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## ABBREVIATIONS

|                       |  |
|-----------------------|--|
| T                     | = Thickness  |
| A                     | = Area   |
| E                     | = Modulus of elasticity                                |
| I                     | = Moment of inertia of area                            |
| EI                    | = Flexural rigidity                                    |
| M                     | = Moment   |
| N                     | = Axial force  |
| S                     | = Shearing force                                       |
| D                     | = Diameter of lining                                   |
| R <sub>o</sub>        | = Outer radius   |
| R <sub>c</sub>        | = Radius of centroid                                   |
| R <sub>i</sub>        | = Inner radius of the lining                           |
| $\gamma$              | = Weight of soil                                       |
| $\gamma'$             | = Submerged unit weight of soil                        |
| $\gamma_w$            | = Unit weight of water                                 |
| $\gamma_c$            | = Unit weight of concrete                              |
| H                     | = Overburden   |
| $\gamma_w \times H_w$ | = Groundwater pressure at crown of lining              |
| P <sub>o</sub>        | = Surcharge  |
| W                     | = Weight of lining per meter in longitudinal direction |
| p <sub>g</sub>        | = Dead Load  |
| P <sub>e1</sub>       | = Vertical earth pressure at crown of lining           |
| P <sub>w1</sub>       | = Vertical water pressure at crown of lining           |
| q <sub>e1</sub>       | = Horizontal earth pressure at crown of lining         |
| q <sub>w1</sub>       | = Horizontal water pressure at crown of lining         |
| P <sub>e2</sub>       | = Vertical earth pressure at bottom of lining          |
| P <sub>w2</sub>       | = Vertical water pressure at bottom of lining          |
| q <sub>e2</sub>       | = Horizontal earth pressure at bottom of lining.       |

- $q_{w2}$  = Horizontal water pressure at bottom of lining  
 $p_w$  = Water pressure.  
 $\Lambda$  = Coefficient of lateral earth pressure.  
 $k$  = Coefficient of subgrade reaction.  
 $\delta$  = Displacement of lining.  
 $p_k$  = Subgrade reaction/la reaction/Bettung.  
 $C$  = Cohesion of soil / La cohesion du sol / Kohäsion vom Boden.  
 $\emptyset$  = Angle of internal friction of soil.  
 $f_{ck}$  = Nominal strength of Concrete (Characteristic Compressive Strength of Concrete)  
 $f_y$  = Yield strength of steel  
 $E_s$  = Modulus of elasticity of steel