



**China and The United States Security And Disaster Rescue
Coordination Workshop**

Karamay to Tacheng wind blowing snow control technology on the highway

**China xinjiang traffic science research institute
Liu Jian researcher
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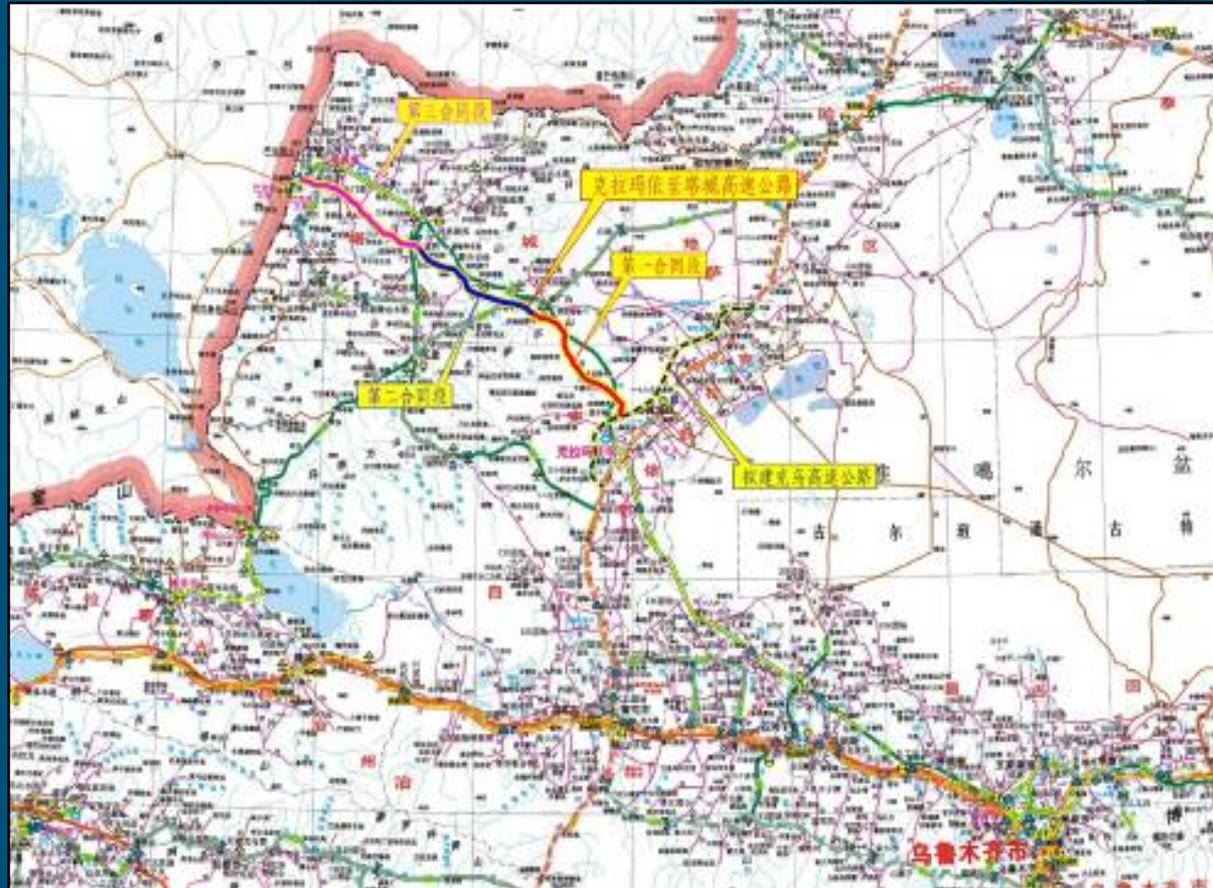




1.1 Project background

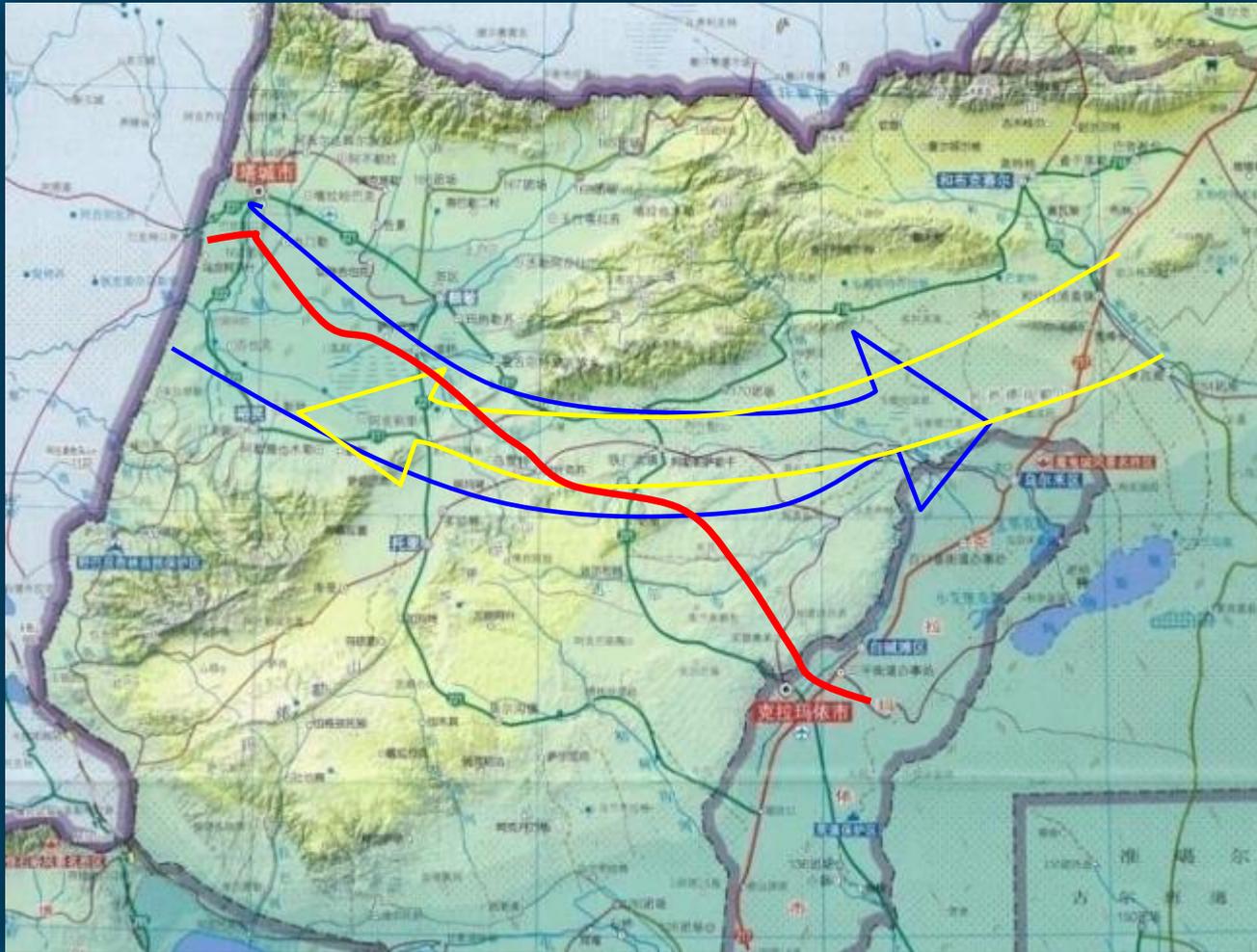


Karamay - Tacheng into the highway is the national high speed highway network planning, lianyungang to huerguos highway link, as well as the xinjiang "two vertical and three horizontal ring eight channel" is an important part of the skeleton channel three main highways, is the 12th five-year plan of major projects in xinjiang, line the total length of 217.714 km.





1.2 Route corridor with location



Route corridor with passing into old tuyere - based, wind area. The region's largest stable snow thickness up to 1.26 meters, maximum wind speed 41 meters per second, something caused by special terrain two-way alternate wind, wind and snow disasters.



1.3 Route corridor with snow



Every winter snow disasters is very serious, the region, resulting in traffic, vehicle were buried, casualties, greatly affecting the local people's production and living.



Half filling and half digging of snow



Visibility



Excavation roadbed snow



Cars were buried



Livestock froze to death



2 The snow disaster research



The project field research stage, in view of the storm deposits and low visibility, carried out within the route corridor with wind speed and direction, move the snow observation, section snow, disaster geomorphologic 3 d scanning, snow damage aerial photography and so on a series of work, preliminary found out the snow hazards along the highway.



Wind speed observation



Field reconnaissance route



Vehicle route reconnaissance



Move the snow observation



Disaster geomorphologic 3 d scanning



2 The snow disaster research



In December 2012, aerial photography





3 The road snow damage distribution



A contract period:K65+000~K79+544.5

This road is located in the mountains high, the terrain ups and downs is bigger, more excavation mountain; Dominant wind direction for the west wind, wind direction and route Angle of $30^{\circ} \sim 60^{\circ}$; Affected by the west wind, lee deposition seriously, the largest snow thickness of 1.8 m. The leeward sedimentary sections of harm is serious.



K70 sections



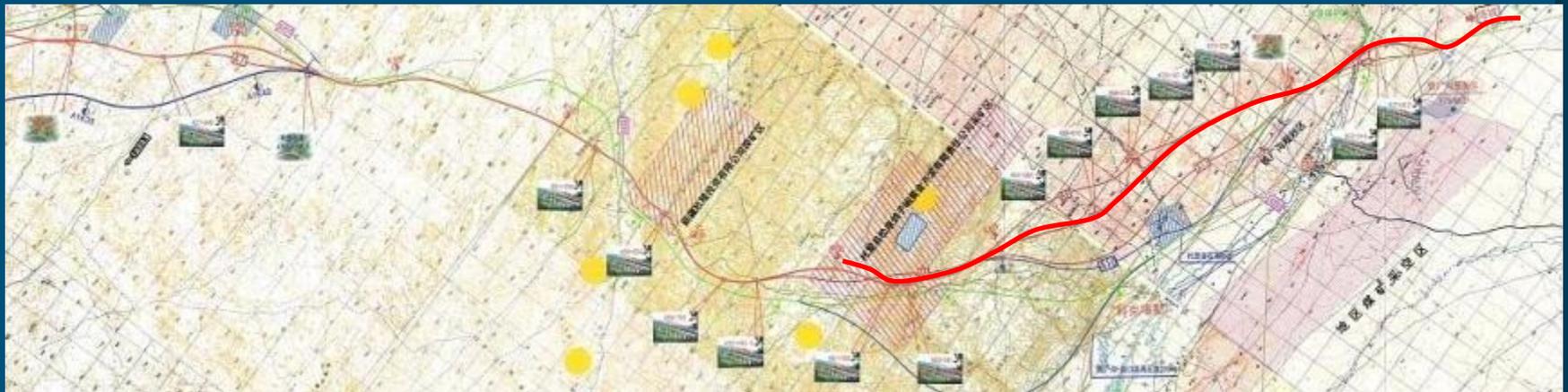
K75 sections



K80 sections



K82 sections





3 The road snow damage distribution



The second contract section:K83+618~K147+903.35

This section of the road runs from the Tal Bach mountains to the north, and the summer mountain, for the day to add 'in southeast mountain, form the opening in the west and low in the middle of the basin, the low terrain northeast Gao Xina, elevation between 470 ~ 1800, local road broken terrain, influenced by things two-way wind, snow resistance, visibility damage is serious.



K95 sections



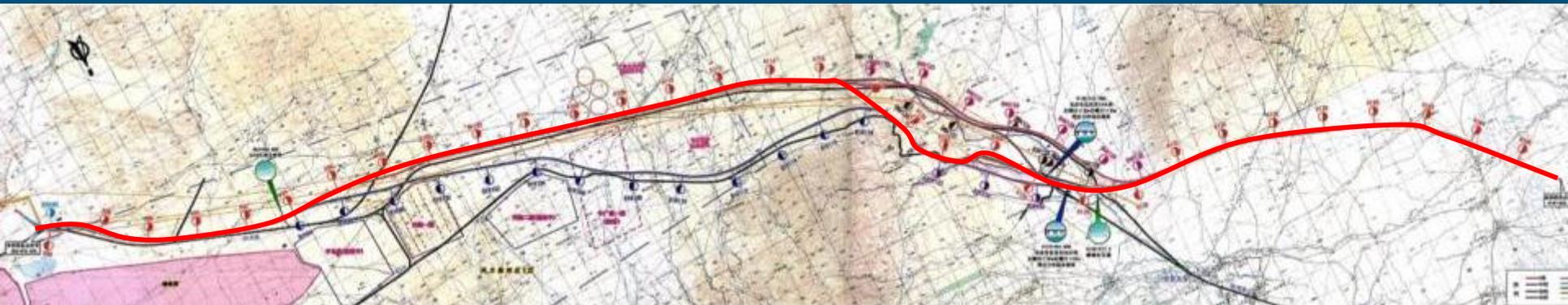
K103 sections



K136 sections



K145 sections





3 Road snow damage distribution



Three contract section: K148 + 000 ~ K219 + 900

This road is located in tal Bach taishan with crookshanks - ur karma between sal mountain, belong to the tower of basin tectonic on tuscaloosa - EMin mountain sag area, open terrain, the terrain ups and downs, wind direction and route Angle of 5° ~ 10° or so, the largest snow thickness of 1.2 m, the leeward sedimentary sections of harm is serious.



K155 sections



K160 sections



K170 sections



K185 sections

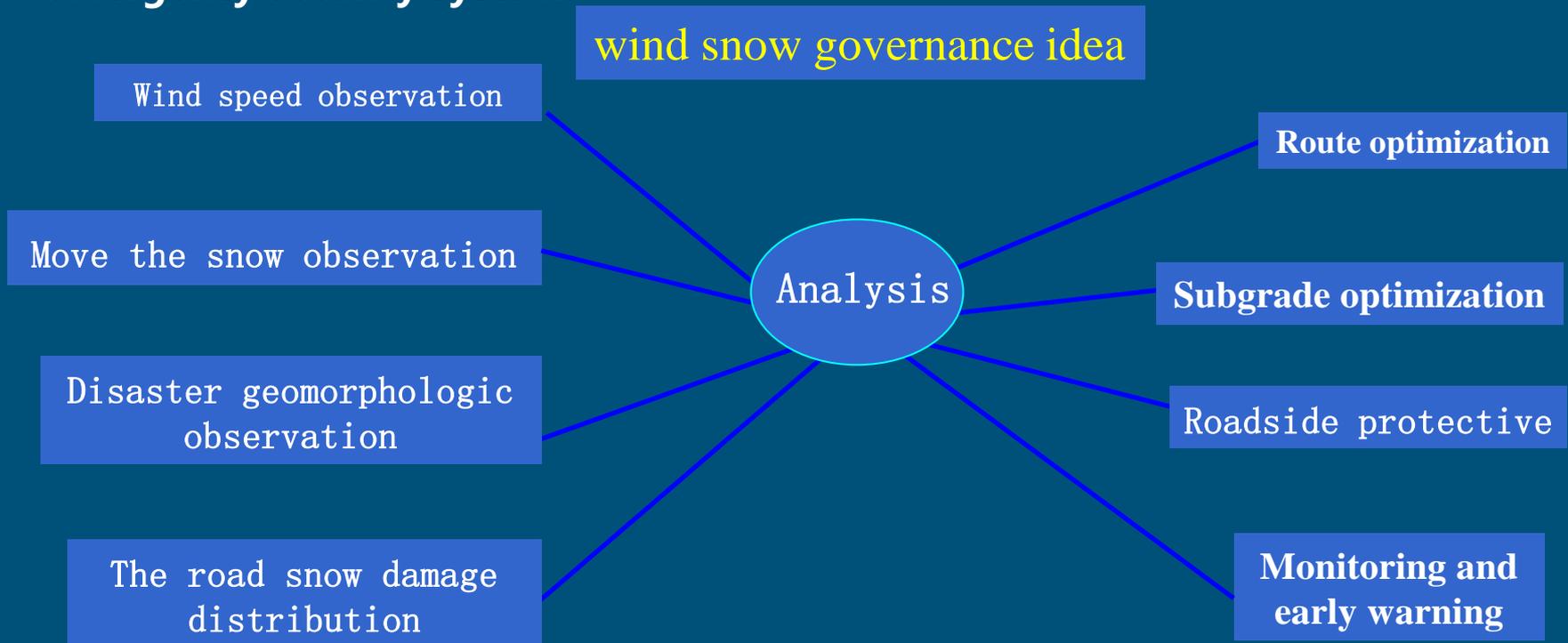




4.1 Wind blowing snow governance overall train of thought



Through the field observation and survey data, combined with domestic and international highway snow damage prevention and control technology, comprehensive analysis g - tower road snow damage prevention and control of key technologies as follows: (1) road snow disaster prevention technologies; to select (2) the reasonable embankment height and cross section design; (3) roadside engineering protection measures; (4) monitoring and early warning and emergency security system.





4.2 Road snow disaster prevention technology to select



Route optimization—More solutions than choose

Route of the project is located in the old tuyere - based, wind area, route inevitably through the wind and snow area, the early stage of the project, after many field reconnaissance, the route course arrangement on flat, open excavation or avoid leeward slope sections such as easy to snow. K116 ~ K122 conditions particularly difficult road construction, and strive for the shortest route through, and appropriately increase the height.



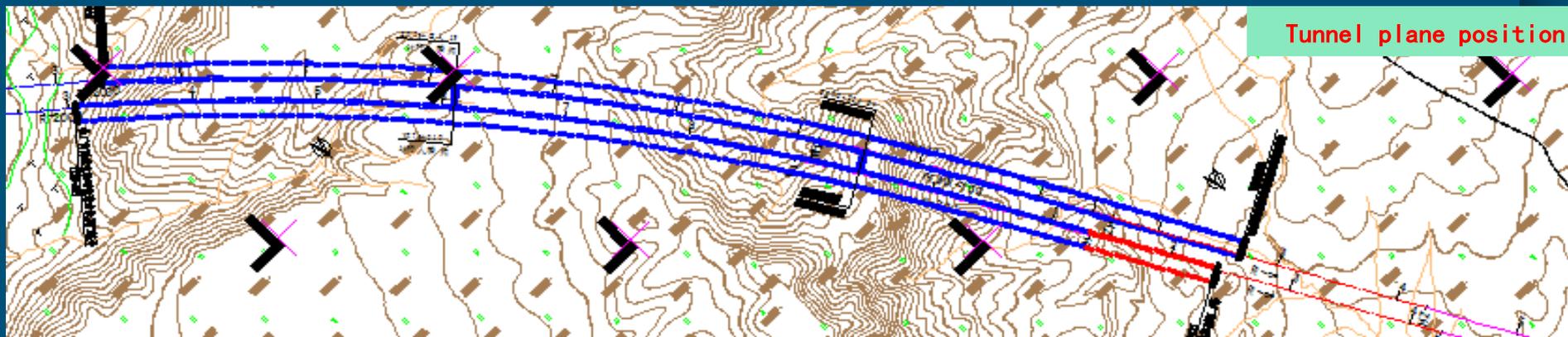
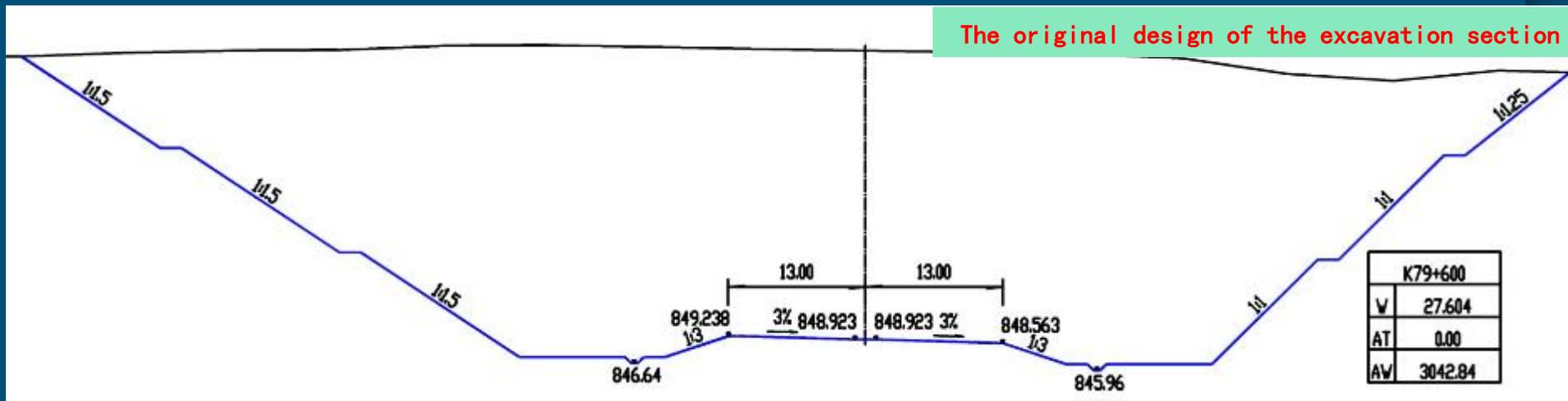


4.2 Road snow disaster prevention technology to select



Route optimization - bridge + tunnel engineering

K79 + 305 -K80 + 270 road through the mountain area, the excavation depth of 24 - 34 m. This road is located in the snow area, excavation cutting inevitably cause storm deposits, by comparison, the bridge and tunnel scheme.





4.2 Reasonable embankment height and cross section design



Subgrade optimization—Separated subgrade

Separated Subgrade Strength

Cancel the zoning in the fence

Cancel the roadside guardrail

Cancel the anti-dazzle facility





4.2 reasonable embankment height and cross section design



Subgrade optimization – engineering measures



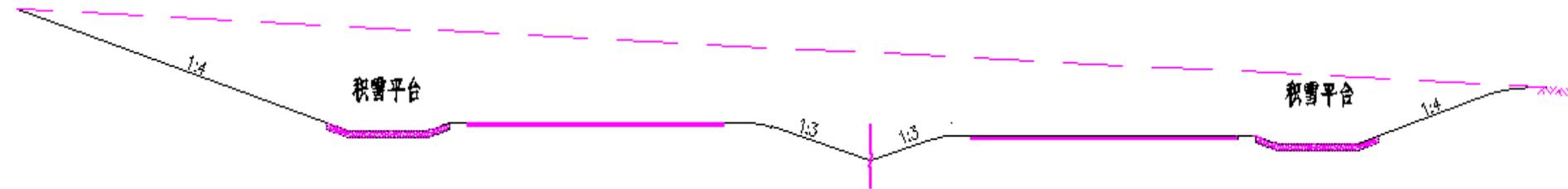
Snow flow can smoothly through the pavement, cause no Yang xue, improve visibility



4.2 Reasonable embankment height and cross section design



Subgrade optimization – engineering measures



Open a streamlined, cutting type embankment, not only ensure the snow flow smoothly through, and avoid the road buried by snow.

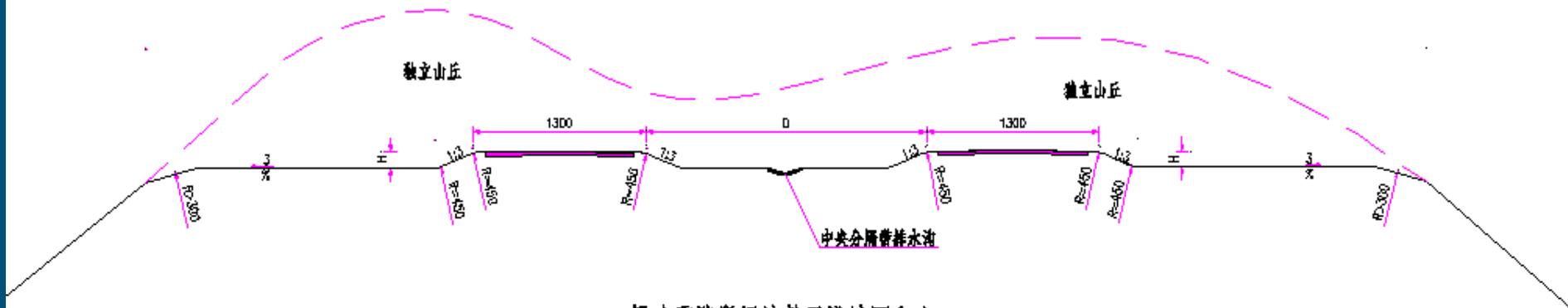


4.2 Reasonable embankment height and cross section design

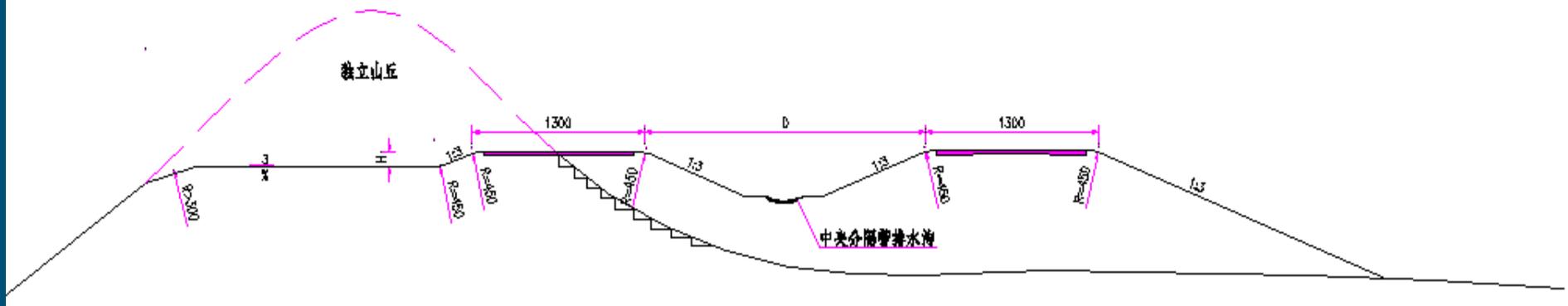


Subgrade optimization - engineering measures

风冰雪路段场地整平设计图(一)



风冰雪路段场地整平设计图(二)

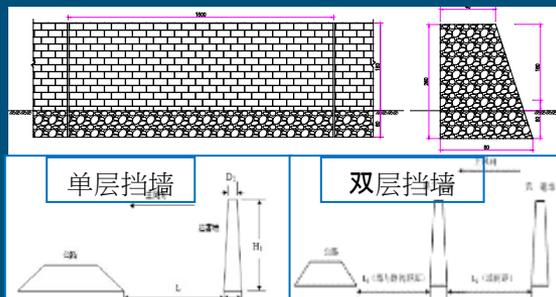




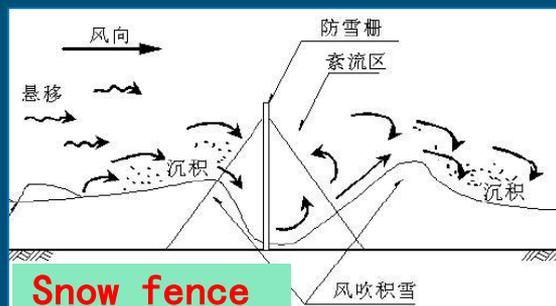
4.3 Roadside engineering protection measures



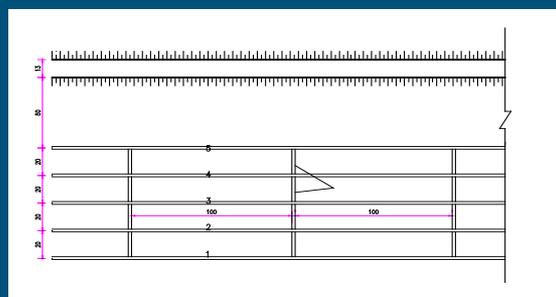
Roadside engineering protection measures



Retaining wall of snow



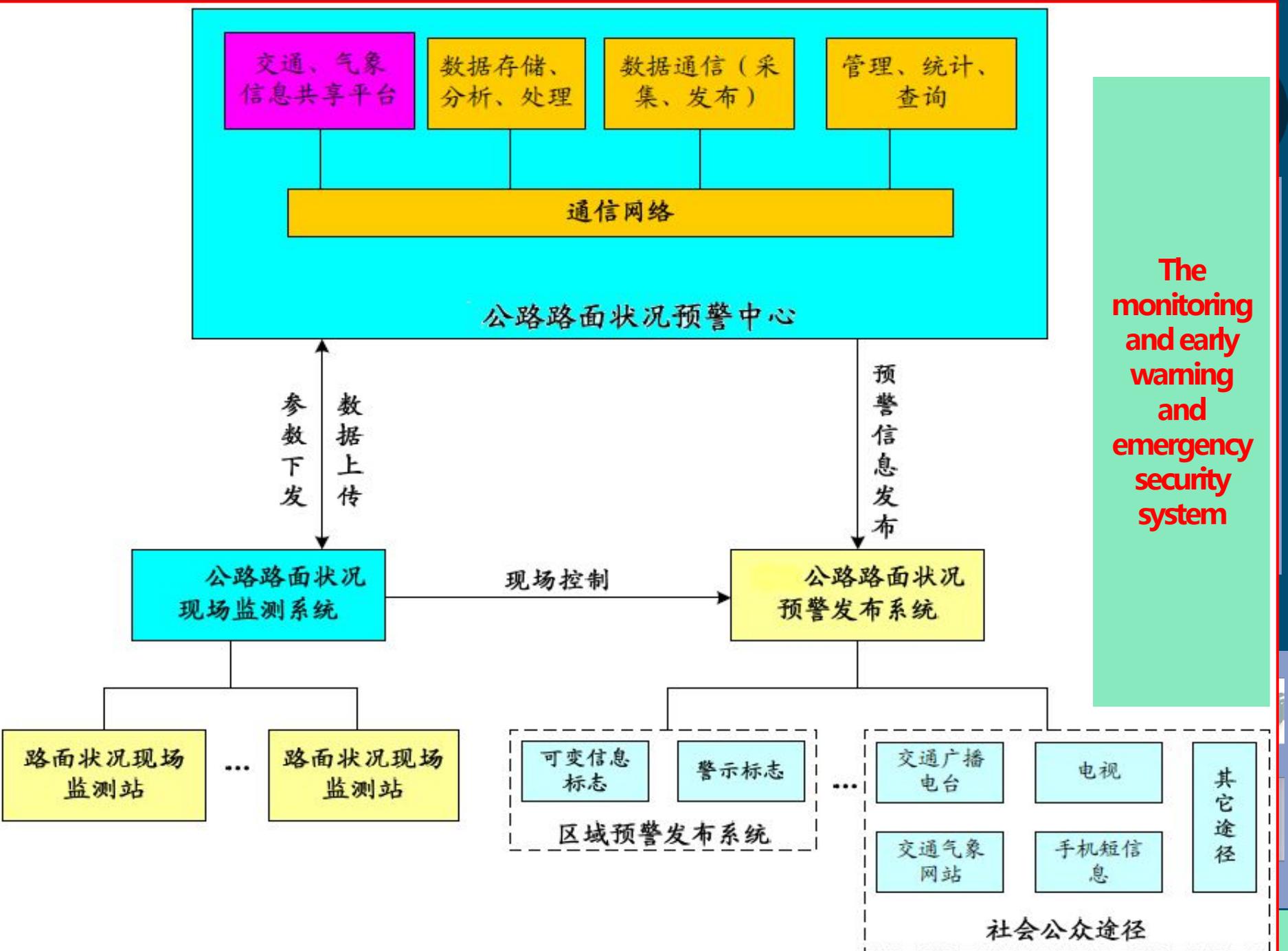
Snow fence



snow drift prevention forest

防风雪设施一览表

起讫桩号	位置	长度 单侧计	防雪墙	防雪网	防雪林
K88+000~K88+400	两侧	800		✓	
K88+400~K105+500	两侧	34200			✓
K105+500~K107+400	两侧	3800		✓	
K107+400~K118+600	两侧	22400			✓
K118+800~K119+100	两侧	600	✓		
K119+400~K119+750	两侧	700	✓		
K120+000~K120+700	右侧	700	✓		
K122+700~K123+500	左侧	800			✓
K123+500~K125+950	两侧	4900			✓
K127+770~K138+000	两侧	20460			✓
K138+000~K141+200	两侧	6400		✓	
K141+200~K145+800	两侧	9200			✓
K145+800~K146+300	两侧	1000			✓
K146+300~K147+900	两侧	3200			✓



交通、气象
信息共享平台

数据存储、
分析、处理

数据通信(采
集、发布)

管理、统计、
查询

通信网络

公路路面状况预警中心

数据上传
参数下发

公路路面状况
现场监测系统

现场控制

公路路面状况
预警发布系统

预警信息
发布

路面状况现场
监测站

路面状况现场
监测站

可变信息
标志
警示标志

区域预警发布系统

交通广播
电台
电视
交通气象
网站
手机短信
信息
其它途径

社会公众途径

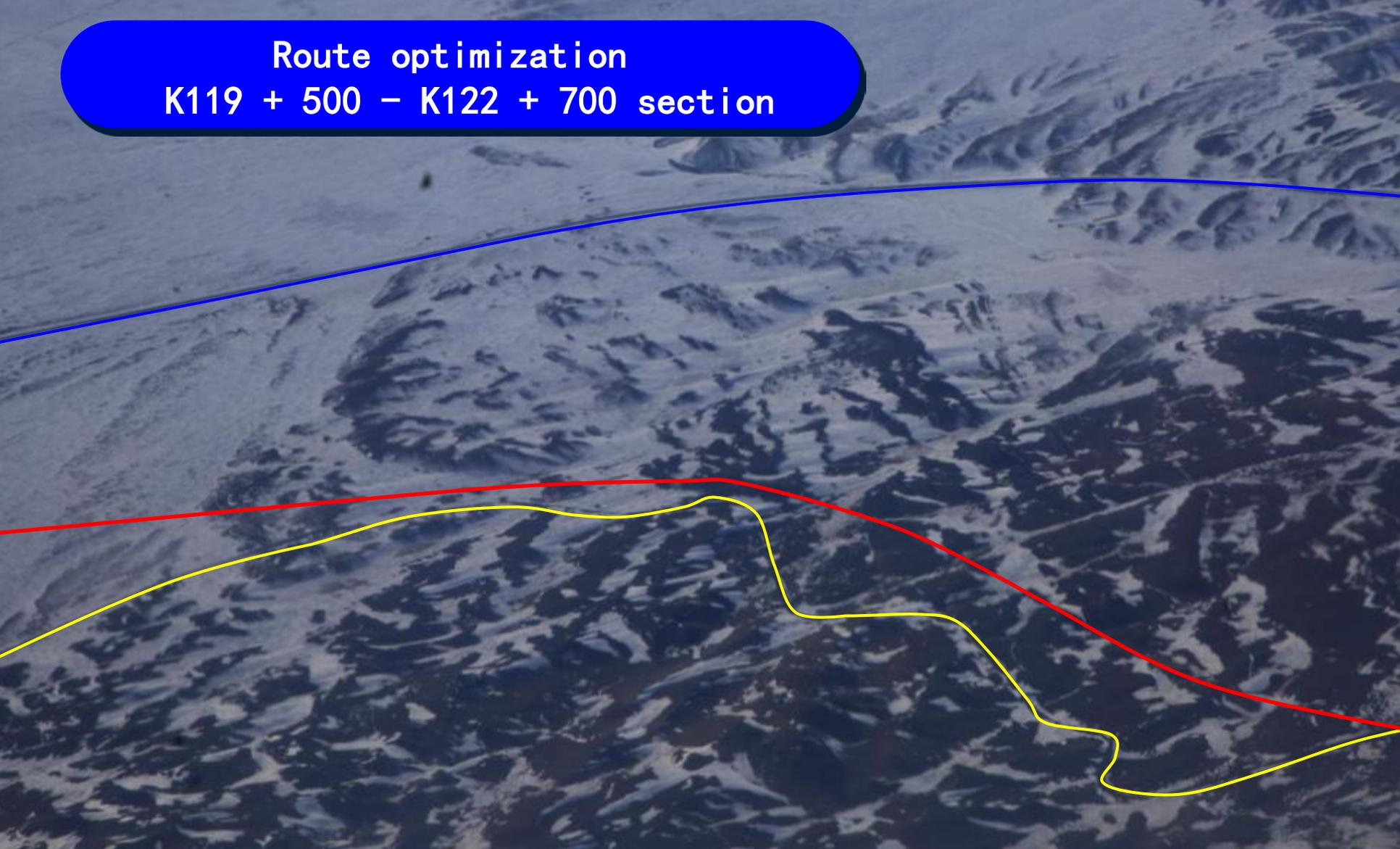
The monitoring and early warning and emergency security system



5 Engineering effect observation



Route optimization
K119 + 500 - K122 + 700 section





5 Engineering effect observation



Route optimization + Bridges – tunnel engineering

K79 + 305 - K80 + 270 section of the wind and the direction Angle of about 65 °, + bridge design to avoid the tunnel excavation and the leeward deposits, exports to Bridges, effectively resolve the problems the wind snow flow backward.



Tunnel + Bridges ... ions ions now ow ... c ...



5 Engineering effect observation



Subgrade optimization - separated subgrade, slow slope, cancel the guardrail

This project K83 + 600 ~K135 + 679 section of the separated subgrade, its highly basic control above 2.5 m, slow slope at the same time, try not to set the guardrail, fence high embankment sections set cable. The end of February 2013 on-site observation of subgrade pavement snow after optimization in the following figure.



Slow slope



Separated subgrade



Separated subgrade without barrier

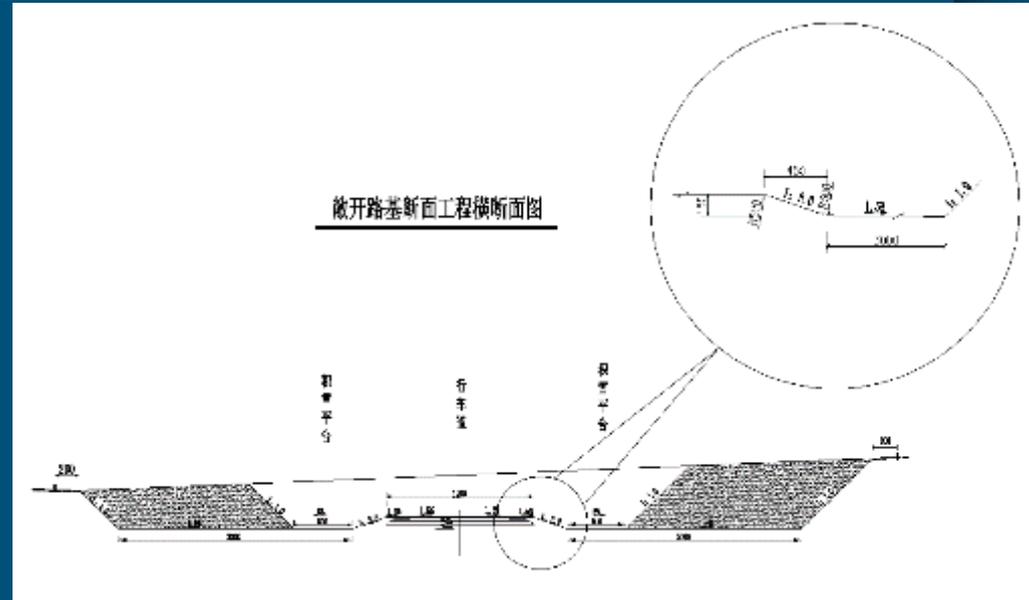


5 Engineering effect observation



Subgrade optimization - Open the subgrade cross-section

S201 line K68 + 178 - K68 + 178 road in the west wind, happen every year more than 10 times road blocking events caused by the snow deposition, become S201 line "their" sections. At the end of 2012 the open section of the highway subgrade treatment, forming LuDiShi cutting. Snow, reduces the cutting open the roadbed protection S201 line unimpeded, the winter of 2012-2013 after six months did not appear snow resistance phenomenon.



Subgrade section open before



Subgrade section after open



5 Engineering effect observation



Roadside engineering protection measures – snow fence

S201 line K32 + 500 section of snow fence (3 way, every 130 m long, 3.5 m high, spacing of 40 m) snow effect is obvious. Investigation and see, all kinds of snow fence is filled with snow, maximum snow depth of 4.0 m, a preliminary estimate, the resistance of snow snow about 40, 000 m³, reduced the K32 pass road of snow.

Snow fence

Pass





5 Engineering effect observation



Roadside vision engineering protection measures – inducing sign

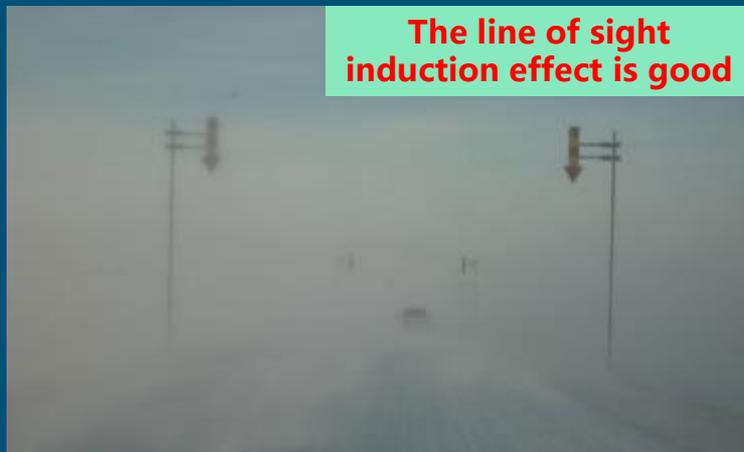
Wind blowing snow S201 line in 2012 caused low visibility serious section of implementation of the 3.6 km line of sight inducing sign, indicating roadbed edge position when wind blowing snow, effect is obvious. The extension project of 2013 by embedding the analysis of the cantilever inducing sign the line of sight, and implement the solar view induction.



Cantilever sight induction



Solar eye induction



The line of sight induction effect is good



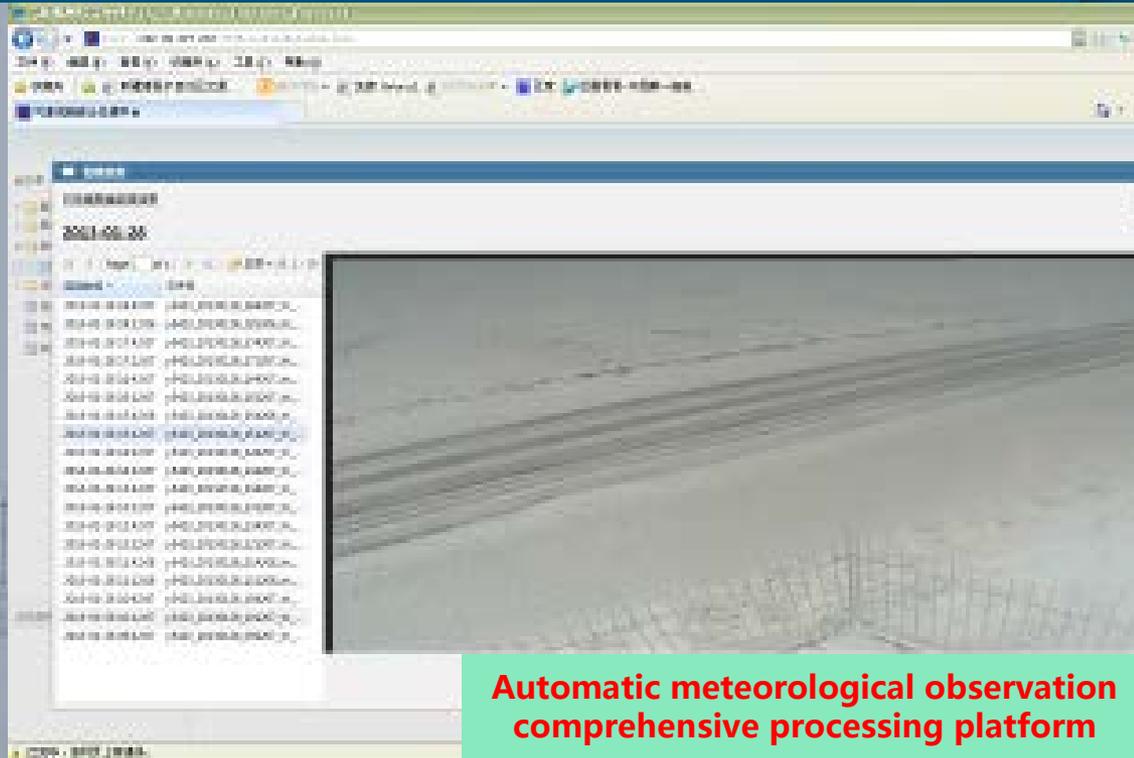
5 Engineering effect observation



Monitoring and early warning system,
highway automatic meteorological station

Project on the basis of the old tuyere - based, the wind the range, on the edge of the wind belt line, the wind belt 8 automatic meteorological offices and stations in the wild, the center line of the layout and form a monitoring network, the implementation will be weather and road conditions to the comprehensive processing platform, after processing, warning information, and start the emergency rescue system.

Highway automatic meteorological observatory has been built



Automatic meteorological observation comprehensive processing platform



5 Engineering effect observation



Total Knot

- (1) Route in mountainous areas, when the hills terrain across the snow is very serious to choose in a relatively open terrain.
- (2) In the wind and snow to harm, severe area, highway and highway subgrade cross-section appropriate USES separate sections. Monolithic roadbed should be appropriately raise the height, usually should not be less than 2.5 meters;
- (3) The route to the dominant wind direction and the vertical cutting or 45-90 ° intersection, dealing with in slope method should be taken. Conditional can use tunnel or Ming hole through;
- (4) In order to ensure the safety of winter road traffic should use cantilever inducing sign, indicating the road profile, prevention and control of the vehicle out of roadbed. Visibility is extremely low road to using solar energy light induced spontaneous standard;
- (5) Storm harm serious road, automatic meteorological stations should be built up to carry out mid-term and long-term programs for highway snow damage research, establishing and perfecting the highway disaster monitoring network, building monitoring and early warning and emergency security system.



**Warm congratulations on
The security and disaster relief coordination workshop
A complete successful!**

Thank You

**China xinjiang traffic science research institute
May 2016**

