2014 12

1 1
2 2
3 5
3.1 5
3.2 6
3.3 8
4 18
4.1 18
4.2 20
4.3 23
4.4 24
4.5 27
5 53
5.1 53
5.2 54
6 56
6.1 56
6.2 56
6.3 59
A 61
B 63
C 64

D 77
.....78
1 78
3 80
4 92
5 108

1

1.0.1 (“ ”)

1.0.2

1.0.3

1.0.4

1.0.5

2

2.0.1 Cutting High-slope

20m 30m

2.0.2 Accident

2.0.3 Risk

2.0.4 Safety

2.0.5 Hazard or Danger

2.0.6 Risk Factors

2.0.7 General Risk Factors

2.0.8 High Risk Factors

2.0.9 Risk Identification

2.0.10 Risk Analysis

2.0.11 Risk Estimation

2.0.12 Risk Assessment in Construction Safety

2.0.13 General Risk Assessment

2.0.14 Specific Risk Assessment

3

3.1

3.1.1

3.1.2

1 20m 30m

2

20m

3

20m

4

20m

3.1.3

3.1.4

3.1.5

3.2

3.2.1

3.2.2

3

10 5

3.2.3

5 4

R_i 4

3 2

1

W_i

$W_i=1$

$W_i=0$ $W_i=0$ 1

1 3-1

3-1

1		R_1	W_1	1 $D_r=\sum W_i \times R_i \quad \sum W_i$ i=1 5 R_i 1 4 W_i D_r 2 $D_r \geq 3.5$ 3.5 $D_r \geq 2.5$ 2.5 $D_r \geq 1.5$ D_r 1.5
2		R_2	W_2	
3		R_3	W_3	
4		R_4	W_4	
5		R_5	W_5	

3.2.4

Dr

Dr

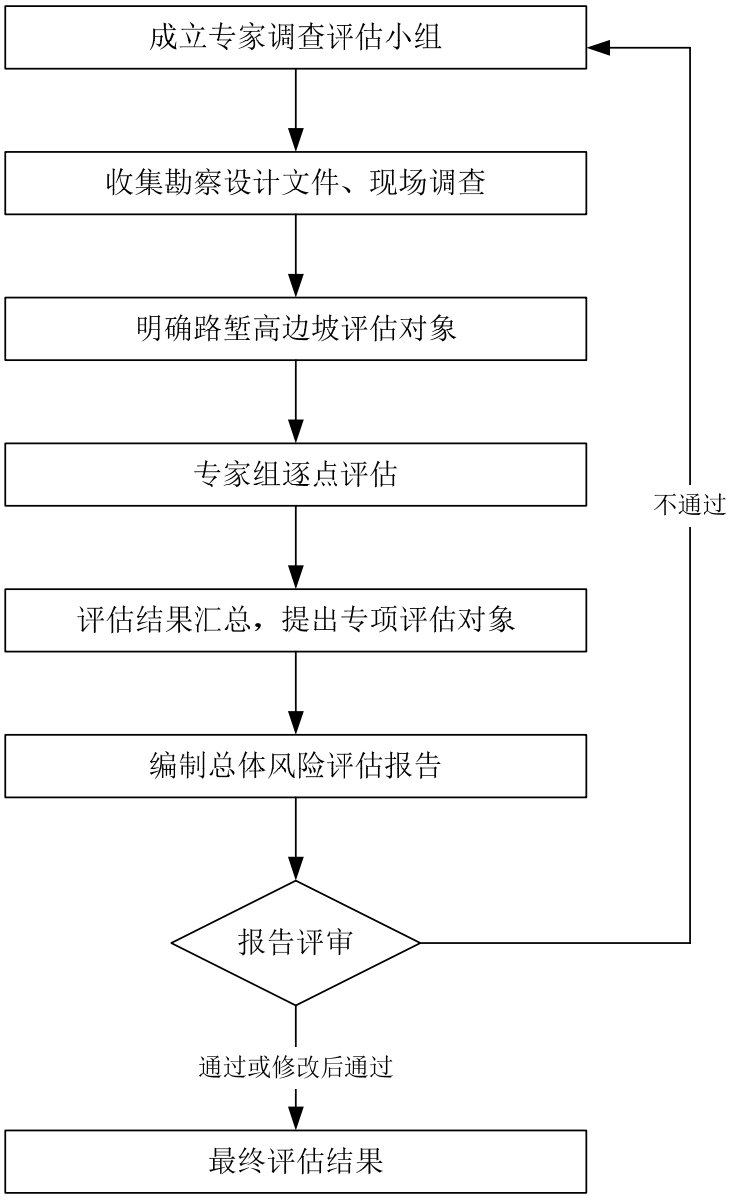
Dr ≥ 3.5

3.5 Dr ≥ 2.5

2.5 Dr ≥ 1.5

Dr 1.5

3.2.5 3-1



3-1

3.3

3.3.1

3.3.2

"

" 3-1

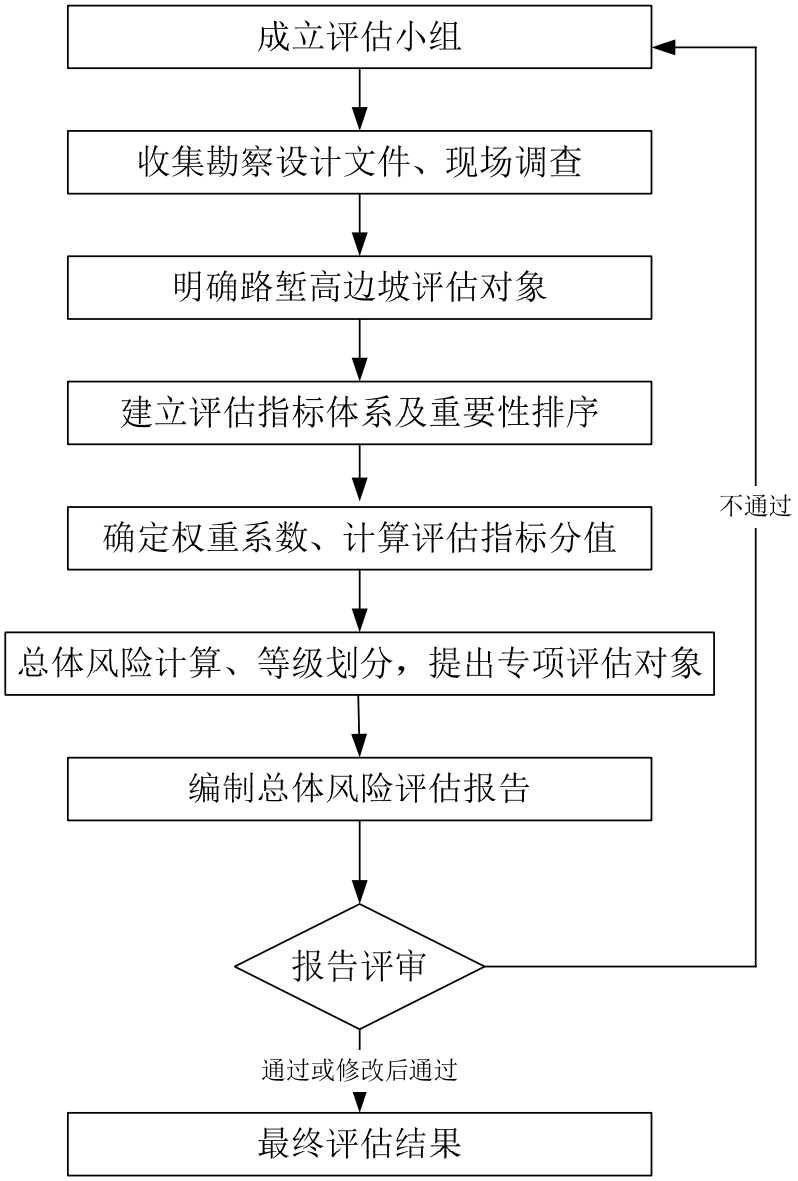
$$\gamma = \frac{2n - 2m + 1}{n^2} \qquad 3\text{-}1$$

γ —

n —

m — m ≤ n

3.3.3 3-2



3-2

3.3.4 5

3-2

3-2 11

3-2

			R_{ij}		(γ_{ij})	X_{ij}	
X_1	X_{11}	H ≥ 40m H ≥ 60m	75 100	R_{11}	γ_{11}	X_{11}= $R_{11} \times \gamma_{11}$	1 H ≥ 60m H ≥ 80m 100
		30m ≤ H<40m 40m ≤ H<60m	50 74				
		20m ≤ H<30m 30m ≤ H<40m	25 49				2 h ≥ 12m h ≥ 15m
		H<20m H<30m	0 24				h ≤ 6m h ≤ 8m h=8m h=10m 3
	X_{12}	Δα ≥ 15°	75 100	R_{12}	γ_{12}	X_{12}= $R_{12} \times \gamma_{12}$	Δα ≥ 25° 100 Δα
		10° ≤ Δα<15°	50 74				
		5° ≤ Δα<10°	25 49				
		Δα<5°	0 24				

				R_{ij}	(γ_{ij})	X_{ij}	
X_2	X_{21}		75 100	R_{21}	γ_{21}	$X_{21}=$ $R_{21}\times\gamma_{21}$	( ) 〃 〃
			50 74				
			25 49				
			0 24				
	X_{22}		75 100	R_{22}	γ_{22}	$X_{22}=$ $R_{22}\times\gamma_{22}$	$\beta=0°$ $\beta=45°$ $\beta=60°$
			50 74				
			25 49				
			0 24				

			R_{ij}		(y_{ij})	X_{ij}	
	X_{23}	0.25H	75 100	R_{23}	y_{23}	X_{23}= $R_{23} \times y_{23}$	
		0.25 0.5 H	50 74				
		0.5 0.75 H	25 49				
		0.75 1.0 H	0 24				
X_3	X_{31}	5 800mm	75 100	R_{31}	y_{31}	X_{31}= $R_{31} \times y_{31}$	5 5 1000mm 100
		5 600-800mm	50 74				

			R_{ij}		(y_{ij})	X_{ij}	
		5 300-600mm	25 49				
		5 300mm	0 24				
	X_{32}		75 100	R_{32}	y_{32}	X_{32}= $R_{32} \times y_{32}$	
			50 74				
			25 49				
			0 24				
X_4	X_{41}		75 100	R_{41}	y_{41}	X_{41}= $R_{41} \times y_{41}$	
			50 74				
			25 49				
			0 24				
	X_{42}	0.5H 1.0H	75 100	R_{42}	y_{42}	X_{42}= $R_{42} \times y_{42}$	

			R_{ij}		(y_{ij})	X_{ij}	
		1.0H 1.5H	50 74				
		1.5H 2.0H	25 49				
			0 24				
X_5	X_{51}	1	75 100	R_{51}	y_{51}	$X_{51}=$ $R_{51} \times y_{51}$	100
		2	50 74				

			R_{ij}		(y_{ij})	X_{ij}	
		3	25 49				
		3	0 24				
	X_{52}		75 100	R_{52}	y_{52}	$X_{52}=$ $R_{52} \times y_{52}$	
			50 74				
			25 49				
			0 24				

			R_{ij}		(γ_{ij})	X_{ij}	

3.3.5 3-2 3-3

$$F=\sum X_{ij} \qquad 3\text{-}2$$

$$X_{ij}=R_{ij}\,\gamma_{ij} \qquad 3\text{-}3$$

X_{ij} — i=1 2 3 4 5 j=1 2 … …

n n i

F 3-3

3-3

	F
	F 60
	45<F ≤ 60
	30<F ≤ 45
	F ≤ 30

3-2

4

4.1

4.1.1

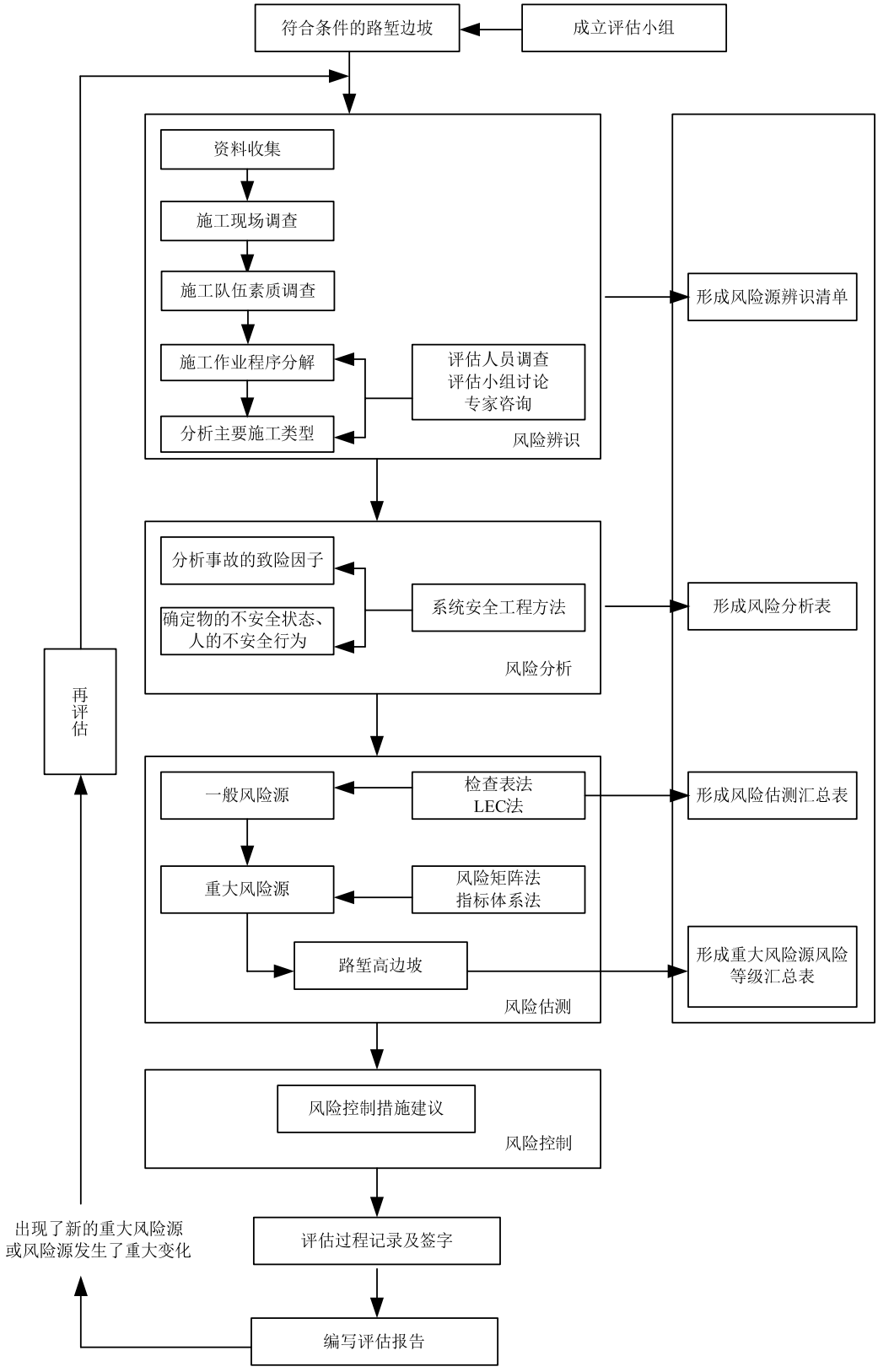
4.1.2

1

2

4.1.3

4-1


符合条件的路堑边坡
成立评估小组
资料收集
施工现场调查
施工队伍素质调查
施工作业程序分解
分析主要施工类型
评估人员调查
评估小组讨论
专家咨询
风险辨识
形成风险源辨识清单
分析事故的致险因子
确定物的不安全状态、
人的不安全行为
系统安全工程方法
风险分析
形成风险分析表
再
评
估
一般风险源
检查表法
LEC法
重大风险源
风险矩阵法
指标体系法
路堑高边坡
风险估测
形成风险估测汇总表
形成重大风险源风险
等级汇总表
风险控制措施建议
风险控制
出现了新的重大风险源
或风险源发生了重大变化
评估过程记录及签字
编写评估报告

4-1

4.1.4

4.1.5

1

2

4.2

4.2.1

4.2.2

1

2

3

4

5

4.2.3

1

2

3

4.2.4

1

2

3

4.2.5

4.2.6

A

4.2.7

4-1

4-1

1	1	
2	2	
…	…	
N	N	

4.2.8

B

4.3

4.3.1

4.3.2

4.3.3

4.3.4

4.3.5 4-2

4-2

		1	2	3	4			
1								
2								
… …								
N								

4.4

4.4.1 = ×

“ × ”

4.4.2

1

2

4.4.3

4-3

4.4.4

4-4

4-3

0.3	1		4
0.03 0.3	0.1		3
0.003 0.03	0.01		2
0.003	0.001		1

1

2

4-4

			4
			3
			2
			1

4-1

L=(1 4)H 4-1

H— m

L— m

4.4.5

4-5

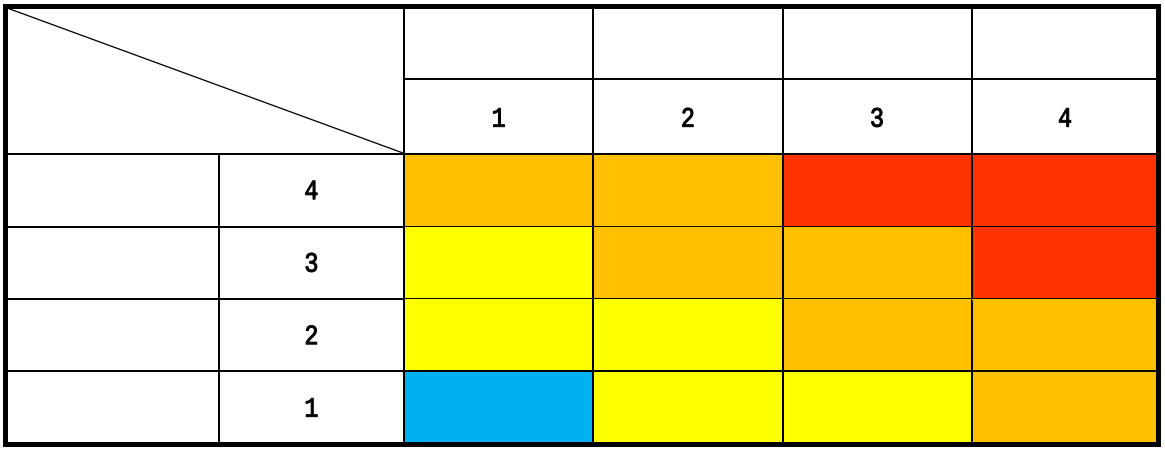
4.4.6

4-6

4-5

1	1						
2	2						
…	…						
N	N						

4-6



4.5

4.5.1

4.5.2 4-4

4.5.3

4.5.4

1 2

3 4 5

6

4.5.5

4.5.6

4-7

4.5.7

4-8

D_0

4-7

			R_{ij}		(γ_{ij})	X_{ij}	
X_1	X_{11}	H ≥ 40m H ≥ 60m	75 100	R_{11}	γ_{11}	X_{11}= $R_{11} \times \gamma_{11}$	1 H ≥ 60m H ≥ 80m 100
		30m ≤ H<40m 40m ≤ H<60m	50 74				2 h ≥ 12m h ≥ 15m
		20m ≤ H<30m 30m ≤ H<40m	25 49				h ≤ 6m h ≤ 8m h=8m
		H<20m H<30m	0 24				h=10m 3
	X_{12}	Δα ≥ 15°	75 100	R_{12}	γ_{12}	X_{12}= $R_{12} \times \gamma_{12}$	Δα ≥ 25° 100 Δα
		10° ≤ Δα<15°	50 74				
		5° ≤ Δα<10°	25 49				
		Δα<5°	0 24				
			75 100	R_{21}	γ_{21}	X_{21}= $R_{21} \times \gamma_{21}$	
			50 74				

			R_{ij}		(y_{ij})	X_{ij}	
X2	X_{21}		25 49				
			0 24				
	X_{22}		75 100	R_{22}	y_{22}	$X_{22}=$ $R_{22} \times y_{22}$	
			50 74				
			25 49				
			0 24				
X_3	X_{31}		75 100	R_{31}	y_{31}	$X_{31}=$ $R_{31} \times y_{31}$	
		2	50 74				
		1	25 49				
			0 24				

			R_{ij}		(y_{ij})	X_{ij}	
	X_{32}		75 100	R_{32}	y_{32}	$X_{32}=$ $R_{32} \times y_{32}$	
			50 74				
			25 49				
			0 24				
	X_{33}		75 100	R_{33}	y_{33}	$X_{33}=$ $R_{33} \times y_{33}$	
			50 74				
			25 49				
			0 24				

			R_{ij}		(y_{ij})	X_{ij}	
X_4	X_{41}	5 800mm	75 100	R_{41}	y_{41}	X_{41}= $R_{41} \times y_{41}$	5 5 1000mm 100
		5 600-800mm	50 74				
		5 300-600mm	25 49				
		5 300mm	0 24				
	X_{42}		75 100	R_{42}	y_{42}	X_{42}= $R_{42} \times y_{42}$	
			50 74				
			25 49				
			0 24				

			R_{ij}		(y_{ij})	X_{ij}	
X_5	X_{51}	0.5H 1.0H	75 100	R_{51}	y_{51}	$X_{51}=$ $R_{51} \times y_{51}$	
		1.0H 1.5H	50 74				
		1.5H 2.0H	25 49				
			0 24				

4-8

			D_0		
			$1.3 \le D_0 < 1.5$	D_0	0.8
			$1.2 \le D_0 < 1.3$		
			$1.1 \le D_0 < 1.2$		1.2
			$1.0 \le D_0 < 1.1$		1.3

4.5.8

4-9

4-9

			R_{ij}		(γ_{ij})	X_{ij}	
X_1	X_{11}	H 16m	75 100	R_{11}	γ_{11}	X_{11}= $R_{11} \times \gamma_{11}$	H ≥ 20m 100
		12m H ≤ 16m	50 74				
		8m H ≤ 12m	25 49				
		H ≤ 8m	0 24				
	X_{12}	α 60°	75 100	R_{12}	γ_{12}	X_{12}= $R_{12} \times \gamma_{12}$	α ≥ 70° 100
		45° H ≤ 60°	50 74				
		30° H ≤ 45°	25 49				
		H ≤ 30°	0 24				
	X_{13}	L 40m	75 100	R_{13}	γ_{13}	X_{13}= $R_{13} \times \gamma_{13}$	L ≥ 60m, 100
		30m L ≤ 40m	50 74				
		20m L ≤ 30m	25 49				
		L ≤ 20m	0 24				
X_2	X_{21}	a	75 100	R_{21}	γ_{21}	X_{21}= $R_{21} \times \gamma_{21}$	a b
		b	50 74				
		c	25 49				
			0 24				
	X_{22}		75 100	R_{22}	γ_{22}	X_{22}= $R_{22} \times \gamma_{22}$	
			50 74				
			25 49				
			0 24				

			R_{ij}		(y_{ij})	X_{ij}	
X_3	X_{31}		75 100	R_{31}	y_{31}	$X_{31}=$ $R_{31} \times y_{31}$	
			50 74				
			25 49				
			0 24				
	X_{32}	2/3	75 100	R_{32}	y_{32}	$X_{32}=$ $R_{32} \times y_{32}$	4/5 , 100
		1/3	50 74				
		1/10 1/3	25 49				
		1/10	0 24				
X_4	X_{41}		75 100	R_{41}	y_{41}	$X_{41}=$ $R_{41} \times y_{41}$	
		2 2	50 74				
		1 1	25 49				
			0 24				

			R_{ij}		(y_{ij})	X_{ij}	
	X_{42}		75 100	R_{42}	y_{42}	X_{42}= $R_{42} \times y_{42}$	
			50 74				
			25 49				
			0 24				
	X_{43}	h>24m	75 100	R_{43}	y_{43}	X_{43}= $R_{43} \times y_{43}$	h ≥ 30m 100
		16m<h ≤ 24m	50 74				
		8m<h ≤ 16m	25 49				
		h ≤ 8m	0 24				
X_5	X_{51}		75 100	R_{51}	y_{51}	X_{51}= $R_{51} \times y_{51}$	GB50021-2001
			50 74				
			25 49				
			0 24				
			75 100	R_{52}	y_{52}	X_{52}= $R_{52} \times y_{52}$	

			R_{ij}		(y_{ij})	X_{ij}	
	X_{52}		50 74				
			25 49				
			0 24				
	X_{53}		75 100	R_{53}	y_{53}	X_{53}= $R_{53} \times y_{53}$	
			50 74				
			25 49				
			0 24				

4.5.9

4-10

4-10

			(R_{ij})		(γ_{ij})	(X_{ij})	
X_1	X_{11}	$L \geq 35m$	75 100	R_{11}	γ_{11}	$X_{11}=$ $R_{11} \times \gamma_{11}$	$L \geq 45m$ 100
		$25m \leq L$ 35m	50 74				
		$15m \leq L$ 25m	25 49				
		L 15m	0 24				
	X_{12}	h	75 100	R_{12}	γ_{12}	$X_{12}=$ $R_{12} \times \gamma_{12}$	
			50 74				
			25 49				
			0 24				
X_2	X_{21}		75 100	R_{21}	γ_{21}	$X_{21}=$ $R_{21} \times \gamma_{21}$	
			50 74				
			25 49				
			0 24				
	X_{22}	30 °	75 100	R_{22}	γ_{22}	$X_{22}=$ $R_{22} \times \gamma_{22}$	40 ° 100
		20 ° 30 °	50 74				
		10 ° 20 °	25 49				
		10 °	0 24				

			(R_{ij})		(y_{ij})	(X_{ij})	
	X_{23}		75 100	R_{23}	y_{23}	$X_{23}=$ $R_{23} \times y_{23}$	
			50 74				
			25 49				
			0 24				
X_3	X_{31}		75 100	R_{31}	y_{31}	$X_{31}=$ $R_{31} \times y_{31}$	0.5 1.0m
			50 74				
			25 49				
			0 24				
	X_{32}		75 100	R_{32}	y_{32}	$X_{32}=$ $R_{32} \times y_{32}$	
			50 74				
			25 49				
			0 24				
X_4	X_{41}		75 100	R_{41}	y_{41}	$X_{41}=$ $R_{41} \times y_{41}$	
			50 74				
			25 49				
			0 24				

			(R_{ij})		(y_{ij})	(X_{ij})	
	X_{42}		75 100	R_{42}	y_{42}	$X_{42}=$ $R_{42} \times y_{42}$	10m
			50 74				
			25 49				
			0 24				
	X_{43}		75 100	R_{43}	y_{43}	$X_{43}=$ $R_{43} \times y_{43}$	
			50 74				
			25 49				
			0 24				

4.5.10

4-11

4-11

			(R_{ij})		(γ_{ij})	(X_{ij})	
X_1	X_{11}	H 12m	75 100	R_{11}	γ_{11}	$X_{11}=$ $R_{11}\times\gamma_{11}$	H ≥16m 100
		10m H≤12m	50 74				
		8m H≤10m	25 49				
		H≤8m	0 24				
	X_{12}		75 100	R_{12}	γ_{12}	$X_{12}=$ $R_{12}\times\gamma_{12}$	
			50 74				
			25 49				
			0 24				
	X_{13}	h_0 4m	75 100	R_{13}	γ_{13}	$X_{13}=$ $R_{13}\times\gamma_{13}$	h_0 ≥5m 100
		2.5m h_0≤4m	50 74				
		1.5m h_0≤2.5m	25 49				
		h_0≤1.5m	0 24				
X_2	X_{21}		75 100	R_{21}	γ_{21}	$X_{21}=$ $R_{21}\times\gamma_{21}$	
			50 74				
			25 49				
			0 24				

			(R_{ij})		(y_{ij})	(X_{ij})	
	X_{22}		75 100	R_{22}	y_{22}	X_{22}= $R_{22} \times y_{22}$	30% 30% 50% 50% 70% 70%
			50 74				
			25 49				
			0 24				
	X_{23}	4m	75 100	R_{23}	y_{23}	X_{23}= $R_{23} \times y_{23}$	5m 100
		2 4m	50 74				
		0 2m	25 49				
			0 24				
X_3	X_{31}	L>12m	75 100	R_{31}	y_{31}	X_{31}= $R_{31} \times y_{31}$	
		10m L ≤ 12m	50 74				
		8m L ≤ 10m	25 49				
		L ≤ 8m	0 24				
	X_{32}	h>16m	75 100	R_{32}	y_{32}	X_{32}= $R_{32} \times y_{32}$	h ≥ 20m 100
		10m<h ≤ 16m	50 74				
		6m<h ≤ 10m	25 49				
		h ≤ 6m	0 24				

			(R_{ij})		(y_{ij})	(X_{ij})	
X_4	X_{41}		75 100	R_{41}	y_{41}	$X_{41}=$ $R_{41} \times y_{41}$	10m
			50 74				
			25 49				
			0 24				

4.5.11

4-12

4-12

			(R_{ij})		(y_{ij})	(X_{ij})	
X_1	X_{11}	R 3.0m	75 100	R_{11}	y_{11}	$X_{11}=$ $R_{11} \times y_{11}$	R 3.6m 100
		2.0m R≤3.0m	50 74				
		1.5m R≤2.0m	25 49				
		R≤1.5m	0 24				
	X_{21}		75 100	R_{21}	y_{21}	$X_{21}=$ $R_{21} \times y_{21}$	
			50 74				
			25 49				
			0 24				

			(R_{ij})		(y_{ij})	(X_{ij})	
X_2	X_{22}		75 100	R_{22}	y_{22}	$X_{22}=R_{22}\times y_{22}$	30% 30% 50% 50% 70% 70%
			50 74				
			25 49				
			0 24				
	X_{23}		75 100	R_{23}	y_{23}	$X_{23}=R_{23}\times y_{23}$	
			50 74				
			25 49				
			0 24				
X_3	X_{31}	$S\geq 2m$	75 100	R_{31}	y_{31}	$X_{31}=R_{31}\times y_{31}$	$S\geq 3m$ 100
		1m S 2m	50 74				
		0 $S\leq 1m$	25 49				
		S=0	0 24				
	X_{32}	>1.5m	75 100	R_{32}	y_{32}	$X_{32}=R_{32}\times y_{32}$	$S\geq 2.5m$ 100
		1 $S\leq 1.5m$	50 74				
		0.5 $S\leq 1m$	25 49				
		$S\leq 0.5m$	0 24				
	X_{33}		75 100	R_{33}	y_{33}	$X_{33}=R_{33}\times y_{33}$	
			50 74				
			25 49				
			0 24				

			(R_{ij})		(y_{ij})	(X_{ij})	
X_4	X_{41}		75 100	R_{41}	y_{41}	X_{41}= $R_{41} \times y_{41}$	10m
			50 74				
			25 49				
			0 24				

4.5.12

4-13

4-13

			(R_{ij})		(y_{ij})	(X_{ij})	
X_1	X_{11}	R 30cm	75 100	R_{11}	y_{11}	X_{11}= $R_{11} \times y_{11}$	R ≥ 36cm 100
		20cm R ≤ 30cm	50 74				
		10cm R ≤ 20cm	25 49				
		R ≤ 10cm	0 24				

			(R_{ij})		(γ_{ij})	(X_{ij})	
X_2	X_{21}		75 100	R_{21}	γ_{21}	$X_{21}=R_{21}\times\gamma_{21}$	
			50 74				
			25 49				
			0 24				
	X_{22}		75 100	R_{22}	γ_{22}	$X_{22}=R_{22}\times\gamma_{22}$	
			50 74				
			25 49				
			0 24				
X_3	X_{31}		75 100	R_{31}	γ_{31}	$X_{31}=R_{31}\times\gamma_{31}$	
			50 74				
			25 49				
			0 24				
	X_{32}	P 5.0 MPa	75 100	R_{32}	γ_{32}	$X_{32}=R_{32}\times\gamma_{32}$	P≥5.5 MPa 100
		3.0 MPa P≤5.0 MPa	50 74				
		1.0 MPa P≤3.0 MPa	25 49				
		P≤1.0 MPa	0 24				
	X_{41}		75 100	R_{41}	γ_{41}	$X_{41}=R_{41}\times\gamma_{41}$	
			50 74				

			(R_{ij})		(y_{ij})	(X_{ij})	
X_4							
			25 49				
			0 24				
	X_{42}		75 100	R_{42}	y_{42}	$X_{42}=$ $R_{42} \times y_{42}$	10m
			50 74				
			25 49				
			0 24				

4.5.13

4-14 $M=A+B+C+D+E+F+G+H+I+J$

4-15

λ

4-14

A		2	
		1	
		0	
B		2	
		0	
C		2	
		0	
D		2	
		1	
		0	
E		2	3 1 2
		1	
		0	
F		2	″ A B C ″
		1	
		0	
G		2	
		1	
		0	
		2	
		1	

H		0	
I		2	
		1	
		0	
J		2	
	2	1	
	3	0	

4-15

M	λ
M≥15	1.2
12≤M 15	1.1
9≤M 12	1
6≤M 9	0.9
M 6	0.8

4.5.14 4-2

4-3

$$P=\lambda \cdot D_0 \sum X_{ij} \qquad 4\text{-}2$$

$$X_{ij}=R_{ij}\,\gamma_{ij} \qquad 4\text{-}3$$

X_{ij}— i=1 2 … … m j=1 2 … …

n m n i

D_0 — 4-8

D_0=1

λ —

P P 4-16

4.5.15

4-6

4-16

		P
	4	P 60
	3	45<P ≤ 60
	2	30<P ≤ 45
	1	P ≤ 30

4.5.16

4-17

4-17

1						
… …						
N						

5

5.1

5.1.1

5-1

5-1

5.1.2

5-2

5-2

5.2

5.2.1

5.2.2

5.2.3

5.2.4

5.2.5

1

2

5.2.6

1

2

3

5.2.7

1

2

5.2.8 C

6

6.1

6.1.1

6.1.2

6.1.3

6.2

6.2.1

1

1

2

3

4

5

2

1

2

3

3

4

5

6

1

2

3

4

7

6.2.2

1

1

2

3

4

5

6

2

3

4

5

6

1

2

3

4

7

6.2.3

1

2

3

4

5

6

6.2.4

1

2

3

6.3

6.3.1

6.3.2

6.3.3

6.3.4

A

A-1

1			→ →
			→ → → →
2			→ →
3			→ → → →
4			→ → → → → → → → → →
5			→ → → → → → → → →
6			4 5

7		→ → → → → → →	
8		→ → → → → → →	
9		→ → → → → → →	
10		→ → → → →	
11		→ → → → → →	
12		→ → →	

B

B-1

1		√		√	√	√					
2		√			√	√	√	√		√	
3		√		√	√						
4			√	√	√	√	√	√	√		√
5		√	√		√	√	√	√		√	√
6		√		√	√	√		√		√	
7		√	√	√	√	√		√	√	√	√
8		√	√	√	√	√		√	√	√	√
9		√				√		√		√	
10			√			√	√	√		√	√
11		√			√	√		√			
12				√	√						
13				√	√	√					
14				√	√	√					

C

C-1

	1	1 2 3	1 2 3 4 1 5 6
	2	1 2	1 2 3
	3	1	1

		2	2
	4	1 2 3	1 2
	5	1 2 3	1 2 3m
	6	1 2	1 5m 2 15

C-2

	1	1 2 3	1 2 1 3 4
	2	1 2	1 2 3 4
	3	1 2 3	1 2 3
	4		1

		1 2	2 10 15m 4 6 10m 45° 1 1 3 4
	5	1 2	1 2 3

C-3

		1	1 “ ” 2
	1	2	3 4
		3	5 6
		1	1
	2	2	2 3 0.5m 4 5
	3	1	1 1.2m 2

		2	3 4 5
	4	1 2	1 2 10m 2 3m^3 10 20min 3
	5	1 2 3	1 36V 2 3
	6	1	1

		2	2

C-4

	1	1 2	1 2 3 4 5
	2	1 2	1 2 3
	3	1 2	1 2 3

C-5

	1	1 2 3	1 2 0.5m 1.0m 3 1.5×1.5m 2.5×2.5m 4 5
	2	1 2 3 4 5 6	1 2 10m 2 3m^3 10 20 3 4 5 6
	3	1	1

		2	2 3 4 5 6 “ ”
	4	1 2 3	1 36V 2 3

C-6

	1	1	1 2 3 1 4 〃 〃 5 6
	2	1 2	1 2 3 4
	3	1	1

		2 3	2 3
	4	1 2 3	1 36V 2 3
	5	 1 2	1 2 10 15m 4 6 10m 45° 1 1 3 4
	6	1	1

		2	2 3
	7	1 2	 1 2 3 0.5m 4 5
	8	1 2	1 2 10m 2 3m³ 10 20min 3
	9	1 2	 1 2

D

1

“ ”

“ ”

2

“ ”

“ ” “ ”

3

“ ”

“ ”

“ ”

1

1.0.2

1.0.3

1-1

A.1-1

1.0.4

3

3.1

3.1.2 20m 30m

500

20m 30m

3.1.3

3.1.4

3.2

3.2.1

3.2.2

1

2 :

3

4

5

〃 〃

3.2.3

5 4

D_r

3.2.4

D_r

D_r

3.2.5

3.3

3.3.1

3.3.2

"

"

A.3-1

A.3-1

		1	2	3	4	5	6	7	8	9	10	11	12	
	y	1.00	—	—	—	—	—	—	—	—	—	—	—	∑ y=1
	y	0.75	0.25	—	—	—	—	—	—	—	—	—	—	∑ y=1
	y	0.56	0.33	0.11	—	—	—	—	—	—	—	—	—	∑ y=1
	y	0.44	0.31	0.19	0.06	—	—	—	—	—	—	—	—	∑ y=1
	y	0.36	0.28	0.20	0.11	0.05	—	—	—	—	—	—	—	∑ y=1
	y	0.31	0.25	0.19	0.14	0.08	0.03	—	—	—	—	—	—	∑ y=1
	y	0.27	0.22	0.18	0.14	0.10	0.06	0.03	—	—	—	—	—	∑ y=1
	y	0.23	0.20	0.17	0.14	0.11	0.08	0.05	0.02	—	—	—	—	∑ y=1
	y	0.21	0.19	0.16	0.14	0.11	0.09	0.06	0.03	0.01	—	—	—	∑ y=1
	y	0.19	0.17	0.15	0.13	0.11	0.09	0.07	0.05	0.03	0.01	—	—	∑ y=1
	y	0.17	0.16	0.14	0.12	0.11	0.09	0.07	0.06	0.04	0.03	0.01	—	∑ y=1
	y	0.16	0.15	0.13	0.12	0.10	0.09	0.08	0.06	0.05	0.03	0.02	0.01	∑ y=1

"

"

1

1

2

3

4

$x_1, x_2, \ldots, x_n$ A.3-2

A.3-2

	x_1	x_2	...	x_n
x_1				
x_2				
...				
x_n				

T.L. Saaty 1-9

A.3-3

A.3-3

1	
3	
5	
7	
9	
2,4,6,8	
	i j b_{ij} j i $b_{ji}=1/b_{ij}$

λ_{max}

ω

CR CR<0.1

$$CR = \frac{CI}{RI}$$

CI

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

n

RI

A.3-4

A.3-4 **RI**

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.89	1.12	1.26	1.36	1.41	1.46	1.49

$$C_j = \frac{2\left(G_{jm2} - G_{j1} - G_{j2}\right)\left(G_{j2} - G_{j1}\right)}{\left(G_{jm2} - G_{jm1}\right)}$$

C_j —

G_{jm2} G_{jm1} —

G_{j2} G_{j1} —

G_{jm2} G_{jm1}

G_{j2} G_{j1}

$$W = \frac{1}{\sum}[C_1, C_2, C_3, C_4]$$

2

Checklist

“ ”

3.3.3

3-1

3-2

F 3-2

3.3.4

1

1

2

φ

φ

2

1

JTG C20—2011

1

2

3

2

JTG C20—2011

〃 〃

1:500 1:2000 1:200 1:1000

1:200 1:500

20m

3.3.5

4

4.1

4.1.2

5 11

11

1

1

2

3

4

5

4.1.5

4.2

4.2.1

4.2.7 B

4.3

4.3.1

1

2

3

4

5

6

4.3.2

1

2

3

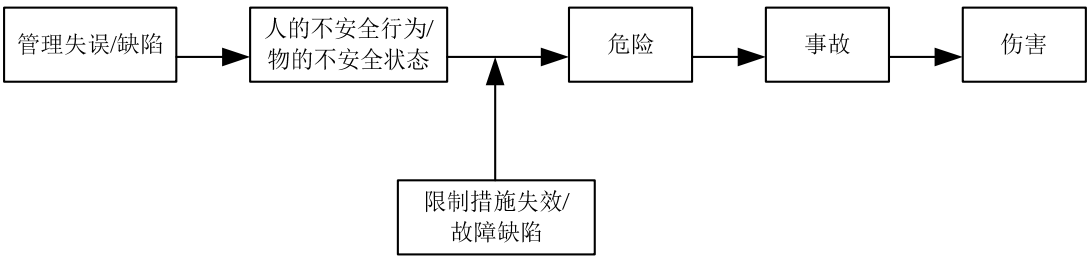
1

2

4.3.4

1

A.4-1



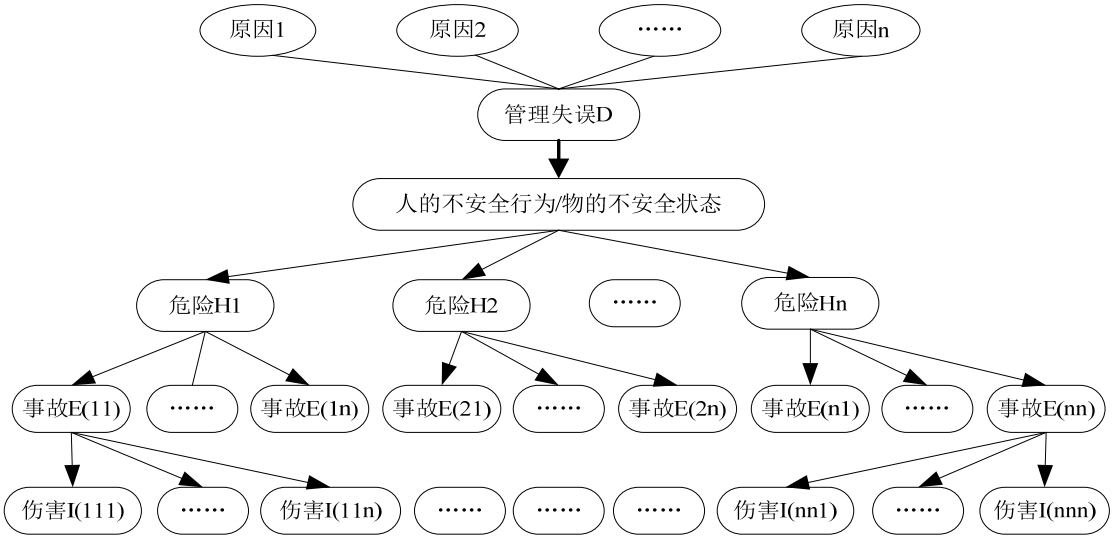
A.4-1

D

H_1 H_2 … … H_n

I_{111} I_{112} … … I_{nnn}

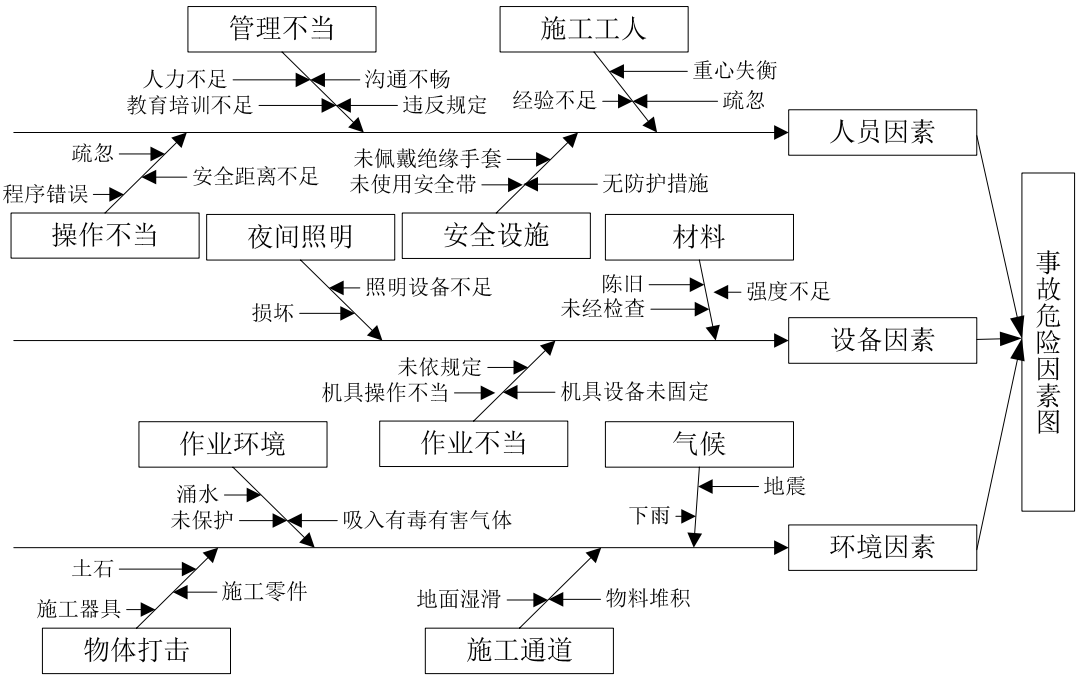
A.4-2


原因1
原因2
……
原因n
管理失误D
人的不安全行为/物的不安全状态
危险H1
危险H2
……
危险Hn
事故E(11)
……
事故E(1n)
事故E(21)
……
事故E(2n)
事故E(n1)
……
事故E(nn)
伤害I(111)
……
伤害I(11n)
……
……
……
伤害I(nn1)
……
伤害I(nnn)

A.4-2

2

“ ” A.4-3


管理不当
施工工人
人力不足
沟通不畅
教育培训不足
违反规定
重心失衡
经验不足
疏忽
人员因素
疏忽
安全距离不足
程序错误
操作不当
未佩戴绝缘手套
未使用安全带
无防护措施
夜间照明
安全设施
材料
照明设备不足
损坏
陈旧
强度不足
未经检查
设备因素
事故危险因素图
未依规定
机具操作不当
机具设备未固定
作业环境
作业不当
气候
涌水
未保护
吸入有毒有害气体
地震
下雨
环境因素
土石
施工器具
施工零件
物体打击
地面湿滑
物料堆积
施工通道

A.4-3

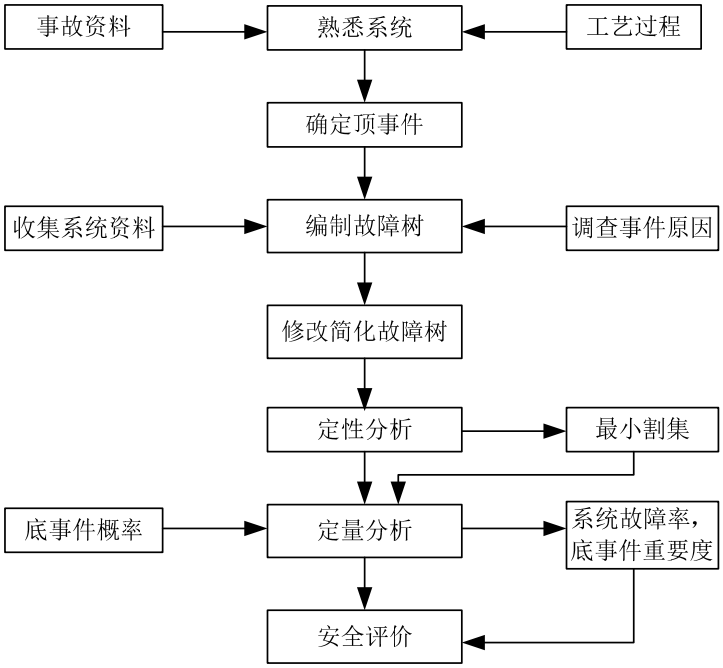
1

2

- -

3

A.4-4



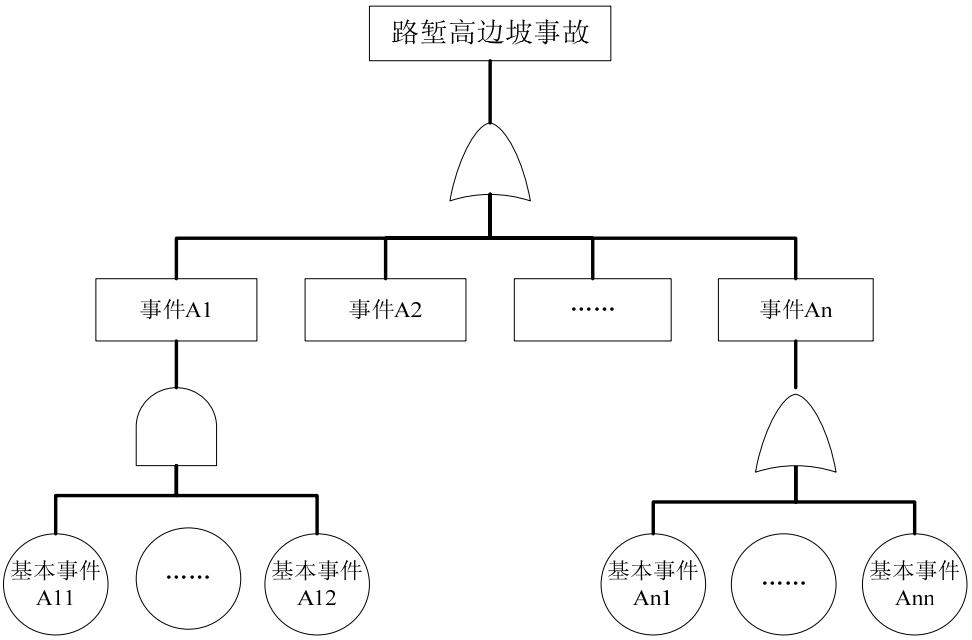
A.4-4

A.4-5

A_1 A_2 … … A_n B_1

B_2 … … B_n A_{11} A_{12} … … A_{nn}

B_{11} B_{12} … … B_{nn}



A.4-5

4.4

4.4.2

LEC

LEC

1

2

L— E—

C—

3 L E C

L E C

D

$$D=L\times E\times C$$

L— A.4-1

E—

A.4-2

C— A.4-3

D—

A.4-4

A.4-1 **L**

	10	6	3	1	0.5	0.2	0.1

A.4-2 **E**

	10	6	3	2	1	0.5

A.4-3 C

	100	40	15	7	3	1
	10	3 9	1			

A.4-4

D	≥320	≥160 320	≥70 160	≥20 70	20
	5	4	3	2	1

1 2 3

5

4.4.4

A.4-5 A.4-6

1

A.4-5

A.4-5

	1	2	3	4
	1≤ <2 1≤ <9	3≤ <9 10≤ <49	10≤ <29 50≤ <99	≥30 ≥100

2

A.4-6

A.4-6

	1	2	3	4
	100≤Z 1000	1000≤Z 5000	5000≤Z 10000	Z≥10000

4.5

4.5.3

6

6

4.5.6

5 10

2

3

10

10

4.5.7

4.5.8

4.5.9

4.5.10

4.5.11

〃 〃

4.5.12

4.5.13

10

5

5.1

5.1.1

5.1.2