WINDBREAK DESIGNED USING TRIZ FOR RAW MATERIAL YARD

Jae-Weon YANG
POSCO E&C / tadid5@poscoenc.com
Sung-Kyu Choi
POSCO E&C / sungkyu_choi@poscoenc.com
Young-Sub Moon
POSCO E&C / ysmoon@poscoen.com

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1. Definition of windbreak

■ **Definition :** **Thermal power plants, steel mills, including large-scale raw materials caused by strong winds in the yard Raw materials for the purpose of preventing particle scattering equipment installation.**

■ **Main function :** **Reducing raw material storage yard wind particles in the scattering volume and reduce the scattering distance material loss and the role of air pollution prevention.**

2. Status of the management of fugitive dust

■ Spray road and Spray equipment on Yard

- ▶ Spray equipment is top priority for Immense dust.
- ▶ Spray equipment is operated for the purpose of dust suppression on Yard.

2. Status of the management of fugitive dust

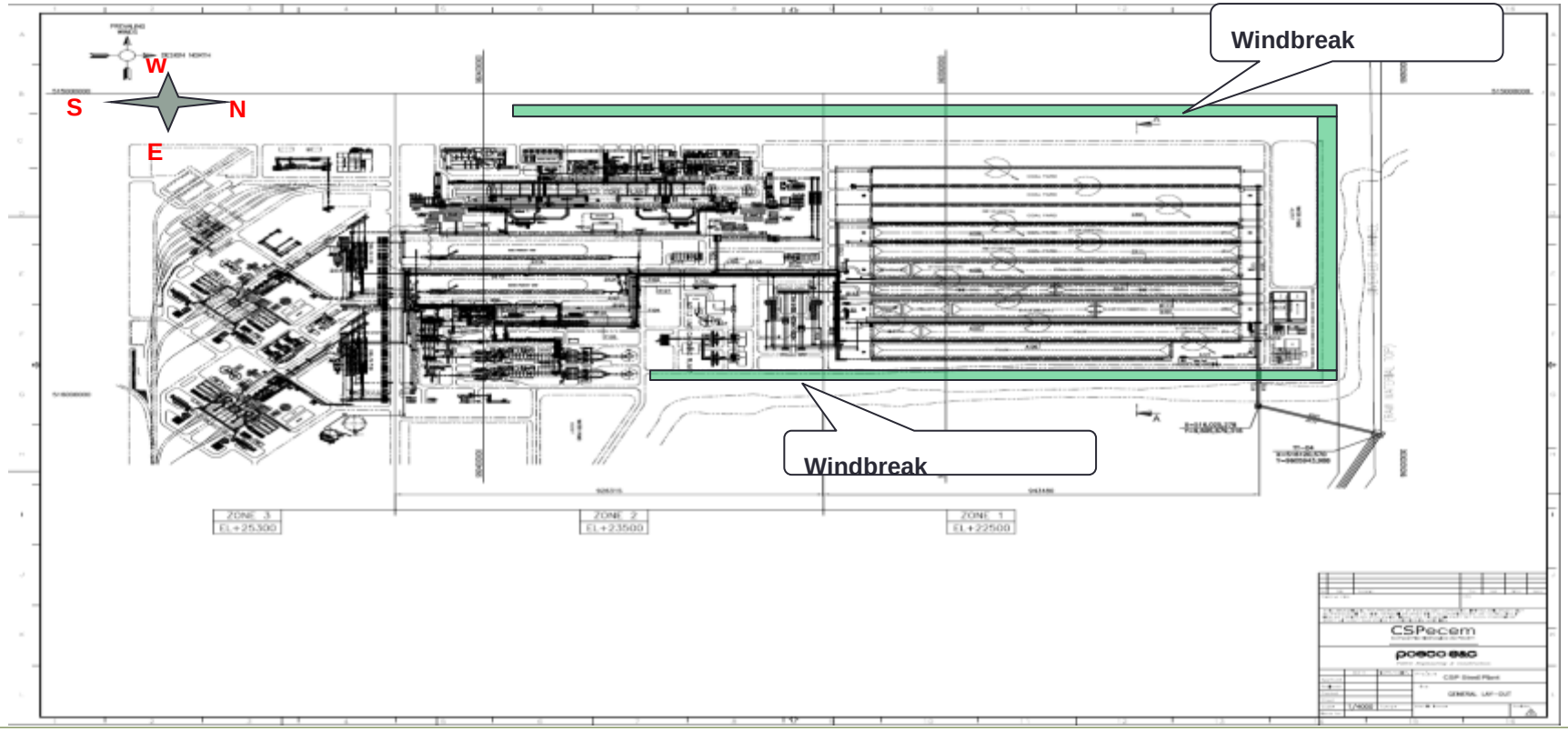
■ Fabric

- When the wind is blowing, Raw material should be covered in order to prevent dust blowout.

2. Status of the management of fugitive dust

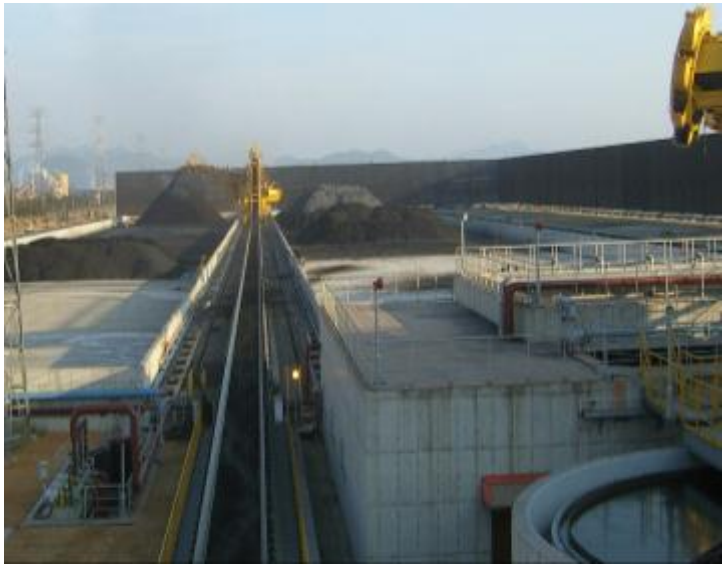
■ Windbreaks plan

- ▶ Windbreak shall be setup East, West, North based on Raw Material Yard.
- ▶ Windbreaks plan need opinion and review of landscape expert.



3.Project background and technical overview

Yard Works of raw materials costs through the optimal design of windbreak



- Meteorological data analysis
- Low-cost, high-efficiency equipment type dust suggestions
- Plant performance review by Flow analysis

Exiting windbreak

1. Polyethylene windbreak
   - Relatively low cost
   - Low efficiency of dust
   - Raw material yard field

PZ

2. Galvanized steel windbreak
   - Relatively high cost
   - High efficiency dust
   - Raw material yard field

PZ

Target site

1. Annual maximum wind : 10m/s
2. Open stage rate, length, height :
   Height - 17m, Length – 1,100m
3. Dustproof device review
   ① Mound
   ② Windbreak installation
   ③ Shelter installation

[target site]

Achieve goals (wanted results)

Dust poof efficiency improvement (exiting 76% -> target 85%)

cost reduction (30 billion)

4. Definition of technical systems

■ mesh -> wire → front/back stage pillar, foundation

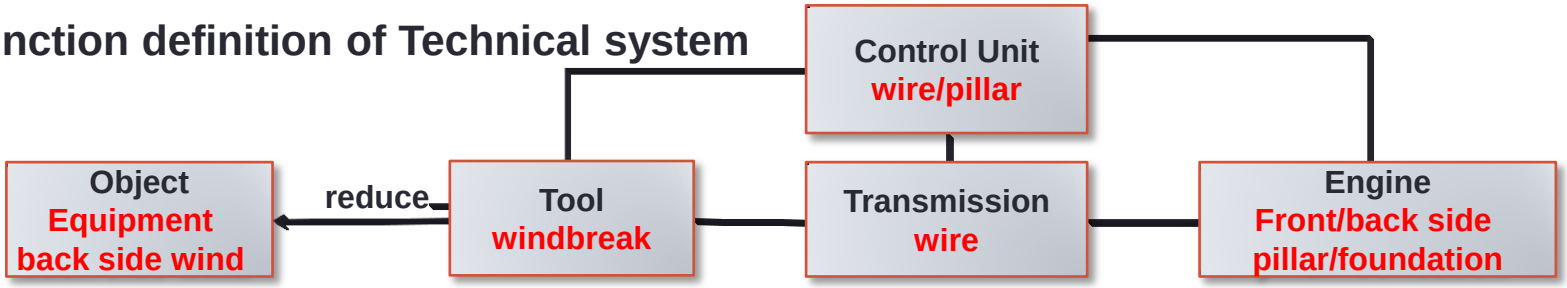
[mesh] Type: Polyethylene, steel, galvanized steel

[wire] Type: wire rope, "ㄱ"square angle, pipe

[pillar] Type: H-Beam, iron tower, pipe

[Iron tower type polyethylene windbreak]

▶ Function definition of Technical system



▶ **Function of windbreak**

- First stage : mesh is to slow the winds equipment
- Second stage : Wire mesh is passed into the foundation is passed to the wind pressure.
- Third stage : Wind pressure is transmitted front / back side pillar between the bearing power and distributed by the base.

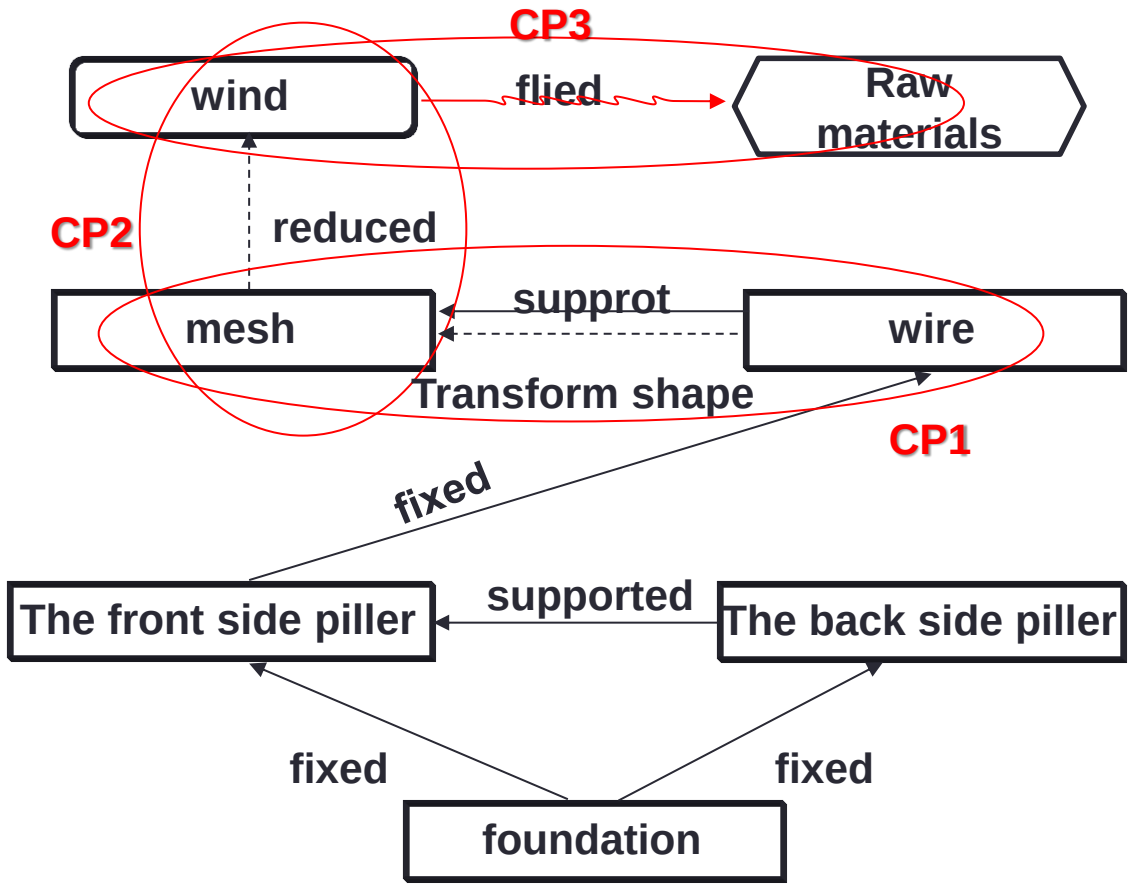
5. Analyzing the problem

Root Cause Analysis

Problem section	Why1	Why2	Why3	Why4	Why5	CP
Fugitive dust is generated.	Material particles are bent by the wind and fly	Effect of particle-like material strength is strong.	deceleration of the wind from the back of the windbreak effect is small.	This is the type of windbreak straight.	The wire is easy to install, the installation costs are lower.	1
				wire of the opening rate is high.	operating ratio is lowered, support the cost increase.	3
			Material particles extend to the wind blowing in the direction directly.	The back side dustproof facility does not change the direction of the wind	That can regulate the direction of the wind system is not built.	2
		Material particles are small and light.	Raw materials during mining, small particles are automatically generated.	RECLAIMER small particles that occur because of mechanical force is applied.	-	X

5. Analyzing the problem

Function Diagram



6. Direction of the core problems and solutions

Core Problem (1)

Straight piller —support (insufficient condition)→ Dustproof equipment

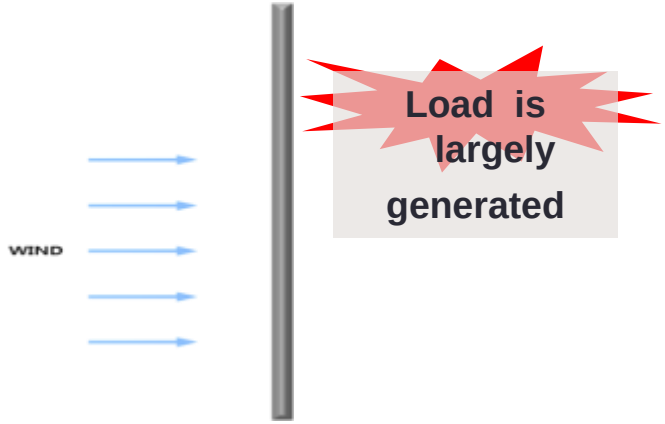
Straight windbreak

↓

The greater the load caused by wind pressure

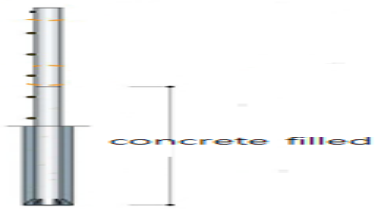
↓

Dustproof equipment supporting the cost is increased

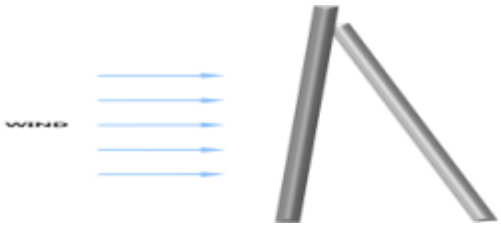


[[H-BEAM requires the selection of the conditions Heavy]

Solution direction



[Method of Steel Pipe Piling]



[A-type Steel Pipe Support]

Standard solution 1-1-2. Internal defects material-fields model

▶**improvement alternative : Straight H-BEAM piller is to replace A type's the steel pipe piles piller.**

6. Direction of the core problems and solutions

■ Core Problem (2)

Straight windbreak —reduce→ **wind**

(Insufficient condition)

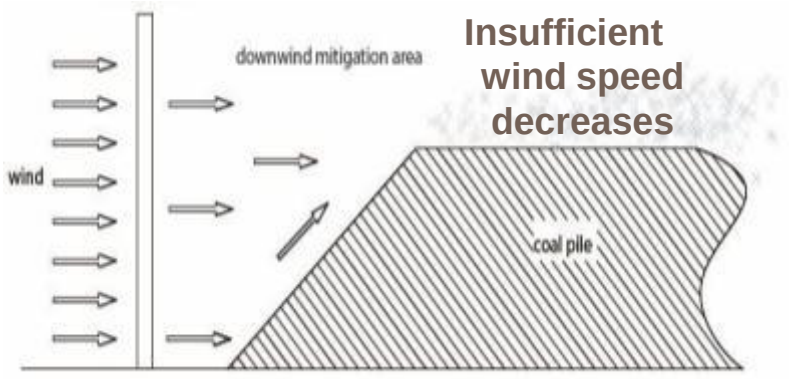
Straight windbreak

↓

Progress direction at the back side of the equipment is constant

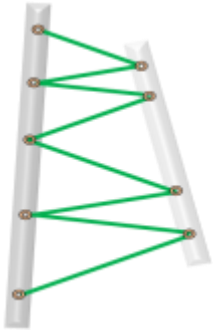
↓

Insufficient wind speed decreases



[Straight windbreak installation]

■ Solution direction



Standard solution 1-1-2. Internal defects material-fields model

▶Improvement solution : This added to the back side piller connecting wires,

And to double the net transforms the installation of the bending type windbreak

6. Direction of the core problems and solutions

■ Core Problem (3)

Windbreak with High opening ratio → reduced **wind** (Inconfitence condition)

Windbreak high aperture ratio

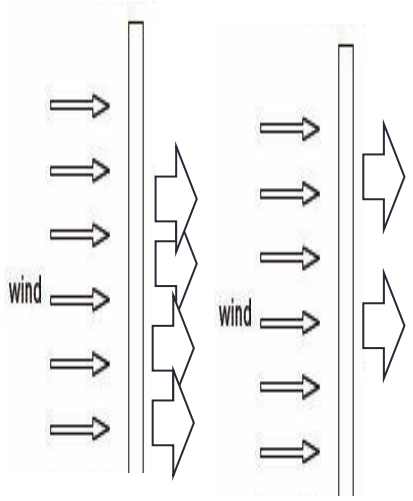
↓

A decrease in an aperture ratio and the dust efficiency accompanying rise in cost of equipment

↓

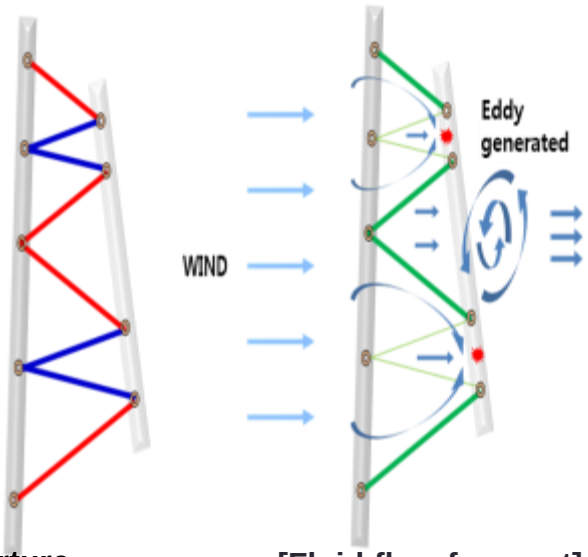
Efficiency increases with increasing the cost is incrased

■ Solution direction



[when the aperture Ratio is higher]

[when the aperture Ratio is lower]



[Fluid flow forecast]

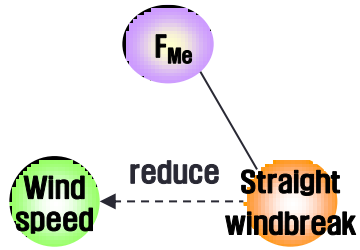
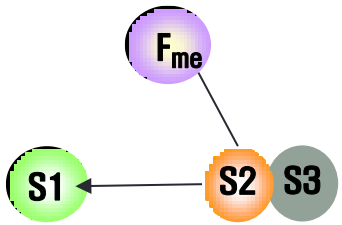
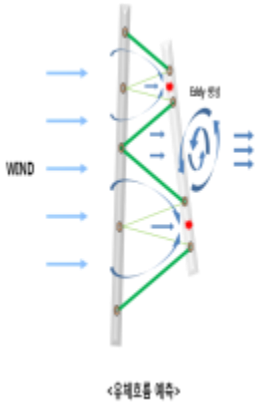
During low an aperture ratio due to increase in load cost rising ground

Standard solution 1-1-2. Internal defects material-fields model ▶ improvement solution

:Unlike the single aperture ratio by windbreak, then the direction of the wind transform, thus offsetting each other.

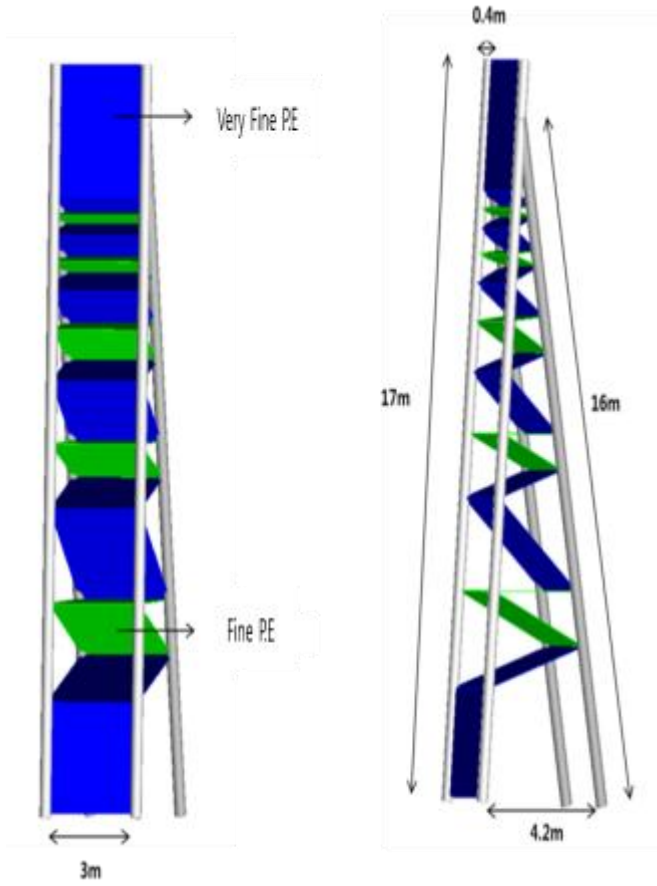
6. Direction of the core problems and solutions

■ Su-Field analysis

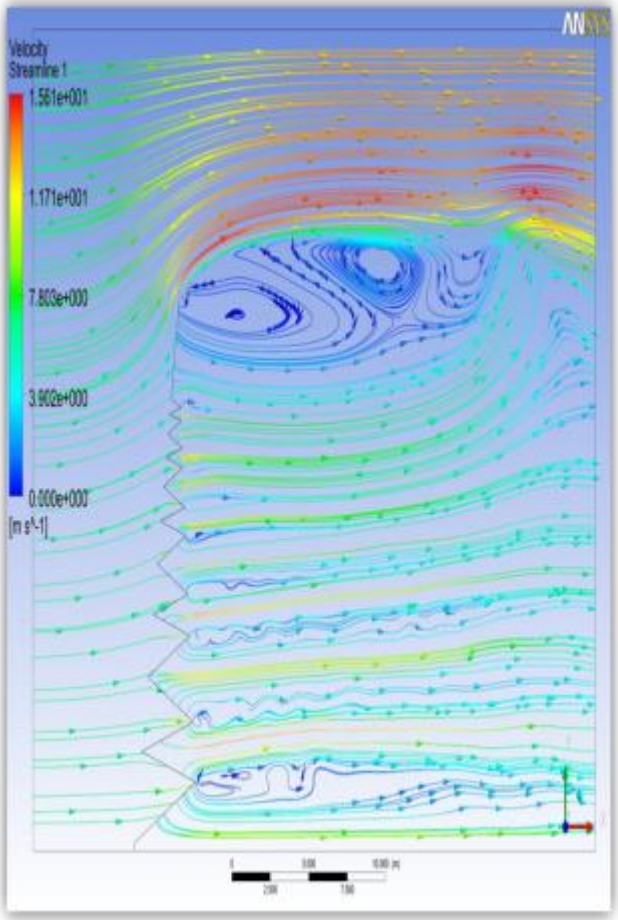
Su-Field Analysis	IFR	Standard solution	Conceptual Solution	remark
 	▶ Without the addition of third-party Components, windbreak wind speed reduction efficiency is to increase the results of their own ▶ As a result, a kind of raw material particles are not blown away by the wind. ▶ Consequently, wind blown particles are not removed at the raw material.	Standard solution 1-1-2 Internal defects material-fields model → on the back side piller straight windbreak add a wire rope. → Transformed into the direction of the wind, cancel each other out, Eddy has to be generated. → ‘ㄱ’square angle Is introduced. → installation the collection canal	IDEA 1 : This added to the back side piller connecting wires, And to double the net transforms the installation of the bending type windbreak IDEA 2 : Unlike the single aperture ratio by windbreak, then the direction of the wind transform, thus offsetting each other. IDEA 3 : ' A' characters by adding the angle, it is easy to fix the wire, through the gap adjusting the angle to be adjusted windbreak function is granted.	 

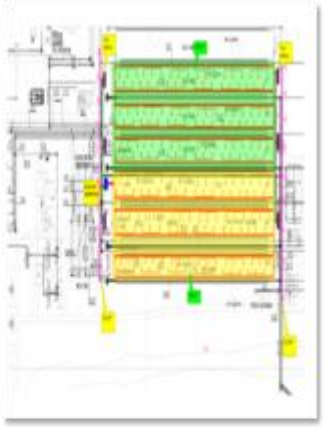
7.Solutions derived

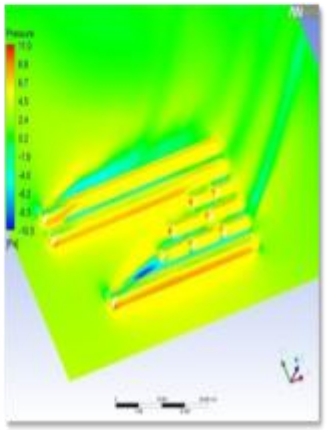
POSCO E&C type windbreak



windbreak flow analysis

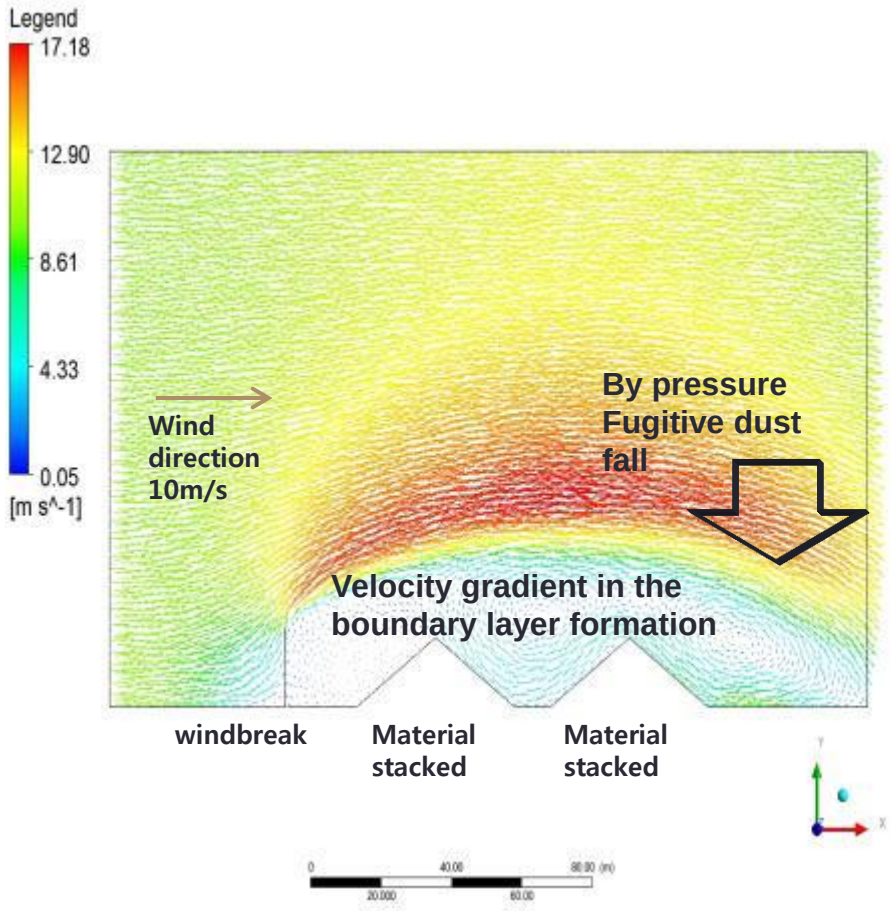




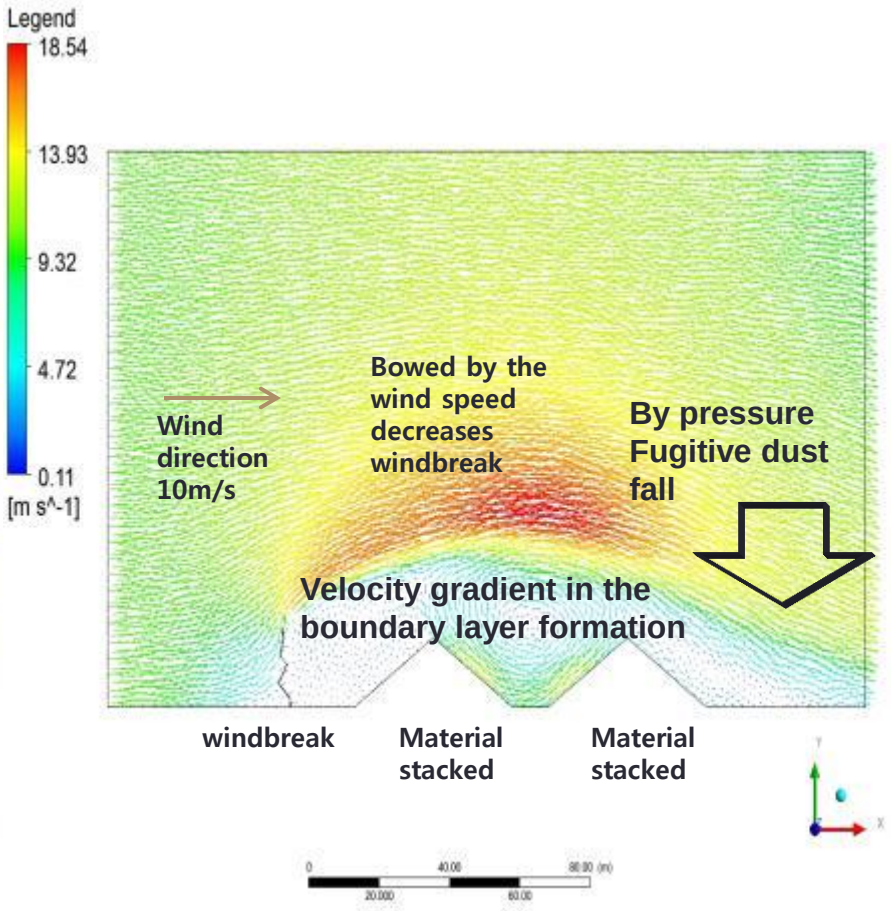


8.Results of this action

Bowed by the wind speed decreases windbreak

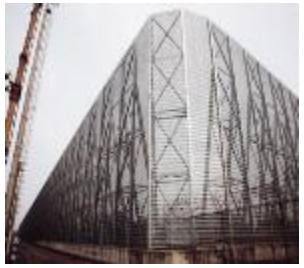
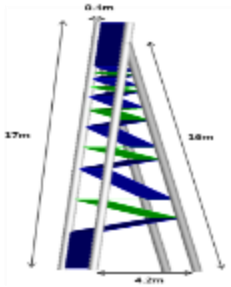


<Before improving>



<After improving>

9.Financial effect

Division	Typical P.E windbreak	Galvanized steel windbreak	Posco e&c type windbreak	Embankment
Concept				
Solution Features	-Using H-Beam Support (2 square) -Using polyethylene windbreak	-Using H-Beam Support (2 square) -Using Galvanized steel -Bolt fixed using	- Based on the pipe ø 165 (4 each) and A-type construction - Injection pipe in concrete - Use polyethylene windbreak	-Fill the earth and sand near the scene - Flood fill with seeds on the surface of the soil surface as a paste ball deadline
Advantages, disadvantages	- Inability excellent aesthetics - Middle dust protection Efficiency (P.E 1ply 27%, 2ply: 73%) - Low-price construction cost, construction speed	- Excellent aesthetics - High efficiency of dust (80%) - High-price construction cost	- Excellent aesthetics - High efficiency of dust (target 85%) - Construction of affordable	- Cost of construction - Inability excellent aesthetics - Large area of land occupied - Low dust efficiency
Economic (Net cost)	About 6.8 billion won	About 9.3 billion won	About 4.5 billion won	About 3.3 billion won

10.Future plans

■ Short-term side (Securing orders)

- Material stacked field
- Domestic, foreign thermal power plant
- Ports, coal wharf
- Domestic, foreign Cement plant

■ Long-term side (field application)

In the future, the facility applies to Dust
All domestic / external yards of material on-site

※30 billion compared to the existing windbreak expected savings