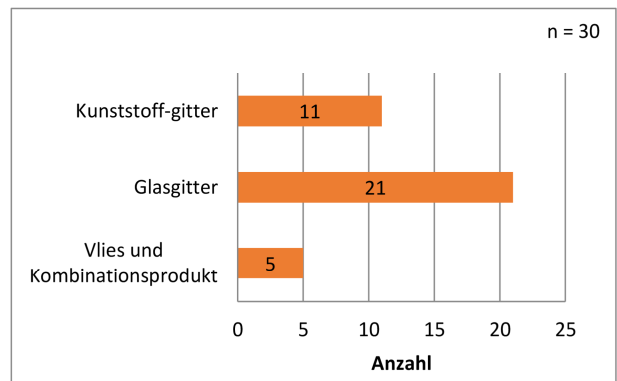
Rückbau durch Fräsen in Tiefe der Asphalteinlage



Rückbau durch Fräsen unterhalb der Asphalteinlagen

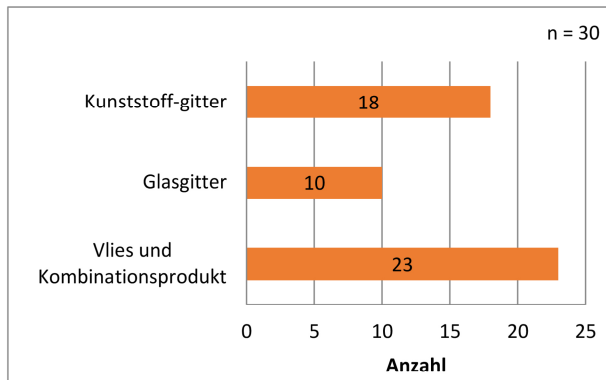


Wiederverwertung nach Aufbereitung möglich



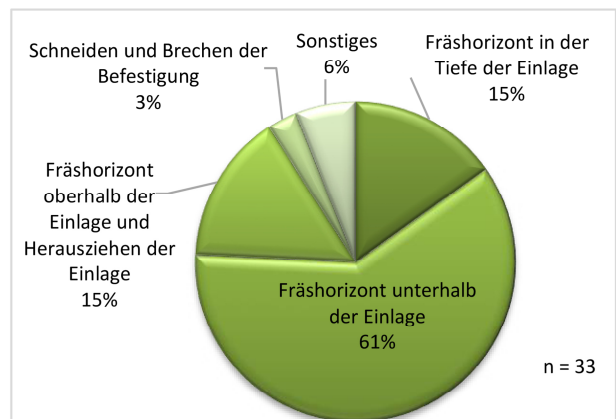
Asphaltgranulat unproblematisch bei der Wiederverwendung



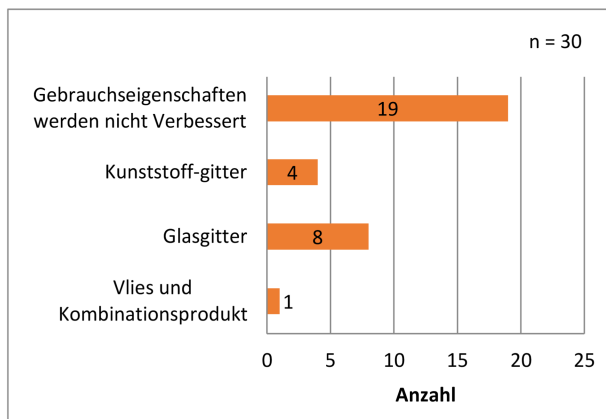


Asphaltgranulat mit Einlagenresten lässt sich nicht im HMA wiederverwenden

### Wie wurde der Rückbau zumeist durchgeführt?

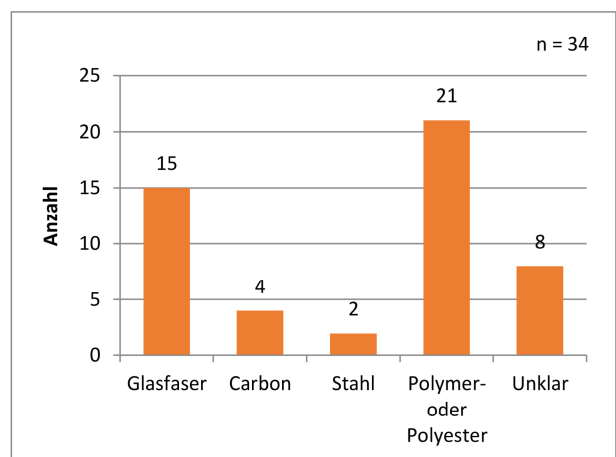


Durchführung des Rückbaus in den meisten Fällen



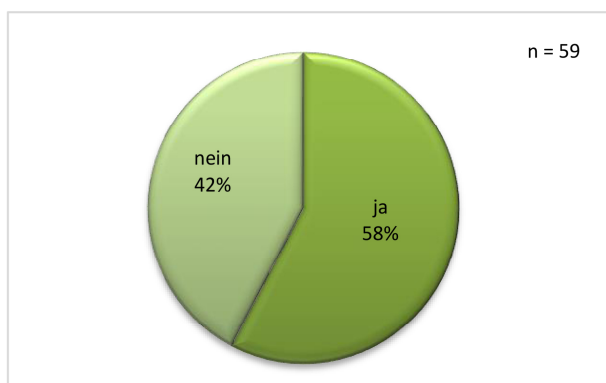
Faserreste verbessern die Gebrauchseigenschaften der Asphalte

### Welches Einlagenmaterial wurde rückgebaut?



Rückgebautes Einlagenmaterial

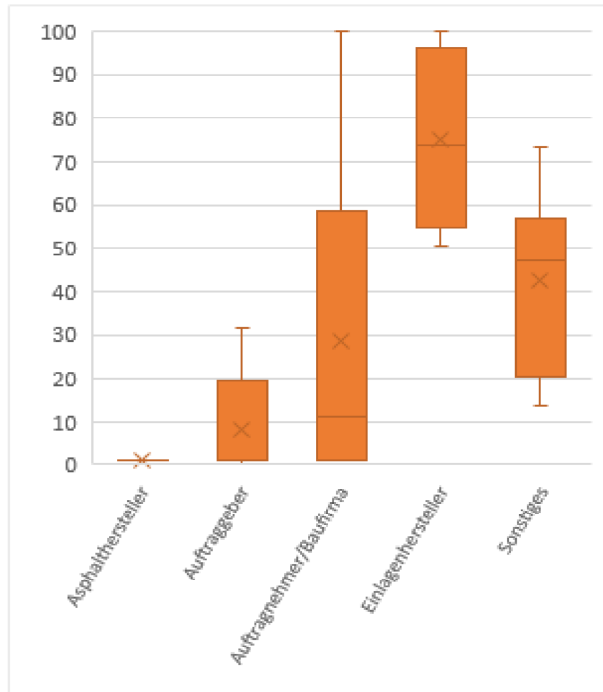
### Haben Sie Erfahrung mit dem Rückbau und Recycling (Wiederverwertung) von Fahrbahnen mit Asphalteinlagen?



Erfahrungen mit dem Rückbau und Recycling von Befestigungen mit Asphalteinlagen

**Wie zufrieden sind Sie mit dem Rückbau der Befestigungen mit Asphalteinlagen?**

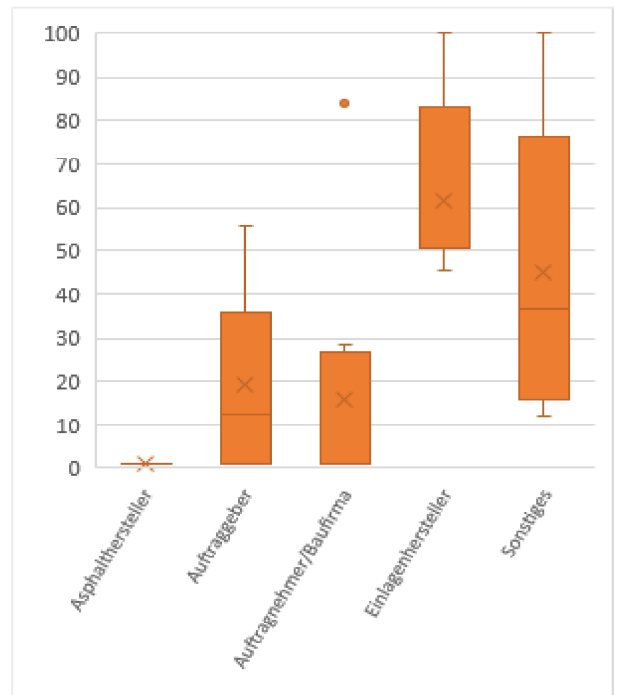
n = 35



Zufriedenheit mit dem Rückbau von Befestigungen mit Asphalteinlagen

**Wie zufrieden sind Sie mit dem Recycling (Aufbereitung und Wiederverwertung) der Befestigungen mit Asphalteinlagen?**

n = 36



Zufriedenheit mit der Wiederverwendung von Befestigungen mit Asphalteinlagen

# Anhang

## Anhang 2: Ergebnisse Probefelder

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Anhang 2: Schersteifigkeiten

| Variante | Temperatur | Normalspannung | Frequenz | Schersteifigkeit Probe 1 | Schersteifigkeit Probe 2 | Schersteifigkeit Mittelwert |
|----------|------------|----------------|----------|--------------------------|--------------------------|-----------------------------|
| -        | °C         | MPa            | Hz       | MPa/mm                   | MPa/mm                   | MPa/mm                      |
| I (k)    | 20         | 0,5            | 10       | 16,8                     | 17,1                     | 16,95                       |
|          |            |                | 5        | 12,8                     | 15,9                     | 14,35                       |
|          |            |                | 1        | 7,5                      | 12,9                     | 10,20                       |
|          |            |                | 0,1      | 7,9                      | 10,7                     | 9,30                        |
|          |            | 0,25           | 10       | 18,4                     | 17,7                     | 18,05                       |
|          |            |                | 10       | 15,5                     | 15,3                     | 15,40                       |
|          |            |                | 5        | 11,9                     | 13,8                     | 12,85                       |
|          |            |                | 1        | 6,3                      | 10,7                     | 8,50                        |
|          |            | 0,0            | 0,1      | 5,0                      | 8,4                      | 6,70                        |
|          |            |                | 10       | 14,7                     | 14,8                     | 14,75                       |
|          |            |                | 10       | 10,3                     | 13,4                     | 11,85                       |
|          |            |                | 5        | 7,7                      | 11,6                     | 9,65                        |
|          | 10         | 0,5            | 1        | 3,7                      | 8,2                      | 5,95                        |
|          |            |                | 0,1      | 1,3                      | 5,4                      | 3,35                        |
|          |            |                | 10       | 9,5                      | 12,8                     | 11,15                       |
|          |            |                | 10       | 18,3                     | 17,3                     | 17,80                       |
|          |            | 0,25           | 5        | 15,4                     | 16,2                     | 15,80                       |
|          |            |                | 1        | 9,6                      | 12,9                     | 11,25                       |
|          |            |                | 0,1      | 6,2                      | 9,4                      | 7,80                        |
|          |            |                | 10       | 18,7                     | 17,3                     | 18,00                       |
|          |            | 0,0            | 10       | 17,3                     | 16,5                     | 16,90                       |
|          |            |                | 5        | 14,5                     | 15,3                     | 14,90                       |
|          |            |                | 1        | 8,6                      | 12,0                     | 10,30                       |
|          |            |                | 0,1      | 4,4                      | 8,1                      | 6,25                        |
|          | 0          | 0,5            | 10       | 16,7                     | 16,3                     | 16,50                       |
|          |            |                | 10       | 14,5                     | 15,7                     | 15,10                       |
|          |            |                | 5        | 11,8                     | 14,0                     | 12,90                       |
|          |            |                | 1        | 6,7                      | 9,6                      | 8,15                        |
|          |            | 0,25           | 0,1      | 2,7                      | 4,9                      | 3,80                        |
|          |            |                | 10       | 13,5                     | 14,9                     | 14,20                       |
|          |            |                | 10       | 25,5                     | 23,8                     | 24,65                       |
|          |            |                | 5        | 25,4                     | 24,0                     | 24,70                       |
|          |            | 0,0            | 1        | 23,4                     | 22,9                     | 23,15                       |
|          |            |                | 0,1      | 20,1                     | 19,6                     | 19,85                       |
|          |            |                | 10       | 25,4                     | 23,7                     | 24,55                       |
|          |            |                | 10       | 23,3                     | 22,4                     | 22,85                       |
|          | 0,25       | 5              | 23,1     | 22,7                     | 22,90                    |                             |
|          |            | 1              | 21,4     | 21,7                     | 21,55                    |                             |
|          |            | 0,1            | 18,7     | 18,4                     | 18,55                    |                             |
|          |            | 10             | 23,3     | 22,4                     | 22,85                    |                             |
|          |            | 0,0            | 10       | 19,8                     | 21,1                     | 20,45                       |
|          |            |                | 5        | 19,5                     | 21,9                     | 20,70                       |
|          |            |                | 1        | 18,2                     | 21,1                     | 19,65                       |
|          |            |                | 0,1      | 15,9                     | 17,4                     | 16,65                       |
|          | 10         | 19,6           | 21,2     | 20,40                    |                          |                             |

Anhang 2: Schersteifigkeiten

| Variante | Temperatur | Normalspannung | Frequenz | Schersteifigkeit Probe 1 | Schersteifigkeit Probe 2 | Schersteifigkeit Mittelwert |
|----------|------------|----------------|----------|--------------------------|--------------------------|-----------------------------|
| -        | °C         | MPa            | Hz       | MPa/mm                   | MPa/mm                   | MPa/mm                      |
| II (v)   | 20         | 0,5            | 10       | 23,6                     | 18,5                     | 21,05                       |
|          |            |                | 5        | 22,0                     | 15,7                     | 18,85                       |
|          |            |                | 1        | 18,1                     | 10,0                     | 14,05                       |
|          |            |                | 0,1      | 14,8                     | 8,2                      | 11,50                       |
|          |            | 0,25           | 10       | 23,7                     | 19,3                     | 21,50                       |
|          |            |                | 10       | 21,6                     | 18,0                     | 19,80                       |
|          |            |                | 5        | 20,1                     | 15,4                     | 17,75                       |
|          |            |                | 1        | 16,3                     | 9,3                      | 12,80                       |
|          |            | 0,0            | 0,1      | 13,2                     | 7,1                      | 10,15                       |
|          |            |                | 10       | 20,0                     | 17,3                     | 18,65                       |
|          |            |                | 10       | 15,1                     | 10,6                     | 12,85                       |
|          |            |                | 5        | 13,2                     | 8,1                      | 10,65                       |
|          | 10         | 0,5            | 1        | 8,8                      | 3,9                      | 6,35                        |
|          |            |                | 0,1      | 5,1                      | 1,3                      | 3,20                        |
|          |            |                | 10       | 13,8                     | 9,5                      | 11,65                       |
|          |            |                | 10       | 20,5                     | 21,2                     | 20,85                       |
|          |            | 0,25           | 5        | 18,9                     | 18,6                     | 18,75                       |
|          |            |                | 1        | 14,3                     | 12,1                     | 13,20                       |
|          |            |                | 0,1      | 9,6                      | 7,0                      | 8,30                        |
|          |            |                | 10       | 21,0                     | 21,9                     | 21,45                       |
|          |            | 0,0            | 10       | 19,5                     | 20,9                     | 20,20                       |
|          |            |                | 5        | 17,8                     | 18,3                     | 18,05                       |
|          |            |                | 1        | 13,2                     | 11,7                     | 12,45                       |
|          |            |                | 0,1      | 7,8                      | 5,9                      | 6,85                        |
|          | 0          | 0,5            | 10       | 15,4                     | 20,1                     | 17,75                       |
|          |            |                | 10       | -                        | 16,3                     | 16,30                       |
|          |            |                | 5        | -                        | 14,3                     | 14,30                       |
|          |            |                | 1        | -                        | 8,9                      | 8,90                        |
|          |            | 0,25           | 0,1      | -                        | 3,6                      | 3,60                        |
|          |            |                | 10       | -                        | 15,7                     | 15,70                       |
|          |            |                | 10       | 27,9                     | 27,1                     | 27,50                       |
|          |            |                | 5        | 28,8                     | 29,0                     | 28,90                       |
|          |            | 0,0            | 1        | 28,2                     | 28,1                     | 28,15                       |
|          |            |                | 0,1      | 22,4                     | 22,5                     | 22,45                       |
|          |            |                | 10       | 27,6                     | 30,1                     | 28,85                       |
|          |            |                | 10       | 24,9                     | 29,4                     | 27,15                       |
|          | 0,25       | 5              | 26,3     | 26,0                     | 26,15                    |                             |
|          |            | 1              | 26,0     | 25,3                     | 25,65                    |                             |
|          |            | 0,1            | 20,5     | 20,9                     | 20,70                    |                             |
|          |            | 10             | 24,5     | 26,2                     | 25,35                    |                             |
|          |            | 0,0            | 10       | 20,7                     | 22,1                     | 21,40                       |
|          |            |                | 5        | 21,6                     | 20,2                     | 20,90                       |
|          |            |                | 1        | 21,8                     | 19,6                     | 20,70                       |
|          |            |                | 0,1      | 17,6                     | 17,0                     | 17,30                       |
|          | 10         | 20,1           | 19,7     | 19,90                    |                          |                             |

Anhang 2: Schersteifigkeiten

| Variante    | Temperatur | Normalspannung | Frequenz | Schersteifigkeit Probe 1 | Schersteifigkeit Probe 2 | Schersteifigkeit Mittelwert |
|-------------|------------|----------------|----------|--------------------------|--------------------------|-----------------------------|
| -           | °C         | MPa            | Hz       | MPa/mm                   | MPa/mm                   | MPa/mm                      |
| V<br>(Ref.) | 20         | 0,5            | 10       | 28,8                     | 35,4                     | 32,10                       |
|             |            |                | 5        | 27,9                     | 34,0                     | 30,95                       |
|             |            |                | 1        | 25,8                     | 28,0                     | 26,90                       |
|             |            |                | 0,1      | 21,0                     | 21,0                     | 21,00                       |
|             |            | 0,25           | 10       | 28,4                     | 35,2                     | 31,80                       |
|             |            |                | 10       | 26,9                     | 34,0                     | 30,45                       |
|             |            |                | 5        | 26,1                     | 32,0                     | 29,05                       |
|             |            |                | 1        | 23,6                     | 25,6                     | 24,60                       |
|             |            | 0,0            | 0,1      | 18,8                     | 18,3                     | 18,55                       |
|             |            |                | 10       | 25,4                     | 32,1                     | 28,75                       |
|             |            |                | 10       | 21,5                     | 27,8                     | 24,65                       |
|             |            |                | 5        | 20,3                     | 25,7                     | 23,00                       |
|             | 10         | 0,5            | 1        | 17,1                     | 18,9                     | 18,00                       |
|             |            |                | 0,1      | 11,1                     | 11,1                     | 11,10                       |
|             |            |                | 10       | 21,4                     | 26,9                     | 24,15                       |
|             |            |                | 10       | 28,6                     | 34,2                     | 31,40                       |
|             |            | 0,25           | 5        | 28,0                     | 33,2                     | 30,60                       |
|             |            |                | 1        | 25,1                     | 27,4                     | 26,25                       |
|             |            |                | 0,1      | 19,4                     | 19,2                     | 19,30                       |
|             |            |                | 10       | 27,8                     | 33,4                     | 30,60                       |
|             |            | 0,0            | 10       | 27,0                     | 33,4                     | 30,20                       |
|             |            |                | 5        | 26,3                     | 31,9                     | 29,10                       |
|             |            |                | 1        | 23,3                     | 25,6                     | 24,45                       |
|             |            |                | 0,1      | 17,3                     | 16,8                     | 17,05                       |
|             | 0          | 0,5            | 10       | 25,8                     | 31,6                     | 28,70                       |
|             |            |                | 10       | 22,4                     | 28,0                     | 25,20                       |
|             |            |                | 5        | 21,8                     | 26,5                     | 24,15                       |
|             |            |                | 1        | 19,0                     | 20,9                     | 19,95                       |
|             |            | 0,25           | 0,1      | 13,1                     | 12,7                     | 12,90                       |
|             |            |                | 10       | 21,5                     | 27,1                     | 24,30                       |
|             |            |                | 10       | 27,8                     | 40,1                     | 33,95                       |
|             |            |                | 5        | 28,4                     | 41,7                     | 35,05                       |
|             |            | 0,0            | 1        | 27,6                     | 39,4                     | 33,50                       |
|             |            |                | 0,1      | 25,8                     | 33,7                     | 29,75                       |
|             |            |                | 10       | 27,5                     | 40,5                     | 34,00                       |
|             |            |                | 10       | 26,9                     | 37,8                     | 32,35                       |
|             | 0,25       | 5              | 27,7     | 38,1                     | 32,90                    |                             |
|             |            | 1              | 26,6     | 35,8                     | 31,20                    |                             |
|             |            | 0,1            | 24,7     | 30,8                     | 27,75                    |                             |
|             |            | 10             | 26,6     | 37,1                     | 31,85                    |                             |
|             |            | 0,0            | 10       | 22,9                     | 33,8                     | 28,35                       |
|             |            |                | 5        | 23,3                     | 31,3                     | 27,30                       |
|             |            |                | 1        | 22,6                     | 29,7                     | 26,15                       |
|             |            |                | 0,1      | 21,1                     | 26,4                     | 23,75                       |
|             | 10         | 22,5           | 33,8     | 28,15                    |                          |                             |

Anhang 2: Schersteifigkeiten

| Variante | Temperatur | Normalspannung | Frequenz | Schersteifigkeit Probe 1 | Schersteifigkeit Probe 2 | Schersteifigkeit Mittelwert |       |
|----------|------------|----------------|----------|--------------------------|--------------------------|-----------------------------|-------|
| -        | °C         | MPa            | Hz       | MPa/mm                   | MPa/mm                   | MPa/mm                      |       |
| VI (K)   | 20         | 0,5            | 10       | 19,0                     | 16,6                     | 17,80                       |       |
|          |            |                | 5        | 17,5                     | 15,3                     | 16,40                       |       |
|          |            |                | 1        | 12,9                     | 12,5                     | 12,70                       |       |
|          |            |                | 0,1      | 10,0                     | 10,3                     | 10,15                       |       |
|          |            | 0,25           | 10       | 19,3                     | 16,2                     | 17,75                       |       |
|          |            |                | 10       | 18,3                     | 14,9                     | 16,60                       |       |
|          |            |                | 5        | 16,7                     | 13,8                     | 15,25                       |       |
|          |            |                | 1        | 11,9                     | 10,9                     | 11,40                       |       |
|          |            | 0,0            | 0,1      | 8,9                      | 8,7                      | 8,80                        |       |
|          |            |                | 10       | 17,4                     | 14,4                     | 15,90                       |       |
|          |            |                | 10       | 11,9                     | 9,7                      | 10,80                       |       |
|          |            |                | 5        | 9,7                      | 8,0                      | 8,85                        |       |
|          | 10         | 0,5            | 1        | 5,4                      | 4,4                      | 4,90                        |       |
|          |            |                | 0,1      | 2,3                      | 1,6                      | 1,95                        |       |
|          |            |                | 10       | 10,6                     | 8,9                      | 9,75                        |       |
|          |            |                | 10       | 18,8                     | 16,4                     | 17,60                       |       |
|          |            | 0,25           | 5        | 16,8                     | 15,1                     | 15,95                       |       |
|          |            |                | 1        | 11,9                     | 11,6                     | 11,75                       |       |
|          |            |                | 0,1      | 7,6                      | 8,0                      | 7,80                        |       |
|          |            |                | 10       | 18,8                     | 16,8                     | 17,80                       |       |
|          |            | 0,0            | 10       | 17,9                     | 16,0                     | 16,95                       |       |
|          |            |                | 5        | 15,8                     | 14,5                     | 15,15                       |       |
|          |            |                | 1        | 10,8                     | 11,1                     | 10,95                       |       |
|          |            |                | 0,1      | 6,1                      | 6,8                      | 6,45                        |       |
|          | 0          | 0,5            | 10       | 17,2                     | 15,6                     | 16,40                       |       |
|          |            |                | 10       | 14,3                     | 12,8                     | 13,55                       |       |
|          |            |                | 5        | 12,2                     | 11,4                     | 11,80                       |       |
|          |            |                | 1        | 7,5                      | 7,7                      | 7,60                        |       |
|          |            | 0,25           | 0,1      | 3,1                      | 3,3                      | 3,20                        |       |
|          |            |                | 10       | 13,6                     | 12,3                     | 12,95                       |       |
|          |            |                | 10       | 29,0                     | 22,4                     | 25,70                       |       |
|          |            |                | 5        | 29,4                     | 22,7                     | 26,05                       |       |
|          |            | 0,0            | 1        | 27,6                     | 22,0                     | 24,80                       |       |
|          |            |                | 0,1      | 22,4                     | 18,5                     | 20,45                       |       |
|          |            |                | 10       | 28,7                     | 22,1                     | 25,40                       |       |
|          |            |                | 10       | 27,7                     | 20,5                     | 24,10                       |       |
|          | 0,25       | 5              | 28,0     | 21,0                     | 24,50                    |                             |       |
|          |            | 1              | 26,5     | 20,7                     | 23,60                    |                             |       |
|          |            | 0,1            | 21,4     | 17,2                     | 19,30                    |                             |       |
|          |            | 10             | 27,3     | 20,4                     | 23,85                    |                             |       |
|          | 0,0        | 10             | 23,1     | 17,1                     | 20,10                    |                             |       |
|          |            | 5              | 23,1     | 16,0                     | 19,55                    |                             |       |
|          |            | 1              | 22,0     | 16,0                     | 19,00                    |                             |       |
|          |            | 0,1            | 18,4     | 13,7                     | 16,05                    |                             |       |
|          |            |                |          | 10                       | 22,6                     | 15,8                        | 19,20 |

Anhang 2: Schersteifigkeiten

| Variante | Temperatur | Normalspannung | Frequenz | Schersteifigkeit Probe 1 | Schersteifigkeit Probe 2 | Schersteifigkeit Mittelwert |       |
|----------|------------|----------------|----------|--------------------------|--------------------------|-----------------------------|-------|
| -        | °C         | MPa            | Hz       | MPa/mm                   | MPa/mm                   | MPa/mm                      |       |
| VII (K)  | 20         | 0,5            | 10       | 21,6                     | 14,3                     | 17,95                       |       |
|          |            |                | 5        | 19,4                     | 12,3                     | 15,85                       |       |
|          |            |                | 1        | 13,3                     | 8,3                      | 10,80                       |       |
|          |            |                | 0,1      | 8,9                      | 6,6                      | 7,75                        |       |
|          |            | 0,25           | 10       | 21,7                     | 14,9                     | 18,30                       |       |
|          |            |                | 10       | 21,0                     | 14,2                     | 17,60                       |       |
|          |            |                | 5        | 18,6                     | 12,0                     | 15,30                       |       |
|          |            |                | 1        | 12,7                     | 7,8                      | 10,25                       |       |
|          |            | 0,0            | 0,1      | 8,0                      | 5,7                      | 6,85                        |       |
|          |            |                | 10       | 19,6                     | 13,9                     | 16,75                       |       |
|          |            |                | 10       | 15,8                     | 9,2                      | 12,50                       |       |
|          |            |                | 5        | 13,1                     | 7,0                      | 10,05                       |       |
|          | 10         | 0,5            | 1        | 7,4                      | 3,4                      | 5,40                        |       |
|          |            |                | 0,1      | 3,0                      | 1,2                      | 2,10                        |       |
|          |            |                | 10       | 14,8                     | 8,5                      | 11,65                       |       |
|          |            |                | 10       | 22,2                     | 15,3                     | 18,75                       |       |
|          |            | 0,25           | 5        | 19,9                     | 13,4                     | 16,65                       |       |
|          |            |                | 1        | 14,1                     | 8,6                      | 11,35                       |       |
|          |            |                | 0,1      | 7,4                      | 4,8                      | 6,10                        |       |
|          |            |                | 10       | 22,3                     | 15,7                     | 19,00                       |       |
|          |            | 0,0            | 10       | 21,9                     | 15,0                     | 18,45                       |       |
|          |            |                | 5        | 19,4                     | 13,0                     | 16,20                       |       |
|          |            |                | 1        | 13,5                     | 8,1                      | 10,80                       |       |
|          |            |                | 0,1      | 6,4                      | 3,9                      | 5,15                        |       |
|          | 0          | 0,5            | 10       | 21,3                     | 14,8                     | 18,05                       |       |
|          |            |                | 10       | 18,9                     | 12,9                     | 15,90                       |       |
|          |            |                | 5        | 16,4                     | 10,9                     | 13,65                       |       |
|          |            |                | 1        | 10,7                     | 6,2                      | 8,45                        |       |
|          |            | 0,25           | 0,1      | 4,4                      | 2,3                      | 3,35                        |       |
|          |            |                | 10       | 18,3                     | 12,5                     | 15,40                       |       |
|          |            |                | 10       | 36,3                     | 25,4                     | 30,85                       |       |
|          |            |                | 5        | 37,2                     | 26,4                     | 31,80                       |       |
|          |            | 0,0            | 1        | 35,4                     | 26,8                     | 31,10                       |       |
|          |            |                | 0,1      | 26,6                     | 19,5                     | 23,05                       |       |
|          |            |                | 10       | 36,5                     | 27,6                     | 32,05                       |       |
|          |            |                | 10       | 35,8                     | 29,7                     | 32,75                       |       |
|          | 0,25       | 5              | 36,7     | 23,8                     | 30,25                    |                             |       |
|          |            | 1              | 34,4     | 23,9                     | 29,15                    |                             |       |
|          |            | 0,1            | 25,7     | 17,8                     | 21,75                    |                             |       |
|          |            | 10             | 35,4     | 28,9                     | 32,15                    |                             |       |
|          | 0,0        | 10             | 35,6     | 26,7                     | 31,15                    |                             |       |
|          |            | 5              | 33,1     | 21,2                     | 27,15                    |                             |       |
|          |            | 1              | 31,4     | 21,3                     | 26,35                    |                             |       |
|          |            | 0,1            | 23,7     | 16,1                     | 19,90                    |                             |       |
|          |            |                |          | 10                       | 40,8                     | 21,7                        | 31,25 |



Anhang 2: Masterfunktionen der Schersteifigkeit

| Variante | Normalspannung     | 0,5 MPa | 0,25 MPa | 0,0 MPa |
|----------|--------------------|---------|----------|---------|
|          | Parameter          |         |          |         |
| I (k)    | E/R                | 14522,1 | 15107,4  | 16495,6 |
|          | S <sub>min</sub>   | 7,8     | 6,3      | 3,4     |
|          | S <sub>max</sub>   | 24,7    | 22,9     | 20,7    |
|          | a                  | -1,455  | -1,519   | -1,496  |
|          | b                  | 1,711   | 1,796    | 1,881   |
|          | Fehlerquadratsumme | 39,594  | 24,785   | 14,773  |
| II (v)   | E/R                | 13016,8 | 13053,6  | 15658,8 |
|          | S <sub>min</sub>   | 8,3     | 6,9      | 3,2     |
|          | S <sub>max</sub>   | 28,9    | 27,2     | 21,4    |
|          | a                  | -1,373  | -1,255   | -1,592  |
|          | b                  | 1,287   | 1,171    | 1,768   |
|          | Fehlerquadratsumme | 73,161  | 64,875   | 15,089  |
| V (ref.) | E/R                | 8651,9  | 8792,8   | 10363,4 |
|          | S <sub>min</sub>   | 19,3    | 17,1     | 11,1    |
|          | S <sub>max</sub>   | 35,1    | 32,9     | 28,4    |
|          | a                  | -1,640  | -1,751   | -1,705  |
|          | b                  | 0,535   | 0,548    | 0,674   |
|          | Fehlerquadratsumme | 32,341  | 27,672   | 16,614  |
| VI (K)   | E/R                | 15147,8 | 15227,1  | 17640,4 |
|          | S <sub>min</sub>   | 7,8     | 6,5      | 2,0     |
|          | S <sub>max</sub>   | 26,1    | 24,5     | 20,1    |
|          | a                  | -1,197  | -1,213   | -1,303  |
|          | b                  | 1,457   | 1,410    | 1,717   |
|          | Fehlerquadratsumme | 57,983  | 50,593   | 15,201  |
| VII (K)  | E/R                | 16872,9 | 16231,1  | 18422,5 |
|          | S <sub>min</sub>   | 6,1     | 5,2      | 2,1     |
|          | S <sub>max</sub>   | 32,1    | 32,8     | 31,3    |
|          | a                  | -1,234  | -1,185   | -1,155  |
|          | b                  | 1,876   | 1,865    | 2,150   |
|          | Fehlerquadratsumme | 91,070  | 78,019   | 39,002  |

Anhang 2: Schersteifigkeiten, statischer Scherversuch, weggeregelt

| Variante          | Temperatur | Dehnrate | Schermodul 1 | Schermodul 2 | Schermodul, MW |
|-------------------|------------|----------|--------------|--------------|----------------|
| -                 | °C         | mm/min   | MPa          | MPa          | MPa            |
| <b>I (k)</b>      | 20         | 0,1      | 5,63         | 5,63         | 5,630          |
|                   |            | 0,2      | 5,91         | 7,04         | 6,475          |
|                   |            | 0,3      | 8,45         | 5,91         | 7,18           |
|                   | 15         | 0,1      | 6,47         | 9,85         | 8,160          |
|                   |            | 0,2      | 7,60         | 5,91         | 6,755          |
|                   |            | 0,3      | 9,85         | 6,19         | 8,020          |
|                   | 10         | 0,1      | 9,85         | 5,63         | 7,740          |
|                   |            | 0,2      | 6,76         | 10,42        | 8,590          |
|                   |            | 0,3      | 7,32         | 9,57         | 8,445          |
| <b>II (v)</b>     | 20         | 0,1      | 5,91         | 5,91         | 5,910          |
|                   |            | 0,2      | 6,19         | 7,04         | 6,615          |
|                   |            | 0,3      | 9,29         | 7,32         | 8,305          |
|                   | 15         | 0,1      | 6,47         | -            | 6,470          |
|                   |            | 0,2      | 7,04         | 7,32         | 7,180          |
|                   |            | 0,3      | 6,76         | 7,03         | 6,895          |
|                   | 10         | 0,1      | 5,63         | 13,79        | 9,710          |
|                   |            | 0,2      | 12,95        | 6,47         | 9,710          |
|                   |            | 0,3      | 11,54        | 10,13        | 10,835         |
| <b>V (ref.)</b>   | 20         | 0,1      | 13,79        | 11,26        | 12,525         |
|                   |            | 0,2      | 22,24        | 27,02        | 24,630         |
|                   |            | 0,3      | 17,17        | 32,94        | 25,055         |
|                   | 15         | 0,1      | 30,40        | 30,97        | 30,685         |
|                   |            | 0,2      | 37,44        | 41,66        | 39,55          |
|                   |            | 0,3      | 41,66        | 41,66        | 41,660         |
|                   | 10         | 0,1      | 10,98        | 10,98        | 10,980         |
|                   |            | 0,2      | 16,89        | 7,88         | 12,385         |
|                   |            | 0,3      | 41,66        | 21,67        | 31,665         |
| <b>VI (K)</b>     | 20         | 0,1      | 8,73         | 6,47         | 7,600          |
|                   |            | 0,2      | 17,45        | 21,96        | 19,705         |
|                   |            | 0,3      | 20,27        | 25,62        | 22,945         |
|                   | 15         | 0,1      | 10,70        | 37,16        | 23,93          |
|                   |            | 0,2      | 14,08        | 25,62        | 19,850         |
|                   |            | 0,3      | 14,36        | 31,52        | 22,94          |
|                   | 10         | 0,1      | 8,16         | 7,60         | 7,880          |
|                   |            | 0,2      | 11,82        | 7,32         | 9,570          |
|                   |            | 0,3      | 14,64        | 7,88         | 11,26          |
| <b>VII (K)</b>    | 20         | 0,1      | 8,45         | 5,91         | 7,180          |
|                   |            | 0,2      | 10,13        | 11,54        | 10,835         |
|                   |            | 0,3      | 17,45        | 14,92        | 16,185         |
|                   | 15         | 0,1      | 5,35         | 7,32         | 6,335          |
|                   |            | 0,2      | 5,91         | 7,04         | 6,475          |
|                   |            | 0,3      | 6,47         | 7,88         | 7,175          |
|                   | 10         | 0,1      | 12,10        | 7,60         | 9,850          |
|                   |            | 0,2      | 6,19         | 7,60         | 6,895          |
|                   |            | 0,3      | 10,41        | 12,10        | 11,255         |
| <b>XII (Ref.)</b> | 20         | 0,1      | 10,13        | 11,54        | 10,835         |
|                   |            | 0,2      | 14,36        | 22,24        | 18,300         |
|                   |            | 0,3      | 15,76        | 33,22        | 24,490         |
|                   | 15         | 0,1      | 17,73        | 15,76        | 16,745         |
|                   |            | 0,2      | 25,34        | 36,03        | 30,685         |
|                   |            | 0,3      | 37,44        | 41,66        | 39,55          |
|                   | 10         | 0,1      | 14,64        | 9,85         | 12,245         |
|                   |            | 0,2      | 31,53        | 13,79        | 22,660         |
|                   |            | 0,3      | 41,660       | 16,32        | 28,990         |

Anhang 2: Schersteifigkeiten, statischer Scherversuch, kraft geregelt

| Variante   | Temperatur | Lastrate | Schermodul 1 | Schermodul 2 | Schermodul, MW |
|------------|------------|----------|--------------|--------------|----------------|
| -          | °C         | N/s      | MPa          | MPa          | MPa            |
| I (k)      | 20         | 2        | 4,50         | 4,79         | 4,645          |
|            |            | 3        | 4,50         | 6,76         | 5,630          |
|            |            | 4        | 13,23        | 10,42        | 11,825         |
|            | 15         | 2        | 10,42        | 4,50         | 7,460          |
|            |            | 3        | 5,91         | 4,79         | 5,350          |
|            |            | 4        | 5,63         | 5,35         | 5,49           |
|            | 10         | 2        | 10,98        | 11,54        | 11,26          |
|            |            | 3        | 7,04         | 8,45         | 7,745          |
|            |            | 4        | 5,07         | 8,73         | 6,900          |
| II (v)     | 20         | 2        | 4,23         | 8,45         | 6,340          |
|            |            | 3        | 7,32         | 6,47         | 6,895          |
|            |            | 4        | 6,76         | 8,73         | 7,745          |
|            | 15         | 2        | 5,35         | 7,88         | 6,615          |
|            |            | 3        | 7,60         | 5,07         | 6,335          |
|            |            | 4        | 5,07         | 7,32         | 6,195          |
|            | 10         | 2        | 5,35         | 5,63         | 5,490          |
|            |            | 3        | 11,54        | 9,57         | 10,555         |
|            |            | 4        | 17,45        | 13,23        | 15,34          |
| V (ref.)   | 20         | 2        | 11,54        | 26,45        | 19,000         |
|            |            | 3        | 27,02        | 47,01        | 37,015         |
|            |            | 4        | 32,09        | -            | 32,090         |
|            | 15         | 2        | 11,60        | 21,39        | 16,495         |
|            |            | 3        | 9,57         | 36,60        | 23,085         |
|            |            | 4        | 9,01         | 45,89        | 27,45          |
|            | 10         | 2        | 23,08        | 20,55        | 21,815         |
|            |            | 3        | 39,97        | 15,76        | 27,865         |
|            |            | 4        | -            | 11,54        | 11,540         |
| VI (K)     | 20         | 2        | 6,76         | 16,05        | 11,405         |
|            |            | 3        | 9,01         | 15,76        | 12,385         |
|            |            | 4        | 12,39        | 18,58        | 15,485         |
|            | 15         | 2        | 6,19         | 4,79         | 5,49           |
|            |            | 3        | 25,05        | 5,91         | 15,480         |
|            |            | 4        | 24,21        | 7,04         | 15,625         |
|            | 10         | 2        | 14,92        | 8,16         | 11,540         |
|            |            | 3        | 26,46        | 16,05        | 21,255         |
|            |            | 4        | 33,50        | 20,55        | 27,025         |
| VII (K)    | 20         | 2        | 5,35         | 10,13        | 7,740          |
|            |            | 3        | 7,60         | 6,19         | 6,895          |
|            |            | 4        | 13,23        | 7,04         | 10,135         |
|            | 15         | 2        | 11,54        | 3,94         | 7,740          |
|            |            | 3        | 7,60         | 7,32         | 7,460          |
|            |            | 4        | 8,16         | 6,19         | 7,175          |
|            | 10         | 2        | 7,88         | 9,01         | 8,445          |
|            |            | 3        | 8,16         | 8,45         | 8,305          |
|            |            | 4        | 7,32         | 9,85         | 8,585          |
| XII (Ref.) | 20         | 2        | 15,20        | -            | 15,200         |
|            |            | 3        | 20,270       | -            | 20,270         |
|            |            | 4        | 20,83        | -            | 20,830         |
|            | 15         | 2        | 8,73         | -            | 8,730          |
|            |            | 3        | 24,77        | -            | 24,770         |
|            |            | 4        | 34,06        | -            | 34,060         |
|            | 10         | 2        | 37,16        | -            | 37,160         |
|            |            | 3        | 37,16        | -            | 37,160         |
|            |            | 4        | -            | -            | -              |

Anhang 2: Abscherversuche

| <b>Variante</b> | <b>Kraft 1</b> | <b>Kraft 2</b> | <b>Kraft Mittelwert</b> | <b>Weg 1</b> | <b>Weg 2</b> | <b>Weg Mittelwert</b> |
|-----------------|----------------|----------------|-------------------------|--------------|--------------|-----------------------|
| -               | kN             | kN             | kN                      | mm           | mm           | mm                    |
| I (k)           | 10,51          | 5,79           | 8,150                   | 2,81         | 3,77         | 3,290                 |
| II (v)          | 14,16          | 16,57          | 15,365                  | 2,73         | 2,84         | 2,785                 |
| V (Ref.)        | 35,74          | 36,82          | 36,280                  | 3,56         | 4,36         | 3,960                 |
| VI (K)          | 17,25          | 16,15          | 16,700                  | 2,67         | 2,83         | 2,750                 |
| VII (K)         | 12,83          | 9,58           | 11,205                  | 3,15         | 3,01         | 3,080                 |
| XII (Ref.)      | 42,73          | 38,89          | 40,810                  | 4,18         | 3,82         | 4,000                 |

Anhang 2: Scherermüdungsprüfungen

| Variante | Wöhler-Linie                                |                    | Amplitude<br>$\epsilon_{Amp}$ | Steifigkeits<br>modul | $N_{f50}$  | $N_{Makro}$ |
|----------|---|--------------------|-------------------------------|-----------------------|------------|-------------|
|          |   |                    | mm                            | MPa/mm                | -          | -           |
| II (v)   | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                    | 0,02                          | 8,63                  | 347.502    | -           |
|          | Parameter C <sub>1</sub>                    | 0,0005             | 0,025                         | 6,88                  | 48.004     | -           |
|          | Parameter C <sub>2</sub>                    | -5,137             | 0,03                          | 9,69                  | 11.010     | -           |
|          | Bestimmtheitsmaß                            | 69,9 %             | 0,03                          | 8,44                  | 38.002     | -           |
|          |   |                    | 0,035                         | 7,86                  | 58.510     | -           |
|          |   |                    | 0,035                         | 9,25                  | 11.001     | 59.001      |
|          |   |                    | 0,04                          | 7,87                  | 6.410      | 19.006      |
| III (g)  | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                    | 0,01                          | 10,44                 | 107.003    | -           |
|          | Parameter C <sub>1</sub>                    | 0,0005             | 0,01                          | 13,13                 | 1.000.000* | -           |
|          | Parameter C <sub>2</sub>                    | -4,397             | 0,02                          | 7,65                  | 4.104      | 16.501      |
|          | Bestimmtheitsmaß                            | 65,5 %             | 0,02                          | 13,05                 | 59.502     | 249.001     |
|          |   |                    | 0,02                          | 10,72                 | 5.010      | -           |
|          |   |                    | 0,03                          | 11,60                 | 2.701      | -           |
|          |   |                    | 0,03                          | 8,67                  | 18.510     | -           |
| V (Ref.) | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                    | 0,03                          | 16,31                 | 249.503    | 347.010     |
|          | Parameter C <sub>1</sub>                    | $2 \times 10^{-8}$ | 0,03                          | 18,12                 | 1.000.000* | -           |
|          | Parameter C <sub>2</sub>                    | -8,769             | 0,035                         | 16,01                 | 160.504    | -           |
|          | Bestimmtheitsmaß                            | 69,9 %             | 0,038                         | 17,21                 | 15.510     | 25.006      |
|          |   |                    | 0,038                         | 20,25                 | 10.510     | 24.501      |
|          |   |                    | 0,045                         | 17,60                 | 23.510     | 69.003      |
|          |   |                    | 0,045                         | 16,31                 | 15.001     | 23.401      |

Anhang 2: Scherermüdungsprüfungen

| Variante   | Wöhler-Linie                                |                    | Amplitude<br>$\epsilon_{Amp}$ | Steifigkeits<br>modul | $N_{f50}$  | $N_{Makro}$ |
|------------|---|--------------------|-------------------------------|-----------------------|------------|-------------|
|            |   |                    | mm                            | MPa/mm                | -          | -           |
| VIII (V)   | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                    | 0,02                          | 9,72                  | 371.507    | -           |
|            | Parameter C <sub>1</sub>                    | 0,0013             | 0,025                         | 11,38                 | 18.002     | -           |
|            | Parameter C <sub>2</sub>                    | -4,741             | 0,03                          | 12,33                 | 17.505     | -           |
|            | Bestimmtheitsmaß                            | 70,5 %             | 0,03                          | 13,69                 | 15.505     | -           |
|            |   |                    | 0,04                          | 8,33                  | 16.008     | -           |
|            |   |                    | 0,04                          | 11,79                 | 3.602      | -           |
| XI (G)     | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                    | 0,01                          | 25,76                 | 1.000.000* |             |
|            | Parameter C <sub>1</sub>                    | 1,7503             | 0,01                          | 12,70                 | 1.000.000* |             |
|            | Parameter C <sub>2</sub>                    | -2,903             | 0,015                         | 13,90                 | 86.003     | 111.003     |
|            | Bestimmtheitsmaß                            | 78,9 %             | 0,02                          | 19,75                 | 70.006     | 80.507      |
|            |   |                    | 0,02                          | 16,19                 | 600.000*   |             |
|            |   |                    | 0,03                          | 11,48                 | 50.508     | 69.503      |
|            |   |                    | 0,03                          | 11,81                 | 28.510     | 43.001      |
| XII (Ref.) | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                    | 0,03                          | 12,82                 | 1.000.000* | -           |
|            | Parameter C <sub>1</sub>                    | 4X10 <sup>-9</sup> | 0,03                          | 15,96                 | 25.501     | 49.507      |
|            | Parameter C <sub>2</sub>                    | -9,603             | 0,038                         | 19,62                 | 19.003     | 54.506      |
|            | Bestimmtheitsmaß                            | 62,2 %             | 0,038                         | 22,02                 | 5.705      | 20.007      |
|            |   |                    | 0,038                         | 16,23                 | 50.010     | 26.803      |
|            |   |                    | 0,045                         | 19,54                 | 4.510      | 6.604       |
|            |   |                    | 0,045                         | 21,01                 | 2.301      | 9.705       |

Durchgestrichene Zahl = in der Auswertung nicht berücksichtigt

\* Kriterium  $N_{f50}$  nicht erreicht, Schätzwert

Anhang 2: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Last-amplitude | Durchbiegung (elastisch und plastisch) nach Lastzyklus |       |        |        |        |         |
|----------|----------------|--|-------|--------|--------|--------|---------|
|          |                | 100  | 1.000 | 10.000 | 20.000 | 50.000 | 100.000 |
|          | kN             | mm   | mm    | mm     | mm     | mm     | mm      |
| I (k)    | 0,2            | 0,173  | 0,610 | 2,196  | 2,807  | 3,638  | 4,583   |
|          | 0,2            | 0,165  | 0,542 | 2,011  | 2,715  | 4,032  | 5,528   |
|          | 0,3            | 0,244  | 0,785 | 2,784  | 3,572  | 4,749  | -       |
|          | 0,3            | 0,428  | 1,231 | 3,959  | 5,199  | 7,255  | -       |
|          | 0,4            | 0,403  | 1,581 | 5,522  | 7,440  | 11,015 | 15,167  |
| III (g)  | 0,2            | 0,122  | 0,411 | 1,351  | 1,759  | 2,422  | 3,200   |
|          | 0,2            | 0,196  | 0,719 | 2,770  | 3,712  | 5,200  | 6,920   |
|          | 0,3            | 0,165  | 0,610 | 2,156  | 2,822  | 3,874  | 5,092   |
|          | 0,3 *          | -  | -     | -      | -      | -      | -       |
|          | 0,4            | 0,280  | 0,929 | 3,235  | 4,422  | 6,485  | 8,815   |
|          | 0,4            | 0,303  | 0,947 | 2,961  | 3,859  | 5,627  | 7,722   |
| IV (g)   | 0,2            | 0,120  | 0,405 | 1,206  | 1,478  | 1,833  | 2,366   |
|          | 0,2            | 0,105  | 0,305 | 0,898  | 1,116  | 1,472  | 1,883   |
|          | 0,3            | 0,194  | 0,669 | 2,156  | 2,836  | 3,985  | 5,414   |
|          | 0,3 *          | -  | -     | -      | -      | -      | -       |
|          | 0,4            | 0,282  | 0,857 | 2,781  | 3,621  | 5,211  | 7,143   |
|          | 0,4            | 0,225  | 0,697 | 2,295  | 3,125  | 4,681  | 6,729   |
| VI (K)   | 0,2            | 0,173  | 0,596 | 2,333  | 2,982  | 3,889  | 4,895   |
|          | 0,2 *          | -  | -     | -      | -      | -      | -       |
|          | 0,3            | 0,235  | 0,912 | 3,787  | 5,282  | 8,434  | 14,884  |
|          | 0,3            | 0,266  | 1,014 | 4,914  | 7,466  | -      | -       |
|          | 0,4            | 0,482  | 2,074 | 6,825  | 9,046  | 12,818 | 17,468  |
|          | 0,4            | 0,407  | 1,673 | 5,743  | 8,019  | 13,578 | 24,623  |

\* Aufgrund eines technische Defekts keine Daten aufgezeichnet.

Anhang 2: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Last-amplitude | Durchbiegung (elastisch und plastisch) nach Lastzyklus |       |        |        |        |         |
|----------|----------------|--|-------|--------|--------|--------|---------|
|          |                | 100  | 1.000 | 10.000 | 20.000 | 50.000 | 100.000 |
|          | kN             | mm   | mm    | mm     | mm     | mm     | mm      |
| VII (K)  | 0,2            | 0,183  | 0,799 | 3,544  | 5,698  | 9,435  | 13,494  |
|          | 0,2            | 0,310  | 1,431 | 5,616  | 7,295  | 9,886  | 12,794  |
|          | 0,3            | 0,329  | 1,281 | 7,138  | 10,090 | 15,336 | 21,977  |
|          | 0,3            | 0,283  | 1,147 | 4,534  | 6,116  | 9,018  | 12,536  |
|          | 0,4            | 0,678  | 2,902 | 11,543 | 16,797 | -      | -       |
|          | 0,4            | 0,452  | 2,234 | 8,965  | 12,524 | 19,744 | -       |
| IX (G)   | 0,2            | 0,140  | 0,429 | 1,381  | 1,777  | 2,478  | 3,287   |
|          | 0,2            | 0,123  | 0,394 | 1,364  | 1,797  | 2,476  | 3,296   |
|          | 0,3            | 0,229  | 0,729 | 2,473  | 3,222  | 4,519  | 5,969   |
|          | 0,3            | 0,251  | 0,703 | 2,019  | 2,645  | 3,767  | 5,077   |
|          | 0,4            | 0,295  | 0,950 | 3,166  | 4,275  | 6,261  | 8,634   |
|          | 0,4            | 0,299  | 0,891 | 2,814  | 3,880  | 5,657  | 7,614   |
| X (G)    | 0,2            | 0,113  | 0,367 | 1,239  | 1,584  | 2,053  | 2,614   |
|          | 0,2            | 0,095  | 0,380 | 1,502  | 2,038  | 2,988  | 4,03    |
|          | 0,3            | 0,179  | 0,664 | 2,899  | 3,982  | 5,762  | 7,846   |
|          | 0,3            | 0,294  | 1,175 | 4,503  | 6,052  | 8,475  | 11,407  |
|          | 0,4            | 0,311  | 1,457 | 12,353 | -      | -      | -       |
|          | 0,4 *          | -  | -     | -      | -      | -      | -       |

\* Aufgrund eines technische Defekts keine Daten aufgezeichnet.



Anhang 2: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante   | Last-amplitude | Durchbiegung (elastisch und plastisch) nach Lastzyklus |       |        |        |        |         |
|------------|----------------|--|-------|--------|--------|--------|---------|
|            |                | 100  | 1.000 | 10.000 | 20.000 | 50.000 | 100.000 |
|            | kN             | mm   | mm    | mm     | mm     | mm     | mm      |
| XI (G)     | 0,1            | 0,006  | 0,135 | 0,685  | 0,834  | -      | -       |
|            | 0,1            | 0,085  | 0,256 | 1,081  | 1,469  | 2,133  | 2,939   |
|            | 0,2            | 0,189  | 0,606 | 2,438  | 3,372  | 4,739  | 6,276   |
|            | 0,2            | 0,179  | 0,641 | 2,700  | 3,664  | 5,116  | 6,844   |
|            | 0,3            | 0,177  | 0,647 | 3,526  | 5,089  | 7,833  | 11,38   |
|            | 0,3            | 0,229  | 0,982 | 3,629  | 5,049  | 7,329  | 9,542   |
|            | 0,4            | 0,402  | 1,588 | 6,014  | 8,430  | 13,591 | -       |
|            | 0,4            | 0,347  | 1,423 | 5,472  | 7,525  | 11,424 | 16,992  |
|            | 0,5            | 0,347  | 1,617 | 6,429  | 9,338  | -      | -       |
| XII (Ref.) | 0,1            | 0,066  | 0,289 | 1,144  | 1,506  | 1,993  | 2,539   |
|            | 0,1            | 0,017  | 0,142 | 0,538  | 0,757  | 1,178  | 1,631   |
|            | 0,2            | 0,131  | 0,435 | 1,325  | 1,644  | 2,146  | 2,758   |
|            | 0,2            | 0,173  | 0,492 | 1,313  | 1,625  | 2,057  | 2,546   |
|            | 0,3            | 0,186  | 0,680 | 2,468  | 3,538  | 6,722  | -       |
|            | 0,3            | 0,168  | 0,533 | 1,629  | 2,148  | 3,047  | 4,264   |
|            | 0,4            | 0,296  | 0,969 | 5,26   | -      | -      | -       |
|            | 0,4            | 0,213  | 0,759 | 3,28   | -      | -      | -       |

Anhang 2: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie               |          | Last-amplitude | N <sub>f50</sub> | N <sub>Makro</sub> |
|----------|----------------------------|----------|----------------|------------------|--------------------|
|          | Parameter N <sub>f50</sub> |          | kN             | -                | -                  |
| I (k)    | Parameter C <sub>1</sub>   | 34869 *  | 0,2            | -                | -                  |
|          | Parameter C <sub>2</sub>   | -2,137 * | 0,2            | -                | -                  |
|          | Bestimmtheitsmaß           | 71,6 % * | 0,3            | -                | 38.630             |
|          |                            |          | 0,3            | -                | 36.710             |
|          |                            |          | 0,4            | 174.700          | -                  |
|          |                            |          | 0,4            | -                | -                  |
| III (g)  | Parameter C <sub>1</sub>   | -        | 0,2            | -                | -                  |
|          | Parameter C <sub>2</sub>   | -        | 0,2            | -                | -                  |
|          | Bestimmtheitsmaß           | -        | 0,3            | -                | -                  |
|          |                            |          | 0,3            | -                | -                  |
|          |                            |          | 0,4            | 1.000.000 *      | 1.000.000 *        |
|          |                            |          | 0,4            | -                | -                  |
| IV (g)   | Parameter C <sub>1</sub>   | -        | 0,2            | -                | -                  |
|          | Parameter C <sub>2</sub>   | -        | 0,2            | -                | -                  |
|          | Bestimmtheitsmaß           | -        | 0,3            | -                | -                  |
|          |                            |          | 0,3            | -                | -                  |
|          |                            |          | 0,4            | 210.640          | 208.580            |
|          |                            |          | 0,4            | 235.380          | 194.320            |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 2: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie               |          | Last-amplitude | N <sub>f50</sub> | N <sub>Makro</sub> |
|----------|----------------------------|----------|----------------|------------------|--------------------|
|          | Parameter N <sub>f50</sub> |          | kN             | -                | -                  |
| VI (K)   | Parameter C <sub>1</sub>   | 180.654  | 0,2            | -                | -                  |
|          | Parameter C <sub>2</sub>   | +1,1726  | 0,2            | 25.260           | 27.000             |
|          | Bestimmtheitsmaß           | 39,3 %   | 0,3            | 83.060           | 79.340             |
|          |                            |          | 0,3            | 28.300           | 26.800             |
|          |                            |          | 0,4            | 70.880           | 104.360            |
|          |                            |          | 0,4            | 47.960           | 53.620             |
| VII (K)  | Parameter C <sub>1</sub>   | 751,4    | 0,2            | 126.880          | -                  |
|          | Parameter C <sub>2</sub>   | -3,252   | 0,2            | -                | -                  |
|          | Bestimmtheitsmaß           | 49,1 %   | 0,3            | 12.300           | 185.300            |
|          |                            |          | 0,3            | 148.600          | -                  |
|          |                            |          | 0,4            | 8.835            | 45.120             |
|          |                            |          | 0,4            | 21.360           | 70.060             |
| IX (G)   | Parameter C <sub>1</sub>   | 252,8 *  | 0,2            | -                | -                  |
|          | Parameter C <sub>2</sub>   | -8,78 *  | 0,2            | -                | -                  |
|          | Bestimmtheitsmaß           | 79,9 % * | 0,3            | -                | -                  |
|          |                            |          | 0,3            | -                | -                  |
|          |                            |          | 0,4            | 218.000          | 245.180            |
|          |                            |          | 0,4            | 228.500          | -                  |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 2: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante   | Wöhler-Linie               |        | Last-amplitude | N <sub>f50</sub> | N <sub>Makro</sub> |
|------------|----------------------------|--------|----------------|------------------|--------------------|
|            | Parameter N <sub>f50</sub> |        | kN             | -                | -                  |
| X (G)      | Parameter C <sub>1</sub>   | 104,2  | 0,2            | 246.020          | -                  |
|            | Parameter C <sub>2</sub>   | -5,412 | 0,2            | 1.000.000*       | -                  |
|            | Bestimmtheitsmaß           | 81,6 % | 0,3            | 159.640          | -                  |
|            |                            |        | 0,3            | 100.380          | 107.280            |
|            |                            |        | 0,4            | 7.485            | 7.365              |
|            |                            |        | 0,4            | -                | -                  |
| XI (G)     | Parameter C <sub>1</sub>   | 13531  | 0,1            | -                |                    |
|            | Parameter C <sub>2</sub>   | -1,738 | 0,2            | 221.660          |                    |
|            | Bestimmtheitsmaß           | 83,8 % | 0,2            | 212.340          |                    |
|            |                            |        | 0,3            | 88.760           | 203.320            |
|            |                            |        | 0,3            | -                |                    |
|            |                            |        | 0,4            | 91.820           | 70.100             |
|            |                            |        | 0,4            | 93.360           | 122.420            |
|            |                            | 0,5    | 30.020         | 33.180           |                    |
| XII (Ref.) | Parameter C <sub>1</sub>   | 742,25 | 0,2            | 224.320          | -                  |
|            | Parameter C <sub>2</sub>   | -3,632 | 0,2            | 170.680          | -                  |
|            | Bestimmtheitsmaß           | 73,9 % | 0,3            | 60.200           | 56.700             |
|            |                            |        | 0,3            | 211.760          | 174.340            |
|            |                            |        | 0,4            | 10.780           | 8.655              |
|            |                            |        | 0,4            | 18.520           | 15.260             |

\* Kriterium N<sub>f50</sub> nicht erreicht, Schätzwert

Anhang 2: 4-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Wöhler-Linie                                |   | Amplitude<br>$\epsilon_{Amp}$ | $N_{f50}$  | $\epsilon_6$ | Riss    |
|--------------------------|---|---|-------------------------------|------------|--------------|---------|
|                          |   |   | $\mu\text{m/m}$               | -          | -            | -       |
| I (k)                    | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |   | 350                           | 23.960     | 164,29       | 2       |
|                          | Parameter C <sub>1</sub>                    | 2,3264x10 <sup>18</sup>                     | 350                           | 17.545     |              | 1       |
|                          | Parameter C <sub>2</sub>                    | -5,5211                                     | 350                           | 15.353     |              | 1       |
|                          | Bestimmtheitsm.                             | 86,9 %                                      | 350                           | 23.401     |              | 2       |
|                          |   |   | 225                           | 280.235    |              | 1       |
|                          |   |   | 225                           | 311.437    |              | 1       |
|                          |   |   | 225                           | 162.008    |              | 3       |
|                          |   |   | 200                           | 145.913    |              | 1       |
|                          |   |   | 200                           | 1.000.000* |              | 2       |
|                          |   |   | 250                           | 211.955    |              | 2       |
|                          |   |   | 250                           | 153.746    |              | 1       |
|                          |   |   | 250                           | 132.800    |              | 2       |
|                          | III (g)                                     | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                               | 250        |              | 153.111 |
| Parameter C <sub>1</sub> |   | 1,1341x10 <sup>19</sup>                     | 250                           | 259.339    | 2            |         |
| Parameter C <sub>2</sub> |   | -5,7877                                     | 250                           | 226.250    | 1            |         |
| Bestimmtheitsm.          |   | 77,8 %                                      | 250                           | 137.001    | 2            |         |
|                          |   | 300   | 28.377                        | 1          |              |         |
|                          |   | 300   | 75.234                        | 2          |              |         |
|                          |   | 300   | 74.539                        | 1          |              |         |
|                          |   | 300   | 33.714                        | 2          |              |         |
|                          |   | 225   | 211.555                       | 1          |              |         |
|                          |   | 225   | 266.108                       | 2          |              |         |
|                          |   | 225   | 212.519                       | 2          |              |         |

Anhang 2: 4-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                                |                         | Amplitude<br>$\epsilon_{Amp}$ | $N_{f50}$ | $\epsilon_6$ | Riss |
|----------|---|-------------------------|-------------------------------|-----------|--------------|------|
|          |   |                         | $\mu\text{m/m}$               | -         | -            | -    |
| IV (g)   | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                         | 250                           | 29.119    | 151,35       | 4    |
|          | Parameter C <sub>1</sub>                    | 1,2830x10 <sup>22</sup> | 250                           | 27.860    |              | 0    |
|          | Parameter C <sub>2</sub>                    | -7,3892                 | 250                           | 5.248     |              | -    |
|          | Bestimmtheitsm.                             | 84,0 %                  | 250                           | 36.444    |              | 1    |
|          |   |                         | 300                           | 12.898    |              | 0    |
|          |   |                         | 200                           | 176.619   |              | 0    |
|          |   |                         | 200                           | 76.204    |              | 0    |
|          |   |                         | 200                           | 163.317   |              | 0    |
|          |   |                         | 200                           | 97.790    |              | -    |
|          |   |                         | 200                           | 86.676    |              | 4    |
|          |   |                         | 175                           | 515.537   |              | 1    |
|          |   |                         | 175                           | 280.158   |              | 0    |
|          |   |                         | 175                           | 409.439   |              | 4    |
|          |   |                         | 175                           | 480.011   |              | 1    |
| VI (K)   | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                         | 250                           | 39.342    | 156,38       | -    |
|          | Parameter C <sub>1</sub>                    | 1,0959x10 <sup>20</sup> | 250                           | 47.334    |              | -    |
|          | Parameter C <sub>2</sub>                    | -6,3986                 | 250                           | 103.167   |              | -    |
|          | Bestimmtheitsm.                             | 61,1 %                  | 250                           | 48.824    |              | -    |
|          |   |                         | 200                           | 213.333   |              | -    |
|          |   |                         | 200                           | 44.335    |              | -    |
|          |   |                         | 200                           | 396.664   |              | -    |
|          |   |                         | 200                           | 155.497   |              | -    |
|          |   |                         | 175                           | 1.000.000 |              | -    |

Anhang 2: 4-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Wöhler-Linie                                |   | Amplitude<br>$\epsilon_{Amp}$ | $N_{f50}$  | $\epsilon_6$ | Riss   |
|--------------------------|---|---|-------------------------------|------------|--------------|--------|
|                          |   |   | $\mu\text{m/m}$               | -          | -            | -      |
| VII (K)                  | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |   | 125                           | 1.000.000* | 126,26       | -      |
|                          | Parameter C <sub>1</sub>                    | 3,7936x10 <sup>15</sup>                     | 125                           | 1.000.000* |              | 0      |
|                          | Parameter C <sub>2</sub>                    | -4,5587                                     | 200                           | 21.212     |              | 0      |
|                          | Bestimmtheitsm.                             | 53,2 %                                      | 200                           | 21.402     |              | 1      |
|                          |   |   | 200                           | 341.556    |              | 3      |
|                          |   |   | 200                           | 159.542    |              | 1      |
|                          |   |   | 225                           | 577.261    |              | 0      |
|                          |   |   | 225                           | 323.488    |              | 1      |
|                          |   |   | 225                           | 93.186     |              | 1      |
|                          |   |   | 250                           | 22.018     |              | 0      |
|                          |   |   | 300                           | 7.114      |              | 0      |
|                          |   |   | 300                           | 22.749     |              | 0      |
|                          | IX (G)                                      | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                               | 200        |              | 168655 |
| Parameter C <sub>1</sub> |   | 2,8085x10 <sup>16</sup>                     | 200                           | 195674     | 1            |        |
| Parameter C <sub>2</sub> |   | -4,8302                                     | 200                           | 408915     | 1            |        |
| Bestimmtheitsm.          |   | 90,3 %                                      | 200                           | 174481     | 1            |        |
|                          |   | 200   | 229668                        | 1          |              |        |
|                          |   | 250   | 50134                         | 1          |              |        |
|                          |   | 250   | 62222                         | 0          |              |        |
|                          |   | 250   | 91906                         | 0          |              |        |
|                          |   | 300   | 31651                         | 0          |              |        |
|                          |   | 300   | 37606                         | 0          |              |        |
|                          |   | 300   | 28303                         | 1          |              |        |

Anhang 2: 4-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Wöhler-Linie                                |   | Amplitude<br>$\epsilon_{Amp}$ | $N_{f50}$ | $\epsilon_6$ | Riss    |
|--------------------------|---|---|-------------------------------|-----------|--------------|---------|
|                          |   |   | $\mu\text{m/m}$               | -         | -            | -       |
| X (G)                    | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |   | 175                           | 189.516   | 130,39       | 0       |
|                          | Parameter C <sub>1</sub>                    | 3,7529x10 <sup>17</sup>                     | 175                           | 189.516   |              | 0       |
|                          | Parameter C <sub>2</sub>                    | -5,4851                                     | 200                           | 85.178    |              | 1       |
|                          | Bestimmtheitsm.                             | 97,6 %                                      | 200                           | 102.113   |              | 0       |
|                          |   |   | 200                           | 75.732    |              | 0       |
|                          |   |   | 250                           | 33.193    |              | 1       |
|                          |   |   | 250                           | 21.804    |              | 1       |
|                          |   |   | 250                           | 26.930    |              | 1       |
|                          |   |   | 250                           | 24.833    |              | 1       |
|                          | XI (G)                                      | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                               | 200       |              | 203.141 |
| Parameter C <sub>1</sub> |   | 1,0789x10 <sup>21</sup>                     | 200                           | 213.019   | 1            |         |
| Parameter C <sub>2</sub> |   | -6,8012                                     | 200                           | 314.031   | 1            |         |
| Bestimmtheitsm.          |   | 88,3 %                                      | 250                           | 47.496    | -            |         |
|                          |   | 250   | 61.357                        | -         |              |         |
|                          |   | 250   | 58.113                        | 1         |              |         |
|                          |   | 275   | 25.326                        | 2         |              |         |
|                          |   | 275   | 14.624                        | 1         |              |         |
|                          |   | 275   | 52.502                        | 1         |              |         |



Anhang 2: 4-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante   | Wöhler-Linie                                |                         | Amplitude<br>$\epsilon_{Amp}$ | $N_{f50}$ | $\epsilon_6$ | Riss |
|------------|---|-------------------------|-------------------------------|-----------|--------------|------|
|            |   |                         | $\mu\text{m/m}$               | -         | -            | -    |
| XII (Ref.) | $N_{f,50} = C_1 \cdot \epsilon_{Amp}^{C_2}$ |                         | 200                           | 55.602    | 97,24        | 0    |
|            | Parameter C <sub>1</sub>                    | 1,0365x10 <sup>14</sup> | 200                           | 57.586    |              | 5    |
|            | Parameter C <sub>2</sub>                    | -4,0323                 | 275                           | 13.536    |              | 5    |
|            | Bestimmtheitsm.                             | 85,9 %                  | 275                           | 12.088    |              | 0    |
|            |   |                         | 300                           | 16.560    |              | 0    |
|            |   |                         | 300                           | 14.056    |              | 0    |
|            |   |                         | 300                           | 6.734     |              | 0    |
|            |   |                         |                               |           |              |      |

\* Kriterium  $N_{f50}$  nicht erreicht, Maximalwert

Riss:

0 = keine Veränderung am Probekörper zu erkennen, ggf. kleiner Riss bis zur Einlage

1 = geringe Ablösungen der Einlage im Bereich der Kerbe

2 = Sichtbare Ablösungen an der Einlage im Bereich der Kerbe

3 = Starke Ablösungen der Einlage im Bereich der Kerbe

4 = Ablösungen an der Einlage, kleiner Riss durch die Einlage

5 = Riss geht zu mindestens 1/3 durch den Probekörper, inkl. der Einlage

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                | Lastzyklus | Spannung [MPa] je Lastvariante |       |       |       |       |       |
|-------------------------|------------|--------------------------------|-------|-------|-------|-------|-------|
|                         |            | 0,4                            | 0,6   | 0,8   | 1,0   | 1,2   | 1,5   |
|                         | -          | kN                             | kN    | kN    | kN    | kN    | kN    |
| I (k)<br>Unterlage<br>1 | 100        | 1,325                          | 1,977 | 2,350 | 2,532 | 2,989 | 3,139 |
|                         | 1000       | 1,620                          | 2,054 | 2,394 | 2,597 | 2,935 | 3,123 |
|                         | 2000       | 1,699                          | 2,054 | 2,379 | 2,568 | 2,877 | 3,075 |
|                         | 10000      | 1,781                          | 2,047 | 2,333 | 2,467 | 2,738 | 2,851 |
|                         | 20000      | 1,786                          | 2,028 | 2,286 | 2,387 | 2,622 | 2,731 |
|                         | 50000      | 1,778                          | 2,006 | 2,219 | 2,285 | 2,514 | 2,574 |
|                         | 100000     | 1,779                          | 1,996 | 2,167 | 2,059 | 2,418 | 2,219 |
|                         | Riss       | 0                              | 0     | 0     | 0     | 1     | 1     |
| I (k)<br>Unterlage<br>2 | 100        | 1,587                          | 1,996 | 2,581 | 2,743 | -     | -     |
|                         | 1000       | 1,816                          | 2,211 | 2,691 | 2,709 | -     | -     |
|                         | 2000       | 1,889                          | 2,241 | 2,681 | 2,681 | -     | -     |
|                         | 10000      | 1,969                          | 2,249 | 2,576 | 2,612 | -     | -     |
|                         | 20000      | 1,976                          | 2,243 | 2,504 | 2,563 | -     | -     |
|                         | 50000      | 1,988                          | 2,198 | 2,408 | 2,509 | -     | -     |
|                         | 100000     | 1,984                          | 2,200 | 2,303 | 2,473 | -     | -     |
|                         | Riss       | 0                              | 0     | 0     | 0     | -     | -     |

Riss:

0 = keine Veränderung am Probekörper zu erkennen, ggf. kleiner Riss bis zur Einlage

1 = geringe Ablösungen der Einlage im Bereich der Kerbe

2 = Sichtbare Ablösungen an der Einlage im Bereich der Kerbe

3 = Starke Ablösungen der Einlage im Bereich der Kerbe

4 = Ablösungen an der Einlage, kleiner Riss durch die Einlage

5 = Riss geht zu mindestens 1/3 durch den Probekörper, inkl. der Einlage

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                  | Lastzyklus | Spannung [MPa] je Lastvariante |       |       |        |       |       |
|---------------------------|------------|--------------------------------|-------|-------|--------|-------|-------|
|                           |            | 0,4                            | 0,6   | 0,8   | 1,0    | 1,2   | 1,5   |
|                           | -          | kN                             | kN    | kN    | kN     | kN    | kN    |
| III (g)<br>Unterlage<br>1 | 100        | 1,468                          | 1,892 | 2,434 | 2,6643 | 2,793 | 3,013 |
|                           | 1000       | 1,642                          | 2,066 | 2,615 | 2,732  | 2,818 | 3,032 |
|                           | 2000       | 1,704                          | 2,101 | 2,631 | 2,709  | 2,743 | 2,984 |
|                           | 10000      | 1,799                          | 2,114 | 2,606 | 2,654  | 2,568 | 2,722 |
|                           | 20000      | 1,822                          | 2,096 | 2,579 | 2,594  | 2,469 | 2,571 |
|                           | 50000      | 1,839                          | 2,094 | 2,502 | 2,501  | 2,349 | 2,349 |
|                           | 100000     | 1,854                          | 2,088 | 2,496 | 2,349  | 2,283 | 2,263 |
|                           | Riss       | 1                              | 0     | 0     | 1      | 2     | 3     |
| III (g)<br>Unterlage<br>2 | 100        | 1,625                          | 2,035 | 2,360 | 2,656  | -     | -     |
|                           | 1000       | 1,783                          | 2,340 | 2,378 | 2,796  | -     | -     |
|                           | 2000       | 1,844                          | 2,417 | 2,386 | 2,817  | -     | -     |
|                           | 10000      | 1,927                          | 2,465 | 2,399 | 2,839  | -     | -     |
|                           | 20000      | 1,920                          | 2,441 | 2,372 | 2,827  | -     | -     |
|                           | 50000      | 1,940                          | 2,452 | 2,252 | 2,799  | -     | -     |
|                           | 100000     | 1,951                          | 2,453 | 2,223 | 2,767  | -     | -     |
|                           | Riss       | 1                              | 0     | -     | 0      | -     | -     |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Spannung [MPa] je Lastvariante |       |       |       |        |       |
|--------------------------|------------|--------------------------------|-------|-------|-------|--------|-------|
|                          |            | 0,4                            | 0,6   | 0,8   | 1,0   | 1,2    | 1,5   |
|                          | -          | kN                             | kN    | kN    | kN    | kN     | kN    |
| IV (g)<br>Unterlage<br>1 | 100        | 1,316                          | 1,314 | 1,915 | 2,281 | 2,9810 | 3,083 |
|                          | 1000       | 1,430                          | 1,544 | 2,203 | 2,444 | 3,018  | 3,111 |
|                          | 2000       | 1,455                          | 1,616 | 2,247 | 2,446 | 3,012  | 3,056 |
|                          | 10000      | 1,535                          | 1,752 | 2,274 | 2,429 | 2,989  | 2,770 |
|                          | 20000      | 1,542                          | 1,755 | 2,232 | 2,392 | 2,906  | 2,581 |
|                          | 50000      | 1,559                          | 1,797 | 2,165 | 2,331 | 2,814  | 2,281 |
|                          | 100000     | 1,854                          | 1,967 | 2,149 | 2,302 | 2,765  | 2,019 |
|                          | Riss       | 0                              | 0     | 0     | 0     | 0      | 5     |
| IV (g)<br>Unterlage<br>2 | 100        | 1,390                          | 1,710 | 2,064 | 2,344 | -      | -     |
|                          | 1000       | 1,598                          | 1,883 | 2,213 | 2,593 | -      | -     |
|                          | 2000       | 1,673                          | 1,928 | 2,248 | 2,634 | -      | -     |
|                          | 10000      | 1,828                          | 1,996 | 2,294 | 2,655 | -      | -     |
|                          | 20000      | 1,860                          | 2,005 | 2,288 | 2,616 | -      | -     |
|                          | 50000      | 1,900                          | 2,047 | 2,272 | 2,551 | -      | -     |
|                          | 100000     | 1,951                          | 2,453 | 2,276 | 2,516 | -      | -     |
|                          | Riss       | 0                              | 0     | 0     | 0     | -      | -     |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Spannung [MPa] je Lastvariante |       |       |       |       |       |
|--------------------------|------------|--------------------------------|-------|-------|-------|-------|-------|
|                          |            | 0,4                            | 0,6   | 0,8   | 1,0   | 1,2   | 1,5   |
|                          | -          | kN                             | kN    | kN    | kN    | kN    | kN    |
| VI (K)<br>Unterlage<br>1 | 100        | 1,533                          | 1,940 | 2,405 | 2,408 | 2,816 | 3,014 |
|                          | 1000       | 1,644                          | 2,015 | 2,409 | 2,366 | 2,722 | 2,894 |
|                          | 2000       | 1,687                          | 2,016 | 2,369 | 2,336 | 2,651 | 2,808 |
|                          | 10000      | 1,759                          | 2,054 | 2,241 | 2,211 | 2,490 | 2,575 |
|                          | 20000      | 1,758                          | 2,055 | 2,180 | 2,154 | 2,410 | 2,454 |
|                          | 50000      | 1,764                          | 2,001 | 2,093 | 2,079 | 2,305 | 2,277 |
|                          | 100000     | 1,854                          | 1,993 | 2,120 | 2,302 | 2,249 | 2,206 |
|                          | Riss       | 0                              | 0     | 0     | 1     | 0     | 1     |
| VI (K)<br>Unterlage<br>2 | 100        | 1,540                          | 1,710 | 2,427 | 2,626 | -     | -     |
|                          | 1000       | 1,715                          | 1,883 | 2,453 | 2,717 | -     | -     |
|                          | 2000       | 1,766                          | 1,928 | 2,421 | 2,714 | -     | -     |
|                          | 10000      | 1,883                          | 1,996 | 2,347 | 2,707 | -     | -     |
|                          | 20000      | 1,900                          | 2,005 | 2,293 | 2,670 | -     | -     |
|                          | 50000      | 1,954                          | 2,047 | 2,228 | 2,619 | -     | -     |
|                          | 100000     | 1,951                          | 2,453 | 2,201 | 2,571 | -     | -     |
|                          | Riss       | 0                              | 0     | 0     | 1     | -     | -     |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                  | Lastzyklus | Spannung [MPa] je Lastvariante    |       |                                    |       |                                    |       |
|---------------------------|------------|-----------------------------------|-------|------------------------------------|-------|------------------------------------|-------|
|                           |            | 0,4                               | 0,6   | 0,8                                | 1,0   | 1,2                                | 1,5   |
|                           | -          | kN                                | kN    | kN                                 | kN    | kN                                 | kN    |
| VII (K)<br>Unterlage<br>1 | 100        | 1,618                             | 1,881 | 1,999                              | 2,493 | 2,794                              | 2,936 |
|                           | 1000       | 1,755                             | 1,912 | 2,155                              | 2,376 | 2,634                              | 2,758 |
|                           | 2000       | 1,781                             | 1,898 | 2,129                              | 2,288 | 2,531                              | 2,646 |
|                           | 10000      | 1,765                             | 1,833 | 2,019                              | 2,082 | 2,283                              | 2,400 |
|                           | 20000      | 1,736                             | 1,787 | 1,943                              | 1,994 | 2,176                              | 2,294 |
|                           | 50000      | 1,666                             | 1,734 | 1,871                              | 1,903 | 2,050                              | 2,165 |
|                           | 100000     | 1,647                             | 1,703 | 1,833                              | 1,841 | 2,006                              | 2,114 |
|                           | Riss       | 0                                 | 0     | 0                                  | 0     | 0                                  | 0     |
| VII (K)<br>Unterlage<br>2 | 100        | 1,593                             | 2,091 | 2,377                              | 2,419 | -                                  | -     |
|                           | 1000       | 1,913                             | 2,159 | 2,435                              | 2,487 | -                                  | -     |
|                           | 2000       | 1,952                             | 2,151 | 2,399                              | 2,459 | -                                  | -     |
|                           | 10000      | 1,954                             | 2,113 | 2,276                              | 2,310 | -                                  | -     |
|                           | 20000      | 1,937                             | 2,090 | 2,161                              | 2,201 | -                                  | -     |
|                           | 50000      | 1,909                             | 2,021 | 2,067                              | 2,086 | -                                  | -     |
|                           | 100000     | 1,951                             | 2,453 | 2,021                              | 2,327 | -                                  | -     |
|                           | Riss       | 0                                 | 0     | 0                                  | 0     | -                                  | -     |
| VII (K)                   |            | T = 0 °C<br>1,5 kN<br>Unterlage 1 |       | T = 10 °C<br>1,5 kN<br>Unterlage 1 |       | T = 10 °C<br>1,5 kN<br>Unterlage 3 |       |
|                           | 100        | 2,788                             |       | 3,603                              |       | 13,198                             |       |
|                           | 1000       | 3,088                             |       | 4,114                              |       | 16,799                             |       |
|                           | 2000       | 3,126                             |       | 4,300                              |       | 17,438                             |       |
|                           | 10000      | 3,011                             |       | 4,613                              |       | 19,038                             |       |
|                           | 20000      | 2,880                             |       | 4,652                              |       | 19,161                             |       |
|                           | 50000      | 2,758                             |       | 4,638                              |       | 19,195                             |       |
|                           | 100000     | 2,703                             |       | 4,598                              |       | 18,987                             |       |
|                           | Riss       | 0                                 |       | 0                                  |       | 0                                  |       |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Spannung [MPa] je Lastvariante |       |       |       |       |       |
|--------------------------|------------|--------------------------------|-------|-------|-------|-------|-------|
|                          |            | 0,4                            | 0,6   | 0,8   | 1,0   | 1,2   | 1,5   |
|                          | -          | kN                             | kN    | kN    | kN    | kN    | kN    |
| IX (G)<br>Unterlage<br>1 | 100        | 1,608                          | 2,033 | 2,354 | 2,533 | 2,814 | 3,109 |
|                          | 1000       | 1,782                          | 2,279 | 2,667 | 2,602 | 2,827 | 3,101 |
|                          | 2000       | 1,811                          | 2,305 | 2,673 | 2,551 | 2,783 | 3,062 |
|                          | 10000      | 1,893                          | 2,302 | 2,583 | 2,425 | 2,651 | 2,895 |
|                          | 20000      | 1,891                          | 2,266 | 2,530 | 2,360 | 2,585 | 2,772 |
|                          | 50000      | 1,896                          | 2,227 | 2,463 | 2,271 | 2,492 | 2,638 |
|                          | 100000     | 1,854                          | 1,993 | 2,329 | 2,229 | 2,456 | 2,564 |
|                          | Riss       | 0                              | 0     | 0     | 0     | 0     | 0     |
| IX (G)<br>Unterlage<br>2 | 100        | 1,945                          | 2,189 | 2,416 | 2,614 | -     | -     |
|                          | 1000       | 2,105                          | 2,271 | 2,562 | 2,644 | -     | -     |
|                          | 2000       | 2,160                          | 2,281 | 2,571 | 2,639 | -     | -     |
|                          | 10000      | 2,280                          | 2,319 | 2,606 | 2,597 | -     | -     |
|                          | 20000      | 2,288                          | 2,344 | 2,600 | 2,549 | -     | -     |
|                          | 50000      | 2,328                          | 2,342 | 2,593 | 2,492 | -     | -     |
|                          | 100000     | 1,951                          | 2,453 | 2,577 | 2,571 | -     | -     |
|                          | Riss       | 0                              | 1     | 0     | 0     | -     | -     |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                | Lastzyklus | Spannung [MPa] je Lastvariante |       |       |       |       |       |
|-------------------------|------------|--------------------------------|-------|-------|-------|-------|-------|
|                         |            | 0,4                            | 0,6   | 0,8   | 1,0   | 1,2   | 1,5   |
|                         | -          | kN                             | kN    | kN    | kN    | kN    | kN    |
| X (G)<br>Unterlage<br>1 | 100        | 1,345                          | 1,462 | 1,803 | 2,389 | 2,780 | 2,947 |
|                         | 1000       | 1,468                          | 1,608 | 2,143 | 2,542 | 2,740 | 2,802 |
|                         | 2000       | 1,510                          | 1,658 | 2,177 | 2,514 | 2,693 | 2,714 |
|                         | 10000      | 1,592                          | 1,747 | 2,114 | 2,396 | 2,521 | 2,493 |
|                         | 20000      | 1,611                          | 1,784 | 2,068 | 2,314 | 2,450 | 1,917 |
|                         | 50000      | 1,643                          | 1,780 | 2,032 | 2,238 | 2,323 | 1,915 |
|                         | 100000     | 1,854                          | 1,993 | 2,329 | 2,207 | 2,266 | 1,923 |
|                         | Riss       | 0                              | 0     | 0     | 0     | 1     | 5     |
| X (G)<br>Unterlage<br>2 | 100        | 1,416                          | 1,754 | 1,968 | 2,273 | -     | -     |
|                         | 1000       | 1,546                          | 1,937 | 2,157 | 2,398 | -     | -     |
|                         | 2000       | 1,584                          | 1,969 | 2,197 | 2,387 | -     | -     |
|                         | 10000      | 1,708                          | 2,008 | 2,241 | 2,343 | -     | -     |
|                         | 20000      | 1,751                          | 2,007 | 2,242 | 2,293 | -     | -     |
|                         | 50000      | 1,811                          | 2,005 | 2,232 | 2,232 | -     | -     |
|                         | 100000     | 1,951                          | 2,453 | 2,227 | 2,315 | -     | -     |
|                         | Riss       | 0                              | 0     | 0     | 0     | -     | -     |



Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Spannung [MPa] je Lastvariante    |       |                                    |       |                                    |       |
|--------------------------|------------|-----------------------------------|-------|------------------------------------|-------|------------------------------------|-------|
|                          |            | 0,4                               | 0,6   | 0,8                                | 1,0   | 1,2                                | 1,5   |
|                          | -          | kN                                | kN    | kN                                 | kN    | kN                                 | kN    |
| XI (G)<br>Unterlage<br>1 | 100        | 1,397                             | 1,577 | 2,055                              | 2,316 | 2,926                              | 2,979 |
|                          | 1000       | 1,496                             | 1,687 | 2,131                              | 2,407 | 2,880                              | 2,950 |
|                          | 2000       | 1,537                             | 1,709 | 2,117                              | 2,392 | 2,816                              | 2,866 |
|                          | 10000      | 1,603                             | 1,748 | 2,034                              | 2,303 | 2,593                              | 2,615 |
|                          | 20000      | 1,617                             | 1,731 | 1,973                              | 2,244 | 2,492                              | 2,478 |
|                          | 50000      | 1,626                             | 1,716 | 1,925                              | 2,173 | 2,352                              | 2,286 |
|                          | 100000     | 1,854                             | 1,718 | 1,892                              | 2,148 | 2,286                              | 2,190 |
|                          | Riss       | 0                                 | 1     | 0                                  | 0     | 1                                  | 5     |
| XI (G)<br>Unterlage<br>2 | 100        | 1,234                             | 1,521 | 1,989                              | 2,510 | -                                  | -     |
|                          | 1000       | 1,446                             | 1,713 | 2,197                              | 2,606 | -                                  | -     |
|                          | 2000       | 1,485                             | 1,746 | 2,214                              | 2,596 | -                                  | -     |
|                          | 10000      | 1,586                             | 1,810 | 2,229                              | 2,520 | -                                  | -     |
|                          | 20000      | 1,611                             | 1,811 | 2,207                              | 2,473 | -                                  | -     |
|                          | 50000      | 1,653                             | 1,808 | 2,193                              | 2,379 | -                                  | -     |
|                          | 100000     | 1,951                             | 2,453 | 2,187                              | 2,315 | -                                  | -     |
|                          | Riss       | 0                                 | 0     | 0                                  | 0     | -                                  | -     |
| XI (G)                   |            | T = 0 °C<br>1,5 kN<br>Unterlage 1 |       | T = 10 °C<br>1,5 kN<br>Unterlage 1 |       | T = 10 °C<br>1,5 kN<br>Unterlage 3 |       |
|                          | 100        | 3,439                             |       | 4,148                              |       | 11,890                             |       |
|                          | 1000       | 3,997                             |       | 4,439                              |       | 16,155                             |       |
|                          | 2000       | 3,999                             |       | 4,565                              |       | 17,546                             |       |
|                          | 10000      | 3,817                             |       | 4,804                              |       | 20,361                             |       |
|                          | 20000      | 3,736                             |       | 4,828                              |       | 20,634                             |       |
|                          | 50000      | 3,571                             |       | 4,922                              |       | 21,008                             |       |
|                          | 100000     | 3,488                             |       | 4,975                              |       | 20,899                             |       |
|                          | Riss       | 4                                 |       | 0                                  |       | 0                                  |       |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                     | Lastzyklus | Spannung [MPa] je Lastvariante    |       |                                    |       |                                    |       |
|------------------------------|------------|-----------------------------------|-------|------------------------------------|-------|------------------------------------|-------|
|                              |            | 0,4                               | 0,6   | 0,8                                | 1,0   | 1,2                                | 1,5   |
|                              | -          | kN                                | kN    | kN                                 | kN    | kN                                 | kN    |
| XII (Ref.)<br>Unterlage<br>1 | 100        | 1,386                             | 1,434 | 1,807                              | 2,113 | 2,990                              | 3,152 |
|                              | 1000       | 1,556                             | 1,608 | 1,978                              | 2,301 | 2,994                              | 3,090 |
|                              | 2000       | 1,605                             | 1,684 | 1,998                              | 2,315 | 2,998                              | 3,046 |
|                              | 10000      | 1,714                             | 1,794 | 2,045                              | 2,295 | 2,849                              | 2,861 |
|                              | 20000      | 1,735                             | 1,819 | 2,022                              | 2,240 | 2,729                              | 2,688 |
|                              | 50000      | 1,757                             | 1,827 | 1,997                              | 2,174 | 2,547                              | 2,415 |
|                              | 100000     | 1,770                             | 1,795 | 1,983                              | 2,134 | 2,440                              | 2,231 |
|                              | Riss       | 0                                 | 0     | 0                                  | 0     | 4                                  | 4     |
| XII (Ref.)<br>Unterlage<br>2 | 100        | 1,437                             | 1,896 | 2,068                              | 2,476 | -                                  | -     |
|                              | 1000       | 1,597                             | 2,046 | 2,187                              | 2,574 | -                                  | -     |
|                              | 2000       | 1,635                             | 2,094 | 2,215                              | 2,558 | -                                  | -     |
|                              | 10000      | 1,718                             | 2,141 | 2,265                              | 2,446 | -                                  | -     |
|                              | 20000      | 1,738                             | 2,134 | 2,278                              | 2,372 | -                                  | -     |
|                              | 50000      | 1,764                             | 2,133 | 2,268                              | 2,292 | -                                  | -     |
|                              | 100000     | 1,951                             | 2,453 | 2,273                              | 2,235 | -                                  | -     |
|                              | Riss       | 0                                 | 0     | 0                                  | 0     | -                                  | -     |
| XII (Ref.)                   |            | T = 0 °C<br>1,5 kN<br>Unterlage 1 |       | T = 10 °C<br>1,5 kN<br>Unterlage 1 |       | T = 10 °C<br>1,5 kN<br>Unterlage 3 |       |
|                              | 100        | 3,513                             |       | 4,568                              |       | 13,475                             |       |
|                              | 1000       | 3,797                             |       | 4,872                              |       | 16,293                             |       |
|                              | 2000       | 3,746                             |       | 4,998                              |       | 17,267                             |       |
|                              | 10000      | 3,294                             |       | 5,311                              |       | 19,637                             |       |
|                              | 20000      | 2,959                             |       | 5,364                              |       | 20,779                             |       |
|                              | 50000      | 2,248                             |       | 5,419                              |       | 21,736                             |       |
|                              | 100000     | 0,529                             |       | 5,327                              |       | 22,136                             |       |
|                              | Riss       | 5                                 |       | 0                                  |       | 0                                  |       |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |             |          |        |        |        |
|-------------------------|------------|---|-------------|----------|--------|--------|--------|
|                         |            | 0,4                                       | 0,6         | 0,8      | 1,0    | 1,2    | 1,5    |
|                         | -          | kN  | kN          | kN       | kN     | kN     | kN     |
| I (k)<br>Unterlage<br>1 | 100        | 15.138                                    | 43.313      | 57.006   | 45.622 | 49.124 | 33.903 |
|                         | 1000       | 47.342                                    | 60.542      | 67.412   | 54.429 | 44.456 | 33.148 |
|                         | 2000       | 84.296                                    | 60.182      | 63.320   | 50.507 | 40.843 | 31.405 |
|                         | 10000      | 500.065                                   | 59.446      | 54.277   | 39.433 | 32.512 | 24.622 |
|                         | 20000      | 705.387                                   | 52.927      | 47.173   | 33.612 | 27.735 | 21.732 |
|                         | 50000      | 406.509                                   | 49.174      | 39.035   | 27.806 | 23.871 | 18.587 |
|                         | 100000     | 378.438                                   | 46.921      | 33.894   | 19.202 | 21.113 | 13.225 |
| I (k)<br>Unterlage<br>2 | 100        | 36.482                                    | 64.840      | 76.8551  | 79.815 | -      | -      |
|                         | 1000       | 699.255                                   | 29.63.095   | -255.914 | 72.564 | -      | -      |
|                         | 2000       | -193.937                                  | -572.541    | -290.720 | 65.992 | -      | -      |
|                         | 10000      | -808.00                                   | -357.395    | 752.918  | 53.117 | -      | -      |
|                         | 20000      | -79.037                                   | -426.531    | 185.829  | 46.854 | -      | -      |
|                         | 50000      | -71.710                                   | -49.730     | 92.644   | 41.646 | -      | -      |
|                         | 100000     | -74.568                                   | -13.323.058 | 59.118   | 38.454 | -      | -      |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                  | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |            |             |         |        |        |
|---------------------------|------------|---|------------|-------------|---------|--------|--------|
|                           |            | 0,4                                       | 0,6        | 0,8         | 1,0     | 1,2    | 1,5    |
|                           | -          | kN  | kN         | kN          | kN      | kN     | kN     |
| III (g)<br>Unterlage<br>1 | 100        | 24.107                                    | 40.234     | 101.321     | 69.260  | 46.524 | 36.470 |
|                           | 1000       | 57.489                                    | 99.131     | 5.973.891   | 90.234  | 49.069 | 37.335 |
|                           | 2000       | 100.761                                   | 136.362    | -22.889.600 | 82.270  | 43.262 | 34.798 |
|                           | 10000      | 170.876                                   | 162.905    | -           | 65.930  | 31.836 | 25.483 |
|                           | 20000      | -3.670.882                                | 135.029    | 404.866     | 55.379  | 27.559 | 21.587 |
|                           | 50000      | -277.910                                  | 132.476    | 153.687     | 44.123  | 23.181 | 17.142 |
|                           | 100000     | -184.575                                  | 125.942    | 139.772     | 32.040  | 21.198 | 15.691 |
| III (g)<br>Unterlage<br>2 | 100        | 42.225                                    | 50.473     | 65.924      | 70.505  |        |        |
|                           | 1000       | 172.629                                   | -3.496.416 | 71.306      | 124.593 |        |        |
|                           | 2000       | 2.056.719                                 | -158.156   | 72.685      | 140.667 |        |        |
|                           | 10000      | -137.567                                  | -108.331   | 75.508      | 162.304 |        |        |
|                           | 20000      | -143.021                                  | -125.312   | 68.382      | 145.072 |        |        |
|                           | 50000      | -118.408                                  | -125.308   | 45.446      | 123.804 |        |        |
|                           | 100000     | -100.461                                  | -124.101   | 41.757      | 105.977 |        |        |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |          |          |          |        |        |
|--------------------------|------------|---|----------|----------|----------|--------|--------|
|                          |            | 0,4                                       | 0,6      | 0,8      | 1,0      | 1,2    | 1,5    |
|                          | -          | kN  | kN       | kN       | kN       | kN     | kN     |
| IV (g)<br>Unterlage<br>1 | 100        | 139.038                                   | 32.041   | 197.526  | 183.727  | 54.494 | 37.899 |
|                          | 1000       | -87.261                                   | -152.654 | -57.765  | -276.128 | 63.143 | 39.929 |
|                          | 2000       | -65.181                                   | -62.213  | -49.490  | -250.204 | 61.340 | 36.175 |
|                          | 10000      | -36.001                                   | -30.844  | -45.643  | -320.148 | 55.780 | 25.879 |
|                          | 20000      | -34.650                                   | -30.316  | -52.637  | -957.635 | 49.064 | 21.046 |
|                          | 50000      | -32.303                                   | -26.821  | -66.937  | 487.667  | 41.653 | 15.519 |
|                          | 100000     | -184.575                                  | 64.290   | -75.389  | 277.629  | 38.100 | 11.960 |
| IV (g)<br>Unterlage<br>2 | 100        | 87.135                                    | -50.725  | -265.690 | 129.086  | -      | -      |
|                          | 1000       | -48.276                                   | -26.491  | -68.149  | -156.292 | -      | -      |
|                          | 2000       | -33.804                                   | -23.593  | -59.325  | -119.011 | -      | -      |
|                          | 10000      | -20.848                                   | -20.535  | -50.644  | -109.501 | -      | -      |
|                          | 20000      | -19.763                                   | -20.086  | -51.601  | -138.048 | -      | -      |
|                          | 50000      | -18.260                                   | -18.942  | -54.759  | -232.473 | -      | -      |
|                          | 100000     | -100.461                                  | -124.101 | -54.850  | -427.172 | -      | -      |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |          |         |         |        |        |
|--------------------------|------------|---|----------|---------|---------|--------|--------|
|                          |            | 0,4                                       | 0,6      | 0,8     | 1,0     | 1,2    | 1,5    |
|                          | -          | kN  | kN       | kN      | kN      | kN     | kN     |
| VI (K)<br>Unterlage<br>1 | 100        | 23.100                                    | 38.038   | 54.176  | 33.140  | 44.138 | 31.036 |
|                          | 1000       | 35.754                                    | 49.597   | 54.726  | 30.692  | 37.603 | 27.258 |
|                          | 2000       | 43.038                                    | 50.445   | 48.538  | 29.123  | 33.426 | 24.924 |
|                          | 10000      | 69.301                                    | 61.196   | 34.859  | 23.811  | 26.282 | 19.480 |
|                          | 20000      | 67.799                                    | 60.338   | 30.309  | 21.740  | 23.522 | 17.302 |
|                          | 50000      | 71.816                                    | 48.002   | 25.310  | 19.346  | 20.426 | 14.553 |
|                          | 100000     | -184.575                                  | 47.196   | -36.373 | 277.629 | 19.008 | 13.561 |
| VI (K)<br>Unterlage<br>2 | 100        | 22.753                                    | -50.725  | 63.469  | 41.005  | -      | -      |
|                          | 1000       | 46.869                                    | -26.492  | 70.139  | 50.677  | -      | -      |
|                          | 2000       | 63.135                                    | -23.594  | 62.889  | 50.154  | -      | -      |
|                          | 10000      | 239.838                                   | -20.535  | 49.687  | 48.502  | -      | -      |
|                          | 20000      | 484.463                                   | -20.086  | 42.283  | 44.315  | -      | -      |
|                          | 50000      | -569.529                                  | -18.943  | 35.690  | 39.885  | -      | -      |
|                          | 100000     | -100.462                                  | -124.102 | 33.448  | 37.480  | -      | -      |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                  | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |          |                                    |        |                                    |        |
|---------------------------|------------|---|----------|------------------------------------|--------|------------------------------------|--------|
|                           |            | 0,4                                       | 0,6      | 0,8                                | 1,0    | 1,2                                | 1,5    |
|                           | -          | kN  | kN       | kN                                 | kN     | kN                                 | kN     |
| VII (K)<br>Unterlage<br>1 | 100        | 34.485                                    | 37.591   | 25.591                             | 41.334 | 35.141                             | 30.909 |
|                           | 1000       | 80.609                                    | 41.980   | 36.892                             | 32.106 | 27.510                             | 25.402 |
|                           | 2000       | 109.228                                   | 39.177   | 34.735                             | 27.376 | 24.030                             | 22.442 |
|                           | 10000      | 90.341                                    | 32.407   | 26.878                             | 19.657 | 17.650                             | 17.424 |
|                           | 20000      | 69.969                                    | 27.661   | 22.994                             | 17.259 | 15.551                             | 15.639 |
|                           | 50000      | 45.799                                    | 24.034   | 19.985                             | 15.164 | 13.452                             | 13.745 |
|                           | 100000     | 40.247                                    | 22.296   | 18.624                             | 13.932 | 12.811                             | 13.047 |
| VII (K)<br>Unterlage<br>2 | 100        | 20.845                                    | 49.635   | 47.611                             | 30.121 | -                                  | -      |
|                           | 1000       | 91.943                                    | 67.101   | 57.119                             | 34.280 | -                                  | -      |
|                           | 2000       | 142.238                                   | 64.156   | 51.065                             | 32.283 | -                                  | -      |
|                           | 10000      | 148.064                                   | 55.305   | 36.875                             | 24.989 | -                                  | -      |
|                           | 20000      | 125.049                                   | 49.431   | 28.330                             | 21.158 | -                                  | -      |
|                           | 50000      | 92.570                                    | 38.840   | 23.395                             | 17.830 | -                                  | -      |
|                           | 100000     | -100.462                                  | -124.102 | 21.621                             | 20.919 | -                                  | -      |
| VII (K)                   |            | T = 0 °C<br>1,5 kN<br>Unterlage 1         |          | T = 10 °C<br>1,5 kN<br>Unterlage 1 |        | T = 10 °C<br>1,5 kN<br>Unterlage 3 |        |
|                           | 100        | 28.321                                    |          | 65.641                             |        | -276.411                           |        |
|                           | 1000       | 42.342                                    |          | 309.621                            |        | -164.685                           |        |
|                           | 2000       | 44.856                                    |          | -3.960.248                         |        | -141.732                           |        |
|                           | 10000      | 37.705                                    |          | -162.123                           |        | -114.277                           |        |
|                           | 20000      | 32.064                                    |          | -147.731                           |        | -113.120                           |        |
|                           | 50000      | 27.571                                    |          | -152.878                           |        | -113.754                           |        |
|                           | 100000     | 25.820                                    |          | -169.247                           |        | -117.640                           |        |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |            |             |        |        |        |
|--------------------------|------------|---|------------|-------------|--------|--------|--------|
|                          |            | 0,4                                       | 0,6        | 0,8         | 1,0    | 1,2    | 1,5    |
|                          | -          | kN  | kN         | kN          | kN     | kN     | kN     |
| IX (G)<br>Unterlage<br>1 | 100        | 35.676                                    | 60.203     | 52.952      | 44.079 | 43.881 | 40.495 |
|                          | 1000       | 125.841                                   | -1.224.519 | 669.401     | 52.261 | 45.101 | 39.825 |
|                          | 2000       | 209.551                                   | -335.751   | -16.199.459 | 46.143 | 42.586 | 37.295 |
|                          | 10000      | -316.689                                  | -358.034   | 180.054     | 34.876 | 34.058 | 30.257 |
|                          | 20000      | -372.523                                  | -1.608.635 | 114.146     | 30.836 | 30.770 | 26.206 |
|                          | 50000      | -288.844                                  | 525.460    | 79.623      | 26.432 | 26.719 | 22.593 |
|                          | 100000     | -184.575                                  | 47.196     | 36.985      | 24.456 | 25.407 | 20.887 |
| IX (G)<br>Unterlage<br>2 | 100        | 229.911                                   | 91.350     | 103.267     | 55.090 | -      | -      |
|                          | 1000       | -110.352                                  | 191.439    | 772.274     | 60.204 | -      | -      |
|                          | 2000       | -74.596                                   | 218.881    | 1.345.762   | 58.669 | -      | -      |
|                          | 10000      | -45.526                                   | 569.401    | -3.294.523  | 51.722 | -      | -      |
|                          | 20000      | -43.564                                   | 1.469.670  | 22.911.832  | 46.221 | -      | -      |
|                          | 50000      | -40.212                                   | 1.038.431  | 1.700.559   | 40.323 | -      | -      |
|                          | 100000     | -100.462                                  | -124.102   | 883.964     | 37.480 | -      | -      |



Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |           |         |         |        |        |
|-------------------------|------------|---|-----------|---------|---------|--------|--------|
|                         |            | 0,4                                       | 0,6       | 0,8     | 1,0     | 1,2    | 1,5    |
|                         | -          | kN  | kN        | kN      | kN      | kN     | kN     |
| X (G)<br>Unterlage<br>1 | 100        | 24.451                                    | 24.167    | 28.505  | 73.669  | 40.712 | 31.598 |
|                         | 1000       | 48.808                                    | 47.696    | 173.222 | 202.644 | 39.185 | 26.935 |
|                         | 2000       | 66.604                                    | 63.813    | 308.767 | 150.573 | 36.327 | 24.436 |
|                         | 10000      | 346.756                                   | 207.985   | 129.284 | 74.940  | 27.651 | 19.227 |
|                         | 20000      | 1.141.573                                 | 1.291.805 | 91.003  | 55.039  | 24.909 | 10.830 |
|                         | 50000      | -563.698                                  | 570.115   | 72.289  | 43.248  | 21.019 | 10.805 |
|                         | 100000     | 40.347                                    | 20.813    | 52.630  | 39.886  | 19.521 | 10.899 |
| X (G)<br>Unterlage<br>2 | 100        | 22.191                                    | 63.750    | 39.366  | 54.200  | -      | -      |
|                         | 1000       | 39.106                                    | -593.573  | 93.839  | 93.629  | -      | -      |
|                         | 2000       | 50.187                                    | -209.651  | 131.520 | 88.128  | -      | -      |
|                         | 10000      | 241.895                                   | -119.064  | 240.189 | 73.208  | -      | -      |
|                         | 20000      | -208.940                                  | -124.793  | 244.718 | 60.628  | -      | -      |
|                         | 50000      | -142.444                                  | -124.536  | 221.788 | 48.745  | -      | -      |
|                         | 100000     | 54.530                                    | 47.176    | 196.751 | 44.759  | -      | -      |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                 | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |         |                                    |         |                                    |        |
|--------------------------|------------|---|---------|------------------------------------|---------|------------------------------------|--------|
|                          |            | 0,3                                       | 0,4     | 0,6                                | 0,8     | 1,2                                | 1,5    |
|                          | -          | kN  | kN      | kN                                 | kN      | kN                                 | kN     |
| XI (G)<br>Unterlage<br>1 | 100        | 25.024                                    | 31.545  | 59.608                             | 39.810  | 54.636                             | 32.161 |
|                          | 1000       | 41.623                                    | 57.999  | 88.473                             | 51.883  | 51.500                             | 30.679 |
|                          | 2000       | 54.819                                    | 67.352  | 81.963                             | 49.414  | 45.797                             | 28.087 |
|                          | 10000      | 109.554                                   | 99.946  | 53.485                             | 38.565  | 31.274                             | 21.369 |
|                          | 20000      | 128.934                                   | 84.075  | 42.349                             | 33.497  | 26.816                             | 18.539 |
|                          | 50000      | 164.842                                   | 74.452  | 36.039                             | 28.378  | 22.099                             | 15.316 |
|                          | 100000     | 40.347                                    | 73.348  | 32.172                             | 26.953  | 20.289                             | 13.888 |
| XI (G)<br>Unterlage<br>2 | 100        | 13.216                                    | 23.577  | 45.253                             | 106.188 | -                                  | -      |
|                          | 1000       | 27.383                                    | 55.052  | 171.507                            | 242.120 | -                                  | -      |
|                          | 2000       | 33.086                                    | 69.947  | 202.052                            | 212.504 | -                                  | -      |
|                          | 10000      | 63.157                                    | 121.107 | 234.153                            | 114.490 | -                                  | -      |
|                          | 20000      | 78.448                                    | 126.304 | 184.231                            | 87.049  | -                                  | -      |
|                          | 50000      | 127.874                                   | 121.698 | 150.701                            | 58.781  | -                                  | -      |
|                          | 100000     | 54.530                                    | 47.176  | 143.138                            | 44.759  | -                                  | -      |
| XI (G)                   |            | T = 0 °C<br>1,5 kN<br>Unterlage 1         |         | T = 10 °C<br>1,5 kN<br>Unterlage 1 |         | T = 10 °C<br>1,5 kN<br>Unterlage 3 |        |
|                          | 100        | 60.960                                    |         | -5.499.783                         |         | 505.055                            |        |
|                          | 1000       | 312.248                                   |         | -176.699                           |         | -183.459                           |        |
|                          | 2000       | 312.460                                   |         | -130.071                           |         | -140.698                           |        |
|                          | 10000      | 141.808                                   |         | -86.395                            |         | -102.315                           |        |
|                          | 20000      | 108.466                                   |         | -83.592                            |         | -99.965                            |        |
|                          | 50000      | 74.908                                    |         | -75.415                            |         | -97.214                            |        |
|                          | 100000     | 63.849                                    |         | -71.415                            |         | -98.405                            |        |

Anhang 2: 1-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante                     | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |          |                                    |         |                                    |        |
|------------------------------|------------|---|----------|------------------------------------|---------|------------------------------------|--------|
|                              |            | 0,3                                       | 0,4      | 0,6                                | 0,8     | 1,2                                | 1,5    |
|                              | -          | kN  | kN       | kN                                 | kN      | kN                                 | kN     |
| XII (Ref.)<br>Unterlage<br>1 | 100        | 25.683                                    | 21.510   | 27.891                             | 31.251  | 63.205                             | 43.155 |
|                              | 1000       | 79.772                                    | 46.407   | 51.643                             | 51.768  | 63.732                             | 39.168 |
|                              | 2000       | 194.967                                   | 75.707   | 56.664                             | 53.829  | 61.931                             | 36.241 |
|                              | 10000      | -124.020                                  | -243.101 | 69.638                             | 51.150  | 47.287                             | 28.967 |
|                              | 20000      | -93.411                                   | -640.992 | 61.750                             | 43.269  | 37.867                             | 23.797 |
|                              | 50000      | -78.692                                   | -428.151 | 54.795                             | 36.442  | 28.465                             | 17.828 |
|                              | 100000     | -66.797                                   | -848.614 | 51.409                             | 32.957  | 24.428                             | 14.819 |
| XII (Ref.)<br>Unterlage<br>2 | 100        | 24.285                                    | 83.253   | 48.037                             | 71.109  | -                                  | -      |
|                              | 1000       | 56.918                                    | 104.159  | 84.389                             | 114.441 | -                                  | -      |
|                              | 2000       | 80.489                                    | -225.459 | 100.624                            | 103.398 | -                                  | -      |
|                              | 10000      | 532.035                                   | -105.917 | 147.681                            | 63.808  | -                                  | -      |
|                              | 20000      | 2.218.867                                 | -114.446 | 170.277                            | 49.691  | -                                  | -      |
|                              | 50000      | -479.727                                  | -113.612 | 153.121                            | 39.661  | -                                  | -      |
|                              | 100000     | 54.530                                    | 47.176   | 157.693                            | 34.247  | -                                  | -      |
| XII (Ref.)                   |            | T = 0 °C<br>1,5 kN<br>Unterlage 1         |          | T = 10 °C<br>1,5 kN<br>Unterlage 1 |         | T = 10 °C<br>1,5 kN<br>Unterlage 3 |        |
|                              | 100        | 66.721                                    |          | -120.156                           |         | -937.775                           |        |
|                              | 1000       | 128.374                                   |          | -76.481                            |         | -186.238                           |        |
|                              | 2000       | 111.706                                   |          | -67.853                            |         | -153.386                           |        |
|                              | 10000      | 47.049                                    |          | -53.271                            |         | -112.765                           |        |
|                              | 20000      | 30.334                                    |          | -51.607                            |         | -101.991                           |        |
|                              | 50000      | 14.555                                    |          | -50.160                            |         | -94.969                            |        |
|                              | 100000     | 1.813                                     |          | -53.300                            |         | -92.292                            |        |

Anhang 2: Spurbildung, rissüberbrückende Funktion

| Probe<br>Variante | Anzahl Überrollungen bei 7,0 mm Verformung |         |        |       |        |
|-------------------|--|---------|--------|-------|--------|
|                   | 1  | 2       | 3      | 4     | Mittel |
| I (k)             | 4.700                                      | 880     | -      | -     | 2.790  |
| III (g)           | (1.400)                                    | (1.300) | 4.200  | 5.300 | 4.750  |
| IV (g)            | 13.700                                     | 7.500   | 10.600 | 7.600 | 9.850  |
| VI (K)            | 6.600                                      | 5.400   | -      | -     | 6.000  |
| VII (K)           | 400  | 250     | 300    | 500   | 363    |
| IX (G)            | 17.800                                     | 12.900  | -      | -     | 15.350 |
| X (G)             | (2.300)                                    | (2.200) | 4.400  | 2.200 | 3.300  |
| XI (G)            | 12.700                                     | 20.000  | -      | -     | 16.350 |
| XII (Ref.)        | 9.400                                      | 7.800   | 4.100  | 4.500 | 6.450  |
| XIII (G)          | 7.100                                      | 3.500   | -      | -     | 5.300  |

() Ergebnisse nicht berücksichtigt (innerhalb Testphase der Versuchsbedingungen)

Anhang 2: Spurbildung, bewehrende Funktion

| Probe<br>Variante   | Anzahl Überrollungen bei 4,0 mm bzw. 12,0 mm Verformung |        |                              |        |
|---------------------|---|--------|------------------------------|--------|
|                     | 4,0 mm  |        | 12,0 mm                      |        |
|                     | Einzelwerte   | Mittel | 1                            | 2      |
| Referenz mit Kerbe  | 940, 1.300, 1.200, 780                                  | 1.055  | 12.470, 9.372, 10.370, 6.044 | 9.564  |
| Referenz ohne Kerbe | 1900, 1700, 1500  | 1.700  | 15.258, 15.428, 15.420       | 15.368 |
| Kombinationsprodukt | 12.800, (60)  | 12.800 | 20.000, (1.600)              | 20.000 |
| Glasgitter 50 kN    | 1.000, (60)   | 1.000  | 20.000, (1.400)              | 20.000 |
| Glasgitter 120 kN   | 2.900, 1.800  | 2.350  | 20.000, 20.000               | 20.000 |

() Ergebnisse nicht berücksichtigt (innerhalb Testphase der Versuchsbedingungen)

Anhang 2: 3-Punkt-Biegeprüfung, bewehrende Funktion

| Variante    | Last-amplitude | Dynamischer Modul MD nach Lastzyklus |       |        |        |         |         |
|-------------|----------------|--------------------------------------|-------|--------|--------|---------|---------|
|             |                | 100                                  | 1.000 | 10.000 | 50.000 | 100.000 | 200.000 |
|             | kN             | mm                                   | mm    | mm     | mm     | mm      | mm      |
| 20          | 0,2            | 5,80                                 | 7,06  | 7,88   | 6,45   | 7,03    | 6,51    |
|             |                | 4,36                                 | 4,62  | 5,01   | 5,35   | 5,33    | 5,66    |
|             | 0,3            | 3,72                                 | 3,19  | 3,07   | 3,06   | 3,31    | 3,89    |
|             |                | 4,67                                 | 5,14  | 5,46   | 5,03   | 5,11    | 5,66    |
|             | 0,4            | 7,97                                 | 8,74  | 8,71   | 8,72   | 8,77    | 9,20    |
|             |                | 6,85                                 | 8,33  | 8,59   | 8,18   | 8,42    | 8,60    |
| 21<br>oben  | 0,2            | 6,17                                 | 6,97  | 8,48   | 9,27   | 9,22    | 9,2     |
|             | 0,3            | 7,66                                 | 7,83  | 9,02   | 9,99   | 10,42   | 10,74   |
|             | 0,4            | 8,16                                 | 8,58  | 9,55   | 10,28  | 10,66   | 10,12   |
| 21<br>unten | 0,2            | 6,39                                 | 6,73  | 7,61   | 7,64   | 7,58    | 7,47    |
|             | 0,3            | 6,23                                 | 6,79  | 8,3    | 9,11   | 8,94    | 8,95    |
|             | 0,4            | 7,47                                 | 8,28  | 9,44   | 9,74   | 9,73    | 9,58    |
| 22<br>oben  | 0,2            | 5,71                                 | 6,53  | 8,14   | 8,62   | 8,8     | 9,91    |
|             | 0,3            | 5,14                                 | 7,2   | 8,72   | 9,07   | 9,08    | 9,41    |
|             | 0,4            | 6,87                                 | 8,57  | 9,36   | 9,64   | 9,26    | 8,37    |
| 22<br>unten | 0,2            | 7,27                                 | 7,69  | 8,89   | 9,3    | 9,91    | 9,6     |
|             | 0,3            | 6,94                                 | 7,48  | 7,5    | 8,22   | 8,32    | 8,62    |
|             | 0,4            | 8,66                                 | 9,25  | 9,58   | 9,9    | 9,7     | 9,33    |
| 23<br>oben  | 0,2            | 3,4                                  | 6,59  | 9,36   | 9,32   | 9,72    | 10,46   |
|             | 0,3            | 5,51                                 | 6,16  | 9,58   | 10,45  | 10,56   | 10,32   |
|             | 0,4            | 6,48                                 | 8,05  | 10,12  | 10,45  | 9,67    | 8,37    |
| 23<br>unten | 0,2            | 5,1                                  | 6,29  | 8,29   | 8,8    | 8,76    | 8,82    |
|             | 0,3            | 5,84                                 | 6,38  | 6,69   | 7,53   | 7,6     | 7,42    |
|             | 0,4            | 7,55                                 | 8,44  | 9,51   | 9,78   | 9,36    | 9,23    |

Anhang 2: 1-Punkt-Biegeprüfung, bewehrende Funktion

| Variante | Lastzyklus | Spannung [MPa] je Lastvariante |        |        |               |        |        |
|----------|------------|--------------------------------|--------|--------|---------------|--------|--------|
|          |            | Einlage oben                   |        |        | Einlage unten |        |        |
|          |            | 1,0 kN                         | 1,2 kN | 1,5 kN | 1,0 kN        | 1,2 kN | 1,5 kN |
| 21       | 100        | 2,992                          | 3,375  | 3,630  | 3,099         | 2,800  | 3,567  |
|          | 1000       | 3,104                          | 3,491  | 3,704  | 3,174         | 2,916  | 3,575  |
|          | 2000       | 3,116                          | 3,487  | 3,726  | 3,142         | 2,917  | 3,541  |
|          | 10000      | 3,160                          | 3,370  | 3,674  | 3,004         | 2,871  | 3,380  |
|          | 20000      | 3,093                          | 3,342  | 3,541  | 2,940         | 2,790  | 3,247  |
|          | 50000      | 3,033                          | 3,186  | 3,284  | 2,826         | 2,683  | 3,092  |
|          | 80000      | 2,977                          | 3,123  | 3,147  | 2,765         | 2,635  | 3,023  |
| 22       | 100        | 2,766                          | 2,879  | 3,102  | 3,224         | 2,990  | 3,069  |
|          | 1000       | 2,876                          | 2,956  | 3,129  | 3,301         | 3,021  | 3,103  |
|          | 2000       | 2,889                          | 2,947  | 3,108  | 3,283         | 2,994  | 3,094  |
|          | 10000      | 2,844                          | 2,844  | 2,989  | 3,194         | 2,874  | 3,008  |
|          | 20000      | 2,783                          | 2,720  | 2,835  | 3,116         | 2,766  | 2,951  |
|          | 50000      | 2,696                          | 2,587  | 2,658  | 3,017         | 2,645  | 2,850  |
|          | 80000      | 2,622                          | 2,512  | 2,578  | 2,958         | 2,593  | 2,802  |
| 23       | 100        | 2,756                          | 2,964  | 3,880  | 2,756         | 3,090  | 3,366  |
|          | 1000       | 2,793                          | 3,019  | 3,839  | 2,812         | 3,118  | 3,312  |
|          | 2000       | 2,778                          | 3,026  | 3,748  | 2,788         | 3,084  | 3,259  |
|          | 10000      | 2,699                          | 2,926  | 3,461  | 2,697         | 2,897  | 3,074  |
|          | 20000      | 2,639                          | 2,833  | 3,306  | 2,640         | 2,806  | 2,943  |
|          | 50000      | 2,548                          | 2,707  | 2,075  | 2,557         | 2,667  | 2,787  |
|          | 80000      | 2,516                          | 2,643  | 1,849  | 2,510         | 2,606  | 2,715  |
| Referenz | 100        | 2,630                          | 2,863  | 2,967  | -             | -      | -      |
|          | 1000       | 2,775                          | 2,946  | 3,072  | -             | -      | -      |
|          | 2000       | 2,808                          | 2,972  | 3,074  | -             | -      | -      |
|          | 10000      | 2,891                          | 3,052  | 3,092  | -             | -      | -      |
|          | 20000      | 2,901                          | 3,063  | 3,085  | -             | -      | -      |
|          | 50000      | 2,933                          | 3,030  | 3,001  | -             | -      | -      |
|          | 80000      | 2,917                          | 3,007  | 2,953  | -             | -      | -      |

Anhang 2: 1-Punkt-Biegeprüfung, bewehrende Funktion

| Variante | Lastzyklus | Berechneter E-Modul [MPa] je Lastvariante |         |         |           |        |        |
|----------|------------|---|---------|---------|-----------|--------|--------|
|          |            | oben                                      |         |         | unten     |        |        |
|          | -          | 1,0 kN                                    | 1,2 kN  | 1,5 kN  | 1,0 kN    | 1,2 kN | 1,5 kN |
| 21       | 100        | 74.580                                    | 65.223  | 39.062  | 119.978   | 17.561 | 28.419 |
|          | 1000       | 198.664                                   | 108.895 | 49.242  | 332.893   | 20.948 | 28.920 |
|          | 2000       | 280.738                                   | 110.391 | 51.771  | 219.166   | 21.125 | 27.371 |
|          | 10000      | 502.123                                   | 63.989  | 44.846  | 68.965    | 19.426 | 21.446 |
|          | 20000      | 211.969                                   | 56.368  | 32.883  | 48.446    | 17.263 | 18.357 |
|          | 50000      | 99.621                                    | 37.082  | 22.135  | 34.539    | 14.828 | 15.174 |
|          | 80000      | 70.398                                    | 30.871  | 18.209  | 29.693    | 13.932 | 14.015 |
| 22       | 100        | 91.902                                    | 63.393  | 42.844  | -63.024   | 36.394 | 20.444 |
|          | 1000       | 402.593                                   | 96.568  | 45.878  | -50.584   | 40.037 | 21.457 |
|          | 2000       | 1.098.389                                 | 90.003  | 42.621  | -51.586   | 36.976 | 21.187 |
|          | 10000      | 201.203                                   | 53.514  | 31.106  | -67.383   | 26.830 | 18.876 |
|          | 20000      | 103.923                                   | 36.270  | 23.710  | -109.416  | 21.815 | 17.399 |
|          | 50000      | 58.215                                    | 25.099  | 17.837  | -424.883  | 17.851 | 15.276 |
|          | 80000      | 43.516                                    | 21.506  | 15.813  | 1.022.466 | 16.558 | 14.337 |
| 23       | 100        | 40.826                                    | 27.818  | 242.956 | 47.569    | 47.834 | 33.067 |
|          | 1000       | 46.937                                    | 32.056  | 176.892 | 59.264    | 53.438 | 29.872 |
|          | 2000       | 44.969                                    | 32.875  | 100.394 | 52.527    | 47.773 | 27.133 |
|          | 10000      | 34.251                                    | 25.621  | 39.694  | 40.190    | 29.082 | 20.457 |
|          | 20000      | 28.778                                    | 21.674  | 29.652  | 32.301    | 23.559 | 17.246 |
|          | 50000      | 23.326                                    | 17.529  | 6.696   | 26.120    | 18.500 | 14.146 |
|          | 80000      | 21.580                                    | 15.845  | 5.350   | 23.278    | 16.767 | 12.975 |
| Referenz | 100        | 26.650                                    | 35.930  | 28083   | -         | -      | -      |
|          | 1000       | 40.311                                    | 46.627  | 34710   | -         | -      | -      |
|          | 2000       | 45.146                                    | 51.212  | 35009   | -         | -      | -      |
|          | 10000      | 64.933                                    | 68.929  | 36967   | -         | -      | -      |
|          | 20000      | 68.043                                    | 72.294  | 35521   | -         | -      | -      |
|          | 50000      | 81.173                                    | 63.336  | 30162   | -         | -      | -      |
|          | 80000      | 74.596                                    | 59.234  | 27422   | -         | -      | -      |



## Anhang 2

Bildnummern in Klammern weisen auf die Verwendung der Abbildung mit der jeweiligen Nummer im Bericht hin.

### zu 3.2.2.5 Statische Keilspaltversuche - spannungsabbauende Wirkung

| Versuche / Auswertungsmethode                           |   | ebene Asphaltunterlage |       |        |          |       |       |       |        |          |        | gefräste Asphaltfläche |        |          |        |      |  |  |  |  |  |
|---|---|------------------------|-------|--------|----------|-------|-------|-------|--------|----------|--------|------------------------|--------|----------|--------|------|--|--|--|--|--|
|   |   | Vlies                  | Kombi | Gitter | Referenz | Kombi | Kombi | Vlies | Gitter | Referenz | Gitter | Vlies                  | Gitter | Referenz | Gitter |      |  |  |  |  |  |
| KS Schichten-<br>verklebung BK150,<br>wegeregelt linear | Ergebnis                                  | T                      | I     | II     | III      | IV    | V     | VI    | VII    | VIII     | IX     | X                      | XI     | XII      | XIII   |      |  |  |  |  |  |
|   |   |                        |       | 4959   | 3561     |       | 8518  |       |        | 4762     |        |                        | 5848   |          |        |      |  |  |  |  |  |
|   |   |                        |       | 3880   | 2650     |       | 8563  |       |        | 4487     |        |                        | 6506   |          |        |      |  |  |  |  |  |
|   |   |                        |       | 0,377  | 0,166    |       | 0,683 |       |        | 0,392    |        |                        | 0,444  |          |        |      |  |  |  |  |  |
|   |   |                        |       | 0,145  | 0,047    |       | 0,595 |       |        | 0,154    |        |                        | 0,200  |          |        |      |  |  |  |  |  |
|   |   |                        |       | 0,258  | 0,129    |       | 0,465 |       |        | 0,264    |        |                        | 0,309  |          |        |      |  |  |  |  |  |
| KS Einlagenwirkung<br>BK220, weggeregelt<br>linear      | Maximale Spaltkraft:<br>$F_{max}$ [N]     | 0 °C                   | 6185  | 6879   | 7323     | 8124  | 8157  | 8180  | 8704   |          | 7965   | 7718                   | 8451   | 8240     |        |      |  |  |  |  |  |
|   |   |                        | 7655  | 8511   | 7965     | 8628  | 9037  | 9458  | 9709   |          | 7726   | 9685                   | 9791   | 9548     |        |      |  |  |  |  |  |
|   |   |                        | 5132  | 2868   | 3653     | 2985  | 1708  | 4041  | 5858   |          | 4531   | 2422                   | 4613   | 1679     |        |      |  |  |  |  |  |
|   |   |                        | 5157  | 1946   | 2099     | 2364  | 953   | 2771  | 5246   |          | 5156   | 2220                   | 3654   | 815      |        |      |  |  |  |  |  |
|   |   |                        | 1,292 | 0,989  | 1,157    | 1,012 | 0,785 | 1,289 | 1,538  |          | 1,310  | 0,915                  | 1,392  | 0,820    |        |      |  |  |  |  |  |
|   |   |                        | 1,675 | 1,009  | 1,197    | 1,147 | 0,762 | 1,246 | 1,800  |          | 1,733  | 1,086                  | 1,442  | 0,758    |        |      |  |  |  |  |  |
| KS Einlagenwirkung<br>BK220, kraftgeregelt<br>zyklisch  | Zyklen bis Rissinitiation<br>$n_{RA}$ [-] | 0 °C                   | 1110  | 2560   | 1840     | 7313  | 7122  | 6060  | 3765   |          | 3270   | 4433                   | 5453   | 4080     |        |      |  |  |  |  |  |
|   |   |                        |       |        |          |       | 44040 | 39600 |        |          |        | 60870                  | 48960  | 47700    |        |      |  |  |  |  |  |
|   |   |                        |       |        |          |       | 9866  | 7590  | 4440   |          |        | 4800                   | 5918   | 7328     | 5280   |      |  |  |  |  |  |
|   |   |                        |       |        |          |       | 46140 | 40830 |        |          |        |                        | 64110  | 52200    | 52440  |      |  |  |  |  |  |
|   |   |                        |       |        |          |       | 2744  | 1530  | 675    |          |        |                        | 1530   | 1485     | 1875   | 1200 |  |  |  |  |  |
|   |   |                        |       |        |          |       | 2100  | 1230  |        |          |        |                        |        | 3240     | 3240   | 4740 |  |  |  |  |  |
| Rissverzögerung $n_{RV}$ [-]                            | Rissfortschritt nach Einlage<br>[cm]      | 0 °C                   | 2,25  | 1,5    | 1,67     | 2,5   | 2,5   | 2,5   | 1      |          | 2,5    | 1,9                    | 1,8    | 2,5      |        |      |  |  |  |  |  |
|   |   |                        |       |        |          |       | 2,5   | 2,5   |        |          |        | 2,5                    | 2,5    | 2,5      |        |      |  |  |  |  |  |
|   |   | -10 °C                 |       |        |          |       |       |       |        |          |        |                        |        |          |        |      |  |  |  |  |  |

Auswertung der Kurvenverläufe Spaltkraft zu Rissöffnung an Probekörpern 220 mm der Varianten I (k), II (v), V (ref.), VI (K), VII (K), XII (ref.)

$T_1 = 0\text{ }^\circ\text{C}$

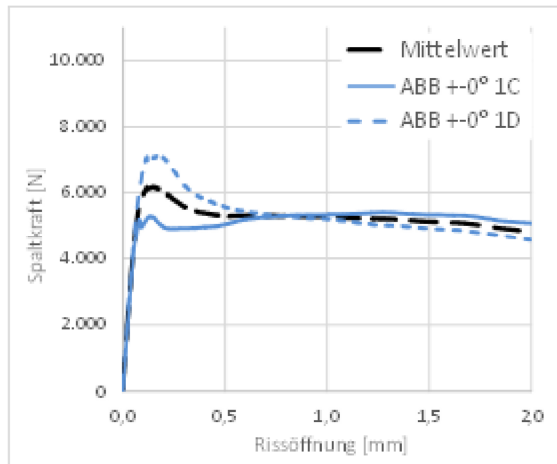


Bild 1: Kurvenverläufe einer 2-fach Belegung an Variante I (k),  $T_1 = 0\text{ }^\circ\text{C}$

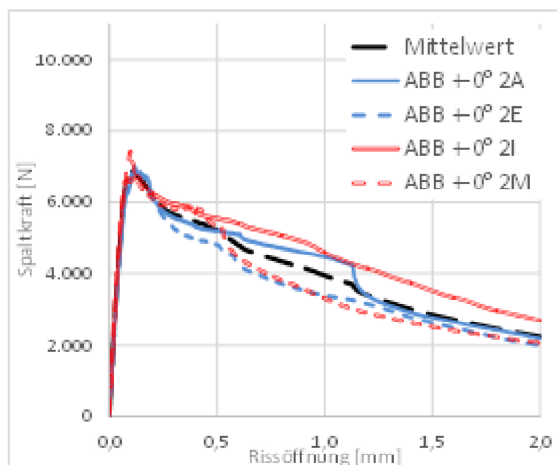


Bild 2: Kurvenverläufe einer 4-fach Belegung an Variante II (v),  $T_1 = 0\text{ }^\circ\text{C}$  (Bild 66)

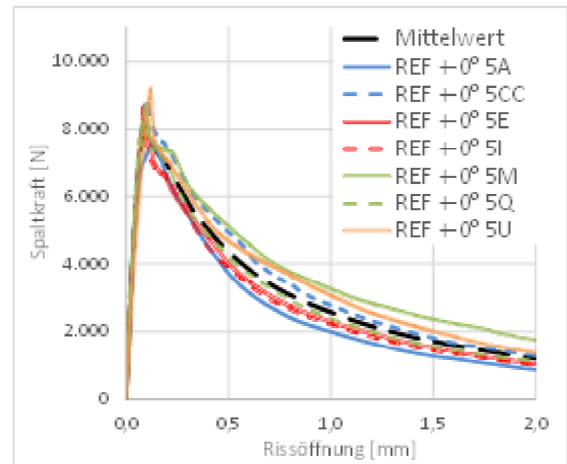


Bild 3: Kurvenverläufe einer 7-fach Belegung an Variante V (ref.),  $T_1 = 0\text{ }^\circ\text{C}$

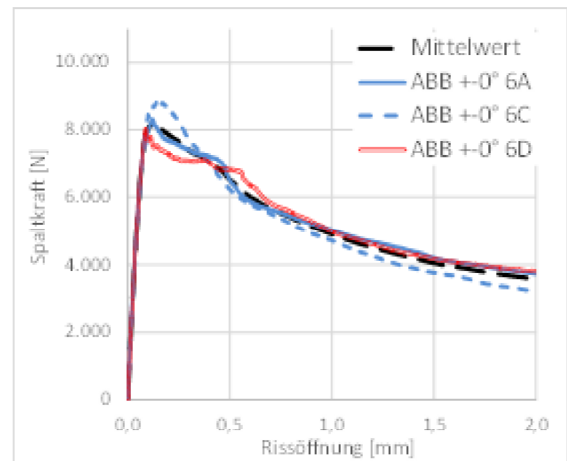


Bild 4: Kurvenverläufe einer 3-fach Belegung an Variante VI (K),  $T_1 = 0\text{ }^\circ\text{C}$

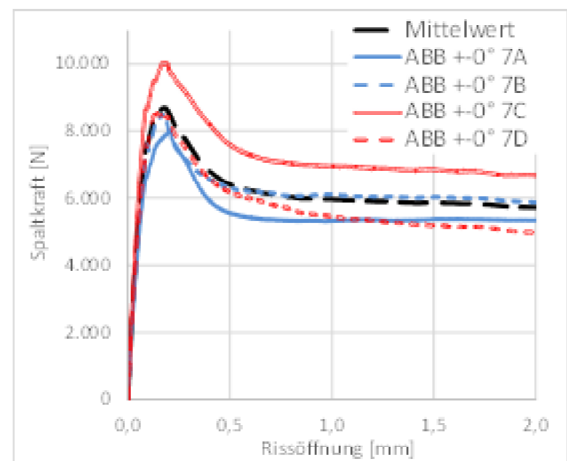


Bild 5: Kurvenverläufe einer 4-fach Belegung an Variante VII (K),  $T_1 = 0\text{ }^\circ\text{C}$

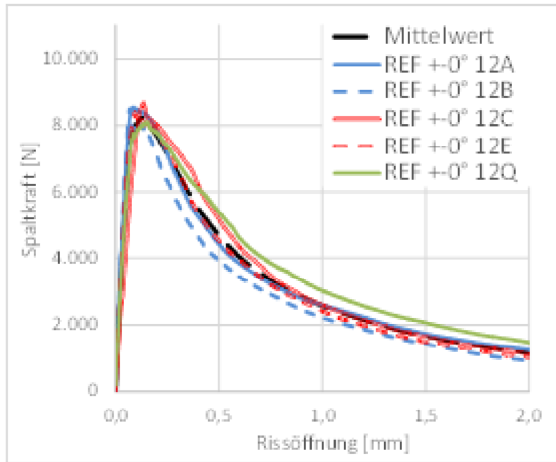


Bild 6: Kurvenverläufe einer 5-fach Belegung an Variante XII (ref.),  $T_1 = 0 \text{ }^\circ\text{C}$

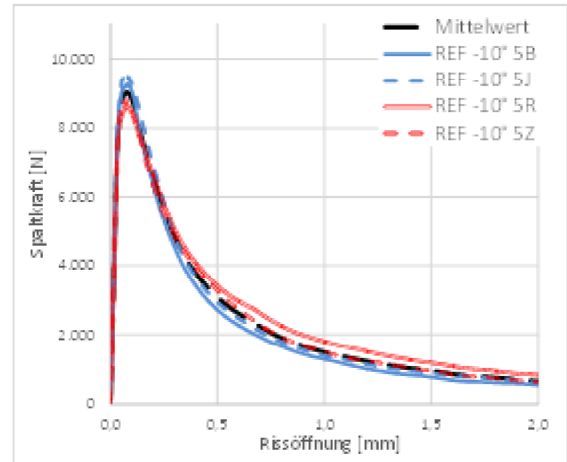


Bild 9: Kurvenverläufe einer 4-fach Belegung an Variante V (ref.),  $T_2 = -10 \text{ }^\circ\text{C}$

$T_2 = -10 \text{ }^\circ\text{C}$

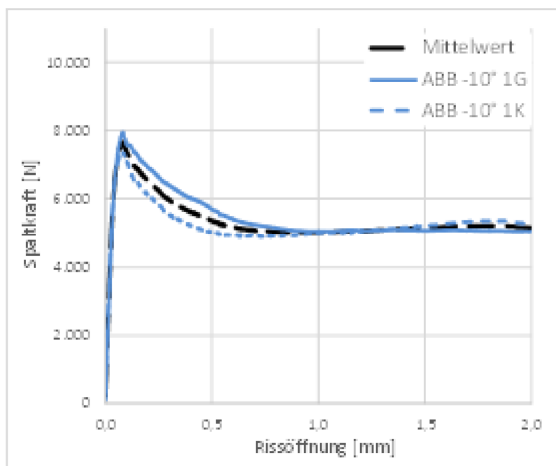


Bild 7: Kurvenverläufe einer 2-fach Belegung an Variante I (k),  $T_2 = -10 \text{ }^\circ\text{C}$

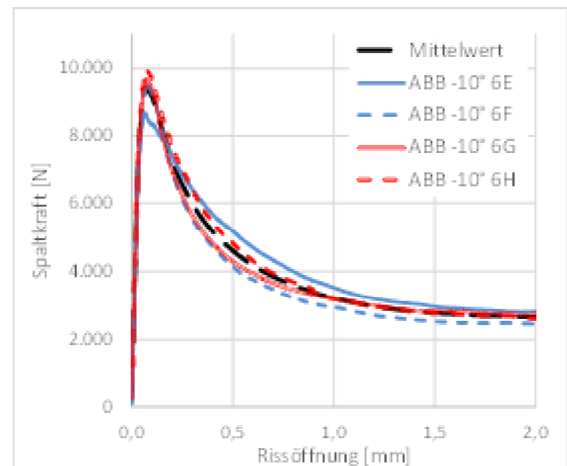


Bild 10: Kurvenverläufe einer 4-fach Belegung an Variante VI (K),  $T_2 = -10 \text{ }^\circ\text{C}$

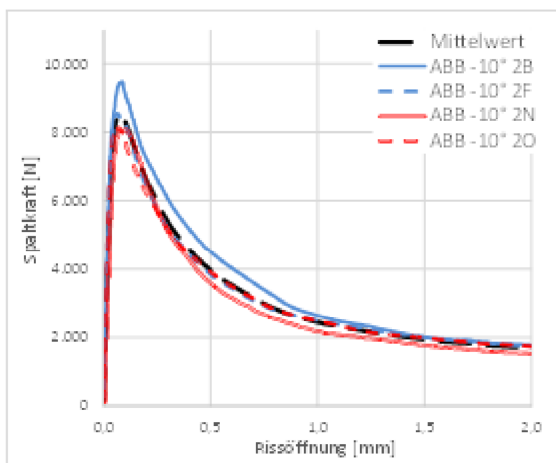


Bild 8: Kurvenverläufe einer 4-fach Belegung an Variante II (v),  $T_2 = -10 \text{ }^\circ\text{C}$

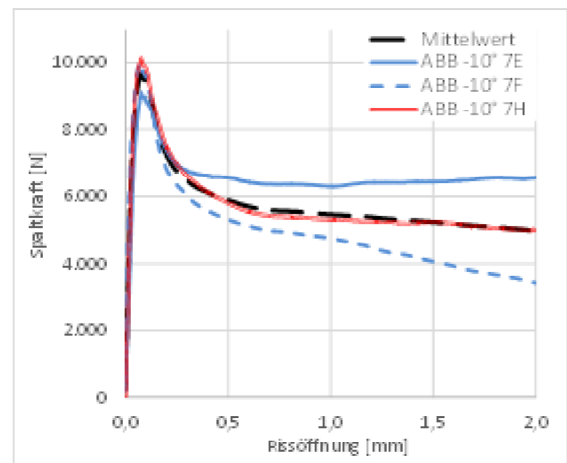


Bild 11: Kurvenverläufe einer 3-fach Belegung an Variante VII (K),  $T_2 = -10 \text{ }^\circ\text{C}$

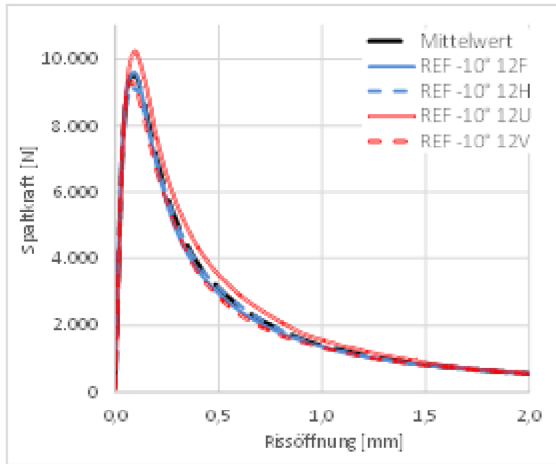


Bild 12: Kurvenverläufe einer 4-fach Belegung an Variante XII (ref.),  $T_2 = -10\text{ °C}$

Zusammenstellung der Varianten I (k), II (v), V (ref.), VI (K), VII (K), XII (Ref.)

$T_1 = 0\text{ °C}$

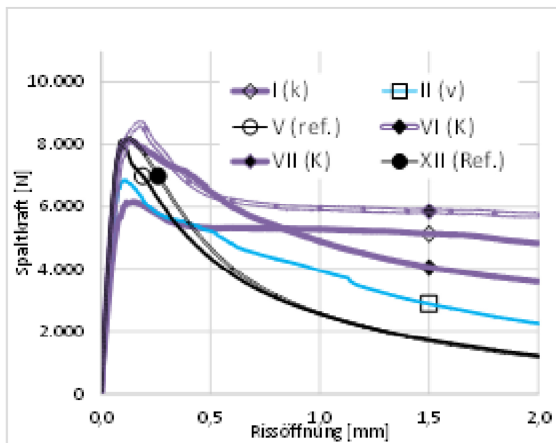


Bild 13: Darstellung der Mittelwertkurven aller spannungsabbauenden Systeme mit Referenzen im Kraft-Weg-Diagramm,  $T_1 = 0\text{ °C}$  (Bild 68)

$T_2 = -10\text{ °C}$

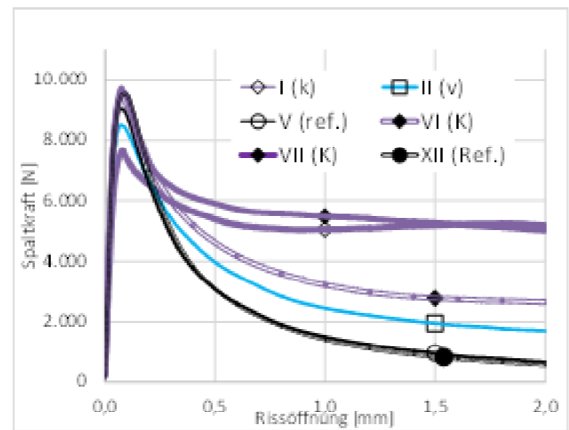


Bild 14: Darstellung der Mittelwertkurven aller spannungsabbauenden Systeme mit Referenzen im Kraft-Weg-Diagramm,  $T_2 = -10\text{ °C}$  (Bild 69)

$T_1 = 0\text{ °C}$

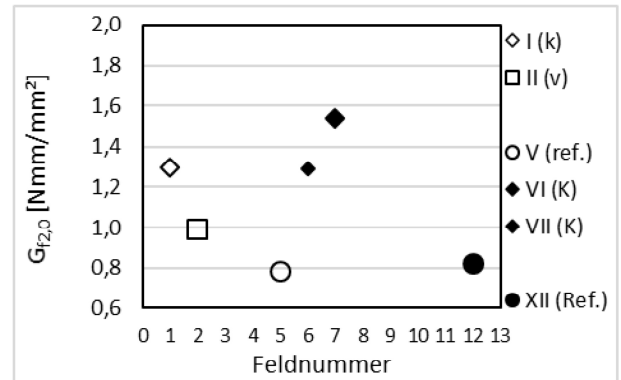


Bild 15: Auswertung der spannungsabbauenden Systeme anhand der spezifischen Bruchenergie  $G_{f2,0}$ ,  $T_1 = 0\text{ °C}$  (Bild 70)

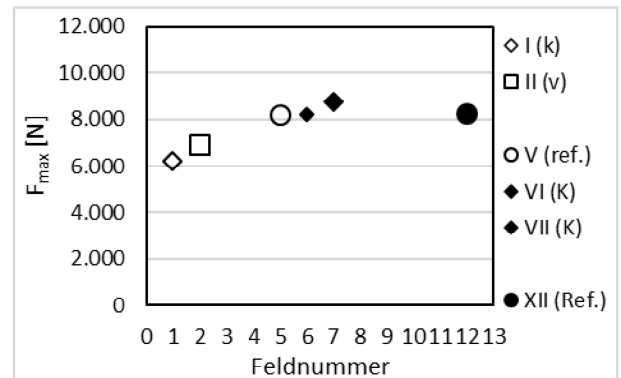


Bild 16: Auswertung der spannungsabbauenden Systeme anhand der maximalen Spaltkraft  $F_{max}$ ,  $T_1 = 0\text{ °C}$  (Bild 71)

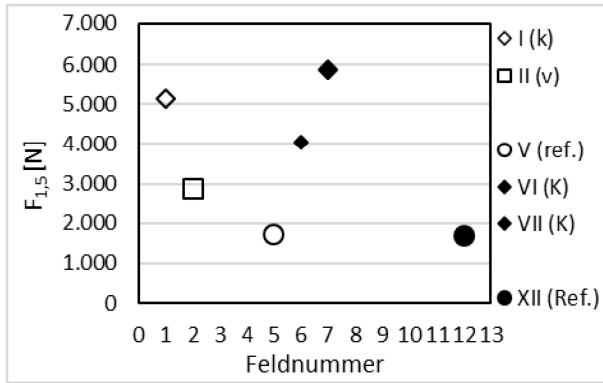


Bild 17: Auswertung der spannungsabbauenden Systeme anhand der Spaltkraft  $F_{1,5}$ ,  $T_1 = 0\text{ °C}$  (Bild 72)

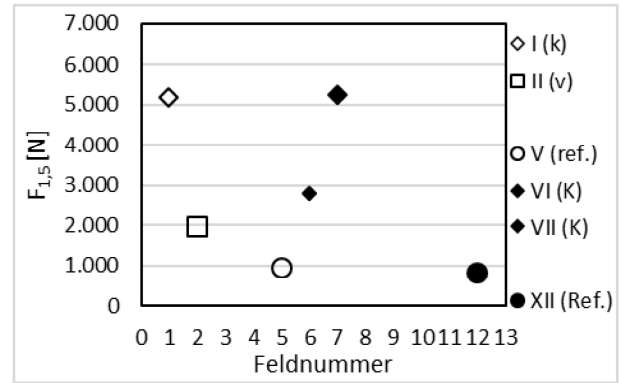


Bild 20: Auswertung der spannungsabbauenden Systeme anhand der Spaltkraft  $F_{1,5}$ ,  $T_2 = -10\text{ °C}$  (Bild 75)

$T_2 = -10\text{ °C}$

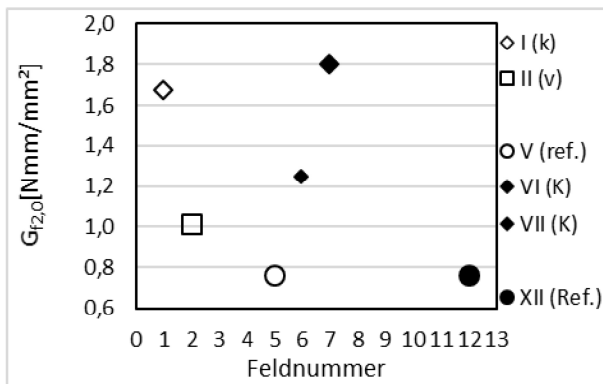


Bild 18: Auswertung der spannungsabbauenden Systeme anhand der spezifischen Bruchenergie  $G_{f2,0}$ ,  $T_2 = -10\text{ °C}$  (Bild 73)

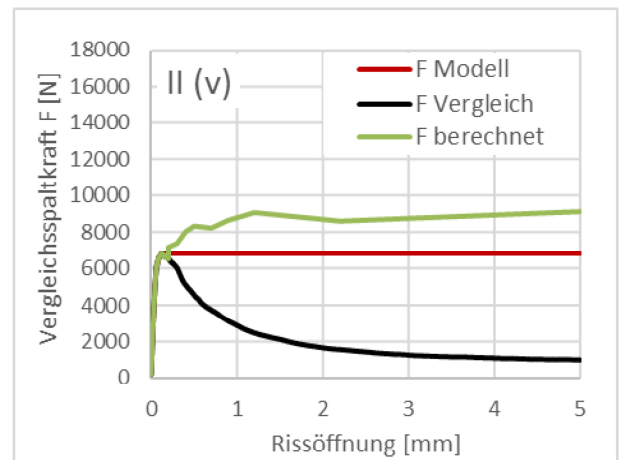


Bild 21: Darstellung der Kraftkurven am Rissufer (Modell und berechnet) im Vergleich zur klassischen Auswertung der Spaltkraft (Vergleich); II (v) (Bild 76)

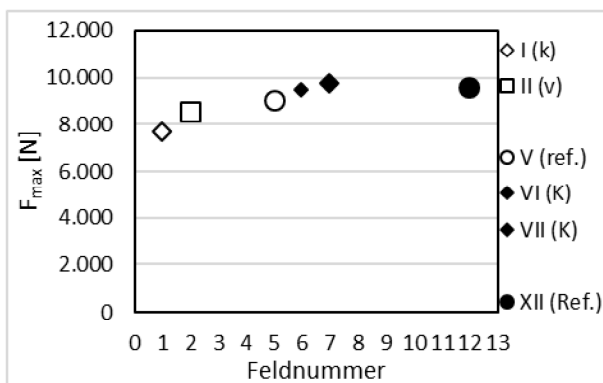


Bild 19: Auswertung der spannungsabbauenden Systeme anhand der maximalen Spaltkraft  $F_{max}$ ,  $T_2 = -10\text{ °C}$  (Bild 74)

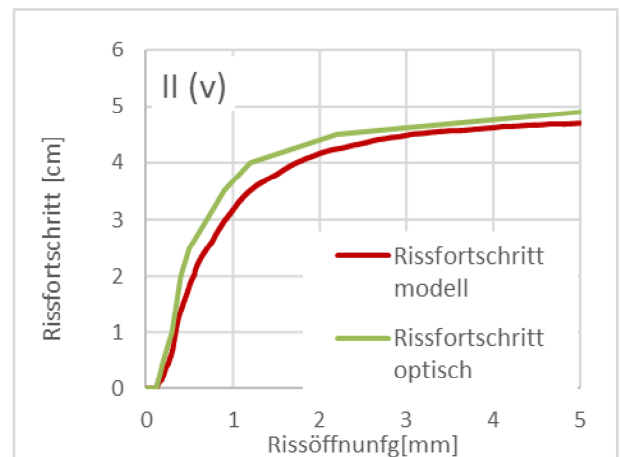


Bild 22: Darstellung des im Modell berechneten und optische erfassten Rissfortschrittes; II (v) (Bild 77)

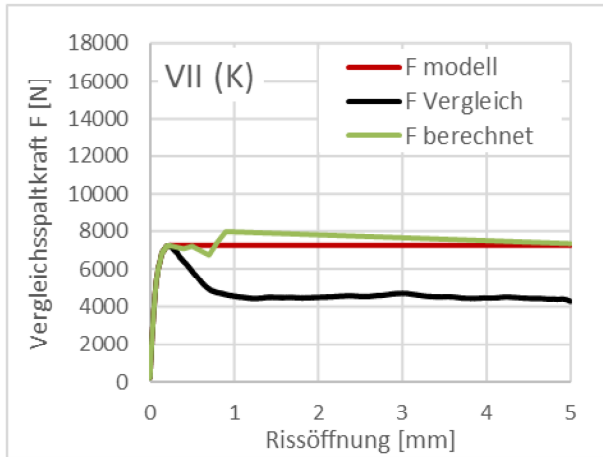


Bild 23: Darstellung der Kraftkurven am Rissufer (Modell und berechnet) im Vergleich zur klassischen Auswertung der Spaltkraft (Vergleich); VII (K) (Bild78)

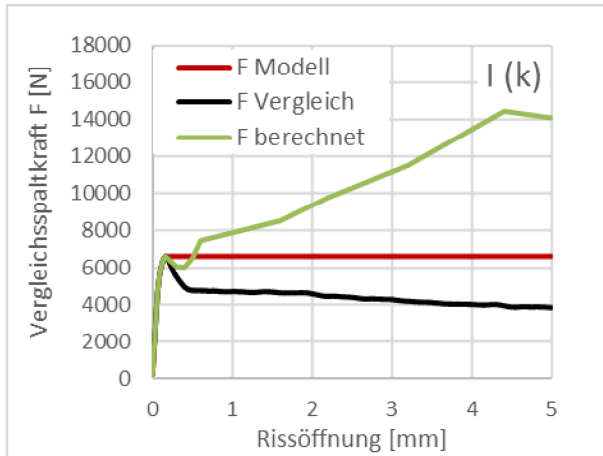


Bild 24: Darstellung des im Modell berechneten und optische erfassten Rissfortschrittes; VII (K) (Bild 79)

### zu 3.2.2.6 Dynamische Keilspaltversuche – spannungsabbauende Wirkung

Auswertung der Kurvenverläufe Rissfortschritt zu Belastungszyklen an Probekörpern 220 mm der Varianten I (k), II (v), V (ref.), VI (K), VII (K), XII (ref.)

T1 = 0 °C

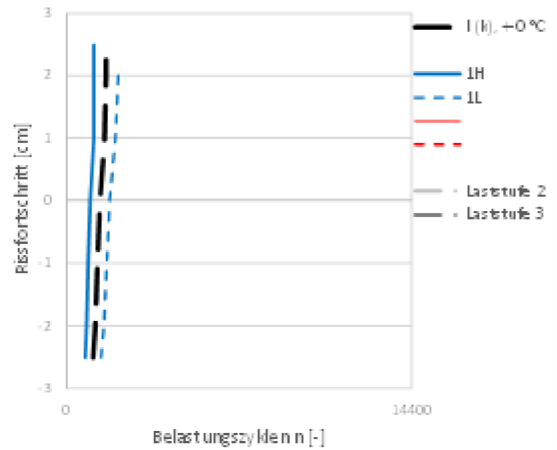


Bild 25: Darstellung Ergebnis der Mehrfachbelegung, Variante I (k), T1 = 0 °C, Streuung bei Rissfortschritt

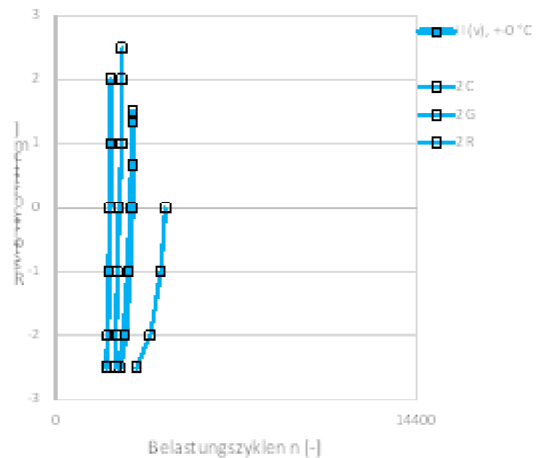


Bild 26: Darstellung Ergebnis der Mehrfachbelegung, Variante II (v), T1 = 0 °C, Streuung bei Rissfortschritt (Bild 85)

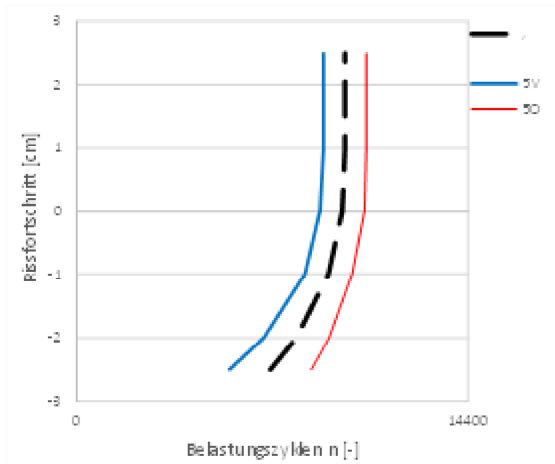


Bild 27: Darstellung Ergebnis der Mehrfachbelegung, Variante V (ref.),  $T_1 = 0 \text{ }^\circ\text{C}$ , Streuung bei Rissfortschritt

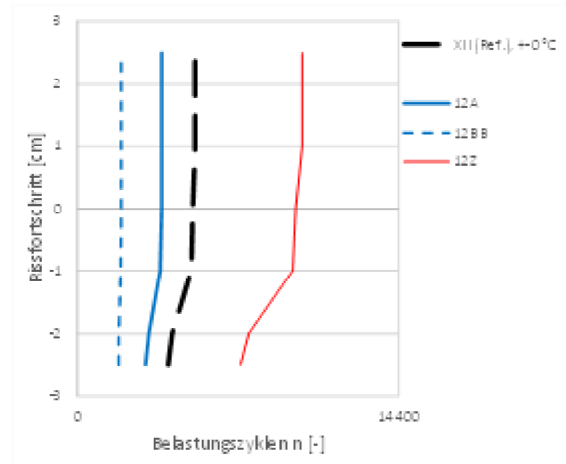


Bild 30: Darstellung Ergebnis der Mehrfachbelegung, Variante XII (ref.),  $T_1 = 0 \text{ }^\circ\text{C}$ , Streuung bei Rissfortschritt

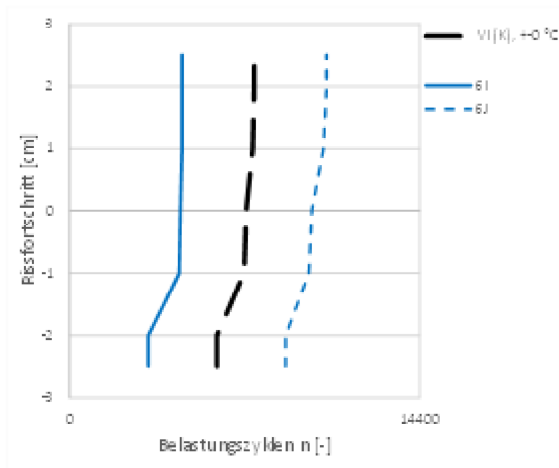


Bild 28: Darstellung Ergebnis der Mehrfachbelegung, Variante VI (K),  $T_1 = 0 \text{ }^\circ\text{C}$ , Streuung bei Rissfortschritt

Zusammenstellung der Varianten I (k), II (v), V (ref.), VI (K), VII (K), XII (ref.)

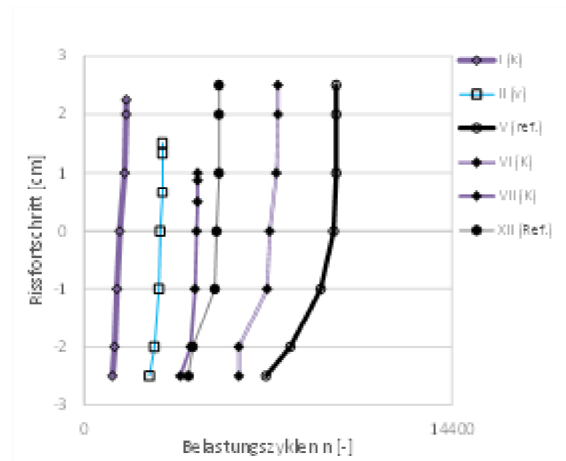


Bild 31: Zusammenstellung der Auswertung des Rissfortschrittes bei Verwendung spannungsabbauender Systeme,  $T_1 = 0 \text{ }^\circ\text{C}$  (Bild 83)

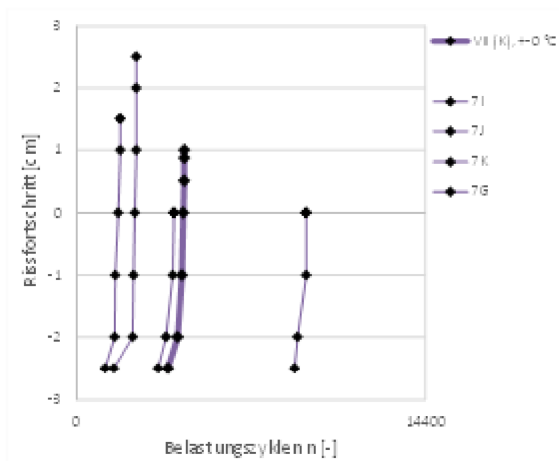
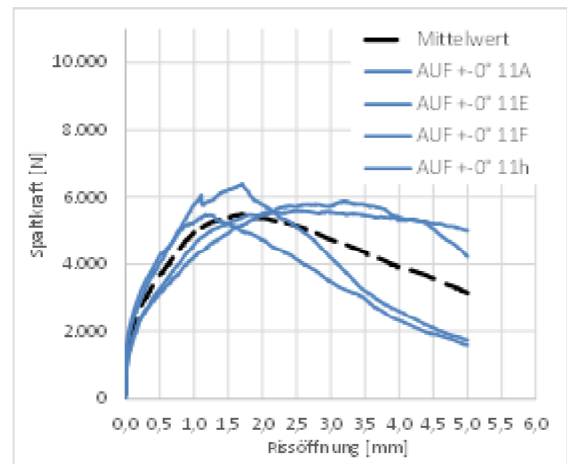
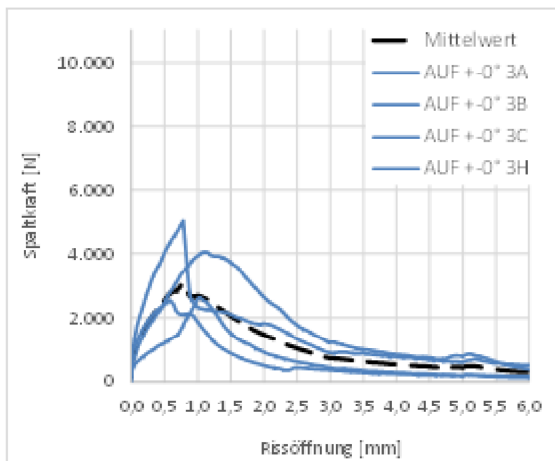
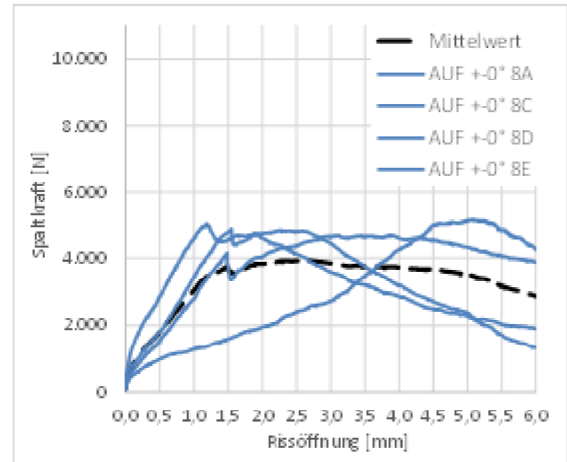
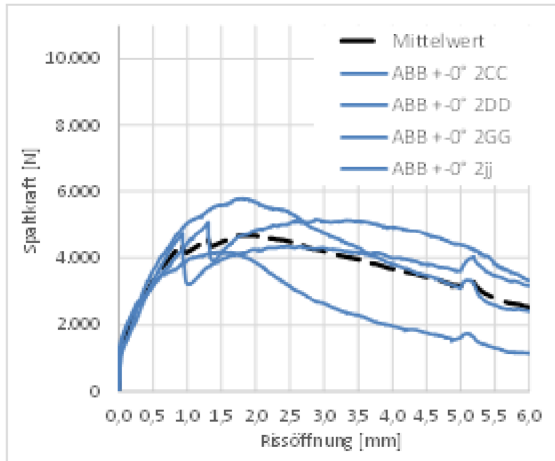


Bild 29: Darstellung Ergebnis der Mehrfachbelegung, Variante VII (K),  $T_1 = 0 \text{ }^\circ\text{C}$ , Streuung bei Rissfortschritt

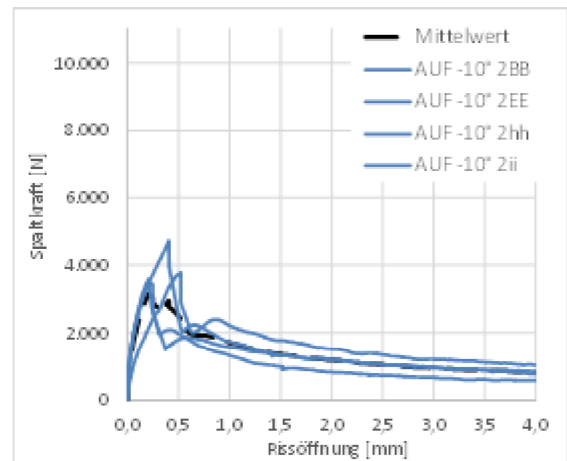
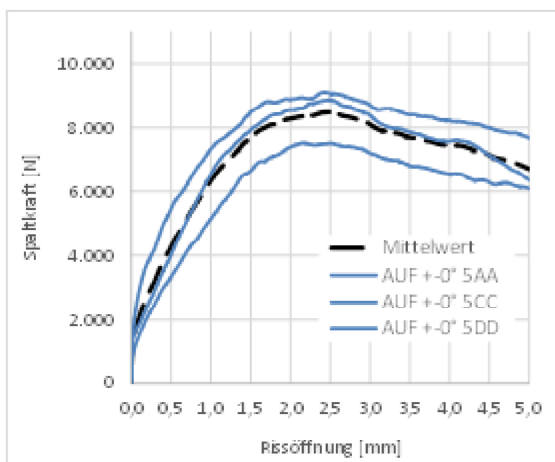
### zu 3.2.2.7 Statischer Keilspaltversuch – Schichtenverbund

Auswertung der Kurvenverläufe Spaltkraft zu Rissöffnung an Probekörpern 150 mm der Varianten II (v), III (g), V (ref.), VIII (V), XI (G)

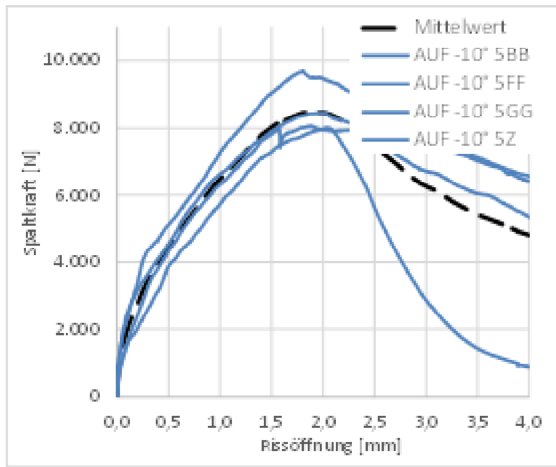
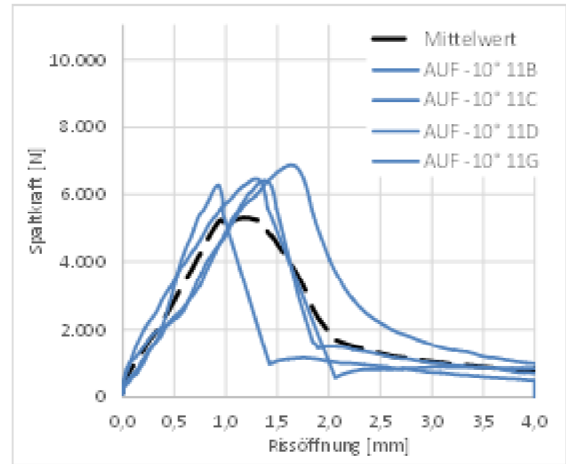
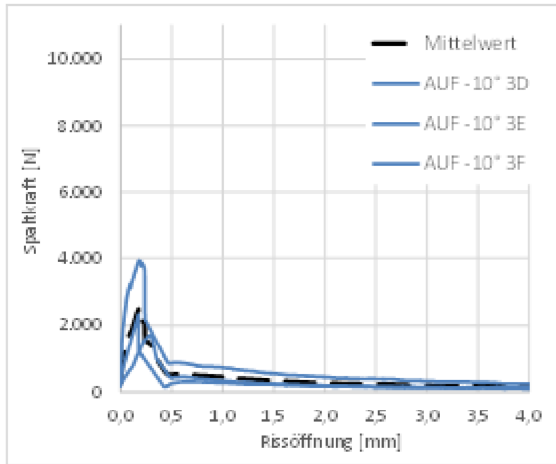
T1 = 0 °C



T2 = -10 °C







### Zusammenstellung der Varianten

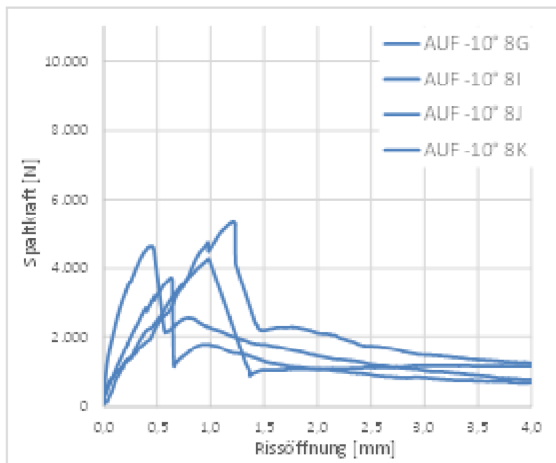
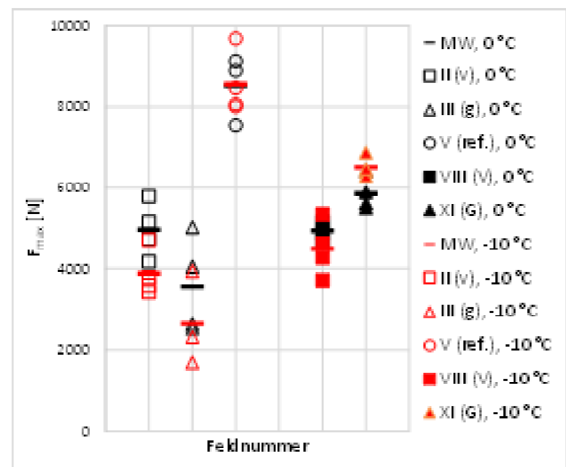


Bild 32: Zusammenstellung der Auswertung des Rissfortschrittes bei Verwendung spannungsaufnehmender Systeme,  $T_1 = 0\text{ }^\circ\text{C}$ ,  $T_2 = -10\text{ }^\circ\text{C}$  (Bild 160)

### zu 3.2.3.5 Statische Keilspaltversuche

Auswertung der Kurvenverläufe Spaltkraft zu Rissöffnung an Probekörpern 150 mm der Varianten III (g), IV (g), V (ref.), IX (G), X (G), XI (G), XII (ref.)

T1 = 0 °C

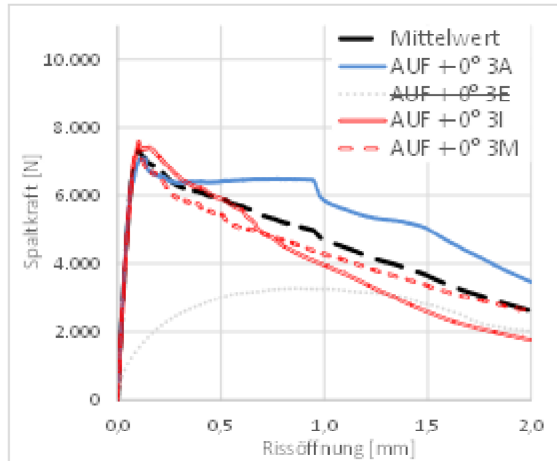


Bild 33: Kurvenverläufe einer 4-fach Belegung an Variante III (g), T1 = 0 °C

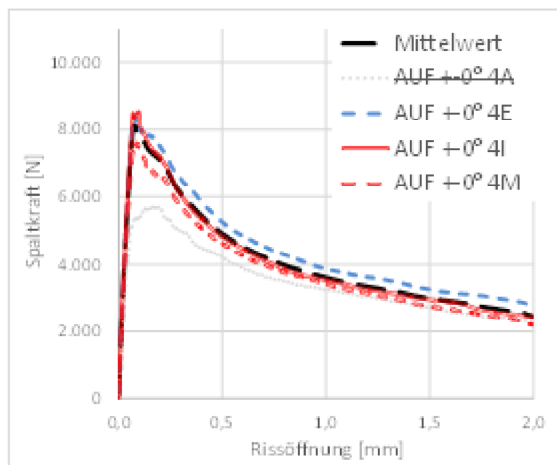


Bild 34: Kurvenverläufe einer 4-fach Belegung an Variante VI (g), T1 = 0 °C

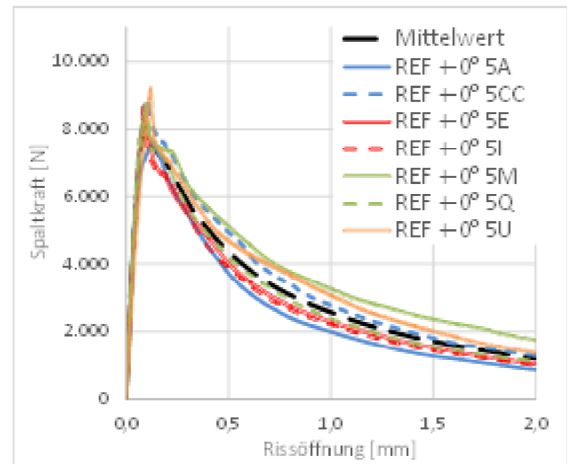


Bild 35: Kurvenverläufe einer 7-fach Belegung an Variante V (ref.), T1 = 0 °C

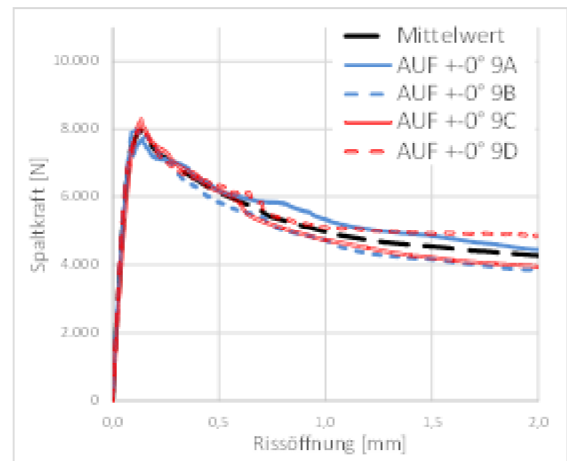


Bild 36: Kurvenverläufe einer 4-fach Belegung an Variante XI (G), T1 = 0 °C (Bild 150)

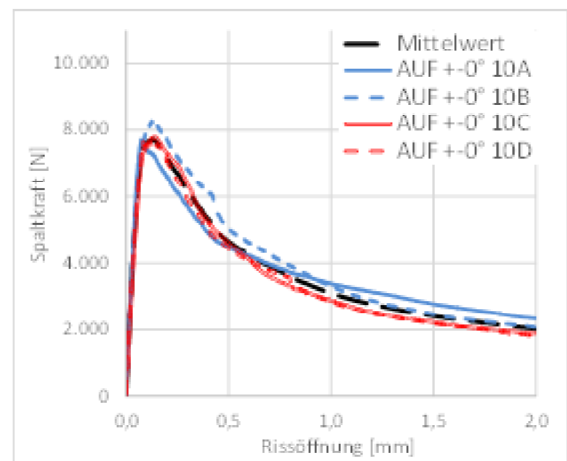


Bild 37: Kurvenverläufe einer 4-fach Belegung an Variante X (G), T1 = 0 °C

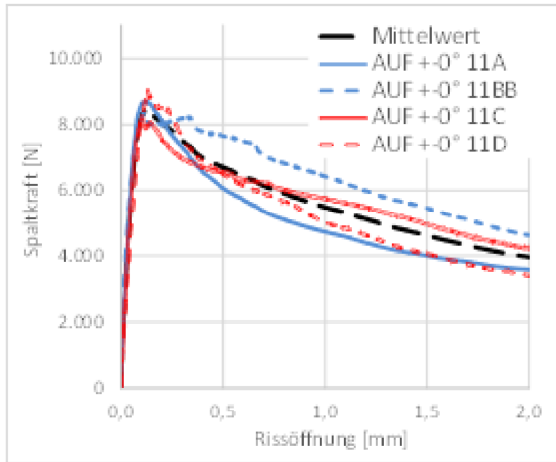


Bild 38: Kurvenverläufe einer 4-fach Belegung an Variante XI (G),  $T_1 = 0 \text{ }^\circ\text{C}$

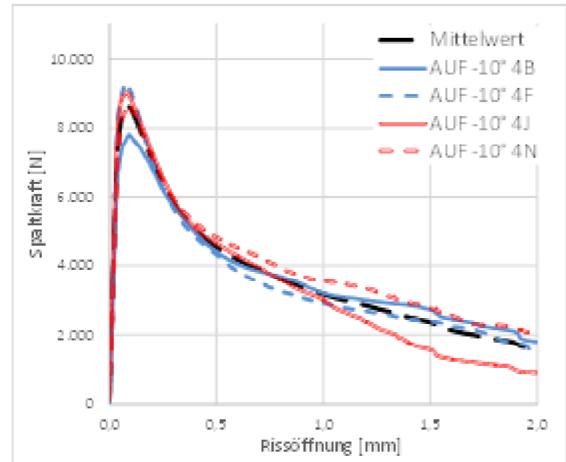


Bild 41: Kurvenverläufe einer 4-fach Belegung an Variante IV (g),  $T_2 = -10 \text{ }^\circ\text{C}$

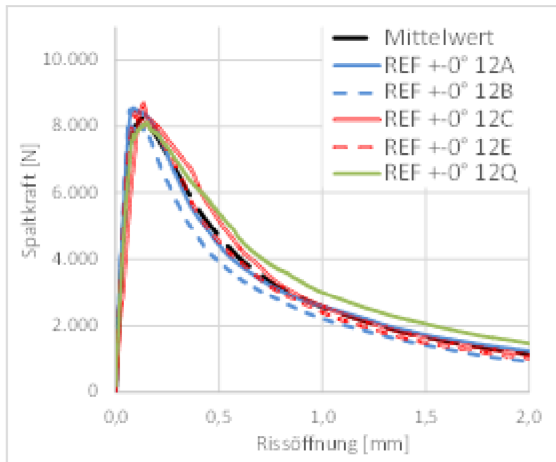


Bild 39: Kurvenverläufe einer 5-fach Belegung an Variante XII (ref.),  $T_1 = 0 \text{ }^\circ\text{C}$

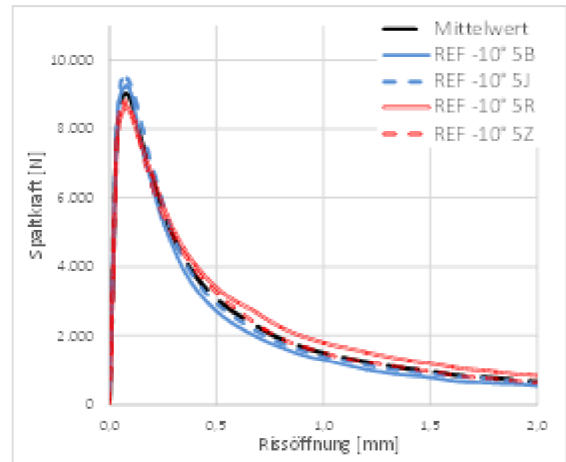


Bild 42: Kurvenverläufe einer 4-fach Belegung an Variante V (ref.),  $T_2 = -10 \text{ }^\circ\text{C}$

$T_2 = -10 \text{ }^\circ\text{C}$

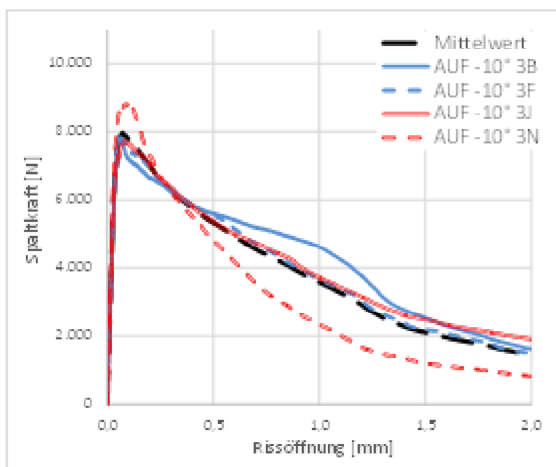


Bild 40: Kurvenverläufe einer 4-fach Belegung an Variante III (g),  $T_2 = -10 \text{ }^\circ\text{C}$

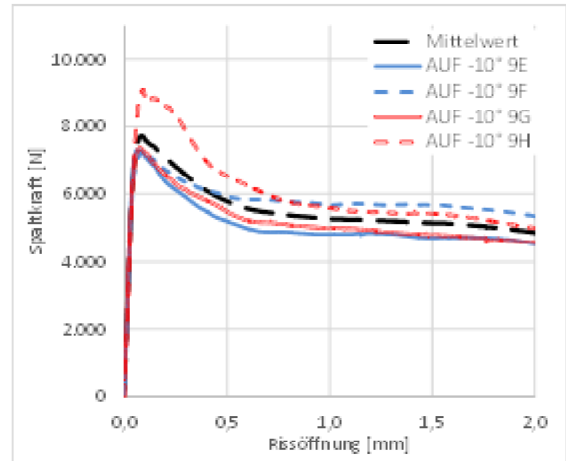


Bild 43: Kurvenverläufe einer 4-fach Belegung an Variante IX (G),  $T_2 = -10 \text{ }^\circ\text{C}$

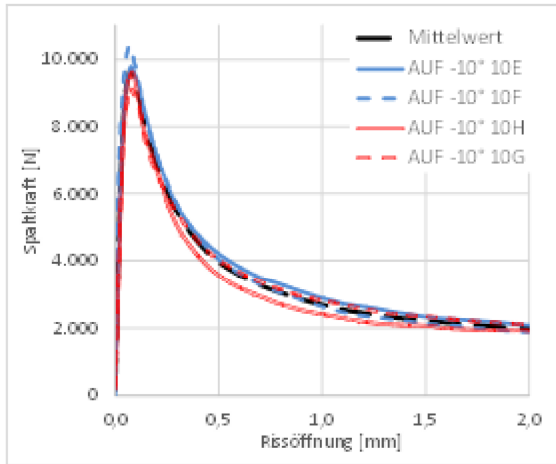


Bild 44: Kurvenverläufe einer 4-fach Belegung an Variante X (G), T2 = -10 °C (Bild 151)

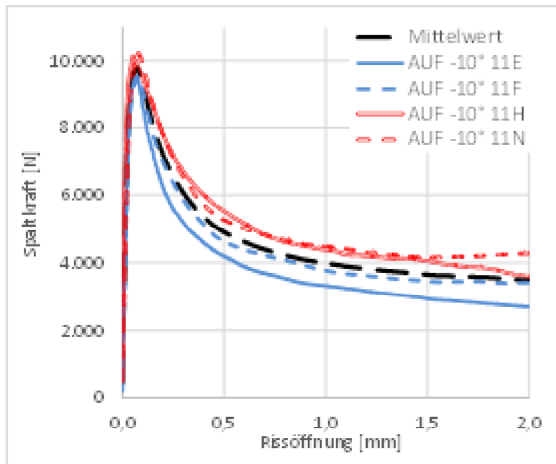


Bild 45: Kurvenverläufe einer 4-fach Belegung an Variante XI (G), T2 = -10 °C

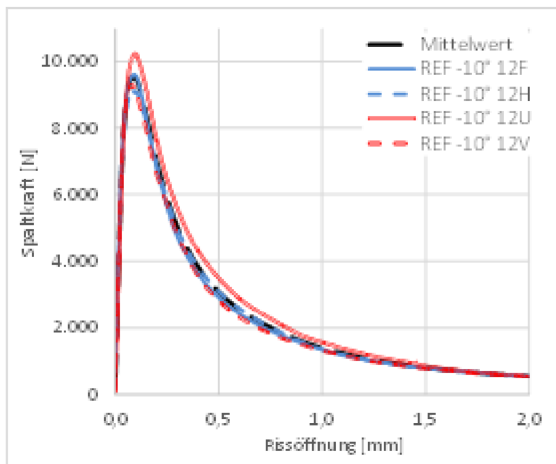


Bild 46: Kurvenverläufe einer 4-fach Belegung an Variante XII (ref.), T2 = -10 °C

Zusammenstellung der Varianten III (g), IV (g), V (ref.), IX (G), X (G), XI (G), XII (ref.)

T1 = 0 °C

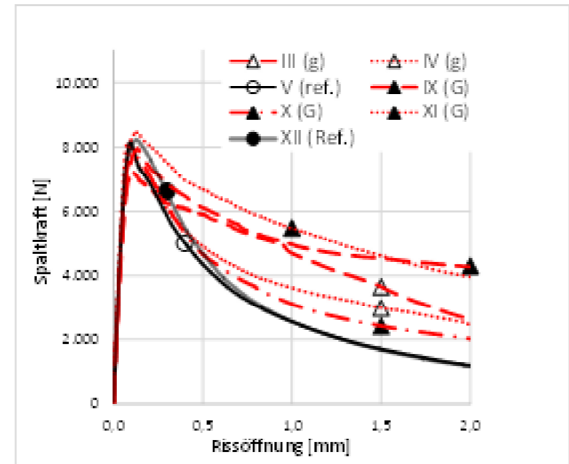


Bild 47: Darstellung der Mittelwertkurven aller spannungsaufnehmenden Systeme mit Referenzen im Kraft-Weg-Diagramm, T1 = 0 °C (Bild 152)

T2 = -10 °C

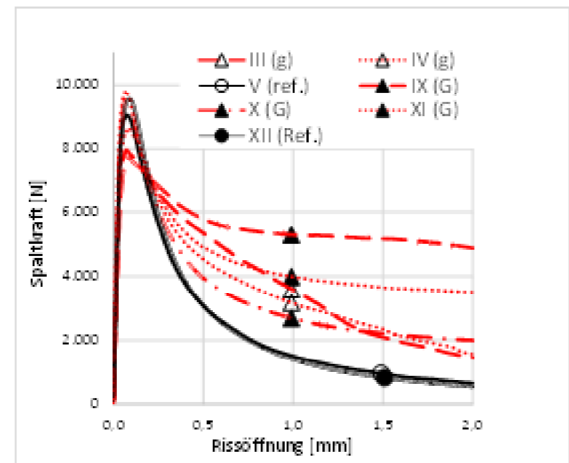


Bild 48: Darstellung der Mittelwertkurven aller spannungsaufnehmenden Systeme mit Referenzen im Kraft-Weg-Diagramm, T2 = -10 °C (Bild 153)

T1 = 0 °C

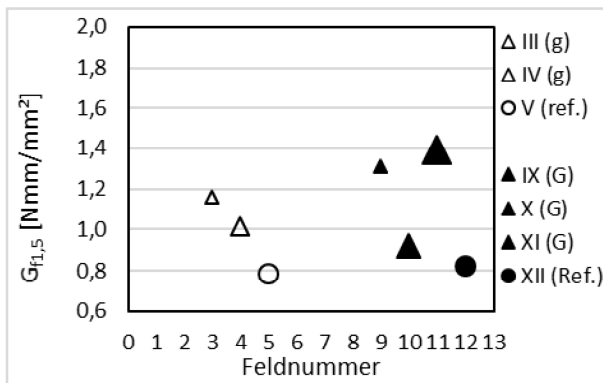


Bild 49: Auswertung der spannungsaufnehmenden Systeme anhand der spezifischen Bruchenergie  $G_{fp2,0}$ , T1 = 0 °C (Bild 154)

T2 = -10 °C

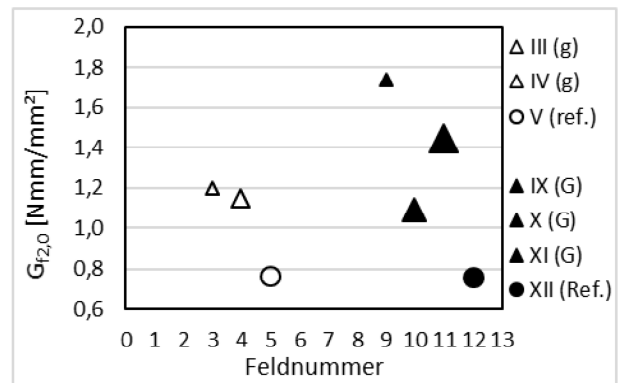


Bild 52: Auswertung der spannungsaufnehmenden Systeme anhand der spezifischen Bruchenergie  $G_{fp2,0}$ , T2 = -10 °C (Bild 157)

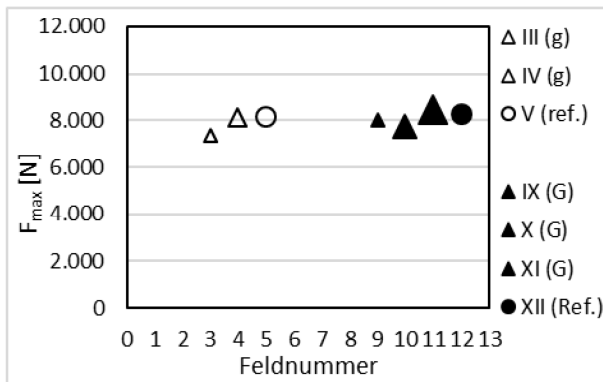


Bild 50: Auswertung der spannungsaufnehmenden Systeme anhand der maximalen Spaltkraft  $F_{max}$ , T1 = 0 °C (Bild 155)

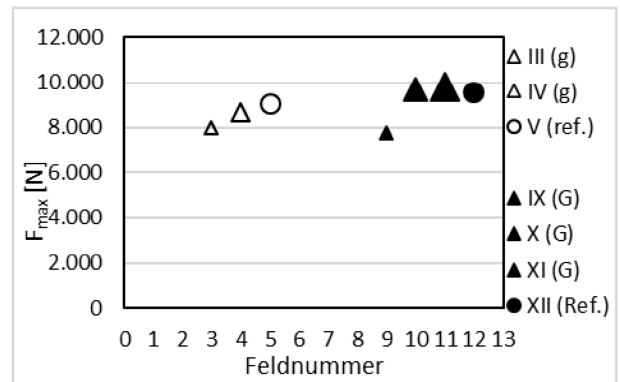


Bild 53: Auswertung der spannungsaufnehmenden Systeme anhand der maximalen Spaltkraft  $F_{max}$ , T2 = -10 °C (Bild 158)

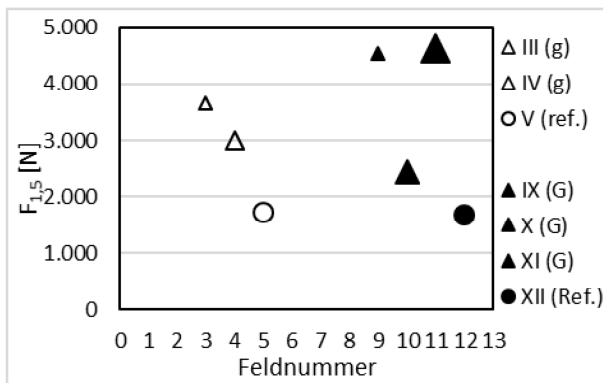


Bild 51: Auswertung der spannungsaufnehmenden Systeme anhand der Spaltkraft  $F_{1,5}$ , T1 = 0 °C (Bild 156)

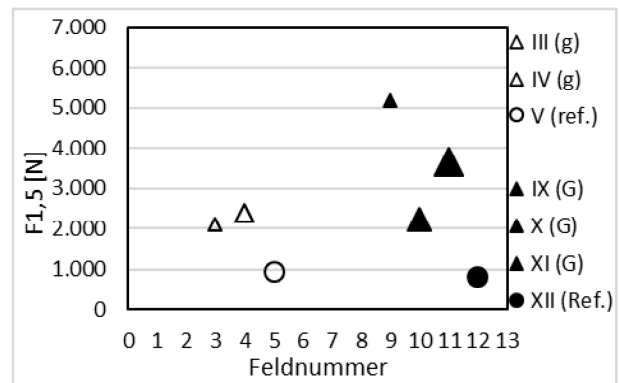


Bild 54: Auswertung der spannungsaufnehmenden Systeme anhand der Spaltkraft  $F_{1,5}$ , T2 = -10 °C (Bild 159)

### zu 3.2.3.6 Dynamische Keilspaltversuche

Auswertung der Kurvenverläufe Rissfortschritt zu Belastungszyklen an Probekörpern 220 mm der Varianten III (g), IV (g), V (ref.), IX (G), X (G), XI (G), XII (ref.)

T2 = -10 °C

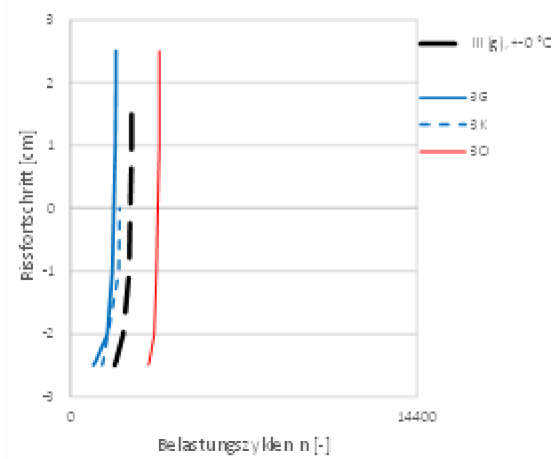


Bild 55: Darstellung Ergebnis der Mehrfachbelegung, Variante III (g), T2 = -10 °C, Streuung bei Rissfortschritt

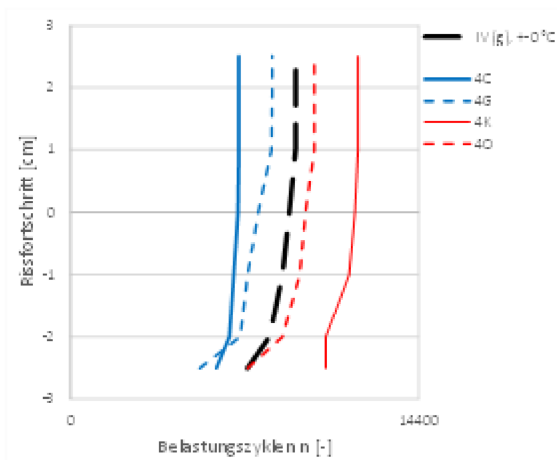


Bild 56: Darstellung Ergebnis der Mehrfachbelegung, Variante IV (g), T2 = -10 °C, Streuung bei Rissfortschritt

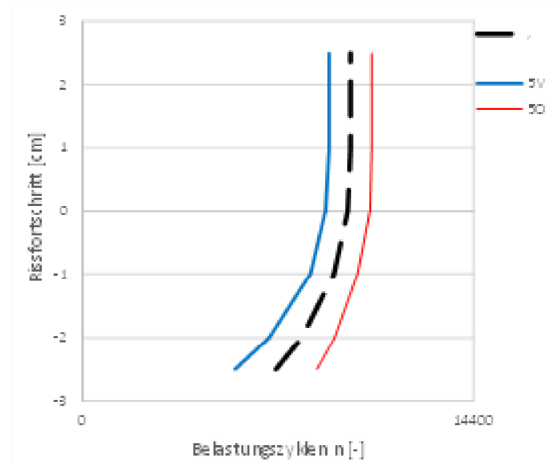


Bild 57: Darstellung Ergebnis der Mehrfachbelegung, Variante V (ref.), T2 = -10 °C, Streuung bei Rissfortschritt

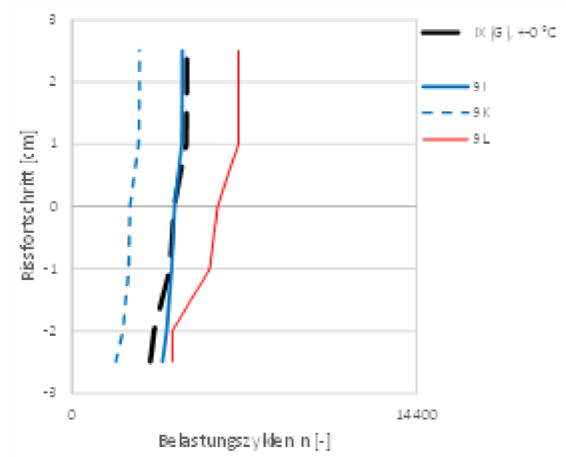


Bild 58: Darstellung Ergebnis der Mehrfachbelegung, Variante IX (G), T2 = -10 °C, Streuung bei Rissfortschritt

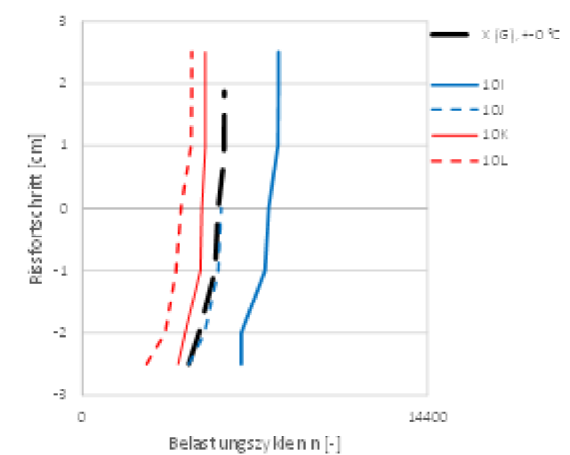


Bild 59: Darstellung Ergebnis der Mehrfachbelegung, Variante X (G), T2 = -10 °C, Streuung bei Rissfortschritt

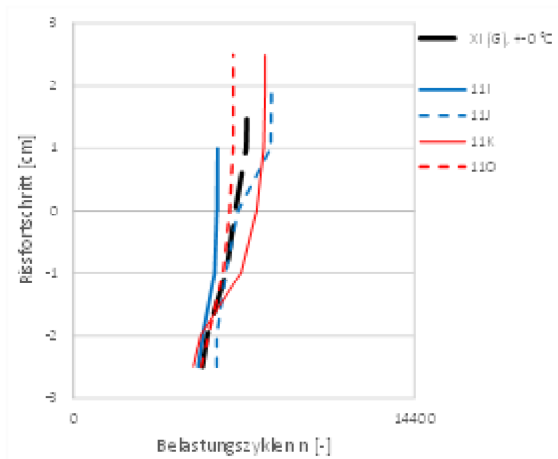


Bild 60: Darstellung Ergebnis der Mehrfachbelegung, Variante XI (G),  $T_2 = -10\text{ °C}$ , Streuung bei Rissfortschritt

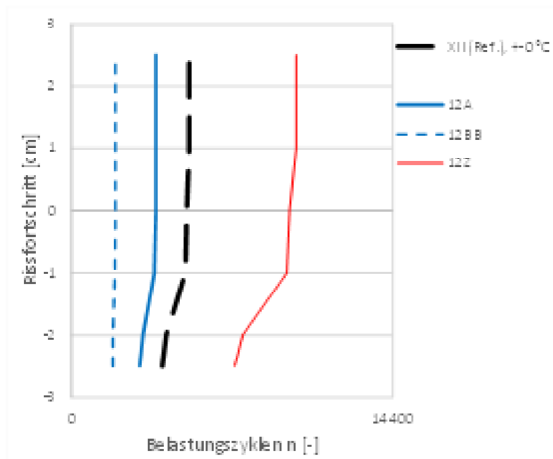


Bild 61: Darstellung Ergebnis der Mehrfachbelegung, Variante XII (ref.),  $T_2 = -10\text{ °C}$ , Streuung bei Rissfortschritt

Zusammenstellung der Varianten III (g), IV (g), V (ref.), IX (G), X (G), XI (G), XII (ref.)

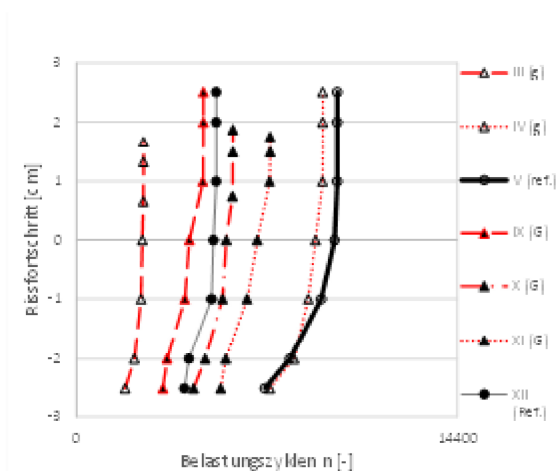


Bild 62: Zusammenstellung der Auswertung des Rissfortschrittes bei Verwendung spannungsaufnehmender Systeme,  $T_1 = 0\text{ °C}$  (Bild 160)

POTEA: Anhang 3

Dimensionierungsrechnung Bk1,8: Referenz (ohne Asphaltteindeckung)

|               |            | Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Referenz (ohne Asphaltteindeckung)         |        |         |         |         |         |         |         |         |         |        |        |        |     |     |     |  |
|---------------|------------|--|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|-----|-----|-----|--|
|               |            | Oberflächentemperatur  |        |         |         |         |         |         |         |         |         |        |        |        |     |     |     |  |
|               |            | -12,5  | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5    | 32,5    | 37,5   | 42,5   | 47,5   |     |     |     |  |
| Schicht       | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule   |        |         |         |         |         |         |         |         |         |        |        |        |     |     |     |  |
| SMA           | 0,5        | 23.922   | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301  | 892    | 616    |     |     |     |  |
| SMA           | 0,5        | 23.793   | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342  | 927    | 642    |     |     |     |  |
| SMA           | 1          | 23.545   | 21.169 | 18.212  | 14.893  | 11.463  | 8.355   | 5.882   | 4.154   | 2.917   | 2.035   | 1.423  | 995    | 695    |     |     |     |  |
| SMA           | 1          | 23.308   | 20.956 | 18.073  | 14.852  | 11.457  | 8.341   | 5.868   | 4.195   | 2.991   | 2.116   | 1.501  | 1.052  | 748    |     |     |     |  |
| SMA           | 0,5        | 23.194   | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539  | 1.095  | 775    |     |     |     |  |
| SMA           | 0,5        | 23.082   | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577  | 1.128  | 801    |     |     |     |  |
| Alter Asphalt | 16         | 500  | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    | 500 | 500 | 500 |  |
| FSS           | 50         | 100  | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100    | 100    | 100    | 100 | 100 | 100 |  |
| Untergrund    | 45         | 45   | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     | 45  | 45  | 45  |  |
|               |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                         |        |         |         |         |         |         |         |         |         |        |        |        |     |     |     |  |
|               | 2          | 1.883  | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787  | 942    | 942    |     |     |     |  |
|               | 4          | 17.280   | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639 | 8.640  | 8.640  |     |     |     |  |
|               | 6          | 13.782   | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317 | 6.891  | 6.891  |     |     |     |  |
|               | 8          | 8.047  | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554 | 4.024  | 4.024  |     |     |     |  |
|               | 10         | 3.535  | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498 | 1.768  | 1.768  |     |     |     |  |
|               | 12         | 1.826  | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522  | 913    | 913    |     |     |     |  |
|               | 14         | 536  | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500  | 268    | 268    |     |     |     |  |
|               | 16         | 66   | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307    | 33     | 33     |     |     |     |  |
|               | 18         | 1  | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7      | 1      | 1      |     |     |     |  |
|               | 20         | 0  | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |     |     |     |  |
|               | 22         | 0  | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |     |     |     |  |
|               |            | <b>Nachweisformat: RDO Asphalt</b>   |        |         |         |         |         |         |         |         |         |        |        |        |     |     |     |  |
|               |            | <b>Ergebnis des Primärwirkungsmodells: Dehnung an der Unterseite der Asphaltdeckschicht [µm/m]</b> |        |         |         |         |         |         |         |         |         |        |        |        |     |     |     |  |
|               | 2          | 36,6   | 37,4   | 38,4    | 39,2    | 39,7    | 39,0    | 36,1    | 30,5    | 22,3    | 11,4    | -1,5   | -16,1  | -31,7  |     |     |     |  |
|               | 4          | 73,2   | 74,9   | 76,8    | 78,5    | 79,4    | 78,0    | 72,1    | 60,9    | 44,5    | 22,9    | -3,0   | -32,2  | -63,5  |     |     |     |  |
|               | 6          | 109,8  | 112,3  | 115,2   | 117,7   | 119,1   | 116,9   | 108,2   | 91,4    | 66,8    | 34,3    | -4,4   | -48,3  | -95,2  |     |     |     |  |
|               | 8          | 146,4  | 149,7  | 153,5   | 157,0   | 158,8   | 155,9   | 144,2   | 121,9   | 89,0    | 45,8    | -5,9   | -64,4  | -127,0 |     |     |     |  |
|               | 10         | 183,0  | 187,2  | 191,9   | 196,2   | 198,5   | 194,9   | 180,3   | 152,4   | 111,3   | 57,2    | -7,4   | -80,4  | -158,7 |     |     |     |  |
|               | 12         | 219,6  | 224,6  | 230,3   | 235,5   | 238,2   | 233,9   | 216,3   | 182,8   | 133,5   | 68,7    | -8,9   | -96,5  | -190,5 |     |     |     |  |
|               | 14         | 256,2  | 262,0  | 268,7   | 274,7   | 278,0   | 272,8   | 252,4   | 213,3   | 155,8   | 80,1    | -10,4  | -112,6 | -222,2 |     |     |     |  |
|               | 16         | 292,8  | 299,5  | 307,1   | 314,0   | 317,7   | 311,8   | 288,4   | 243,8   | 178,1   | 91,6    | -11,9  | -128,7 | -254,0 |     |     |     |  |
|               | 18         | 329,4  | 336,9  | 345,5   | 353,2   | 357,4   | 350,8   | 324,5   | 274,2   | 200,3   | 103,0   | -13,3  | -144,8 | -285,7 |     |     |     |  |
|               | 20         | 366,0  | 374,3  | 383,8   | 392,4   | 397,1   | 389,8   | 360,5   | 304,7   | 222,6   | 114,5   | -14,8  | -160,9 | -317,4 |     |     |     |  |
|               | 22         | 402,6  | 411,8  | 422,2   | 431,7   | 436,8   | 428,8   | 396,6   | 335,2   | 244,8   | 125,9   | -16,3  | -177,0 | -349,2 |     |     |     |  |

Achslastklassen

Achslastklassen



|                 |  | Ertragbare Anzahl an Lastfällen   |          |          |          |          |          |          |          |          |          | Schädigungsquotient |          |          |    |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-----------------|--|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------------|----------|----------|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
|                 |  | -12,5   | -7,5     | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5                | 42,5     | 47,5     |    |          | -12,5    | -7,5     | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5 |
| Achslastklassen |  | 2   | 2,98E+10 | 2,66E+10 | 2,35E+10 | 2,11E+10 | 1,99E+10 | 2,18E+10 | 3,21E+10 | 7,41E+10 | 3,53E+11 | 9,59E+12            | 0,00E+00 | 0,00E+00 | 2  | 8,86E-07 | 1,16E-06 | 3,50E-06 | 4,20E-06 | 2,32E-06 | 2,56E-06 | 1,35E-06 | 3,43E-07 | 4,54E-08 | 1,24E-09 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 4   | 7,08E-05 | 1,58E-04 | 6,91E-04 | 9,44E-04 | 6,67E-04 | 7,36E-04 | 3,87E-04 | 9,86E-05 | 1,30E-05 | 3,57E-07            | 0,00E+00 | 0,00E+00 | 4  | 7,08E-05 | 1,58E-04 | 6,91E-04 | 9,44E-04 | 6,67E-04 | 7,36E-04 | 3,87E-04 | 9,86E-05 | 1,30E-05 | 3,57E-07 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 6   | 2,65E-04 | 7,36E-04 | 3,67E-03 | 5,22E-03 | 3,99E-03 | 4,40E-03 | 2,32E-03 | 5,89E-04 | 7,79E-05 | 2,14E-06            | 0,00E+00 | 0,00E+00 | 6  | 2,65E-04 | 7,36E-04 | 3,67E-03 | 5,22E-03 | 3,99E-03 | 4,40E-03 | 2,32E-03 | 5,89E-04 | 7,79E-05 | 2,14E-06 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 8   | 5,10E-04 | 1,59E-03 | 8,44E-03 | 1,23E-02 | 9,72E-03 | 1,07E-02 | 5,85E-03 | 1,44E-03 | 1,90E-04 | 5,21E-06            | 0,00E+00 | 0,00E+00 | 8  | 5,10E-04 | 1,59E-03 | 8,44E-03 | 1,23E-02 | 9,72E-03 | 1,07E-02 | 5,85E-03 | 1,44E-03 | 1,90E-04 | 5,21E-06 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 10  | 5,91E-04 | 1,97E-03 | 1,09E-02 | 1,59E-02 | 1,29E-02 | 1,43E-02 | 7,52E-03 | 1,91E-03 | 2,53E-04 | 6,93E-06            | 0,00E+00 | 0,00E+00 | 10 | 5,91E-04 | 1,97E-03 | 1,09E-02 | 1,59E-02 | 1,29E-02 | 1,43E-02 | 7,52E-03 | 1,91E-03 | 2,53E-04 | 6,93E-06 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 12  | 6,89E-04 | 2,40E-03 | 1,36E-02 | 2,01E-02 | 1,65E-02 | 1,83E-02 | 9,60E-03 | 2,44E-03 | 3,23E-04 | 8,85E-06            | 0,00E+00 | 0,00E+00 | 12 | 6,89E-04 | 2,40E-03 | 1,36E-02 | 2,01E-02 | 1,65E-02 | 1,83E-02 | 9,60E-03 | 2,44E-03 | 3,23E-04 | 8,85E-06 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 14  | 4,08E-04 | 1,47E+03 | 8,42E-03 | 1,25E-02 | 1,04E-02 | 1,15E-02 | 6,06E-03 | 1,54E-03 | 2,04E-04 | 5,59E-06            | 0,00E+00 | 0,00E+00 | 14 | 4,08E-04 | 1,47E+03 | 8,42E-03 | 1,25E-02 | 1,04E-02 | 1,15E-02 | 6,06E-03 | 1,54E-03 | 2,04E-04 | 5,59E-06 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 16  | 9,25E-05 | 3,41E-04 | 1,98E-03 | 2,96E-03 | 2,48E-03 | 2,74E-03 | 1,44E-03 | 3,67E-04 | 4,85E-05 | 1,33E-06            | 0,00E+00 | 0,00E+00 | 16 | 9,25E-05 | 3,41E-04 | 1,98E-03 | 2,96E-03 | 2,48E-03 | 2,74E-03 | 1,44E-03 | 3,67E-04 | 4,85E-05 | 1,33E-06 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 18  | 3,55E-06 | 1,33E-05 | 7,81E-05 | 1,17E-04 | 9,88E-05 | 1,09E-04 | 5,74E-05 | 1,46E-05 | 1,93E-06 | 5,29E-08            | 0,00E+00 | 0,00E+00 | 18 | 3,55E-06 | 1,33E-05 | 7,81E-05 | 1,17E-04 | 9,88E-05 | 1,09E-04 | 5,74E-05 | 1,46E-05 | 1,93E-06 | 5,29E-08 | 0,00E+00 | 0,00E+00 |          |      |
| Achslastklassen |  | 20  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00            | 0,00E+00 | 0,00E+00 | 20 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |
| Achslastklassen |  | 22  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00            | 0,00E+00 | 0,00E+00 | 22 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |
|                 |  | <b>Schädigungssumme (inkl. Shift-Faktor und Sicherheitsbeiwert):</b>                          |          |          |          |          |          |          |          |          |          | <b>0,29</b>         |          |          |    |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                 |  | <b>Nachweis: Reflektionsrissbildung (3PB)</b>   |          |          |          |          |          |          |          |          |          |                     |          |          |    |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                 |  | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |          |          |          |          |          |          |          |          |          |                     |          |          |    |          |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Achslastklassen |  | 2   | 1,3      | 1,1      | 1,0      | 0,8      | 0,6      | 0,4      | 0,3      | 0,1      | 0,0      | 0,0                 | -0,1     | -0,1     | 2  | 1,3      | 1,1      | 1,0      | 0,8      | 0,6      | 0,4      | 0,3      | 0,1      | 0,0      | 0,0      | -0,1     | -0,1     |          |      |
| Achslastklassen |  | 4   | 2,5      | 2,3      | 2,0      | 1,7      | 1,3      | 0,9      | 0,5      | 0,3      | 0,1      | 0,1                 | -0,1     | -0,2     | 4  | 2,5      | 2,3      | 2,0      | 1,7      | 1,3      | 0,9      | 0,5      | 0,3      | 0,1      | 0,1      | -0,1     | -0,2     |          |      |
| Achslastklassen |  | 6   | 3,8      | 3,4      | 3,0      | 2,5      | 1,9      | 1,3      | 0,8      | 0,4      | 0,1      | 0,1                 | -0,1     | -0,2     | 6  | 3,8      | 3,4      | 3,0      | 2,5      | 1,9      | 1,3      | 0,8      | 0,4      | 0,1      | 0,1      | -0,1     | -0,2     |          |      |
| Achslastklassen |  | 8   | 5,0      | 4,6      | 4,0      | 3,4      | 2,6      | 1,7      | 1,0      | 0,5      | 0,1      | -0,1                | -0,3     | -0,4     | 8  | 5,0      | 4,6      | 4,0      | 3,4      | 2,6      | 1,7      | 1,0      | 0,5      | 0,1      | -0,1     | -0,3     | -0,4     |          |      |
| Achslastklassen |  | 10  | 6,3      | 5,7      | 5,0      | 4,2      | 3,2      | 2,2      | 1,3      | 0,7      | 0,2      | -0,2                | -0,4     | -0,5     | 10 | 6,3      | 5,7      | 5,0      | 4,2      | 3,2      | 2,2      | 1,3      | 0,7      | 0,2      | -0,2     | -0,4     | -0,5     |          |      |
| Achslastklassen |  | 12  | 7,5      | 6,9      | 6,0      | 5,0      | 3,8      | 2,6      | 1,6      | 0,8      | 0,2      | -0,2                | -0,5     | -0,6     | 12 | 7,5      | 6,9      | 6,0      | 5,0      | 3,8      | 2,6      | 1,6      | 0,8      | 0,2      | -0,2     | -0,5     | -0,6     |          |      |
| Achslastklassen |  | 14  | 8,8      | 8,0      | 7,0      | 5,9      | 4,5      | 3,1      | 1,8      | 0,9      | 0,2      | -0,2                | -0,5     | -0,7     | 14 | 8,8      | 8,0      | 7,0      | 5,9      | 4,5      | 3,1      | 1,8      | 0,9      | 0,2      | -0,2     | -0,5     | -0,7     |          |      |
| Achslastklassen |  | 16  | 10,0     | 9,2      | 8,1      | 6,7      | 5,1      | 3,5      | 2,1      | 1,0      | 0,3      | -0,3                | -0,6     | -0,8     | 16 | 10,0     | 9,2      | 8,1      | 6,7      | 5,1      | 3,5      | 2,1      | 1,0      | 0,3      | -0,3     | -0,6     | -0,8     |          |      |
| Achslastklassen |  | 18  | 11,3     | 10,3     | 9,1      | 7,5      | 5,8      | 3,9      | 2,3      | 1,2      | 0,3      | -0,3                | -0,7     | -0,9     | 18 | 11,3     | 10,3     | 9,1      | 7,5      | 5,8      | 3,9      | 2,3      | 1,2      | 0,3      | -0,3     | -0,7     | -0,9     |          |      |
| Achslastklassen |  | 20  | 12,5     | 11,4     | 10,1     | 8,4      | 6,4      | 4,4      | 2,6      | 1,3      | 0,3      | -0,3                | -0,8     | -1,1     | 20 | 12,5     | 11,4     | 10,1     | 8,4      | 6,4      | 4,4      | 2,6      | 1,3      | 0,3      | -0,3     | -0,8     | -1,1     |          |      |
| Achslastklassen |  | 22  | 13,8     | 12,6     | 11,1     | 9,2      | 7,0      | 4,8      | 2,8      | 1,4      | 0,4      | -0,4                | -0,8     | -1,2     | 22 | 13,8     | 12,6     | 11,1     | 9,2      | 7,0      | 4,8      | 2,8      | 1,4      | 0,4      | -0,4     | -0,8     | -1,2     |          |      |

Dimensionierungsrechnung Bk1,8: Referenz (ohne Asphaltanlage)

|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |      |      |      |  |  |  |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|------|------|------|--|--|--|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5 | 42,5 | 47,5 |  |  |  |
| Achslastklassen |  | 2                               | 5,83E+05  | 1,07E+06 | 2,59E+06 | 9,12E+06 | 5,84E+07 | 8,16E+08 | 2,99E+10 | 3,39E+12 | 2,93E+16 |      |      |      |  |  |  |
|                 |  | 4                               | 4,94E+03  | 9,09E+03 | 2,20E+04 | 7,73E+04 | 4,95E+05 | 6,92E+06 | 2,53E+08 | 2,87E+10 | 2,48E+14 |      |      |      |  |  |  |
|                 |  | 6                               | 3,03E+02  | 5,58E+02 | 1,35E+03 | 4,75E+03 | 3,04E+04 | 4,25E+05 | 1,56E+07 | 1,77E+09 | 1,52E+13 |      |      |      |  |  |  |
|                 |  | 8                               | 4,19E+01  | 7,71E+01 | 1,86E+02 | 6,56E+02 | 4,20E+03 | 5,87E+04 | 2,15E+06 | 2,44E+08 | 2,10E+12 |      |      |      |  |  |  |
|                 |  | 10                              | 9,02E+00  | 1,66E+01 | 4,01E+01 | 1,41E+02 | 9,04E+02 | 1,26E+04 | 4,63E+05 | 5,25E+07 | 4,53E+11 |      |      |      |  |  |  |
|                 |  | 12                              | 2,57E+00  | 4,73E+00 | 1,14E+01 | 4,03E+01 | 2,58E+02 | 3,60E+03 | 1,32E+05 | 1,50E+07 | 1,29E+11 |      |      |      |  |  |  |
|                 |  | 14                              | 8,91E-01  | 1,64E+00 | 3,96E+00 | 1,39E+01 | 8,92E+01 | 1,25E+03 | 4,57E+04 | 5,18E+06 | 4,47E+10 |      |      |      |  |  |  |
|                 |  | 16                              | 3,55E-01  | 6,53E-01 | 1,58E+00 | 5,56E+00 | 3,56E+01 | 4,97E+02 | 1,82E+04 | 2,07E+06 | 1,78E+10 |      |      |      |  |  |  |
|                 |  | 18                              | 1,58E-01  | 2,90E-01 | 7,03E-01 | 2,47E+00 | 1,58E+01 | 2,21E+02 | 8,10E+03 | 9,19E+05 | 7,93E+09 |      |      |      |  |  |  |
|                 |  | 20                              | 7,65E-02  | 1,41E-01 | 3,40E-01 | 1,20E+00 | 7,66E+00 | 1,07E+02 | 3,92E+03 | 4,45E+05 | 3,84E+09 |      |      |      |  |  |  |
|                 |  | 22                              | 3,97E-02  | 7,30E-02 | 1,77E-01 | 6,21E-01 | 3,98E+00 | 5,56E+01 | 2,04E+03 | 2,31E+05 | 1,99E+09 |      |      |      |  |  |  |
|                 |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |          |          |      |      |      |  |  |  |
|                 |  | 2                               | 3,23E-03  | 6,73E-03 | 1,55E-02 | 6,05E-03 | 7,90E-04 | 6,85E-05 | 1,45E-06 | 7,50E-09 | 5,47E-13 |      |      |      |  |  |  |
|                 |  | 4                               | 3,50E+00  | 7,29E+00 | 1,68E+01 | 6,55E+00 | 8,55E-01 | 7,41E-02 | 1,57E-03 | 8,11E-06 | 5,92E-10 |      |      |      |  |  |  |
|                 |  | 6                               | 4,54E+01  | 9,47E+01 | 2,18E+02 | 8,51E+01 | 1,11E+01 | 9,63E-01 | 2,04E-02 | 1,05E-04 | 7,69E-09 |      |      |      |  |  |  |
|                 |  | 8                               | 1,92E+02  | 4,00E+02 | 9,21E+02 | 3,60E+02 | 4,70E+01 | 4,07E+00 | 8,51E-02 | 4,46E-04 | 3,25E-08 |      |      |      |  |  |  |
|                 |  | 10                              | 3,92E+02  | 8,17E+02 | 1,88E+03 | 7,35E+02 | 9,58E+01 | 8,31E+00 | 1,76E-01 | 9,09E-04 | 6,63E-08 |      |      |      |  |  |  |
|                 |  | 12                              | 7,10E+02  | 1,48E+03 | 3,40E+03 | 1,33E+03 | 1,74E+02 | 1,50E+01 | 3,18E-01 | 1,65E-03 | 1,20E-07 |      |      |      |  |  |  |
|                 |  | 14                              | 6,01E+02  | 1,25E+03 | 2,88E+03 | 1,13E+03 | 1,47E+02 | 1,27E+01 | 2,70E-01 | 1,40E-03 | 1,02E-07 |      |      |      |  |  |  |
|                 |  | 16                              | 1,85E+02  | 3,85E+02 | 8,86E+02 | 3,47E+02 | 4,52E+01 | 3,92E+00 | 8,29E-02 | 4,29E-04 | 3,13E-08 |      |      |      |  |  |  |
|                 |  | 18                              | 9,21E+00  | 1,92E+01 | 4,42E+01 | 1,73E+01 | 2,25E+00 | 1,95E-01 | 4,13E-03 | 2,14E-05 | 1,56E-09 |      |      |      |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |  |  |  |
|                 |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |          |      |      |      |  |  |  |
|                 |  |                                 | <b>21424,01</b>                                     |          |          |          |          |          |          |          |          |      |      |      |  |  |  |
|                 |  |                                 | <b>Nachweis: Rissernergie (Kellispatversuch)</b>    |          |          |          |          |          |          |          |          |      |      |      |  |  |  |
|                 |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |          |          |      |      |      |  |  |  |
|                 |  | 2                               | 8,62E-02  | 3,09E-01 | 1,55E+00 | 1,82E+00 | 1,17E+00 | 9,51E-01 | 4,04E-01 | 1,01E-01 | 1,24E-02 |      |      |      |  |  |  |
|                 |  | 4                               | 3,16E+00  | 1,14E+01 | 5,70E+01 | 6,67E+01 | 4,31E+01 | 3,49E+01 | 1,48E+01 | 3,70E+00 | 4,56E-01 |      |      |      |  |  |  |
|                 |  | 6                               | 5,68E+00  | 2,04E+01 | 1,02E+02 | 1,20E+02 | 7,73E+01 | 6,26E+01 | 2,66E+01 | 6,64E+00 | 8,18E-01 |      |      |      |  |  |  |
|                 |  | 8                               | 5,89E+00  | 2,12E+01 | 1,06E+02 | 1,24E+02 | 8,02E+01 | 6,50E+01 | 2,76E+01 | 6,89E+00 | 8,49E-01 |      |      |      |  |  |  |
|                 |  | 10                              | 4,05E+00  | 1,45E+01 | 7,29E+01 | 8,53E+01 | 5,51E+01 | 4,46E+01 | 1,90E+01 | 4,73E+00 | 5,83E-01 |      |      |      |  |  |  |
|                 |  | 12                              | 3,01E+00  | 1,08E+01 | 5,42E+01 | 6,35E+01 | 4,10E+01 | 3,32E+01 | 1,41E+01 | 3,52E+00 | 4,33E-01 |      |      |      |  |  |  |
|                 |  | 14                              | 1,20E+00  | 4,31E+00 | 2,16E+01 | 2,53E+01 | 1,64E+01 | 1,33E+01 | 5,63E+00 | 1,40E+00 | 1,73E-01 |      |      |      |  |  |  |
|                 |  | 16                              | 1,92E-01  | 6,91E-01 | 3,47E+00 | 4,08E+00 | 2,62E+00 | 2,12E+00 | 9,02E-01 | 2,25E-01 | 2,77E-02 |      |      |      |  |  |  |
|                 |  | 18                              | 5,40E-03  | 1,94E-02 | 9,72E-02 | 1,14E-01 | 7,35E-02 | 5,95E-02 | 2,53E-02 | 6,31E-03 | 7,78E-04 |      |      |      |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |  |  |  |
|                 |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |          |          |      |      |      |  |  |  |
|                 |  |                                 | <b>1730,22</b>                                      |          |          |          |          |          |          |          |          |      |      |      |  |  |  |

|                 |            | Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Referenz (ohne Asphalteneinlage)           |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |
|-----------------|------------|--|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--|--|--|
|                 |            | Oberflächentemperatur  |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |
|                 |            | -12,5  | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5    | 32,5    | 37,5    | 42,5    | 47,5    |  |  |  |
| Schicht         | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule   |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |
| SMA             | 0,5        | 23.922   | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301   | 892     | 616     |  |  |  |
| SMA             | 0,5        | 23.793   | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342   | 927     | 642     |  |  |  |
| SMA             | 1          | 23.545   | 21.169 | 18.212  | 14.893  | 11.463  | 8.355   | 5.882   | 4.154   | 2.917   | 2.035   | 1.423   | 995     | 695     |  |  |  |
| SMA             | 1          | 23.308   | 20.956 | 18.073  | 14.852  | 11.457  | 8.341   | 5.868   | 4.195   | 2.991   | 2.116   | 1.501   | 1.052   | 748     |  |  |  |
| SMA             | 0,5        | 23.194   | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539   | 1.095   | 775     |  |  |  |
| SMA             | 0,5        | 23.082   | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577   | 1.128   | 801     |  |  |  |
| Asphalteinlage  | 0,5        | 350  | 250    | 125     | 100     | 50      | 22      | 10      | 4       | 1       | 0,5     | 0,5     | 0,5     | 0,5     |  |  |  |
| Alter Asphalt   | 16         | 500  | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     |  |  |  |
| FSS             | 50         | 100  | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     |  |  |  |
| Untergrund      |            | 45   | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      |  |  |  |
|                 |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                         |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |
|                 | 2          | 1.883  | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787   | 942     | 942     |  |  |  |
|                 | 4          | 17.280   | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639  | 8.640   | 8.640   |  |  |  |
|                 | 6          | 13.782   | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317  | 6.891   | 6.891   |  |  |  |
|                 | 8          | 8.047  | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554  | 4.024   | 4.024   |  |  |  |
|                 | 10         | 3.535  | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498  | 1.768   | 1.768   |  |  |  |
|                 | 12         | 1.826  | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522   | 913     | 913     |  |  |  |
|                 | 14         | 536  | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500   | 268     | 268     |  |  |  |
|                 | 16         | 66   | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307     | 33      | 33      |  |  |  |
|                 | 18         | 1  | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7       | 1       | 1       |  |  |  |
|                 | 20         | 0  | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |  |  |  |
|                 | 22         | 0  | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |  |  |  |
|                 |            | <b>Nachweisformat: RDO Asphalt</b>   |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |
|                 |            | <b>Ergebnis des Primärwirkungsmodells: Dehnung an der Unterseite der Asphaltdeckschicht [µm/m]</b> |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |
|                 | 2          | 51.1   | 53.3   | 56.7    | 60.8    | 67.2    | 77.6    | 94.7    | 128.8   | 238.5   | 369.6   | 430.6   | 494.3   | 558.9   |  |  |  |
|                 | 4          | 102.1  | 106.7  | 113.4   | 121.6   | 134.5   | 155.2   | 189.4   | 257.6   | 477.0   | 739.3   | 861.2   | 988.5   | 1.117.9 |  |  |  |
|                 | 6          | 153.2  | 160.0  | 170.1   | 182.4   | 201.7   | 232.8   | 284.1   | 386.4   | 715.6   | 1.108.9 | 1.291.7 | 1.482.8 | 1.676.8 |  |  |  |
|                 | 8          | 204.2  | 213.3  | 226.8   | 243.2   | 269.0   | 310.4   | 378.8   | 515.2   | 954.1   | 1.478.5 | 1.722.3 | 1.977.1 | 2.235.7 |  |  |  |
|                 | 10         | 265.3  | 266.7  | 283.5   | 303.9   | 336.2   | 388.1   | 473.5   | 644.0   | 1.192.6 | 1.848.2 | 2.152.9 | 2.471.4 | 2.794.6 |  |  |  |
|                 | 12         | 306.4  | 320.0  | 340.2   | 364.7   | 403.4   | 465.7   | 568.2   | 772.8   | 1.431.1 | 2.217.8 | 2.583.5 | 2.965.6 | 3.353.6 |  |  |  |
|                 | 14         | 357.4  | 373.3  | 396.9   | 425.5   | 470.7   | 543.3   | 662.8   | 901.6   | 1.669.6 | 2.587.5 | 3.014.0 | 3.459.9 | 3.912.5 |  |  |  |
|                 | 16         | 408.5  | 426.7  | 453.6   | 486.3   | 537.9   | 620.9   | 757.5   | 1.030.4 | 1.908.2 | 2.957.1 | 3.444.6 | 3.954.2 | 4.471.4 |  |  |  |
|                 | 18         | 459.5  | 480.0  | 510.3   | 547.1   | 605.2   | 698.5   | 852.2   | 1.159.2 | 2.146.7 | 3.326.7 | 3.875.2 | 4.448.4 | 5.030.3 |  |  |  |
|                 | 20         | 510.6  | 533.3  | 567.0   | 607.9   | 672.4   | 776.1   | 946.9   | 1.288.0 | 2.385.2 | 3.696.4 | 4.305.8 | 4.942.7 | 5.589.3 |  |  |  |
|                 | 22         | 561.6  | 586.7  | 623.7   | 668.7   | 739.6   | 853.7   | 1.041.6 | 1.416.8 | 2.623.7 | 4.066.0 | 4.736.3 | 5.437.0 | 6.148.2 |  |  |  |
| Achslastklassen |            |  |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |
| Achslastklassen |            |  |        |         |         |         |         |         |         |         |         |         |         |         |  |  |  |

|  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |          |          |          |          |
|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |          |
|  | 2                               | 5.70E+09  | 4.59E+09 | 3.38E+09 | 2.40E+09 | 1.45E+09 | 7.12E+08 | 2.65E+08 | 5.75E+07 | 2.69E+06 | 3.05E+05 | 1.43E+05 | 7.21E+04 | 3.91E+04 |
|  | 4                               | 1.82E+08  | 1.47E+08 | 1.08E+08 | 7.66E+07 | 4.64E+07 | 2.27E+07 | 8.47E+06 | 1.84E+06 | 8.50E+04 | 9.76E+03 | 4.57E+03 | 2.30E+03 | 1.25E+03 |
|  | 6                               | 2.43E+07  | 1.96E+07 | 1.44E+07 | 1.02E+07 | 6.19E+06 | 3.03E+06 | 1.13E+06 | 2.45E+05 | 1.15E+04 | 1.30E+03 | 6.10E+02 | 3.07E+02 | 1.67E+02 |
|  | 8                               | 5.82E+06  | 4.69E+06 | 3.46E+06 | 2.45E+06 | 1.48E+06 | 7.27E+05 | 2.70E+05 | 5.87E+04 | 2.75E+03 | 3.12E+02 | 1.46E+02 | 7.36E+01 | 4.00E+01 |
|  | 10                              | 1.92E+06  | 1.55E+06 | 1.14E+06 | 8.07E+05 | 4.89E+05 | 2.40E+05 | 8.93E+04 | 1.94E+04 | 9.07E+02 | 1.03E+02 | 4.82E+01 | 2.43E+01 | 1.32E+01 |
|  | 12                              | 7.76E+05  | 6.25E+05 | 4.61E+05 | 3.26E+05 | 1.98E+05 | 9.69E+04 | 3.67E+04 | 7.83E+03 | 3.67E+02 | 4.16E+01 | 1.95E+01 | 9.82E+00 | 5.33E+00 |
|  | 14                              | 3.61E+05  | 2.91E+05 | 2.14E+05 | 1.52E+05 | 9.19E+04 | 4.51E+04 | 1.68E+04 | 3.64E+03 | 1.70E+02 | 1.93E+01 | 9.06E+01 | 4.57E+00 | 2.48E+00 |
|  | 16                              | 1.86E+05  | 1.50E+05 | 1.10E+05 | 7.82E+04 | 4.73E+04 | 2.32E+04 | 8.64E+03 | 1.87E+03 | 8.78E+01 | 9.96E+00 | 4.67E+00 | 2.35E+00 | 1.28E+00 |
|  | 18                              | 1.04E+05  | 8.34E+04 | 6.15E+04 | 4.35E+04 | 2.64E+04 | 1.29E+04 | 4.81E+03 | 1.04E+03 | 4.89E+01 | 5.55E+00 | 2.60E+00 | 1.31E+00 | 7.11E-01 |
|  | 20                              | 6.14E+04  | 4.94E+04 | 3.64E+04 | 2.58E+04 | 1.56E+04 | 7.66E+03 | 2.88E+03 | 6.19E+02 | 2.90E+01 | 3.29E+00 | 1.54E+00 | 7.76E-01 | 4.21E-01 |
|  | 22                              | 3.82E+04  | 3.08E+04 | 2.27E+04 | 1.61E+04 | 9.73E+03 | 4.77E+03 | 1.78E+03 | 3.85E+02 | 1.80E+01 | 2.05E+00 | 9.59E-01 | 4.83E-01 | 2.62E-01 |
|  |                                 | <b>Schädigungsquotient</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
|  | 2                               | 1.85E-07  | 7.89E-07 | 5.93E-06 | 1.15E-05 | 3.18E-05 | 7.85E-05 | 1.63E-04 | 4.42E-04 | 5.95E-03 | 3.91E-02 | 6.14E-02 | 1.31E-02 | 2.41E-02 |
|  | 4                               | 4.76E-05  | 2.26E-04 | 1.70E-03 | 3.31E-03 | 9.13E-03 | 2.25E-02 | 4.69E-02 | 1.27E-01 | 1.71E+00 | 1.12E+01 | 1.76E+01 | 3.75E+00 | 6.91E+00 |
|  | 6                               | 2.84E-04  | 1.35E-03 | 1.02E-02 | 1.98E-02 | 5.46E-02 | 1.35E-01 | 2.81E-01 | 7.60E-01 | 1.02E+01 | 6.71E+01 | 1.05E+02 | 2.24E+01 | 4.13E+01 |
|  | 8                               | 6.92E-04  | 3.29E-03 | 2.48E-02 | 4.83E-02 | 1.33E-01 | 3.29E-01 | 6.84E-01 | 1.85E+00 | 2.49E+01 | 1.63E+02 | 2.57E+02 | 5.47E+01 | 1.01E+02 |
|  | 10                              | 9.21E-04  | 4.38E-03 | 3.31E-02 | 6.42E-02 | 1.77E-01 | 4.37E-01 | 9.11E-01 | 2.47E+00 | 3.31E+01 | 2.18E+02 | 3.42E+02 | 7.28E+01 | 1.34E+02 |
|  | 12                              | 1.18E-03  | 5.60E-03 | 4.23E-02 | 8.21E-02 | 2.26E-01 | 5.69E-01 | 1.16E+00 | 3.15E+00 | 4.23E+01 | 2.78E+02 | 4.37E+02 | 9.30E+01 | 1.71E+02 |
|  | 14                              | 7.42E-04  | 3.53E-03 | 2.67E-02 | 5.18E-02 | 1.43E-01 | 3.63E-01 | 7.34E-01 | 1.99E+00 | 2.67E+01 | 1.75E+02 | 2.76E+02 | 5.87E+01 | 1.08E+02 |
|  | 16                              | 1.77E-04  | 8.41E-04 | 6.35E-03 | 1.23E-02 | 3.40E-02 | 8.39E-02 | 1.75E-01 | 4.73E-01 | 6.36E+00 | 4.18E+01 | 6.57E+01 | 1.40E+01 | 2.57E+01 |
|  | 18                              | 7.03E-06  | 3.35E-05 | 2.52E-04 | 4.90E-04 | 1.35E-03 | 3.34E-03 | 6.95E-03 | 1.88E-02 | 2.53E-01 | 1.66E+00 | 2.61E+00 | 5.56E-01 | 1.02E+00 |
|  | 20                              | 0.00E+00  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|  | 22                              | 0.00E+00  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|  |                                 | <b>Schädigungssumme (inkl. Shift-Faktor und Sicherheitsbeiwert): 353,11</b> |          |          |          |          |          |          |          |          |          |          |          |          |
|  |                                 | <b>Nachweis: Rissernergie (Keilspaltversuch)</b>                            |          |          |          |          |          |          |          |          |          |          |          |          |
|  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>                               |          |          |          |          |          |          |          |          |          |          |          |          |
|  | 2                               | 2.09E-01  | 7.86E-01 | 4.33E+00 | 5.72E+00 | 4.71E+00 | 5.83E+00 | 5.58E+00 | 5.17E+00 | 8.90E+00 | 6.68E+00 | 4.13E+00 | 4.83E-01 | 4.32E-01 |
|  | 4                               | 7.69E+00  | 2.89E+01 | 1.59E+02 | 2.10E+02 | 1.73E+02 | 2.14E+02 | 2.05E+02 | 1.90E+02 | 3.27E+02 | 2.45E+02 | 1.52E+02 | 1.77E+01 | 1.59E+01 |
|  | 6                               | 1.38E+01  | 5.18E+01 | 2.85E+02 | 3.77E+02 | 3.10E+02 | 3.84E+02 | 3.68E+02 | 3.40E+02 | 5.86E+02 | 4.40E+02 | 2.72E+02 | 3.18E+01 | 2.85E+01 |
|  | 8                               | 1.43E+01  | 5.38E+01 | 2.96E+02 | 3.91E+02 | 3.22E+02 | 3.99E+02 | 3.82E+02 | 3.53E+02 | 6.08E+02 | 4.57E+02 | 2.83E+02 | 3.30E+01 | 2.96E+01 |
|  | 10                              | 9.83E+00  | 3.69E+01 | 2.03E+02 | 2.68E+02 | 2.21E+02 | 2.74E+02 | 2.62E+02 | 2.42E+02 | 4.18E+02 | 3.14E+02 | 1.94E+02 | 2.27E+01 | 2.03E+01 |
|  | 12                              | 7.31E+00  | 2.74E+01 | 1.51E+02 | 2.00E+02 | 1.64E+02 | 2.04E+02 | 1.95E+02 | 1.80E+02 | 3.11E+02 | 2.33E+02 | 1.44E+02 | 1.68E+01 | 1.51E+01 |
|  | 14                              | 2.92E+00  | 1.10E+01 | 6.03E+01 | 7.97E+01 | 6.56E+01 | 8.13E+01 | 7.78E+01 | 7.20E+01 | 1.24E+02 | 9.32E+01 | 5.76E+01 | 6.73E+00 | 6.03E+00 |
|  | 16                              | 4.68E-01  | 1.76E+00 | 9.66E+00 | 1.28E+01 | 1.05E+01 | 1.30E+01 | 1.29E+01 | 1.15E+01 | 1.99E+01 | 1.49E+01 | 9.23E+00 | 1.08E+00 | 9.65E-01 |
|  | 18                              | 1.31E-02  | 4.92E-02 | 2.71E-01 | 3.58E-01 | 2.95E-01 | 3.65E-01 | 3.49E-01 | 3.23E-01 | 5.57E-01 | 4.19E-01 | 2.59E-01 | 3.02E-02 | 2.71E-02 |
|  | 20                              | 0.00E+00  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|  | 22                              | 0.00E+00  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|  |                                 | <b>Summe Verformungsarbeit: 14300,19</b>                                    |          |          |          |          |          |          |          |          |          |          |          |          |
|  |                                 | <b>#BEZUG!</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
|  |                                 | <b>Achslastklassen</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
|  |                                 | <b>Achslastklassen</b>  |          |          |          |          |          |          |          |          |          |          |          |          |

|                |            | Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Kombinationsprodukt Glas              |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|----------------|------------|---|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--|--|--|
|                |            | Oberflächentemperatur   |        |         |         | -12,5   |         |         |         | -7,5    |         |        |        | -2,5   |  |  |  |
| Schicht        | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule  |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
| SMA            | 0,5        | 23.922  | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301  | 892    | 616    |  |  |  |
| SMA            | 0,5        | 23.793  | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342  | 927    | 642    |  |  |  |
| SMA            | 1          | 23.545  | 21.169 | 18.212  | 14.893  | 11.463  | 8.355   | 5.882   | 4.154   | 2.917   | 2.035   | 1.423  | 995    | 695    |  |  |  |
| SMA            | 1          | 23.308  | 20.956 | 18.073  | 14.852  | 11.457  | 8.341   | 5.868   | 4.195   | 2.991   | 2.116   | 1.501  | 1.062  | 748    |  |  |  |
| SMA            | 0,5        | 23.194  | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539  | 1.095  | 775    |  |  |  |
| SMA            | 0,5        | 23.082  | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577  | 1.128  | 801    |  |  |  |
| Asphalteinlage | 0,5        | 31.833  | 29.932 | 27.644  | 25.099  | 22.350  | 19.786  | 17.758  | 16.441  | 15.487  | 14.778  | 14.272 | 13.901 | 13.630 |  |  |  |
| Alter Asphalt  | 16         | 500   | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    |  |  |  |
| FSS            | 50         | 100   | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100    | 100    | 100    |  |  |  |
| Untergrund     |            | 45  | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     |  |  |  |
|                |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                    |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|                | 2          | 1.883   | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787  | 942    | 942    |  |  |  |
|                | 4          | 17.280  | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639 | 8.640  | 8.640  |  |  |  |
|                | 6          | 13.782  | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317 | 6.891  | 6.891  |  |  |  |
|                | 8          | 8.047   | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554 | 4.024  | 4.024  |  |  |  |
|                | 10         | 3.535   | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498 | 1.768  | 1.768  |  |  |  |
|                | 12         | 1.826   | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522  | 913    | 913    |  |  |  |
|                | 14         | 536   | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500  | 268    | 268    |  |  |  |
|                | 16         | 66  | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307    | 33     | 33     |  |  |  |
|                | 18         | 1   | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7      | 1      | 1      |  |  |  |
|                | 20         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |  |  |  |
|                | 22         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |  |  |  |
|                |            | <b>Nachweis: Reflexionsrisssbildung (3PB)</b>   |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|                |            | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|                | 2          | 1,4   | 1,3    | 1,2     | 1,0     | 0,8     | 0,6     | 0,4     | 0,3     | 0,2     | 0,1     | 0,0    | 0,0    | 0,0    |  |  |  |
|                | 4          | 2,8   | 2,6    | 2,3     | 2,0     | 1,6     | 1,2     | 0,8     | 0,6     | 0,4     | 0,2     | 0,1    | 0,0    | 0,0    |  |  |  |
|                | 6          | 4,2   | 3,9    | 3,5     | 3,0     | 2,4     | 1,8     | 1,3     | 0,9     | 0,5     | 0,3     | 0,1    | 0,0    | 0,0    |  |  |  |
|                | 8          | 5,6   | 5,2    | 4,7     | 4,0     | 3,2     | 2,4     | 1,7     | 1,1     | 0,7     | 0,4     | 0,2    | 0,0    | 0,0    |  |  |  |
|                | 10         | 7,0   | 6,5    | 5,8     | 5,0     | 4,0     | 3,0     | 2,1     | 1,4     | 0,9     | 0,5     | 0,2    | 0,0    | 0,0    |  |  |  |
|                | 12         | 8,4   | 7,8    | 7,0     | 6,0     | 4,9     | 3,6     | 2,5     | 1,7     | 1,1     | 0,6     | 0,3    | 0,0    | 0,0    |  |  |  |
|                | 14         | 9,8   | 9,1    | 8,2     | 7,0     | 5,7     | 4,2     | 2,9     | 2,0     | 1,3     | 0,7     | 0,3    | 0,0    | 0,0    |  |  |  |
|                | 16         | 11,1  | 10,4   | 9,3     | 8,0     | 6,5     | 4,8     | 3,4     | 2,3     | 1,4     | 0,8     | 0,3    | 0,0    | 0,0    |  |  |  |
|                | 18         | 12,5  | 11,7   | 10,5    | 9,0     | 7,3     | 5,4     | 3,8     | 2,6     | 1,6     | 0,9     | 0,4    | 0,0    | 0,0    |  |  |  |
|                | 20         | 13,9  | 12,9   | 11,6    | 10,0    | 8,1     | 6,1     | 4,2     | 2,8     | 1,8     | 1,0     | 0,4    | 0,0    | 0,0    |  |  |  |
|                | 22         | 15,3  | 14,2   | 12,8    | 11,0    | 8,9     | 6,7     | 4,6     | 3,1     | 2,0     | 1,1     | 0,5    | 0,0    | 0,0    |  |  |  |

|                |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|--|--|
|                |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |  |  |  |
| Achslastklasse |  | 2                               | 1,19E+05  | 1,71E+05 | 2,88E+05 | 5,98E+05 | 1,72E+06 | 7,19E+06 | 4,29E+07 | 2,95E+08 | 2,86E+09 | 5,15E+10 | 3,18E+12 | 7,52E+17 |  |  |  |
|                |  | 4                               | 3,96E+03  | 5,68E+03 | 9,56E+03 | 1,99E+04 | 5,70E+04 | 2,39E+05 | 1,42E+06 | 9,79E+06 | 9,50E+07 | 1,71E+09 | 1,06E+11 | 2,50E+16 |  |  |  |
|                |  | 6                               | 5,40E+02  | 7,77E+02 | 1,30E+03 | 2,71E+03 | 7,77E+03 | 3,25E+04 | 1,94E+05 | 1,34E+06 | 1,30E+07 | 2,33E+08 | 1,44E+10 | 3,40E+15 |  |  |  |
|                |  | 8                               | 1,31E+02  | 1,89E+02 | 3,17E+02 | 6,59E+02 | 1,89E+03 | 7,92E+03 | 4,72E+04 | 3,25E+05 | 3,15E+06 | 5,68E+07 | 3,50E+09 | 8,28E+14 |  |  |  |
|                |  | 10                              | 4,39E+01  | 6,30E+01 | 1,06E+02 | 2,20E+02 | 6,32E+02 | 2,65E+03 | 1,58E+04 | 1,09E+05 | 1,05E+06 | 1,90E+07 | 1,17E+09 | 2,77E+14 |  |  |  |
|                |  | 12                              | 1,79E+01  | 2,57E+01 | 4,33E+01 | 8,99E+01 | 2,58E+02 | 1,08E+03 | 6,44E+03 | 4,43E+04 | 4,30E+05 | 7,74E+06 | 4,78E+08 | 1,13E+14 |  |  |  |
|                |  | 14                              | 8,41E+00  | 1,21E+01 | 2,03E+01 | 4,22E+01 | 1,21E+02 | 5,06E+02 | 3,02E+03 | 2,08E+04 | 2,02E+05 | 3,63E+06 | 2,24E+08 | 5,30E+13 |  |  |  |
|                |  | 16                              | 4,36E+00  | 6,22E+00 | 1,05E+01 | 2,19E+01 | 6,28E+01 | 2,63E+02 | 1,57E+03 | 1,08E+04 | 1,05E+05 | 1,88E+06 | 1,16E+08 | 2,75E+13 |  |  |  |
|                |  | 18                              | 2,45E+00  | 3,51E+00 | 5,91E+00 | 1,23E+01 | 3,52E+01 | 1,47E+02 | 8,79E+02 | 6,05E+03 | 5,87E+04 | 1,06E+06 | 6,52E+07 | 1,54E+13 |  |  |  |
|                |  | 20                              | 1,46E+00  | 2,09E+00 | 3,52E+00 | 7,31E+00 | 2,10E+01 | 8,78E+01 | 5,24E+02 | 3,60E+03 | 3,50E+04 | 6,29E+05 | 3,89E+07 | 9,19E+12 |  |  |  |
|                |  | 22                              | 9,12E-01  | 1,31E+00 | 2,20E+00 | 4,58E+00 | 1,31E+01 | 5,50E+01 | 3,28E+02 | 2,26E+03 | 2,19E+04 | 3,94E+05 | 2,43E+07 | 5,75E+12 |  |  |  |
|                |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                |  | 2                               | 1,58E-02  | 4,22E-02 | 1,39E-01 | 9,23E-02 | 2,69E-02 | 7,77E-03 | 1,01E-03 | 8,62E-05 | 5,59E-06 | 2,31E-07 | 2,76E-09 | 1,25E-15 |  |  |  |
|                |  | 4                               | 4,36E+00  | 1,17E+01 | 3,86E+01 | 2,55E+01 | 7,43E+00 | 2,15E+00 | 2,79E-01 | 2,38E-02 | 1,55E-03 | 6,40E-05 | 7,64E-07 | 3,48E-13 |  |  |  |
|                |  | 6                               | 2,55E+01  | 6,82E+01 | 2,25E+02 | 1,49E+02 | 4,35E+01 | 1,26E+01 | 1,63E+00 | 1,39E-01 | 9,04E-03 | 3,74E-04 | 4,47E-06 | 2,02E-12 |  |  |  |
|                |  | 8                               | 6,12E+01  | 1,64E+02 | 5,41E+02 | 3,58E+02 | 1,04E+02 | 3,02E+01 | 3,92E+00 | 3,34E-01 | 2,17E-02 | 8,98E-04 | 1,07E-05 | 4,86E-12 |  |  |  |
|                |  | 10                              | 8,05E+01  | 2,15E+02 | 7,11E+02 | 4,71E+02 | 1,37E+02 | 3,97E+01 | 5,15E+00 | 4,40E-01 | 2,85E-02 | 1,18E-03 | 1,41E-05 | 6,39E-12 |  |  |  |
|                |  | 12                              | 1,02E+02  | 2,72E+02 | 9,00E+02 | 5,96E+02 | 1,73E+02 | 5,02E+01 | 6,52E+00 | 5,56E-01 | 3,61E-02 | 1,49E-03 | 1,78E-05 | 8,08E-12 |  |  |  |
|                |  | 14                              | 6,37E+01  | 1,70E+02 | 5,63E+02 | 3,73E+02 | 1,09E+02 | 3,14E+01 | 4,08E+00 | 3,48E-01 | 2,25E-02 | 9,34E-04 | 1,12E-05 | 5,05E-12 |  |  |  |
|                |  | 16                              | 1,51E+01  | 4,02E+01 | 1,33E+02 | 8,81E+01 | 2,56E+01 | 7,42E+00 | 9,94E-01 | 8,22E-02 | 5,33E-03 | 2,21E-04 | 2,64E-06 | 1,19E-12 |  |  |  |
|                |  | 18                              | 5,95E-01  | 1,59E+00 | 5,26E+00 | 3,48E+00 | 1,01E+00 | 2,93E-01 | 3,81E-02 | 3,25E-03 | 2,11E-04 | 8,73E-06 | 1,04E-07 | 4,72E-14 |  |  |  |
|                |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                |  |                                 | <b>7276,45</b>                                      |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                |  |                                 | <b>Nachweis: Rissernergie (Keilspaltversuch)</b>    |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                |  | 2                               | 1,06E-01  | 3,93E-01 | 2,06E+00 | 2,57E+00 | 1,84E+00 | 1,76E+00 | 9,83E-01 | 3,91E-01 | 1,52E-01 | 6,04E-02 | 1,82E-02 | 1,47E-04 |  |  |  |
|                |  | 4                               | 3,90E+00  | 1,44E+01 | 7,55E+01 | 9,43E+01 | 6,74E+01 | 6,45E+01 | 3,61E+01 | 1,44E+01 | 5,58E+00 | 2,22E+00 | 6,67E-01 | 5,38E-03 |  |  |  |
|                |  | 6                               | 7,00E+00  | 2,59E+01 | 1,35E+02 | 1,69E+02 | 1,21E+02 | 1,16E+02 | 6,47E+01 | 2,58E+01 | 1,00E+01 | 3,98E+00 | 1,20E+00 | 9,66E-03 |  |  |  |
|                |  | 8                               | 7,27E+00  | 2,68E+01 | 1,41E+02 | 1,78E+02 | 1,26E+02 | 1,20E+02 | 6,72E+01 | 2,67E+01 | 1,04E+01 | 4,13E+00 | 1,24E+00 | 1,00E-02 |  |  |  |
|                |  | 10                              | 4,99E+00  | 1,84E+01 | 9,65E+01 | 1,21E+02 | 8,62E+01 | 8,25E+01 | 4,61E+01 | 1,84E+01 | 7,13E+00 | 2,83E+00 | 8,53E-01 | 6,88E-03 |  |  |  |
|                |  | 12                              | 3,71E+00  | 1,37E+01 | 7,18E+01 | 8,97E+01 | 6,41E+01 | 6,14E+01 | 3,43E+01 | 1,36E+01 | 5,30E+00 | 2,11E+00 | 6,34E-01 | 5,12E-03 |  |  |  |
|                |  | 14                              | 1,48E+00  | 5,47E+00 | 2,87E+01 | 3,58E+01 | 2,56E+01 | 2,45E+01 | 1,37E+01 | 5,45E+00 | 2,12E+00 | 8,42E-01 | 2,53E-01 | 2,04E-03 |  |  |  |
|                |  | 16                              | 2,37E-01  | 8,77E-01 | 4,59E+00 | 5,74E+00 | 4,10E+00 | 3,92E+00 | 2,19E+00 | 8,73E-01 | 3,39E-01 | 1,35E-01 | 4,06E-02 | 3,27E-04 |  |  |  |
|                |  | 18                              | 6,66E-03  | 2,46E-02 | 1,29E-01 | 1,61E-01 | 1,15E-01 | 1,10E-01 | 6,15E-02 | 2,45E-02 | 9,51E-03 | 3,78E-03 | 1,14E-03 | 9,18E-06 |  |  |  |
|                |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                |  |                                 | <b>2787,90</b>                                      |          |          |          |          |          |          |          |          |          |          |          |  |  |  |

|               |            | Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Kombinatornaprodukt Glas              |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|---------------|------------|---|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--|--|--|
|               |            | Oberflächentemperatur   |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|               |            | -12,5   | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5    | 32,5    | 37,5   | 42,5   | 47,5   |  |  |  |
| Schicht       | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule  |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
| SMA           | 0,5        | 23.922  | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301  | 892    | 616    |  |  |  |
| SMA           | 0,5        | 23.793  | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342  | 927    | 642    |  |  |  |
| SMA           | 1          | 23.545  | 21.169 | 18.212  | 14.893  | 11.463  | 8.355   | 5.882   | 4.154   | 2.917   | 2.035   | 1.423  | 995    | 695    |  |  |  |
| SMA           | 1          | 23.308  | 20.956 | 18.073  | 14.852  | 11.457  | 8.341   | 5.868   | 4.195   | 2.991   | 2.116   | 1.501  | 1.062  | 748    |  |  |  |
| SMA           | 0,5        | 23.194  | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539  | 1.095  | 775    |  |  |  |
| SMA           | 0,5        | 23.082  | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577  | 1.128  | 801    |  |  |  |
| Asphaltanlage | 0,5        | 85.921  | 84.229 | 82.192  | 79.926  | 77.479  | 75.197  | 73.392  | 72.219  | 71.370  | 70.739  | 70.288 | 69.958 | 69.716 |  |  |  |
| Alter Asphalt | 16         | 500   | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    |  |  |  |
| FSS           | 50         | 100   | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100    | 100    | 100    |  |  |  |
| Untergrund    |            | 45  | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     |  |  |  |
|               |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                    |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|               | 2          | 1.883   | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787  | 942    | 942    |  |  |  |
|               | 4          | 17.280  | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639 | 8.640  | 8.640  |  |  |  |
|               | 6          | 13.782  | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317 | 6.891  | 6.891  |  |  |  |
|               | 8          | 8.047   | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554 | 4.024  | 4.024  |  |  |  |
|               | 10         | 3.535   | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498 | 1.768  | 1.768  |  |  |  |
|               | 12         | 1.826   | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522  | 913    | 913    |  |  |  |
|               | 14         | 536   | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500  | 268    | 268    |  |  |  |
|               | 16         | 66  | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307    | 33     | 33     |  |  |  |
|               | 18         | 1   | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7      | 1      | 1      |  |  |  |
|               | 20         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |  |  |  |
|               | 22         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |  |  |  |
|               |            | <b>Nachweis: Reflexionsrisssbildung (3PB)</b>   |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|               |            | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |        |         |         |         |         |         |         |         |         |        |        |        |  |  |  |
|               | 2          | 1,0   | 0,9    | 0,8     | 0,7     | 0,5     | 0,3     | 0,2     | 0,1     | 0,0     | 0,0     | 0,0    | -0,1   | -0,1   |  |  |  |
|               | 4          | 2,0   | 1,9    | 1,6     | 1,3     | 1,0     | 0,6     | 0,4     | 0,2     | 0,0     | 0,0     | -0,1   | -0,1   | -0,1   |  |  |  |
|               | 6          | 3,1   | 2,8    | 2,4     | 2,0     | 1,5     | 1,0     | 0,5     | 0,3     | 0,1     | -0,1    | -0,1   | -0,2   | -0,2   |  |  |  |
|               | 8          | 4,1   | 3,7    | 3,2     | 2,6     | 1,9     | 1,3     | 0,7     | 0,4     | 0,1     | -0,1    | -0,2   | -0,2   | -0,3   |  |  |  |
|               | 10         | 5,1   | 4,6    | 4,0     | 3,3     | 2,4     | 1,6     | 0,9     | 0,4     | 0,1     | -0,1    | -0,2   | -0,3   | -0,3   |  |  |  |
|               | 12         | 6,1   | 5,6    | 4,8     | 3,9     | 2,9     | 1,9     | 1,1     | 0,5     | 0,1     | -0,1    | -0,3   | -0,3   | -0,4   |  |  |  |
|               | 14         | 7,2   | 6,5    | 5,6     | 4,6     | 3,4     | 2,2     | 1,3     | 0,6     | 0,2     | -0,1    | -0,3   | -0,4   | -0,5   |  |  |  |
|               | 16         | 8,2   | 7,4    | 6,4     | 5,2     | 3,9     | 2,5     | 1,4     | 0,7     | 0,2     | -0,1    | -0,3   | -0,5   | -0,5   |  |  |  |
|               | 18         | 9,2   | 8,3    | 7,2     | 5,9     | 4,4     | 2,9     | 1,6     | 0,8     | 0,2     | -0,2    | -0,4   | -0,6   | -0,6   |  |  |  |
|               | 20         | 10,2  | 9,3    | 8,0     | 6,5     | 4,9     | 3,2     | 1,8     | 0,9     | 0,2     | -0,2    | -0,4   | -0,7   | -0,7   |  |  |  |
|               | 22         | 11,2  | 10,2   | 8,8     | 7,2     | 5,3     | 3,5     | 2,0     | 1,0     | 0,3     | -0,2    | -0,5   | -0,7   | -0,7   |  |  |  |

|                |  | Ertragbare Anzahl an Lastfällen |  |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |
|----------------|--|---------------------------------|--|----------|----------|----------|----------|----------|----------|----------|-----------|------|------|------|--|--|--|--|
|                |  | -12,5                           | -7,5   | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5      | 37,5 | 42,5 | 47,5 |  |  |  |  |
| Achslastklasse |  | 2                               | 7.17E+05   | 9.51E+05 | 1.43E+06 | 2.57E+06 | 6.07E+06 | 2.04E+07 | 1.03E+08 | 8.03E+08 | 3.11E+09  |      |      |      |  |  |  |  |
|                |  | 4                               | 9.82E+04   | 1.30E+05 | 1.96E+05 | 3.52E+05 | 8.32E+05 | 2.79E+06 | 1.41E+07 | 1.10E+08 | 4.26E+09  |      |      |      |  |  |  |  |
|                |  | 6                               | 3.07E+04   | 4.07E+04 | 6.14E+04 | 1.10E+05 | 2.60E+05 | 8.71E+05 | 4.41E+06 | 3.44E+07 | 1.33E+09  |      |      |      |  |  |  |  |
|                |  | 8                               | 1.35E+04   | 1.78E+04 | 2.69E+04 | 4.83E+04 | 1.14E+05 | 3.82E+05 | 1.93E+06 | 1.51E+07 | 5.83E+08  |      |      |      |  |  |  |  |
|                |  | 10                              | 7.10E+03   | 9.41E+03 | 1.42E+04 | 2.55E+04 | 6.01E+04 | 2.01E+05 | 1.02E+06 | 7.94E+06 | 3.08E+08  |      |      |      |  |  |  |  |
|                |  | 12                              | 4.21E+03   | 5.58E+03 | 8.41E+03 | 1.51E+04 | 3.56E+04 | 1.19E+05 | 6.04E+05 | 4.71E+06 | 1.92E+08  |      |      |      |  |  |  |  |
|                |  | 14                              | 2.70E+03   | 3.59E+03 | 5.41E+03 | 9.70E+03 | 2.29E+04 | 7.67E+04 | 3.88E+05 | 3.03E+06 | 1.17E+08  |      |      |      |  |  |  |  |
|                |  | 16                              | 1.84E+03   | 2.44E+03 | 3.69E+03 | 6.61E+03 | 1.56E+04 | 5.23E+04 | 2.65E+05 | 2.06E+06 | 7.99E+07  |      |      |      |  |  |  |  |
|                |  | 18                              | 1.31E+03   | 1.74E+03 | 2.63E+03 | 4.72E+03 | 1.11E+04 | 3.73E+04 | 1.89E+05 | 1.47E+06 | 5.70E+07  |      |      |      |  |  |  |  |
|                |  | 20                              | 9.72E+02   | 1.29E+03 | 1.94E+03 | 3.49E+03 | 8.23E+03 | 2.76E+04 | 1.40E+05 | 1.09E+06 | 4.21E+07  |      |      |      |  |  |  |  |
|                |  | 22                              | 7.40E+02   | 9.81E+02 | 1.48E+03 | 2.65E+03 | 6.26E+03 | 2.10E+04 | 1.06E+05 | 8.28E+05 | 3.21E+07  |      |      |      |  |  |  |  |
|                |  |                                 | <b>Schädigungsquotient</b>                         |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |
|                |  | 2                               | 2.63E-03   | 7.59E-03 | 2.80E-02 | 2.15E-02 | 7.60E-03 | 2.75E-03 | 4.20E-04 | 3.17E-05 | 5.15E-07  |      |      |      |  |  |  |  |
|                |  | 4                               | 1.76E-01   | 5.08E-01 | 1.88E+00 | 1.44E+00 | 5.09E-01 | 1.84E-01 | 2.82E-02 | 2.12E-03 | 3.45E-05  |      |      |      |  |  |  |  |
|                |  | 6                               | 4.49E-01   | 1.30E+00 | 4.79E+00 | 3.67E+00 | 1.30E+00 | 4.69E-01 | 7.19E-02 | 5.41E-03 | 8.80E-05  |      |      |      |  |  |  |  |
|                |  | 8                               | 5.98E-01   | 1.73E+00 | 6.38E+00 | 4.89E+00 | 1.73E+00 | 6.25E-01 | 9.58E-02 | 7.21E-03 | 1.17E-04  |      |      |      |  |  |  |  |
|                |  | 10                              | 4.98E-01   | 1.44E+00 | 5.32E+00 | 4.07E+00 | 1.44E+00 | 5.21E-01 | 7.98E-02 | 6.01E-03 | 9.77E-05  |      |      |      |  |  |  |  |
|                |  | 12                              | 4.34E-01   | 1.25E+00 | 4.63E+00 | 3.55E+00 | 1.26E+00 | 4.54E-01 | 6.95E-02 | 5.23E-03 | 8.51E-05  |      |      |      |  |  |  |  |
|                |  | 14                              | 1.98E-01   | 5.73E-01 | 2.11E+00 | 1.62E+00 | 5.73E-01 | 2.07E-01 | 3.17E-02 | 2.39E-03 | 3.89E-05  |      |      |      |  |  |  |  |
|                |  | 16                              | 3.56E-02   | 1.03E-01 | 3.80E-01 | 2.91E-01 | 1.03E-01 | 3.73E-02 | 5.71E-03 | 4.30E-04 | 6.99E-06  |      |      |      |  |  |  |  |
|                |  | 18                              | 1.11E-03   | 3.20E-03 | 1.18E-02 | 9.05E-03 | 3.20E-03 | 1.16E-03 | 1.77E-04 | 1.33E-05 | 2.17E-07  |      |      |      |  |  |  |  |
|                |  | 20                              | 0.00E+00   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |      |      |      |  |  |  |  |
|                |  | 22                              | 0.00E+00   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |      |      |      |  |  |  |  |
|                |  |                                 | <b>Schädigungssumme (ohne Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |
|                |  |                                 | <b>64,23</b>                                       |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |
|                |  |                                 | <b>Nachweis: Rissernergie (Keilsparversuch)</b>    |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |
|                |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>      |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |
|                |  | 2                               | 3.33E-02   | 1.14E-01 | 5.30E-01 | 5.55E-01 | 3.00E-01 | 1.83E-01 | 4.60E-02 | 1.07E-03 | -3.47E-03 |      |      |      |  |  |  |  |
|                |  | 4                               | 1.22E+00   | 4.18E+00 | 1.95E+01 | 2.04E+01 | 1.10E+01 | 6.71E+00 | 1.69E+00 | 3.92E-02 | -1.27E-01 |      |      |      |  |  |  |  |
|                |  | 6                               | 2.20E+00   | 7.50E+00 | 3.49E+01 | 3.65E+01 | 1.98E+01 | 1.20E+01 | 3.03E+00 | 7.04E-02 | -2.28E-01 |      |      |      |  |  |  |  |
|                |  | 8                               | 2.28E+00   | 7.79E+00 | 3.63E+01 | 3.79E+01 | 2.05E+01 | 1.25E+01 | 3.14E+00 | 7.31E-02 | -2.37E-01 |      |      |      |  |  |  |  |
|                |  | 10                              | 1.56E+00   | 5.35E+00 | 2.49E+01 | 2.60E+01 | 1.41E+01 | 8.58E+00 | 2.16E+00 | 5.02E-02 | -1.63E-01 |      |      |      |  |  |  |  |
|                |  | 12                              | 1.16E+00   | 3.98E+00 | 1.85E+01 | 1.94E+01 | 1.05E+01 | 6.38E+00 | 1.61E+00 | 3.73E-02 | -1.21E-01 |      |      |      |  |  |  |  |
|                |  | 14                              | 4.65E-01   | 1.59E+00 | 7.39E+00 | 7.73E+00 | 4.18E+00 | 2.55E+00 | 6.41E-01 | 1.49E-02 | -4.83E-02 |      |      |      |  |  |  |  |
|                |  | 16                              | 7.44E-02   | 2.54E-01 | 1.18E+00 | 1.24E+00 | 6.70E-01 | 4.08E-01 | 1.03E-01 | 2.39E-03 | -7.74E-03 |      |      |      |  |  |  |  |
|                |  | 18                              | 2.09E-03   | 7.13E-03 | 3.32E-02 | 3.47E-02 | 1.88E-02 | 1.14E-02 | 2.88E-03 | 6.69E-05 | -2.17E-04 |      |      |      |  |  |  |  |
|                |  | 20                              | 0.00E+00   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |      |      |      |  |  |  |  |
|                |  | 22                              | 0.00E+00   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  |      |      |      |  |  |  |  |
|                |  |                                 | <b>Summe Verformungsarbeit:</b>                    |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |
|                |  |                                 | <b>474,85</b>                                      |          |          |          |          |          |          |          |           |      |      |      |  |  |  |  |



Dimensiohnierungsrechnung Bk1,8: Kombinationsprodukt Kunststoff (5-0)

|               |            | Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Kombinationaprodukt Kunststoff        |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|---------------|------------|---|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|-------|-------|--|--|--|
|               |            | Oberflächentemperatur   |        |         |         | -12,5   |         |         |         | -7,5    |         |        |       | -2,5  |  |  |  |
| Schicht       | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule  |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
| SMA           | 0,5        | 23.922  | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301  | 892   | 616   |  |  |  |
| SMA           | 0,5        | 23.793  | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342  | 927   | 642   |  |  |  |
| SMA           | 1          | 23.545  | 21.169 | 18.212  | 14.893  | 11.463  | 8.355   | 5.882   | 4.154   | 2.917   | 2.035   | 1.423  | 995   | 695   |  |  |  |
| SMA           | 1          | 23.308  | 20.956 | 18.073  | 14.852  | 11.457  | 8.341   | 5.868   | 4.195   | 2.991   | 2.116   | 1.501  | 1.062 | 748   |  |  |  |
| SMA           | 0,5        | 23.194  | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539  | 1.095 | 775   |  |  |  |
| SMA           | 0,5        | 23.082  | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577  | 1.128 | 801   |  |  |  |
| Asphaltanlage | 0,5        | 19.377  | 17.476 | 15.188  | 12.643  | 9.894   | 7.330   | 5.302   | 3.985   | 3.031   | 2.322   | 1.816  | 1.445 | 1.174 |  |  |  |
| Alter Asphalt | 16         | 500   | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500   | 500   |  |  |  |
| FSS           | 50         | 100   | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100    | 100   | 100   |  |  |  |
| Untergrund    |            | 45  | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45    | 45    |  |  |  |
|               |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                    |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|               | 2          | 1.883   | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787  | 942   | 942   |  |  |  |
|               | 4          | 17.280  | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639 | 8.640 | 8.640 |  |  |  |
|               | 6          | 13.782  | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317 | 6.891 | 6.891 |  |  |  |
|               | 8          | 8.047   | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554 | 4.024 | 4.024 |  |  |  |
|               | 10         | 3.535   | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498 | 1.768 | 1.768 |  |  |  |
|               | 12         | 1.826   | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522  | 913   | 913   |  |  |  |
|               | 14         | 536   | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500  | 268   | 268   |  |  |  |
|               | 16         | 66  | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307    | 33    | 33    |  |  |  |
|               | 18         | 1   | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7      | 1     | 1     |  |  |  |
|               | 20         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0     | 0     |  |  |  |
|               | 22         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0     | 0     |  |  |  |
|               |            | <b>Nachweis: Reflexionsrisssbildung (3PB)</b>   |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|               |            | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|               | 2          | 1,5   | 1,4    | 1,3     | 1,1     | 0,9     | 0,7     | 0,5     | 0,4     | 0,3     | 0,2     | 0,1    | 0,1   | 0,1   |  |  |  |
|               | 4          | 3,0   | 2,8    | 2,6     | 2,3     | 1,9     | 1,5     | 1,1     | 0,8     | 0,6     | 0,4     | 0,3    | 0,2   | 0,1   |  |  |  |
|               | 6          | 4,6   | 4,3    | 3,9     | 3,4     | 2,8     | 2,2     | 1,6     | 1,2     | 0,9     | 0,6     | 0,4    | 0,3   | 0,2   |  |  |  |
|               | 8          | 6,1   | 5,7    | 5,2     | 4,5     | 3,8     | 2,9     | 2,2     | 1,6     | 1,1     | 0,8     | 0,5    | 0,3   | 0,2   |  |  |  |
|               | 10         | 7,6   | 7,1    | 6,5     | 5,7     | 4,7     | 3,7     | 2,7     | 2,0     | 1,4     | 1,0     | 0,7    | 0,4   | 0,3   |  |  |  |
|               | 12         | 9,1   | 8,5    | 7,8     | 6,8     | 5,6     | 4,4     | 3,3     | 2,4     | 1,7     | 1,2     | 0,8    | 0,5   | 0,3   |  |  |  |
|               | 14         | 10,6  | 9,9    | 9,1     | 7,9     | 6,6     | 5,1     | 3,8     | 2,8     | 2,0     | 1,4     | 0,9    | 0,6   | 0,4   |  |  |  |
|               | 16         | 12,1  | 11,4   | 10,3    | 9,1     | 7,5     | 5,9     | 4,3     | 3,2     | 2,3     | 1,6     | 1,1    | 0,7   | 0,4   |  |  |  |
|               | 18         | 13,7  | 12,8   | 11,6    | 10,2    | 8,5     | 6,6     | 4,9     | 3,6     | 2,6     | 1,8     | 1,2    | 0,8   | 0,5   |  |  |  |
|               | 20         | 15,2  | 14,2   | 12,9    | 11,3    | 9,4     | 7,3     | 5,4     | 4,0     | 2,9     | 2,0     | 1,3    | 0,9   | 0,5   |  |  |  |
|               | 22         | 16,7  | 15,6   | 14,2    | 12,5    | 10,3    | 8,1     | 6,0     | 4,4     | 3,1     | 2,2     | 1,5    | 1,0   | 0,6   |  |  |  |

|                |  | Ertragbare Anzahl an Lastfällen |  |          |          |          |          |          |          |          |          |          |          |          |          |
|----------------|--|---------------------------------|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                |  | -12,5                           | -7,5   | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |          |
| Achslastklasse |  | 2                               | 6,18E+05   | 1,25E+06 | 3,44E+06 | 1,40E+07 | 1,04E+08 | 1,50E+09 | 3,77E+10 | 1,02E+12 | 3,70E+13 | 1,92E+15 | 1,30E+17 | 1,32E+19 | 2,61E+21 |
|                |  | 4                               | 3,69E+02   | 7,47E+02 | 2,05E+03 | 8,37E+03 | 6,21E+04 | 8,95E+05 | 2,29E+07 | 6,11E+08 | 2,21E+10 | 1,15E+12 | 7,77E+13 | 7,89E+15 | 1,56E+18 |
|                |  | 6                               | 4,79E+00   | 9,72E+00 | 2,67E+01 | 1,09E+02 | 8,07E+02 | 1,16E+04 | 2,92E+05 | 7,94E+06 | 2,87E+08 | 1,49E+10 | 1,01E+12 | 1,03E+14 | 2,02E+16 |
|                |  | 8                               | 2,20E-01   | 4,46E-01 | 1,23E+00 | 5,00E+00 | 3,70E+01 | 5,34E+02 | 1,34E+04 | 3,65E+05 | 1,32E+07 | 6,84E+08 | 4,64E+10 | 4,71E+12 | 9,28E+14 |
|                |  | 10                              | 2,02E-02   | 4,09E-02 | 1,12E-01 | 4,58E-01 | 3,39E+00 | 4,89E+01 | 1,23E+03 | 3,34E+04 | 1,21E+06 | 6,27E+07 | 4,25E+09 | 4,31E+11 | 8,50E+13 |
|                |  | 12                              | 2,86E-03   | 5,80E-03 | 1,59E-02 | 6,49E-02 | 4,82E-01 | 6,94E+00 | 1,74E+02 | 4,74E+03 | 1,71E+05 | 8,90E+06 | 6,03E+08 | 6,12E+10 | 1,21E+13 |
|                |  | 14                              | 5,49E-04   | 1,11E-03 | 3,06E-03 | 1,25E-02 | 9,24E-02 | 1,33E+00 | 3,34E+01 | 9,09E+02 | 3,28E+04 | 1,71E+06 | 1,16E+08 | 1,17E+10 | 2,31E+12 |
|                |  | 16                              | 1,31E-04   | 2,66E-04 | 7,31E-04 | 2,98E-03 | 2,21E-02 | 3,19E-01 | 8,00E+00 | 2,18E+02 | 7,85E+03 | 4,08E+05 | 2,77E+07 | 2,81E+09 | 5,54E+11 |
|                |  | 18                              | 3,72E-05   | 7,54E-05 | 2,07E-04 | 8,44E-04 | 6,26E-03 | 9,02E-02 | 2,27E+00 | 6,16E+01 | 2,22E+03 | 1,16E+05 | 7,84E+06 | 7,95E+08 | 1,57E+11 |
|                |  | 20                              | 1,20E-05   | 2,44E-05 | 6,70E-05 | 2,73E-04 | 2,02E-03 | 2,92E-02 | 7,33E-01 | 1,99E+01 | 7,20E+02 | 3,74E+04 | 2,54E+06 | 2,57E+08 | 5,07E+10 |
|                |  | 22                              | 4,33E-06   | 8,78E-06 | 2,41E-05 | 9,84E-05 | 7,30E-04 | 1,05E-02 | 2,84E-01 | 7,18E+00 | 2,59E+02 | 1,35E+04 | 9,13E+05 | 9,27E+07 | 1,83E+10 |
|                |  |                                 | <b>Schädigungsquotient</b>                         |          |          |          |          |          |          |          |          |          |          |          |          |
|                |  | 2                               | 9,36E-03   | 2,80E-02 | 1,10E-01 | 9,25E-02 | 3,84E-02 | 1,84E-02 | 4,84E-03 | 8,61E-04 | 1,55E-04 | 2,92E-05 | 4,96E-06 | 1,06E-07 | 1,69E-08 |
|                |  | 4                               | 1,14E+00   | 3,42E+00 | 1,34E+01 | 1,13E+01 | 4,68E+00 | 2,24E+00 | 5,85E-01 | 1,05E-01 | 1,89E-02 | 3,56E-03 | 6,05E-04 | 1,30E-05 | 2,06E-06 |
|                |  | 6                               | 4,13E+00   | 1,24E+01 | 4,84E+01 | 4,08E+01 | 1,70E+01 | 8,11E+00 | 2,04E+00 | 3,80E-01 | 6,86E-02 | 1,29E-02 | 2,19E-03 | 4,69E-05 | 7,44E-06 |
|                |  | 8                               | 7,05E+00   | 2,17E+01 | 8,27E+01 | 6,97E+01 | 2,90E+01 | 1,38E+01 | 3,49E+00 | 6,49E-01 | 1,17E-01 | 2,20E-02 | 3,74E-03 | 8,01E-05 | 1,27E-05 |
|                |  | 10                              | 7,12E+00   | 2,13E+01 | 8,35E+01 | 7,04E+01 | 2,93E+01 | 1,40E+01 | 3,53E+00 | 6,55E-01 | 1,18E-01 | 2,23E-02 | 3,78E-03 | 8,09E-05 | 1,28E-05 |
|                |  | 12                              | 7,26E+00   | 2,18E+01 | 8,52E+01 | 7,18E+01 | 2,98E+01 | 1,43E+01 | 3,60E+00 | 6,68E-01 | 1,21E-01 | 2,27E-02 | 3,85E-03 | 8,25E-05 | 1,31E-05 |
|                |  | 14                              | 3,79E+00   | 1,13E+01 | 4,44E+01 | 3,74E+01 | 1,56E+01 | 7,44E+00 | 1,88E+00 | 3,48E-01 | 6,29E-02 | 1,18E-02 | 2,01E-03 | 4,30E-05 | 6,83E-06 |
|                |  | 16                              | 7,64E-01   | 2,29E+00 | 8,96E+00 | 7,55E+00 | 3,14E+00 | 1,50E+00 | 3,79E-01 | 7,03E-02 | 1,27E-02 | 2,39E-03 | 4,05E-04 | 8,68E-06 | 1,38E-06 |
|                |  | 18                              | 2,63E-02   | 7,88E-02 | 3,08E-01 | 2,60E-01 | 1,08E-01 | 5,16E-02 | 1,30E-02 | 2,42E-03 | 4,37E-04 | 8,21E-05 | 1,39E-05 | 2,99E-07 | 4,74E-08 |
|                |  | 20                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                |  | 22                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                |  |                                 | <b>Schädigungssumme (ohne Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |          |          |          |          |          |
|                |  |                                 | <b>1010,37</b>                                     |          |          |          |          |          |          |          |          |          |          |          |          |
|                |  |                                 | <b>Nachweis: Rissernergie (Keilspaltversuch)</b>   |          |          |          |          |          |          |          |          |          |          |          |          |
|                |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>      |          |          |          |          |          |          |          |          |          |          |          |          |
|                |  | 2                               | 1,26E-01   | 4,72E-01 | 2,53E+00 | 3,27E+00 | 2,46E+00 | 2,55E+00 | 1,60E+00 | 7,33E-01 | 3,49E-01 | 1,91E-01 | 1,01E-01 | 7,69E-03 | 5,25E-03 |
|                |  | 4                               | 4,62E+00   | 1,73E+01 | 9,29E+01 | 1,20E+02 | 9,04E+01 | 9,36E+01 | 5,86E+01 | 2,69E+01 | 1,28E+01 | 7,01E+00 | 3,72E+00 | 2,82E-01 | 1,93E-01 |
|                |  | 6                               | 8,29E+00   | 3,11E+01 | 1,67E+02 | 2,15E+02 | 1,62E+02 | 1,68E+02 | 1,05E+02 | 4,83E+01 | 2,30E+01 | 1,26E+01 | 6,68E+00 | 5,07E-01 | 3,46E-01 |
|                |  | 8                               | 8,61E+00   | 3,23E+01 | 1,73E+02 | 2,23E+02 | 1,68E+02 | 1,74E+02 | 1,09E+02 | 5,02E+01 | 2,39E+01 | 1,30E+01 | 6,94E+00 | 5,26E-01 | 3,59E-01 |
|                |  | 10                              | 5,91E+00   | 2,22E+01 | 1,19E+02 | 1,53E+02 | 1,16E+02 | 1,20E+02 | 7,49E+01 | 3,44E+01 | 1,64E+01 | 8,96E+00 | 4,76E+00 | 3,61E-01 | 2,47E-01 |
|                |  | 12                              | 4,40E+00   | 1,65E+01 | 8,83E+01 | 1,14E+02 | 8,60E+01 | 8,90E+01 | 5,57E+01 | 2,56E+01 | 1,22E+01 | 6,66E+00 | 3,54E+00 | 2,69E-01 | 1,83E-01 |
|                |  | 14                              | 1,76E+00   | 6,58E+00 | 3,53E+01 | 4,58E+01 | 3,43E+01 | 3,55E+01 | 2,23E+01 | 1,02E+01 | 4,87E+00 | 2,66E+00 | 1,41E+00 | 1,07E-01 | 7,32E-02 |
|                |  | 16                              | 2,81E-01   | 1,03E+00 | 5,65E+00 | 7,30E+00 | 5,50E+00 | 5,69E+00 | 3,56E+00 | 1,64E+00 | 7,80E-01 | 4,26E-01 | 2,26E-01 | 1,72E-02 | 1,17E-02 |
|                |  | 18                              | 7,88E-03   | 2,96E-02 | 1,58E-01 | 2,05E-01 | 1,54E-01 | 1,60E-01 | 1,00E-01 | 4,59E-02 | 2,19E-02 | 1,20E-02 | 6,35E-03 | 4,82E-04 | 3,29E-04 |
|                |  | 20                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                |  | 22                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                |  |                                 | <b>Summe Verformungsarbeit:</b>                    |          |          |          |          |          |          |          |          |          |          |          |          |
|                |  |                                 | <b>3886,54</b>                                     |          |          |          |          |          |          |          |          |          |          |          |          |

| Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Glasgitter                            |            |                       |        |         |         |         |         |         |         |         |         |        |        |        |  |  |
|---|------------|-----------------------|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--|--|
|   |            | Oberflächentemperatur |        |         |         |         |         |         |         |         |         |        |        |        |  |  |
| Schicht   | Dicke [cm] | -12,5                 | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5    | 32,5    | 37,5   | 42,5   | 47,5   |  |  |
| Schichtaufbau und Steifigkeitsmodule  |            |                       |        |         |         |         |         |         |         |         |         |        |        |        |  |  |
| SMA   | 0,5        | 23.922                | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301  | 892    | 616    |  |  |
| SMA   | 0,5        | 23.793                | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342  | 927    | 642    |  |  |
| SMA   | 1          | 23.606                | 21.225 | 18.249  | 14.903  | 11.464  | 8.358   | 5.886   | 4.143   | 2.897   | 2.014   | 1.403  | 978    | 682    |  |  |
| SMA   | 1          | 23.366                | 21.008 | 18.107  | 14.862  | 11.459  | 8.344   | 5.871   | 4.185   | 2.973   | 2.096   | 1.481  | 1.045  | 735    |  |  |
| SMA   | 0,5        | 23.194                | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539  | 1.095  | 775    |  |  |
| SMA   | 0,5        | 23.082                | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577  | 1.128  | 801    |  |  |
| Asphaltanlage   | 0,5        | 31.815                | 29.916 | 27.634  | 25.096  | 22.349  | 19.785  | 17.757  | 16.444  | 15.493  | 14.785  | 14.278 | 13.906 | 13.634 |  |  |
| Alter Asphalt   | 16         | 500                   | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    |  |  |
| FSS   | 50         | 100                   | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100    | 100    | 100    |  |  |
| Untergrund  |            | 45                    | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     |  |  |
| <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                    |            |                       |        |         |         |         |         |         |         |         |         |        |        |        |  |  |
|   | 2          | 1.883                 | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787  | 942    | 942    |  |  |
|   | 4          | 17.280                | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639 | 8.640  | 8.640  |  |  |
|   | 6          | 13.782                | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317 | 6.891  | 6.891  |  |  |
|   | 8          | 8.047                 | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554 | 4.024  | 4.024  |  |  |
|   | 10         | 3.535                 | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498 | 1.768  | 1.768  |  |  |
|   | 12         | 1.826                 | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522  | 913    | 913    |  |  |
|   | 14         | 536                   | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500  | 268    | 268    |  |  |
|   | 16         | 66                    | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307    | 33     | 33     |  |  |
|   | 18         | 1                     | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7      | 1      | 1      |  |  |
|   | 20         | 0                     | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |  |  |
|   | 22         | 0                     | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |  |  |
| <b>Nachweis: Reflexionsrisssbildung (3PB)</b>   |            |                       |        |         |         |         |         |         |         |         |         |        |        |        |  |  |
| <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |            |                       |        |         |         |         |         |         |         |         |         |        |        |        |  |  |
|   | 2          | 1,0                   | 0,9    | 0,8     | 0,7     | 0,5     | 0,3     | 0,2     | 0,1     | 0,0     | 0,0     | -0,1   | -0,1   | -0,1   |  |  |
|   | 4          | 2,1                   | 1,9    | 1,7     | 1,4     | 1,0     | 0,7     | 0,4     | 0,2     | 0,0     | -0,1    | -0,1   | -0,2   | -0,2   |  |  |
|   | 6          | 3,1                   | 2,8    | 2,5     | 2,0     | 1,5     | 1,0     | 0,6     | 0,3     | 0,1     | -0,1    | -0,2   | -0,2   | -0,3   |  |  |
|   | 8          | 4,1                   | 3,8    | 3,3     | 2,7     | 2,1     | 1,4     | 0,8     | 0,4     | 0,1     | -0,1    | -0,3   | -0,3   | -0,4   |  |  |
|   | 10         | 5,2                   | 4,7    | 4,1     | 3,4     | 2,6     | 1,7     | 1,0     | 0,5     | 0,1     | -0,2    | -0,3   | -0,4   | -0,4   |  |  |
|   | 12         | 6,2                   | 5,7    | 5,0     | 4,1     | 3,1     | 2,1     | 1,2     | 0,6     | 0,1     | -0,2    | -0,4   | -0,5   | -0,5   |  |  |
|   | 14         | 7,2                   | 6,6    | 5,8     | 4,8     | 3,6     | 2,4     | 1,4     | 0,7     | 0,1     | -0,2    | -0,5   | -0,6   | -0,6   |  |  |
|   | 16         | 8,3                   | 7,5    | 6,6     | 5,5     | 4,1     | 2,8     | 1,6     | 0,7     | 0,1     | -0,3    | -0,5   | -0,7   | -0,7   |  |  |
|   | 18         | 9,3                   | 8,5    | 7,4     | 6,1     | 4,6     | 3,1     | 1,8     | 0,8     | 0,2     | -0,3    | -0,6   | -0,7   | -0,8   |  |  |
|   | 20         | 10,3                  | 9,4    | 8,3     | 6,8     | 5,2     | 3,5     | 2,0     | 0,9     | 0,2     | -0,3    | -0,6   | -0,8   | -0,9   |  |  |
|   | 22         | 11,3                  | 10,4   | 9,1     | 7,5     | 5,7     | 3,8     | 2,2     | 1,0     | 0,2     | -0,4    | -0,7   | -0,9   | -1,0   |  |  |



|                |            | Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Kunststoffgitter                      |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|----------------|------------|---|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|-------|-------|--|--|--|
|                |            | Oberflächentemperatur   |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
| Schicht        | Dicke [cm] | -12,5   | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5    | 32,5    | 37,5   | 42,5  | 47,5  |  |  |  |
| SMA            | 0,5        | Schichtaufbau und Steifigkeitsmodule  |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
| SMA            | 0,5        | 23.922  | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301  | 892   | 616   |  |  |  |
| SMA            | 0,5        | 23.793  | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342  | 927   | 642   |  |  |  |
| SMA            | 1          | 23.545  | 21.169 | 18.212  | 14.893  | 11.463  | 8.355   | 5.882   | 4.154   | 2.917   | 2.035   | 1.423  | 995   | 695   |  |  |  |
| SMA            | 1          | 23.308  | 20.956 | 18.073  | 14.852  | 11.457  | 8.341   | 5.868   | 4.195   | 2.991   | 2.116   | 1.501  | 1.062 | 748   |  |  |  |
| SMA            | 0,5        | 23.194  | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539  | 1.095 | 775   |  |  |  |
| SMA            | 0,5        | 23.082  | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577  | 1.128 | 801   |  |  |  |
| Asphalteinlage | 0,5        | 19.377  | 17.476 | 15.188  | 12.643  | 9.894   | 7.330   | 5.302   | 3.985   | 3.031   | 2.322   | 1.816  | 1.445 | 1.174 |  |  |  |
| Alter Asphalt  | 16         | 500   | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500   | 500   |  |  |  |
| FSS            | 50         | 100   | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100    | 100   | 100   |  |  |  |
| Untergrund     |            | 45  | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45    | 45    |  |  |  |
|                |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                    |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|                | 2          | 1.883   | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787  | 942   | 942   |  |  |  |
|                | 4          | 17.280  | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639 | 8.640 | 8.640 |  |  |  |
|                | 6          | 13.782  | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317 | 6.891 | 6.891 |  |  |  |
|                | 8          | 8.047   | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554 | 4.024 | 4.024 |  |  |  |
|                | 10         | 3.535   | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498 | 1.768 | 1.768 |  |  |  |
|                | 12         | 1.826   | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522  | 913   | 913   |  |  |  |
|                | 14         | 536   | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500  | 268   | 268   |  |  |  |
|                | 16         | 66  | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307    | 33    | 33    |  |  |  |
|                | 18         | 1   | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7      | 1     | 1     |  |  |  |
|                | 20         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0     | 0     |  |  |  |
|                | 22         | 0   | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0     | 0     |  |  |  |
|                |            | <b>Nachweis: Reflexionsrisssbildung (3PB)</b>   |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|                |            | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |        |         |         |         |         |         |         |         |         |        |       |       |  |  |  |
|                | 2          | 1,1   | 1,0    | 0,9     | 0,8     | 0,6     | 0,4     | 0,3     | 0,1     | 0,1     | 0,0     | -0,1   | -0,1  | -0,1  |  |  |  |
|                | 4          | 2,2   | 2,0    | 1,8     | 1,5     | 1,2     | 0,8     | 0,5     | 0,3     | 0,1     | 0,0     | -0,1   | -0,2  | -0,2  |  |  |  |
|                | 6          | 3,3   | 3,1    | 2,7     | 2,3     | 1,8     | 1,2     | 0,8     | 0,4     | 0,2     | 0,0     | -0,2   | -0,2  | -0,3  |  |  |  |
|                | 8          | 4,5   | 4,1    | 3,6     | 3,1     | 2,4     | 1,7     | 1,0     | 0,6     | 0,2     | -0,1    | -0,2   | -0,3  | -0,4  |  |  |  |
|                | 10         | 5,6   | 5,1    | 4,5     | 3,8     | 3,0     | 2,1     | 1,3     | 0,7     | 0,3     | -0,1    | -0,3   | -0,4  | -0,5  |  |  |  |
|                | 12         | 6,7   | 6,1    | 5,4     | 4,6     | 3,6     | 2,5     | 1,5     | 0,8     | 0,3     | -0,1    | -0,3   | -0,5  | -0,5  |  |  |  |
|                | 14         | 7,8   | 7,1    | 6,4     | 5,3     | 4,1     | 2,9     | 1,8     | 1,0     | 0,4     | -0,1    | -0,4   | -0,5  | -0,6  |  |  |  |
|                | 16         | 8,9   | 8,2    | 7,3     | 6,1     | 4,7     | 3,3     | 2,0     | 1,1     | 0,4     | -0,1    | -0,4   | -0,6  | -0,7  |  |  |  |
|                | 18         | 10,0  | 9,2    | 8,2     | 6,9     | 5,3     | 3,7     | 2,3     | 1,2     | 0,5     | -0,1    | -0,5   | -0,7  | -0,8  |  |  |  |
|                | 20         | 11,2  | 10,2   | 9,1     | 7,6     | 5,9     | 4,1     | 2,5     | 1,4     | 0,5     | -0,1    | -0,5   | -0,8  | -0,9  |  |  |  |
|                | 22         | 12,3  | 11,2   | 10,0    | 8,4     | 6,5     | 4,5     | 2,8     | 1,5     | 0,6     | -0,1    | -0,6   | -0,9  | -1,0  |  |  |  |



| Instandsetzung: Befestigung der Belastungsklasse Bk1,8: Glasgitter                            |            |                                      |        |         |         |         |         |         |         |         |         |        |        |        |
|---|------------|--------------------------------------|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
|   |            | Oberflächentemperatur                |        |         |         |         |         |         |         |         |         |        |        |        |
| Schicht   | Dicke [cm] | -12,5                                | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5    | 32,5    | 37,5   | 42,5   | 47,5   |
| SMA   | 0,5        | Schichtaufbau und Steifigkeitsmodule |        |         |         |         |         |         |         |         |         |        |        |        |
| SMA   | 0,5        | 23.922                               | 21.518 | 18.444  | 14.961  | 11.472  | 8.378   | 5.905   | 4.085   | 2.796   | 1.906   | 1.301  | 892    | 616    |
| SMA   | 0,5        | 23.793                               | 21.397 | 18.363  | 14.937  | 11.469  | 8.370   | 5.897   | 4.109   | 2.838   | 1.950   | 1.342  | 927    | 642    |
| SMA   | 1          | 23.545                               | 21.169 | 18.212  | 14.893  | 11.463  | 8.355   | 5.882   | 4.154   | 2.917   | 2.035   | 1.423  | 995    | 695    |
| SMA   | 1          | 23.308                               | 20.956 | 18.073  | 14.852  | 11.457  | 8.341   | 5.868   | 4.195   | 2.991   | 2.116   | 1.501  | 1.062  | 748    |
| SMA   | 0,5        | 23.194                               | 20.854 | 18.007  | 14.832  | 11.455  | 8.335   | 5.861   | 4.215   | 3.027   | 2.156   | 1.539  | 1.095  | 775    |
| SMA   | 0,5        | 23.082                               | 20.755 | 17.944  | 14.814  | 11.452  | 8.328   | 5.855   | 4.234   | 3.062   | 2.195   | 1.577  | 1.128  | 801    |
| Asphaltanlage   | 0,5        | 85.921                               | 84.229 | 82.192  | 79.926  | 77.479  | 75.197  | 73.392  | 72.219  | 71.370  | 70.739  | 70.288 | 69.958 | 69.716 |
| Alter Asphalt   | 16         | 500                                  | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    |
| FSS   | 50         | 100                                  | 100    | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100     | 100    | 100    | 100    |
| Untergrund  |            | 45                                   | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     |
| <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                    |            |                                      |        |         |         |         |         |         |         |         |         |        |        |        |
|   | 2          | 1.883                                | 7.218  | 40.171  | 55.235  | 46.134  | 55.862  | 43.309  | 25.421  | 16.006  | 11.926  | 8.787  | 942    | 942    |
|   | 4          | 17.280                               | 66.239 | 368.635 | 506.873 | 423.354 | 512.633 | 397.435 | 233.277 | 146.878 | 109.439 | 80.639 | 8.640  | 8.640  |
|   | 6          | 13.782                               | 52.832 | 294.022 | 404.281 | 337.666 | 408.875 | 316.993 | 186.061 | 117.150 | 87.288  | 64.317 | 6.891  | 6.891  |
|   | 8          | 8.047                                | 30.848 | 171.674 | 236.052 | 197.157 | 238.734 | 185.086 | 108.637 | 68.401  | 50.966  | 37.554 | 4.024  | 4.024  |
|   | 10         | 3.535                                | 13.552 | 75.421  | 103.704 | 86.616  | 104.882 | 81.313  | 47.727  | 30.051  | 22.391  | 16.498 | 1.768  | 1.768  |
|   | 12         | 1.826                                | 7.000  | 38.956  | 53.564  | 44.738  | 54.173  | 41.999  | 24.652  | 15.521  | 11.565  | 8.522  | 913    | 913    |
|   | 14         | 536                                  | 2.053  | 11.428  | 15.713  | 13.124  | 15.892  | 12.321  | 7.232   | 4.553   | 3.393   | 2.500  | 268    | 268    |
|   | 16         | 66                                   | 252    | 1.401   | 1.927   | 1.609   | 1.949   | 1.511   | 887     | 558     | 416     | 307    | 33     | 33     |
|   | 18         | 1                                    | 6      | 31      | 43      | 36      | 43      | 33      | 20      | 12      | 9       | 7      | 1      | 1      |
|   | 20         | 0                                    | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |
|   | 22         | 0                                    | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0      | 0      | 0      |
| <b>Nachweis: Reflexionsrisssbildung (3PB)</b>   |            |                                      |        |         |         |         |         |         |         |         |         |        |        |        |
| <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |            |                                      |        |         |         |         |         |         |         |         |         |        |        |        |
|   | 2          | 0,8                                  | 0,7    | 0,6     | 0,5     | 0,3     | 0,2     | 0,1     | 0,0     | 0,0     | -0,1    | -0,1   | -0,1   | -0,1   |
|   | 4          | 1,5                                  | 1,4    | 1,2     | 0,9     | 0,6     | 0,4     | 0,1     | 0,0     | -0,1    | -0,1    | -0,2   | -0,2   | -0,2   |
|   | 6          | 2,3                                  | 2,1    | 1,7     | 1,4     | 0,9     | 0,5     | 0,2     | 0,0     | -0,1    | -0,2    | -0,2   | -0,3   | -0,3   |
|   | 8          | 3,1                                  | 2,8    | 2,3     | 1,8     | 1,3     | 0,7     | 0,3     | 0,0     | -0,2    | -0,3    | -0,3   | -0,3   | -0,3   |
|   | 10         | 3,9                                  | 3,4    | 2,9     | 2,3     | 1,6     | 0,9     | 0,4     | 0,0     | -0,2    | -0,3    | -0,4   | -0,4   | -0,4   |
|   | 12         | 4,6                                  | 4,1    | 3,5     | 2,7     | 1,9     | 1,1     | 0,4     | 0,0     | -0,2    | -0,4    | -0,5   | -0,5   | -0,5   |
|   | 14         | 5,4                                  | 4,8    | 4,1     | 3,2     | 2,2     | 1,3     | 0,5     | 0,0     | -0,3    | -0,5    | -0,6   | -0,6   | -0,6   |
|   | 16         | 6,2                                  | 5,5    | 4,7     | 3,6     | 2,5     | 1,4     | 0,6     | 0,0     | -0,3    | -0,5    | -0,6   | -0,7   | -0,7   |
|   | 18         | 6,9                                  | 6,2    | 5,2     | 4,1     | 2,8     | 1,6     | 0,7     | 0,0     | -0,4    | -0,6    | -0,7   | -0,8   | -0,8   |
|   | 20         | 7,7                                  | 6,9    | 5,8     | 4,6     | 3,1     | 1,8     | 0,7     | 0,0     | -0,4    | -0,7    | -0,8   | -0,8   | -0,9   |
|   | 22         | 8,5                                  | 7,6    | 6,4     | 5,0     | 3,5     | 2,0     | 0,8     | 0,0     | -0,4    | -0,7    | -0,9   | -0,9   | -0,9   |

|                |  | Ertragbare Anzahl an Lastfällen |  |          |          |          |          |          |          |          |      |      |      |      |  |  |  |
|----------------|--|---------------------------------|--|----------|----------|----------|----------|----------|----------|----------|------|------|------|------|--|--|--|
|                |  | -12,5                           | -7,5   | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5 | 37,5 | 42,5 | 47,5 |  |  |  |
| Achslastklasse |  | 2                               | 1,30E+06   | 1,81E+06 | 2,98E+06 | 6,11E+06 | 1,82E+07 | 9,42E+07 | 1,33E+09 | 6,03E+12 |      |      |      |      |  |  |  |
|                |  | 4                               | 1,69E+05   | 2,37E+05 | 3,89E+05 | 7,99E+05 | 2,38E+06 | 1,23E+07 | 1,73E+08 | 7,88E+11 |      |      |      |      |  |  |  |
|                |  | 6                               | 5,15E+04   | 7,22E+04 | 1,18E+05 | 2,43E+05 | 7,24E+05 | 3,75E+06 | 5,27E+07 | 2,40E+11 |      |      |      |      |  |  |  |
|                |  | 8                               | 2,22E+04   | 3,10E+04 | 5,09E+04 | 1,05E+05 | 3,11E+05 | 1,61E+06 | 2,27E+07 | 1,03E+11 |      |      |      |      |  |  |  |
|                |  | 10                              | 1,16E+04   | 1,61E+04 | 2,65E+04 | 5,43E+04 | 1,62E+05 | 8,37E+05 | 1,18E+07 | 5,35E+10 |      |      |      |      |  |  |  |
|                |  | 12                              | 6,74E+03   | 9,43E+03 | 1,55E+04 | 3,18E+04 | 9,46E+04 | 4,90E+05 | 6,89E+06 | 3,13E+10 |      |      |      |      |  |  |  |
|                |  | 14                              | 4,29E+03   | 6,00E+03 | 9,85E+03 | 2,02E+04 | 6,02E+04 | 3,12E+05 | 4,39E+06 | 1,99E+10 |      |      |      |      |  |  |  |
|                |  | 16                              | 2,90E+03   | 4,06E+03 | 6,66E+03 | 1,37E+04 | 4,07E+04 | 2,11E+05 | 2,96E+06 | 1,35E+10 |      |      |      |      |  |  |  |
|                |  | 18                              | 2,05E+03   | 2,87E+03 | 4,71E+03 | 9,67E+03 | 2,88E+04 | 1,49E+05 | 2,10E+06 | 9,54E+09 |      |      |      |      |  |  |  |
|                |  | 20                              | 1,50E+03   | 2,11E+03 | 3,46E+03 | 7,10E+03 | 2,11E+04 | 1,09E+05 | 1,54E+06 | 7,00E+09 |      |      |      |      |  |  |  |
|                |  | 22                              | 1,14E+03   | 1,59E+03 | 2,61E+03 | 5,37E+03 | 1,60E+04 | 8,27E+04 | 1,16E+06 | 5,29E+09 |      |      |      |      |  |  |  |
|                |  |                                 | <b>Schädigungsquotient</b>                         |          |          |          |          |          |          |          |      |      |      |      |  |  |  |
|                |  | 2                               | 1,45E-03   | 3,98E-03 | 1,35E-02 | 9,04E-03 | 2,54E-03 | 5,93E-04 | 3,27E-05 | 4,22E-09 |      |      |      |      |  |  |  |
|                |  | 4                               | 1,02E-01   | 2,79E-01 | 9,47E-01 | 6,34E-01 | 1,78E-01 | 4,16E-02 | 2,29E-03 | 2,96E-07 |      |      |      |      |  |  |  |
|                |  | 6                               | 2,67E-01   | 7,32E-01 | 2,48E+00 | 1,66E+00 | 4,67E-01 | 1,09E-01 | 6,01E-03 | 7,76E-07 |      |      |      |      |  |  |  |
|                |  | 8                               | 3,63E-01   | 9,95E-01 | 3,37E+00 | 2,26E+00 | 6,34E-01 | 1,48E-01 | 8,17E-03 | 1,05E-06 |      |      |      |      |  |  |  |
|                |  | 10                              | 3,07E-01   | 8,41E-01 | 2,85E+00 | 1,91E+00 | 5,36E-01 | 1,25E-01 | 6,91E-03 | 8,92E-07 |      |      |      |      |  |  |  |
|                |  | 12                              | 2,71E-01   | 7,42E-01 | 2,51E+00 | 1,68E+00 | 4,73E-01 | 1,11E-01 | 6,09E-03 | 7,86E-07 |      |      |      |      |  |  |  |
|                |  | 14                              | 1,25E-01   | 3,42E-01 | 1,16E+00 | 7,77E-01 | 2,18E-01 | 5,10E-02 | 2,81E-03 | 3,63E-07 |      |      |      |      |  |  |  |
|                |  | 16                              | 2,27E-02   | 6,21E-02 | 2,10E-01 | 1,41E-01 | 3,96E-02 | 9,25E-03 | 5,10E-04 | 6,58E-08 |      |      |      |      |  |  |  |
|                |  | 18                              | 7,10E-04   | 1,94E-03 | 6,59E-03 | 4,41E-03 | 1,24E-03 | 2,90E-04 | 1,50E-05 | 2,06E-09 |      |      |      |      |  |  |  |
|                |  | 20                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |
|                |  | 22                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |
|                |  |                                 | <b>Schädigungssumme (ohne Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |      |      |      |      |  |  |  |
|                |  |                                 | <b>31,28</b>                                       |          |          |          |          |          |          |          |      |      |      |      |  |  |  |
|                |  |                                 | <b>Nachweis: Rissernergie (Kellsparversuch)</b>    |          |          |          |          |          |          |          |      |      |      |      |  |  |  |
|                |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>      |          |          |          |          |          |          |          |      |      |      |      |  |  |  |
|                |  | 2                               | 3,33E-02   | 1,14E-01 | 5,30E-01 | 5,55E-01 | 3,00E-01 | 1,83E-01 | 4,60E-02 | 1,07E-03 |      |      |      |      |  |  |  |
|                |  | 4                               | 1,22E+00   | 4,18E+00 | 1,95E+01 | 2,04E+01 | 1,10E+01 | 6,71E+00 | 1,69E+00 | 3,92E-02 |      |      |      |      |  |  |  |
|                |  | 6                               | 2,20E+00   | 7,50E+00 | 3,49E+01 | 3,65E+01 | 1,98E+01 | 1,20E+01 | 3,03E+00 | 7,04E-02 |      |      |      |      |  |  |  |
|                |  | 8                               | 2,28E+00   | 7,79E+00 | 3,63E+01 | 3,79E+01 | 2,05E+01 | 1,25E+01 | 3,14E+00 | 7,31E-02 |      |      |      |      |  |  |  |
|                |  | 10                              | 1,56E+00   | 5,35E+00 | 2,49E+01 | 2,60E+01 | 1,41E+01 | 8,58E+00 | 2,16E+00 | 5,02E-02 |      |      |      |      |  |  |  |
|                |  | 12                              | 1,16E+00   | 3,98E+00 | 1,85E+01 | 1,94E+01 | 1,05E+01 | 6,38E+00 | 1,61E+00 | 3,73E-02 |      |      |      |      |  |  |  |
|                |  | 14                              | 4,65E-01   | 1,59E+00 | 7,39E+00 | 7,73E+00 | 4,18E+00 | 2,55E+00 | 6,41E-01 | 1,49E-02 |      |      |      |      |  |  |  |
|                |  | 16                              | 7,44E-02   | 2,54E-01 | 1,18E+00 | 1,24E+00 | 6,70E-01 | 4,08E-01 | 1,03E-01 | 2,39E-03 |      |      |      |      |  |  |  |
|                |  | 18                              | 2,09E-03   | 7,13E-03 | 3,32E-02 | 3,47E-02 | 1,88E-02 | 1,14E-02 | 2,88E-03 | 6,69E-05 |      |      |      |      |  |  |  |
|                |  | 20                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |
|                |  | 22                              | 0,00E+00   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |
|                |  |                                 | <b>Summe Verformungsarbeit:</b>                    |          |          |          |          |          |          |          |      |      |      |      |  |  |  |
|                |  |                                 | <b>475,79</b>                                      |          |          |          |          |          |          |          |      |      |      |      |  |  |  |



|               |            | Instandsetzung: Befestigung der Belastungsklasse Bk10: Glasfitter                                  |        |         |         |         |         |         |         |        |        |        |        |        |  |  |  |
|---------------|------------|--|--------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--|--|--|
|               |            | Oberflächentemperatur  |        |         |         |         |         |         |         |        |        |        |        |        |  |  |  |
|               |            | -12,5  | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5   | 32,5   | 37,5   | 42,5   | 47,5   |  |  |  |
| Schicht       | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule   |        |         |         |         |         |         |         |        |        |        |        |        |  |  |  |
| SMA           | 1          | 23.857   | 21.457 | 18.403  | 14.949  | 11.470  | 8.374   | 5.901   | 4.097   | 2.817  | 1.928  | 1.322  | 910    | 629    |  |  |  |
| SMA           | 1          | 23.606   | 21.225 | 18.249  | 14.903  | 11.464  | 8.358   | 5.886   | 4.143   | 2.897  | 2.014  | 1.403  | 978    | 682    |  |  |  |
| SMA           | 2          | 23.251   | 20.905 | 18.040  | 14.842  | 11.456  | 8.338   | 5.865   | 4.205   | 3.009  | 2.136  | 1.520  | 1.078  | 761    |  |  |  |
| ACB           | 2          | 27.780   | 26.031 | 23.761  | 20.961  | 17.464  | 13.669  | 10.245  | 7.846   | 5.970  | 4.468  | 3.332  | 2.457  | 1.785  |  |  |  |
| AC B          | 2          | 27.460   | 25.756 | 23.572  | 20.899  | 17.455  | 13.642  | 10.213  | 7.950   | 6.181  | 4.722  | 3.599  | 2.704  | 1.991  |  |  |  |
| AC B          | 2          | 27.188   | 25.504 | 23.401  | 20.844  | 17.446  | 13.618  | 10.186  | 8.043   | 6.373  | 4.959  | 3.854  | 2.943  | 2.194  |  |  |  |
| AE            | 0,3        | 39.181   | 37.958 | 36.456  | 34.635  | 32.173  | 29.372  | 26.865  | 25.348  | 24.168 | 23.155 | 22.356 | 21.687 | 21.126 |  |  |  |
| Alter Asphalt | 14         | 500  | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    | 500    | 500    |  |  |  |
| FSS           | 50         | 120  | 120    | 120     | 120     | 120     | 120     | 120     | 120     | 120    | 120    | 120    | 120    | 120    |  |  |  |
| Untergrund    | 45         | 45   | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     | 45     | 45     |  |  |  |
|               |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                         |        |         |         |         |         |         |         |        |        |        |        |        |  |  |  |
|               | 2          | 906  | 3.474  | 19.335  | 26.585  | 22.205  | 26.887  | 20.845  | 12.235  | 7.704  | 5.740  | 4.229  | 453    | 453    |  |  |  |
|               | 4          | 8.317  | 31.882 | 177.429 | 243.965 | 203.766 | 246.737 | 191.291 | 112.279 | 70.694 | 52.674 | 38.813 | 4.158  | 4.158  |  |  |  |
|               | 6          | 6.634  | 25.429 | 141.517 | 194.586 | 162.523 | 196.797 | 152.573 | 89.554  | 56.386 | 42.013 | 30.957 | 3.317  | 3.317  |  |  |  |
|               | 8          | 3.873  | 14.847 | 82.629  | 113.615 | 94.894  | 114.906 | 89.084  | 52.289  | 32.922 | 24.530 | 18.075 | 1.937  | 1.937  |  |  |  |
|               | 10         | 1.702  | 6.523  | 36.301  | 49.914  | 41.690  | 50.481  | 39.137  | 22.972  | 14.464 | 10.777 | 7.941  | 851    | 851    |  |  |  |
|               | 12         | 879  | 3.369  | 18.750  | 25.781  | 21.533  | 26.074  | 20.215  | 11.865  | 7.471  | 5.566  | 4.102  | 439    | 439    |  |  |  |
|               | 14         | 258  | 988    | 5.500   | 7.563   | 6.317   | 7.649   | 5.930   | 3.481   | 2.192  | 1.633  | 1.203  | 129    | 129    |  |  |  |
|               | 16         | 32   | 121    | 675     | 927     | 775     | 938     | 727     | 427     | 269    | 200    | 148    | 16     | 16     |  |  |  |
|               | 18         | 0,7  | 2,7    | 14,9    | 20,6    | 17,2    | 20,8    | 16,1    | 9,5     | 6,0    | 4,4    | 3,3    | 0,4    | 0,4    |  |  |  |
|               | 20         | 0,0  | 0,0    | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0    | 0,0    | 0,0    | 0,0    | 0,0    |  |  |  |
|               | 22         | 0,0  | 0,0    | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0    | 0,0    | 0,0    | 0,0    | 0,0    |  |  |  |
|               |            | <b>Nachweisformat: RDO Asphalt</b>   |        |         |         |         |         |         |         |        |        |        |        |        |  |  |  |
|               |            | <b>Ergebnis des Primärwirkungsmodells: Dehnung an der Unterseite der Asphaltdeckschicht [µm/m]</b> |        |         |         |         |         |         |         |        |        |        |        |        |  |  |  |
|               | 2          | 19,1   | 19,9   | 21,1    | 22,6    | 25,0    | 28,2    | 31,8    | 34,5    | 36,5   | 37,9   | 38,3   | 37,5   | 35,4   |  |  |  |
|               | 4          | 38,2   | 39,8   | 42,1    | 45,3    | 50,0    | 56,4    | 63,6    | 68,9    | 73,1   | 75,9   | 76,6   | 75,0   | 70,8   |  |  |  |
|               | 6          | 57,3   | 59,7   | 63,2    | 67,9    | 75,0    | 84,7    | 95,4    | 103,4   | 109,6  | 113,8  | 114,9  | 112,5  | 106,2  |  |  |  |
|               | 8          | 76,4   | 79,7   | 84,3    | 90,6    | 100,1   | 112,9   | 127,2   | 137,9   | 146,1  | 151,7  | 153,2  | 150,1  | 141,6  |  |  |  |
|               | 10         | 95,5   | 99,6   | 105,3   | 113,2   | 125,1   | 141,1   | 159,0   | 172,3   | 182,7  | 189,7  | 191,5  | 187,6  | 177,0  |  |  |  |
|               | 12         | 114,6  | 119,5  | 126,4   | 135,9   | 150,1   | 169,3   | 190,8   | 206,8   | 219,2  | 227,6  | 229,8  | 225,1  | 212,4  |  |  |  |
|               | 14         | 133,6  | 139,4  | 147,5   | 158,5   | 175,1   | 197,6   | 222,6   | 241,3   | 255,8  | 265,5  | 268,1  | 262,6  | 247,8  |  |  |  |
|               | 16         | 152,7  | 159,3  | 168,5   | 181,2   | 200,1   | 225,8   | 254,4   | 275,7   | 292,3  | 303,4  | 306,4  | 300,1  | 283,2  |  |  |  |
|               | 18         | 171,8  | 179,2  | 189,6   | 203,8   | 225,1   | 254,0   | 286,2   | 310,2   | 328,8  | 341,4  | 344,7  | 337,6  | 318,6  |  |  |  |
|               | 20         | 190,9  | 199,2  | 210,7   | 226,5   | 250,2   | 282,2   | 318,0   | 344,7   | 365,4  | 379,3  | 383,0  | 375,2  | 354,0  |  |  |  |
|               | 22         | 210,0  | 219,1  | 231,7   | 249,1   | 275,2   | 310,5   | 349,8   | 379,1   | 401,9  | 417,2  | 421,3  | 412,7  | 389,4  |  |  |  |

|                 |  | Ertragbare Anzahl an Lastfällen   |          |          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |  |
|-----------------|--|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|--|--|--|
|                 |  | -12,5   | -7,5     | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |          |          |  |  |  |  |
| Achslastklassen |  | 2   | 9,36E+12 | 7,19E+12 | 5,07E+12 | 3,23E+12 | 1,74E+12 | 8,19E+11 | 3,89E+11 | 2,36E+11 | 1,64E+11 | 1,30E+11 | 1,22E+11 | 1,39E+11 | 2,00E+11 | 2,00E+11 |  |  |  |  |
|                 |  | 4   | 1,24E+11 | 9,57E+10 | 6,74E+10 | 4,29E+10 | 2,31E+10 | 1,09E+10 | 5,18E+09 | 3,14E+09 | 2,18E+09 | 1,73E+09 | 1,63E+09 | 1,85E+09 | 2,65E+09 | 2,65E+09 |  |  |  |  |
|                 |  | 6   | 9,95E+09 | 7,64E+09 | 5,39E+09 | 3,43E+09 | 1,85E+09 | 8,71E+08 | 4,14E+08 | 2,51E+08 | 1,74E+08 | 1,38E+08 | 1,30E+08 | 1,48E+08 | 2,12E+08 | 2,12E+08 |  |  |  |  |
|                 |  | 8   | 1,66E+09 | 1,27E+09 | 8,97E+08 | 5,71E+08 | 3,07E+08 | 1,45E+08 | 6,89E+07 | 4,17E+07 | 2,90E+07 | 2,30E+07 | 2,16E+07 | 2,46E+07 | 3,53E+07 | 3,53E+07 |  |  |  |  |
|                 |  | 10  | 4,12E+08 | 3,17E+08 | 2,23E+08 | 1,42E+08 | 7,65E+07 | 3,61E+07 | 1,71E+07 | 1,04E+07 | 7,22E+06 | 5,72E+06 | 5,38E+06 | 6,12E+06 | 8,79E+06 | 8,79E+06 |  |  |  |  |
|                 |  | 12  | 1,32E+08 | 1,02E+08 | 7,17E+07 | 4,57E+07 | 2,46E+07 | 1,16E+07 | 5,57E+06 | 3,33E+06 | 2,32E+06 | 1,84E+06 | 1,73E+06 | 1,97E+06 | 2,82E+06 | 2,82E+06 |  |  |  |  |
|                 |  | 14  | 5,06E+07 | 3,89E+07 | 2,74E+07 | 1,75E+07 | 9,40E+06 | 4,43E+06 | 2,11E+06 | 8,97E+05 | 7,02E+05 | 6,61E+05 | 7,52E+05 | 1,08E+06 | 1,08E+06 |          |  |  |  |  |
|                 |  | 16  | 2,20E+07 | 1,69E+07 | 1,19E+07 | 7,60E+06 | 4,09E+06 | 1,93E+06 | 9,17E+05 | 5,55E+05 | 3,86E+05 | 3,06E+05 | 2,88E+05 | 3,27E+05 | 4,70E+05 | 4,70E+05 |  |  |  |  |
|                 |  | 18  | 1,06E+07 | 8,13E+06 | 5,73E+06 | 3,65E+06 | 1,96E+06 | 9,25E+05 | 4,40E+05 | 2,66E+05 | 1,85E+05 | 1,47E+05 | 1,38E+05 | 1,57E+05 | 2,26E+05 | 2,26E+05 |  |  |  |  |
|                 |  | 20  | 5,48E+06 | 4,21E+06 | 2,97E+06 | 1,89E+06 | 1,02E+06 | 4,80E+05 | 2,28E+05 | 1,38E+05 | 9,50E+04 | 7,61E+04 | 7,16E+04 | 8,15E+04 | 1,17E+05 | 1,17E+05 |  |  |  |  |
|                 |  | 22  | 3,03E+06 | 2,33E+06 | 1,64E+06 | 1,04E+06 | 5,62E+05 | 2,65E+05 | 1,26E+05 | 7,63E+04 | 5,30E+04 | 4,20E+04 | 3,96E+04 | 4,50E+04 | 6,46E+04 | 6,46E+04 |  |  |  |  |
|                 |  | <b>Schädigungsquotient</b>  |          |          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |  |
|                 |  | 2   | 6,40E-09 | 7,32E-09 | 1,93E-08 | 2,69E-08 | 1,28E-08 | 3,28E-08 | 5,36E-08 | 5,19E-08 | 4,70E-08 | 4,42E-08 | 3,46E-08 | 3,28E-08 | 2,27E-09 | 2,27E-09 |  |  |  |  |
|                 |  | 4   | 6,42E-07 | 1,30E-06 | 5,70E-06 | 9,92E-06 | 8,82E-06 | 2,26E-05 | 3,69E-05 | 3,58E-05 | 3,24E-05 | 3,05E-05 | 2,39E-05 | 2,25E-06 | 1,57E-06 | 1,57E-06 |  |  |  |  |
|                 |  | 6   | 2,99E-06 | 8,01E-06 | 4,32E-05 | 8,12E-05 | 8,80E-05 | 2,26E-04 | 3,69E-04 | 3,57E-04 | 3,24E-04 | 3,05E-04 | 2,38E-04 | 2,24E-05 | 1,56E-05 | 1,56E-05 |  |  |  |  |
|                 |  | 8   | 7,07E-06 | 2,22E-05 | 1,33E-04 | 2,59E-04 | 3,09E-04 | 7,93E-04 | 1,29E-03 | 1,25E-03 | 1,14E-03 | 1,07E-03 | 8,36E-04 | 7,87E-05 | 5,48E-05 | 5,48E-05 |  |  |  |  |
|                 |  | 10  | 9,85E-06 | 3,41E-05 | 2,17E-04 | 4,32E-04 | 5,45E-04 | 1,40E-03 | 2,28E-03 | 2,21E-03 | 2,00E-03 | 1,89E-03 | 1,47E-03 | 1,39E-04 | 9,68E-05 | 9,68E-05 |  |  |  |  |
|                 |  | 12  | 1,35E-05 | 5,01E-05 | 3,31E-04 | 6,71E-04 | 8,77E-04 | 2,25E-03 | 3,67E-03 | 3,56E-03 | 3,22E-03 | 3,03E-03 | 2,37E-03 | 2,24E-04 | 1,56E-04 | 1,56E-04 |  |  |  |  |
|                 |  | 14  | 9,30E-06 | 3,61E+05 | 2,45E-04 | 5,01E-04 | 6,72E-04 | 1,73E-03 | 2,82E-03 | 2,73E-03 | 2,47E-03 | 2,33E-03 | 1,82E-03 | 1,71E-04 | 1,19E-04 | 1,19E-04 |  |  |  |  |
|                 |  | 16  | 2,42E-06 | 9,70E-06 | 6,73E-05 | 1,39E-04 | 1,89E-04 | 4,86E-04 | 7,93E-04 | 7,69E-04 | 6,97E-04 | 6,55E-04 | 5,13E-04 | 4,83E-05 | 3,36E-05 | 3,36E-05 |  |  |  |  |
|                 |  | 18  | 1,05E-07 | 4,32E-07 | 3,04E-06 | 6,31E-06 | 8,74E-06 | 2,29E-05 | 3,66E-05 | 3,55E-05 | 3,22E-05 | 3,03E-05 | 2,37E-05 | 2,23E-06 | 1,55E-06 | 1,55E-06 |  |  |  |  |
|                 |  | 20  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |  |
|                 |  | 22  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |  |
|                 |  | <b>Schädigungssumme (inkl. Shift-Faktor und Sicherheitsbeiwert):</b>                          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |  |
|                 |  | <b>0,06</b>   |          |          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |  |
|                 |  | <b>Nachweis: Reflektionsrissbildung (3PB)</b>   |          |          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |  |
|                 |  | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |          |          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |  |
| Achslastklassen |  | 2   | 0,8      | 0,8      | 0,7      | 0,7      | 0,7      | 0,6      | 0,5      | 0,4      | 0,3      | 0,3      | 0,2      | 0,1      | 0,1      |          |  |  |  |  |
|                 |  | 4   | 1,6      | 1,5      | 1,5      | 1,4      | 1,3      | 1,1      | 1,0      | 0,8      | 0,7      | 0,5      | 0,4      | 0,3      | 0,2      |          |  |  |  |  |
|                 |  | 6   | 2,4      | 2,3      | 2,2      | 2,1      | 2,0      | 1,7      | 1,4      | 1,2      | 1,0      | 0,8      | 0,6      | 0,4      | 0,3      |          |  |  |  |  |
|                 |  | 8   | 3,2      | 3,1      | 3,0      | 2,9      | 2,6      | 2,3      | 1,9      | 1,6      | 1,3      | 1,0      | 0,8      | 0,5      | 0,3      |          |  |  |  |  |
|                 |  | 10  | 3,9      | 3,9      | 3,7      | 3,6      | 3,3      | 2,9      | 2,4      | 2,0      | 1,6      | 1,3      | 1,0      | 0,7      | 0,4      |          |  |  |  |  |
|                 |  | 12  | 4,7      | 4,6      | 4,5      | 4,3      | 3,9      | 3,4      | 2,9      | 2,4      | 2,0      | 1,5      | 1,1      | 0,8      | 0,5      |          |  |  |  |  |
|                 |  | 14  | 5,5      | 5,4      | 5,2      | 5,0      | 4,6      | 4,0      | 3,3      | 2,8      | 2,3      | 1,8      | 1,3      | 0,9      | 0,5      |          |  |  |  |  |
|                 |  | 16  | 6,3      | 6,2      | 6,0      | 5,7      | 5,2      | 4,6      | 3,8      | 3,2      | 2,6      | 2,1      | 1,5      | 1,0      | 0,6      |          |  |  |  |  |
|                 |  | 18  | 7,1      | 6,9      | 6,7      | 6,4      | 5,9      | 5,2      | 4,3      | 3,6      | 3,0      | 2,3      | 1,7      | 1,2      | 0,7      |          |  |  |  |  |
|                 |  | 20  | 7,9      | 7,7      | 7,5      | 7,1      | 6,6      | 5,7      | 4,8      | 4,0      | 3,3      | 2,6      | 1,9      | 1,3      | 0,8      |          |  |  |  |  |
|                 |  | 22  | 8,7      | 8,5      | 8,2      | 7,8      | 7,2      | 6,3      | 5,2      | 4,4      | 3,6      | 2,8      | 2,1      | 1,4      | 0,8      |          |  |  |  |  |

|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|--|--|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |          |  |  |  |
| Achslastklassen |  | 2                               | 3,86E+05  | 4,25E+05 | 4,85E+05 | 5,88E+05 | 8,34E+05 | 1,47E+06 | 3,19E+06 | 6,56E+06 | 1,50E+07 | 4,27E+07 | 1,49E+08 | 7,52E+08 | 7,31E+09 |  |  |  |
|                 |  | 4                               | 2,09E+04  | 2,30E+04 | 2,63E+04 | 3,19E+04 | 4,52E+04 | 7,97E+04 | 1,73E+05 | 3,55E+05 | 8,13E+05 | 2,31E+06 | 8,07E+06 | 4,08E+07 | 3,96E+08 |  |  |  |
|                 |  | 6                               | 3,80E+03  | 4,18E+03 | 4,78E+03 | 5,79E+03 | 8,21E+03 | 1,45E+04 | 3,14E+04 | 6,45E+04 | 1,48E+05 | 4,20E+05 | 1,47E+06 | 7,41E+06 | 7,20E+07 |  |  |  |
|                 |  | 8                               | 1,13E+03  | 1,25E+03 | 1,42E+03 | 1,73E+03 | 2,45E+03 | 4,32E+03 | 9,36E+03 | 1,92E+04 | 4,41E+04 | 1,25E+05 | 4,38E+05 | 2,21E+06 | 2,15E+07 |  |  |  |
|                 |  | 10                              | 4,43E+02  | 4,88E+02 | 5,57E+02 | 6,76E+02 | 9,58E+02 | 1,69E+03 | 3,66E+03 | 7,53E+03 | 1,72E+04 | 4,90E+04 | 1,71E+05 | 8,64E+05 | 8,40E+06 |  |  |  |
|                 |  | 12                              | 2,06E+02  | 2,27E+02 | 2,59E+02 | 3,14E+02 | 4,45E+02 | 7,85E+02 | 1,70E+03 | 3,50E+03 | 8,00E+03 | 2,28E+04 | 7,95E+04 | 4,01E+05 | 3,90E+06 |  |  |  |
|                 |  | 14                              | 1,08E+02  | 1,19E+02 | 1,35E+02 | 1,64E+02 | 2,33E+02 | 4,10E+02 | 8,89E+02 | 1,83E+03 | 4,19E+03 | 1,19E+04 | 4,16E+04 | 2,10E+05 | 2,04E+06 |  |  |  |
|                 |  | 16                              | 6,13E+01  | 6,78E+01 | 7,72E+01 | 9,36E+01 | 1,33E+02 | 2,34E+02 | 5,07E+02 | 1,04E+03 | 2,39E+03 | 6,79E+03 | 2,37E+04 | 1,20E+05 | 1,16E+06 |  |  |  |
|                 |  | 18                              | 3,74E+01  | 4,12E+01 | 4,70E+01 | 5,70E+01 | 8,08E+01 | 1,43E+02 | 3,09E+02 | 6,35E+02 | 1,45E+03 | 4,14E+03 | 1,44E+04 | 7,29E+04 | 7,09E+05 |  |  |  |
|                 |  | 20                              | 2,40E+01  | 2,64E+01 | 3,02E+01 | 3,66E+01 | 5,19E+01 | 9,15E+01 | 1,99E+02 | 4,08E+02 | 9,34E+02 | 2,66E+03 | 9,27E+03 | 4,68E+04 | 4,55E+05 |  |  |  |
|                 |  | 22                              | 1,61E+01  | 1,77E+01 | 2,02E+01 | 2,45E+01 | 3,48E+01 | 6,13E+01 | 1,33E+02 | 2,73E+02 | 6,25E+02 | 1,78E+03 | 6,21E+03 | 3,13E+04 | 3,05E+05 |  |  |  |
|                 |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  | 2                               | 2,35E-03  | 8,18E-03 | 3,98E-02 | 4,52E-02 | 2,66E-02 | 1,83E-02 | 6,54E-03 | 1,87E-03 | 5,13E-04 | 1,35E-04 | 2,84E-05 | 6,02E-07 | 6,20E-08 |  |  |  |
|                 |  | 4                               | 3,98E-01  | 1,38E+00 | 6,75E+00 | 7,65E+00 | 4,51E+00 | 3,10E+00 | 1,11E+00 | 3,16E-01 | 8,70E-02 | 2,28E-02 | 4,81E-03 | 1,02E-04 | 1,05E-05 |  |  |  |
|                 |  | 6                               | 1,75E+00  | 6,08E+00 | 2,96E+01 | 3,36E+01 | 1,98E+01 | 1,36E+01 | 4,86E+00 | 1,39E+00 | 3,82E-01 | 1,00E-01 | 2,11E-02 | 4,48E-04 | 4,61E-05 |  |  |  |
|                 |  | 8                               | 3,42E+00  | 1,19E+01 | 5,80E+01 | 6,58E+01 | 3,88E+01 | 2,66E+01 | 9,52E+00 | 2,72E+00 | 7,47E-01 | 1,96E-01 | 4,13E-02 | 8,77E-04 | 9,02E-05 |  |  |  |
|                 |  | 10                              | 3,84E+00  | 1,34E+01 | 6,51E+01 | 7,39E+01 | 4,35E+01 | 2,99E+01 | 1,07E+01 | 3,05E+00 | 8,39E-01 | 2,20E-01 | 4,64E-02 | 9,88E-04 | 1,01E-04 |  |  |  |
|                 |  | 12                              | 4,27E+00  | 1,49E+01 | 7,24E+01 | 8,21E+01 | 4,84E+01 | 3,32E+01 | 1,19E+01 | 3,39E+00 | 9,33E-01 | 2,45E-01 | 5,16E-02 | 1,10E-03 | 1,13E-04 |  |  |  |
|                 |  | 14                              | 2,40E+00  | 8,34E+00 | 4,06E+01 | 4,61E+01 | 2,72E+01 | 1,86E+01 | 6,67E+00 | 1,90E+00 | 5,24E-01 | 1,37E-01 | 2,89E-02 | 6,14E-04 | 6,32E-05 |  |  |  |
|                 |  | 16                              | 5,16E-01  | 1,79E+00 | 8,74E+00 | 9,91E+00 | 5,84E+00 | 4,01E+00 | 1,43E+00 | 4,09E-01 | 1,13E-01 | 2,95E-02 | 6,22E-03 | 1,32E-04 | 1,36E-05 |  |  |  |
|                 |  | 18                              | 1,87E-02  | 6,52E-02 | 3,18E-01 | 3,60E-01 | 2,12E-01 | 1,46E-01 | 5,22E-02 | 1,49E-02 | 4,09E-03 | 1,07E-03 | 2,26E-04 | 4,80E-06 | 4,94E-07 |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>1057,08</b>                                      |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>Nachweis: Rissernergie (Keilspaltversuch)</b>    |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  | 2                               | 2,27E-02  | 9,19E-02 | 5,51E-01 | 8,34E-01 | 7,93E-01 | 1,12E+00 | 1,02E+00 | 6,68E-01 | 4,56E-01 | 3,57E-01 | 2,64E-01 | 2,71E-02 | 2,45E-02 |  |  |  |
|                 |  | 4                               | 8,33E-01  | 3,37E+00 | 2,02E+01 | 3,06E+01 | 2,91E+01 | 4,12E+01 | 3,73E+01 | 2,45E+01 | 1,67E+01 | 1,31E+01 | 9,70E+00 | 9,95E-01 | 8,98E-01 |  |  |  |
|                 |  | 6                               | 1,50E+00  | 6,05E+00 | 3,63E+01 | 5,50E+01 | 5,22E+01 | 7,39E+01 | 6,70E+01 | 4,40E+01 | 3,01E+01 | 2,35E+01 | 1,74E+01 | 1,79E+00 | 1,61E+00 |  |  |  |
|                 |  | 8                               | 1,55E+00  | 6,28E+00 | 3,77E+01 | 5,70E+01 | 5,42E+01 | 7,67E+01 | 6,95E+01 | 4,57E+01 | 3,12E+01 | 2,44E+01 | 1,81E+01 | 1,85E+00 | 1,67E+00 |  |  |  |
|                 |  | 10                              | 1,07E+00  | 4,31E+00 | 2,58E+01 | 3,92E+01 | 3,72E+01 | 5,26E+01 | 4,77E+01 | 3,13E+01 | 2,14E+01 | 1,68E+01 | 1,24E+01 | 1,27E+00 | 1,15E+00 |  |  |  |
|                 |  | 12                              | 7,92E-01  | 3,21E+00 | 1,92E+01 | 2,91E+01 | 2,77E+01 | 3,92E+01 | 3,55E+01 | 2,33E+01 | 1,59E+01 | 1,25E+01 | 9,23E+00 | 9,47E-01 | 8,54E-01 |  |  |  |
|                 |  | 14                              | 3,16E-01  | 1,28E+00 | 7,68E+00 | 1,18E+01 | 1,11E+01 | 1,56E+01 | 1,42E+01 | 9,31E+00 | 6,36E+00 | 4,97E+00 | 3,68E+00 | 3,79E-01 | 3,41E-01 |  |  |  |
|                 |  | 16                              | 5,07E-02  | 2,05E-01 | 1,23E+00 | 1,68E+00 | 1,77E+00 | 2,50E+00 | 2,27E+00 | 1,49E+00 | 1,02E+00 | 7,97E-01 | 5,90E-01 | 6,05E-02 | 5,46E-02 |  |  |  |
|                 |  | 18                              | 1,42E-03  | 5,75E-03 | 3,45E-02 | 5,22E-02 | 4,97E-02 | 7,02E-02 | 6,36E-02 | 4,18E-02 | 2,86E-02 | 2,23E-02 | 1,66E-02 | 1,70E-03 | 1,53E-03 |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>1681,60</b>                                      |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |

|               |            | Instandsetzung: Befestigung der Belastungsklasse Bk10: Kombinationsprodukt (Kunststoff)            |        |         |         |         |         |         |         |        |        |        |         |         |  |  |  |  |  |  |  |
|---------------|------------|--|--------|---------|---------|---------|---------|---------|---------|--------|--------|--------|---------|---------|--|--|--|--|--|--|--|
|               |            | Oberflächentemperatur  |        |         |         |         |         |         |         |        |        |        |         |         |  |  |  |  |  |  |  |
|               |            | -12,5  | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5   | 32,5   | 37,5   | 42,5    | 47,5    |  |  |  |  |  |  |  |
| Schicht       | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule   |        |         |         |         |         |         |         |        |        |        |         |         |  |  |  |  |  |  |  |
| SMA           | 1          | 23.857   | 21.457 | 18.403  | 14.949  | 11.470  | 8.374   | 5.901   | 4.097   | 2.817  | 1.928  | 1.322  | 910     | 629     |  |  |  |  |  |  |  |
| SMA           | 1          | 23.606   | 21.225 | 18.249  | 14.903  | 11.464  | 8.358   | 5.886   | 4.143   | 2.897  | 2.014  | 1.403  | 978     | 682     |  |  |  |  |  |  |  |
| SMA           | 2          | 23.251   | 20.905 | 18.040  | 14.842  | 11.456  | 8.338   | 5.865   | 4.205   | 3.009  | 2.136  | 1.520  | 1.078   | 761     |  |  |  |  |  |  |  |
| ACB           | 2          | 27.780   | 26.031 | 23.761  | 20.961  | 17.464  | 13.669  | 10.245  | 7.846   | 5.970  | 4.468  | 3.332  | 2.457   | 1.785   |  |  |  |  |  |  |  |
| AC B          | 2          | 27.480   | 25.756 | 23.572  | 20.899  | 17.455  | 13.642  | 10.213  | 7.950   | 6.181  | 4.722  | 3.599  | 2.704   | 1.991   |  |  |  |  |  |  |  |
| AC B          | 2          | 27.188   | 25.504 | 23.401  | 20.844  | 17.446  | 13.618  | 10.186  | 8.043   | 6.373  | 4.959  | 3.854  | 2.943   | 2.194   |  |  |  |  |  |  |  |
| AE            | 0,3        | 22.870   | 21.496 | 19.809  | 17.763  | 14.997  | 11.851  | 9.035   | 7.331   | 6.006  | 4.868  | 3.971  | 3.219   | 2.588   |  |  |  |  |  |  |  |
| Alter Asphalt | 14         | 500  | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    | 500     | 500     |  |  |  |  |  |  |  |
| FSS           | 50         | 120  | 120    | 120     | 120     | 120     | 120     | 120     | 120     | 120    | 120    | 120    | 120     | 120     |  |  |  |  |  |  |  |
| Untergrund    | 45         | 45   | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     | 45      | 45      |  |  |  |  |  |  |  |
|               |            | <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                         |        |         |         |         |         |         |         |        |        |        |         |         |  |  |  |  |  |  |  |
|               | 2          | 906  | 3.474  | 19.335  | 26.585  | 22.205  | 26.887  | 20.845  | 12.235  | 7.704  | 5.740  | 4.229  | 453     | 453     |  |  |  |  |  |  |  |
|               | 4          | 8.317  | 31.882 | 177.429 | 243.965 | 203.766 | 246.737 | 191.291 | 112.279 | 70.694 | 52.674 | 38.813 | 4.158   | 4.158   |  |  |  |  |  |  |  |
|               | 6          | 6.634  | 25.429 | 141.517 | 194.586 | 162.523 | 196.797 | 152.573 | 89.554  | 56.386 | 42.013 | 30.957 | 3.317   | 3.317   |  |  |  |  |  |  |  |
|               | 8          | 3.873  | 14.847 | 82.629  | 113.615 | 94.894  | 114.906 | 89.084  | 52.289  | 32.922 | 24.530 | 18.075 | 1.937   | 1.937   |  |  |  |  |  |  |  |
|               | 10         | 1.702  | 6.523  | 36.301  | 49.914  | 41.690  | 50.481  | 39.137  | 22.972  | 14.464 | 10.777 | 7.941  | 851     | 851     |  |  |  |  |  |  |  |
|               | 12         | 879  | 3.369  | 18.750  | 25.781  | 21.533  | 26.074  | 20.215  | 11.865  | 7.471  | 5.566  | 4.102  | 439     | 439     |  |  |  |  |  |  |  |
|               | 14         | 258  | 988    | 5.500   | 7.563   | 6.317   | 7.649   | 5.930   | 3.481   | 2.192  | 1.633  | 1.203  | 129     | 129     |  |  |  |  |  |  |  |
|               | 16         | 32   | 121    | 675     | 927     | 775     | 938     | 727     | 427     | 269    | 200    | 148    | 16      | 16      |  |  |  |  |  |  |  |
|               | 18         | 0,7  | 2,7    | 14,9    | 20,6    | 17,2    | 20,8    | 16,1    | 9,5     | 6,0    | 4,4    | 3,3    | 0,4     | 0,4     |  |  |  |  |  |  |  |
|               | 20         | 0,0  | 0,0    | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0    | 0,0    | 0,0    | 0,0     | 0,0     |  |  |  |  |  |  |  |
|               | 22         | 0,0  | 0,0    | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0    | 0,0    | 0,0    | 0,0     | 0,0     |  |  |  |  |  |  |  |
|               |            | <b>Nachweisformat: RDO Asphalt</b>   |        |         |         |         |         |         |         |        |        |        |         |         |  |  |  |  |  |  |  |
|               |            | <b>Ergebnis des Primärwirkungsmodells: Dehnung an der Unterseite der Asphaltdeckschicht [µm/m]</b> |        |         |         |         |         |         |         |        |        |        |         |         |  |  |  |  |  |  |  |
|               | 2          | 22,8   | 24,0   | 25,8    | 28,3    | 32,4    | 38,7    | 47,0    | 55,0    | 63,6   | 73,6   | 84,2   | 96,2    | 110,0   |  |  |  |  |  |  |  |
|               | 4          | 45,5   | 48,0   | 51,6    | 56,7    | 64,9    | 77,3    | 94,0    | 110,0   | 127,3  | 147,2  | 168,5  | 192,3   | 219,9   |  |  |  |  |  |  |  |
|               | 6          | 68,3   | 72,0   | 77,3    | 85,0    | 97,3    | 116,0   | 141,0   | 164,9   | 190,9  | 220,8  | 252,7  | 288,5   | 329,9   |  |  |  |  |  |  |  |
|               | 8          | 91,1   | 96,0   | 103,1   | 113,3   | 129,7   | 154,7   | 188,0   | 219,9   | 254,6  | 294,4  | 336,9  | 384,7   | 439,8   |  |  |  |  |  |  |  |
|               | 10         | 113,8  | 120,0  | 128,9   | 141,7   | 162,2   | 193,4   | 235,0   | 274,9   | 318,2  | 367,9  | 421,1  | 480,8   | 549,8   |  |  |  |  |  |  |  |
|               | 12         | 136,6  | 144,0  | 154,7   | 170,0   | 194,6   | 232,0   | 281,9   | 329,9   | 381,8  | 441,5  | 505,4  | 577,0   | 659,7   |  |  |  |  |  |  |  |
|               | 14         | 159,4  | 168,0  | 180,4   | 198,3   | 227,1   | 270,7   | 328,9   | 384,8   | 445,5  | 515,1  | 589,6  | 673,2   | 769,7   |  |  |  |  |  |  |  |
|               | 16         | 182,1  | 192,0  | 206,2   | 226,7   | 259,5   | 309,4   | 375,9   | 439,8   | 509,1  | 588,7  | 673,8  | 769,3   | 879,6   |  |  |  |  |  |  |  |
|               | 18         | 204,9  | 216,0  | 232,0   | 255,0   | 291,9   | 348,0   | 422,9   | 494,8   | 572,7  | 662,3  | 758,0  | 865,5   | 989,6   |  |  |  |  |  |  |  |
|               | 20         | 227,7  | 240,0  | 257,8   | 283,3   | 324,4   | 386,7   | 469,9   | 549,8   | 636,4  | 735,9  | 842,3  | 961,7   | 1.099,5 |  |  |  |  |  |  |  |
|               | 22         | 250,5  | 264,0  | 283,6   | 311,7   | 356,8   | 425,4   | 516,9   | 604,7   | 700,0  | 809,5  | 926,5  | 1.057,8 | 1.209,5 |  |  |  |  |  |  |  |

|                 | Ertragbare Anzahl an Lastfällen   |          |          |          |          |          |          |          |          |          |          |          |          |
|-----------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                 | -12,5   | -7,5     | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |
| Achslastklassen | 2   | 4        | 6        | 8        | 10       | 12       | 14       | 16       | 18       | 20       | 22       |          |          |
|                 | 3,12E+12  | 2,25E+12 | 1,44E+12 | 8,00E+11 | 3,44E+11 | 1,15E+11 | 3,42E+10 | 1,28E+10 | 5,16E+09 | 2,09E+09 | 9,00E+08 | 3,94E+08 | 1,71E+08 |
|                 | 4,15E+10  | 2,99E+10 | 1,92E+10 | 1,08E+10 | 4,58E+09 | 1,53E+09 | 4,54E+08 | 1,71E+08 | 6,86E+07 | 2,78E+07 | 1,20E+07 | 5,24E+06 | 2,27E+06 |
|                 | 3,32E+09  | 2,33E+09 | 1,53E+09 | 8,50E+08 | 3,66E+08 | 1,22E+08 | 3,63E+07 | 1,37E+07 | 5,49E+06 | 2,22E+06 | 9,56E+05 | 4,19E+05 | 1,82E+05 |
|                 | 5,53E+08  | 3,98E+08 | 2,55E+08 | 1,42E+08 | 6,09E+07 | 2,04E+07 | 6,05E+06 | 2,27E+06 | 9,13E+05 | 3,69E+05 | 1,59E+05 | 6,97E+04 | 3,02E+04 |
|                 | 1,38E+08  | 9,90E+07 | 6,35E+07 | 3,52E+07 | 1,52E+07 | 5,07E+06 | 1,50E+06 | 5,66E+05 | 2,27E+05 | 9,19E+04 | 3,96E+04 | 1,73E+04 | 7,53E+03 |
|                 | 4,42E+07  | 3,18E+07 | 2,04E+07 | 1,13E+07 | 4,87E+06 | 1,63E+06 | 4,83E+05 | 1,82E+05 | 7,30E+04 | 2,95E+04 | 1,27E+04 | 5,57E+03 | 2,42E+03 |
|                 | 1,69E+07  | 1,22E+07 | 7,80E+06 | 4,33E+06 | 1,86E+06 | 6,23E+05 | 1,85E+05 | 6,95E+04 | 2,79E+04 | 1,13E+04 | 4,87E+03 | 2,13E+03 | 9,25E+02 |
|                 | 7,35E+06  | 5,29E+06 | 3,39E+06 | 1,88E+06 | 8,10E+05 | 2,71E+05 | 8,04E+04 | 3,02E+04 | 1,22E+04 | 4,91E+03 | 2,12E+03 | 9,27E+02 | 4,02E+02 |
|                 | 3,53E+06  | 2,54E+06 | 1,63E+06 | 9,04E+05 | 3,89E+05 | 1,30E+05 | 3,86E+04 | 1,45E+04 | 5,83E+03 | 2,36E+03 | 1,02E+03 | 4,45E+02 | 1,93E+02 |
|                 | 1,83E+06  | 1,32E+06 | 8,44E+05 | 4,69E+05 | 2,02E+05 | 6,74E+04 | 2,00E+04 | 7,53E+03 | 3,02E+03 | 1,22E+03 | 5,27E+02 | 2,31E+02 | 1,00E+02 |
|                 | 1,01E+06  | 7,27E+05 | 4,66E+05 | 2,59E+05 | 1,11E+05 | 3,72E+04 | 1,11E+04 | 4,16E+03 | 1,57E+03 | 6,75E+02 | 2,91E+02 | 1,27E+02 | 5,53E+01 |
|                 | <b>Schädigungsquotient</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
| Achslastklassen | 2   | 4        | 6        | 8        | 10       | 12       | 14       | 16       | 18       | 20       | 22       |          |          |
|                 | 1,09E-08  | 1,51E-08 | 4,99E-08 | 8,42E-08 | 6,45E-08 | 2,34E-07 | 6,10E-07 | 9,53E-07 | 1,49E-06 | 2,75E-06 | 4,70E-06 | 1,15E-06 | 2,65E-06 |
|                 | 1,34E-06  | 3,25E-06 | 1,72E-05 | 3,55E-05 | 4,45E-05 | 1,61E-04 | 4,21E-04 | 6,57E-04 | 1,03E-03 | 1,90E-03 | 3,24E-03 | 7,94E-04 | 1,83E-03 |
|                 | 6,95E-06  | 2,18E-05 | 1,38E-04 | 3,04E-04 | 4,44E-04 | 1,61E-03 | 4,20E-03 | 6,56E-03 | 1,03E-02 | 1,89E-02 | 3,24E-02 | 7,92E-03 | 1,83E-02 |
|                 | 1,75E-05  | 6,31E-05 | 4,35E-04 | 9,89E-04 | 1,56E-03 | 5,64E-03 | 1,47E-02 | 2,30E-02 | 3,60E-02 | 6,64E-02 | 1,14E-01 | 2,78E-02 | 6,40E-02 |
|                 | 2,53E-05  | 9,95E-05 | 7,21E-04 | 1,67E-03 | 2,75E-03 | 9,96E-03 | 2,50E-02 | 4,06E-02 | 6,36E-02 | 1,17E-01 | 2,00E-01 | 4,90E-02 | 1,13E-01 |
|                 | 3,58E-05  | 1,49E-04 | 1,11E-03 | 2,61E-03 | 4,42E-03 | 1,60E-02 | 4,18E-02 | 6,53E-02 | 1,02E-01 | 1,89E-01 | 3,22E-01 | 7,89E-02 | 1,82E-01 |
|                 | 2,51E-05  | 1,08E-04 | 8,30E-04 | 1,96E-03 | 3,39E-03 | 1,23E-02 | 3,21E-02 | 5,01E-02 | 7,85E-02 | 1,45E-01 | 2,47E-01 | 6,05E-02 | 1,39E-01 |
|                 | 6,61E-06  | 2,94E-05 | 2,29E-04 | 5,45E-04 | 9,56E-04 | 3,46E-03 | 9,04E-03 | 1,41E-02 | 2,21E-02 | 4,07E-02 | 6,97E-02 | 1,70E-02 | 3,93E-02 |
|                 | 2,90E-07  | 1,32E-06 | 1,04E-05 | 2,49E-05 | 4,41E-05 | 1,60E-04 | 4,17E-04 | 6,52E-04 | 1,02E-03 | 1,88E-03 | 3,22E-03 | 7,87E-04 | 1,81E-03 |
|                 | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 | 22  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 | <b>Schädigungssumme (inkl. Shift-Faktor und Sicherheitsbeiwert): 3,09</b>                       |          |          |          |          |          |          |          |          |          |          |          |          |
|                 | <b>Nachweis: Reflektionsrisssbildung (3PB)</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
|                 | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltbinderschicht [MPa]</b> |          |          |          |          |          |          |          |          |          |          |          |          |
| Achslastklassen | 2   | 4        | 6        | 8        | 10       | 12       | 14       | 16       | 18       | 20       | 22       |          |          |
|                 | 0,9   | 0,9      | 0,9      | 0,9      | 0,9      | 0,8      | 0,7      | 0,7      | 0,6      | 0,5      | 0,5      | 0,4      | 0,3      |
|                 | 1,9   | 1,9      | 1,8      | 1,8      | 1,7      | 1,6      | 1,4      | 1,3      | 1,2      | 1,1      | 0,9      | 0,8      | 0,6      |
|                 | 2,8   | 2,8      | 2,8      | 2,7      | 2,6      | 2,4      | 2,1      | 2,0      | 1,8      | 1,6      | 1,4      | 1,2      | 1,0      |
|                 | 3,8   | 3,7      | 3,7      | 3,6      | 3,4      | 3,2      | 2,9      | 2,6      | 2,4      | 2,1      | 1,8      | 1,6      | 1,3      |
|                 | 4,7   | 4,7      | 4,6      | 4,5      | 4,3      | 4,0      | 3,6      | 3,3      | 3,0      | 2,6      | 2,3      | 2,0      | 1,6      |
|                 | 5,7   | 5,6      | 5,5      | 5,4      | 5,1      | 4,8      | 4,3      | 3,9      | 3,6      | 3,2      | 2,8      | 2,3      | 1,9      |
|                 | 6,6   | 6,5      | 6,4      | 6,3      | 6,0      | 5,6      | 5,0      | 4,6      | 4,2      | 3,7      | 3,2      | 2,7      | 2,2      |
|                 | 7,5   | 7,5      | 7,3      | 7,2      | 6,8      | 6,3      | 5,7      | 5,2      | 4,8      | 4,2      | 3,7      | 3,1      | 2,6      |
|                 | 8,5   | 8,4      | 8,3      | 8,1      | 7,7      | 7,1      | 6,4      | 5,9      | 5,4      | 4,7      | 4,1      | 3,5      | 2,9      |
|                 | 9,4   | 9,3      | 9,2      | 9,0      | 8,6      | 7,9      | 7,2      | 6,6      | 5,9      | 5,3      | 4,6      | 3,9      | 3,2      |
|                 | 10,4  | 10,2     | 10,1     | 9,9      | 9,4      | 8,7      | 7,9      | 7,2      | 6,5      | 5,8      | 5,1      | 4,3      | 3,5      |

|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |          |          |          |          |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |          |
| Achslastklassen |  | 2                               | 6,39E+05  | 6,74E+05 | 7,22E+05 | 7,98E+05 | 9,73E+05 | 1,36E+06 | 2,13E+06 | 3,12E+06 | 4,78E+06 | 8,07E+06 | 1,46E+07 | 2,99E+07 | 7,04E+07 |
|                 |  | 4                               | 3,10E+04  | 3,27E+04 | 3,51E+04 | 3,88E+04 | 4,73E+04 | 6,61E+04 | 1,04E+05 | 1,52E+05 | 2,32E+05 | 3,92E+05 | 7,12E+05 | 1,45E+06 | 3,42E+06 |
|                 |  | 6                               | 5,29E+03  | 5,58E+03 | 5,98E+03 | 6,61E+03 | 8,06E+03 | 1,13E+04 | 1,77E+04 | 2,59E+04 | 3,96E+04 | 6,69E+04 | 1,21E+05 | 2,47E+05 | 5,84E+05 |
|                 |  | 8                               | 1,51E+03  | 1,59E+03 | 1,70E+03 | 1,88E+03 | 2,30E+03 | 3,21E+03 | 5,04E+03 | 7,38E+03 | 1,13E+04 | 1,91E+04 | 3,46E+04 | 7,05E+04 | 1,66E+05 |
|                 |  | 10                              | 5,70E+02  | 6,01E+02 | 6,44E+02 | 7,12E+02 | 8,68E+02 | 1,21E+03 | 1,90E+03 | 2,79E+03 | 4,26E+03 | 7,20E+03 | 1,31E+04 | 2,66E+04 | 6,28E+04 |
|                 |  | 12                              | 2,57E+02  | 2,71E+02 | 2,91E+02 | 3,21E+02 | 3,92E+02 | 5,48E+02 | 8,59E+02 | 1,26E+03 | 1,92E+03 | 3,25E+03 | 5,90E+03 | 1,20E+04 | 2,84E+04 |
|                 |  | 14                              | 1,31E+02  | 1,38E+02 | 1,48E+02 | 1,64E+02 | 2,00E+02 | 2,80E+02 | 4,38E+02 | 6,42E+02 | 9,82E+02 | 1,66E+03 | 3,01E+03 | 6,13E+03 | 1,45E+04 |
|                 |  | 16                              | 7,33E+01  | 7,73E+01 | 8,29E+01 | 9,15E+01 | 1,12E+02 | 1,56E+02 | 2,45E+02 | 3,59E+02 | 5,48E+02 | 9,27E+02 | 1,68E+03 | 3,43E+03 | 8,08E+03 |
|                 |  | 18                              | 4,38E+01  | 4,63E+01 | 4,96E+01 | 5,48E+01 | 6,68E+01 | 9,34E+01 | 1,46E+02 | 2,14E+02 | 3,28E+02 | 5,54E+02 | 1,01E+03 | 2,05E+03 | 4,84E+03 |
|                 |  | 20                              | 2,77E+01  | 2,92E+01 | 3,13E+01 | 3,48E+01 | 4,22E+01 | 5,90E+01 | 9,24E+01 | 1,35E+02 | 2,07E+02 | 3,50E+02 | 6,35E+02 | 1,29E+03 | 3,05E+03 |
|                 |  | 22                              | 1,83E+01  | 1,93E+01 | 2,06E+01 | 2,28E+01 | 2,78E+01 | 3,89E+01 | 6,10E+01 | 8,94E+01 | 1,37E+02 | 2,31E+02 | 4,19E+02 | 8,54E+02 | 2,01E+03 |
|                 |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  | 2                               | 1,42E-03  | 5,16E-03 | 2,68E-02 | 3,33E-02 | 2,28E-02 | 1,98E-02 | 9,78E-03 | 3,92E-03 | 1,61E-03 | 7,11E-04 | 2,89E-04 | 1,52E-05 | 6,43E-06 |
|                 |  | 4                               | 2,68E-01  | 9,74E-01 | 5,06E+00 | 6,29E+00 | 4,31E+00 | 3,73E+00 | 1,85E+00 | 7,39E-01 | 3,05E-01 | 1,34E-01 | 5,45E-02 | 2,87E-03 | 1,21E-03 |
|                 |  | 6                               | 1,25E+00  | 4,56E+00 | 2,37E+01 | 2,94E+01 | 2,02E+01 | 1,75E+01 | 8,64E+00 | 3,46E+00 | 1,42E+00 | 6,28E-01 | 2,55E-01 | 1,34E-02 | 5,68E-03 |
|                 |  | 8                               | 2,57E+00  | 9,33E+00 | 4,85E+01 | 6,03E+01 | 4,13E+01 | 3,58E+01 | 1,77E+01 | 7,09E+00 | 2,92E+00 | 1,29E+00 | 5,23E-01 | 2,79E-02 | 1,16E-02 |
|                 |  | 10                              | 2,99E+00  | 1,09E+01 | 5,64E+01 | 7,01E+01 | 4,80E+01 | 4,16E+01 | 2,06E+01 | 8,24E+00 | 3,39E+00 | 1,50E+00 | 6,08E-01 | 3,20E-02 | 1,35E-02 |
|                 |  | 12                              | 3,42E+00  | 1,24E+01 | 6,45E+01 | 8,03E+01 | 5,50E+01 | 4,76E+01 | 2,35E+01 | 9,43E+00 | 3,88E+00 | 1,71E+00 | 6,96E-01 | 3,66E-02 | 1,55E-02 |
|                 |  | 14                              | 1,96E+00  | 7,14E+00 | 3,71E+01 | 4,61E+01 | 3,16E+01 | 2,74E+01 | 1,35E+01 | 5,42E+00 | 2,23E+00 | 9,84E-01 | 4,00E-01 | 2,10E-02 | 8,90E-03 |
|                 |  | 16                              | 4,31E-01  | 1,57E+00 | 8,14E+00 | 1,01E+01 | 6,94E+00 | 6,01E+00 | 2,97E+00 | 1,19E+00 | 4,90E-01 | 2,16E-01 | 8,78E-02 | 4,61E-03 | 1,96E-03 |
|                 |  | 18                              | 1,60E-02  | 5,81E-02 | 3,02E-01 | 3,75E-01 | 2,57E-01 | 2,23E-01 | 1,10E-01 | 4,41E-02 | 1,82E-02 | 8,01E-03 | 3,25E-03 | 1,77E-04 | 7,24E-05 |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  |                                 | <b>1142,33</b>                                      |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  |                                 | <b>Nachweis: Rissenergie (Keilspatversuch)</b>      |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  | 2                               | 1,87E-02  | 7,47E-02 | 4,42E-01 | 6,59E-01 | 6,09E-01 | 8,26E-01 | 7,16E-01 | 4,65E-01 | 3,19E-01 | 2,55E-01 | 1,98E-01 | 2,20E-02 | 2,26E-02 |
|                 |  | 4                               | 6,85E-01  | 2,74E+00 | 1,62E+01 | 2,42E+01 | 2,24E+01 | 3,03E+01 | 2,63E+01 | 1,71E+01 | 1,17E+01 | 9,36E+00 | 7,27E+00 | 8,09E-01 | 8,30E-01 |
|                 |  | 6                               | 1,23E+00  | 4,92E+00 | 2,91E+01 | 4,34E+01 | 4,01E+01 | 5,44E+01 | 4,72E+01 | 3,06E+01 | 2,10E+01 | 1,68E+01 | 1,31E+01 | 1,45E+00 | 1,49E+00 |
|                 |  | 8                               | 1,28E+00  | 5,11E+00 | 3,02E+01 | 4,51E+01 | 4,16E+01 | 5,65E+01 | 4,90E+01 | 3,18E+01 | 2,18E+01 | 1,74E+01 | 1,35E+01 | 1,51E+00 | 1,55E+00 |
|                 |  | 10                              | 8,75E-01  | 3,51E+00 | 2,08E+01 | 3,09E+01 | 2,86E+01 | 3,88E+01 | 3,36E+01 | 2,18E+01 | 1,50E+01 | 1,20E+01 | 9,30E+00 | 1,03E+00 | 1,06E+00 |
|                 |  | 12                              | 6,51E-01  | 2,61E+00 | 1,54E+01 | 2,30E+01 | 2,13E+01 | 2,88E+01 | 2,50E+01 | 1,62E+01 | 1,11E+01 | 8,90E+00 | 6,92E+00 | 7,69E-01 | 7,89E-01 |
|                 |  | 14                              | 2,60E-01  | 1,04E+00 | 6,17E+00 | 9,19E+00 | 8,49E+00 | 1,15E+01 | 9,99E+00 | 6,48E+00 | 4,45E+00 | 3,56E+00 | 2,76E+00 | 3,07E-01 | 3,15E-01 |
|                 |  | 16                              | 4,16E-02  | 1,67E-01 | 9,88E-01 | 1,47E+00 | 1,36E+00 | 1,84E+00 | 1,60E+00 | 1,04E+00 | 7,12E-01 | 5,69E-01 | 4,42E-01 | 4,92E-02 | 5,05E-02 |
|                 |  | 18                              | 1,17E-03  | 4,68E-03 | 2,77E-02 | 4,13E-02 | 3,81E-02 | 5,17E-02 | 4,49E-02 | 2,91E-02 | 2,00E-02 | 1,60E-02 | 1,24E-02 | 1,38E-03 | 1,42E-03 |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  |                                 | <b>1249,70</b>                                      |          |          |          |          |          |          |          |          |          |          |          |          |

|               |            | <b>Instandsetzung: Befestigung der Belastungsklasse Bk10: Kunststoffgitter</b>                     |        |         |         |         |         |         |         |        |        |        |       |       |  |
|---------------|------------|--|--------|---------|---------|---------|---------|---------|---------|--------|--------|--------|-------|-------|--|
|               |            | <b>Oberflächentemperatur</b>   |        |         |         |         |         |         |         |        |        |        |       |       |  |
|               |            | -12,5  | -7,5   | -2,5    | 2,5     | 7,5     | 12,5    | 17,5    | 22,5    | 27,5   | 32,5   | 37,5   | 42,5  | 47,5  |  |
| Schicht       | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule   |        |         |         |         |         |         |         |        |        |        |       |       |  |
| SMA           | 1          | 23.857   | 21.457 | 18.403  | 14.949  | 11.470  | 8.374   | 5.901   | 4.097   | 2.817  | 1.928  | 1.322  | 910   | 629   |  |
| SMA           | 1          | 23.606   | 21.225 | 18.249  | 14.903  | 11.464  | 8.358   | 5.886   | 4.143   | 2.897  | 2.014  | 1.403  | 978   | 682   |  |
| SMA           | 2          | 23.251   | 20.905 | 18.040  | 14.842  | 11.456  | 8.338   | 5.865   | 4.205   | 3.009  | 2.136  | 1.520  | 1.078 | 761   |  |
| ACB           | 2          | 27.780   | 26.031 | 23.761  | 20.961  | 17.464  | 13.669  | 10.245  | 7.846   | 5.970  | 4.468  | 3.332  | 2.457 | 1.785 |  |
| AC B          | 2          | 27.480   | 25.756 | 23.572  | 20.899  | 17.455  | 13.642  | 10.213  | 7.950   | 6.181  | 4.722  | 3.599  | 2.704 | 1.991 |  |
| AC B          | 2          | 27.198   | 25.504 | 23.401  | 20.844  | 17.446  | 13.618  | 10.186  | 8.043   | 6.373  | 4.959  | 3.854  | 2.943 | 2.194 |  |
| AE            | 0,3        | 22.679   | 21.306 | 19.618  | 17.572  | 14.806  | 11.660  | 8.844   | 7.140   | 5.815  | 4.677  | 3.780  | 3.028 | 2.398 |  |
| Alter Asphalt | 14         | 500  | 500    | 500     | 500     | 500     | 500     | 500     | 500     | 500    | 500    | 500    | 500   | 500   |  |
| FSS           | 50         | 120  | 120    | 120     | 120     | 120     | 120     | 120     | 120     | 120    | 120    | 120    | 120   | 120   |  |
| Untergrund    | 45         | 45   | 45     | 45      | 45      | 45      | 45      | 45      | 45      | 45     | 45     | 45     | 45    | 45    |  |
|               |            | <b>Vorhandene Anzahl an Lastfällen (Achsenübergängen des Schwerverkehrs)</b>                       |        |         |         |         |         |         |         |        |        |        |       |       |  |
|               | 2          | 906  | 3.474  | 19.335  | 26.585  | 22.205  | 26.887  | 20.845  | 12.235  | 7.704  | 5.740  | 4.229  | 453   | 453   |  |
|               | 4          | 8.317  | 31.882 | 177.429 | 243.965 | 203.766 | 246.737 | 191.291 | 112.279 | 70.694 | 52.674 | 38.813 | 4.158 | 4.158 |  |
|               | 6          | 6.634  | 25.429 | 141.517 | 194.566 | 162.523 | 196.797 | 152.573 | 89.554  | 56.366 | 42.013 | 30.957 | 3.317 | 3.317 |  |
|               | 8          | 3.873  | 14.847 | 82.629  | 113.615 | 94.894  | 114.906 | 89.084  | 52.289  | 32.922 | 24.530 | 18.075 | 1.937 | 1.937 |  |
|               | 10         | 1.702  | 6.523  | 36.301  | 49.914  | 41.690  | 50.481  | 39.137  | 22.972  | 14.464 | 10.777 | 7.941  | 851   | 851   |  |
|               | 12         | 879  | 3.369  | 18.750  | 25.781  | 21.533  | 26.074  | 20.215  | 11.865  | 7.471  | 5.566  | 4.102  | 439   | 439   |  |
|               | 14         | 258  | 988    | 5.500   | 7.563   | 6.317   | 7.649   | 5.930   | 3.481   | 2.192  | 1.633  | 1.203  | 129   | 129   |  |
|               | 16         | 32   | 121    | 675     | 927     | 775     | 938     | 727     | 427     | 269    | 200    | 148    | 16    | 16    |  |
|               | 18         | 0,7  | 2,7    | 14,9    | 20,6    | 17,2    | 20,8    | 16,1    | 9,5     | 6,0    | 4,4    | 3,3    | 0,4   | 0,4   |  |
|               | 20         | 0,0  | 0,0    | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0    | 0,0    | 0,0    | 0,0   | 0,0   |  |
|               | 22         | 0,0  | 0,0    | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0     | 0,0    | 0,0    | 0,0    | 0,0   | 0,0   |  |
|               |            | <b>Nachweisformat: RDO Asphalt</b>   |        |         |         |         |         |         |         |        |        |        |       |       |  |
|               |            | <b>Ergebnis des Primärwirkungsmodells: Dehnung an der Unterseite der Asphaltdeckschicht [µm/m]</b> |        |         |         |         |         |         |         |        |        |        |       |       |  |
|               | 2          | 20,1   | 21,1   | 22,4    | 24,3    | 27,2    | 31,4    | 36,4    | 40,7    | 44,7   | 48,5   | 51,5   | 53,6  | 54,5  |  |
|               | 4          | 40,3   | 42,2   | 44,9    | 48,6    | 54,4    | 62,7    | 72,8    | 81,4    | 89,4   | 97,0   | 103,0  | 107,2 | 109,1 |  |
|               | 6          | 60,4   | 63,3   | 67,3    | 72,9    | 81,6    | 94,1    | 109,3   | 122,1   | 134,1  | 145,4  | 154,4  | 160,8 | 163,6 |  |
|               | 8          | 80,5   | 84,3   | 89,7    | 97,2    | 108,8   | 125,5   | 145,7   | 162,8   | 178,8  | 193,9  | 205,9  | 214,4 | 218,1 |  |
|               | 10         | 100,7  | 105,4  | 112,1   | 121,5   | 136,0   | 156,8   | 182,1   | 203,5   | 223,5  | 242,4  | 257,4  | 268,0 | 272,6 |  |
|               | 12         | 120,8  | 126,5  | 134,6   | 145,8   | 163,3   | 188,2   | 218,5   | 244,2   | 268,2  | 290,9  | 308,9  | 321,6 | 327,2 |  |
|               | 14         | 141,0  | 147,6  | 157,0   | 170,1   | 190,5   | 219,6   | 255,0   | 284,9   | 312,9  | 339,3  | 360,3  | 375,2 | 381,7 |  |
|               | 16         | 161,1  | 168,7  | 179,4   | 194,4   | 217,7   | 250,9   | 291,4   | 325,6   | 357,6  | 387,8  | 411,8  | 428,8 | 436,2 |  |
|               | 18         | 181,2  | 189,8  | 201,8   | 218,7   | 244,9   | 282,3   | 327,8   | 366,3   | 402,3  | 436,3  | 463,3  | 482,4 | 490,8 |  |
|               | 20         | 201,4  | 210,9  | 224,3   | 243,0   | 272,1   | 313,7   | 364,2   | 407,0   | 447,0  | 484,8  | 514,8  | 536,0 | 545,3 |  |
|               | 22         | 221,5  | 231,9  | 246,7   | 267,3   | 299,3   | 345,0   | 400,7   | 447,7   | 491,7  | 533,2  | 566,2  | 589,6 | 599,8 |  |

Achslastklassen

Achslastklassen

|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |          |          |          |          |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |          |
| Achslastklassen |  | 2                               | 6,71E+12  | 5,04E+12 | 3,43E+12 | 2,08E+12 | 1,03E+12 | 4,24E+11 | 1,67E+11 | 8,36E+10 | 4,66E+10 | 2,31E+10 | 1,93E+10 | 1,50E+10 | 1,35E+10 |
|                 |  | 4                               | 8,93E+10  | 6,70E+10 | 4,57E+10 | 2,77E+10 | 1,37E+10 | 5,64E+09 | 2,22E+09 | 1,11E+09 | 6,20E+08 | 3,74E+08 | 2,57E+08 | 2,00E+08 | 1,80E+08 |
|                 |  | 6                               | 7,14E+09  | 5,36E+09 | 3,65E+09 | 2,21E+09 | 1,09E+09 | 4,51E+08 | 1,78E+08 | 8,89E+07 | 4,96E+07 | 2,99E+07 | 2,06E+07 | 1,60E+07 | 1,44E+07 |
|                 |  | 8                               | 1,19E+09  | 8,92E+08 | 6,08E+08 | 3,68E+08 | 1,82E+08 | 7,51E+07 | 2,96E+07 | 1,48E+07 | 8,25E+06 | 4,98E+06 | 3,42E+06 | 2,66E+06 | 2,39E+06 |
|                 |  | 10                              | 2,96E+08  | 2,22E+08 | 1,51E+08 | 9,16E+07 | 4,53E+07 | 1,87E+07 | 7,36E+06 | 3,68E+06 | 2,05E+06 | 1,24E+06 | 8,52E+05 | 6,63E+05 | 5,95E+05 |
|                 |  | 12                              | 9,49E+07  | 7,13E+07 | 4,86E+07 | 2,94E+07 | 6,00E+06 | 2,36E+06 | 1,18E+06 | 6,59E+05 | 3,98E+05 | 2,74E+05 | 2,13E+05 | 1,91E+05 | 1,91E+05 |
|                 |  | 14                              | 3,63E+07  | 2,73E+07 | 1,86E+07 | 1,13E+07 | 5,57E+06 | 9,04E+05 | 4,52E+05 | 2,52E+05 | 1,52E+05 | 1,05E+05 | 8,14E+04 | 7,31E+04 | 7,31E+04 |
|                 |  | 16                              | 1,58E+07  | 1,19E+07 | 8,08E+06 | 4,90E+06 | 2,42E+06 | 9,99E+05 | 3,93E+05 | 1,97E+05 | 1,10E+05 | 6,63E+04 | 4,56E+04 | 3,54E+04 | 3,18E+04 |
|                 |  | 18                              | 7,59E+06  | 5,69E+06 | 3,88E+06 | 2,35E+06 | 1,16E+06 | 4,79E+05 | 1,89E+05 | 9,45E+04 | 5,27E+04 | 3,18E+04 | 2,19E+04 | 1,70E+04 | 1,53E+04 |
|                 |  | 20                              | 3,93E+06  | 2,95E+06 | 2,01E+06 | 1,22E+06 | 6,03E+05 | 2,49E+05 | 9,79E+04 | 4,90E+04 | 2,73E+04 | 1,65E+04 | 1,13E+04 | 8,82E+03 | 7,92E+03 |
|                 |  | 22                              | 2,17E+06  | 1,63E+06 | 1,11E+06 | 6,73E+05 | 3,33E+05 | 1,37E+05 | 5,41E+04 | 2,71E+04 | 1,51E+04 | 9,11E+03 | 6,26E+03 | 4,87E+03 | 4,37E+03 |
|                 |  |                                 | <b>Schädigungsquotient</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  | 2                               | 7,47E-09  | 9,07E-09 | 2,58E-08 | 3,83E-08 | 2,16E-08 | 6,34E-08 | 1,25E-07 | 1,46E-07 | 1,65E-07 | 2,04E-07 | 2,19E-07 | 3,01E-08 | 3,35E-08 |
|                 |  | 4                               | 7,98E-07  | 1,71E-06 | 8,00E-06 | 1,48E-05 | 1,49E-05 | 4,37E-05 | 8,61E-05 | 1,01E-04 | 1,14E-04 | 1,41E-04 | 1,51E-04 | 2,08E-05 | 2,31E-05 |
|                 |  | 6                               | 3,85E-06  | 1,08E-05 | 6,17E-05 | 1,23E-04 | 1,49E-04 | 4,36E-04 | 8,59E-04 | 1,01E-03 | 1,14E-03 | 1,40E-03 | 1,50E-03 | 2,07E-04 | 2,31E-04 |
|                 |  | 8                               | 9,27E-06  | 3,05E-05 | 1,91E-04 | 3,95E-04 | 5,21E-04 | 1,53E-03 | 3,01E-03 | 3,53E-03 | 3,99E-03 | 4,93E-03 | 5,28E-03 | 7,27E-04 | 8,10E-04 |
|                 |  | 10                              | 1,31E-05  | 4,72E-05 | 3,14E-04 | 6,61E-04 | 9,20E-04 | 2,70E-03 | 5,32E-03 | 6,24E-03 | 7,04E-03 | 8,69E-03 | 9,31E-03 | 1,28E-03 | 1,43E-03 |
|                 |  | 12                              | 1,81E-05  | 6,98E-05 | 4,82E-04 | 1,03E-03 | 1,48E-03 | 4,35E-03 | 8,56E-03 | 1,00E-02 | 1,13E-02 | 1,40E-02 | 1,50E-02 | 2,07E-03 | 2,30E-03 |
|                 |  | 14                              | 1,25E-05  | 5,04E-05 | 3,57E-04 | 7,70E-04 | 1,13E-03 | 3,33E-03 | 6,56E-03 | 7,69E-03 | 8,68E-03 | 1,07E-02 | 1,15E-02 | 1,58E-03 | 1,76E-03 |
|                 |  | 16                              | 3,27E-06  | 1,36E-05 | 9,83E-05 | 2,13E-04 | 3,20E-04 | 9,39E-04 | 1,85E-03 | 2,17E-03 | 2,45E-03 | 3,02E-03 | 3,24E-03 | 4,46E-04 | 4,97E-04 |
|                 |  | 18                              | 1,42E-07  | 6,07E-07 | 4,45E-06 | 9,71E-06 | 1,48E-05 | 4,34E-05 | 8,54E-05 | 1,00E-04 | 1,13E-04 | 1,40E-04 | 1,50E-04 | 2,06E-05 | 2,29E-05 |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
|                 |  |                                 | <b>Schädigungssumme (inkl. Shift-Faktor und Sicherheitsbeiwert):</b>                            |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  |                                 | <b>0,22</b>   |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  |                                 | <b>Nachweis: Reflektionsrissebildung (3PB)</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
|                 |  |                                 | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltbinderschicht [MPa]</b> |          |          |          |          |          |          |          |          |          |          |          |          |
| Achslastklassen |  | 2                               | 0,8   | 0,8      | 0,8      | 0,8      | 0,8      | 0,7      | 0,6      | 0,5      | 0,5      | 0,5      | 0,4      | 0,3      | 0,3      |
|                 |  | 4                               | 1,7   | 1,6      | 1,6      | 1,5      | 1,4      | 1,3      | 1,3      | 1,1      | 1,0      | 1,0      | 0,8      | 0,7      | 0,5      |
|                 |  | 6                               | 2,5   | 2,4      | 2,4      | 2,3      | 2,1      | 1,9      | 1,9      | 1,6      | 1,4      | 1,4      | 1,2      | 1,0      | 0,8      |
|                 |  | 8                               | 3,3   | 3,3      | 3,2      | 3,1      | 2,9      | 2,6      | 2,6      | 2,2      | 1,9      | 1,9      | 1,6      | 1,3      | 1,1      |
|                 |  | 10                              | 4,2   | 4,1      | 4,0      | 3,8      | 3,6      | 3,2      | 3,2      | 2,7      | 2,4      | 2,4      | 2,0      | 1,7      | 1,3      |
|                 |  | 12                              | 5,0   | 4,9      | 4,8      | 4,6      | 4,3      | 3,8      | 3,8      | 3,3      | 2,9      | 2,4      | 2,4      | 2,0      | 1,6      |
|                 |  | 14                              | 5,8   | 5,7      | 5,6      | 5,4      | 5,0      | 4,5      | 4,5      | 3,8      | 3,3      | 2,9      | 2,9      | 2,3      | 1,9      |
|                 |  | 16                              | 6,7   | 6,5      | 6,4      | 6,1      | 5,7      | 5,1      | 5,1      | 4,4      | 3,8      | 3,3      | 3,3      | 2,7      | 2,1      |
|                 |  | 18                              | 7,5   | 7,3      | 7,2      | 7,2      | 6,9      | 6,4      | 6,4      | 4,9      | 4,3      | 3,7      | 3,7      | 3,0      | 2,4      |
|                 |  | 20                              | 8,3   | 8,2      | 8,2      | 7,9      | 7,7      | 7,1      | 7,1      | 6,4      | 4,8      | 4,3      | 4,1      | 3,4      | 2,7      |
|                 |  | 22                              | 9,1   | 9,0      | 8,7      | 8,4      | 7,9      | 7,0      | 7,0      | 6,0      | 5,3      | 4,8      | 4,5      | 3,7      | 2,9      |



|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|--|--|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |          |  |  |  |
| Achslastklassen |  | 2                               | 1,03E+06  | 1,11E+06 | 1,23E+06 | 1,42E+06 | 1,84E+06 | 2,83E+06 | 5,04E+06 | 8,53E+06 | 1,55E+07 | 3,27E+07 | 7,85E+07 | 2,35E+08 | 9,93E+08 |  |  |  |
|                 |  | 4                               | 7,41E+04  | 7,97E+04 | 8,80E+04 | 1,02E+05 | 1,32E+05 | 2,03E+05 | 3,61E+05 | 6,11E+05 | 1,11E+06 | 2,34E+06 | 5,62E+06 | 1,69E+07 | 7,12E+07 |  |  |  |
|                 |  | 6                               | 1,59E+04  | 1,71E+04 | 1,88E+04 | 2,17E+04 | 2,83E+04 | 4,34E+04 | 7,73E+04 | 1,31E+05 | 2,38E+05 | 5,01E+05 | 1,20E+06 | 3,61E+06 | 1,52E+07 |  |  |  |
|                 |  | 8                               | 5,31E+03  | 5,72E+03 | 6,31E+03 | 7,28E+03 | 9,47E+03 | 1,45E+04 | 2,59E+04 | 4,38E+04 | 7,96E+04 | 1,68E+05 | 4,03E+05 | 1,21E+06 | 5,11E+06 |  |  |  |
|                 |  | 10                              | 2,27E+03  | 2,45E+03 | 2,70E+03 | 3,12E+03 | 4,05E+03 | 6,22E+03 | 1,11E+04 | 3,41E+04 | 7,19E+04 | 1,73E+05 | 5,18E+05 | 1,21E+06 | 5,11E+06 |  |  |  |
|                 |  | 12                              | 1,14E+03  | 1,22E+03 | 1,35E+03 | 1,56E+03 | 2,03E+03 | 3,11E+03 | 5,54E+03 | 9,38E+03 | 1,70E+04 | 3,59E+04 | 8,63E+04 | 2,59E+05 | 1,09E+06 |  |  |  |
|                 |  | 14                              | 6,33E+02  | 6,81E+02 | 7,52E+02 | 8,67E+02 | 1,13E+03 | 1,73E+03 | 3,09E+03 | 5,22E+03 | 9,48E+03 | 2,00E+04 | 4,80E+04 | 1,44E+05 | 6,08E+05 |  |  |  |
|                 |  | 16                              | 3,81E+02  | 4,10E+02 | 4,52E+02 | 5,22E+02 | 6,79E+02 | 1,04E+03 | 1,86E+03 | 3,14E+03 | 5,71E+03 | 1,20E+04 | 2,89E+04 | 8,67E+04 | 3,66E+05 |  |  |  |
|                 |  | 18                              | 2,43E+02  | 2,62E+02 | 2,89E+02 | 3,34E+02 | 4,34E+02 | 6,66E+02 | 1,19E+03 | 2,01E+03 | 3,65E+03 | 7,69E+03 | 1,85E+04 | 5,54E+04 | 2,34E+05 |  |  |  |
|                 |  | 20                              | 1,63E+02  | 1,75E+02 | 1,94E+02 | 2,23E+02 | 2,91E+02 | 4,46E+02 | 7,95E+02 | 1,34E+03 | 2,44E+03 | 5,15E+03 | 1,24E+04 | 3,71E+04 | 1,57E+05 |  |  |  |
|                 |  | 22                              | 1,13E+02  | 1,22E+02 | 1,35E+02 | 1,56E+02 | 2,02E+02 | 3,10E+02 | 5,53E+02 | 9,36E+02 | 1,70E+03 | 3,59E+03 | 8,61E+03 | 2,58E+04 | 1,09E+05 |  |  |  |
|                 |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  | 2                               | 8,77E-04  | 3,12E-03 | 1,57E-02 | 1,88E-02 | 1,21E-02 | 9,51E-03 | 4,14E-03 | 1,44E-03 | 4,97E-04 | 1,76E-04 | 5,39E-05 | 1,93E-06 | 4,56E-07 |  |  |  |
|                 |  | 4                               | 1,12E-01  | 4,00E-01 | 2,02E+00 | 2,40E+00 | 1,54E+00 | 1,22E+00 | 5,30E-01 | 1,84E-01 | 6,37E-02 | 2,25E-02 | 6,90E-03 | 2,47E-04 | 5,84E-05 |  |  |  |
|                 |  | 6                               | 4,18E-01  | 1,49E+00 | 7,51E+00 | 8,95E+00 | 5,75E+00 | 4,54E+00 | 1,97E+00 | 6,85E-01 | 2,37E-01 | 8,38E-02 | 2,57E-02 | 9,19E-04 | 2,18E-04 |  |  |  |
|                 |  | 8                               | 7,29E-01  | 2,60E+00 | 1,31E+01 | 1,56E+01 | 1,00E+01 | 7,91E+00 | 3,44E+00 | 1,19E+00 | 4,14E-01 | 1,46E-01 | 4,48E-02 | 1,60E-03 | 3,79E-04 |  |  |  |
|                 |  | 10                              | 7,48E-01  | 2,67E+00 | 1,34E+01 | 1,60E+01 | 1,03E+01 | 8,12E+00 | 3,53E+00 | 1,22E+00 | 4,24E-01 | 1,50E-01 | 4,60E-02 | 1,64E-03 | 3,89E-04 |  |  |  |
|                 |  | 12                              | 7,73E-01  | 2,76E+00 | 1,39E+01 | 1,65E+01 | 1,06E+01 | 8,38E+00 | 3,65E+00 | 1,27E+00 | 4,38E-01 | 1,55E-01 | 4,75E-02 | 1,70E-03 | 4,02E-04 |  |  |  |
|                 |  | 14                              | 4,07E-01  | 1,45E+00 | 7,32E+00 | 8,72E+00 | 5,60E+00 | 4,42E+00 | 1,92E+00 | 6,57E-01 | 2,31E-01 | 8,16E-02 | 2,50E-02 | 8,95E-04 | 2,12E-04 |  |  |  |
|                 |  | 16                              | 8,30E-02  | 2,96E-01 | 1,49E+00 | 1,78E+00 | 1,14E+00 | 9,01E-01 | 3,92E-01 | 1,36E-01 | 4,71E-02 | 1,66E-02 | 5,10E-03 | 1,82E-04 | 4,32E-05 |  |  |  |
|                 |  | 18                              | 2,88E-03  | 1,03E-02 | 5,17E-02 | 6,16E-02 | 3,96E-02 | 3,12E-02 | 1,36E-02 | 4,71E-03 | 1,63E-03 | 5,77E-04 | 1,77E-04 | 6,32E-06 | 1,50E-06 |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>247,94</b>                                       |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>Nachweis: Rissenergie (Keilspaltversuch)</b>     |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  | 2                               | 1,45E-02  | 5,71E-02 | 3,31E-01 | 4,80E-01 | 4,23E-01 | 5,34E-01 | 4,20E-01 | 2,47E-01 | 1,51E-01 | 1,05E-01 | 6,87E-02 | 6,17E-03 | 4,76E-03 |  |  |  |
|                 |  | 4                               | 5,31E-01  | 2,10E+00 | 1,22E+01 | 1,76E+01 | 1,55E+01 | 1,96E+01 | 1,54E+01 | 9,05E+00 | 5,54E+00 | 3,84E+00 | 2,52E+00 | 2,26E-01 | 1,75E-01 |  |  |  |
|                 |  | 6                               | 9,53E-01  | 3,76E+00 | 2,18E+01 | 3,16E+01 | 2,79E+01 | 3,51E+01 | 2,77E+01 | 1,62E+01 | 9,95E+00 | 6,90E+00 | 4,53E+00 | 4,06E-01 | 3,14E-01 |  |  |  |
|                 |  | 8                               | 9,89E-01  | 3,91E+00 | 2,27E+01 | 3,28E+01 | 2,89E+01 | 3,65E+01 | 2,87E+01 | 1,69E+01 | 1,03E+01 | 7,16E+00 | 4,70E+00 | 4,22E-01 | 3,26E-01 |  |  |  |
|                 |  | 10                              | 6,79E-01  | 2,68E+00 | 1,56E+01 | 2,25E+01 | 1,98E+01 | 2,50E+01 | 1,97E+01 | 1,16E+01 | 7,09E+00 | 4,92E+00 | 3,22E+00 | 2,89E-01 | 2,24E-01 |  |  |  |
|                 |  | 12                              | 5,05E-01  | 1,99E+00 | 1,16E+01 | 1,67E+01 | 1,48E+01 | 1,86E+01 | 1,47E+01 | 8,61E+00 | 5,27E+00 | 3,66E+00 | 2,40E+00 | 2,15E-01 | 1,66E-01 |  |  |  |
|                 |  | 14                              | 2,02E-01  | 7,96E-01 | 4,62E+00 | 6,69E+00 | 5,89E+00 | 7,44E+00 | 5,89E+00 | 3,44E+00 | 2,11E+00 | 1,46E+00 | 9,58E-01 | 8,59E-02 | 6,64E-02 |  |  |  |
|                 |  | 16                              | 3,23E-02  | 1,28E-01 | 7,40E-01 | 1,07E+00 | 9,44E-01 | 1,19E+00 | 9,37E-01 | 5,51E-01 | 3,37E-01 | 2,34E-01 | 1,38E-02 | 1,38E-02 | 1,06E-02 |  |  |  |
|                 |  | 18                              | 9,06E-04  | 3,58E-03 | 2,08E-02 | 3,00E-02 | 2,65E-02 | 3,34E-02 | 2,63E-02 | 1,54E-02 | 9,46E-03 | 6,56E-03 | 4,30E-03 | 3,86E-04 | 2,98E-04 |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |  |  |  |
|                 |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |
|                 |  |                                 | <b>767,19</b>                                       |          |          |          |          |          |          |          |          |          |          |          |          |  |  |  |

| Instandsetzung: Befestigung der Belastungsklasse Bk100: Referenz (ohne Asphaltanlage)              |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |
|--|------------|--------------------------------------|---------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|--------|--------|
|  |            | Oberflächentemperatur                |         |           |           |           |           |           |           |           |           |         |        |        |
|  |            | -12,5                                | -7,5    | -2,5      | 2,5       | 7,5       | 12,5      | 17,5      | 22,5      | 27,5      | 32,5      | 37,5    | 42,5   | 47,5   |
| Schicht  | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule |         |           |           |           |           |           |           |           |           |         |        |        |
| SMA  | 0,5        | 23.922                               | 21.518  | 18.444    | 14.961    | 11.472    | 8.378     | 5.905     | 4.085     | 2.796     | 1.906     | 1.301   | 892    | 616    |
| SMA  | 0,5        | 23.793                               | 21.397  | 18.363    | 14.937    | 11.469    | 8.370     | 5.897     | 4.109     | 2.838     | 1.950     | 1.342   | 927    | 642    |
| SMA  | 1          | 23.606                               | 21.225  | 18.249    | 14.903    | 11.464    | 8.358     | 5.886     | 4.143     | 2.897     | 2.014     | 1.403   | 978    | 682    |
| SMA  | 1          | 23.366                               | 21.008  | 18.107    | 14.862    | 11.459    | 8.344     | 5.871     | 4.185     | 2.973     | 2.096     | 1.481   | 1.045  | 735    |
| SMA  | 0,5        | 23.194                               | 20.854  | 18.007    | 14.832    | 11.455    | 8.335     | 5.861     | 4.215     | 3.027     | 2.156     | 1.539   | 1.095  | 775    |
| SMA  | 0,5        | 23.082                               | 20.755  | 17.944    | 14.814    | 11.452    | 8.328     | 5.855     | 4.234     | 3.062     | 2.195     | 1.577   | 1.128  | 801    |
| Alter Asphalt  | 22         | 500                                  | 500     | 500       | 500       | 500       | 500       | 500       | 500       | 500       | 500       | 500     | 500    | 500    |
| FSS  | 50         | 120                                  | 120     | 120       | 120       | 120       | 120       | 120       | 120       | 120       | 120       | 120     | 120    | 120    |
| Untergrund   |            | 45                                   | 45      | 45        | 45        | 45        | 45        | 45        | 45        | 45        | 45        | 45      | 45     | 45     |
| <b>Vorhandene Anzahl an Lastfällen (Achsenübergängen des Schwerverkehrs)</b>                       |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |
|  | 2          | 17.019                               | 65.239  | 363.068   | 499.218   | 416.961   | 504.891   | 391.433   | 229.754   | 144.660   | 107.786   | 79.421  | 8.509  | 8.509  |
|  | 4          | 128.660                              | 493.197 | 2.744.746 | 3.774.026 | 3.152.169 | 3.816.912 | 2.959.179 | 1.736.910 | 1.093.610 | 814.846   | 600.413 | 64.330 | 64.330 |
|  | 6          | 158.734                              | 608.479 | 3.386.316 | 4.656.185 | 3.888.972 | 4.709.096 | 3.650.872 | 2.142.903 | 1.349.235 | 1.005.313 | 740.757 | 79.367 | 79.367 |
|  | 8          | 184.114                              | 705.769 | 3.927.760 | 5.400.670 | 4.510.787 | 5.462.041 | 4.234.616 | 2.485.536 | 1.564.967 | 1.166.054 | 859.198 | 92.057 | 92.057 |
|  | 10         | 70.142                               | 268.877 | 1.496.358 | 2.057.492 | 1.718.477 | 2.080.872 | 1.613.261 | 946.914   | 596.205   | 444.231   | 327.328 | 35.071 | 35.071 |
|  | 12         | 29.426                               | 112.801 | 627.761   | 863.172   | 720.945   | 872.981   | 676.805   | 397.255   | 250.124   | 186.367   | 137.323 | 14.713 | 14.713 |
|  | 14         | 9.913                                | 38.000  | 211.479   | 290.783   | 242.870   | 294.087   | 228.000   | 133.826   | 84.261    | 62.783    | 46.261  | 4.957  | 4.957  |
|  | 16         | 1.251                                | 4.795   | 26.684    | 36.691    | 30.645    | 37.108    | 28.769    | 16.886    | 10.632    | 7.922     | 5.837   | 625    | 625    |
|  | 18         | 76                                   | 289     | 1.611     | 2.215     | 1.850     | 2.240     | 1.737     | 1.019     | 642       | 478       | 352     | 38     | 38     |
|  | 20         | 4.2                                  | 16.1    | 89.5      | 123.1     | 102.8     | 124.5     | 96.5      | 56.6      | 35.7      | 26.6      | 19.6    | 2.1    | 2.1    |
|  | 22         | 0.6                                  | 2.3     | 12.8      | 17.6      | 14.7      | 17.8      | 13.8      | 8.1       | 5.1       | 3.8       | 2.8     | 0.3    | 0.3    |
| <b>Nachweisformat: RDO Asphalt</b>   |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |
| <b>Ergebnis des Primärwirkungsmodells: Dehnung an der Unterseite der Asphaltdeckschicht [µm/m]</b> |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |
|  | 2          | 32.5                                 | 33.3    | 34.2      | 35.1      | 35.9      | 35.8      | 34.2      | 30.8      | 25.7      | 19.3      | 12.1    | 4.7    | -2.5   |
|  | 4          | 65.0                                 | 66.6    | 68.4      | 70.3      | 71.7      | 71.6      | 68.5      | 61.6      | 51.4      | 38.6      | 24.3    | 9.4    | -5.0   |
|  | 6          | 97.5                                 | 99.9    | 102.7     | 105.4     | 107.6     | 107.4     | 102.7     | 92.3      | 77.1      | 57.9      | 36.4    | 14.2   | -7.4   |
|  | 8          | 130.1                                | 133.2   | 136.9     | 140.6     | 143.5     | 143.3     | 137.0     | 123.1     | 102.8     | 77.2      | 48.5    | 18.9   | -9.9   |
|  | 10         | 162.6                                | 166.5   | 171.1     | 175.7     | 179.3     | 179.1     | 171.2     | 153.9     | 128.4     | 96.5      | 60.7    | 23.6   | -12.4  |
|  | 12         | 195.1                                | 199.8   | 205.3     | 210.9     | 215.2     | 214.9     | 205.5     | 184.7     | 154.1     | 115.8     | 72.8    | 28.3   | -14.9  |
|  | 14         | 227.6                                | 233.1   | 239.6     | 246.0     | 251.1     | 250.7     | 239.7     | 215.4     | 179.8     | 135.1     | 84.9    | 33.1   | -17.3  |
|  | 16         | 260.1                                | 266.4   | 273.8     | 281.1     | 286.9     | 286.5     | 274.0     | 246.2     | 205.5     | 154.3     | 97.1    | 37.8   | -19.8  |
|  | 18         | 292.6                                | 299.7   | 308.0     | 316.3     | 322.8     | 322.3     | 308.2     | 277.0     | 231.2     | 173.6     | 109.2   | 42.5   | -22.3  |
|  | 20         | 325.1                                | 333.0   | 342.2     | 351.4     | 358.7     | 358.1     | 342.5     | 307.8     | 256.9     | 192.9     | 121.3   | 47.2   | -24.8  |
|  | 22         | 357.6                                | 366.3   | 376.5     | 386.6     | 394.5     | 394.0     | 376.7     | 338.6     | 282.6     | 212.2     | 133.5   | 51.9   | -27.2  |

Achslastklassen

Achslastklassen

|  |                 | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |          |          |          |
|--|-----------------|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|  |                 | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5     | 42,5     | 47,5     |
|  | Achslastklassen | 2                               | 6,63E+08  | 2,53E+09 | 7,53E+09 | 1,02E+10 | 1,98E+10 | 1,99E+10 | 2,49E+10 | 4,23E+10 | 1,04E+11 | 4,30E+11 | 4,31E+12 | 4,69E+14 |
|  |                 | 4                               | 1,02E+08  | 2,35E+08 | 4,22E+08 | 4,71E+08 | 6,32E+08 | 6,36E+08 | 7,95E+08 | 1,35E+09 | 3,32E+09 | 1,37E+10 | 1,38E+11 | 1,50E+13 |
|  |                 | 6                               | 2,63E+07  | 4,73E+07 | 6,90E+07 | 7,14E+07 | 8,43E+07 | 8,49E+07 | 1,06E+08 | 1,80E+08 | 4,42E+08 | 1,83E+09 | 1,84E+10 | 2,00E+12 |
|  |                 | 8                               | 9,06E+06  | 1,41E+07 | 1,84E+07 | 1,83E+07 | 2,02E+07 | 2,03E+07 | 2,54E+07 | 4,32E+07 | 1,06E+08 | 4,39E+08 | 4,40E+09 | 4,78E+11 |
|  |                 | 10                              | 3,77E+06  | 5,34E+06 | 6,46E+06 | 6,27E+06 | 6,66E+06 | 6,71E+06 | 8,38E+06 | 1,42E+07 | 3,50E+07 | 1,45E+08 | 1,45E+09 | 1,58E+11 |
|  |                 | 12                              | 1,79E+06  | 2,37E+06 | 2,72E+06 | 2,60E+06 | 2,69E+06 | 2,71E+06 | 3,57E+06 | 5,76E+06 | 1,41E+07 | 5,86E+07 | 5,87E+08 | 6,38E+10 |
|  |                 | 14                              | 9,37E+05  | 1,18E+06 | 1,31E+06 | 1,23E+06 | 1,25E+06 | 1,26E+06 | 1,57E+06 | 2,68E+06 | 6,57E+06 | 2,72E+07 | 2,73E+08 | 2,97E+10 |
|  |                 | 16                              | 5,29E+05  | 6,40E+05 | 6,89E+05 | 6,45E+05 | 6,45E+05 | 6,50E+05 | 8,11E+05 | 1,38E+06 | 3,38E+06 | 1,40E+07 | 1,40E+08 | 1,53E+10 |
|  |                 | 18                              | 3,16E+05  | 3,71E+05 | 3,91E+05 | 3,63E+05 | 3,59E+05 | 3,62E+05 | 4,52E+05 | 7,68E+05 | 1,89E+06 | 7,82E+06 | 7,83E+07 | 8,51E+09 |
|  |                 | 20                              | 1,99E+05  | 2,27E+05 | 2,35E+05 | 2,17E+05 | 2,13E+05 | 2,14E+05 | 2,68E+05 | 4,55E+05 | 1,12E+06 | 4,63E+06 | 4,64E+07 | 5,04E+09 |
|  |                 | 22                              | 1,30E+05  | 1,45E+05 | 1,48E+05 | 1,38E+05 | 1,33E+05 | 1,34E+05 | 1,67E+05 | 2,83E+05 | 6,96E+05 | 2,88E+06 | 2,89E+07 | 3,14E+09 |
|  |                 |                                 | <b>Schädigungsquotient</b>  |          |          |          |          |          |          |          |          |          |          |          |
|  |                 | 2                               | 1,31E-05  | 1,40E-05 | 3,14E-05 | 3,58E-05 | 2,11E-05 | 2,54E-05 | 1,57E-05 | 5,43E-06 | 1,39E-06 | 2,50E-07 | 1,84E-08 | 1,82E-11 |
|  |                 | 4                               | 6,94E-04  | 1,32E-03 | 4,97E-03 | 6,71E-03 | 4,99E-03 | 6,00E-03 | 3,72E-03 | 1,29E-03 | 3,30E-04 | 5,93E-05 | 4,36E-06 | 4,30E-09 |
|  |                 | 6                               | 3,60E-03  | 8,93E-03 | 4,04E-02 | 5,76E-02 | 4,61E-02 | 5,65E-02 | 3,44E-02 | 1,19E-02 | 3,05E-03 | 5,48E-04 | 4,03E-05 | 3,97E-08 |
|  |                 | 8                               | 1,30E-02  | 3,71E-02 | 1,84E-01 | 2,69E-01 | 2,23E-01 | 2,69E-01 | 1,67E-01 | 5,76E-02 | 1,48E-02 | 2,65E-03 | 1,95E-04 | 1,92E-07 |
|  |                 | 10                              | 1,25E-02  | 3,91E-02 | 2,05E-01 | 3,04E-01 | 2,58E-01 | 3,10E-01 | 1,93E-01 | 6,65E-02 | 1,77E-02 | 3,06E-03 | 2,26E-04 | 2,22E-07 |
|  |                 | 12                              | 1,16E-02  | 3,83E-02 | 2,08E-01 | 3,11E-01 | 2,68E-01 | 3,22E-01 | 2,00E-01 | 6,90E-02 | 1,77E-02 | 3,18E-03 | 2,34E-04 | 2,31E-07 |
|  |                 | 14                              | 7,72E-03  | 2,66E-02 | 1,48E-01 | 2,23E-01 | 1,94E-01 | 2,33E-01 | 1,45E-01 | 5,00E-02 | 1,28E-02 | 2,30E-03 | 1,70E-04 | 1,67E-07 |
|  |                 | 16                              | 1,78E-03  | 6,32E-03 | 3,58E-02 | 5,42E-02 | 4,75E-02 | 5,71E-02 | 3,55E-02 | 1,22E-02 | 3,14E-03 | 5,64E-04 | 4,15E-05 | 4,09E-08 |
|  |                 | 18                              | 1,84E-04  | 6,68E-04 | 3,84E-03 | 5,84E-03 | 5,15E-03 | 6,19E-03 | 3,84E-03 | 1,33E-03 | 3,40E-04 | 6,12E-05 | 4,50E-06 | 4,44E-09 |
|  |                 | 20                              | 1,66E-05  | 6,15E-05 | 3,57E-04 | 5,45E-04 | 4,83E-04 | 5,81E-04 | 3,60E-04 | 1,24E-04 | 3,19E-05 | 5,74E-06 | 4,22E-07 | 4,16E-10 |
|  |                 | 22                              | 3,70E-06  | 1,39E-05 | 8,14E-05 | 1,24E-04 | 1,11E-04 | 1,33E-04 | 8,27E-05 | 2,85E-05 | 7,32E-06 | 1,32E-06 | 9,68E-08 | 9,54E-11 |
|  |                 |                                 | <b>Schädigungssumme (inkl. Shift-Faktor und Sicherheitsbeiwert):</b>                          |          |          |          |          |          |          |          |          |          |          |          |
|  |                 |                                 | <b>5,71</b>   |          |          |          |          |          |          |          |          |          |          |          |
|  |                 |                                 | <b>Nachweis: Reflektionsrissbildung (3PB)</b>   |          |          |          |          |          |          |          |          |          |          |          |
|  |                 |                                 | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |          |          |          |          |          |          |          |          |          |          |          |
|  |                 | 2                               | 1,1   | 1,0      | 0,9      | 0,7      | 0,6      | 0,4      | 0,2      | 0,1      | 0,0      | 0,0      | 0,0      | -0,1     |
|  |                 | 4                               | 2,2   | 2,0      | 1,8      | 1,5      | 1,1      | 0,8      | 0,5      | 0,3      | 0,1      | 0,0      | -0,1     | -0,2     |
|  |                 | 6                               | 3,3   | 3,0      | 2,7      | 2,2      | 1,7      | 1,2      | 0,7      | 0,4      | 0,1      | 0,0      | -0,1     | -0,2     |
|  |                 | 8                               | 4,4   | 4,0      | 3,6      | 3,0      | 2,3      | 1,6      | 1,0      | 0,5      | 0,2      | 0,0      | -0,2     | -0,3     |
|  |                 | 10                              | 5,5   | 5,0      | 4,4      | 3,7      | 2,8      | 2,0      | 1,2      | 0,6      | 0,2      | 0,0      | -0,2     | -0,4     |
|  |                 | 12                              | 6,6   | 6,1      | 5,3      | 4,4      | 3,4      | 2,3      | 1,4      | 0,8      | 0,3      | -0,1     | -0,3     | -0,5     |
|  |                 | 14                              | 7,7   | 7,1      | 6,2      | 5,2      | 4,0      | 2,7      | 1,7      | 0,9      | 0,3      | -0,1     | -0,3     | -0,5     |
|  |                 | 16                              | 8,8   | 8,1      | 7,1      | 5,9      | 4,5      | 3,1      | 1,9      | 1,0      | 0,4      | -0,1     | -0,4     | -0,6     |
|  |                 | 18                              | 9,9   | 9,1      | 8,0      | 6,7      | 5,1      | 3,5      | 2,1      | 1,1      | 0,4      | -0,1     | -0,4     | -0,7     |
|  |                 | 20                              | 11,0  | 10,1     | 8,9      | 7,4      | 5,7      | 3,9      | 2,4      | 1,3      | 0,5      | -0,1     | -0,5     | -0,8     |
|  |                 | 22                              | 12,1  | 11,1     | 9,8      | 8,1      | 6,2      | 4,3      | 2,6      | 1,4      | 0,5      | -0,1     | -0,7     | -0,9     |

|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|----------|------|------|------|--|--|--|--|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5     | 37,5 | 42,5 | 47,5 |  |  |  |  |
| Achslastklassen |  | 2                               | 4,39E+05  | 6,25E+05 | 1,04E+06 | 2,15E+06 | 6,20E+06 | 2,75E+07 | 2,01E+08 | 2,42E+09 | 1,34E+11 |      |      |      |  |  |  |  |
|                 |  | 4                               | 2,75E+04  | 3,91E+04 | 6,52E+04 | 1,34E+05 | 3,88E+05 | 1,72E+06 | 1,26E+07 | 1,52E+08 | 8,37E+09 |      |      |      |  |  |  |  |
|                 |  | 6                               | 5,44E+03  | 7,74E+03 | 1,29E+04 | 2,66E+04 | 7,67E+04 | 3,40E+05 | 2,49E+06 | 3,00E+07 | 1,55E+09 |      |      |      |  |  |  |  |
|                 |  | 8                               | 1,72E+03  | 2,45E+03 | 4,08E+03 | 8,41E+03 | 2,43E+04 | 1,08E+05 | 7,88E+05 | 9,49E+06 | 5,24E+08 |      |      |      |  |  |  |  |
|                 |  | 10                              | 7,05E+02  | 1,00E+03 | 1,67E+03 | 3,45E+03 | 9,95E+03 | 4,41E+04 | 3,23E+05 | 3,89E+06 | 2,15E+08 |      |      |      |  |  |  |  |
|                 |  | 12                              | 3,40E+02  | 4,84E+02 | 8,07E+02 | 1,66E+03 | 4,80E+03 | 2,13E+04 | 1,56E+05 | 1,88E+06 | 1,04E+08 |      |      |      |  |  |  |  |
|                 |  | 14                              | 1,84E+02  | 2,61E+02 | 4,35E+02 | 8,97E+02 | 2,59E+03 | 1,15E+04 | 8,42E+04 | 1,01E+06 | 5,59E+07 |      |      |      |  |  |  |  |
|                 |  | 16                              | 1,08E+02  | 1,53E+02 | 2,55E+02 | 5,26E+02 | 1,52E+03 | 6,74E+03 | 4,93E+04 | 5,94E+05 | 3,28E+07 |      |      |      |  |  |  |  |
|                 |  | 18                              | 6,73E+01  | 9,57E+01 | 1,59E+02 | 3,29E+02 | 9,49E+02 | 4,21E+03 | 3,08E+04 | 3,71E+05 | 2,05E+07 |      |      |      |  |  |  |  |
|                 |  | 20                              | 4,41E+01  | 6,28E+01 | 1,05E+02 | 2,16E+02 | 6,23E+02 | 2,76E+03 | 2,02E+04 | 2,43E+05 | 1,34E+07 |      |      |      |  |  |  |  |
|                 |  | 22                              | 3,02E+01  | 4,29E+01 | 7,15E+01 | 1,47E+02 | 4,25E+02 | 1,89E+03 | 1,38E+04 | 1,66E+05 | 9,18E+06 |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |
|                 |  | 2                               | 3,87E-02  | 1,04E-01 | 3,49E-01 | 2,33E-01 | 6,73E-02 | 1,84E-02 | 1,94E-03 | 9,48E-05 | 1,08E-06 |      |      |      |  |  |  |  |
|                 |  | 4                               | 4,68E+00  | 1,26E+01 | 4,21E+01 | 2,81E+01 | 8,13E+00 | 2,22E+00 | 2,35E-01 | 1,15E-02 | 1,31E-04 |      |      |      |  |  |  |  |
|                 |  | 6                               | 2,92E+01  | 7,87E+01 | 2,63E+02 | 1,75E+02 | 5,07E+01 | 1,38E+01 | 1,47E+00 | 7,15E-02 | 8,16E-04 |      |      |      |  |  |  |  |
|                 |  | 8                               | 1,07E+02  | 2,88E+02 | 9,63E+02 | 6,42E+02 | 1,86E+02 | 5,07E+01 | 5,37E+00 | 2,62E-01 | 2,99E-03 |      |      |      |  |  |  |  |
|                 |  | 10                              | 9,95E+01  | 2,68E+02 | 8,95E+02 | 5,97E+02 | 1,73E+02 | 4,72E+01 | 4,99E+00 | 2,43E-01 | 2,78E-03 |      |      |      |  |  |  |  |
|                 |  | 12                              | 8,65E+01  | 2,33E+02 | 7,78E+02 | 5,19E+02 | 1,50E+02 | 4,10E+01 | 4,34E+00 | 2,12E-01 | 2,42E-03 |      |      |      |  |  |  |  |
|                 |  | 14                              | 5,40E+01  | 1,45E+02 | 4,86E+02 | 3,24E+02 | 9,37E+01 | 2,56E+01 | 2,71E+00 | 1,32E-01 | 1,51E-03 |      |      |      |  |  |  |  |
|                 |  | 16                              | 1,16E+01  | 3,13E+01 | 1,05E+02 | 6,97E+01 | 2,02E+01 | 5,51E+00 | 5,83E-01 | 2,84E-02 | 3,24E-04 |      |      |      |  |  |  |  |
|                 |  | 18                              | 1,12E+00  | 3,02E+00 | 1,01E+01 | 6,74E+00 | 1,95E+00 | 5,33E-01 | 5,64E-02 | 2,75E-03 | 3,14E-05 |      |      |      |  |  |  |  |
|                 |  | 20                              | 9,50E-02  | 2,56E-01 | 8,55E-01 | 5,71E-01 | 1,65E-01 | 4,51E-02 | 4,77E-03 | 2,33E-04 | 2,65E-06 |      |      |      |  |  |  |  |
|                 |  | 22                              | 1,99E-02  | 5,35E-02 | 1,79E-01 | 1,19E-01 | 3,45E-02 | 9,43E-03 | 9,98E-04 | 4,87E-05 | 5,55E-07 |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |
|                 |  |                                 | <b>8251,60</b>                                      |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Nachweis: Rissernergie (Kellsparversuch)</b>     |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |
|                 |  | 2                               | 6,09E-01  | 2,19E+00 | 1,10E+01 | 1,30E+01 | 8,50E+00 | 7,08E+00 | 3,19E+00 | 9,03E-01 | 1,74E-01 |      |      |      |  |  |  |  |
|                 |  | 4                               | 1,84E+01  | 6,62E+01 | 3,33E+02 | 3,93E+02 | 2,57E+02 | 2,14E+02 | 9,64E+01 | 2,73E+01 | 5,26E+00 |      |      |      |  |  |  |  |
|                 |  | 6                               | 5,12E+01  | 1,84E+02 | 9,26E+02 | 1,09E+03 | 7,13E+02 | 5,94E+02 | 2,68E+02 | 7,58E+01 | 1,46E+01 |      |      |      |  |  |  |  |
|                 |  | 8                               | 1,05E+02  | 3,79E+02 | 1,91E+03 | 2,25E+03 | 1,47E+03 | 1,23E+03 | 5,52E+02 | 1,56E+02 | 3,01E+01 |      |      |      |  |  |  |  |
|                 |  | 10                              | 6,28E+01  | 2,26E+02 | 1,14E+03 | 1,34E+03 | 8,75E+02 | 7,29E+02 | 3,29E+02 | 9,30E+01 | 1,79E+01 |      |      |      |  |  |  |  |
|                 |  | 12                              | 3,79E+01  | 1,36E+02 | 6,86E+02 | 8,09E+02 | 5,29E+02 | 4,41E+02 | 1,99E+02 | 5,62E+01 | 1,08E+01 |      |      |      |  |  |  |  |
|                 |  | 14                              | 1,74E+01  | 6,25E+01 | 3,15E+02 | 3,71E+02 | 2,42E+02 | 2,02E+02 | 9,10E+01 | 2,58E+01 | 4,97E+00 |      |      |      |  |  |  |  |
|                 |  | 16                              | 2,87E+00  | 1,03E+01 | 5,19E+01 | 6,11E+01 | 4,00E+01 | 3,33E+01 | 1,50E+01 | 4,25E+00 | 8,18E-01 |      |      |      |  |  |  |  |
|                 |  | 18                              | 2,19E-01  | 7,87E-01 | 3,96E+00 | 4,67E+00 | 3,05E+00 | 2,54E+00 | 1,15E+00 | 3,24E-01 | 6,25E-02 |      |      |      |  |  |  |  |
|                 |  | 20                              | 1,50E-02  | 5,40E-02 | 2,72E-01 | 3,20E-01 | 2,09E-01 | 1,74E-01 | 7,86E-02 | 2,23E-02 | 4,29E-03 |      |      |      |  |  |  |  |
|                 |  | 22                              | 2,60E-03  | 9,33E-03 | 4,70E-02 | 5,54E-02 | 3,62E-02 | 3,02E-02 | 1,36E-02 | 3,86E-03 | 7,41E-04 |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |
|                 |  |                                 | <b>22733,80</b>                                     |          |          |          |          |          |          |          |          |      |      |      |  |  |  |  |

| Instandsetzung: Befestigung der Belastungsklasse Bk100: Glasgitter                                 |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |  |  |  |  |  |  |
|--|------------|--------------------------------------|---------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|--------|--------|--|--|--|--|--|--|
| Oberflächentemperatur  |            | -12,5                                | -7,5    | -2,5      | 2,5       | 7,5       | 12,5      | 17,5      | 22,5      | 27,5      | 32,5      | 37,5    | 42,5   | 47,5   |  |  |  |  |  |  |
| Schicht  | Dicke [cm] | Schichtaufbau und Steifigkeitsmodule |         |           |           |           |           |           |           |           |           |         |        |        |  |  |  |  |  |  |
| SMA  | 0,5        | 23.922                               | 21.518  | 18.444    | 14.961    | 11.472    | 8.378     | 5.905     | 4.085     | 2.796     | 1.906     | 1.301   | 892    | 616    |  |  |  |  |  |  |
| SMA  | 0,5        | 23.793                               | 21.397  | 18.363    | 14.937    | 11.469    | 8.370     | 5.897     | 4.109     | 2.838     | 1.950     | 1.342   | 927    | 642    |  |  |  |  |  |  |
| SMA  | 1          | 23.606                               | 21.225  | 18.249    | 14.903    | 11.464    | 8.358     | 5.886     | 4.143     | 2.897     | 2.014     | 1.403   | 978    | 682    |  |  |  |  |  |  |
| SMA  | 1          | 23.366                               | 21.008  | 18.107    | 14.862    | 11.459    | 8.344     | 5.871     | 4.185     | 2.973     | 2.096     | 1.481   | 1.045  | 735    |  |  |  |  |  |  |
| SMA  | 0,5        | 23.194                               | 20.854  | 18.007    | 14.832    | 11.455    | 8.335     | 5.861     | 4.215     | 3.027     | 2.156     | 1.539   | 1.095  | 775    |  |  |  |  |  |  |
| SMA  | 0,5        | 23.082                               | 20.755  | 17.944    | 14.814    | 11.452    | 8.328     | 5.855     | 4.234     | 3.062     | 2.195     | 1.577   | 1.128  | 801    |  |  |  |  |  |  |
| Asphaltanlage  | 0,3        | 36.225                               | 34.535  | 32.503    | 30.244    | 27.799    | 25.516    | 23.711    | 22.541    | 21.695    | 21.064    | 20.613  | 20.283 | 20.040 |  |  |  |  |  |  |
| Alter Asphalt  | 16         | 500                                  | 500     | 500       | 500       | 500       | 500       | 500       | 500       | 500       | 500       | 500     | 500    | 500    |  |  |  |  |  |  |
| FSS  | 50         | 100                                  | 100     | 100       | 100       | 100       | 100       | 100       | 100       | 100       | 100       | 100     | 100    | 100    |  |  |  |  |  |  |
| Untergrund   | 45         | 45                                   | 45      | 45        | 45        | 45        | 45        | 45        | 45        | 45        | 45        | 45      | 45     | 45     |  |  |  |  |  |  |
| <b>Vorhandene Anzahl an Lastfällen (Achsübergängen des Schwerverkehrs)</b>                         |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |  |  |  |  |  |  |
|  | 2          | 17.019                               | 65.239  | 363.068   | 499.218   | 416.961   | 504.891   | 391.433   | 229.754   | 144.660   | 107.786   | 79.421  | 8.509  | 8.509  |  |  |  |  |  |  |
|  | 4          | 128.660                              | 493.197 | 2.744.746 | 3.774.026 | 3.152.169 | 3.816.912 | 2.959.179 | 1.736.910 | 1.093.610 | 814.846   | 600.413 | 64.330 | 64.330 |  |  |  |  |  |  |
|  | 6          | 158.734                              | 608.479 | 3.386.316 | 4.656.185 | 3.888.972 | 4.709.096 | 3.650.872 | 2.142.903 | 1.349.235 | 1.005.313 | 740.757 | 79.367 | 79.367 |  |  |  |  |  |  |
|  | 8          | 184.114                              | 705.769 | 3.927.760 | 5.400.670 | 4.510.787 | 5.462.041 | 4.234.616 | 2.485.536 | 1.564.967 | 1.166.054 | 859.198 | 92.057 | 92.057 |  |  |  |  |  |  |
|  | 10         | 70.142                               | 268.877 | 1.496.358 | 2.057.492 | 1.718.473 | 2.080.872 | 1.613.261 | 946.914   | 596.205   | 444.231   | 327.328 | 35.071 | 35.071 |  |  |  |  |  |  |
|  | 12         | 29.426                               | 112.801 | 627.761   | 863.172   | 720.945   | 872.981   | 676.805   | 397.255   | 250.124   | 186.367   | 137.323 | 14.713 | 14.713 |  |  |  |  |  |  |
|  | 14         | 9.913                                | 38.000  | 211.479   | 290.783   | 242.870   | 294.087   | 228.000   | 133.826   | 84.261    | 62.783    | 46.261  | 4.957  | 4.957  |  |  |  |  |  |  |
|  | 16         | 1.251                                | 4.795   | 26.684    | 36.691    | 30.645    | 37.108    | 28.769    | 16.886    | 10.632    | 7.922     | 5.837   | 625    | 625    |  |  |  |  |  |  |
|  | 18         | 76                                   | 289     | 1.611     | 2.215     | 1.850     | 2.240     | 1.737     | 1.019     | 642       | 478       | 352     | 38     | 38     |  |  |  |  |  |  |
|  | 20         | 4,2                                  | 16,1    | 89,5      | 123,1     | 102,8     | 124,5     | 96,5      | 56,6      | 35,7      | 26,6      | 19,6    | 2,1    | 2,1    |  |  |  |  |  |  |
|  | 22         | 0,6                                  | 2,3     | 12,8      | 17,6      | 14,7      | 17,8      | 13,8      | 8,1       | 5,1       | 3,8       | 2,8     | 0,3    | 0,3    |  |  |  |  |  |  |
| <b>Nachweisformat: RDO Asphalt</b>   |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |  |  |  |  |  |  |
| <b>Ergebnis des Primärwirkungsmodells: Dehnung an der Unterseite der Asphaltdeckschicht [µm/m]</b> |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |  |  |  |  |  |  |
|  | 2          | 25,6                                 | 26,0    | 26,4      | 26,5      | 26,3      | 25,1      | 22,4      | 18,4      | 13,3      | 7,6       | 1,9     | -3,5   | -8,3   |  |  |  |  |  |  |
|  | 4          | 51,2                                 | 52,0    | 52,7      | 53,1      | 52,5      | 50,1      | 44,8      | 36,8      | 26,6      | 15,3      | 3,7     | -7,0   | -16,5  |  |  |  |  |  |  |
|  | 6          | 76,8                                 | 78,0    | 79,1      | 79,6      | 78,8      | 75,2      | 67,3      | 55,2      | 40,0      | 22,9      | 5,6     | -10,6  | -24,8  |  |  |  |  |  |  |
|  | 8          | 102,3                                | 103,9   | 105,4     | 106,1     | 105,0     | 100,2     | 89,7      | 73,6      | 53,3      | 30,5      | 7,5     | -14,1  | -33,0  |  |  |  |  |  |  |
|  | 10         | 127,9                                | 129,9   | 131,8     | 132,7     | 131,3     | 125,3     | 112,1     | 92,0      | 66,6      | 38,1      | 9,4     | -17,6  | -41,3  |  |  |  |  |  |  |
|  | 12         | 153,5                                | 155,9   | 158,2     | 159,2     | 157,6     | 150,3     | 134,5     | 110,4     | 79,9      | 45,8      | 11,2    | -21,1  | -49,6  |  |  |  |  |  |  |
|  | 14         | 179,1                                | 181,9   | 184,5     | 185,7     | 183,8     | 175,4     | 156,9     | 128,8     | 93,3      | 53,4      | 13,1    | -24,7  | -57,8  |  |  |  |  |  |  |
|  | 16         | 204,7                                | 207,9   | 210,9     | 212,2     | 210,1     | 200,4     | 179,4     | 147,1     | 106,6     | 61,0      | 15,0    | -28,2  | -66,1  |  |  |  |  |  |  |
|  | 18         | 230,3                                | 233,9   | 237,2     | 238,8     | 236,4     | 225,5     | 201,8     | 165,5     | 119,9     | 68,6      | 16,9    | -31,7  | -74,3  |  |  |  |  |  |  |
|  | 20         | 255,8                                | 259,9   | 263,6     | 265,3     | 262,6     | 250,5     | 224,2     | 183,9     | 133,2     | 76,3      | 18,7    | -35,2  | -82,6  |  |  |  |  |  |  |
|  | 22         | 281,4                                | 285,9   | 290,0     | 291,8     | 288,9     | 275,6     | 246,6     | 202,3     | 146,6     | 83,9      | 20,6    | -38,7  | -90,9  |  |  |  |  |  |  |
| <b>Achslastklassen</b>   |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |  |  |  |  |  |  |
| <b>Achslastklassen</b>   |            |                                      |         |           |           |           |           |           |           |           |           |         |        |        |  |  |  |  |  |  |

|                 |   | Ertragbare Anzahl an Lastfällen |          |          |          |          |          |             |          |          |          |          |      |      |      |  |  |
|-----------------|---|---------------------------------|----------|----------|----------|----------|----------|-------------|----------|----------|----------|----------|------|------|------|--|--|
|                 |   | -12,5                           | -7,5     | -2,5     | 2,5      | 7,5      | 12,5     | 17,5        | 22,5     | 27,5     | 32,5     | 37,5     | 42,5 | 47,5 |      |  |  |
| Achslastklassen | 2   | 1,76E+11                        | 1,63E+11 | 1,52E+11 | 1,47E+11 | 1,55E+11 | 1,96E+11 | 3,40E+11    | 9,09E+11 | 4,51E+12 | 7,21E+13 | 7,71E+16 |      |      |      |  |  |
|                 | 4   | 5,64E+09                        | 5,22E+09 | 4,86E+09 | 4,71E+09 | 4,95E+09 | 6,26E+09 | 1,09E+10    | 2,91E+10 | 1,44E+11 | 2,30E+12 | 2,46E+15 |      |      |      |  |  |
|                 | 6   | 7,52E+08                        | 6,96E+08 | 6,48E+08 | 6,28E+08 | 6,61E+08 | 8,35E+08 | 1,44E+09    | 3,88E+09 | 1,92E+10 | 3,07E+11 | 3,28E+14 |      |      |      |  |  |
|                 | 8   | 1,80E+08                        | 1,67E+08 | 1,55E+08 | 1,50E+08 | 1,58E+08 | 2,00E+08 | 3,47E+08    | 9,28E+08 | 4,60E+09 | 7,36E+10 | 7,87E+13 |      |      |      |  |  |
|                 | 10  | 5,95E+07                        | 5,50E+07 | 5,13E+07 | 4,99E+07 | 5,22E+07 | 6,60E+07 | 1,15E+08    | 3,06E+08 | 1,52E+09 | 2,43E+10 | 2,60E+13 |      |      |      |  |  |
|                 | 12  | 2,40E+07                        | 2,22E+07 | 2,07E+07 | 2,01E+07 | 2,11E+07 | 2,67E+07 | 4,63E+07    | 1,24E+08 | 6,14E+08 | 9,82E+09 | 1,05E+13 |      |      |      |  |  |
|                 | 14  | 1,12E+07                        | 1,03E+07 | 9,63E+06 | 9,33E+06 | 9,81E+06 | 1,24E+07 | 2,15E+07    | 5,76E+07 | 2,86E+08 | 4,56E+09 | 4,88E+12 |      |      |      |  |  |
|                 | 16  | 5,76E+06                        | 5,33E+06 | 4,96E+06 | 4,81E+06 | 5,06E+06 | 6,39E+06 | 1,11E+07    | 2,97E+07 | 1,47E+08 | 2,35E+09 | 2,51E+12 |      |      |      |  |  |
|                 | 18  | 3,21E+06                        | 2,97E+06 | 2,76E+06 | 2,68E+06 | 2,82E+06 | 3,56E+06 | 6,18E+06    | 1,65E+07 | 8,19E+07 | 1,31E+09 | 1,40E+12 |      |      |      |  |  |
|                 | 20  | 1,90E+06                        | 1,76E+06 | 1,64E+06 | 1,59E+06 | 1,67E+06 | 2,11E+06 | 3,66E+06    | 9,79E+06 | 4,85E+07 | 7,76E+08 | 8,29E+11 |      |      |      |  |  |
|                 | 22  | 1,18E+06                        | 1,09E+06 | 1,02E+06 | 9,88E+05 | 1,04E+06 | 1,31E+06 | 2,28E+06    | 6,10E+06 | 3,02E+07 | 4,83E+08 | 5,17E+11 |      |      |      |  |  |
|                 |   | <b>Schädigungsquotient</b>      |          |          |          |          |          |             |          |          |          |          |      |      |      |  |  |
|                 | 2   | 3,70E-07                        | 3,52E-07 | 7,65E-07 | 7,65E-07 | 2,98E-07 | 2,85E-07 | 1,27E-07    | 2,80E-08 | 3,55E-09 | 1,65E-10 | 1,14E-13 |      |      |      |  |  |
|                 | 4   | 2,11E-05                        | 3,57E-05 | 1,26E-04 | 1,51E-04 | 8,55E-05 | 8,19E-05 | 3,66E-05    | 1,02E-06 | 4,75E-08 | 2,84E-07 | 1,96E-10 |      |      |      |  |  |
|                 | 6   | 6,66E-05                        | 1,49E-04 | 6,31E-04 | 8,04E-04 | 5,11E-04 | 4,90E-04 | 2,19E-04    | 4,80E-05 | 6,09E-06 | 2,84E-07 | 6,93E-07 |      |      |      |  |  |
|                 | 8   | 1,16E-04                        | 3,04E-04 | 1,41E-03 | 1,85E-03 | 1,25E-03 | 1,19E-03 | 5,33E-04    | 1,17E-04 | 1,49E-05 | 6,93E-07 | 4,77E-10 |      |      |      |  |  |
|                 | 10  | 1,27E-04                        | 3,64E-04 | 1,79E-03 | 2,38E-03 | 1,66E-03 | 1,69E-03 | 7,10E-04    | 1,98E-05 | 1,98E-06 | 9,22E-07 | 6,36E-10 |      |      |      |  |  |
|                 | 12  | 1,41E-04                        | 4,34E-04 | 2,21E-03 | 2,97E-03 | 2,12E-03 | 2,03E-03 | 9,07E-04    | 1,99E-04 | 2,53E-05 | 1,18E-06 | 8,12E-10 |      |      |      |  |  |
|                 | 14  | 8,12E-05                        | 2,61E-04 | 1,36E-03 | 1,85E-03 | 1,34E-03 | 1,28E-03 | 5,72E-04    | 1,26E-04 | 1,59E-05 | 7,43E-07 | 5,12E-10 |      |      |      |  |  |
|                 | 16  | 1,80E-05                        | 6,00E-05 | 3,18E-04 | 4,35E-04 | 3,18E-04 | 3,05E-04 | 1,36E-04    | 2,99E-05 | 3,80E-06 | 1,77E-07 | 1,22E-10 |      |      |      |  |  |
|                 | 18  | 6,80E-07                        | 2,32E-06 | 1,25E-05 | 1,71E-05 | 1,27E-05 | 1,21E-05 | 5,42E-06    | 1,19E-06 | 1,51E-07 | 7,04E-09 | 4,85E-12 |      |      |      |  |  |
|                 | 20  | 0,00E+00                        | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00    | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |  |  |
| 22              | 0,00E+00  | 0,00E+00                        | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00    | 0,00E+00 | 0,00E+00 | 0,00E+00 |          |      |      |      |  |  |
|                 | <b>Schädigungssumme (inkl. Shift-Faktor und Sicherheitsbeiwert):</b>                          |                                 |          |          |          |          |          | <b>0,04</b> |          |          |          |          |      |      |      |  |  |
|                 |   |                                 |          |          |          |          |          |             |          |          |          |          |      |      |      |  |  |
|                 |   |                                 |          |          |          |          |          |             |          |          |          |          |      |      |      |  |  |
|                 | <b>Nachweis: Reflektionsrissbildung (3PB)</b>   |                                 |          |          |          |          |          |             |          |          |          |          |      |      |      |  |  |
|                 | <b>Ergebnis Primärwirkungsmodell: Spannung an der Unterseite der Asphaltdeckschicht [MPa]</b> |                                 |          |          |          |          |          |             |          |          |          |          |      |      |      |  |  |
| 2               | 0,9   | 0,8                             | 0,7      | 0,7      | 0,5      | 0,4      | 0,3      | 0,1         | 0,1      | 0,0      | 0,0      | -0,1     | -0,1 | -0,1 |      |  |  |
| 4               | 1,7   | 1,6                             | 1,3      | 1,3      | 1,1      | 0,8      | 0,5      | 0,3         | 0,1      | 0,0      | -0,1     | -0,1     | -0,1 | -0,2 | -0,2 |  |  |
| 6               | 2,6   | 2,3                             | 2,0      | 2,0      | 1,6      | 1,2      | 0,8      | 0,4         | 0,2      | 0,0      | -0,1     | -0,2     | -0,2 | -0,3 | -0,3 |  |  |
| 8               | 3,4   | 3,1                             | 2,7      | 2,7      | 2,2      | 1,6      | 1,0      | 0,5         | 0,2      | 0,0      | -0,2     | -0,3     | -0,3 | -0,3 | -0,3 |  |  |
| 10              | 4,3   | 3,9                             | 3,4      | 3,4      | 2,7      | 2,0      | 1,3      | 0,7         | 0,3      | 0,0      | -0,2     | -0,3     | -0,4 | -0,4 | -0,4 |  |  |
| 12              | 5,2   | 4,7                             | 4,0      | 4,0      | 3,3      | 2,4      | 1,6      | 0,8         | 0,3      | 0,0      | -0,3     | -0,4     | -0,5 | -0,5 | -0,5 |  |  |
| 14              | 6,0   | 5,5                             | 4,7      | 4,7      | 3,8      | 2,8      | 1,8      | 1,0         | 0,4      | -0,1     | -0,3     | -0,5     | -0,6 | -0,6 | -0,6 |  |  |
| 16              | 6,9   | 6,2                             | 5,4      | 5,4      | 4,4      | 3,2      | 2,1      | 1,1         | 0,4      | -0,1     | -0,4     | -0,6     | -0,7 | -0,7 | -0,7 |  |  |
| 18              | 7,7   | 7,0                             | 6,1      | 6,1      | 4,9      | 3,6      | 2,3      | 1,2         | 0,5      | -0,1     | -0,4     | -0,6     | -0,7 | -0,8 | -0,8 |  |  |
| 20              | 8,6   | 7,8                             | 6,7      | 6,7      | 5,5      | 4,0      | 2,6      | 1,4         | 0,5      | -0,1     | -0,5     | -0,7     | -0,8 | -0,9 | -0,9 |  |  |
| 22              | 9,5   | 8,6                             | 7,4      | 7,4      | 6,0      | 4,4      | 2,8      | 1,5         | 0,6      | -0,1     | -0,5     | -0,8     | -0,9 | -0,9 | -0,9 |  |  |

|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|----------|------|------|------|------|--|--|--|--|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5     | 32,5 | 37,5 | 42,5 | 47,5 |  |  |  |  |
| Achslastklassen |  | 2                               | 1,18E+07  | 2,19E+07 | 5,39E+07 | 1,96E+08 | 1,35E+09 | 2,20E+10 | 1,22E+12 | 5,59E+14 |      |      |      |      |  |  |  |  |
|                 |  | 4                               | 1,54E+05  | 2,84E+05 | 6,99E+05 | 2,55E+06 | 1,75E+07 | 2,86E+08 | 1,59E+10 | 7,26E+12 |      |      |      |      |  |  |  |  |
|                 |  | 6                               | 1,21E+04  | 2,24E+04 | 5,51E+04 | 2,01E+05 | 1,38E+06 | 2,25E+07 | 1,25E+09 | 5,72E+11 |      |      |      |      |  |  |  |  |
|                 |  | 8                               | 2,00E+03  | 3,69E+03 | 9,08E+03 | 3,31E+04 | 2,27E+05 | 3,71E+06 | 2,06E+08 | 9,43E+10 |      |      |      |      |  |  |  |  |
|                 |  | 10                              | 4,93E+02  | 9,12E+02 | 2,24E+03 | 8,17E+03 | 5,61E+04 | 9,17E+05 | 5,10E+07 | 2,33E+10 |      |      |      |      |  |  |  |  |
|                 |  | 12                              | 1,57E+02  | 2,91E+02 | 7,15E+02 | 2,61E+03 | 1,79E+04 | 2,92E+05 | 1,63E+07 | 7,43E+09 |      |      |      |      |  |  |  |  |
|                 |  | 14                              | 5,99E+01  | 1,11E+02 | 2,72E+02 | 9,92E+02 | 6,80E+03 | 1,11E+05 | 6,19E+06 | 2,83E+09 |      |      |      |      |  |  |  |  |
|                 |  | 16                              | 2,59E+01  | 4,79E+01 | 1,18E+02 | 4,30E+02 | 2,95E+03 | 4,82E+04 | 2,68E+06 | 1,22E+09 |      |      |      |      |  |  |  |  |
|                 |  | 18                              | 1,24E+01  | 2,29E+01 | 5,64E+01 | 2,05E+02 | 1,41E+03 | 2,30E+04 | 1,28E+06 | 5,85E+08 |      |      |      |      |  |  |  |  |
|                 |  | 20                              | 6,40E+00  | 1,18E+01 | 2,91E+01 | 1,08E+02 | 7,28E+02 | 1,19E+04 | 6,62E+05 | 3,02E+08 |      |      |      |      |  |  |  |  |
|                 |  | 22                              | 3,52E+00  | 6,52E+00 | 1,60E+01 | 5,84E+01 | 4,01E+02 | 6,55E+03 | 3,64E+05 | 1,66E+08 |      |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |
|                 |  | 2                               | 1,59E-04  | 3,30E-04 | 7,46E-04 | 2,82E-04 | 3,43E-05 | 2,54E-06 | 3,54E-08 | 4,55E-11 |      |      |      |      |  |  |  |  |
|                 |  | 4                               | 1,12E-01  | 2,33E-01 | 5,27E-01 | 1,99E-01 | 2,42E-02 | 1,79E-03 | 2,50E-05 | 3,21E-08 |      |      |      |      |  |  |  |  |
|                 |  | 6                               | 1,14E+00  | 2,36E+00 | 5,34E+00 | 2,01E+00 | 2,45E-01 | 1,82E-02 | 2,53E-04 | 3,25E-07 |      |      |      |      |  |  |  |  |
|                 |  | 8                               | 4,03E+00  | 8,36E+00 | 1,89E+01 | 7,14E+00 | 8,69E-01 | 6,43E-02 | 8,97E-04 | 1,15E-06 |      |      |      |      |  |  |  |  |
|                 |  | 10                              | 7,17E+00  | 1,49E+01 | 3,36E+01 | 1,27E+01 | 1,55E+00 | 1,14E-01 | 1,59E-03 | 2,05E-06 |      |      |      |      |  |  |  |  |
|                 |  | 12                              | 1,16E+01  | 2,41E+01 | 5,45E+01 | 2,06E+01 | 2,50E+00 | 1,85E-01 | 2,58E-03 | 3,32E-06 |      |      |      |      |  |  |  |  |
|                 |  | 14                              | 8,95E+00  | 1,85E+01 | 4,20E+01 | 1,58E+01 | 1,93E+00 | 1,43E-01 | 1,99E-03 | 2,56E-06 |      |      |      |      |  |  |  |  |
|                 |  | 16                              | 2,53E+00  | 5,25E+00 | 1,19E+01 | 4,49E+00 | 5,46E-01 | 4,04E-02 | 5,64E-04 | 7,25E-07 |      |      |      |      |  |  |  |  |
|                 |  | 18                              | 1,17E-01  | 2,43E-01 | 5,51E-01 | 2,08E-01 | 2,53E-02 | 1,87E-03 | 2,61E-05 | 3,36E-08 |      |      |      |      |  |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |
|                 |  |                                 | <b>348,22</b>                                       |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Nachweis: Rissenergie (Kellsparversuch)</b>      |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |
|                 |  | 2                               | 4,14E-02  | 1,46E-01 | 7,15E-01 | 8,05E-01 | 4,89E-01 | 3,62E-01 | 1,32E-01 | 2,40E-02 |      |      |      |      |  |  |  |  |
|                 |  | 4                               | 1,52E+00  | 5,37E+00 | 2,62E+01 | 2,95E+01 | 1,80E+01 | 1,33E+01 | 4,85E+00 | 8,80E-01 |      |      |      |      |  |  |  |  |
|                 |  | 6                               | 2,73E+00  | 9,63E+00 | 4,71E+01 | 5,30E+01 | 3,22E+01 | 2,38E+01 | 8,71E+00 | 1,58E+00 |      |      |      |      |  |  |  |  |
|                 |  | 8                               | 2,83E+00  | 9,99E+00 | 4,89E+01 | 5,50E+01 | 3,35E+01 | 2,47E+01 | 9,04E+00 | 1,64E+00 |      |      |      |      |  |  |  |  |
|                 |  | 10                              | 1,94E+00  | 6,86E+00 | 3,35E+01 | 3,78E+01 | 2,30E+01 | 1,70E+01 | 6,21E+00 | 1,12E+00 |      |      |      |      |  |  |  |  |
|                 |  | 12                              | 1,45E+00  | 5,10E+00 | 2,50E+01 | 2,81E+01 | 1,71E+01 | 1,26E+01 | 4,62E+00 | 8,37E-01 |      |      |      |      |  |  |  |  |
|                 |  | 14                              | 5,77E-01  | 2,04E+00 | 9,96E+00 | 1,12E+01 | 6,82E+00 | 5,04E+00 | 1,84E+00 | 3,34E-01 |      |      |      |      |  |  |  |  |
|                 |  | 16                              | 9,25E-02  | 3,26E-01 | 1,60E+00 | 1,80E+00 | 1,09E+00 | 8,08E-01 | 2,95E-01 | 5,35E-02 |      |      |      |      |  |  |  |  |
|                 |  | 18                              | 2,59E-03  | 9,15E-03 | 4,48E-02 | 5,04E-02 | 3,06E-02 | 2,27E-02 | 8,28E-03 | 1,50E-03 |      |      |      |      |  |  |  |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |  |  |  |  |
|                 |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |
|                 |  |                                 | <b>733,03</b>                                       |          |          |          |          |          |          |          |      |      |      |      |  |  |  |  |







|                 |  | Ertragbare Anzahl an Lastfällen |   |          |          |          |          |          |          |      |      |      |      |      |  |  |               |  |
|-----------------|--|---------------------------------|---|----------|----------|----------|----------|----------|----------|------|------|------|------|------|--|--|---------------|--|
|                 |  | -12,5                           | -7,5  | -2,5     | 2,5      | 7,5      | 12,5     | 17,5     | 22,5     | 27,5 | 32,5 | 37,5 | 42,5 | 47,5 |  |  |               |  |
| Achslastklassen |  | 2                               | 2,12E+06  | 3,00E+06 | 5,04E+06 | 1,07E+07 | 3,38E+07 | 1,98E+08 | 4,28E+09 |      |      |      |      |      |  |  |               |  |
|                 |  | 4                               | 2,77E+05  | 3,93E+05 | 6,58E+05 | 1,40E+06 | 4,41E+06 | 2,59E+07 | 5,60E+08 |      |      |      |      |      |  |  |               |  |
|                 |  | 6                               | 8,43E+04  | 1,20E+05 | 2,00E+05 | 4,25E+05 | 1,34E+06 | 7,89E+06 | 1,70E+08 |      |      |      |      |      |  |  |               |  |
|                 |  | 8                               | 3,62E+04  | 5,14E+04 | 8,61E+04 | 1,83E+05 | 5,77E+05 | 3,39E+06 | 7,32E+07 |      |      |      |      |      |  |  |               |  |
|                 |  | 10                              | 1,88E+04  | 2,67E+04 | 4,47E+04 | 9,49E+04 | 3,00E+05 | 1,76E+06 | 3,80E+07 |      |      |      |      |      |  |  |               |  |
|                 |  | 12                              | 1,10E+04  | 1,56E+04 | 2,62E+04 | 5,56E+04 | 1,76E+05 | 1,03E+06 | 2,23E+07 |      |      |      |      |      |  |  |               |  |
|                 |  | 14                              | 7,01E+03  | 9,94E+03 | 1,67E+04 | 3,54E+04 | 1,12E+05 | 6,56E+05 | 1,42E+07 |      |      |      |      |      |  |  |               |  |
|                 |  | 16                              | 4,74E+03  | 6,72E+03 | 1,13E+04 | 2,39E+04 | 7,55E+04 | 4,44E+05 | 9,57E+06 |      |      |      |      |      |  |  |               |  |
|                 |  | 18                              | 3,35E+03  | 4,75E+03 | 7,97E+03 | 1,69E+04 | 5,34E+04 | 3,14E+05 | 6,78E+06 |      |      |      |      |      |  |  |               |  |
|                 |  | 20                              | 2,46E+03  | 3,49E+03 | 5,85E+03 | 1,24E+04 | 3,92E+04 | 2,30E+05 | 4,97E+06 |      |      |      |      |      |  |  |               |  |
|                 |  | 22                              | 1,86E+03  | 2,64E+03 | 4,42E+03 | 9,39E+03 | 2,96E+04 | 1,74E+05 | 3,76E+06 |      |      |      |      |      |  |  |               |  |
|                 |  |                                 | <b>Schädigungsquotient</b>                          |          |          |          |          |          |          |      |      |      |      |      |  |  |               |  |
|                 |  | 2                               | 8,89E-04  | 2,40E-03 | 7,98E-03 | 5,17E-03 | 1,37E-03 | 2,82E-04 | 1,01E-05 |      |      |      |      |      |  |  |               |  |
|                 |  | 4                               | 6,24E-02  | 1,69E-01 | 5,60E-01 | 3,63E-01 | 9,59E-02 | 1,98E-02 | 7,10E-04 |      |      |      |      |      |  |  |               |  |
|                 |  | 6                               | 1,64E-01  | 4,42E-01 | 1,47E+00 | 9,51E-01 | 2,51E-01 | 5,18E-02 | 1,86E-03 |      |      |      |      |      |  |  |               |  |
|                 |  | 8                               | 2,22E-01  | 6,00E-01 | 1,99E+00 | 1,29E+00 | 3,42E-01 | 7,04E-02 | 2,53E-03 |      |      |      |      |      |  |  |               |  |
|                 |  | 10                              | 1,88E-01  | 5,08E-01 | 1,69E+00 | 1,09E+00 | 2,89E-01 | 5,95E-02 | 2,14E-03 |      |      |      |      |      |  |  |               |  |
|                 |  | 12                              | 1,66E-01  | 4,48E-01 | 1,49E+00 | 9,63E-01 | 2,55E-01 | 5,25E-02 | 1,89E-03 |      |      |      |      |      |  |  |               |  |
|                 |  | 14                              | 7,64E-02  | 2,07E-01 | 6,86E-01 | 4,44E-01 | 1,18E-01 | 2,42E-02 | 8,70E-04 |      |      |      |      |      |  |  |               |  |
|                 |  | 16                              | 1,39E-02  | 3,75E-02 | 1,24E-01 | 8,06E-02 | 2,13E-02 | 4,39E-03 | 1,58E-04 |      |      |      |      |      |  |  |               |  |
|                 |  | 18                              | 4,34E-04  | 1,17E-03 | 3,90E-03 | 2,52E-03 | 6,68E-04 | 1,38E-04 | 4,94E-06 |      |      |      |      |      |  |  |               |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |      |  |  |               |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |      |  |  |               |  |
|                 |  |                                 | <b>Schädigungssumme (inkl. Anpassungsfaktoren):</b> |          |          |          |          |          |          |      |      |      |      |      |  |  | <b>18,18</b>  |  |
|                 |  |                                 | <b>Nachweis: Rissernergie (Keilspatversuch)</b>     |          |          |          |          |          |          |      |      |      |      |      |  |  |               |  |
|                 |  |                                 | <b>Verformungsarbeit (Spannung * Dehnung)</b>       |          |          |          |          |          |          |      |      |      |      |      |  |  |               |  |
|                 |  | 2                               | 2,42E-02  | 8,22E-02 | 3,79E-01 | 3,90E-01 | 2,06E-01 | 1,20E-01 | 2,60E-02 |      |      |      |      |      |  |  |               |  |
|                 |  | 4                               | 8,88E-01  | 3,02E+00 | 1,39E+01 | 1,43E+01 | 7,55E+00 | 4,39E+00 | 9,55E-01 |      |      |      |      |      |  |  |               |  |
|                 |  | 6                               | 1,59E+00  | 5,41E+00 | 2,49E+01 | 2,57E+01 | 1,36E+01 | 7,89E+00 | 1,71E+00 |      |      |      |      |      |  |  |               |  |
|                 |  | 8                               | 1,65E+00  | 5,62E+00 | 2,59E+01 | 2,67E+01 | 1,41E+01 | 8,19E+00 | 1,78E+00 |      |      |      |      |      |  |  |               |  |
|                 |  | 10                              | 1,14E+00  | 3,86E+00 | 1,78E+01 | 1,83E+01 | 9,66E+00 | 5,62E+00 | 1,22E+00 |      |      |      |      |      |  |  |               |  |
|                 |  | 12                              | 8,45E-01  | 2,87E+00 | 1,32E+01 | 1,36E+01 | 7,18E+00 | 4,18E+00 | 9,09E-01 |      |      |      |      |      |  |  |               |  |
|                 |  | 14                              | 3,37E-01  | 1,15E+00 | 5,28E+00 | 5,44E+00 | 2,87E+00 | 1,67E+00 | 3,63E-01 |      |      |      |      |      |  |  |               |  |
|                 |  | 16                              | 5,40E-02  | 1,83E-01 | 8,46E-01 | 8,71E-01 | 4,59E-01 | 2,67E-01 | 5,81E-02 |      |      |      |      |      |  |  |               |  |
|                 |  | 18                              | 1,52E-03  | 5,14E-03 | 2,37E-02 | 2,44E-02 | 1,29E-02 | 7,60E-03 | 1,63E-03 |      |      |      |      |      |  |  |               |  |
|                 |  | 20                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |      |  |  |               |  |
|                 |  | 22                              | 0,00E+00  | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |      |      |      |      |      |  |  |               |  |
|                 |  |                                 | <b>Summe Verformungsarbeit:</b>                     |          |          |          |          |          |          |      |      |      |      |      |  |  | <b>331,27</b> |  |

## **Anhang 4: Ergebnisse Sensitivitätsanalyse und Verifikation**

- Anhang 4 Durchlässigkeitsprüfungen**
- Anhang 4 Schersteifigkeiten, statischer Scherversuch**
- Anhang 4 Abscherversuche**
- Anhang 4 3-Punkt-Biegeprüfungen, rissüberbrückende Funktion**
- Anhang 4 3-Punkt-Biegeprüfungen, bewehrende Funktion**
- Anhang 4 Verifikation, Schersteifigkeiten, statischer Scherversuch**
- Anhang 4 Verifikation, Abscherversuche**
- Anhang 4 Verifikation, 3-Punkt-Biegeprüfungen, rissüberbrückende Funktion**
- Anhang 4 Verifikation, 3-Punkt-Biegeprüfungen, bewehrende Funktion**
- Anhang 4 Keilspaltversuche – Sensitivitätsanalyse**
- Anahng 4 Keilspaltversuche - Verifikationsstrecken**

## Anhang 4 – Ergebnisse der Durchlässigkeitsprüfungen

| Variante | Variante | 1      | 2      | Mittelwert | Mittelwert |
|----------|----------|--------|--------|------------|------------|
| K1-10    | 2-0      | 115,83 | 94,6   | 105,215    | 73,07      |
| K1-11    |          | 46,19  | 66,7   | 56,445     |            |
| K1-12    |          | 47,95  | 67,12  | 57,535     |            |
| K1-13    | 2-5      | 56,89  | 85,9   | 71,395     | 71,40      |
| K1-14    | 2-6      | 85,33  | 91,4   | 88,365     | 88,37      |
| K1-15    | 2-7      | 110,7  | 93,16  | 101,93     | 101,93     |
| K2-16    | 3-0      | 81,77  | 62,85  | 72,31      | 69,14      |
| K2-17    |          | 59,84  | 64,14  | 61,99      |            |
| K2-18    |          | 79,68  | 66,57  | 73,125     |            |
| K2-19    | 3-5      | 73,5   | 38,08  | 55,79      | 55,79      |
| K2-20    | 3-6      | 81,86  | 71,3   | 76,58      | 76,58      |
| K2-21    | 3-7      | 129,2  | 52,4   | 90,8       | 90,80      |
| K3-22    | 4-0      | 71,2   | 58,1   | 64,65      | 64,65      |
| K4-23    | 4-1      | 124,5  | 105,1  | 114,8      | 114,80     |
| K5-24    | 4-2      | 42,7   | 24,4   | 33,55      | 33,55      |
| K6-25    | 4-3      | 62,5   | 37,4   | 49,95      | 49,95      |
| K7-26    | 4-4      | 99,9   | 103,2  | 101,55     | 101,55     |
| K9-28    | 4-6      | 174,7  | 124,8  | 149,75     | 149,75     |
| V1-4     | 1-0      | 54,1   | 88,02  | 71,06      | 126,61     |
| V1-5     |          | 164,77 | 170,46 | 167,615    |            |
| V1-6     |          | 125    | 157,3  | 141,15     |            |
| V1-7     | 1-5      | 987,1  | 734,1  | 860,6      | 860,60     |
| V1-8     | 1-6      | 93,3   | 97,8   | 95,55      | 95,55      |
| V1-9     | 1-7      | 22,76  | 27,39  | 25,075     | 25,08      |
| Ref 1    | 0-0      | 1538,9 | 1175,2 | 1357,05    | 1.356,27   |
| Ref 2    |          | 1440,8 | 1003,3 | 1222,05    |            |
| Ref 3    |          | 1170,5 | 1808,9 | 1489,7     |            |

Anhang 4: Schersteifigkeiten, statischer Scherversuch, weggeregelt

| Variante           | Beschaffenheit     | Dehnrate | Schermodul 1 bei Dehnung 0,0002 | Schermodul 2 bei Dehnung 0,0002 | Schermodul, MW |
|--------------------|--------------------|----------|---------------------------------|---------------------------------|----------------|
| -                  | °C                 | mm/min   | MPa                             | MPa                             | MPa            |
| <b>Variante 0</b>  | 0<br>normal        | 0,1      | 28,55                           | 26,85                           | 27,70          |
|                    |                    | 0,2      | 43,02                           | 58,67                           | 50,84          |
|                    |                    | 0,3      | 46,85                           | 71,55                           | 59,20          |
|                    | 1<br>fein          | 0,1      | 23,71                           | 4,52                            | 14,12          |
|                    |                    | 0,2      | 33,77                           | 5,67                            | 19,72          |
|                    |                    | 0,3      | 12,46                           | 5,97                            | 9,22           |
|                    | 1b<br>fein, gestr. | 0,1      | 5,94                            | 33,62                           | 19,78          |
|                    |                    | 0,2      | 25,32                           | 42,19                           | 33,76          |
|                    |                    | 0,3      | 5,70                            | 37,95                           | 21,82          |
|                    | 2<br>grob          | 0,1      | 22,25                           | 18,09                           | 20,17          |
|                    |                    | 0,2      | 13,89                           | 22,39                           | 18,14          |
|                    |                    | 0,3      | 14,24                           | 23,46                           | 18,67          |
| 2b<br>grob, gestr. | 0,1                | 17,78    | 46,37                           | 32,07                           |                |
|                    | 0,2                | 39,36    | 47,08                           | 43,22                           |                |
|                    | 0,3                | 62,58    | 41,88                           | 52,23                           |                |
| <b>Referenz</b>    | 3<br>AC8DN         | 0,1      | 16,69                           | 30,79                           | 23,74          |
|                    |                    | 0,2      | 42,02                           | 25,56                           | 33,79          |
|                    |                    | 0,3      | 42,00                           | 41,97                           | 41,98          |
|                    | 4<br>SMA8S         | 0,1      | 10,75                           | 11,29                           | 11,02          |
|                    |                    | 0,2      | 9,95                            | 8,80                            | 9,38           |
|                    |                    | 0,3      | 7,67                            | 11,34                           | 9,51           |
|                    | 5<br>C40           | 0,1      | 15,99                           | 4,24                            | 10,11          |
|                    |                    | 0,2      | 9,09                            | 6,23                            | 7,66           |
|                    |                    | 0,3      | 9,10                            | 4,82                            | 6,96           |

Anhang 4: Schersteifigkeiten, statischer Scherversuch, weggeregelt

| Variante   | Beschaffenheit | Dehnrate | Schermodul 1 bei Dehnung 0,0002 | Schermodul 2 bei Dehnung 0,0002 | Schermodul, MW |
|------------|----------------|----------|---------------------------------|---------------------------------|----------------|
| -          | °C             | mm/min   | MPa                             | MPa                             | MPa            |
| Variante 1 | 0<br>normal    | 0,1      | 4,80                            | 4,52                            | 4,66           |
|            |                | 0,2      | 6,24                            | 5,40                            | 5,82           |
|            |                | 0,3      | 8,78                            | 5,67                            | 7,23           |
|            | 1<br>fein      | 0,1      | 4,52                            | 4,8                             | 4,66           |
|            |                | 0,2      | 4,81                            | 6,80                            | 5,81           |
|            |                | 0,3      | 4,84                            | 6,84                            | 5,84           |
|            | 2<br>grob      | 0,1      | 4,52                            | 5,08                            | 4,80           |
|            |                | 0,2      | 5,12                            | 4,81                            | 4,97           |
|            |                | 0,3      | 5,41                            | 4,82                            | 5,12           |
|            | 3<br>AC8DN     | 0,1      | 5,93                            | 7,35                            | 6,64           |
|            |                | 0,2      | 10,19                           | 27,59                           | 18,89          |
|            |                | 0,3      | 16,76                           | 17,93                           | 17,34          |
| 4<br>SMA8S | 0,1            | 4,80     | 4,24                            | 4,52                            |                |
|            | 0,2            | 9,36     | 6,23                            | 7,79                            |                |
|            | 0,3            | 8,23     | 8,24                            | 8,23                            |                |
| Vlies      | 5<br>C60       | 0,1      | 4,52                            | 7,63                            | 6,08           |
|            |                | 0,2      | 6,80                            | 10,50                           | 8,65           |
|            |                | 0,3      | 9,94                            | 6,23                            | 8,08           |
|            | 6<br>-30%      | 0,1      | 5,36                            | 5,36                            | 5,36           |
|            |                | 0,2      | 6,82                            | 13,32                           | 10,07          |
|            |                | 0,3      | 7,40                            | 5,14                            | 6,27           |
|            | 7<br>doppelt   | 0,1      | 4,52                            | 5,36                            | 4,94           |
|            |                | 0,2      | 7,11                            | 9,09                            | 8,10           |
|            |                | 0,3      | 6,81                            | 9,13                            | 7,97           |
|            | 8<br>halb      | 0,1      | 4,24                            | 4,80                            | 4,52           |
|            |                | 0,2      | 16,74                           | 4,83                            | 10,78          |
|            |                | 0,3      | 33,28                           | 7,37                            | 20,33          |

Anhang 4: Schersteifigkeiten, statischer Scherversuch, weggeregelt

| Variante  | Beschaffenheit     | Dehnrate | Schermodul 1 bei Dehnung 0,0002 | Schermodul 2 bei Dehnung 0,0002 | Schermodul, MW |
|---|--------------------|----------|---------------------------------|---------------------------------|----------------|
| -   | °C                 | mm/min   | MPa                             | MPa                             | MPa            |
| <b>Variante 2</b><br><br><b>K1 Kombiprodukt</b> | 0<br>normal        | 0,1      | 5,36                            | 4,52                            | 4,94           |
|   |                    | 0,2      | 14,75                           | 5,68                            | 10,21          |
|   |                    | 0,3      | 25,61                           | 7,70                            | 16,65          |
|   | 1<br>fein          | 0,1      | 5,64                            | 4,81                            | 5,23           |
|   |                    | 0,2      | 7,10                            | 7,11                            | 7,10           |
|   |                    | 0,3      | 9,36                            | 5,97                            | 7,66           |
|   | 1b<br>fein, gestr. | 0,1      | 4,53                            | 5,65                            | 5,09           |
|   |                    | 0,2      | 5,39                            | 9,09                            | 7,24           |
|   |                    | 0,3      | 5,96                            | 5,95                            | 5,95           |
|   | 2<br>grob          | 0,1      | 5,65                            | 4,52                            | 5,09           |
|   |                    | 0,2      | 17,06                           | 5,67                            | 11,37          |
|   |                    | 0,3      | 14,52                           | 5,10                            | 9,81           |
|   | 2b<br>grob, gestr. | 0,1      | 4,52                            | 5,09                            | 4,80           |
|   |                    | 0,2      | 6,25                            | 7,66                            | 6,96           |
|   |                    | 0,3      | 5,39                            | 15,90                           | 10,65          |
|   | 3<br>AC8DN         | 0,1      | 5,09                            | 4,80                            | 4,95           |
|   |                    | 0,2      | 7,38                            | 5,69                            | 6,53           |
|   |                    | 0,3      | 6,55                            | 6,53                            | 6,54           |
|   | 4<br>SMA8S         | 0,1      | 4,52                            | 4,80                            | 4,66           |
|   |                    | 0,2      | 7,09                            | 5,40                            | 6,25           |
|   |                    | 0,3      | 7,69                            | 6,84                            | 7,27           |
|   | 5<br>C60           | 0,1      | 5,65                            | 5,09                            | 5,37           |
|   |                    | 0,2      | 9,96                            | 7,38                            | 8,67           |
|   |                    | 0,3      | 9,34                            | 11,70                           | 10,52          |
|   | 6<br>-30%          | 0,1      | 4,80                            | 5,08                            | 4,94           |
|   |                    | 0,2      | 5,97                            | 7,39                            | 6,68           |
|   |                    | 0,3      | 5,94                            | 7,66                            | 6,80           |
| 7<br>doppelt                                    | 0,1                | 4,80     | 4,81                            | 4,80                            |                |
|   | 0,2                | 5,39     | 8,50                            | 6,94                            |                |
|   | 0,3                | 5,98     | 17,64                           | 11,81                           |                |
| 8<br>halb                                       | 0,1                | 5,66     | 4,80                            | 5,23                            |                |
|   | 0,2                | 5,95     | 6,26                            | 6,10                            |                |
|   | 0,3                | 6,53     | 9,11                            | 7,82                            |                |

Anhang 4: Schersteifigkeiten, statischer Scherversuch, weggeregelt

| Variante                   | Beschaffenheit | Dehnrate | Schermodul 1 bei Dehnung 0,0002 | Schermodul 2 bei Dehnung 0,0002 | Schermodul, MW |
|----------------------------|----------------|----------|---------------------------------|---------------------------------|----------------|
| -                          | °C             | mm/min   | MPa                             | MPa                             | MPa            |
| <b>Variante 3</b>          | 0<br>normal    | 0,1      | 4,81                            | 5,37                            | 5,09           |
|                            |                | 0,2      | 4,82                            | 7,94                            | 6,38           |
|                            |                | 0,3      | 4,84                            | 8,23                            | 6,53           |
|                            | 1<br>fein      | 0,1      | 5,09                            | 4,52                            | 4,81           |
|                            |                | 0,2      | 7,09                            | 5,96                            | 6,52           |
|                            |                | 0,3      | 6,79                            | 5,39                            | 6,09           |
|                            | 2<br>grob      | 0,1      | 4,24                            | 4,52                            | 4,38           |
|                            |                | 0,2      | 5,97                            | 6,24                            | 6,10           |
|                            |                | 0,3      | 6,54                            | 5,09                            | 5,82           |
| 3<br>AC8DN                 | 0,1            | 4,80     | 5,37                            | 5,09                            |                |
|                            | 0,2            | 5,38     | 5,68                            | 5,53                            |                |
|                            | 0,3            | 5,67     | 8,25                            | 6,96                            |                |
| 4<br>SMA8S                 | 0,1            | 4,52     | 4,53                            | 4,52                            |                |
|                            | 0,2            | 5,10     | 4,82                            | 4,96                            |                |
|                            | 0,3            | 6,25     | 5,39                            | 5,82                            |                |
| <b>K2<br/>Kombiprodukt</b> | 5<br>C60       | 0,1      | 4,80                            | 5,37                            | 5,08           |
|                            |                | 0,2      | 5,09                            | 5,39                            | 5,24           |
|                            |                | 0,3      | 5,12                            | 5,98                            | 5,55           |
|                            | 6<br>-30%      | 0,1      | 5,09                            | 5,37                            | 5,23           |
|                            |                | 0,2      | 5,10                            | 6,52                            | 5,81           |
|                            |                | 0,3      | 5,10                            | 8,52                            | 6,81           |
|                            | 7<br>doppelt   | 0,1      | 5,09                            | 4,52                            | 4,81           |
|                            |                | 0,2      | 6,54                            | 4,55                            | 5,54           |
|                            |                | 0,3      | 5,10                            | 4,26                            | 4,68           |
| 8<br>halb                  | 0,1            | 7,63     | 5,94                            | 6,78                            |                |
|                            | 0,2            | 14,47    | 5,10                            | 9,79                            |                |
|                            | 0,3            | 15,65    | 6,26                            | 10,96                           |                |



Anhang 4: Schersteifigkeiten, statischer Scherversuch, weggeregelt

| Variante      | Einlage/<br>Beschaffenheit | Dehnrage | Schermodul 1<br>bei Dehnung<br>0,0002 | Schermodul 2<br>bei Dehnung<br>0,0002 | Schermodul,<br>MW |
|---------------|----------------------------|----------|---------------------------------------|---------------------------------------|-------------------|
| -             | °C                         | mm/min   | MPa                                   | MPa                                   | MPa               |
| Varianten 4-9 | 4-K3<br>normal             | 0,1      | 4,52                                  | 5,08                                  | 4,80              |
|               |                            | 0,2      | 5,40                                  | 7,38                                  | 6,39              |
|               |                            | 0,3      | 5,96                                  | 7,39                                  | 6,67              |
|               | 5-K4<br>normal             | 0,1      | 5,09                                  | 4,80                                  | 4,94              |
|               |                            | 0,2      | 10,22                                 | 5,40                                  | 7,81              |
|               |                            | 0,3      | 14,80                                 | 5,12                                  | 9,96              |
|               | 6-K5<br>normal             | 0,1      | 4,81                                  | 6,22                                  | 5,51              |
|               |                            | 0,2      | 5,40                                  | 6,83                                  | 6,11              |
|               |                            | 0,3      | 8,22                                  | 21,65                                 | 14,93             |
|               | 7-K6<br>normal             | 0,1      | 4,81                                  | 7,63                                  | 6,22              |
|               |                            | 0,2      | 11,64                                 | 6,53                                  | 9,09              |
|               |                            | 0,3      | 7,96                                  | 26,23                                 | 17,09             |
|               | 8-K7<br>normal             | 0,1      |                                       |                                       |                   |
|               |                            | 0,2      |                                       |                                       |                   |
|               |                            | 0,3      |                                       |                                       |                   |
|               | 9-K8<br>normal             | 0,1      | 4,52                                  | 4,24                                  | 4,38              |
|               |                            | 0,2      | 5,40                                  | 8,22                                  | 6,81              |
|               |                            | 0,3      | 5,38                                  | 7,39                                  | 6,39              |

Anhang 4: Abscherversuche

| Variante                    |       | Kraft 1 | Kraft 2 | Kraft Mittelwert | Weg 1 | Weg 2 | Weg Mittelwert |
|-----------------------------|-------|---------|---------|------------------|-------|-------|----------------|
| -                           | -     | [kN]    | [kN]    | [kN]             | [mm]  | [mm]  | [mm]           |
| <b>0</b><br><b>Referenz</b> | 0     | 45,30   | 45,27   | 45,29            | 2,06  | 1,95  | 2,01           |
|                             | 1     | 31,38   | 29,03   | 30,21            | 1,32  | 1,27  | 1,30           |
|                             | 1b    | 31,56   | 45,56   | 38,56            | 0,99  | 1,43  | 1,61           |
|                             | 2     | 36,80   | 42,73   | 39,77            | 1,54  | 1,68  | 1,21           |
|                             | 2b    | 34,26   | 39,16   | 36,71            | 1,77  | 1,50  | 1,64           |
|                             | 3     | 28,27   | 35,02   | 31,65            | 1,42  | 1,87  | 1,65           |
|                             | 4     | 33,32   | 40,41   | 36,87            | 2,14  | 2,76  | 2,45           |
|                             | 5     | 47,57   | 29,68   | 38,63            | 2,39  | 1,52  | 1,96           |
| <b>1</b><br><b>Vlies</b>    | 0     | 15,56   | 16,23   | 15,90            | 1,36  | 1,32  | 1,34           |
|                             | 1     | 16,95   | 19,41   | 18,18            | 1,76  | 1,59  | 1,68           |
|                             | 2     | 19,84   | 14,27   | 17,06            | 1,60  | 1,52  | 1,56           |
|                             | 3     | 18,09   | 27,96   | 23,03            | 1,69  | 2,44  | 2,07           |
|                             | 4     | 15,57   | 24,63   | 20,10            | 2,36  | 2,62  | 2,49           |
|                             | 5     | 26,17   | 24,55   | 25,36            | 1,62  | 1,51  | 1,57           |
|                             | 6     | 19,95   | 18,52   | 19,24            | 1,45  | 1,54  | 1,50           |
|                             | 7     | 8,62    | 7,22    | 7,92             | 1,61  | 1,07  | 1,34           |
| 8                           | 13,00 | 19,96   | 16,48   | 1,33             | 1,51  | 1,42  |                |
| <b>2</b><br><b>K1</b>       | 0     | 23,60   | 16,40   | 20,00            | 2,17  | 1,94  | 2,06           |
|                             | 1     | 16,25   | 21,35   | 18,8             | 1,78  | 1,93  | 1,86           |
|                             | 1b    | 15,73   | 17,42   | 16,58            | 2,51  | 1,93  | 2,22           |
|                             | 2     | 20,25   | 22,29   | 21,27            | 4,67  | 2,19  | 3,43           |
|                             | 2b    | 19,02   | 18,72   | 18,87            | 3,63  | 2,73  | 3,18           |
|                             | 3     | 18,15   | 19,82   | 18,99            | 2,25  | 2,70  | 2,48           |
|                             | 4     | 24,08   | 18,43   | 21,26            | 3,24  | 2,67  | 2,00           |
|                             | 5     | 17,08   | 17,45   | 17,27            | 2,62  | 1,59  | 2,11           |
|                             | 6     | 17,94   | 23,66   | 20,80            | 2,04  | 1,98  | 2,01           |
| 7                           | 6,17  | 7,37    | 6,77    | 1,50             | 1,87  | 1,69  |                |
| 8                           | 18,07 | 24,41   | 21,24   | 1,64             | 2,01  | 1,83  |                |
| <b>3</b><br><b>K2</b>       | 0     | 16,21   | 13,63   | 14,92            | 2,28  | 1,98  | 2,13           |
|                             | 1     | 14,05   | 15,29   | 14,67            | 1,52  | 1,93  | 1,73           |
|                             | 2     | 19,91   | 14,01   | 16,96            | 1,99  | 2,26  | 2,13           |
|                             | 3     | 12,68   | 13,57   | 13,13            | 1,92  | 1,80  | 1,86           |
|                             | 4     | 13,96   | 17,95   | 15,96            | 3,00  | 2,55  | 2,78           |
|                             | 5     | 14,98   | 20,40   | 17,69            | 1,79  | 2,05  | 1,92           |
|                             | 6     | 13,20   | 15,99   | 14,60            | 2,21  | 1,72  | 1,97           |
|                             | 7     | 6,02    | 0,44    | 3,23             | 1,40  | 1,32  | 1,36           |
| 8                           | 15,48 | 21,66   | 18,57   | 2,18             | 2,85  | 2,52  |                |
| <b>4-9</b><br><b>K3-K9</b>  | 0     | 23,36   | 21,56   | 22,46            | 2,67  | 2,05  | 2,36           |
|                             | 1     | 15,33   | 13,53   | 14,43            | 2,21  | 2,01  | 2,13           |
|                             | 2     | 26,25   | 21,58   | 23,92            | 2,07  | 2,04  | 2,06           |
|                             | 3     | 22,89   | 16,79   | 19,84            | 2,34  | 1,65  | 2,00           |
|                             | 4     |         |         |                  |       |       |                |
| 5                           | 21,54 | 19,27   | 20,41   | 1,91             | 1,85  | 1,88  |                |

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie  |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|---|-----------|----------------|----------------------|--------------------|-------------|
| 0-0      | Parameter N <sub>Makro</sub>  |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>  | 7,2295E+3 | 0,3            | 9.1038               | 1.000.000*         | 8,6791      |
|          | Parameter C <sub>2</sub>  | -4,2490   | 0,3            | 8.7846               | 1.000.000*         | 8,3557      |
|          | Bestimmtheitsmaß  | 94,0      | 0,4            | 8.8086               | 1.000.000*         | 8,8403      |
|          | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |           | 0,4            | 7.5878               | 105.280            | 6,7068      |
|          |   |           | 0,5            | 6.9829               | 80.260             | 6,1168      |
|          |   |           | 0,5            | 6.7972               | 128.660            | 6,2649      |
|          |   |           | 0,6            | 6.1771               | 53.860             | 6,0766      |
| 0,6      |   |           | 6.2138         | 75.280               | 5,5701             |             |
| 0-1      | Parameter C <sub>1</sub>  | 6,9323E+2 | 0,3            | 7.8086               | 1.000.000*         | 7,9317      |
|          | Parameter C <sub>2</sub>  | -7,6580   | 0,4            | 7.3821               | 1.000.000*         | 6,9756      |
|          | Bestimmtheitsmaß  | 99,4      | 0,5            | 6.9232               | 139.400            | 5,7503      |
|          |   |           | 0,6            | 0                    | 41.820             | 6,8060      |
| 0-1b     | Parameter C <sub>1</sub>  | 1,0477E+3 | 0,3            | 7.8086               | 1.000.000*         | 7,9317      |
|          | Parameter C <sub>2</sub>  | -7,4697   | 0,4            | 8,9948               | 1.000.000*         | 7,6019      |
|          | Bestimmtheitsmaß  | 99,9      | 0,5            | 8,4790               | 178.940            | 7,0013      |
|          |   |           | 0,6            | 5,9653               | 48.560             | 6,6620      |
| 0-2      | Parameter C <sub>1</sub>  | 2.6336E+2 | 0,3            | 7,2732               | 1.000.000*         | 7,1295      |
|          | Parameter C <sub>2</sub>  | -8,9978   | 0,3            | 8,9371               | 1.000.000*         | 8,5673      |
|          | Bestimmtheitsmaß  | 99,9      | 0,4            | 7,5512               | 1.000.000*         | 6,3558      |
|          | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |           | 0,4            | 8,6474               | 1.000.000*         | 8,3899      |
|          |   |           | 0,5            | 6,6116               | 188.400            | 5,7970      |
|          |   |           | 0,5            | 8,0081               | 82.460             | 6,5742      |
|          |   |           | 0,6            | 0                    | 26.020             | 6,5238      |
| 0,6      |   |           |                |                      |                    |             |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie  |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|---|-----------|----------------|----------------------|--------------------|-------------|
| 0-2b     | Parameter N <sub>Makro</sub>  |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>  | 7,4477E+2 | 0,3            | 9,0211               | 1.000.000*         | 9,0433      |
|          | Parameter C <sub>2</sub>  | -8,4163   | 0,3            | 9,6438               | 1.000.000*         | 9,3062      |
|          | Bestimmtheitsmaß  | 98,6      | 0,4            | 8,1882               | 2.000.000*         | 6,9866      |
|          | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |           | 0,4            | 7,5861               | 1.000.000*         | 7,5419      |
|          |   |           | 0,5            | 7,0236               | 141.160            | 5,9022      |
|          |   |           | 0,5            | 7,7484               | 500.000            | 6,9152      |
|          |   |           | 0,6            | 5,3572               | 48.300             | 5,7781      |
|          |   | 0,6       |                |                      |                    |             |
| 0-3      | Parameter C <sub>1</sub>  | 5,1297E+2 | 0,3            | 5,5329               | 149.900            | 4,2290      |
|          | Parameter C <sub>2</sub>  | -4,5810   | 0,4            | 0                    | 26.100             | 3,9702      |
|          | Bestimmtheitsmaß  | 98,0      | 0,5            | 0                    | 12.020             | 4,8311      |
|          | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |           | 0,6            | 0                    | 6.045              | 3,9191      |
| 0-4      | Parameter C <sub>1</sub>  | 5,6795E+2 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>  | -3,7450   | 0,4            | 0                    | 16.180             | 3,4434      |
|          | Bestimmtheitsmaß  | 95,9      | 0,5            | 0                    | 9.135              | 4,0104      |
|          | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |           | 0,6            | 0                    | 3.480              | 4,0960      |
| 0-5      | Parameter C <sub>1</sub>  | 3,6513E+2 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>  | -8,7027   | 0,4            | 8,1474               | 1.000.000*         | 7,2762      |
|          | Bestimmtheitsmaß  | 99,6      | 0,5            | 7,7912               | 173.440            | 6,5239      |
|          | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |           | 0,6            | 0                    | 28.960             | 6,1431      |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                 |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|------------------------------|-----------|----------------|----------------------|--------------------|-------------|
| 2-0      | Parameter N <sub>Makro</sub> |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>     | 1,5299E+3 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -5,8299   | 0,4            | 5,3914               | 300.000*           | 4,7755      |
|          | Bestimmtheitsmaß             | 98,9      | 0,5            | 5,2959               | 100.200            | 4,6310      |
|          |                              |           | 0,6            | 0                    | 27.820             | 4,3310      |
| 2-1      | Parameter C <sub>1</sub>     | 3,8032E+2 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -8,3841   | 0,4            | 6,8083               | 1.000.000*         | 6,3120      |
|          | Bestimmtheitsmaß             | 95,5      | 0,5            | 5,0858               | 82.860             | 4,3085      |
|          |                              |           | 0,6            | 0                    | 34.860             | 4,6030      |
| 2-1b     | Parameter C <sub>1</sub>     | 2,5801E+3 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -4,1953   | 0,4            | 5,2223               | 140.000*           | 4,6109      |
|          | Bestimmtheitsmaß             | 89,7      | 0,5            | 0                    | 33.880             | 4,0963      |
|          |                              |           | 0,6            | 0                    | 26.420             | 4,3526      |
| 2-2      | Parameter C <sub>1</sub>     | 5,5711E+2 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -8,3171   | 0,4            | 6,8485               | 1.000.000*         | 6,4930      |
|          | Bestimmtheitsmaß             | 97,9      | 0,5            | 6,5166               | 236.280            | 5,3430      |
|          |                              |           | 0,6            | 0                    | 33.340             | 4,5623      |
| 2-2b     | Parameter C <sub>1</sub>     | 1,1648E+3 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -5,5763   | 0,4            | 6,3949               | 230.000*           | 5,2825      |
|          | Bestimmtheitsmaß             | 91,8      | 0,5            | 0                    | 37.580             | 4,1495      |
|          |                              |           | 0,6            | 0                    | 24.940             | 4,2379      |
| 2-3      | Parameter C <sub>1</sub>     | 7,8499E+2 | 0,3            | 4,7063               | 300.000*           | 3,7410      |
|          | Parameter C <sub>2</sub>     | -4,9106   | 0,4            | 4,3711               | 67.580             | 3,9303      |
|          | Bestimmtheitsmaß             | 99,9      | 0,5            | 0                    | 22.920             | 3,8768      |
|          |                              |           | 0,6            | 0                    | 10.040             | 3,6838      |
| 2-4      | Parameter C <sub>1</sub>     | 436,1497  | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -4,7382   | 0,4            | 0                    | 33.080             | 2.5320      |
|          | Bestimmtheitsmaß             | 99,9      | 0,5            | 0                    | 11.980             | 2.8640      |
|          |                              |           | 0,6            | 0                    | 4.830              | 2.7430      |

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                 |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|------------------------------|-----------|----------------|----------------------|--------------------|-------------|
| 2-5      | Parameter N <sub>Makro</sub> |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>     | 1,5308E+3 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -6,9685   | 0,4            | 7,3957               | 1.000.000*         | 6,6460      |
|          | Bestimmtheitsmaß             | 98,3      | 0,5            | 7,0129               | 154.560            | 5,5550      |
|          |                              |           | 0,6            | 5,1989               | 60.580             | 4,9430      |
| 2-6      | Parameter C <sub>1</sub>     | 3,1969E+3 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -6,4473   | 0,4            | 5,9813               | 1.000.000*         | 5,4197      |
|          | Bestimmtheitsmaß             | 94,6      | 0,5            | 6,0636               | 400.000*           | 5,5556      |
|          |                              |           | 0,6            | 5,3912               | 70.620             | 5,1213      |
| 2-7      | Parameter C <sub>1</sub>     | 2,3926E+3 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -5,6159   | 0,4            | 4,6228               | 500.000*           | 4,2911      |
|          | Bestimmtheitsmaß             | 90,0      | 0,5            | 4,2063               | 75.800             | 3,3558      |
|          |                              |           | 0,6            | 4,2484               | 53.600             | 3,7704      |
| 2-8      | Parameter C <sub>1</sub>     | 1,2138E+3 | 0,4            | 5,6042               | 300.000*           | 5,1415      |
|          | Parameter C <sub>2</sub>     | -5,6845   | 0,4            | 5,4128               | 172.440            | 4,0793      |
|          | Bestimmtheitsmaß             | 98,9      | 0,5            | 4,3943               | 54.340             | 4,6711      |
|          |                              |           | 0,6            | 0                    | 23.900             | 4,0802      |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                 |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|------------------------------|-----------|----------------|----------------------|--------------------|-------------|
| 3-0      | Parameter N <sub>Makro</sub> |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>     | 2,0194E+4 | 0,4            | 6,2021               | 1.000.000*         | 5,7795      |
|          | Parameter C <sub>2</sub>     | -4,2305   | 0,5            | 6,1729               | 400.000*           | 5,2099      |
|          | Bestimmtheitsmaß             | 93,3      | 0,6            | 6,0889               | 125.540            | 4,6267      |
|          |                              |           | 0,65           | 5,8869               | 161.080            | 4,0980      |
| 4-0      | Parameter C <sub>1</sub>     | 6,5648E+3 | 0,4            | 5,7578               | 197.220            | 4,4594      |
|          | Parameter C <sub>2</sub>     | -3,7343   | 0,5            | 5,1422               | 89.440             | 4,3980      |
|          | Bestimmtheitsmaß             | 99,8      | 0,6            | 3,6287               | 46.000             | 4,4047      |
|          |                              |           | 0,65           | 0                    | 31.400             | 3,9838      |
| 5-0      | Parameter C <sub>1</sub>     | 4759,3    | 0,3            |                      | 1.000.000*         |             |
|          | Parameter C <sub>2</sub>     | -4,472    | 0,35           |                      | 569.200            |             |
|          | Bestimmtheitsmaß             | 96,3      | 0,4            |                      | 247.400            |             |
|          |                              |           | 0,45           |                      | 244.200            |             |
|          |                              |           | 0,5            |                      | 92.100             |             |
|          |                              |           | 0,55           |                      | 49.700             |             |
|          |                              |           | 0,65           | 0                    | 39.580             | 5,2132      |
| 7-0      | Parameter C <sub>1</sub>     | 4,7963E+3 | 0,4            | 7,3819               | 1.000.000*         | 5,9268      |
|          | Parameter C <sub>2</sub>     | -5,8570   | 0,5            | 6,4547               | 300.000*           | 5,8610      |
|          | Bestimmtheitsmaß             | 99,7      | 0,6            | 5,5866               | 87.620             | 4,5854      |
|          |                              |           | 0,65           | 5,6066               | 62.080             | 5,0370      |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                 |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|------------------------------|-----------|----------------|----------------------|--------------------|-------------|
| 10-0     | Parameter N <sub>Makro</sub> |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>     | 1,3616E+3 | 0,4            | 7,3699               | 1.000.000*         | 7,2102      |
|          | Parameter C <sub>2</sub>     | -9,5205   | 0,5            | 7,4966               | 1.000.000*         | 6,9248      |
|          | Bestimmtheitsmaß             | 100       | 0,6            | 6,3674               | 182.140            | 4,5203      |
|          |                              |           | 0,6            | 8,0875               | 170.380            | 6,1901      |
| 10-1     | Parameter C <sub>1</sub>     | 2,5672E+1 | 0,4            | 6,8772               | 1.000.000*         | 6,9145      |
|          | Parameter C <sub>2</sub>     | -15,2490  | 0,5            | 7,4510               | 1.000.000*         | 7,2909      |
|          | Bestimmtheitsmaß             | 100       | 0,6            | 6,7316               | 62.020             | 6,1961      |
|          |                              |           | 0,6            |                      |                    |             |
| 10-1b    | Parameter C <sub>1</sub>     | 1,5067E+3 | 0,4            | 7,3033               | 1.000.000*         | 7,3788      |
|          | Parameter C <sub>2</sub>     | -9,3744   | 0,5            | 8,2042               | 1.000.000*         | 8,0644      |
|          | Bestimmtheitsmaß             | 100       | 0,6            | 7,3761               | 181.020            | 5,7866      |
|          |                              |           | 0,6            |                      |                    |             |
| 10-2     | Parameter C <sub>1</sub>     | 2,4199E+3 | 0,4            | 8,2839               | 1.000.000*         | 8,1078      |
|          | Parameter C <sub>2</sub>     | -7,6670   | 0,5            | 8,5977               | 500.000*           | 8,3289      |
|          | Bestimmtheitsmaß             | 99,8      | 0,6            | 7,1208               | 115.120            | 5,6889      |
|          |                              |           | 0,65           | 6,8686               | 68.320             | 5,9690      |
| 10-2b    | Parameter C <sub>1</sub>     | 8,9510E+2 | 0,4            | 6,9181               | 1.000.000*         | 6,8172      |
|          | Parameter C <sub>2</sub>     | -10,1484  | 0,5            | 7,3987               | 1.000.000*         | 7,2516      |
|          | Bestimmtheitsmaß             | 99,9      | 0,6            | 7,0480               | 168.140            | 5,4510      |
|          |                              |           | 0,65           | 5,8993               | 68.380             | 5,4060      |
| 10-3     | Parameter C <sub>1</sub>     | 2,0286E+3 | 0,4            | 4,3274               | 62.660             | 3,9070      |
|          | Parameter C <sub>2</sub>     | -4,0173   | 0,5            | 4,6714               | 57.360             | 4,6180      |
|          | Bestimmtheitsmaß             | 74,0      | 0,6            | 0                    | 11.620             | 3,8650      |
|          |                              |           | 0,65           |                      |                    |             |
| 10-4     | Parameter C <sub>1</sub>     | 1,7891E+2 | 0,4            | 4,8466               | 400.000*           | 4,1870      |
|          | Parameter C <sub>2</sub>     | -8,2095   | 0,5            | 0                    | 34.700             | 3,8940      |
|          | Bestimmtheitsmaß             | 95,4      | 0,6            | 0                    | 14.960             | 3,8670      |
|          |                              |           | 0,65           |                      |                    |             |



Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                 |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|------------------------------|-----------|----------------|----------------------|--------------------|-------------|
| 10-5     | Parameter N <sub>Makro</sub> |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>     | 4,0176E+2 | 0,4            | 6,3622               | 1.000.000*         | 6,2776      |
|          | Parameter C <sub>2</sub>     | -11,1744  | 0,5            | 6,4288               | 1.000.000*         | 6,1183      |
|          | Bestimmtheitsmaß             | 97,9      | 0,6            | 5,6563               | 94.940             | 4,6879      |
|          |                              |           | 0,65           | 4,4055               | 58.600             | 4,2550      |
| 10-6     | Parameter C <sub>1</sub>     | 2595,6    | 0,4            | 6,5330               | 1.000.000*         | 6,3217      |
|          | Parameter C <sub>2</sub>     | -6,6942   | 0,5            |                      | 240.020            |             |
|          | Bestimmtheitsmaß             | 96,5      | 0,6            |                      | 101.540            |             |
|          |                              |           | 0,7            |                      | 24720              |             |
| 10-7     | Parameter C <sub>1</sub>     | 7939,7    | 0,5            |                      | 250.000            |             |
|          | Parameter C <sub>2</sub>     | -5,2116   | 0,6            |                      | 202.280            | 5,5617      |
|          | Bestimmtheitsmaß             | 77,7      | 0,6            |                      | 91.280             |             |
|          |                              |           | 0,7            |                      | 42.020             |             |
| 10-8     | Parameter C <sub>1</sub>     | 12274,1   | 0,6            |                      | 75.880             |             |
|          | Parameter C <sub>2</sub>     | -3,139    | 0,65           |                      | 30.140             |             |
|          | Bestimmtheitsmaß             | 29,8      | 0,7            |                      | 52.640             |             |
|          |                              |           | 0,7            |                      | 34.000             |             |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                 |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|------------------------------|-----------|----------------|----------------------|--------------------|-------------|
| 11-0     | Parameter N <sub>Makro</sub> |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>     | 2,3190E+3 | 0,4            | 6,6698               | 1.000.000*         | 6,6196      |
|          | Parameter C <sub>2</sub>     | -8,7523   | 0,5            | 6,3776               | 1:000.000*         | 6,2544      |
|          | Bestimmtheitsmaß             | 100       | 0,6            | 6,1841               | 105.520            | 4,9706      |
|          |                              |           | 0,6            | 6,3956               | 300.000*           | 6,0165      |
| 11-1     | Parameter C <sub>1</sub>     | 6,8388E+3 | 0,4            | 7,4497               | 1.000.000*         | 7,2498      |
|          | Parameter C <sub>2</sub>     | -6,9809   | 0,5            | 6,1258               | 1.000.000*         | 5,8712      |
|          | Bestimmtheitsmaß             | 82,9      | 0,6            | 6,9207               | 149.750            | 6,3229      |
|          |                              |           | 0,65           | 7,5046               | 193.100            | 5,8001      |
| 11-2     | Parameter C <sub>1</sub>     | 1,1608E+3 | 0,4            | 6,3907               | 1.000.000*         | 6,1564      |
|          | Parameter C <sub>2</sub>     | -9,4861   | 0,5            | 6,5411               | 1.000.000*         | 6,2388      |
|          | Bestimmtheitsmaß             | 85,1      | 0,6            | 5,6304               | 80.960             | 4,6778      |
|          |                              |           | 0,65           | 6,3359               | 104.920            | 5,3210      |
| 11-3     | Parameter C <sub>1</sub>     | 7,8027E+3 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -2,3793   | 0,4            | 3,5411               | 82.540             | 2,9290      |
|          | Bestimmtheitsmaß             | 66,3      | 0,5            | 0                    | 27.280             | 2,8390      |
|          |                              |           | 0,6            | 0                    | 32.740             | 2,8826      |
| 11-4     | Parameter C <sub>1</sub>     | 1,8986E+2 | 0,3            |                      |                    |             |
|          | Parameter C <sub>2</sub>     | -6,9584   | 0,4            | 4,1458               | 122.820            | 3,306       |
|          | Bestimmtheitsmaß             | 98,3      | 0,5            | 0                    | 19.060             | 3,124       |
|          |                              |           | 0,6            | 0                    | 7.470              | 2,839       |
| 11-5     | Parameter C <sub>1</sub>     | 1,4835E+3 | 0,4            | 7,1699               | 1.000.000*         | 7,0441      |
|          | Parameter C <sub>2</sub>     | -9,355    | 0,5            | 7,1778               | 1.000.000*         | 6,9015      |
|          | Bestimmtheitsmaß             | 99,6      | 0,6            | 6,5610               | 160.720            | 5,4314      |
|          |                              |           | 0,65           | 5,7811               | 89.100             | 4,9340      |
| 11-6     | Parameter C <sub>1</sub>     | 2,1819E+1 | 0,4            | 6,7632               | 1.000.000*         | 6,6113      |
|          | Parameter C <sub>2</sub>     | -15,4505  | 0,5            | 6,3934               | 1.000.000          | 6,2189      |
|          | Bestimmtheitsmaß             | 99,9      | 0,55           | 6,7879               | 213.400            | 5,5520      |
|          |                              |           | 0,6            | 6,0428               | 59.920             | 5,7818      |

Anhang 4: 3-Punkt-Biegeprüfung, rissüberbrückende Funktion

| Variante | Wöhler-Linie                 |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------|------------------------------|-----------|----------------|----------------------|--------------------|-------------|
| 11-7     | Parameter N <sub>Makro</sub> |           | [kN]           | [MPa]                | -                  | -           |
|          | Parameter C <sub>1</sub>     | 1,0258E+3 | 0,4            | 5,3084               | 1.000.000*         | 5,0399      |
|          | Parameter C <sub>2</sub>     | -9,6861   | 0,5            | 5,9727               | 1.000.000*         | 5,5613      |
|          | Bestimmtheitsmaß             | 87,6      | 0,6            | 4,8616               | 83.200             | 4,0753      |
|          |                              |           | 0,65           | 5,2635               | 97.680             | 4,1990      |
| 11-8     | Parameter C <sub>1</sub>     | 2,5367E+2 | 0,4            | 6,6782               | 1.000.000*         | 6,5877      |
|          | Parameter C <sub>2</sub>     | -15,5043  | 0,5            | 6,2607               | 1.000.000*         | 6,0483      |
|          | Bestimmtheitsmaß             | 98,6      | 0,6            | 6,2843               | 1.000.000*         | 6,0871      |
|          |                              |           | 0,7            | 5,6526               | 52.640             | 5,6420      |
| 12-0     | Parameter C <sub>1</sub>     | 5999,16   | 0,3            |                      | 1.000.000*         |             |
|          | Parameter C <sub>2</sub>     | -4,3743   | 0,35           |                      | 548.300            |             |
|          | Bestimmtheitsmaß             | 94,8      | 0,4            |                      | 338.600            |             |
|          |                              |           | 0,45           |                      | 319.500            |             |
|          |                              |           | 0,5            |                      | 142.100            |             |
|          |                              |           | 0,55           |                      | 59.900             |             |
|          |                              |           | 0,6            |                      | 50.780             |             |
| 13-0     | Parameter C <sub>1</sub>     | 3,1807E+3 | 0,4            | 7,2780               | 1.000.000*         | 7,1400      |
|          | Parameter C <sub>2</sub>     | -8,2690   | 0,5            | 7,0100               | 1.000.000*         | 6,7511      |
|          | Bestimmtheitsmaß             | 99,8      | 0,6            | 6,3212               | 204.160            | 4,5878      |
|          |                              |           | 0,65           | 6,2522               | 117.040            | 4,9440      |
| 14-0     | Parameter C <sub>1</sub>     | 1,8314E+3 | 0,4            | 6,7522               | 1.000.000*         | 6,4908      |
|          | Parameter C <sub>2</sub>     | -6,2496   | 0,5            | 6,8594               | 140.000*           | 6,3491      |
|          | Bestimmtheitsmaß             | 99,9      | 0,55           | 6,3606               | 76.060             | 5,6170      |
|          |                              |           | 0,6            | 3,4042               | 44.820             | 5,2478      |
| 15-0     | Parameter C <sub>1</sub>     | 9,3008E+2 | 0,4            | 6,6397               | 1.000.000*         | 6,5485      |
|          | Parameter C <sub>2</sub>     | -7,2281   | 0,5            | 0                    | 35.800             | 5,3038      |
|          | Bestimmtheitsmaß             | 81,9      | 0,5            | 5,8280               | 90.220             | 4,9480      |
|          |                              |           | 0,6            | 6,1208               | 57.800             | 5,8020      |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: 3-Punkt-Biegeprüfung, bewehrende Funktion

| Variante               | Last-amplitude | Dynamischer Modul MD nach Lastzyklus [MPa] |       |        |        |         |         |
|------------------------|----------------|--|-------|--------|--------|---------|---------|
|                        |                | 100  | 1.000 | 10.000 | 50.000 | 100.000 | 200.000 |
|                        | kN             |  |       |        |        |         |         |
| 0-0<br>normal<br>unten | 0,3            |  |       |        |        |         |         |
|                        | 0,4            | 7,515                                      | 8,230 | 8,983  | 8,421  | 6,967   | 0       |
|                        | 0,5            | 6,927                                      | 7,219 | 8,215  | 8,081  | 6,967   | 0       |
|                        | 0,6            | 8,765                                      | 8,769 | 8,919  | 0      | 0       | 0       |
| 0-0<br>normal<br>mitte | 0,3            |  |       |        |        |         |         |
|                        | 0,4            | 7,578                                      | 8,511 | 9,146  | 8,271  | 3,287   | 0       |
|                        | 0,5            | 8,333                                      | 8,729 | 8,886  | 6,365  | 0       | 0       |
|                        | 0,6            | 8,819                                      | 9,258 | 8,933  | 0      | 0       | 0       |
| 0-0<br>normal<br>oben  | 0,3            |  |       |        |        |         |         |
|                        | 0,4            | 7,984                                      | 8,084 | 8,428  | 8,923  | 8,895   | 8,305   |
|                        | 0,5            | 8,093                                      | 8,710 | 9,349  | 9,22   | 8,483   | 0       |
|                        | 0,6            | 8,754                                      | 9,232 | 9,679  | 9,384  | 7,673   | 0       |
| 0-1<br>fein<br>unten   | 0,3            |  |       |        |        |         |         |
|                        | 0,4            | 5,970                                      | 8,329 | 9,797  | 10,143 | 10,067  | 9,596   |
|                        | 0,5            | 7,937                                      | 8,474 | 9,530  | 9,122  | 7,154   | 0       |
|                        | 0,6            | 6,434                                      | 7,267 | 8,140  | 0      | 0       | 0       |
| 0-3<br>AC8DN<br>unten  | 0,3            | 7,116                                      | 7,964 | 8,971  | 9,338  | 9,415   | 9,079   |
|                        | 0,4            | 5,275                                      | 6,368 | 7,309  | 6,554  | 4,498   | 0       |
|                        | 0,5            | 7,262                                      | 7,674 | 7,159  | 0      | 0       | 0       |
|                        | 0,6            | 8,074                                      | 8,155 | 5,269  | 0      | 0       | 0       |
| 0-4<br>SMA8S<br>unten  | 0,3            |  |       |        |        |         |         |
|                        | 0,4            | 3,815                                      | 3,976 | 4,716  | 0      | 0       | 0       |
|                        | 0,5            | 5,271                                      | 5,931 | 3,041  | 0      | 0       | 0       |
|                        | 0,6            | 6,236                                      | 6,645 | 3,428  | 0      | 0       | 0       |

Anhang 4: 3-Punkt-Biegeprüfung, bewehrende Funktion

| Variante            | Last-amplitude | Dynamischer Modul MD nach Lastzyklus [MPa] |       |        |        |         |         |
|---------------------|----------------|--|-------|--------|--------|---------|---------|
|                     |                | 100  | 1.000 | 10.000 | 50.000 | 100.000 | 200.000 |
|                     | kN             |  |       |        |        |         |         |
| 0-5<br>C40<br>unten | 0,3            |  |       |        |        |         |         |
|                     | 0,3            | 4,741                                      | 6,842 | 8,865  | 9,869  | 9,014   | 9,521   |
|                     | 0,4            | 6,493                                      | 6,734 | 7,099  | 7,023  | 7,027   | 6,549   |
|                     | 0,4            | 8,563                                      | 8,665 | 8,730  | 9,430  | 8,664   | 8,779   |
|                     | 0,5            | 8,940                                      | 8,733 | 9,118  | 9,310  | 8,478   | 6,162   |
|                     | 0,5            | 8,275                                      | 8,884 | 9,543  | 9,342  | 8,664   | 7,133   |
|                     | 0,6            | 8,838                                      | 8,983 | 9,059  | 8,435  | 7,442   | 0       |
|                     | 0,6            | 8,204                                      | 9,052 | 9,491  | 8,924  | 7,141   | 0       |
| 2-0<br>K1<br>unten  | 0,3            |  |       |        |        |         |         |
|                     | 0,4            | 7,589                                      | 8,222 | 8,645  | 8,745  | 8,465   | 7,239   |
|                     | 0,5            | 6,242                                      | 6,497 | 7,295  | 6,237  | 5,587   | 4,524   |
|                     | 0,6            | 6,513                                      | 7,652 | 8,183  | 5,875  | 0       | 0       |
| 3-0<br>K2<br>unten  | 0,3            | 7,272                                      | 7,330 | 7,573  | 8,116  | 8,101   | 8,088   |
|                     | 0,4            | 4,791                                      | 6,813 | 7,644  | 6,534  | 6,085   | 5,513   |
|                     | 0,5            | 5,857                                      | 7,011 | 6,644  | 6,013  | 5,637   | 0       |
|                     | 0,6            | 7,305                                      | 8,440 | 8,798  | 8,098  | 7,068   | 0       |
| 10-0<br>G1<br>unten | 0,3            | 7,265                                      | 7,802 | 9,107  | 9,085  | 9,105   | 9,135   |
|                     | 0,4            | 6,887                                      | 8,089 | 9,127  | 9,682  | 9,682   | 9,041   |
|                     | 0,5            | 6,716                                      | 8,097 | 9,945  | 9,847  | 9,056   | -       |
|                     | 0,6            | 7,174                                      | 8,196 | 9,041  | 8,700  | 8,208   | -       |
| 10-0<br>G1<br>mitte | 0,3            | 6,495                                      | 8,110 | 8,585  | 9,564  | 9,980   | -       |
|                     | 0,4            | 8,460                                      | 8,907 | 9,654  | 10,436 | 10,605  | -       |
|                     | 0,5            | 6,905                                      | 7,162 | 8,605  | 10,546 | 10,776  | -       |
|                     | 0,6            | 7,396                                      | 8,778 | 11,068 | 11,311 | 11,138  | 0       |
| 10-0<br>G1<br>oben  | 0,3            | 6,743                                      | 8,863 | 9,536  | 10,235 | 10,250  | 0       |
|                     | 0,4            | 6,888                                      | 9,633 | 10,401 | 10,618 | 10,565  | -       |
|                     | 0,5            | 8,203                                      | 9,019 | 10,024 | 10,300 | 10,085  | -       |
|                     | 0,6            | 8,774                                      |       | 10,544 | 10,062 | 0       | 0       |

Anhang 4: 3-Punkt-Biegeprüfung, bewehrende Funktion

| Variante                 | Last-amplitude | Dynamischer Modul MD nach Lastzyklus [MPa] |       |        |        |         |         |
|--------------------------|----------------|--|-------|--------|--------|---------|---------|
|                          |                | 100  | 1.000 | 10.000 | 50.000 | 100.000 | 200.000 |
|                          | kN             |  |       |        |        |         |         |
| 10-3<br>AC8+G1<br>unten  | 0,3            |  |       |        |        |         |         |
|                          | 0,4            | 6,986                                      | 7,590 | 7,922  | 8,222  | 7,887   | 7,285   |
|                          | 0,5            | 7,961                                      | 8,585 | 8,716  | 4,634  | 0       | 0       |
|                          | 0,6            | 7,061                                      | 7,703 | 6,427  | 0      | 0       | 0       |
| 10-3<br>AC8+G1<br>mitte  | 0,3            |  |       |        |        |         |         |
|                          | 0,4            | 6,994                                      | 7,839 | 8,410  | 8,682  | 8,069   | 4,498   |
|                          | 0,5            | 7,393                                      | 8,189 | 8,565  | 7,711  | 0       | 0       |
|                          | 0,6            | 8,161                                      | 8,521 | 8,545  | 0      | 0       | 0       |
| 10-3<br>AC8+G1<br>oben   | 0,3            |  |       |        |        |         |         |
|                          | 0,4            | 7,688                                      | 8,269 | 8,917  | 8,831  | 8,540   | 6,890   |
|                          | 0,5            | 8,026                                      | 8,455 | 8,877  | 8,437  | 0       | 0       |
|                          | 0,6            | 8,322                                      | 8,881 | 8,922  | 0      | 0       | 0       |
| 10-4<br>SMA8+G1<br>unten | 0,3            |  |       |        |        |         |         |
|                          | 0,4            | 5,742                                      | 6,583 | 6,862  | 6,595  | 5,963   | 4,939   |
|                          | 0,5            | 5,919                                      | 6,511 | 6,308  | 5,284  | 4,727   | 4,195   |
|                          | 0,6            | 6,471                                      | 7,532 | 7,573  | 0      | 0       | 0       |
| 10-4<br>SMA8+G1<br>mitte | 0,3            |  |       |        |        |         |         |
|                          | 0,4            | 5,880                                      | 7,177 | 7,502  | 7,401  | 7,253   | 6,387   |
|                          | 0,5            | 6,719                                      | 6,997 | 7,503  | 2,777  | 0       | 0       |
|                          | 0,6            | 7,498                                      | 7,563 | 7,846  | 6,759  | 0       | 0       |
| 10-4<br>SMA8+G1<br>oben  | 0,3            |  |       |        |        |         |         |
|                          | 0,4            | 6,669                                      | 6,921 | 7,409  | 7,268  | 6,743   | 0       |
|                          | 0,5            | 7,472                                      | 7,552 | 7,896  | 7,507  | 0,719   | 0       |
|                          | 0,6            | 7,484                                      | 7,762 | 8,046  | 6,983  | 0       | 0       |
| 11-0<br>G2<br>unten      | 0,4            | 5,294                                      | 5,722 | 8,101  | 8,997  | 9,016   | -       |
|                          | 0,5            | 6,471                                      | 8,207 | 9,174  | 8,823  | 8,179   | -       |
|                          | 0,6            | 7,151                                      | 8,046 | 8,280  | 6,946  | 6,156   | -       |
|                          | 0,6            | 7,398                                      | 9,051 | 8,596  | 7,748  | 7,152   | 6,110   |

Anhang 4: 3-Punkt-Biegeprüfung, bewehrende Funktion

| Variante                 | Last-amplitude<br>kN | Dynamischer Modul MD nach Lastzyklus [MPa] |       |        |        |         |         |
|--------------------------|----------------------|--|-------|--------|--------|---------|---------|
|                          |                      | 100  | 1.000 | 10.000 | 50.000 | 100.000 | 200.000 |
| 11-0<br>G2<br>mitte      | 0,3                  |  |       |        |        |         |         |
|                          | 0,4                  | 5,100                                      | 5,599 | 6,549  | 7,034  | 7,242   | -       |
|                          | 0,5                  | 3,263                                      | 5,641 | 6,836  | 7,333  | 7,449   | -       |
|                          | 0,6                  | 3,987                                      | 5,995 | 7,180  | 7,849  | 7,903   | -       |
| 11-0<br>G2<br>oben       | 0,4                  | 5,337                                      | 6,494 | 8,580  | 9,155  | 8,905   | -       |
|                          | 0,5                  | 8,093                                      | 8,467 | 9,952  | 9,864  | 9,119   | -       |
|                          | 0,6                  | 7,380                                      | 8,563 | 9,661  | 8,465  | 0       | 0       |
|                          | 0,6                  | 8,867                                      | 9,553 | 10,015 | 8,759  | 0       | 0       |
| 11-3<br>AC8+G2<br>unten  | 0,3                  |  |       |        |        |         |         |
|                          | 0,4                  | 6,363                                      | 7,406 | 8,171  | 7,505  | 5,365   | 4,156   |
|                          | 0,5                  | 6,469                                      | 6,973 | 7,764  | 7,685  | 6,760   | 4,209   |
|                          | 0,6                  | 6,280                                      | 7,215 | 6,280  | 0      | 0       | 0       |
| 11-3<br>AC8+G2<br>mitte  | 0,3                  |  |       |        |        |         |         |
|                          | 0,4                  | 7,074                                      | 7,688 | 7,890  | 7,385  | 6,707   | 0       |
|                          | 0,5                  | 6,868                                      | 7,640 | 8,018  | 7,361  | 0       | 0       |
|                          | 0,6                  | 7,773                                      | 8,293 | 8,652  | 0      | 0       | 0       |
| 11-3<br>AC8+G2<br>oben   | 0,3                  |  |       |        |        |         |         |
|                          | 0,4                  | 5,785                                      | 7,391 | 8,132  | 7,682  | 5,563   | 0       |
|                          | 0,5                  | 7,704                                      | 7,914 | 8,126  | 0      | 0       | 0       |
|                          | 0,6                  | 7,758                                      | 8,154 | 7,873  | 0      | 0       | 0       |
| 11-4<br>SMA8+G2<br>unten | 0,3                  |  |       |        |        |         |         |
|                          | 0,4                  | 6,329                                      | 6,608 | 6,845  | 6,509  | 5,868   | 4,890   |
|                          | 0,5                  | 5,812                                      | 6,387 | 6,443  | 4,390  | 0       | 0       |
|                          | 0,6                  | 6,314                                      | 7,016 | 6,469  | 0      | 0       | 0       |
| 11-4<br>SMA8+G2<br>mitte | 0,3                  |  |       |        |        |         |         |
|                          | 0,4                  | 6,781                                      | 6,895 | 7,501  | 7,311  | 6,152   | 0       |
|                          | 0,5                  | 6,628                                      | 7,070 | 7,118  | 2,421  | 0       | 0       |
|                          | 0,6                  | 6,479                                      | 6,848 | 6,859  | 0      | 0       | 0       |

Anhang 4: 3-Punkt-Biegeprüfung, bewehrende Funktion

| Variante                | Last-amplitude<br>kN | Dynamischer Modul MD nach Lastzyklus [MPa] |       |        |        |         |         |
|-------------------------|----------------------|--|-------|--------|--------|---------|---------|
|                         |                      | 100  | 1.000 | 10.000 | 50.000 | 100.000 | 200.000 |
| 11-4<br>SMA8+G2<br>oben | 0,3                  |  |       |        |        |         |         |
|                         | 0,4                  | 5,875                                      | 7,296 | 7,771  | 7,214  | 0       | 0       |
|                         | 0,5                  | 6,111                                      | 7,147 | 7,323  | 0      | 0       | 0       |
|                         | 0,6                  | 6,556                                      | 7,276 | 6,462  | 0      | 0       | 0       |
| 12-0<br>G3<br>unten     | 0,4                  | 6,928                                      | 7,251 | 7,969  | 8,042  | 7,862   | 7,385   |
|                         | 0,4                  | 7,033                                      | 7,332 | -      | -      | -       | -       |
|                         | 0,5                  | 5,094                                      | 5,783 | 6,809  | 6,256  | 5,867   | -       |
|                         | 0,6                  | 6,8585                                     | 9,006 | 9,269  | 8,308  | 6,815   | 5,577   |
| 13-0<br>G4<br>unten     | 0,3                  | 7,368                                      | 7,460 | 8,129  | 8,792  | 8,864   | 8,894   |
|                         | 0,4                  | 7,678                                      | 8,431 | 8,544  | 7,862  | 7,242   | -       |
|                         | 0,5                  | 5,744                                      | 7,011 | 7,718  | 7,697  | 7,417   | -       |
|                         | 0,6                  | 8,542                                      | 8,873 | 8,917  | 7,607  | 6,849   | 0       |
| 14-0<br>G5<br>unten     | 0,3                  | 3,547                                      | 4,764 | 6,222  | 9,088  | 9,810   | 9,926   |
|                         | 0,4                  | 7,678                                      | 7,418 | 8,544  | 7,862  | 7,242   | -       |
|                         | 0,5                  | 5,744                                      | 8,057 | 7,718  | 7,697  | 7,417   | -       |
|                         | 0,6                  | 8,542                                      | 9,265 | 8,917  | 7,607  | 6,849   | 0       |
| 15-0<br>G6<br>unten     | 0,3                  | 8,043                                      | 8,617 | 9,496  | 10,128 | 10,053  | 9,900   |
|                         | 0,4                  | 7,516                                      | 8,417 | 9,615  | 9,261  | 9,011   | -       |
|                         | 0,5                  | 7,175                                      | 7,869 | 9,262  | 8,291  | 7,030   | -       |
|                         | 0,6                  | 6,909                                      | 7,993 | 8,562  | 6,846  | 5,886   | 0       |



Anhang 4: Verifikation, Schersteifigkeiten, statischer Scherversuch, weggeregelt

| Variante  | Beschaffenheit                              | Dehnrage | Schermodul 1 bei Dehnung 0,0002 | Schermodul 2 bei Dehnung 0,0002 | Schermodul, MW |
|---|---|----------|---------------------------------|---------------------------------|----------------|
| -   | -   | mm/min   | MPa                             | MPa                             | MPa            |
| <b>Strecke 1</b><br><b>B70</b><br><b>Südlohn –</b><br><b>Vreden</b> | 1<br>Ohne Einlage,<br>unbelastet            | 0,1      | 4,52                            | 4,24                            | 4,38           |
|   |   | 0,2      | 5,38                            | 4,25                            | 4,81           |
|   |   | 0,3      | 4,53                            | 4,56                            | 4,55           |
|   | 2<br>Mit Einlage,<br>unbelastet<br>(intakt) | 0,1      | 4,23                            | 9,05                            | 6,64           |
|   |   | 0,2      | 6,83                            | 15,06                           | 10,94          |
|   |   | 0,3      | 11,09                           | 14,72                           | 12,91          |
|   | 3<br>Mit Einlage,<br>belastet<br>(Schäden)  | 0,1      | 4,24                            | 14,71                           | 9,48           |
|   |   | 0,2      | 4,54                            | 16,49                           | 10,51          |
|   |   | 0,3      | 4,54                            | 38,20                           | 21,37          |

| Variante  | Beschaffenheit                                    | Dehnrage | Schermodul 1 bei Dehnung 0,0002 | Schermodul 2 bei Dehnung 0,0002 | Schermodul 3 bei Dehnung 0,0002 | Schermodul 4 bei Dehnung 0,0002 | Schermodul, MW |
|---|---|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|----------------|
| -   | -   | mm/min   | MPa                             | MPa                             | MPa                             | MPa                             | MPa            |
| <b>Strecke 2</b><br><b>Fulda</b><br><b>Decke</b><br><b>auf</b><br><b>Binder</b> | Ohne Einlage,<br>unbelastet<br>(intakt)           | 0,1      | 17,81                           | 11,86                           | 6,50                            | 10,47                           | 11,66          |
|   |   | 0,2      | 28,93                           | 11,06                           | 5,68                            | 10,50                           | 14,04          |
|   |   | 0,3      | 27,83                           | 7,69                            | 6,52                            | 7,64                            | 12,42          |
|   | Mit Einlage,<br>unbelastet<br>(intakt)            | 0,1      | 4,24                            | 5,66                            | 4,52                            | 4,81                            | 4,81           |
|   |   | 0,2      | 4,53                            | 5,11                            | 5,69                            | 5,10                            | 5,11           |
|   |   | 0,3      | 5,38                            | 4,85                            | 5,96                            | 5,95                            | 5,53           |
|   | Mit Einlage,<br>belastet<br>(Schäden)             | 0,1      | 5,93                            | 4,81                            | 4,80                            | 4,52                            | 5,02           |
|   |   | 0,2      | 5,39                            | 7,10                            | 5,97                            | 4,55                            | 5,75           |
|   |   | 0,3      | 5,95                            | 8,83                            | 5,96                            | 4,27                            | 6,25           |
|   | Mit Einlage,<br>geschädigt<br>(Risse in<br>Decke) | 0,1      | 5,93                            | 4,81                            | 4,52                            | 4,52                            | 4,94           |
|   |   | 0,2      | 9,94                            | 7,09                            | 5,39                            | 4,83                            | 6,81           |
|   |   | 0,3      | 11,67                           | 5,68                            | 4,26                            | 4,56                            | 6,54           |

Anhang 4: Verifikation, Abscherversuche

| Variante  | Beschaffenheit                              | Kraft 1 | Kraft 2 | Kraft Mittelwert | Weg 1 | Weg 2 | Weg Mittelwert |
|---|---|---------|---------|------------------|-------|-------|----------------|
| -   | -   | [kN]    | [kN]    | [kN]             | mm    | [mm]  | [mm]           |
| <b>Strecke 1</b><br><b>B70</b><br><b>Südlohn –</b><br><b>Vreden</b> | 1<br>Ohne Einlage,<br>unbelastet            | 33,75   | 27,65   | 30,70            | 2,98  | 3,19  | 3,09           |
|   | 2<br>Mit Einlage,<br>unbelastet<br>(intakt) | 31,32   | 46,87   | 39,10            | 4,08  | 2,87  | 3,48           |
|   | 3<br>Mit Einlage,<br>belastet<br>(Schäden)  | 29,10   | 26,42   | 27,76            | 2,05  | 2,08  | 2,07           |

| Variante  | Beschaffenheit                                      | Kraft 1 | Kraft 2 | Kraft 3 | Kraft 4 | Kraft Mittelwert |
|---|---|---------|---------|---------|---------|------------------|
| -   | -   | [kN]    | [kN]    | [kN]    | [kN]    | [kN]             |
| <b>Strecke 2</b><br><b>Fulda</b><br><b>Decke auf</b><br><b>Binder</b> | 1<br>Ohne Einlage,<br>unbelastet                    | 45,17   | 50,43   | 50,36   | 47,59   | <b>48,39</b>     |
|   | 2<br>Mit Einlage,<br>unbelastet<br>(intakt)         | 32,75   | 22,92   | 22,69   | 22,31   | <b>25,17</b>     |
|   | 3<br>Mit Einlage,<br>belastet<br>(Schäden)          | 23,77   | 26,94   | 25,31   | 22,08   | <b>24,53</b>     |
|   | 4<br>Mit Einlage,<br>geschädigt<br>(Risse in Decke) | 15,38   | 14,24   | 17,17   | 15,62   | <b>15,60</b>     |

| Variante  | Beschaffenheit                                      | Weg 1 | Weg 2 | Weg 3 | Weg 4 | Kraft Mittelwert |
|---|---|-------|-------|-------|-------|------------------|
| -   | -   | [mm]  | [mm]  | [kN]  | mm    | [mm]             |
| <b>Strecke 3</b><br><b>Fulda</b><br><b>Decke auf</b><br><b>Binder</b> | 1<br>Ohne Einlage,<br>unbelastet                    | 2,88  | 1,41  | 2,06  | 1,68  | 2,01             |
|   | 2<br>Mit Einlage,<br>unbelastet<br>(intakt)         | 2,15  | 2,38  | 2,22  | 2,01  | 2,19             |
|   | 3<br>Mit Einlage,<br>belastet<br>(Schäden)          | 1,99  | 1,92  | 2,93  | 1,89  | 2,18             |
|   | 4<br>Mit Einlage,<br>geschädigt<br>(Risse in Decke) | 3,05  | 3,47  | /     | 3,44  | 3,32             |

Anhang 4: Verifikation, 3-Punkt-Biegeprüfung, rissüberbrückende Funktion, Strecke 1

| Variante   | Wöhler-Linie   |           | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|--|--|-----------|----------------|----------------------|--------------------|-------------|
| -  | Parameter N <sub>Makro</sub>   |           | [kN]           | [MPa]                | -                  | -           |
| <b>Strecke 1<br/>mit<br/>Einlage<br/>belastet</b>    | Parameter C <sub>1</sub>   | 11.494,29 | 0,3            |                      | >250.000           | 7,8433      |
|  | Parameter C <sub>2</sub>   | -3,6510   | 0,3            |                      | >250.000           | 7,7480      |
|  | Bestimmtheitsmaß   | 88,3      | 0,4            |                      | 190.720            | 5,8220      |
|  | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup>                                |           | 0,4            |                      | 500.000*           | 7,1706      |
|  |  |           | 0,5            |                      | 192.580            | 5,7961      |
|  |  |           | 0,5            |                      | 105.680            | 5,4207      |
|  |  |           | 0,6            |                      | 71.900             | 5,4563      |
| 0,6  |  | 81.580    | 5,6452         |                      |                    |             |
| <b>Strecke 1<br/>mit<br/>Einlage<br/>unbelastet</b>  | Parameter C <sub>1</sub>   | 15.355,48 | 0,3            |                      | >250.000           | 7,1248      |
|  | Parameter C <sub>2</sub>   | -4,5653   | 0,3            |                      | >250.000           | 8,0252      |
|  | Bestimmtheitsmaß   | 99,9      | 0,4            |                      | >250.000           | 8,5158      |
|  | Regression über Mittelwerte<br>N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |           | 0,4            |                      | >250.000           | 7,9024      |
|  |  |           | 0,5            |                      | 500.000*           | 8,4324      |
|  |  |           | 0,5            |                      | 238.220            | 5,8708      |
|  |  |           | 0,6            |                      | 13.660             | 6,9123      |
| 0,6  |  | 300.000*  | 6,6490         |                      |                    |             |
| <b>Strecke 1<br/>ohne<br/>Einlage<br/>unbelastet</b> | Parameter C <sub>1</sub>   | 2.005,19  | 0,3            |                      | >250.000           | 6,7955      |
|  | Parameter C <sub>2</sub>   | -4,6096   | 0,3            |                      | 500.000*           | 6,6724      |
|  | Bestimmtheitsmaß   | 81,9      | 0,4            |                      | 101.040            | 5,0138      |
|  | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup>                                |           | 0,4            |                      | 132.620            | 5,2693      |
|  |  |           | 0,5            |                      | 88.540             | 5,9798      |
|  |  |           | 0,5            |                      | 64.300             | 5,5798      |
|  |  |           | 0,6            |                      | 7.770              | 5,6417      |
| 0,6  |  | 34.900    | 4,9661         |                      |                    |             |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: Verifikation, 3-Punkt-Biegeprüfung, rissüberbrückende Funktion, Strecke 2

| Variante  | Wöhler-Linie  |        | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|---|---|--------|----------------|----------------------|--------------------|-------------|
|   | Parameter N <sub>Makro</sub>  |        | [kN]           | [MPa]                | -                  | -           |
| Strecke 2<br><br>ohne Einlage<br><br>unbelastet | Parameter C <sub>1</sub>  | 1868,7 | 0,3            | 2,195                | 40.900             | 4,1710      |
|   | Parameter C <sub>2</sub>  | -2,548 | 0,35           | -                    | 22.480             | 4,1074      |
|   | Bestimmtheitsmaß  | 65,2   | 0,4            | -                    | 35.160             | 5,1658      |
|   | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup>   |        | 0,45           | -                    | 6.425              | 6,425       |
|   |   |        | 0,45           | -                    | 16.920             | 5,4380      |
|   |   |        | 0,5            | -                    | 12.660             | 5,0936      |
|   |   |        | 0,55           | -                    | (1.975)            | (4,6124)    |
| 0,6   | -   | 7.245  | 5,7843         |                      |                    |             |
| Strecke 2<br><br>mit Einlage<br><br>unbelastet  | Parameter C <sub>1</sub>  | 227,42 | 0,2            | 5,352                | >250.000           | 5,2938      |
|   | Parameter C <sub>2</sub>  | -4,714 | 0,25           | 7,245                | >250.000           | 7,0450      |
|   | Bestimmtheitsmaß  | 81,5   | 0,25           | 5,306                | 260.000*           | 5,0625      |
|   | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup>   |        | 0,3            | -                    | 14.400             | 2,4594      |
|   |   |        | 0,4            | -                    | 7.605              | 1,7967      |
|   |   |        | 0,4            | -                    | (2.590)            | (2,1630)    |
|   |   |        | 0,5            | -                    | 8.345              | 2,7556      |
| 0,6   | -   | 5.045  | 4,6374         |                      |                    |             |
| Strecke 2<br><br>mit Einlage<br><br>belastet    | Parameter C <sub>1</sub>  | 753,9  | 0,3            | -                    | 18.220             | 4,4322      |
|   | Parameter C <sub>2</sub>  | -3,563 | 0,35           | 5,122                | 120.740            | 2,5527      |
|   | Bestimmtheitsmaß  | 33,3   | 0,35           | -                    | 17.880             | 4,7080      |
|   | Werte sind abhängig vom Bohrkern<br>Mittelwerte für Regression<br>N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |        | 0,4            | 5,149                | 88.000             | 3,0054      |
|   |   |        | 0,45           | -                    | 6.300              | 1,3016      |
|   |   |        | 0,5            | -                    | 17.040             | 3,7633      |
|   |   |        | 0,55           | -                    | 990                | 4,5044      |
| 0,6   | -   | 10.140 | 4,7548         |                      |                    |             |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: Verifikation, 3-Punkt-Biegeprüfung, rissüberbrückende Funktion, Strecke 2

| Variante                                    | Wöhler-Linie                   |        | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|---|--------------------------------|--------|----------------|----------------------|--------------------|-------------|
| -   | Parameter N <sub>Makro</sub>   |        | [kN]           | [MPa]                | -                  | -           |
| Strecke 2<br><br>mit<br>Einlage<br><br>Riss | Parameter C <sub>1</sub>       | 2,9087 | 0,15           | 4,603                | >250.000           | 4,7695      |
|   | Parameter C <sub>2</sub>       | -6,644 | 0,2            | 1,049                | 110.960            | 0,3583      |
|   | Bestimmtheitsmaß               | 97,1   | 0,2            | 2,595-               | 162.080            | 1,0522      |
|   | $N_{Makro} = C_1 * Last^{C_2}$ |        | 0,25           | -                    | 15.260             | 0,3200      |
|   |                                |        | 0,25           | -                    | 29740              | 0,6755      |
|   |                                |        | 0,3            | -                    | 7.660              | 0,4433      |
|   |                                |        | 0,3            | -                    | 12640              | 1,4589      |
|   |                                |        | 0,35           | -                    | 37575              | 0,2303      |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: Verifikation, 3-Punkt-Biegeprüfung, rissüberbrückende Funktion, Strecke 3

| Variante           | Wöhler-Linie  |        | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|--------------------|---|--------|----------------|----------------------|--------------------|-------------|
|                    | Parameter N <sub>Makro</sub>  |        | [kN]           | [MPa]                | -                  | -           |
| Strecke 3<br><br>2 | Parameter C <sub>1</sub>  | 894,5  | 0,4            | -                    | 24.580             | 5,0419      |
|                    | Parameter C <sub>2</sub>  | -4,229 | 0,4            | 5,395                | 80.100             | 4,4681      |
|                    | Bestimmtheitsmaß  | 71,3   | 0,45           | -                    | 17.080             | 4,0271      |
|                    | Werte streuen sehr stark<br><br>N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |        | 0,5            | 4,902                | (75.080)           | 4,0180      |
|                    |   |        | 0,5            | -                    | 29.020             | 4,8206      |
|                    |   |        | 0,55           | 5,182                | (91.020)           | 3,6751      |
|                    |   |        | 0,6            | -                    | 8.150              | 3,5854      |
|                    |   |        | 0,6            | -                    | 6.190              | 2,9594      |
| Strecke 3<br><br>6 | Parameter C <sub>1</sub>  | 764,3  | 0,4            | 5,579                | 350.000*           | 4,9150      |
|                    | Parameter C <sub>2</sub>  | -7,238 | 0,45           | 6,405                | 300.000*           | 5,5553      |
|                    | Bestimmtheitsmaß  | 91,5   | 0,5            | 5,103                | 138.500            | 2,8743      |
|                    | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup>                                 |        | 0,5            | 6,334                | 156.880            | 3,6294      |
|                    |   |        | 0,55           | 5,311                | 90.420             | (0,8669)    |
|                    |   |        | 0,55           | 3,947                | 57.900             | 2,9741      |
|                    |   |        | 0,6            | -                    | 21.420             | 3,0766      |
|                    |   |        | 0,65           | -                    | 13.300             | 3,6485      |
| Strecke 3<br><br>7 | Parameter C <sub>1</sub>  | 2704,3 | 0,4            | 7,344                | >250.000           | 6,9211      |
|                    | Parameter C <sub>2</sub>  | -5,937 | 0,45           | 6,546                | 197.920            | 5,0521      |
|                    | Bestimmtheitsmaß  | 78,0   | 0,5            | 7,011                | 187.660            | 5,7108      |
|                    | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup>                                 |        | 0,55           | -                    | 37.480             | 4,6928      |
|                    |   |        | 0,55           | 6,551                | 103.660            | 4,5863      |
|                    |   |        | 0,6            | 6,768                | 111.000            | 5,1536      |
|                    |   |        | 0,6            | 4,475                | 46.480             | 4,6914      |
|                    |   |        | 0,65           | -                    | 41.720             | 4,4940      |

\* Anhand der Kurvenverläufe geschätzte Werte

Anhang 4: Verifikation, 3-Punkt-Biegeprüfung, rissüberbrückende Funktion, Strecke 3

| Variante                         | Wöhler-Linie  |        | Last-amplitude | MD <sub>50.000</sub> | N <sub>Makro</sub> | Steigung ER |
|----------------------------------|---|--------|----------------|----------------------|--------------------|-------------|
| -                                | Parameter N <sub>Makro</sub>  |        | [kN]           | [MPa]                | -                  | -           |
| <b>Strecke 3</b><br><br><b>9</b> | Parameter C <sub>1</sub>  | 378,5  | 0,4            | 6,060                | 350.000*           | 5,3771      |
|                                  | Parameter C <sub>2</sub>  | -6,505 | 0,4            | 5,042                | 94.700             | 3,3341      |
|                                  | Bestimmtheitsmaß  | 73,9   | 0,45           | -                    | 25.620             | 2,3984      |
|                                  | N <sub>Makro</sub> = C <sub>1</sub> * Last <sup>C<sub>2</sub></sup> |        | 0,5            | 3,547                | 51.340             | 3,1344      |
|                                  |   |        | 0,5            | 6,286                | (216.020)          | 5,0275      |
|                                  |   |        | 0,55           | -                    | 29.560             | 3,4793      |
|                                  |   |        | 0,55           | -                    | 17.020             | 2,5224      |
|                                  |   |        | 0,6            | -                    | 8.260              | 2,6608      |

\* Anhand der Kurvenverläufe geschätzte Werte

## Anhang 4 Prüfergebnisse Sensitivitätsanalyse

### zu 6.5.1 Keilspaltversuche

#### Versuchsergebnisse tabellarisch

| Versuch  | KS Einlagenwirkung WSV/4, weggeregelt |  |  |
|----------|---------------------------------------|--|--|
| Ergebnis | Maximale Spaltkraft: $F_{\max}$ [N]   | Spaltkraft bei Rissöffnung 1,5 mm: $F_{1,5}$ [N] | Spezifische Bruchenergie : $G_{f2,0}$ [Nmm/cm <sup>2</sup> ] |
| T        | 0 °C                                  |  |  |
| 0-0      | 5018                                  | 222  | 28   |
| 0-1      | 5112                                  | 201  | 28   |
| 0-1b     | x                                     | x  | x  |
| 0-2      | 4963                                  | 261  | 29   |
| 0-2b     | x                                     | x  | x  |
| 0-3      | 4861                                  | 405  | 36   |
| 0-4      | 5257                                  | 735  | 55   |
| 0-5      | 5013                                  | 357  | 34   |
| 0-5b     | 5203                                  | 280  | 32   |
| 1-0      | 5329                                  | 1065   | 56   |
| 1-1      | 5333                                  | 1257   | 70   |
| 1-2      | 5138                                  | 986  | 52   |
| 1-3      | 4880                                  | 1065   | 56   |
| 1-4      | 5117                                  | 1256   | 70   |
| 1-5      | 5324                                  | 1034   | 56   |
| 1-6      | 5178                                  | 1096   | 58   |
| 1-7      | 5533                                  | 1098   | 62   |
| 1-8      | 5409                                  | 1061   | 59   |
| 2-0      | 5282                                  | 1586   | 75   |
| 2-1      | 5362                                  | 1641   | 77   |
| 2-2      | 5409                                  | 1765   | 80   |
| 2-3      | 4602                                  | 1375   | 63   |
| 2-4      | 4870                                  | 1560   | 77   |
| 2-5      | 5173                                  | 1335   | 66   |
| 2-6      | 4675                                  | 1327   | 64   |
| 2-7      | 5110                                  | 2433   | 98   |
| 2-8      | 5174                                  | 1477   | 67   |

| Versuch  | KS Einlagenwirkung WSV/4, weggeregelt |  |  |
|----------|---------------------------------------|--|--|
| Ergebnis | Maximale Spaltkraft: $F_{\max}$ [N]   | Spaltkraft bei Rissöffnung 1,5 mm: $F_{1,5}$ [N] | Spezifische Bruchenergie : $G_{f2,0}$ [Nmm/cm <sup>2</sup> ] |
| T        | 0 °C                                  |  |  |
| 3-0      | 5677                                  | 4397   | 154  |
| 3-1      | 5941                                  | 3611   | 133  |
| 3-2      | 5724                                  | 4160   | 148  |
| 3-3      | 5328                                  | 3142   | 117  |
| 3-4      | 5517                                  | 3695   | 141  |
| 3-5      | 5780                                  | 3486   | 129  |
| 3-6      | 5335                                  | 1932   | 85   |
| 3-7      | 5635                                  | 4537   | 160  |
| 3-8      | 5669                                  | 3414   | 127  |
| 4-0      | 5328                                  | 2119   | 91   |
| 5-0      | 4929                                  | 1675   | 77   |
| 6-0      | 5541                                  | 3754   | 139  |
| 7-0      | 5231                                  | 2327   | 92   |
| 8-0      | 5398                                  | 1819   | 80   |
| 9-0      | 4988                                  | 1757   | 76   |
| 10-0     | 5243                                  | 1675   | 72   |
| 10-1     | 5539                                  | 1960   | 86   |
| 10-2     | 5390                                  | 1749   | 76   |
| 10-3     | 4664                                  | 1556   | 66   |
| 10-4     | 5581                                  | 1749   | 84   |
| 10-5     | 5490                                  | 1668   | 76   |
| 10-6     | 5669                                  | 1830   | 84   |
| 10-7     | 5673                                  | 2868   | 111  |
| 10-8     | 5179                                  | 1768   | 76   |
| 11-0     | 5434                                  | 1668   | 78   |
| 11-1     | 5507                                  | 1991   | 87   |
| 11-2     | 5636                                  | 1658   | 80   |
| 11-3     | 5035                                  | 1836   | 82   |
| 11-4     | 5489                                  | 1953   | 93   |
| 11-5     | 5501                                  | 1703   | 80   |
| 11-6     | 5615                                  | 1855   | 88   |
| 11-7     | 5893                                  | 3170   | 128  |
| 11-8     | 5737                                  | 1896   | 92   |
| 12-0     | 5609                                  | 1218   | 65   |
| 13-0     | 5695                                  | 1845   | 82   |
| 14-0     | 5712                                  | 909  | 57   |
| 15-0     | 5682                                  | 1176   | 68   |

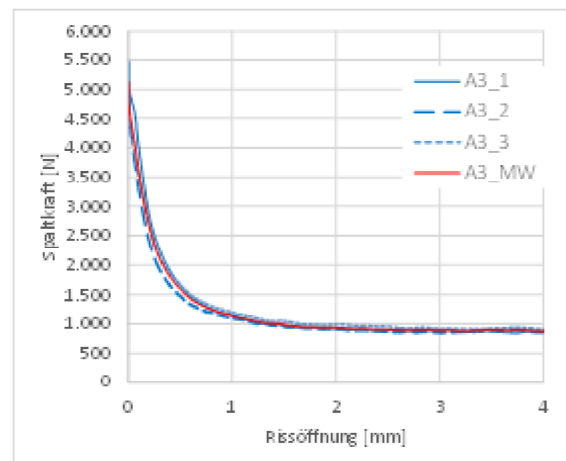
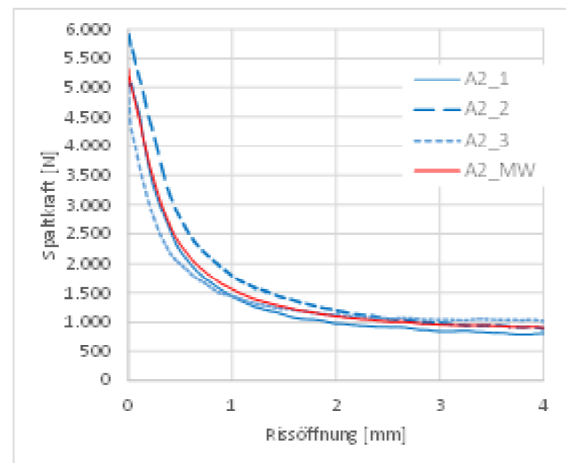
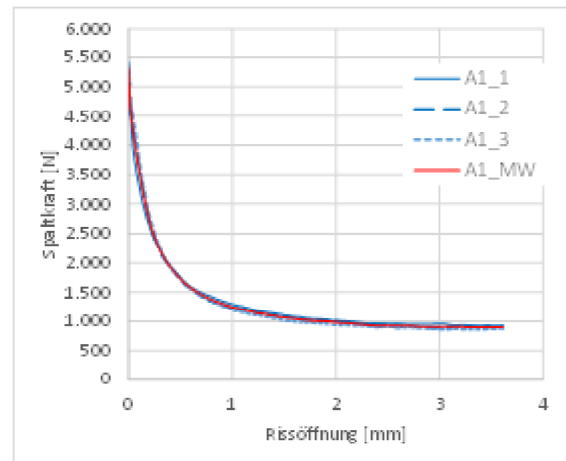


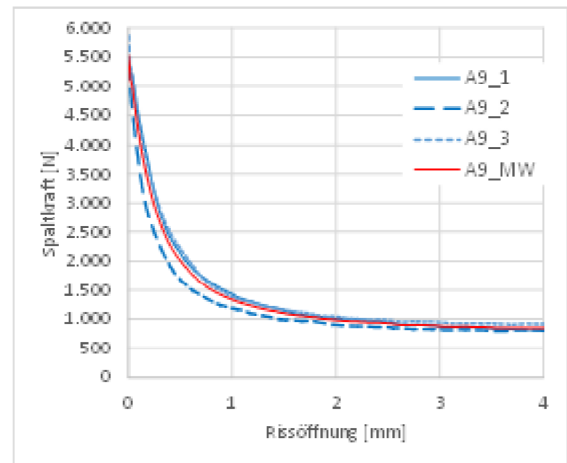
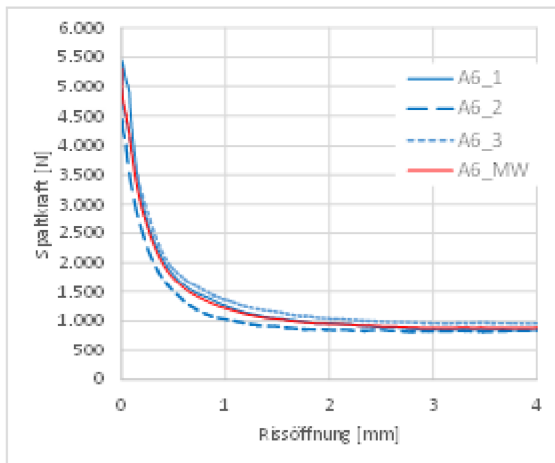
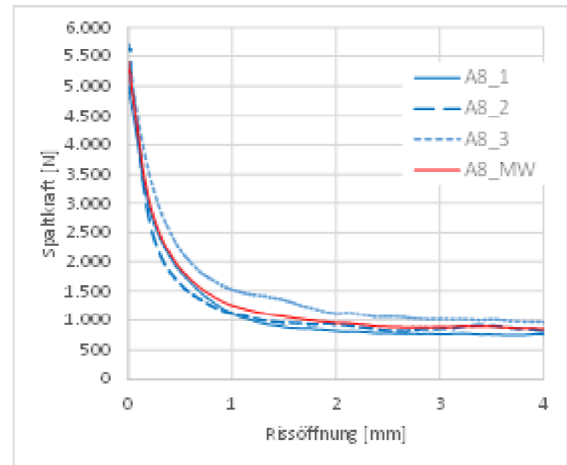
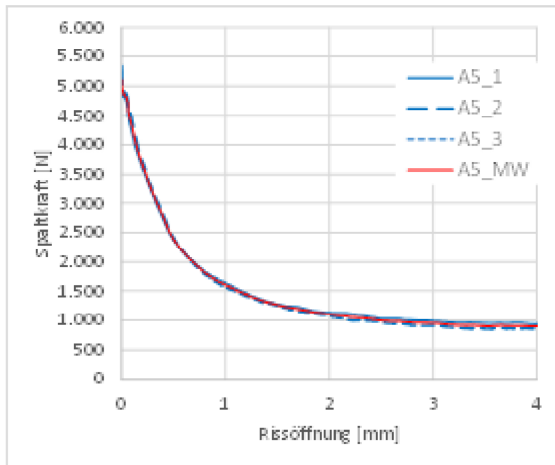
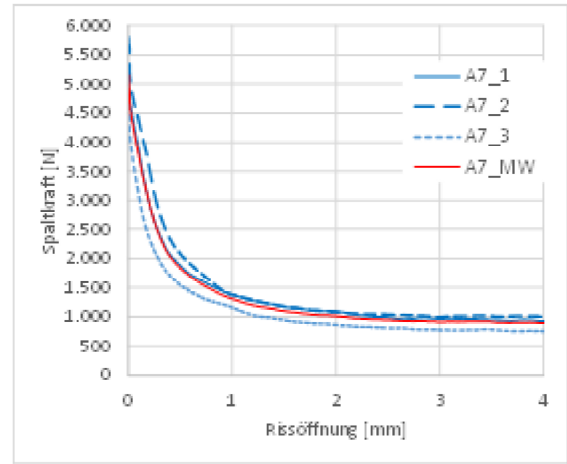
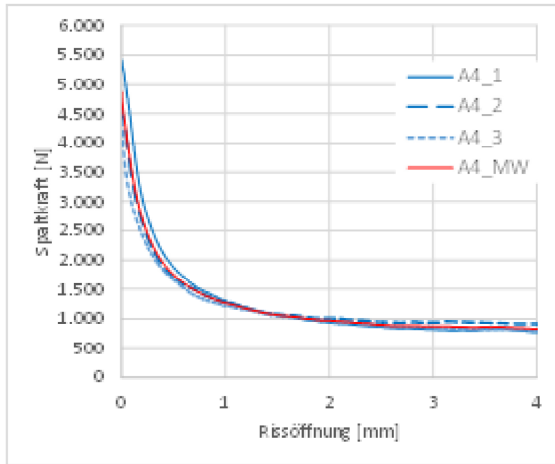
## Versuchsergebnisse Kurvenverläufe

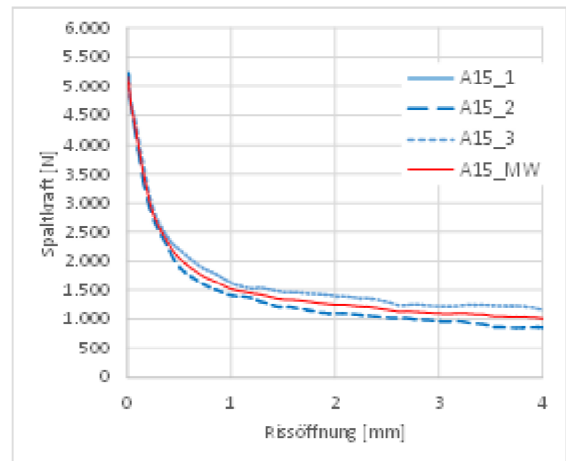
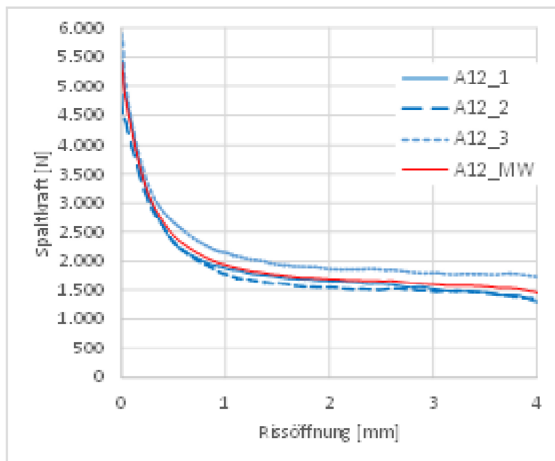
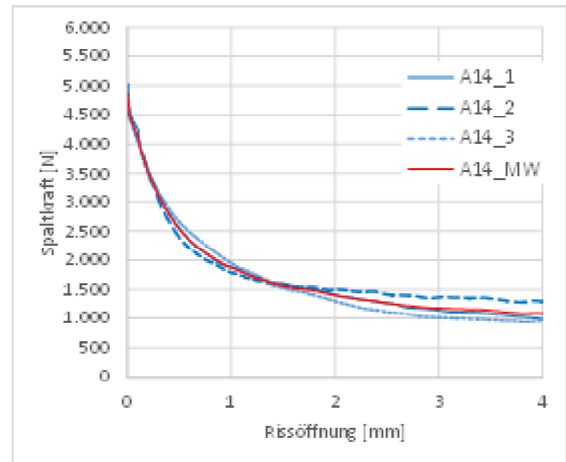
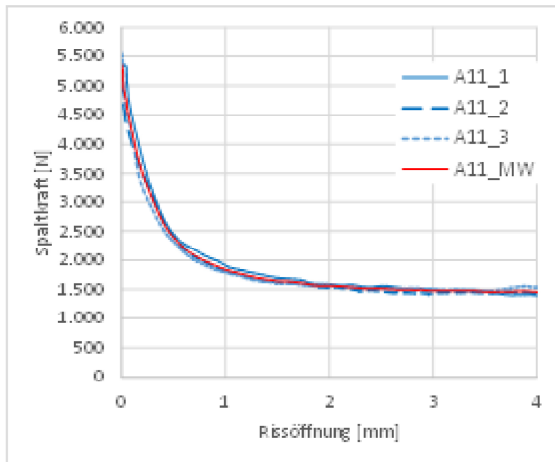
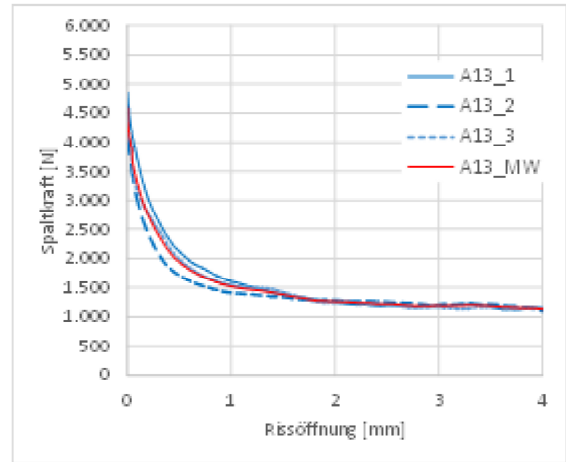
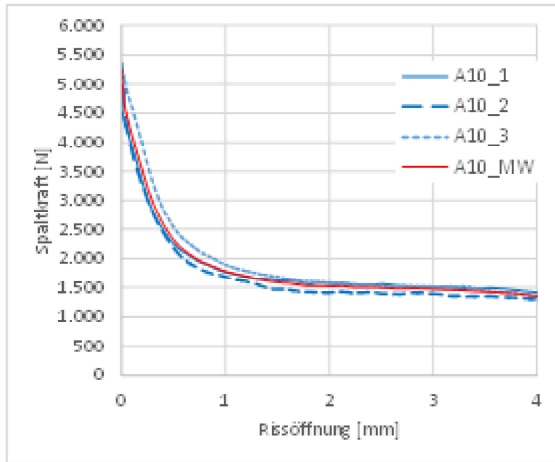
Bezeichnungshinweis für nachfolgende  
Auswertung der Kurvenverläufe Spaltkraft zu  
Rissöffnung ab Spaltkraftmaximum

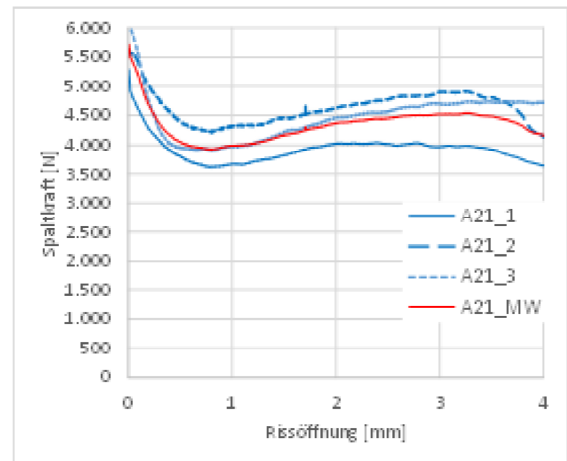
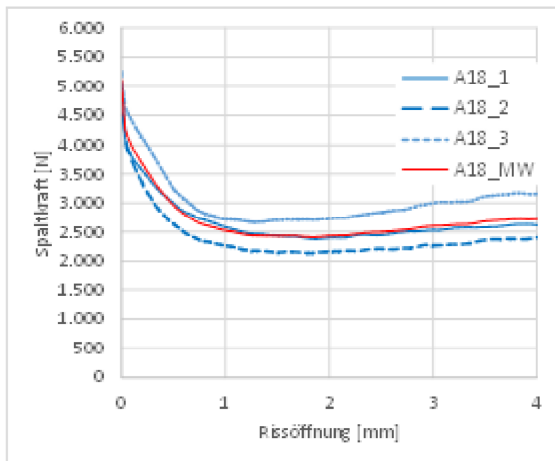
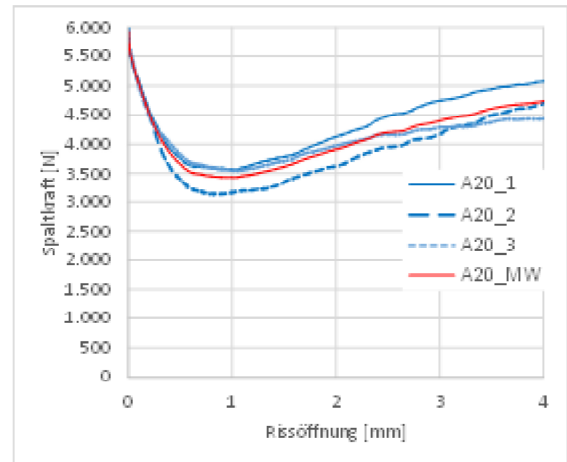
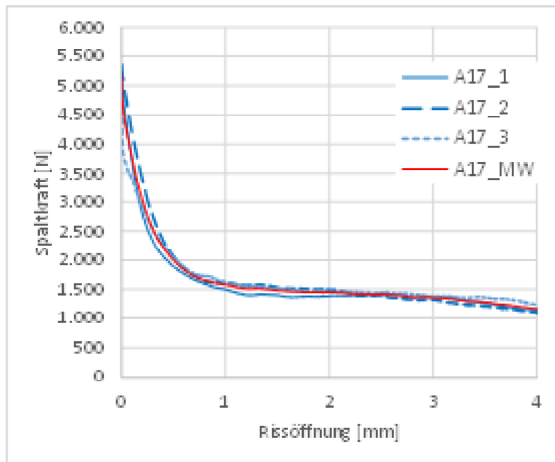
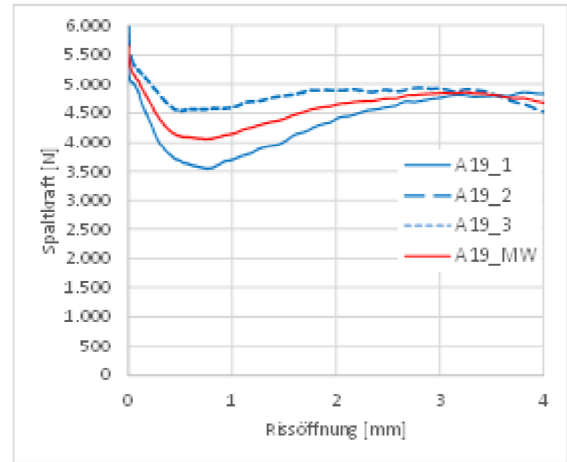
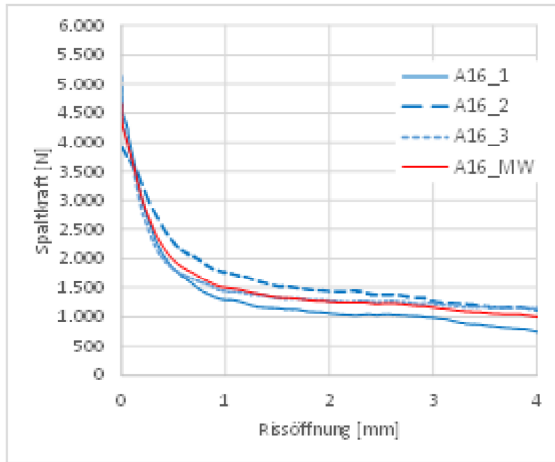
| Variante | V.Nr. | Variante | V.Nr. |
|----------|-------|----------|-------|
| R01      | 0-0   | A21      | 3-2   |
| R02      | 0-1   | A22      | 3-3   |
| A01      | 1-0   | A23      | 3-4   |
| A02      | 1-1   | A24      | 3-5   |
| A10      | 2-0   | A25      | 3-6   |
| A11      | 2-1   | A27      | 3-7   |
| A19      | 3-0   | A26      | 3-8   |
| A20      | 3-1   | A33      | 4-0   |
| B01      | 10-0  | A29      | 5-0   |
| B02      | 10-1  | A30      | 6-0   |
| B10      | 11-0  | A31      | 7-0   |
| B11      | 11-1  | A32      | 8-0   |
| R03      | 0-2   | A34      | 9-0   |
| R04      | 0-3   | B03      | 10-2  |
| R05      | 0-4   | B04      | 10-3  |
| R06      | 0-5   | B05      | 10-4  |
| R07      | 0-5b  | B06      | 10-5  |
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| A04      | 1-3   | B09      | 10-7  |
| A05      | 1-4   | B08      | 10-8  |
| A06      | 1-5   | B12      | 11-2  |
| A07      | 1-6   | B13      | 11-3  |
| A09      | 1-7   | B14      | 11-4  |
| A08      | 1-8   | B15      | 11-5  |
| A12      | 2-2   | B16      | 11-6  |
| A13      | 2-3   | B18      | 11-7  |
| A14      | 2-4   | B17      | 11-8  |
| A15      | 2-5   | B19      | 12-0  |
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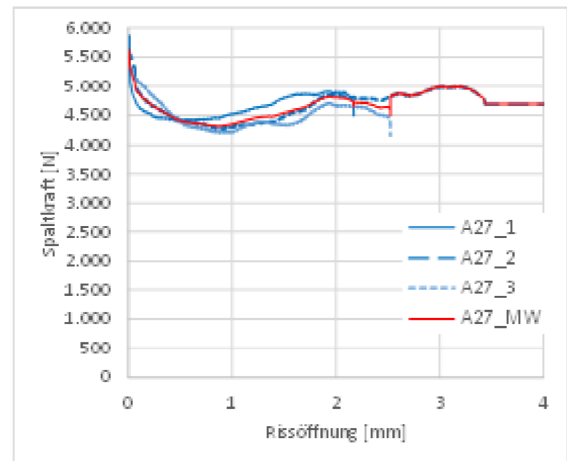
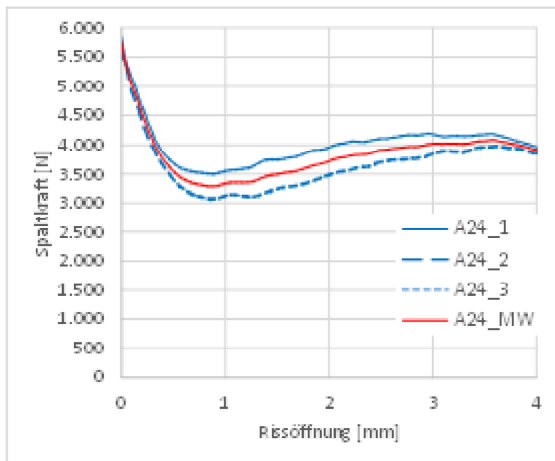
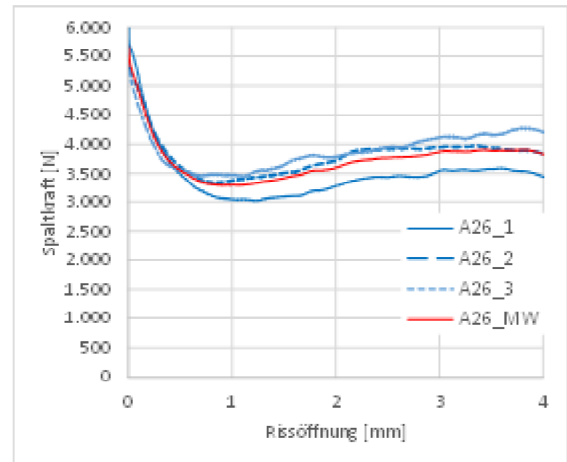
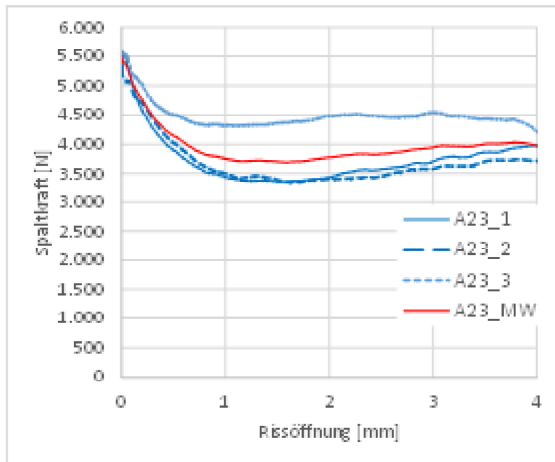
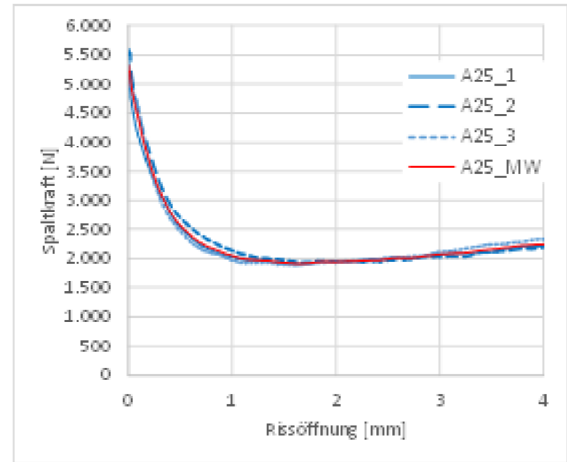
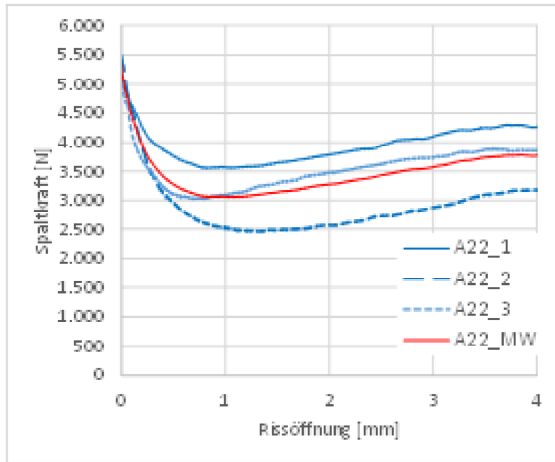
Auswertung der Kurvenverläufe Spaltkraft zu  
Rissöffnung ab Spaltkraftmaximum

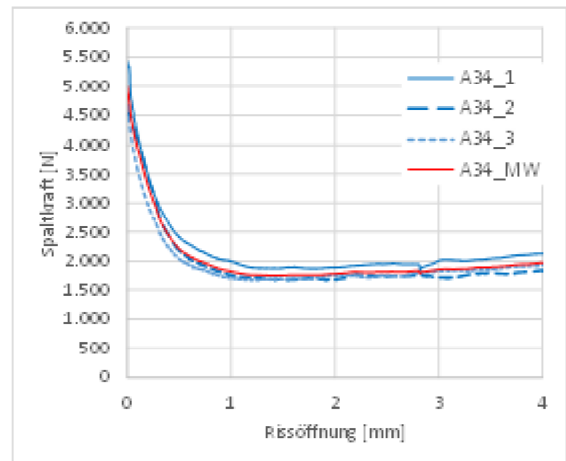
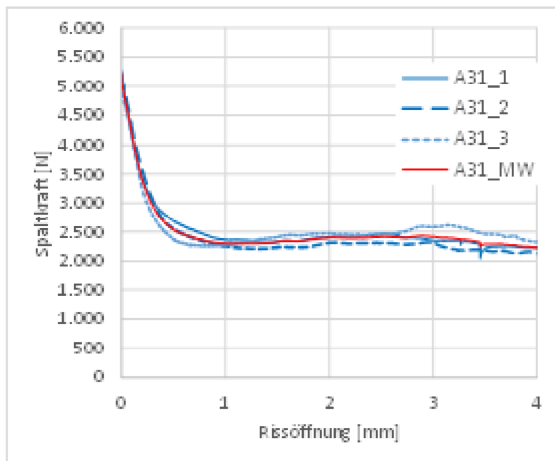
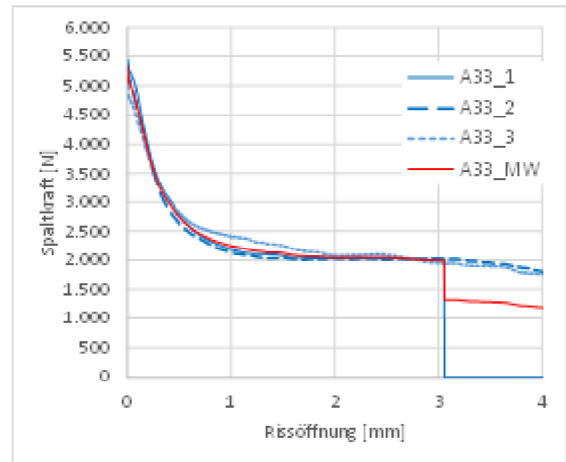
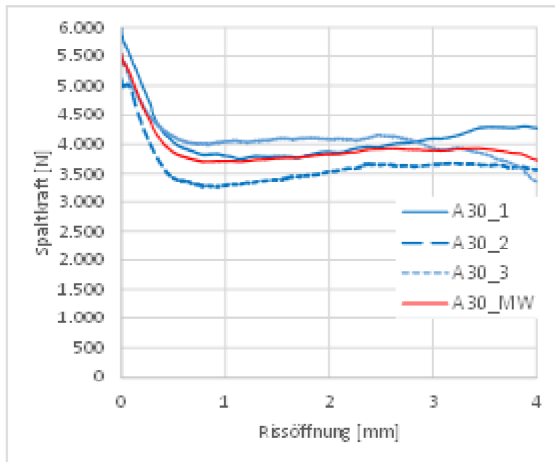
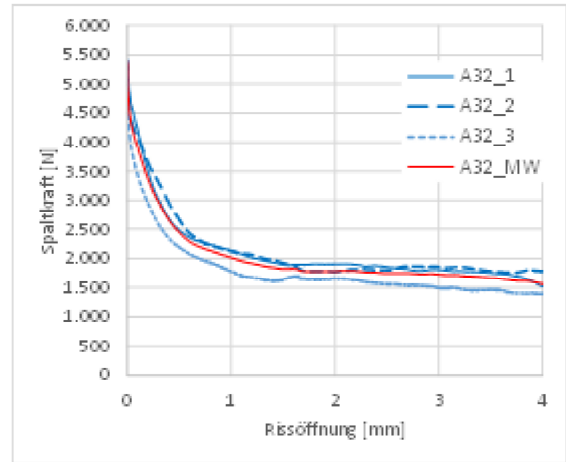
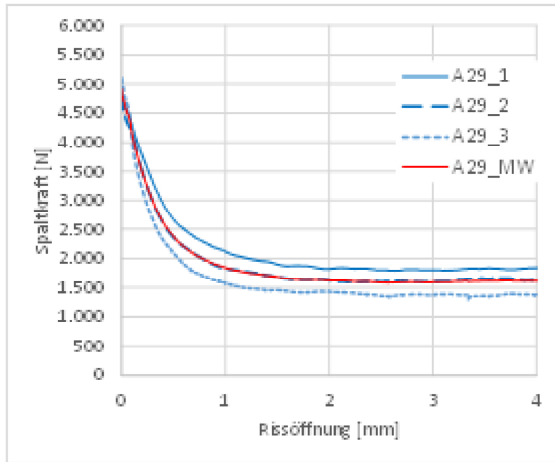


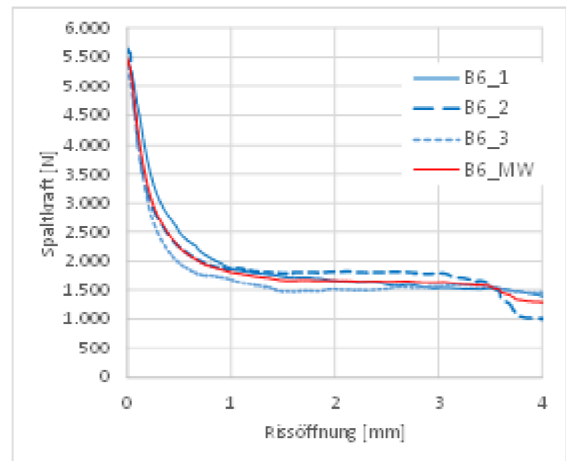
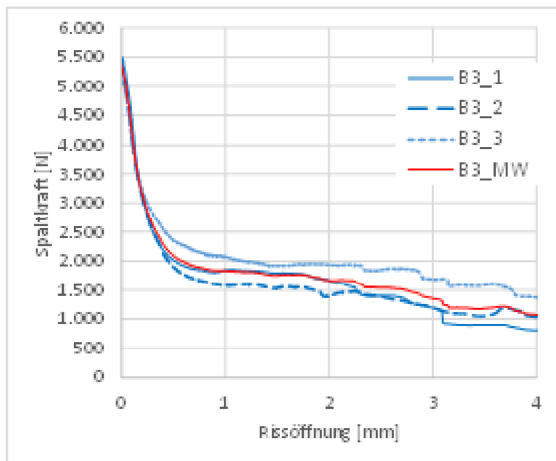
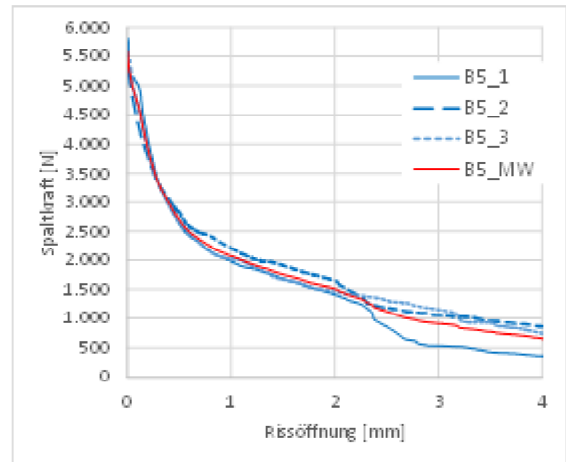
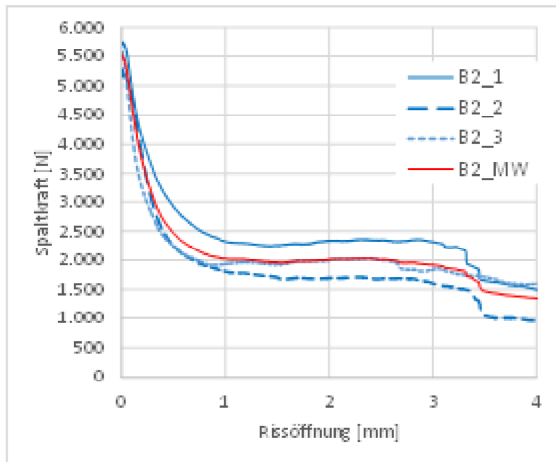
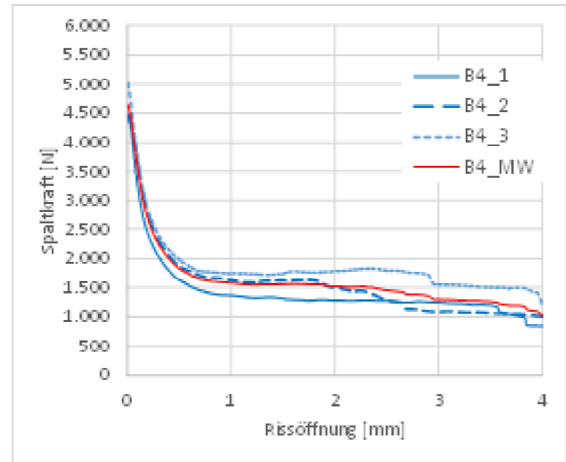
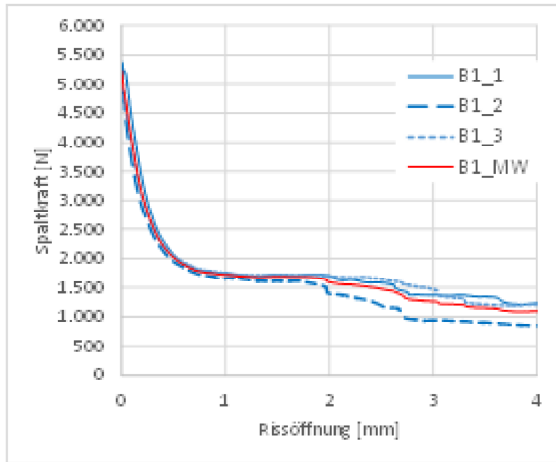


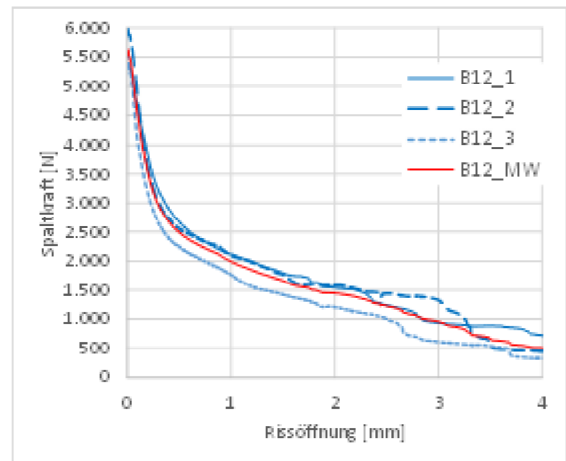
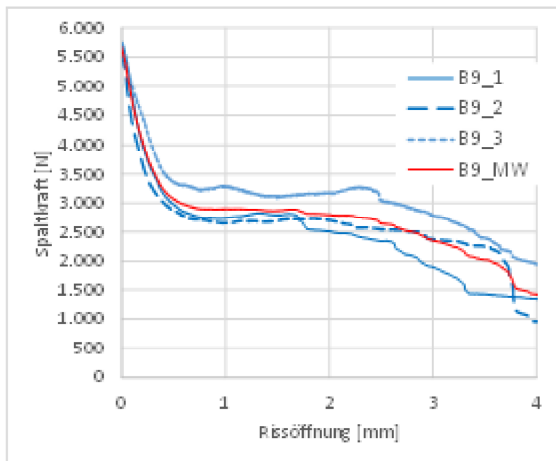
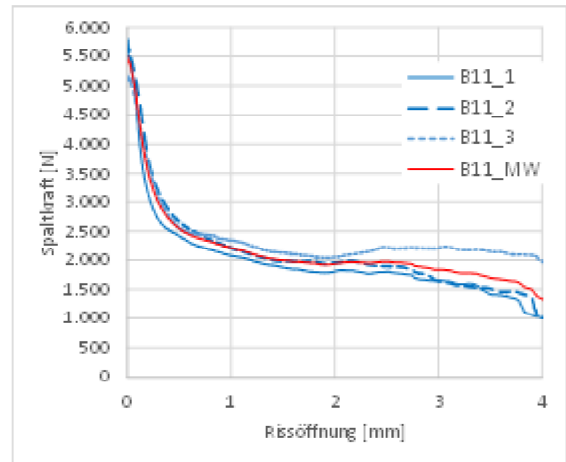
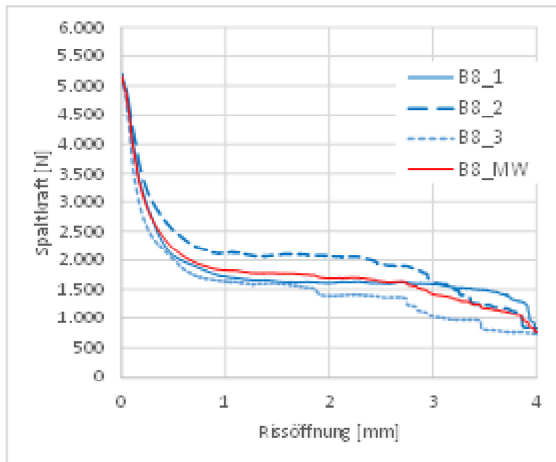
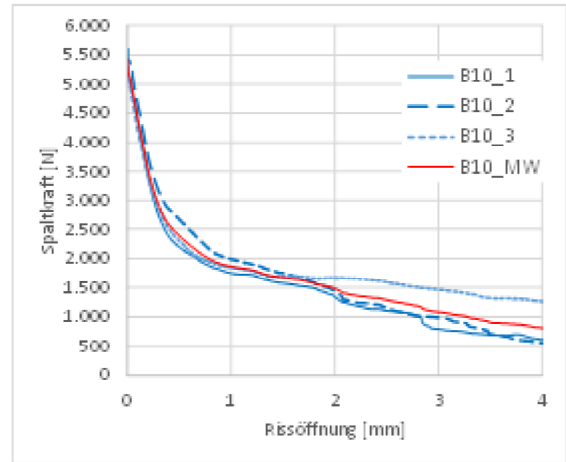
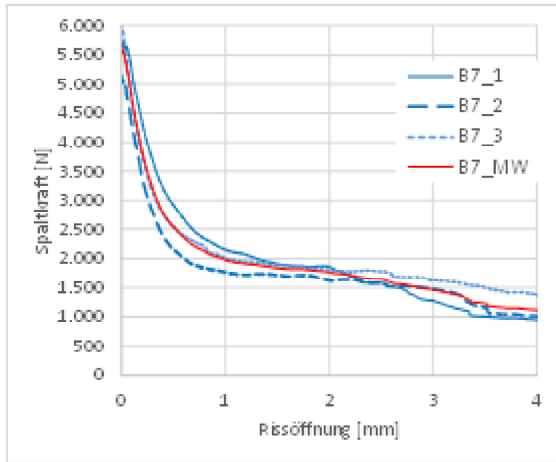




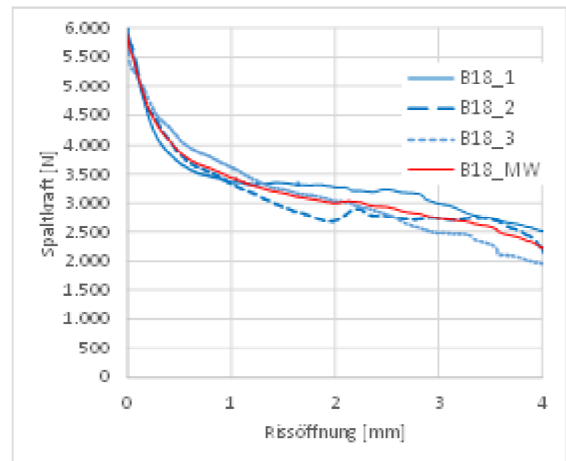
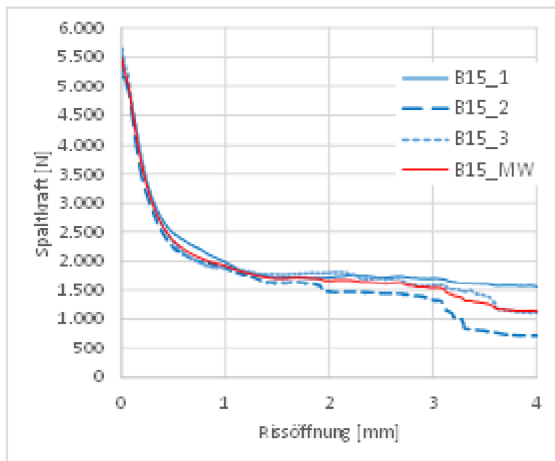
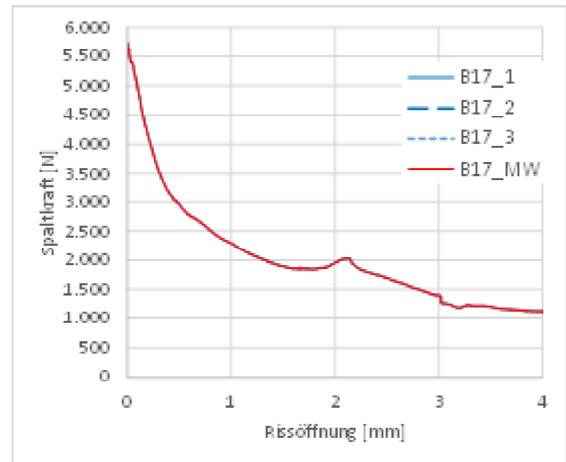
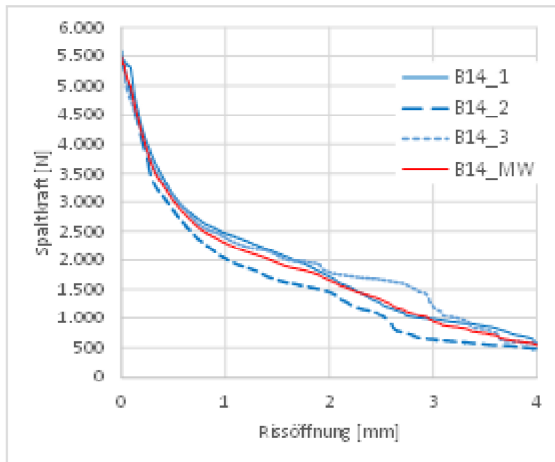
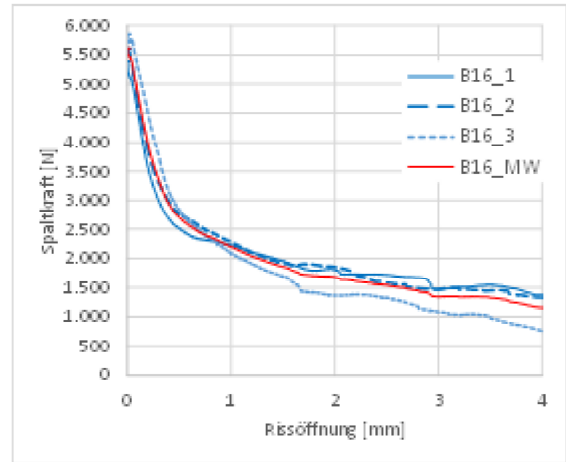
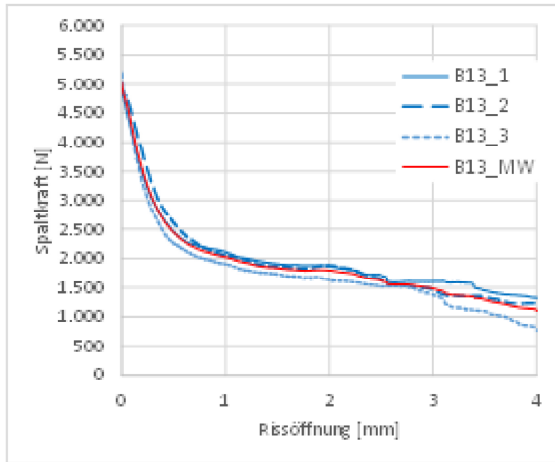


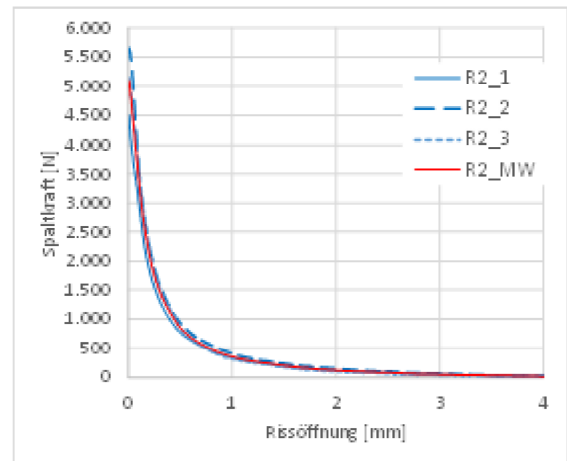
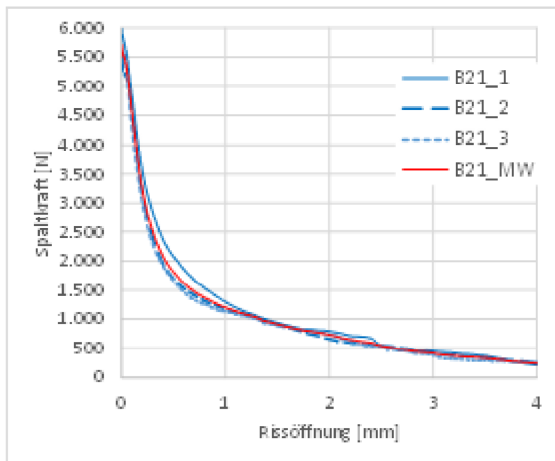
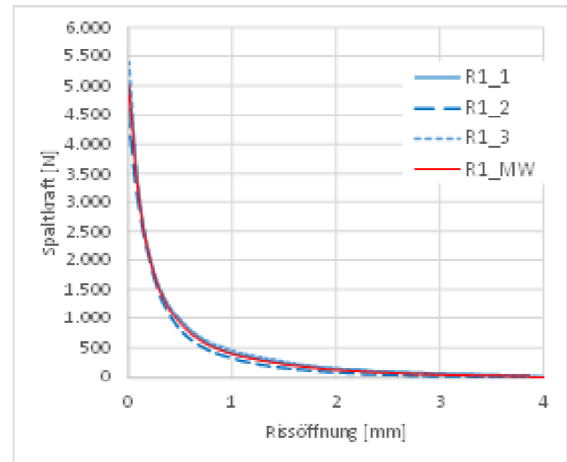
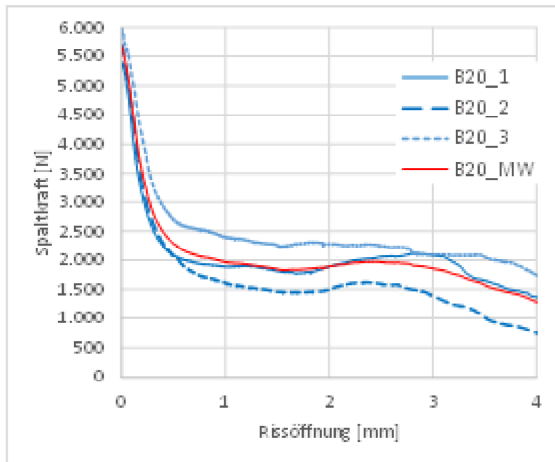
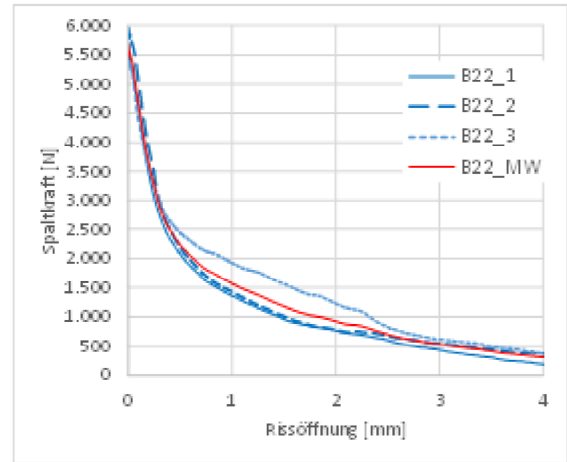
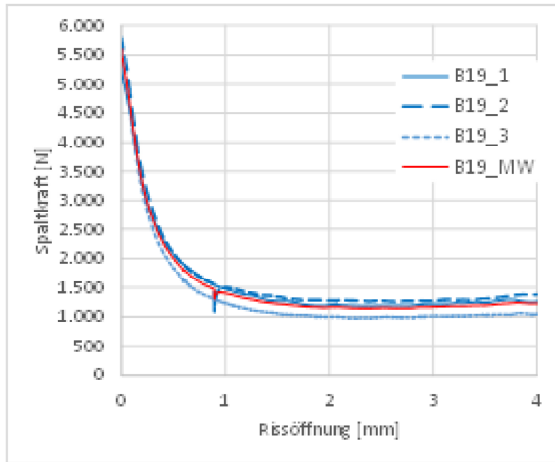


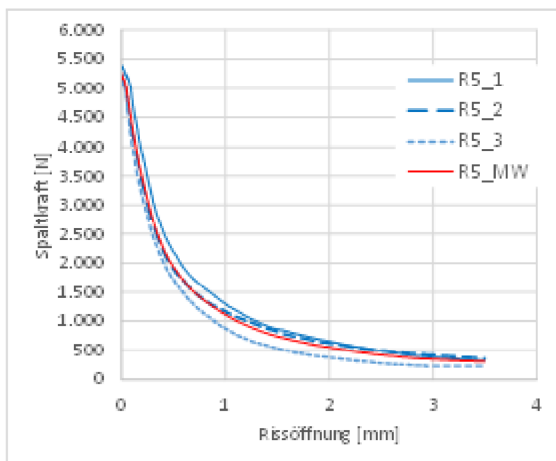
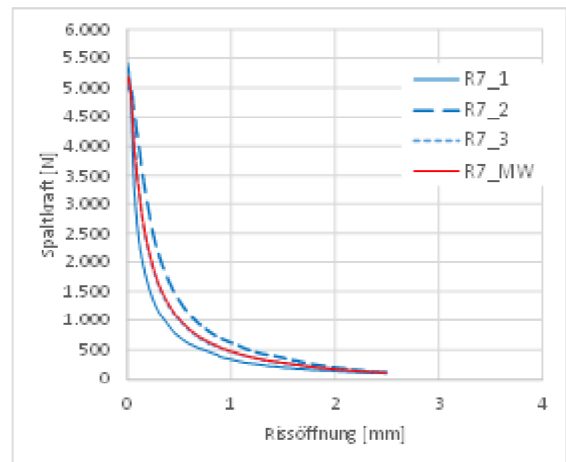
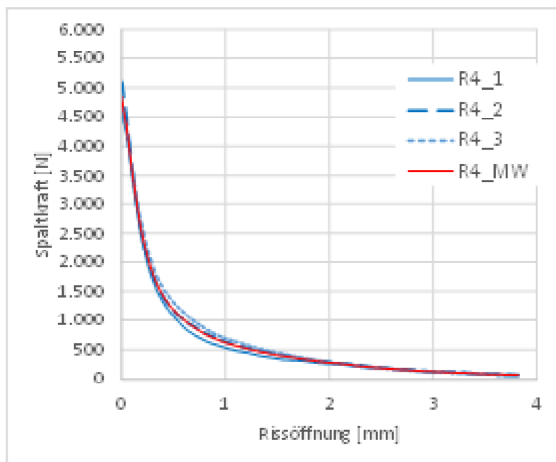
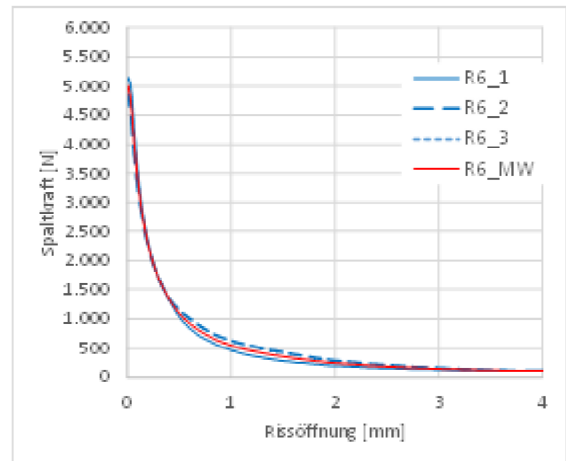
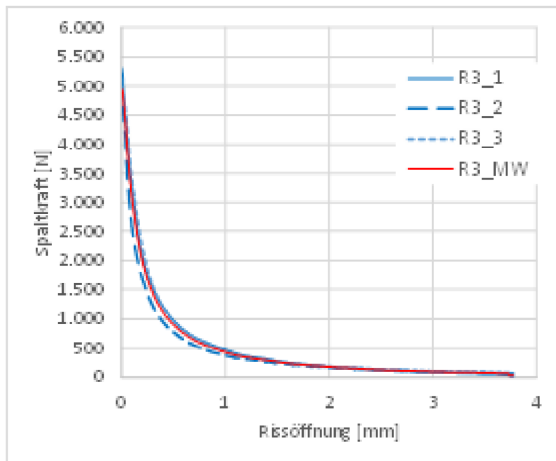












### Zusammenstellung der Varianten

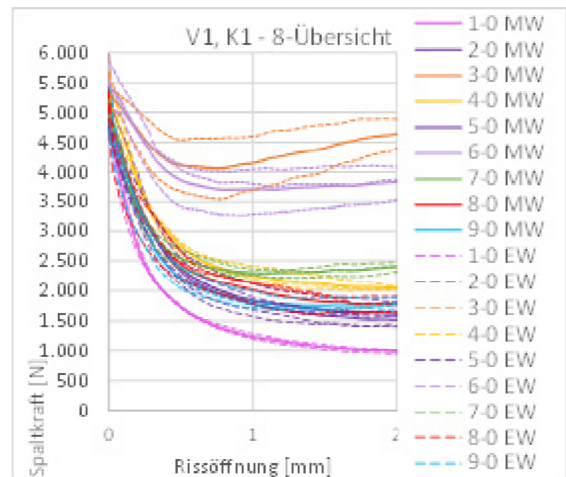


Bild 63: Vergleich der spannungsabbauenden Varianten ohne Variation mit Darstellung der Einzelwerte (Bild 332)

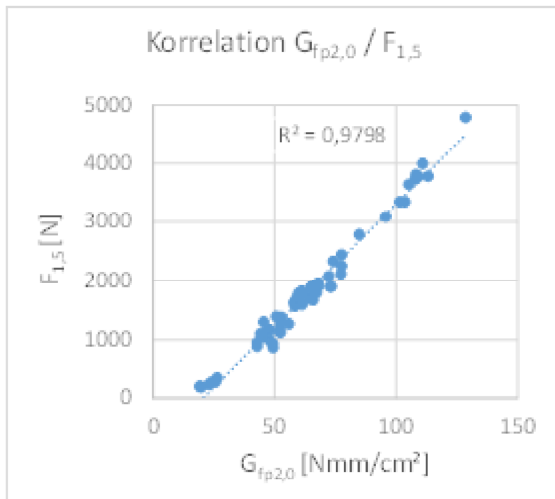


Bild 64: Korrelationsbetrachtung zwischen  $F_{p1,5}$  und  $G_{fp2,0}$  (Bild 333)

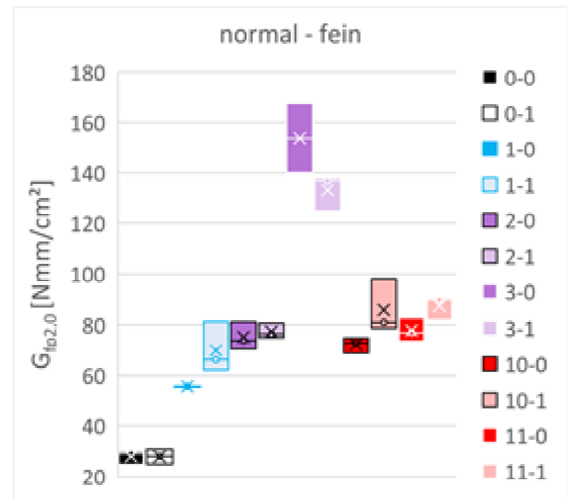


Bild 67: Einfluss der simuliert feingefrästen Binderschichtoberfläche auf die ausgewählten Einlagenvarianten (Bild 336)

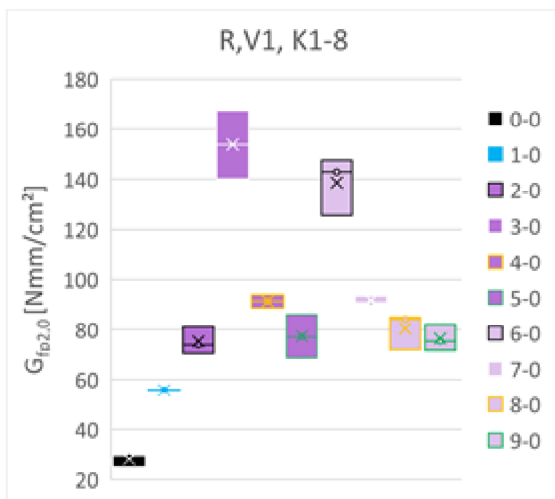


Bild 65: Standard-Variation der Asphaltelinlagen V1 und K1-8 mit Referenz R (Bild 334)

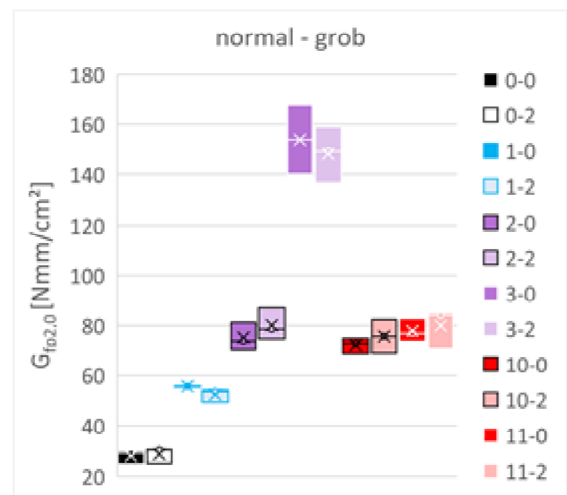


Bild 68: Einfluss der simuliert grobgefästen Binderschichtoberfläche auf die ausgewählten Einlagenvarianten (Bild 337)

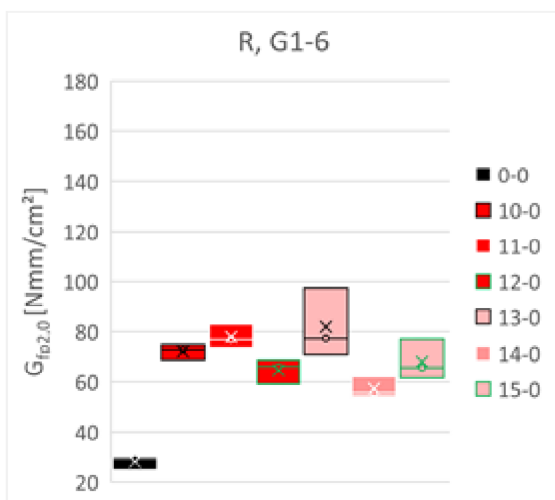


Bild 66: Standard-Variation der Gitter G1 bis G8 mit Referenz R (Bild 335)

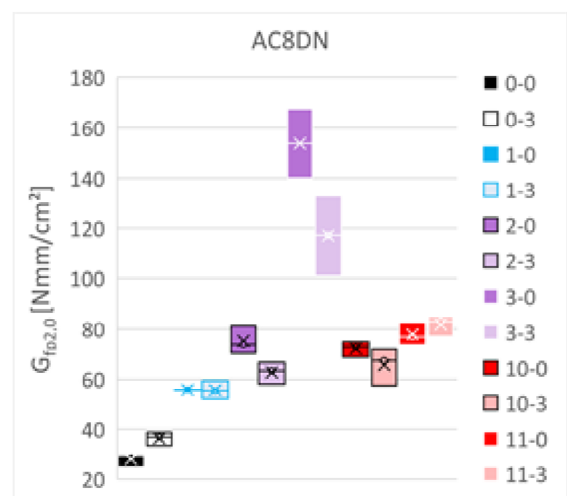


Bild 69: Einfluss des abweichenden Deckschichtmaterials AC 8 D N auf die ausgewählten Varianten (Bild 338)

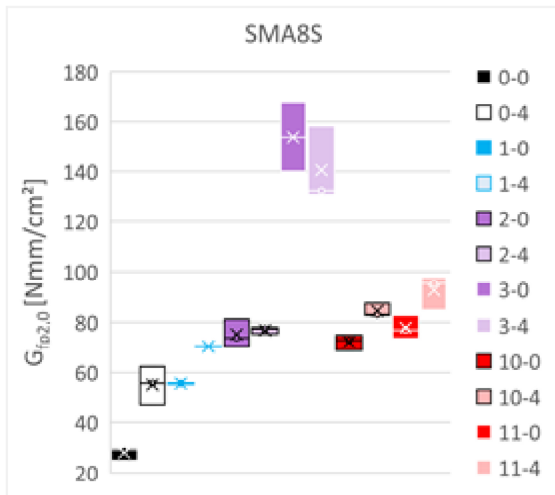


Bild 70: Einfluss des abweichenden Deckschichtmaterials SMA 8 S auf die ausgewählten Varianten (Bild 339)

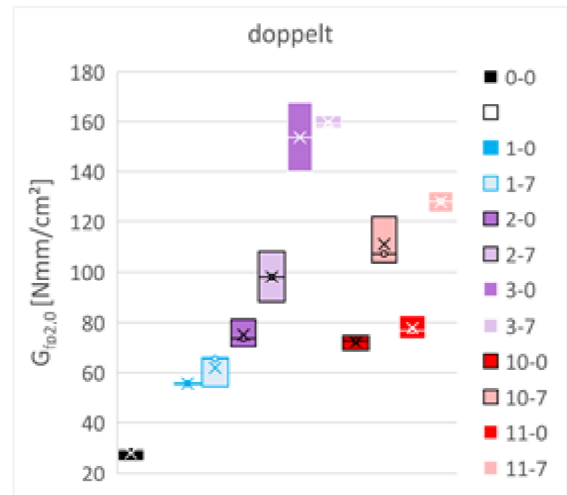


Bild 73: Einfluss doppelt verlegter Einlage auf die ausgewählten Varianten (Bild 342)

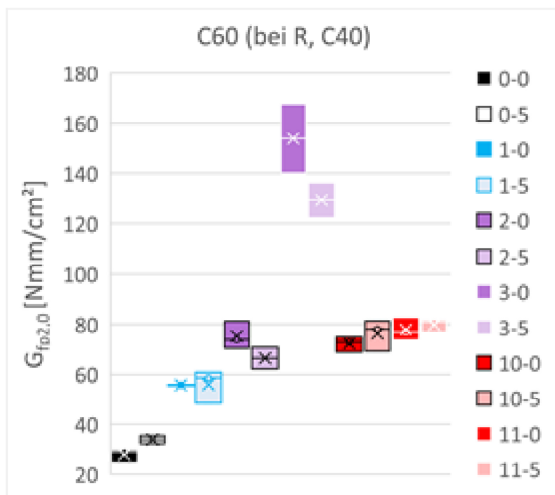


Bild 71: Einfluss unterschiedlicher Emulsionssorten C70 zu C60 (bei R: ohne zu C40) auf die ausgewählten Varianten (Bild 340)

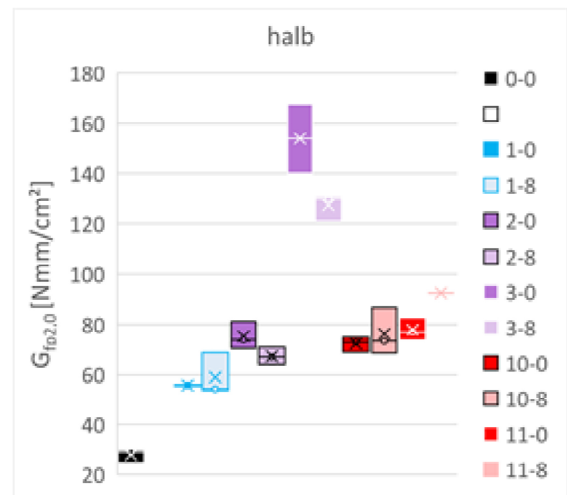


Bild 74: Einfluss bei Bitumenemulsion auf nur 50% der Probekörperfläche auf die ausgewählten Varianten (Bild 343)

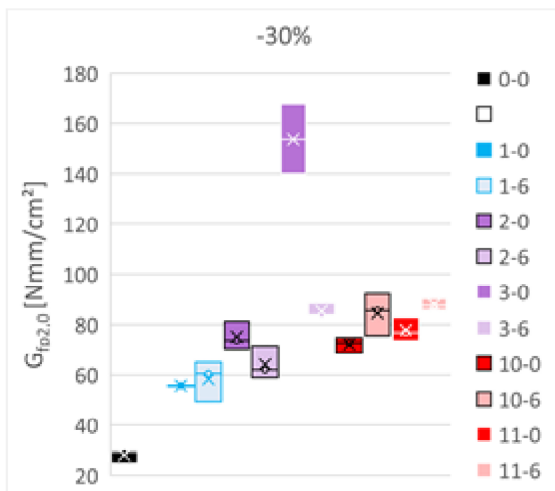


Bild 72: Einfluss der reduzierten Emulsionsmenge auf die ausgewählten Varianten (Bild 341)

zu 7. Prüfergebnisse an Proben aus  
Verifikationsstrecken

zu 7.3.7 Keilspaltversuche

Versuchsergebnisse Tabellarisch

| Versuch       | KS Schichten-<br>verklebung<br>BK150,<br>wegeregelt<br>linear | KS Einlagenwirkung BK220, wegeregelt<br>linear |  |  |        |
|---------------|---|--|--|--|--------|
| Ergebnis      | Maximale<br>Spaltkraft<br>$F_{\max}$ [N]                      | Maximale<br>Spaltkraft:<br>$F_{\max}$ [N]      | Spaltkraft bei<br>Rissöffnung<br>1,5 mm: $F_{p1,5}$<br>[N] | Spezifische<br>Bruchenergie<br>: $G_{fp2,0}$<br>[Nmm/mm <sup>2</sup> ] |        |
| T             | 0 °C  | 0 °C   |  |  |        |
| Teststrecke 1 | S1 - a  | 5544   | 4540   | 628  | 21,13  |
|               | S1 - b  | 6204   | 5696   | 1472   | 31,91  |
|               | S1 - c  | 6219   | 7290   | 2178   | 44,7   |
| Teststrecke 2 | S2 - a  | 4936   | 11461  | 856  | 38,13  |
|               | S2 - b  | 3191   | 11370  | 3734   | 77,08  |
|               | S2 - c  | 3071   | 10855  | 4329   | 86,18  |
|               | S2 - d  | 3447   | 6903   | 3668   | 67,56  |
| Teststrecke 3 | S3 - a  | x  | 9332   | 2728   | 97,81  |
|               | S3 - b  | x  | 17093  | 7326   | 118,43 |
|               | S3 - c  | x  | 13058  | 3306   | 92,49  |
|               | S3 - d  | x  | 9435   | 2840   | 81,38  |

## Versuchsergebnisse anhand der Kurvenverläufe

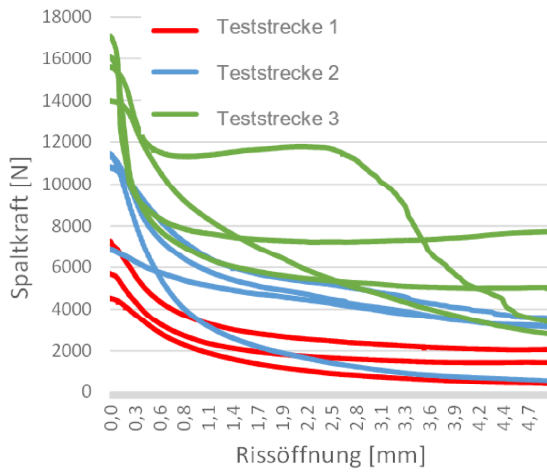


Bild 75: Last-Verformungs-Kurve der verschiedenen Probekörper und Teststrecken (Bild 397)

Auswertung der Kurvenverläufe Spaltkraft zu Rissöffnung der Teststrecken S1 bis S3 und ihrer jeweiligen Varianten und Darstellung durch  $G_{fp2,0}$

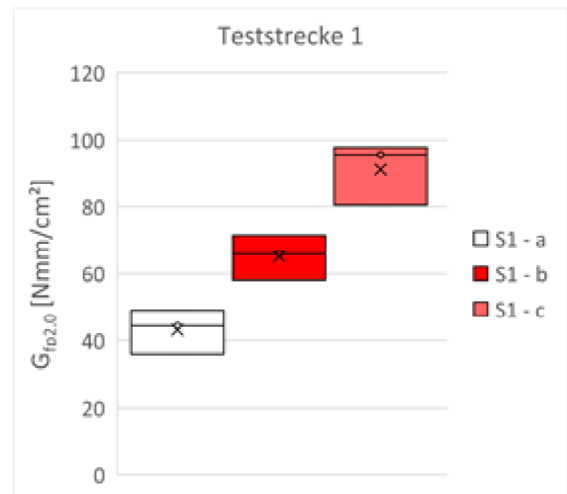
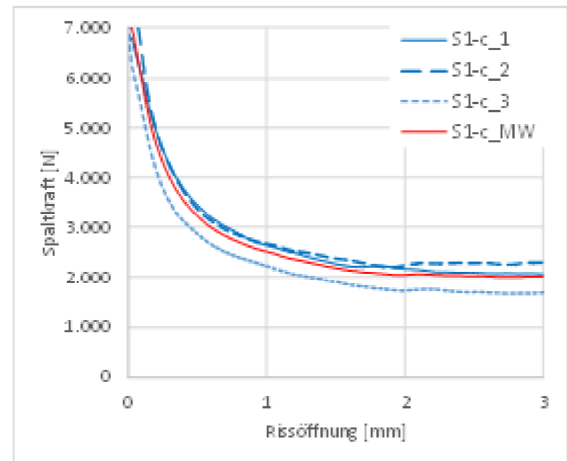
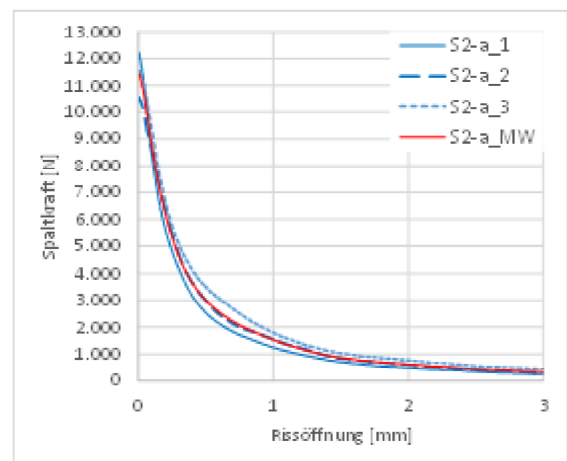
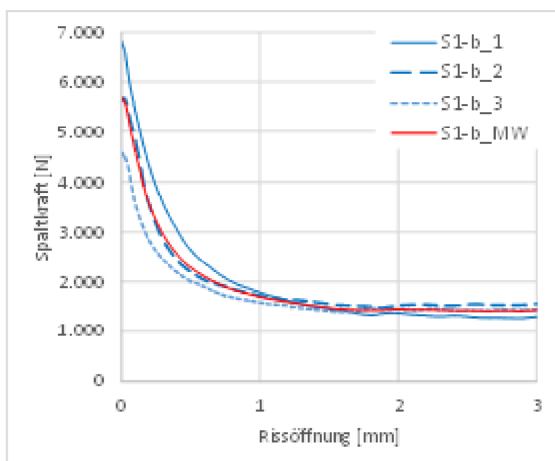
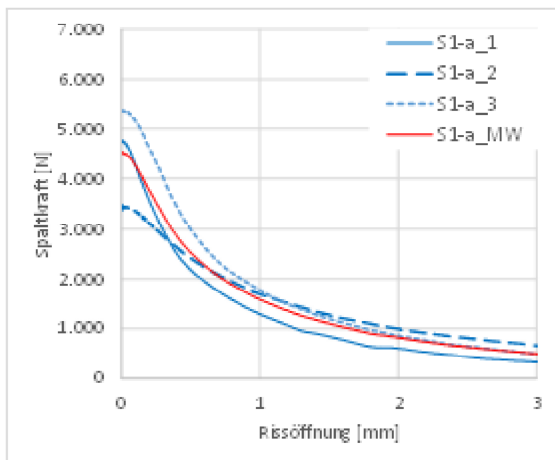


Bild 76: Ergebnisse für  $G_{fp2,0}$  der verschiedenen Bereiche S1 - a, S1 - b und S1 - c in Teststrecke 1 (Bild 398)



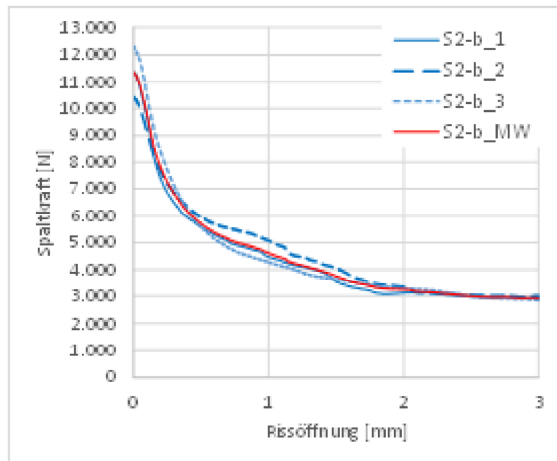
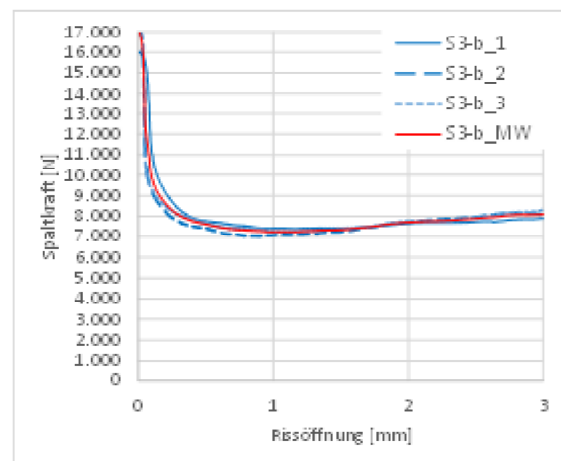
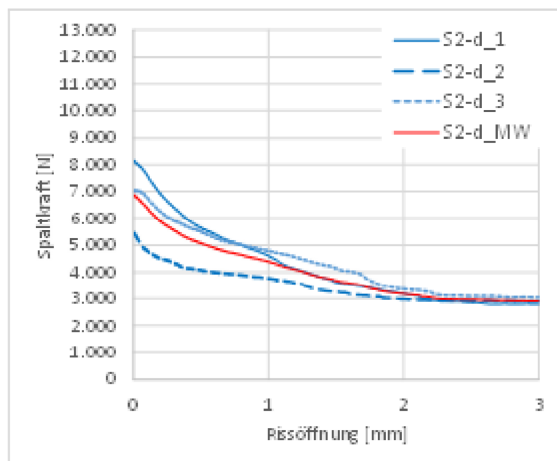
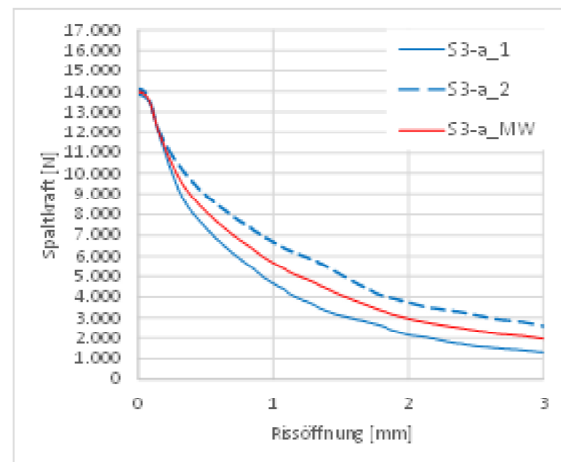
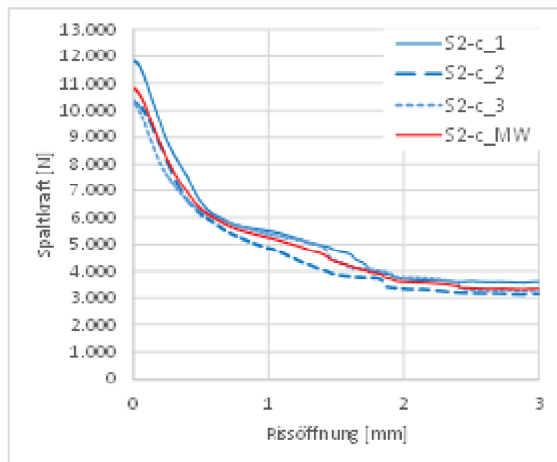


Bild 77: Ergebnisse für  $G_{fp2,0}$  der verschiedenen Bereiche S2 - a, S2 - b, S2 - c und S2 - d in Teststrecke 2 (Bild 399)





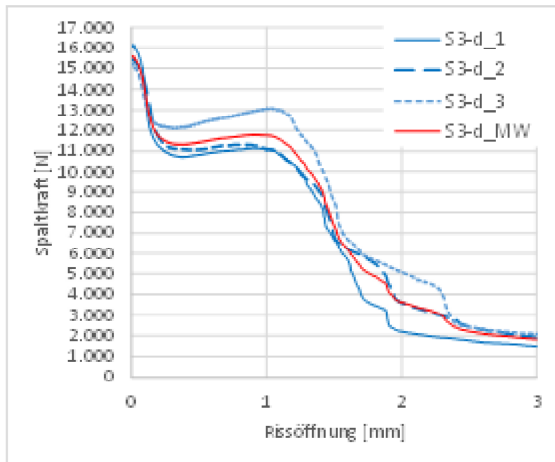
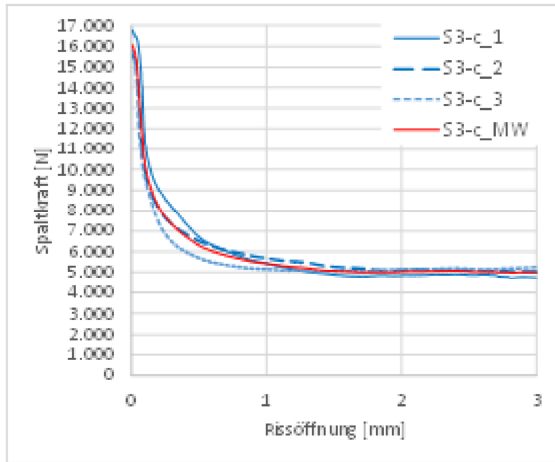
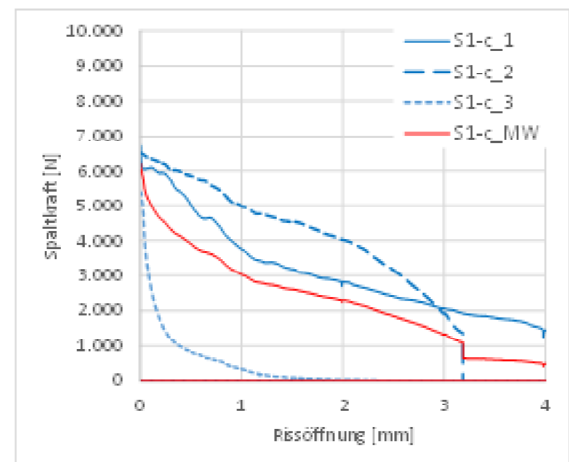
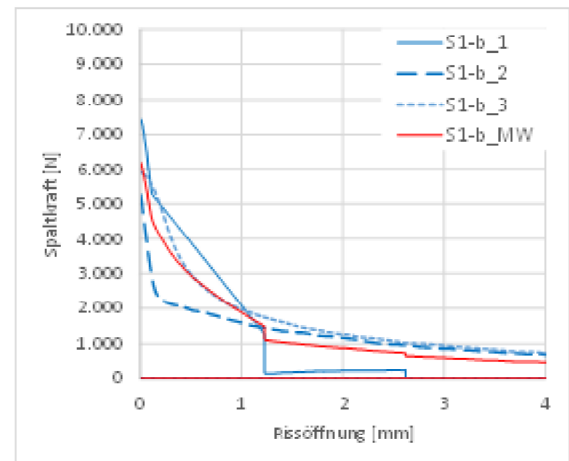
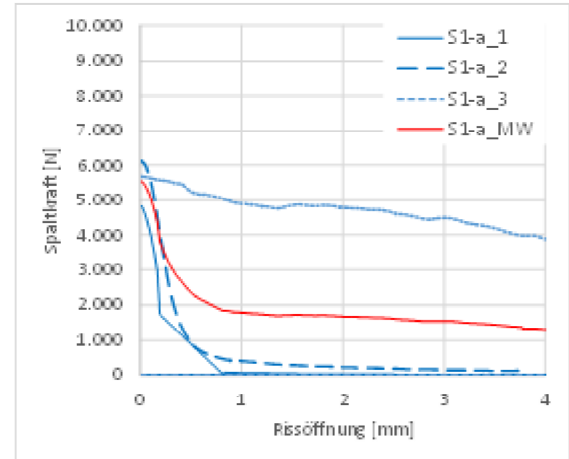


Bild 78: Ergebnisse für  $G_{fp2,0}$  der verschiedenen Testfelder in Teststrecke 3 (Bild 400)

### zu 7.3.8.1 Keilspaltversuch Schichtenverklebung

Auswertung der Kurvenverläufe Spaltkraft zu Rissöffnung der Teststrecken S1 und S2 und ihrer jeweiligen Varianten und Darstellung durch  $F_{max}$



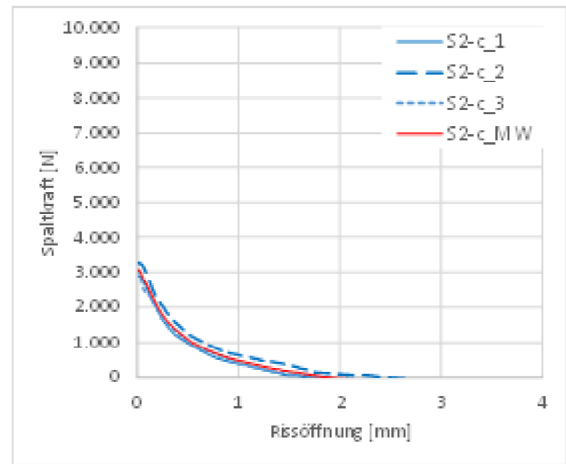
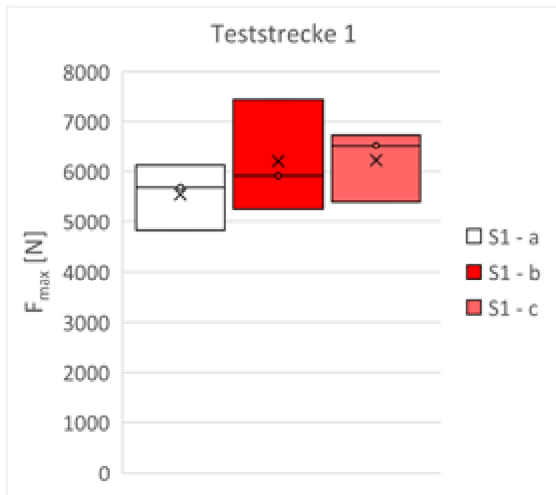


Bild 79: Maximalkräfte bei Rissinitierung für Varianten der Teststrecke 1 (Bild 403)

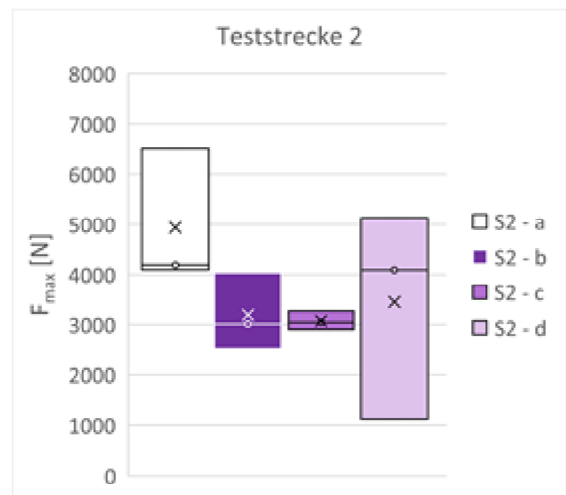
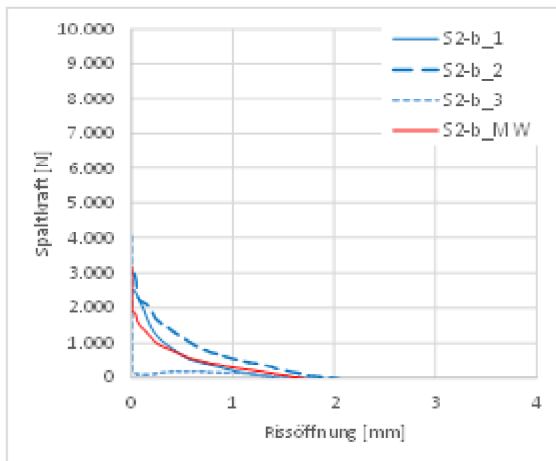
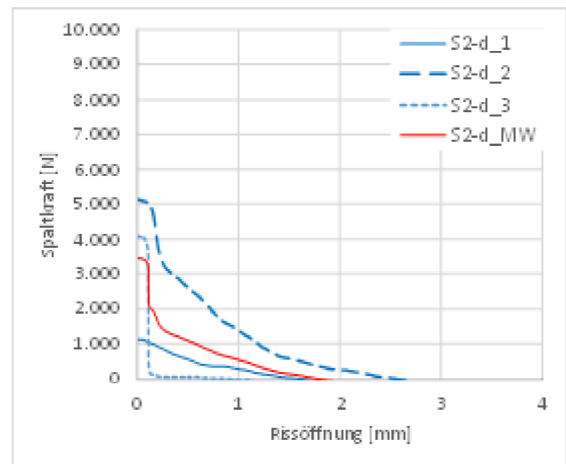
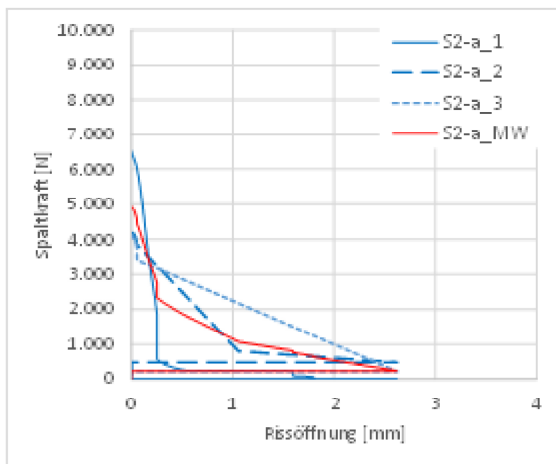


Bild 80: Maximalkräfte bei Rissinitierung für die Varianten der Teststrecke 2 (Bild 404)

# Anhang 5 – Ergebnisse der Lebenszyklusberechnungen

Mit Aufzinsung

| BK  | Szenarien   | Variante | Jahre              |             |                    |                     |                  |             |                  |              |              |              | Kosten gesamt |
|---|---|----------|--------------------|-------------|--------------------|---------------------|------------------|-------------|------------------|--------------|--------------|--------------|---------------|
|   |   |          | 0                  | 6           | 12,5               | 18,5                | 25               | 31          | 37,5             | 43,5         | 50           |              |               |
| BK 10 -<br>(L608)   | Szenario RStO - Regelerhaltungszzyklus 0                  |          |                    |             | 2.339.804 €        |                     | 7.126.805 €      |             | 3.838.696 €      |              | 21.446.834 € |              | 34.752.138 €  |
|   | Deckschichterneuerung nach 6+18,5 a                       | 1a       | 2.057.209 €        |             | 2.634.999 €        | 7.126.805 €         |                  | 3.838.696 € |                  | 21.446.834 € |              | 37.104.542 € |               |
|   | Deckschichterneuerung mit AE nach 6 a                     | 1b       | <b>2.771.173 €</b> |             |                    | 7.126.805 €         |                  | 3.838.696 € |                  | 21.446.834 € |              | 35.183.508 € |               |
|   | Binderaustausch nach 18,5 Jahren                          | 2a       |                    |             | 2.339.804 €        | 6.266.048 €         |                  | 3.375.069 € |                  | 18.856.548 € |              | 38.339.499 € |               |
|   | Binderaustausch nach 18,5 und 43,5 Jahren                 | 2b       |                    |             | 2.339.804 €        | 6.266.048 €         |                  | 3.375.069 € |                  | 10.280.116 € | 21.446.834 € | 43.707.871 € |               |
|   | Regelerhaltungszzyklus + AE nach 18,5 a                   | 2c       |                    |             | 2.339.804 €        | <b>3.549.489 €</b>  | 7.126.805 €      |             | 3.838.696 €      |              | 21.446.834 € |              | 38.301.627 €  |
| Binderaustausch nach 18,5 Jahren + Regelerhaltungszzyklus | 2d  |          |                    | 2.339.804 € | <b>7.552.777 €</b> |                     | 3.375.069 €      |             | 4.322.995 €      | 21.446.834 € |              | 41.879.278 € |               |
| BK 1,8  |   |          |                    |             |                    |                     |                  |             |                  |              |              |              |               |
| BK  | Szenarien   | Variante | Jahre              |             |                    |                     |                  |             |                  |              |              |              | Kosten gesamt |
|   |   |          | 0                  | 6           | 12,5               | 18,5                | 25               | 31          | 37,5             | 43,5         | 50           |              |               |
|   | Szenario RStO - Regelerhaltungszzyklus 0                  |          |                    |             | 210.576 €          |                     | 269.718 €        |             | 346.471 €        |              | 3.145.805 €  |              | 3.971.570 €   |
|   | Deckschichterneuerung nach 6+18,5 a                       | 1a       | 185.143 €          |             |                    | 237.142 €           | 269.718 €        |             | 346.471 €        |              | 3.145.805 €  |              | 4.183.280 €   |
|   | Deckschichterneuerung mit AE nach 6 a                     | 1b       | <b>295.392 €</b>   |             |                    |                     | 269.718 €        |             | 346.471 €        |              | 3.145.805 €  |              | 4.056.387 €   |
|   | Grundhafte Erneuerung nach 25 Jahren                      | 2a       |                    |             | 210.576 €          |                     | 1.917.465 €      |             | 346.471 €        |              | 3.145.805 €  |              | 5.619.318 €   |
|   | Deckschichtaustausch nach 12,5 a alle 6 a                 | 2b       |                    |             | 210.576 €          | 237.142 €           | 269.718 €        | 303.746 €   | 345.471 €        | 389.057 €    | 3.145.805 €  |              | 4.901.516 €   |
|   | Szenario RStO - Regelerhaltungszzyklus + 2xAE             | 2c       |                    |             | <b>335.969 €</b>   |                     | <b>430.330 €</b> |             | <b>551.193 €</b> |              | 3.145.805 €  |              | 4.463.298 €   |
| BK 100  |   |          |                    |             |                    |                     |                  |             |                  |              |              |              |               |
| BK  | Szenarien   | Variante | Jahre              |             |                    |                     |                  |             |                  |              |              |              | Kosten gesamt |
|   |   |          | 0                  | 6           | 12,5               | 18,5                | 25               | 31          | 37,5             | 43,5         | 50           |              |               |
|   | Szenario RStO - Regelerhaltungszzyklus 0                  |          |                    |             | 4.533.470 €        |                     | 14.417.319 €     |             | 7.437.638 €      |              | 53.116.631 € |              | 79.505.058 €  |
|   | Deckschichterneuerung nach 6+18,5 a                       | 1a       | 3.985.929 €        |             | 5.105.423 €        | 14.417.319 €        |                  | 7.437.638 € |                  | 53.116.631 € |              | 84.062.941 € |               |
|   | Deckschichterneuerung mit AE nach 6 a                     | 1b       | <b>5.887.521 €</b> |             |                    | 14.417.319 €        |                  | 7.437.638 € |                  | 53.116.631 € |              | 80.859.109 € |               |
|   | Binderaustausch nach 18,5 Jahren                          | 2a       |                    |             | 4.533.470 €        | 12.676.034 €        |                  | 6.539.340 € |                  | 46.701.347 € |              | 87.817.936 € |               |
|   | Binderaustausch nach 18,5 und 43,5 Jahren                 | 2b       |                    |             | 4.533.470 €        | 12.676.034 €        |                  | 6.539.340 € |                  | 20.796.378 € | 53.116.631 € | 97.661.853 € |               |
|   | Regelerhaltungszzyklus + AE nach 18,5 a                   | 2c       |                    |             | 4.533.470 €        | <b>7.541.098 €</b>  | 14.417.319 €     |             | 7.437.638 €      |              | 53.116.631 € | 87.046.156 € |               |
|   | Binderaustausch nach 18,5 Jahren + Regelerhaltungszzyklus | 2d       |                    |             | 4.533.470 €        | <b>15.111.709 €</b> |                  | 6.539.340 € |                  | 8.375.988 €  | 53.116.631 € | 92.630.961 € |               |

# Ohne Aufzinsung

| BK             | Szenarien                                       | Variante | Jahre |                    |                  |                     |                  |             |             |              |              |               | Kosten gesamt |              |
|----------------|---|----------|-------|--------------------|------------------|---------------------|------------------|-------------|-------------|--------------|--------------|---------------|---------------|--------------|
|                |   |          | 0     | 6                  | 12,5             | 18,5                | 25               | 31          | 37,5        | 43,5         | 50           |               |               |              |
| BK 10 - (L608) | Szenario RSO - Regelerhaltungszyklus 0          |          | 0 €   | 0 €                | 1.826.738 €      | 0 €                 | 4.343.997 €      | 0 €         | 1.826.738 € | 0 €          | 1.826.738 €  | 0 €           | 7.968.077 €   | 15.965.550 € |
|                | Deckschichterneuerung nach 6+18,5 a             | 1a       | 0 €   | 1.826.738 €        | 0 €              | 1.826.738 €         | 4.343.997 €      | 0 €         | 1.826.738 € | 0 €          | 1.826.738 €  | 0 €           | 7.968.077 €   | 17.792.288 € |
|                | Deckschichterneuerung mit AE nach 6 a           | 1b       | 0 €   | <b>2.460.717 €</b> | 0 €              | 0 €                 | 4.343.997 €      | 0 €         | 1.826.738 € | 0 €          | 1.826.738 €  | 0 €           | 7.968.077 €   | 16.999.528 € |
|                | Binder austausch nach 18,5 Jahren               | 2a       | 0 €   | 0 €                | 1.826.738 €      | 4.343.997 €         | 0 €              | 1.826.738 € | 0 €         | 1.826.738 €  | 0 €          | 7.968.077 €   | 0 €           | 18.041.071 € |
|                | Binder austausch nach 18,5 und 43,5 Jahren      | 2b       | 0     | 0                  | 1.826.738 €      | 4.343.997 €         | 0 €              | 1.826.738 € | 0 €         | 1.826.738 €  | 0            | 4.343.997 €   | 7.968.077 €   | 20.309.546 € |
|                | Regelerhaltungszyklus + AE nach 18,5 Jahren     | 2c       | 0 €   | 0 €                | 1.826.738 €      | <b>2.460.717 €</b>  | 4.343.997 €      | 0 €         | 1.826.738 € | 0 €          | 1.826.738 €  | 0 €           | 7.968.077 €   | 18.426.266 € |
|                | Binder austausch nach 18,5 Jahren + Regelzyklus | 2d       | 0     | 0                  | 1.826.738 €      | <b>5.236.034 €</b>  | 0                | 1.826.738 € | 0           | 1.826.738 €  | 0            | 1.826.738 €   | 19.034.228 €  |              |
| BK             | Szenarien                                       | Variante | 0     | 6                  | 12,5             | 18,5                | 25               | 31          | 37,5        | 43,5         | 50           | Kosten gesamt |               |              |
| BK 1,8         | Szenario RSO - Regelerhaltungszyklus 0          |          | 0 €   | 0 €                | 164.397 €        | 0 €                 | 164.397 €        | 0 €         | 164.397 €   | 0 €          | 584.363 €    | 1.077.555 €   |               |              |
|                | Deckschichterneuerung nach 6+18,5 a             | 1a       |       | 164.397 €          |                  | 164.397 €           |                  | 164.397 €   |             | 164.397 €    |              | 1.241.953 €   |               |              |
|                | Deckschichterneuerung mit AE nach 6 a           | 1b       |       | <b>249.485 €</b>   |                  | 164.397 €           |                  | 164.397 €   |             | 164.397 €    |              | 1.162.643 €   |               |              |
|                | Grundhafte Erneuerung nach 25 Jahren            | 2a       |       |                    | 164.397 €        | 584.363 €           |                  | 164.397 €   |             | 164.397 €    |              | 1.497.521 €   |               |              |
|                | Deckschicht austausch nach 12,5 a alle 6 a      | 2b       |       |                    | 164.397 €        | 164.397 €           |                  | 164.397 €   |             | 164.397 €    |              | 1.570.748 €   |               |              |
|                | Szenario RSO - Regelerhaltungszyklus + 2x AE    | 2c       |       |                    | <b>164.397 €</b> |                     | <b>249.485 €</b> |             |             |              |              | 584.363 €     | 1.247.731 €   |              |
| BK             | Szenarien                                       | Variante | 0     | 6                  | 12,5             | 18,5                | 25               | 31          | 37,5        | 43,5         | 50           | Kosten gesamt |               |              |
| BK 100         | Szenario RSO - Regelerhaltungszyklus 0          |          | 0     |                    | 3.539.305 €      |                     | 8.787.586 €      |             | 3.539.305 € |              | 16.118.834 € | 31.985.029 €  |               |              |
|                | Deckschichterneuerung nach 6+18,5 a             | 1a       |       | 3.539.305 €        |                  | 3.539.305 €         | 8.787.586 €      |             | 3.539.305 € |              | 16.118.834 € | 35.524.333 €  |               |              |
|                | Deckschichterneuerung mit AE nach 6 a           | 1b       |       | <b>4.979.673 €</b> |                  | 8.787.586 €         |                  | 3.539.305 € |             | 3.539.305 €  |              | 33.425.397 €  |               |              |
|                | Binder austausch nach 18,5 Jahren               | 2a       |       |                    | 3.539.305 €      | 8.787.586 €         |                  | 3.539.305 € |             | 16.118.834 € |              | 36.143.083 €  |               |              |
|                | Binder austausch nach 18,5 und 43,5 Jahren      | 2b       |       |                    | 3.539.305 €      | 8.787.586 €         |                  | 3.539.305 € |             | 8.787.586 €  |              | 40.772.615 €  |               |              |
|                | Regelerhaltungszyklus + AE nach 18,5 Jahren     | 2c       |       |                    | 3.539.305 €      | <b>4.979.673 €</b>  | 8.787.586 €      |             | 3.539.305 € |              | 16.118.834 € | 36.964.701 €  |               |              |
|                | Binder austausch nach 18,5 Jahren + Regelzyklus | 2d       |       |                    | 3.539.305 €      | <b>10.227.934 €</b> |                  | 3.539.305 € |             | 3.539.305 €  |              | 38.805.140 €  |               |              |