Analysis Process

Data Sources:
[H: 1860, h: 1876, RQD: 1991, W: 3898]

Algorithm Configuration:
Algorithm: Analytic Hierarchy Process (AHP)
Variables: Calculation Method: {Root Square Method}

Analysis Results:
The Analytic Hierarchy Process was used to calculate the weight (importance) of each indicator: the weight of tunnel depth (H) is 5.502%, the weight of groundwater level (h) is 11.779%, the weight of Rock Quality Designation (RQD) is 26.338%, and the weight of water production rate (W) is 56.381%.

Analysis Steps:

1. Fill in the judgment matrix to construct a subjective evaluation matrix.
2. Check the weight of each indicator, using the root square method to obtain the eigenvector.
3. Use a consistency check to determine whether the constructed judgment matrix contains logical errors. If it does not pass, the judgment matrix needs to be reconstructed.

Detailed Conclusions:

Output Result 1: Indicator Index

Indicator	Tunnel Depth (H)	Groundwater Level (h)	Rock Quality Designation (RQD)	Water Production Rate (W)
Tunnel Depth (H)	1	0.333	0.2	0.143
Groundwater Level (h)	3	1	0.333	0.2
Rock Quality Designation (RQD)	5	3	1	0.333
Water Production Rate (W)	7	5	3	1

Table Explanation:

The table above shows the constructed judgment matrix.

Output Result 2: AHP Hierarchical Analysis Results

AHP Hierarchical Analysis Results				
Item	Eigenvector	Weight Value (%)	Maximum Eigenvalue	CI Value
Tunnel Depth (H)	0.312	5.502	4.117	0.039
Groundwater Level (h)	0.669	11.779		
Rock Quality Designation (RQD)	1.495	26.338		
Water Production Rate (W)	3.201	56.381		

Table Explanation:

The table above presents the weight calculation results of the Analytic Hierarchy Process, analyzing the weight of each indicator based on the results.

Analysis:

The weight calculation results of the Analytic Hierarchy Process (Root Square Method) show that the weight of tunnel depth (H) is 5.502%, the weight of groundwater level (h) is 11.779%, the weight of Rock Quality Designation (RQD) is 26.338%, and the weight of water production rate (W) is 56.381%.

Output Result 3: Consistency Check Results

Consistency Check Results				
Maximum Eigenvalue	CI Value	RI Value	CR Value	Consistency Check Result

4.117	0.039	0.882	0.044	Pass

Table Explanation:

The table above displays the consistency check results.

Analysis:

The calculation results of the Analytic Hierarchy Process show that the maximum eigenvalue is 4.117. According to the RI table, the corresponding RI value is 0.882, so CR = CI/RI = 0.044 < 0.1, passing the consistency check.

References:

[1] Scientific Platform Serving for Statistics Professional 2021. SPSSPRO. (Version 1.0.11)[Online Application Software]. Retrieved from https://www.spsspro.com.
[2] Xu Xiaomin. Application of the Analytic Hierarchy Process[J]. Statistics and Decision, 2008(1):156-158.