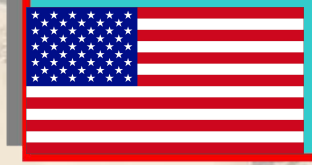
FIVE- DIMENSIONAL WORKING POINT FOR ROOF BOLTING SYSTEM DESIGN IN COAL BURST CONDITIONS



ROCBOLT TECHNOLOGIES, CHINA
ZIBO MINING GROUP

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CONTENTS

- Project Background
- Coal Pillar Design
- Five- Dimensional Working Points Design
- Products Development
- Application Cases

PROJECT BACKGROUND

- Overburden Depth: 200-1200 m
- Coal Pillar Width: 20-40 m
- Coal Burst: Overburden Depth>400m
- Headgate and Tailgate Development
- Some Typical Burst Cases
- Problems to be solved

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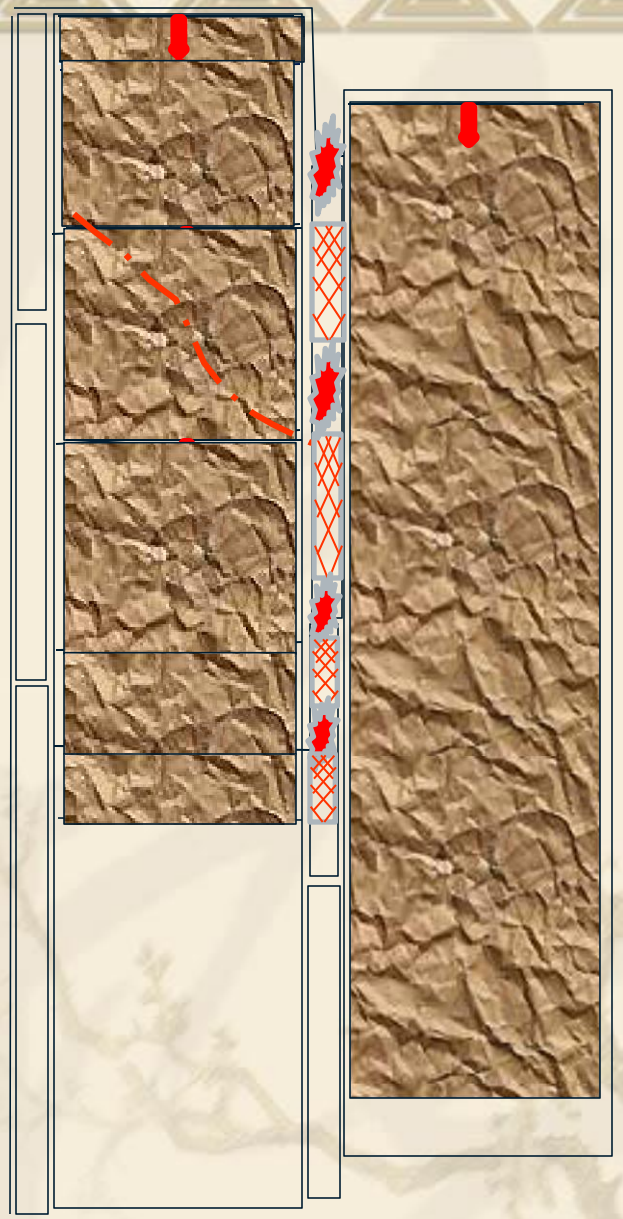
Bayangaole Mine

- 650m cover
- 30m pillar
  - Burst Record
    - First Burst
      - 240 m from Setup room
      - Affected area 60m outby face line
      - Front Chocks damaged, cable and bolt broken
      - Floor heave, roof sagging and rib spall.
    - Second Burst
      - 453 m from Setup room
      - Affected area 100m outby face line
    - Third Burst
      - 680 m from Setup room
      - Affected area 60m outby face line
    - Fourth Burst
      - 791m from Setup room
      - Affected area 60m outby face line



PROJECT BACKGROUND

- Some Typical Burst Cases
  - Baiyangaole Burst: 15 Bursts
  - Tingnan 10 Bursts
  - Gaojiabao: 10 Bursts During Shaft Bottom and Main Development.
- Problems To be Solved
  - Pillar Size
  - Dynamic Roof Bolting System

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COAL PILLAR SIZE

- Larger Pillar Size
- Smaller Pillar Size ---Burst free
- Smaller Pillar Size---Harmless Burst

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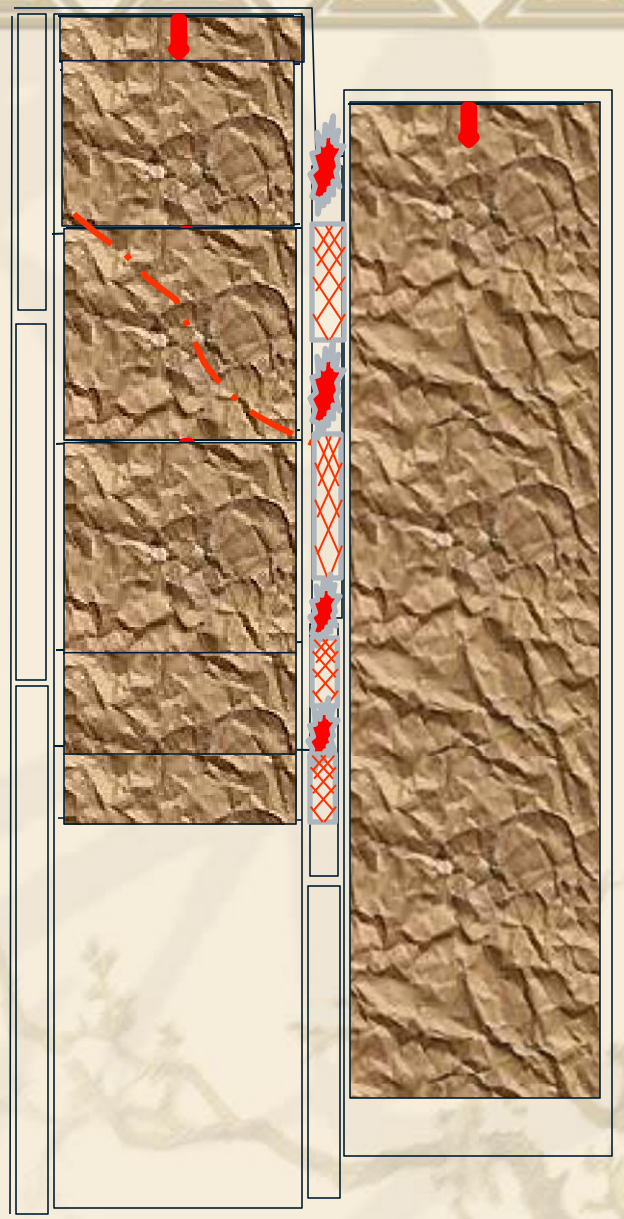
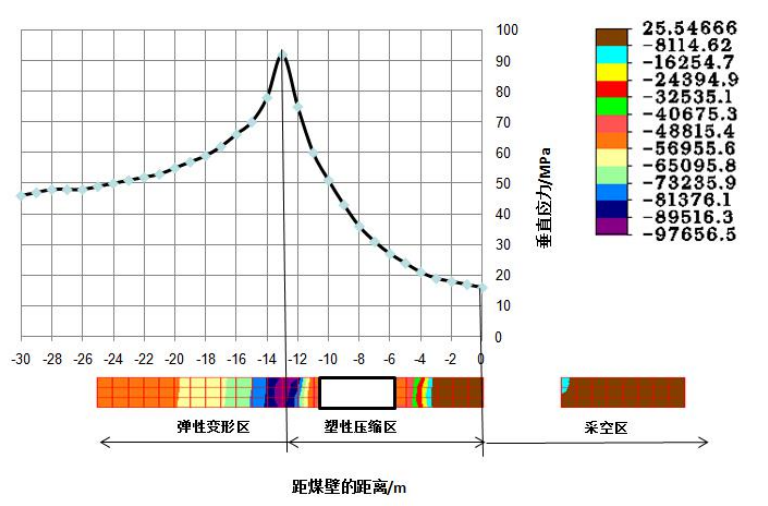
COAL PILLAR SIZE

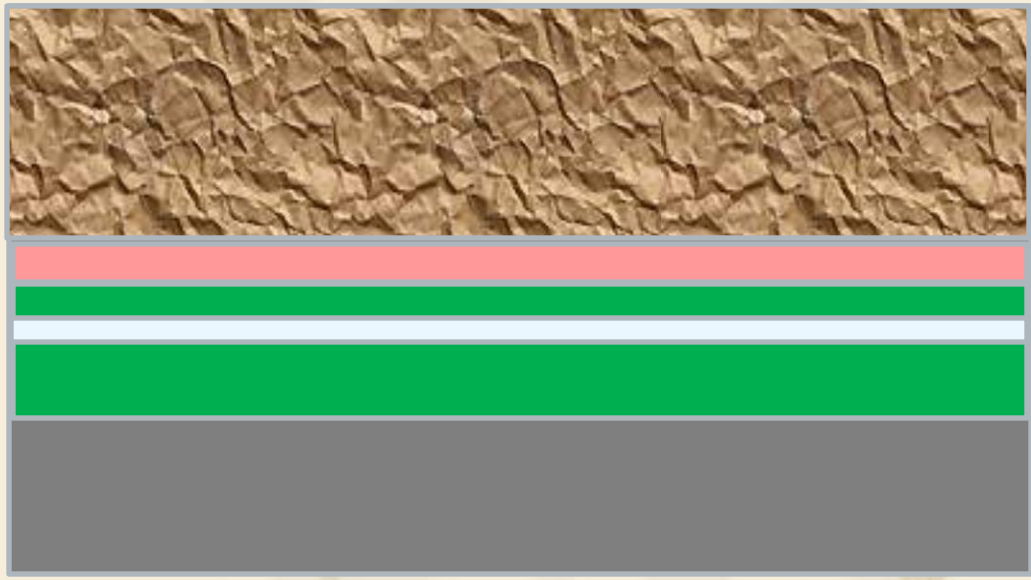
- Larger Pillar Size
  - Initiation Point Moves Further inby Face Line
  - Propagation Zone Some Distance inby Face Line
  - Burst Intensity Increases and Frequecy Decrease
  - Large Enough to be Burst Free
  - Not Feasible to Mine Operation



COAL PILLAR SIZE

- **Smaller Pillar Size ---Burst free**
  - First Longwall Retreating
  - Tensile Fractured zone(1-2m)
  - Compressive Fractured Zone(11m)
  - Yield Zone(13m)
  - Pillar Size and Tailge development
    - 5-8m
  - Application





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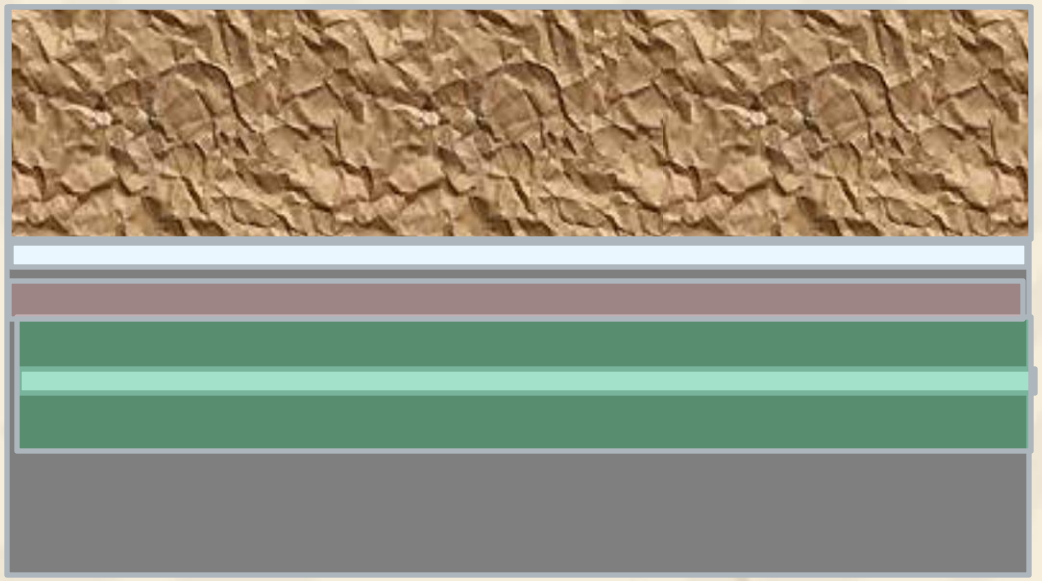
COAL PILLAR SIZE

- Smaller Pillar Size---Harmless Burst



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FIVE-DIMENSIONAL WORKING POINT BOLTING DESIGN

- Five Dimensions
  - Support Capacity
  - Displacement And Yieldable Bolt
  - Length of Bolt
  - Installed Load
  - Energy release and Absorption for Burst Conditions

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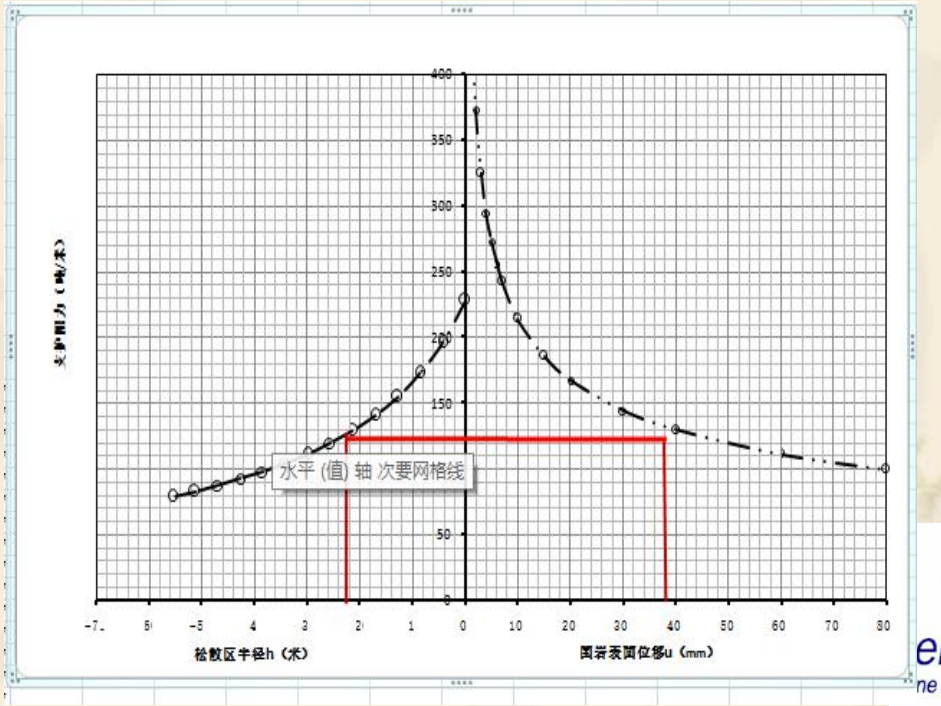
Mine Roof Support Products Co.

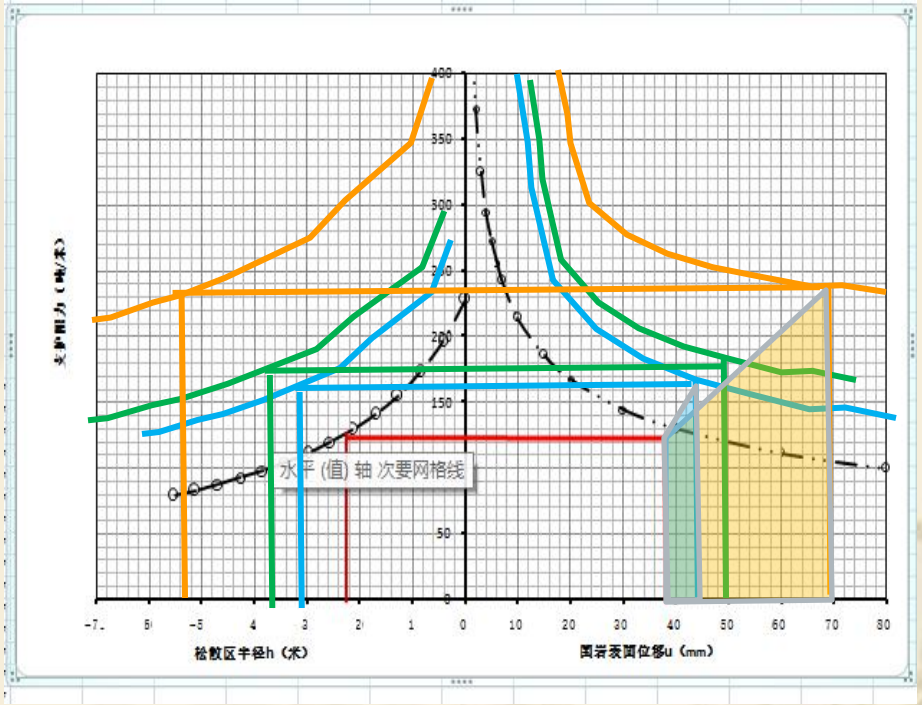
FIVE-DIMENSIONAL WORKING POINT BOLTING DESIGN

- Five Dimensions--Static
  - Support Capacity
  - Displacement And Yieldable Bolt
  - Length of Bolt
  - Installed Load



FIVE-DIMENSIONAL WORKING POINT BOLTING DESIGN

- Five Dimensions--Dynamic
  - Energy release and Absorption
    - Working Point Drifting
    - Energy Absorption
    - Energy Releasing



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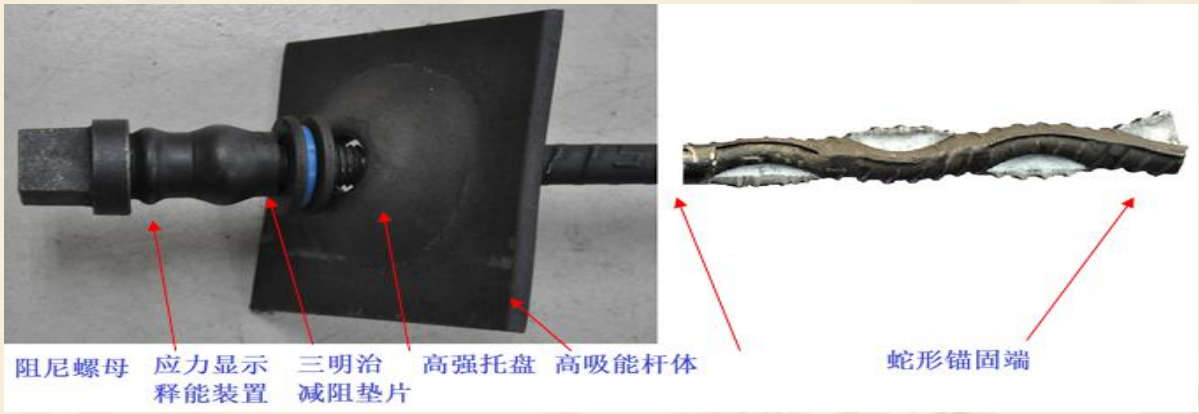
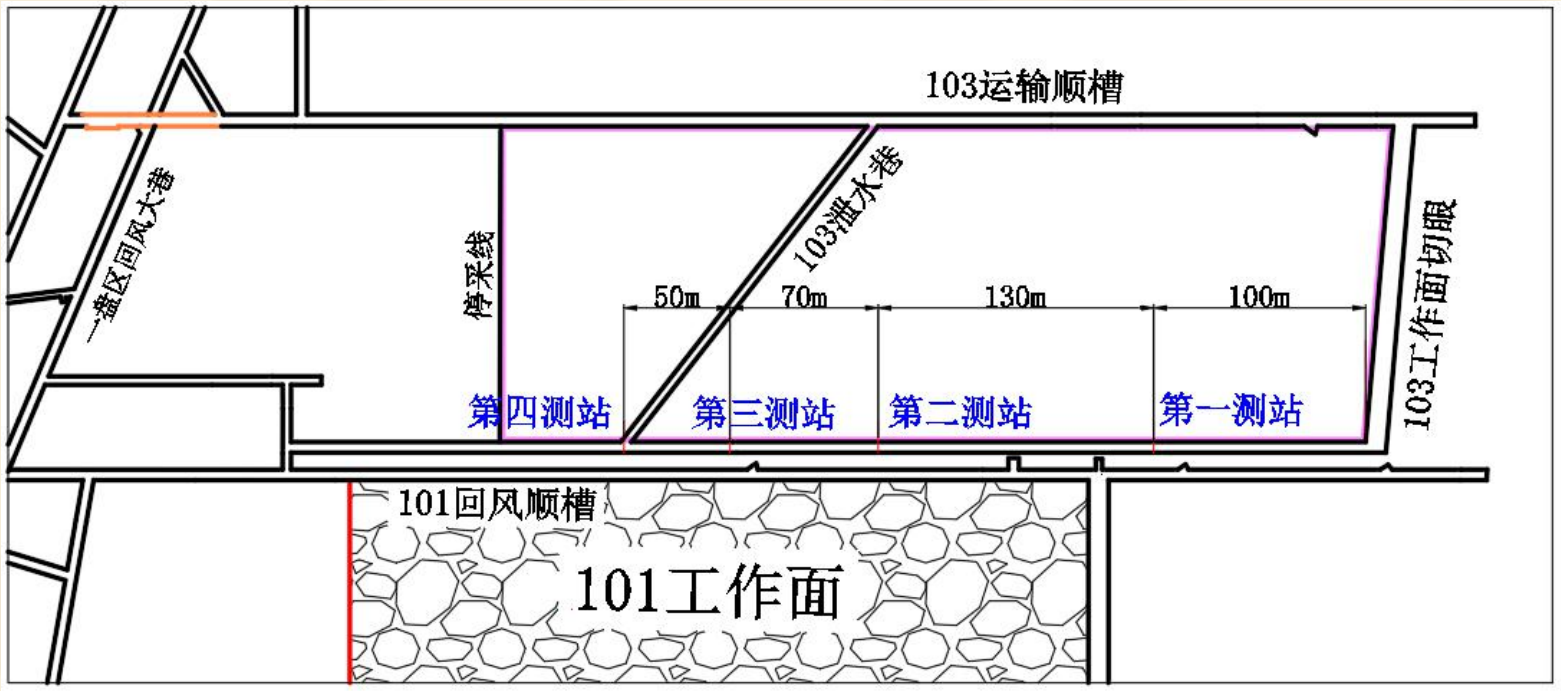
PRODUCTS DEVELOPMENT

- High Energy Absorption Steel Development
  - Increase Impact Energy Index from 48J to 150J
- Energy Release Parts Development
  - Yield Tube



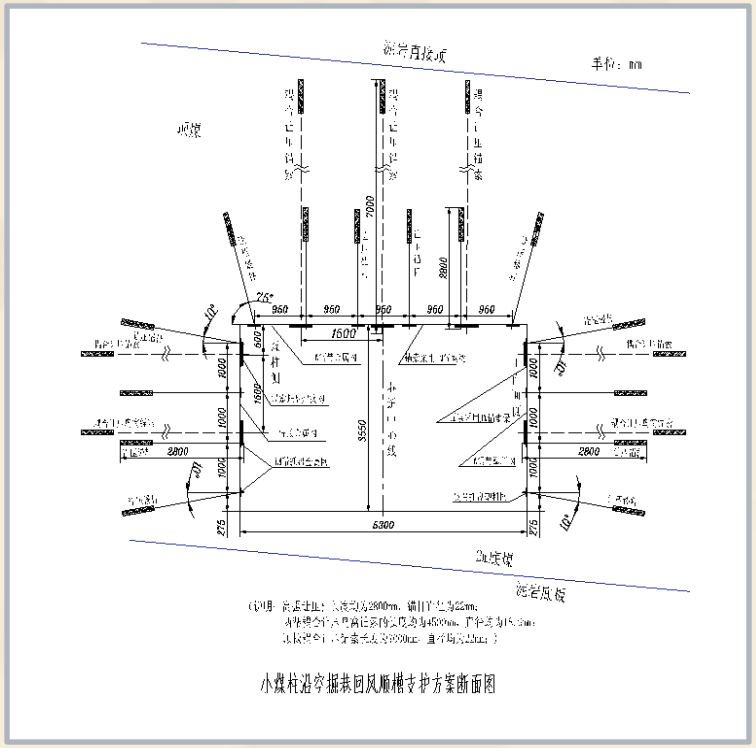
APPLICATION CASES

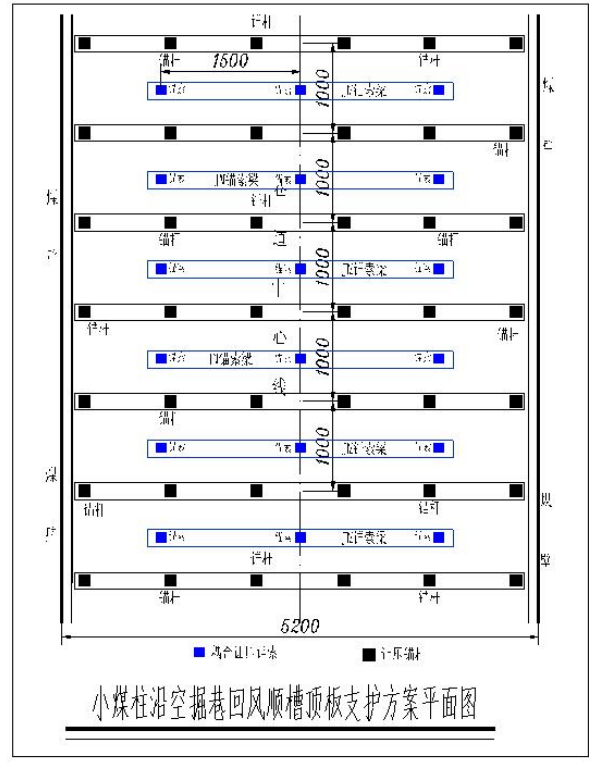
- **Application Cases**



APPLICATION CASES

- **Application Cases**





APPLICATION CASES

- Application Cases
  - More than 10 tailgates in three mines have successfully supported.
  - Harmful Coal bursts have not happed during the tailgate development and longwall retreating
  - In some cases, although some small bumping, tailgate support absorbs and releases the dynamic energy.
  - Tailgate deformation is minimum, no maintenance team is required any more.