

Development of Hot In-place Transforming of Dense Graded Asphalt Mixture to Porous Asphalt

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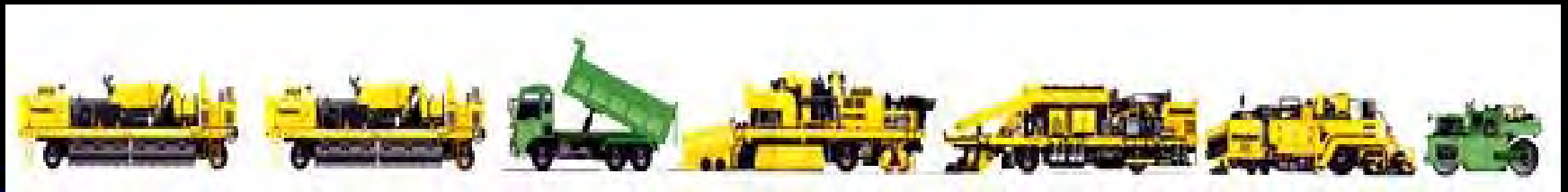
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Train of Hot In-Place Transforming Machines



Making history for asphalt paved roads

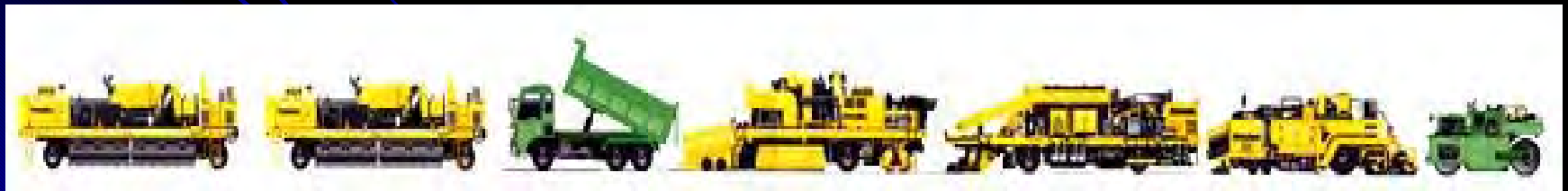
HIR vs. HIT

<i>After work</i> <i>Before work</i>	D	P
D	HIR D → D	HIT D → P
P	P → D	HIR P → P

First Technology in the World

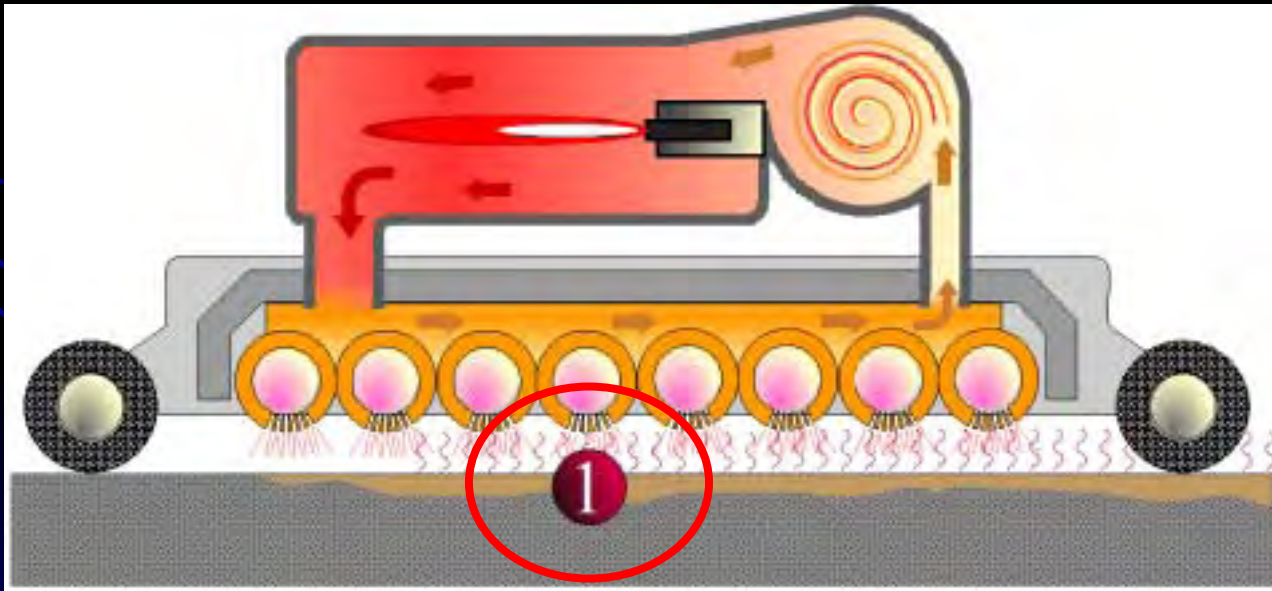
Patent Granted, August, 2006

**Through One Pass
from Dense to Porous
on Site**



Pre-Heater

1. Heating and softening the asphalt pavement

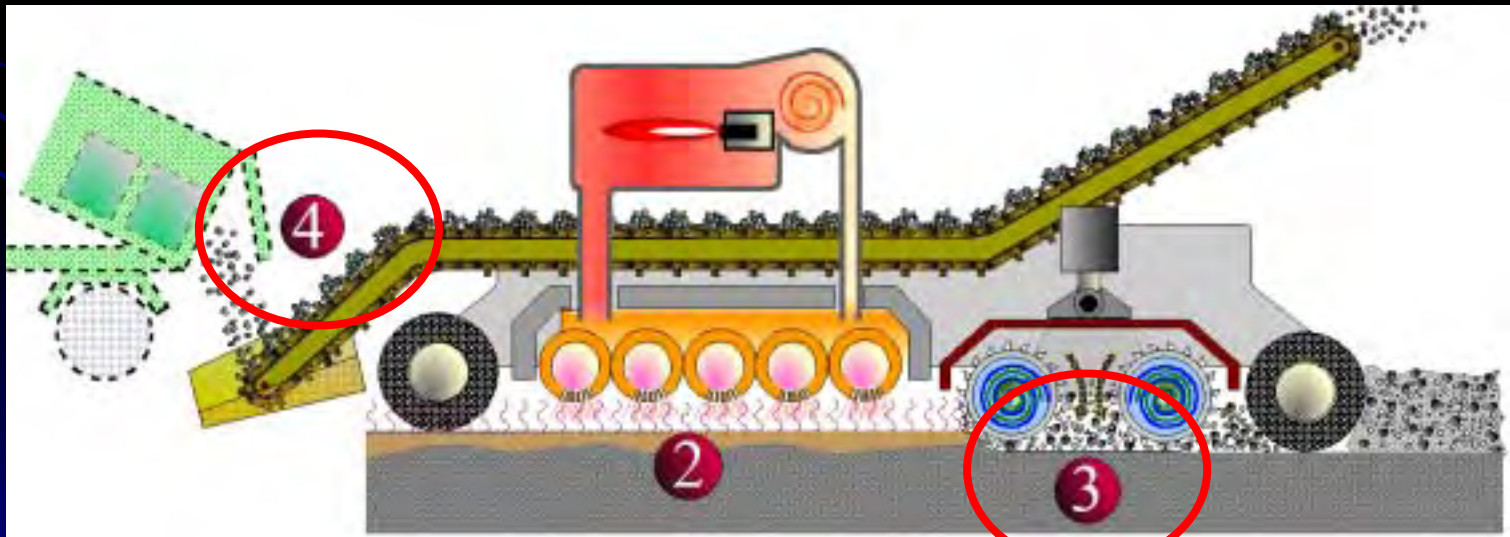


Heater & Miller

2. Heating and softening the asphalt pavement

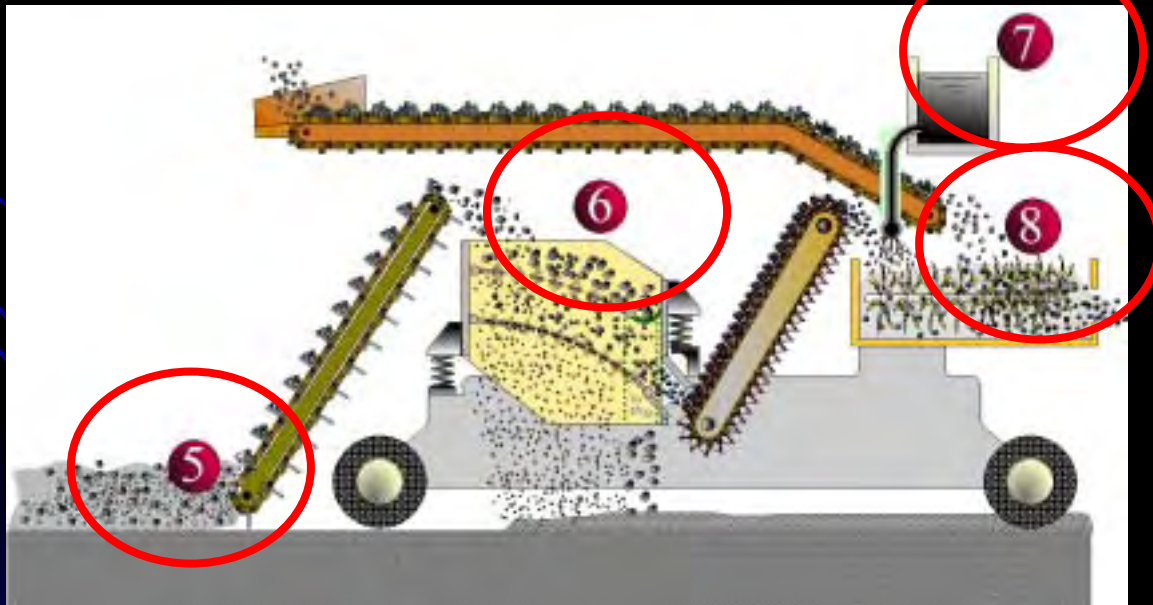
3. Milling of existing asphalt mixture

4. Transferring new asphalt mixture



Screener & Mixer

5. Gathering recycled asphalt mixture from the pavement surface
6. Screening recycled asphalt mixture into in accordance with aggregate size
7. Supply of additives (Bitumen and/or Rejuvenator)
8. Mixing of the recycled asphalt mixture for upper layer with new asphalt mixture and additives (Bitumen and/or Rejuvenator)

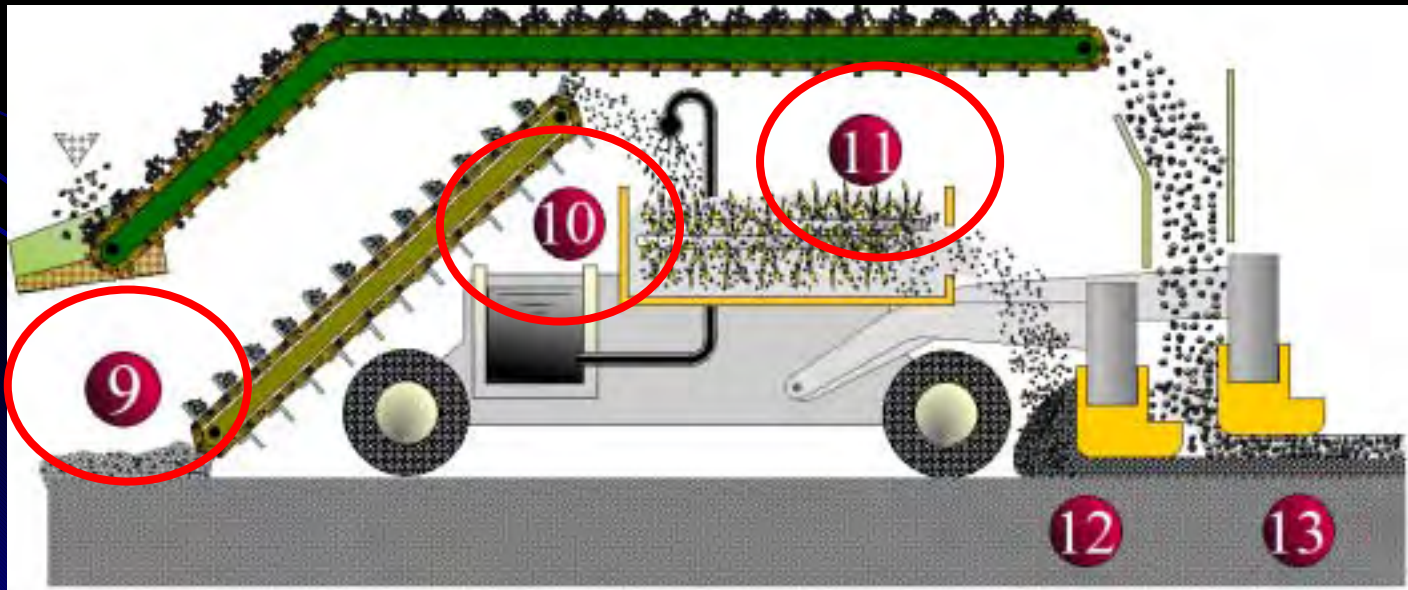


Mixer & Tandem Paver

9. Gathering recycled screened asphalt mixture for the lower layer

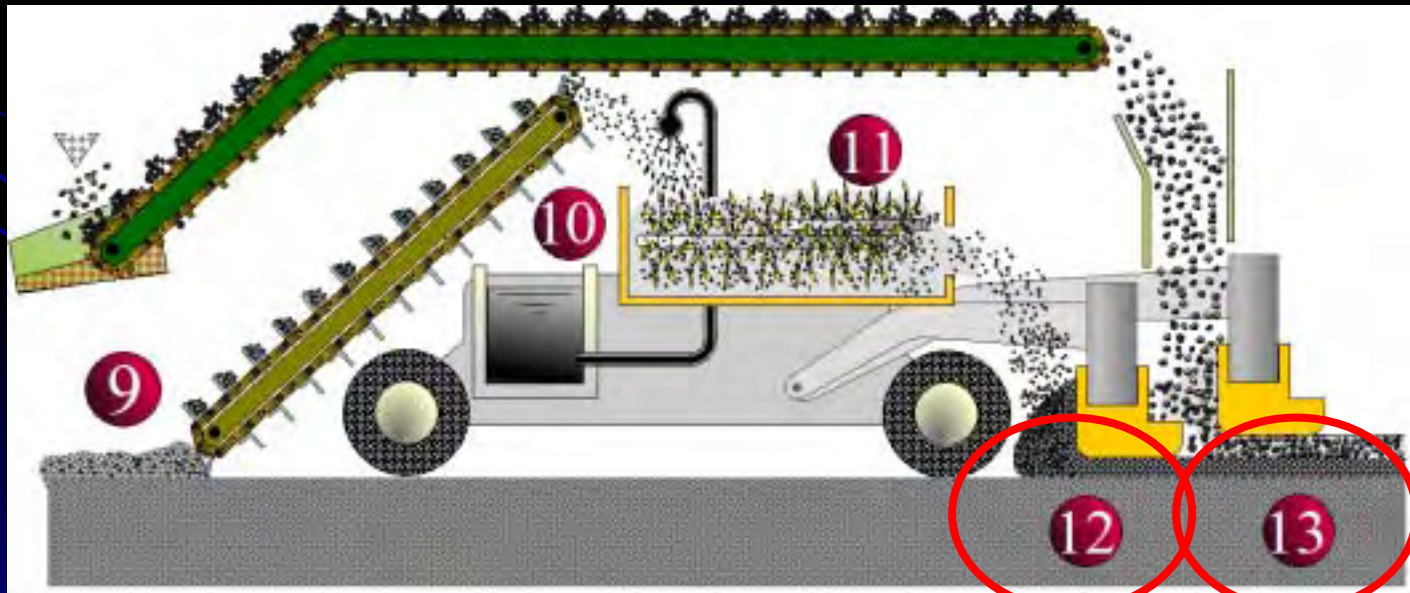
10. Supply of additives (Bitumen and/or Rejuvenator)

11. Mixing of recycled screened asphalt mixture for the lower layer with additives (Bitumen and/or Rejuvenator)

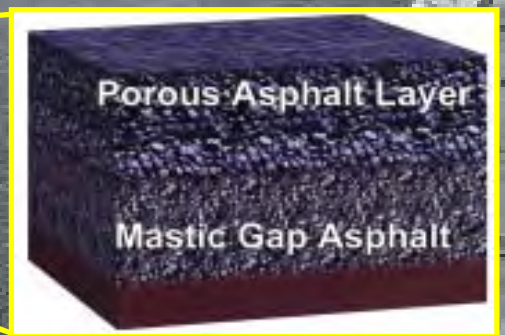
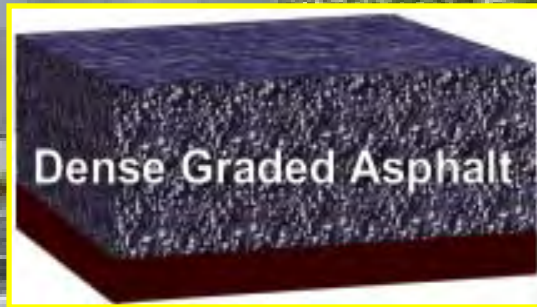


12. Spreading of the recycled asphalt mixture for the lower layer

13. Spreading of the recycled asphalt mixture for the upper layer

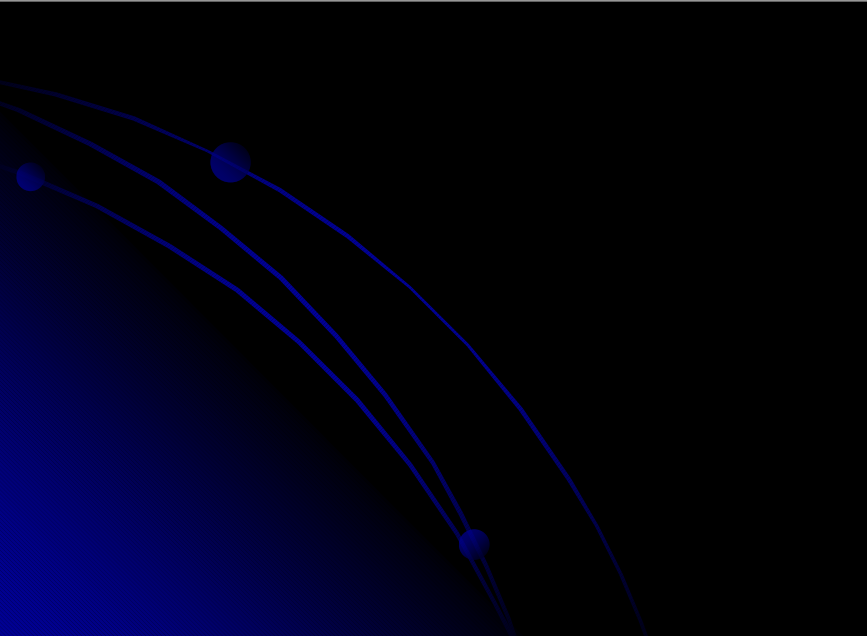
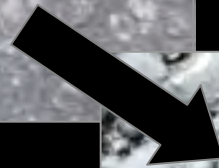
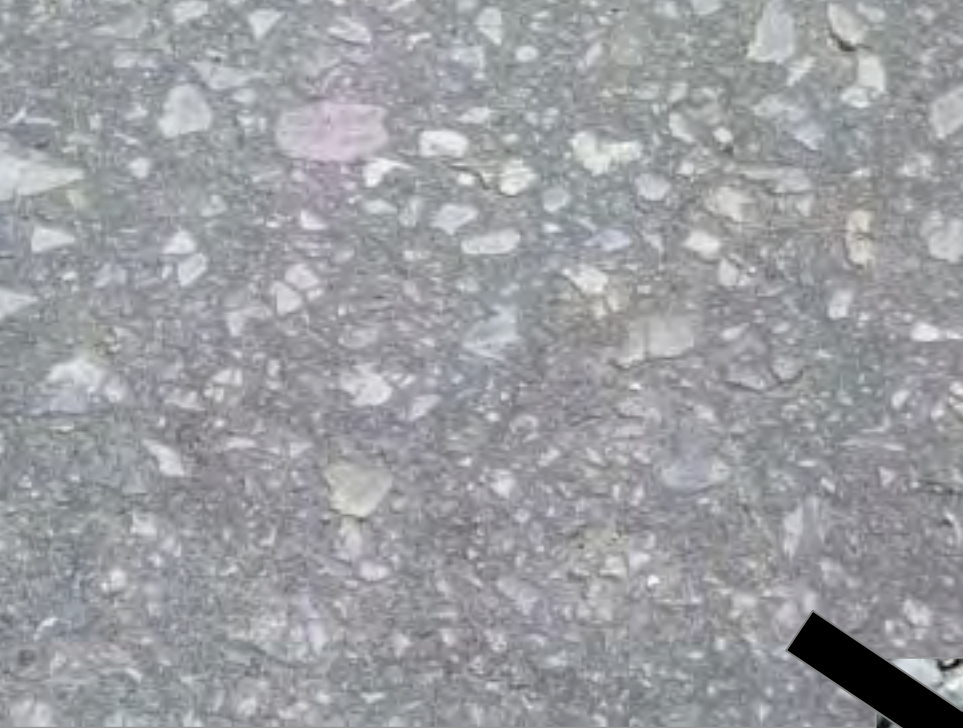


Product of HIT



Road before and after HIT (Sept. '05 OKINAWA)

Surface Layer Change



Key Technologies

Mechanics:

Heating & Milling

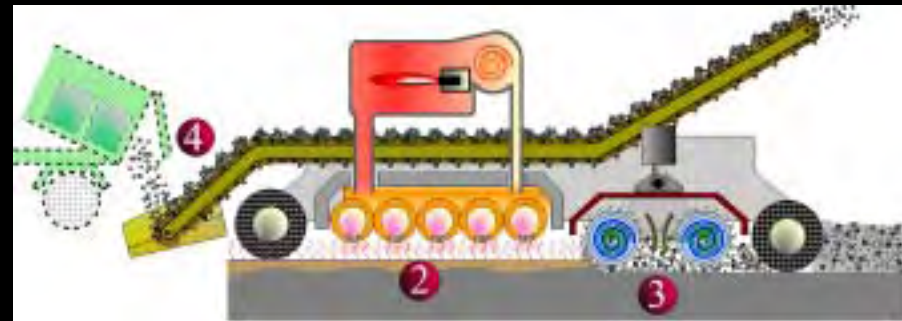
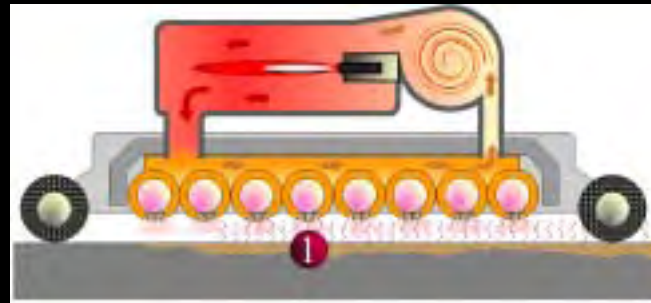
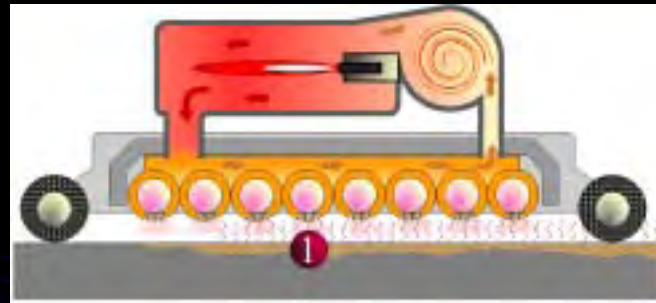
Screening

Tandem Paving

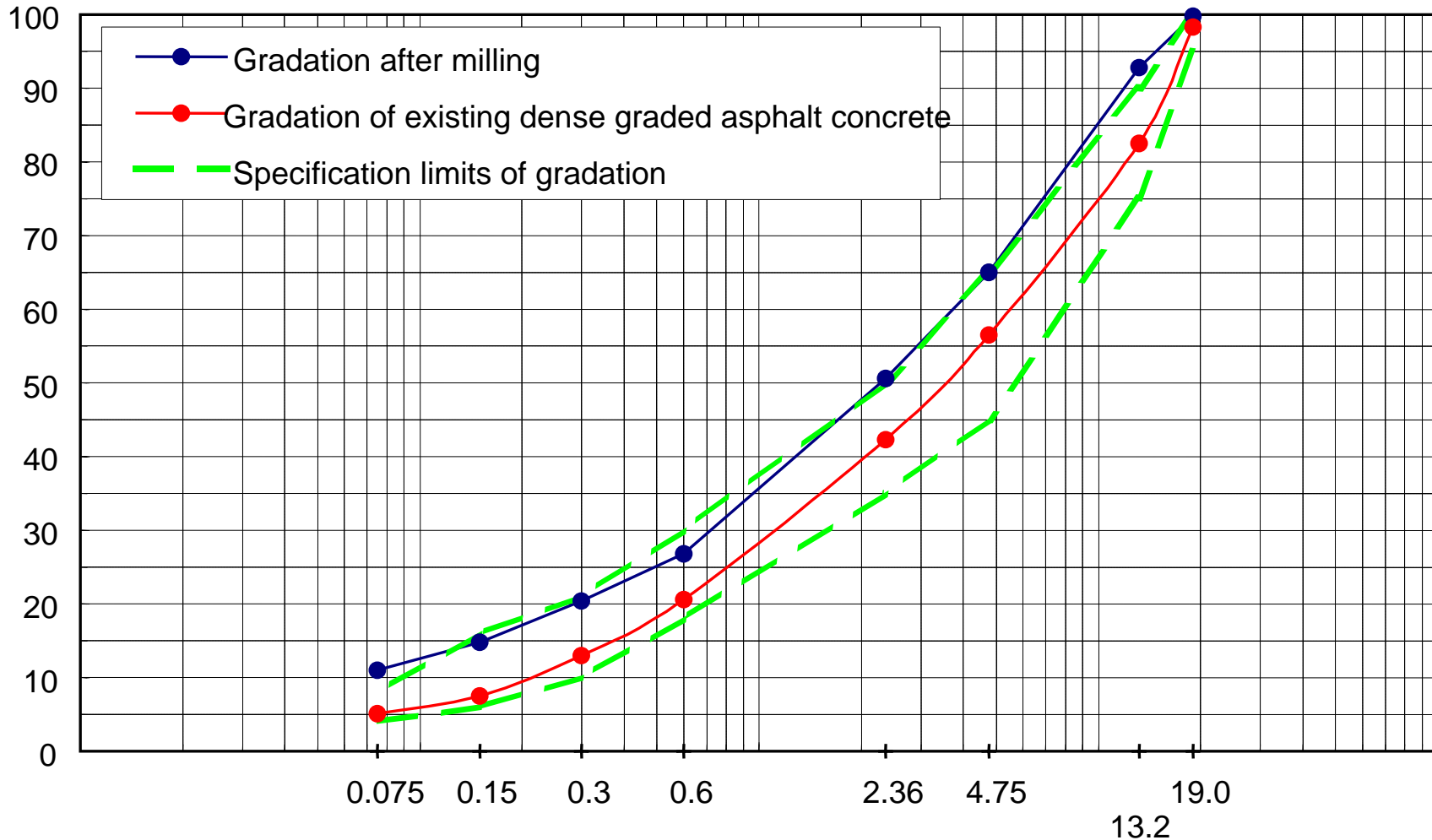
Materials:

Warm mixing

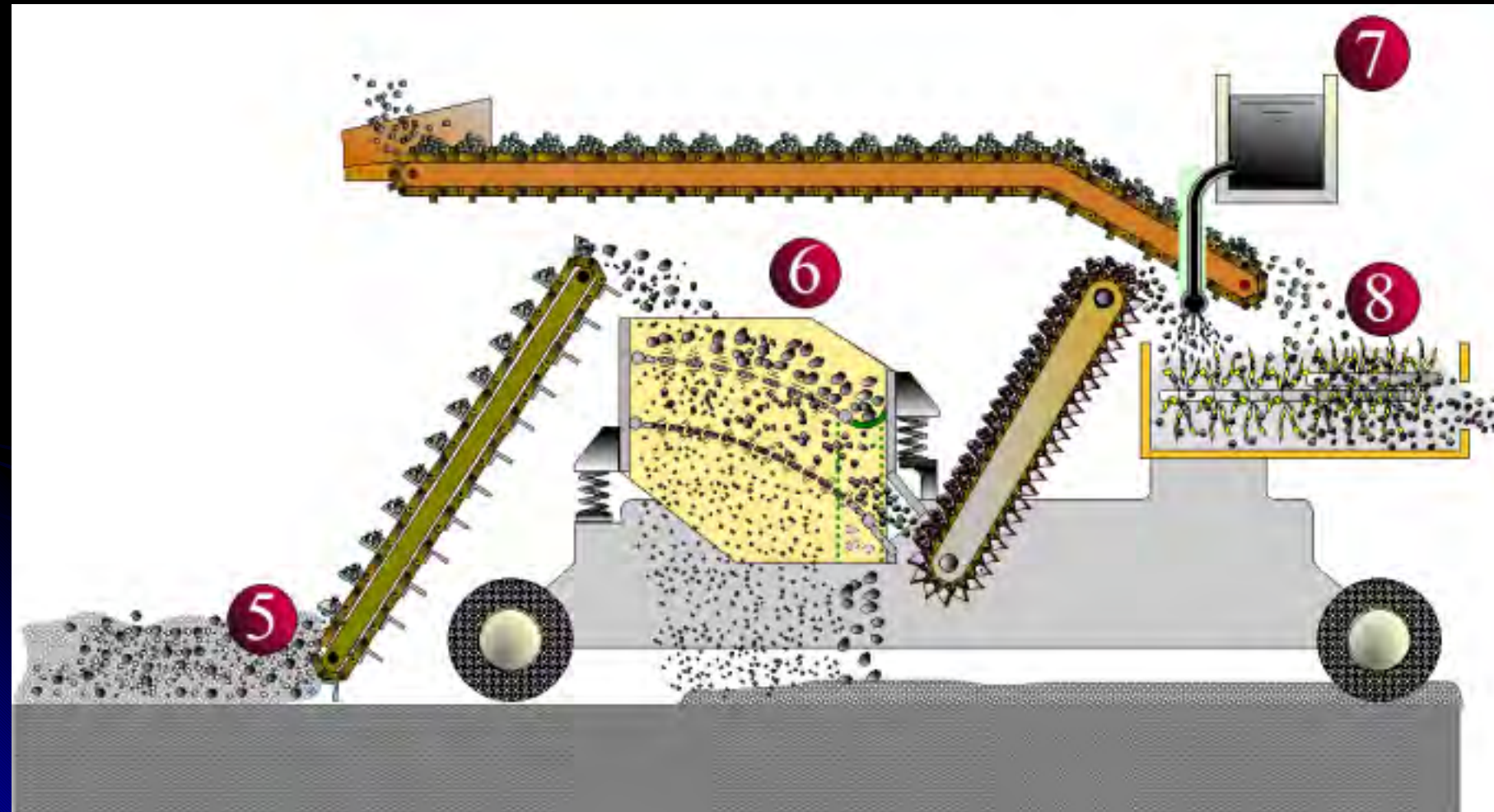
Heating Capacity



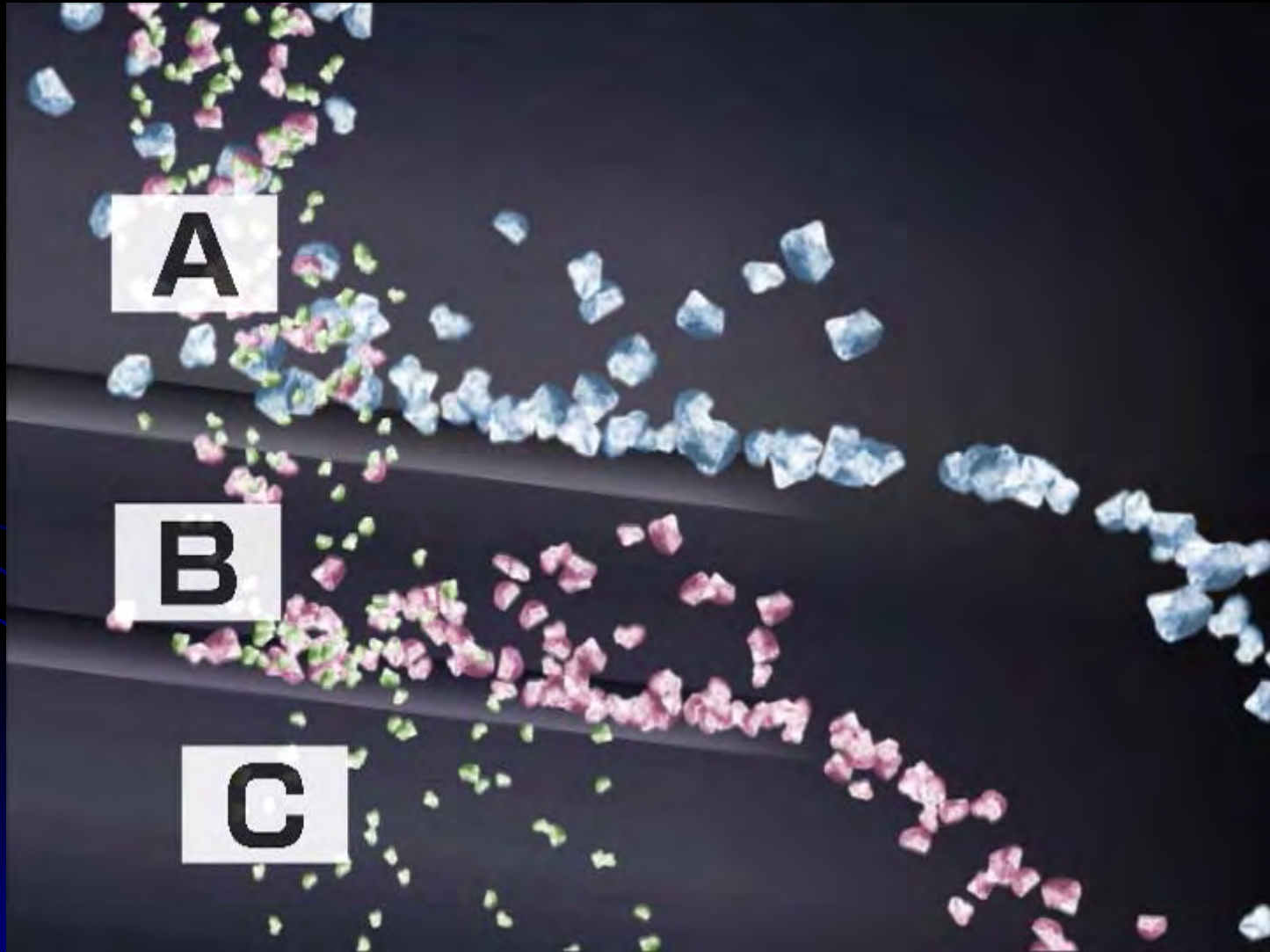
Gradation after Milling



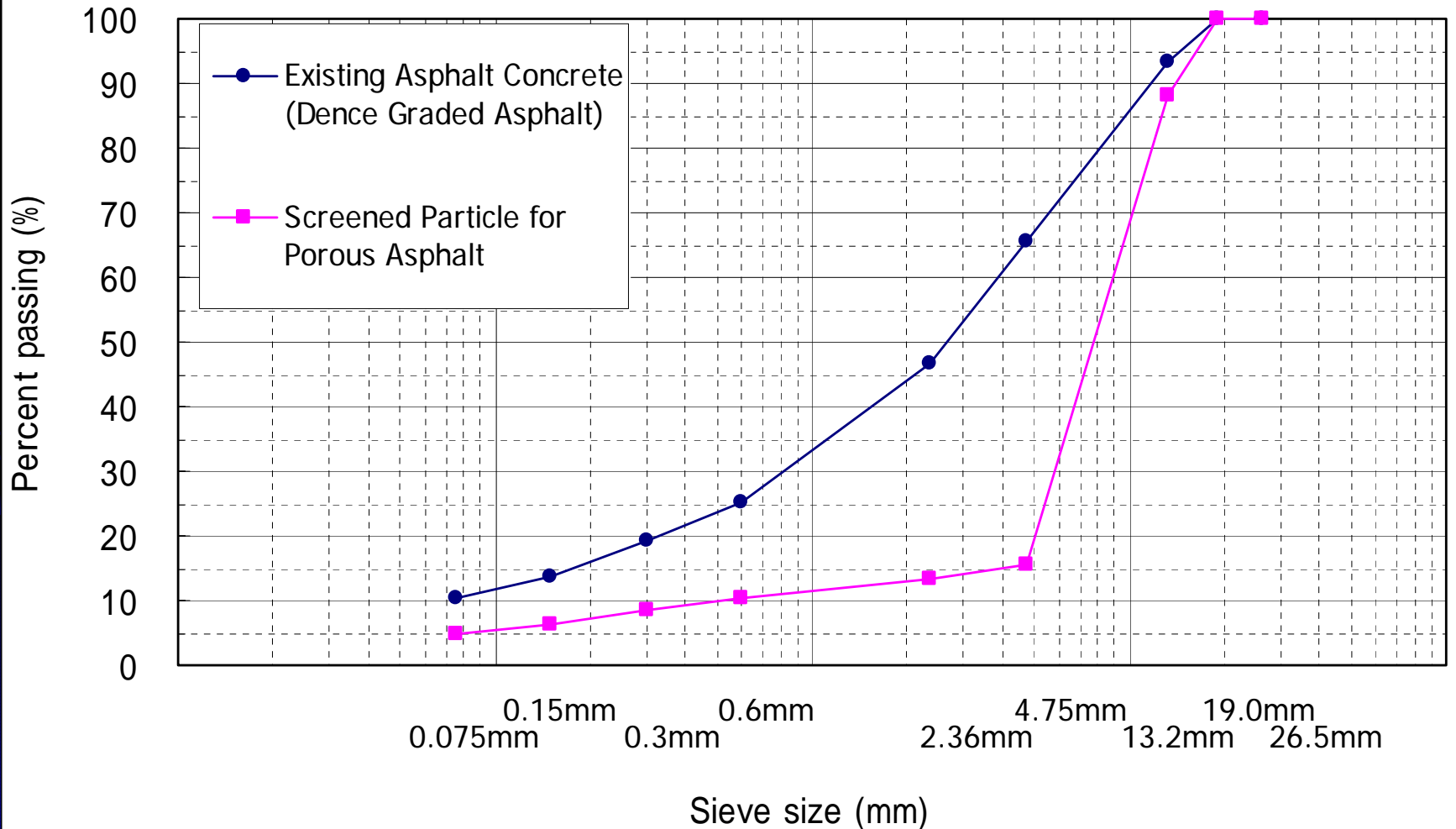
Screening



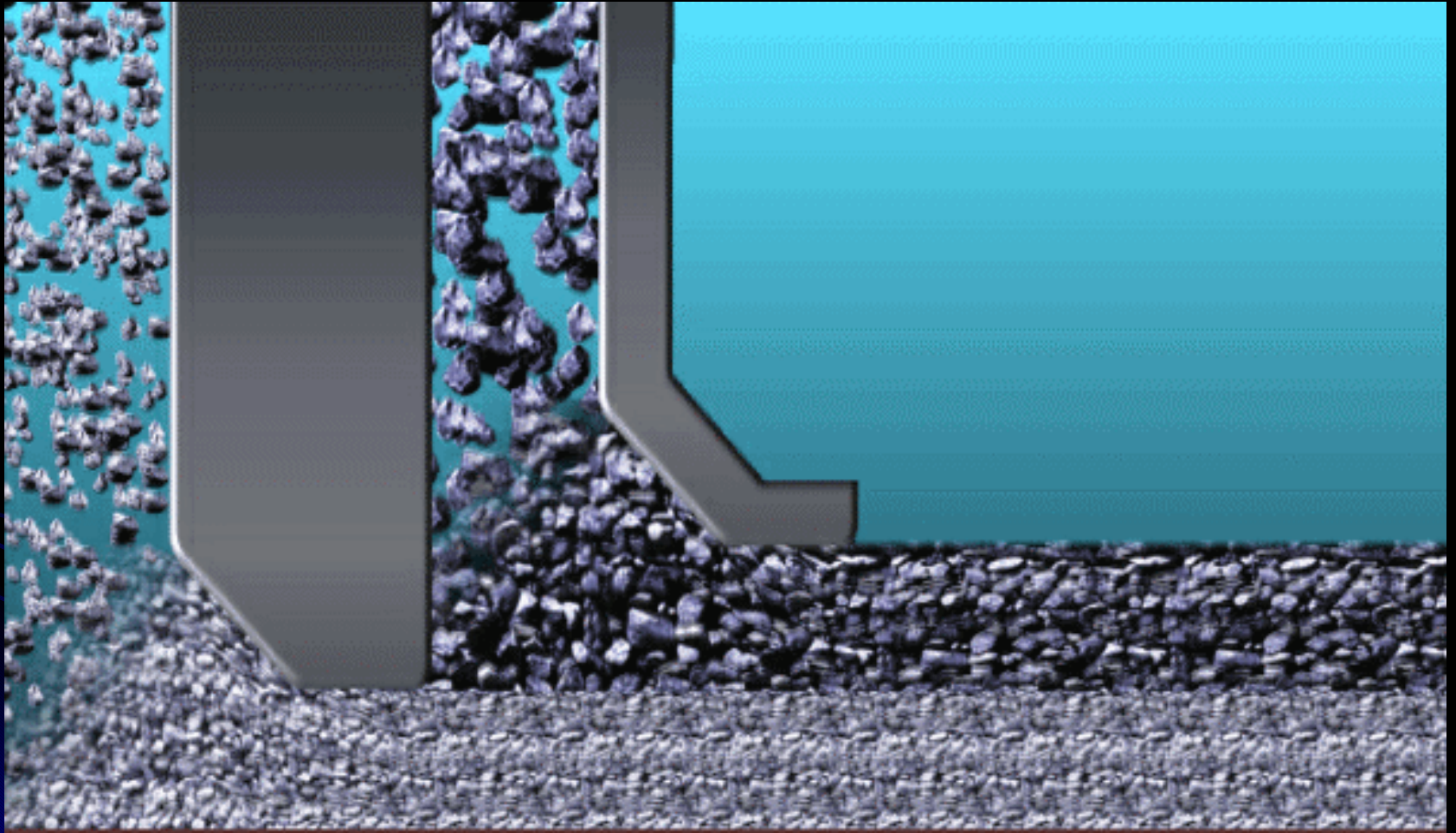
Screening



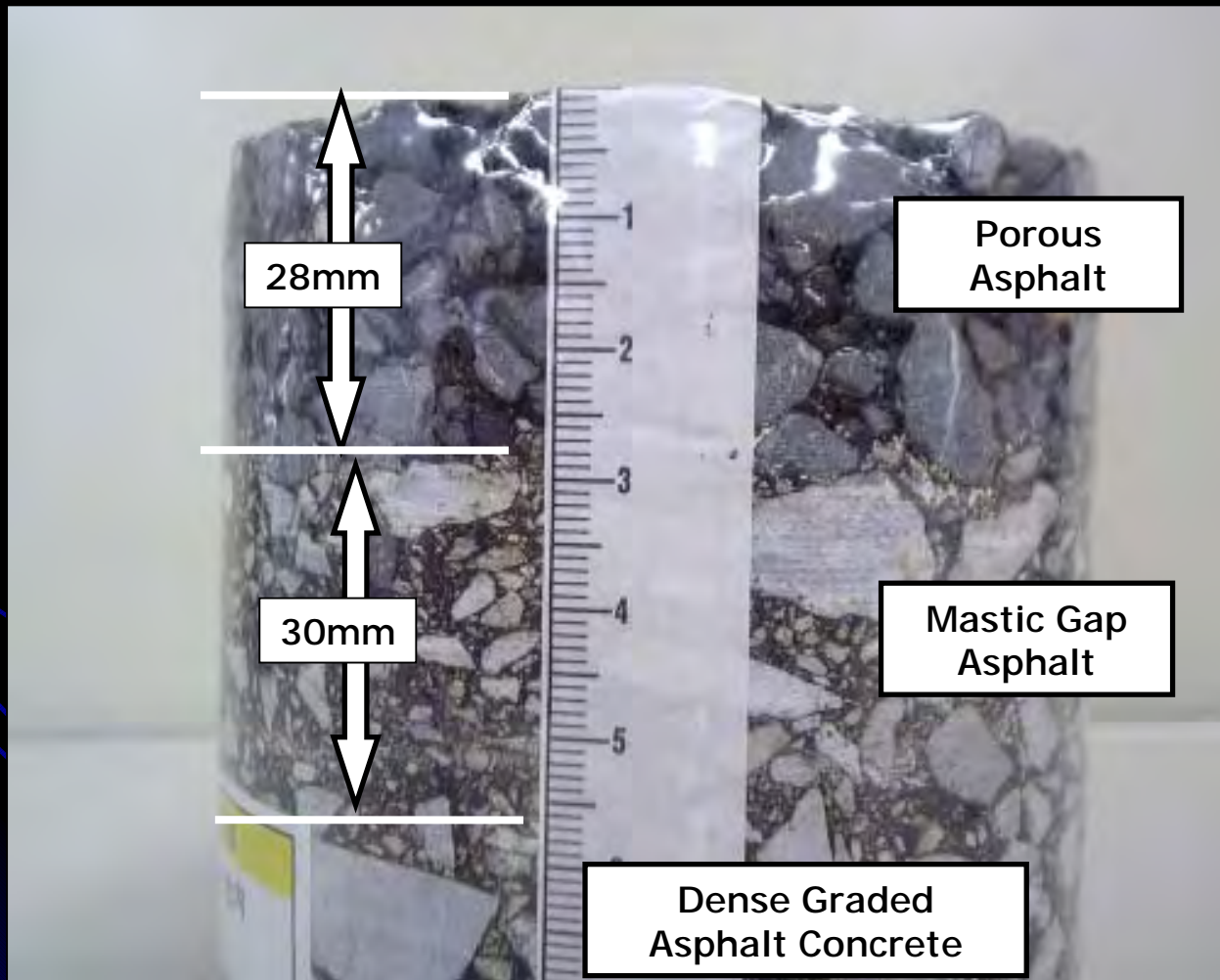
Screening Capacity



Tandem paving and Compacting



Compacted Core



Degree of Compaction

Degree of Compaction	
Porous Asphalt (Upper Layer)	Mastic Gap Asphalt (Lower Layer)
96.6%	100.6%

Compaction Temperature: 127.0C

Warm Mixing of Porous Asphalt

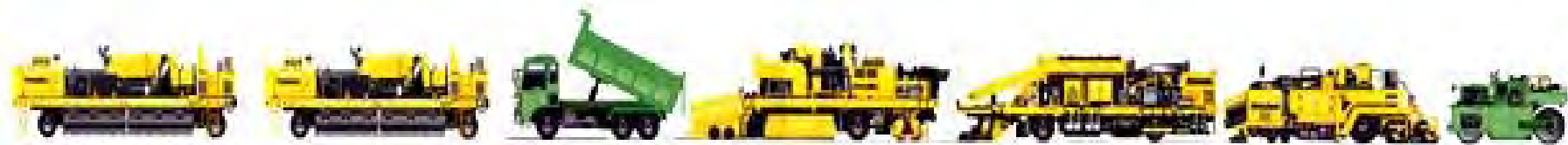
Compaction Temperature: 127.0C

Degree of Compaction:
96.6%

Hot Mixing

	Property
Penetration (25C) 1/10mm	59
Softening Point C	90.5
Flash Point C	342
Density (15C) g/cm ³	1.005
Viscosity (150C) mPa.S	5,410
Viscosity (180C) mPa.S	1,720

Train of Machines





Tokyo

Okinawa

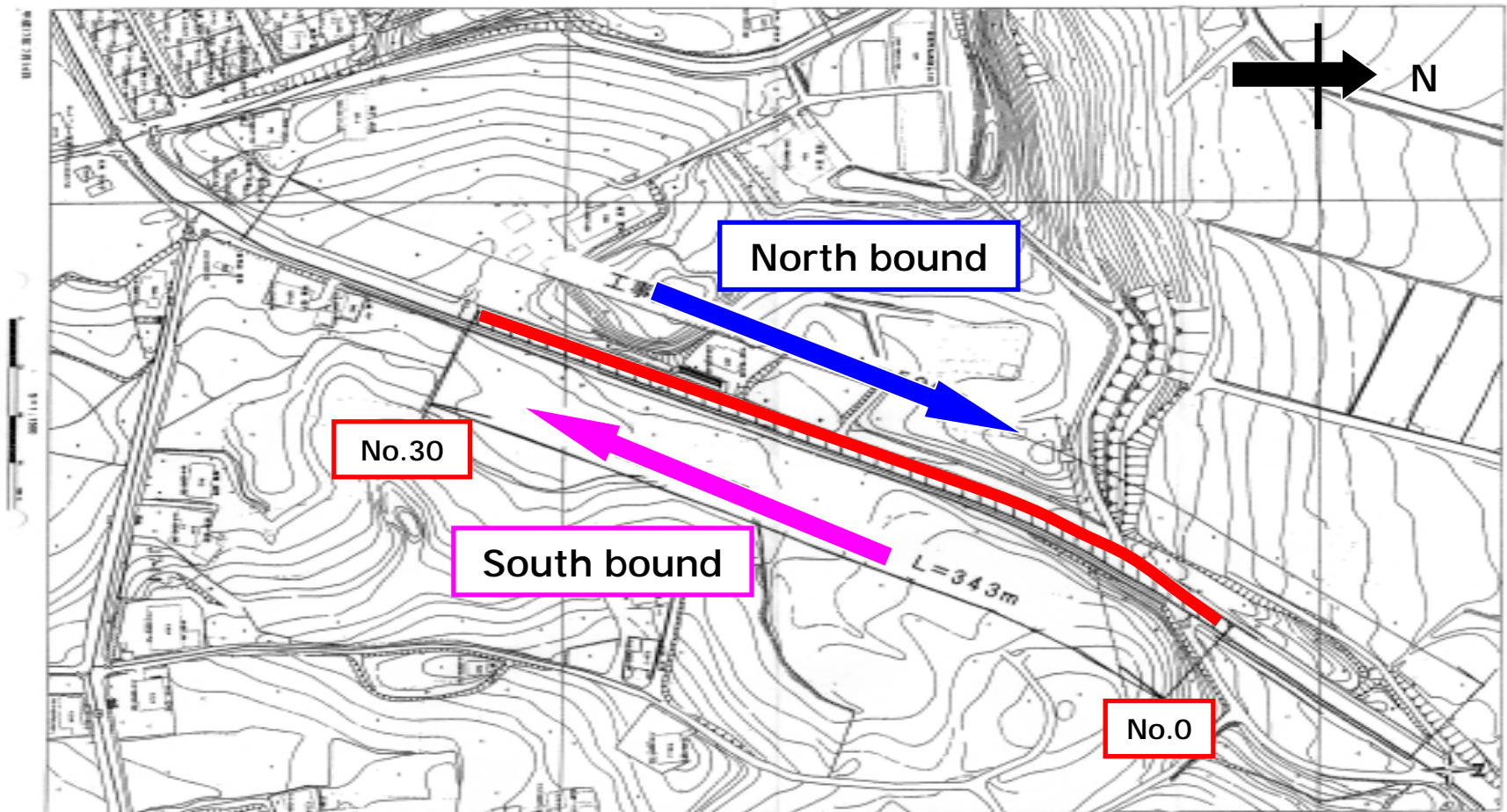


Naha Airport

Test Transforming™ work date & Plan view

Execution area : 2,470m²

{ 2 Lines (1Line ; 3.5m) , Execution length is 686m (1Line ; 343m)



Transforming Operation









Temperature Measurement

a. 194.3C

b. 229.0C

c. 162.2C

d. 149.3C

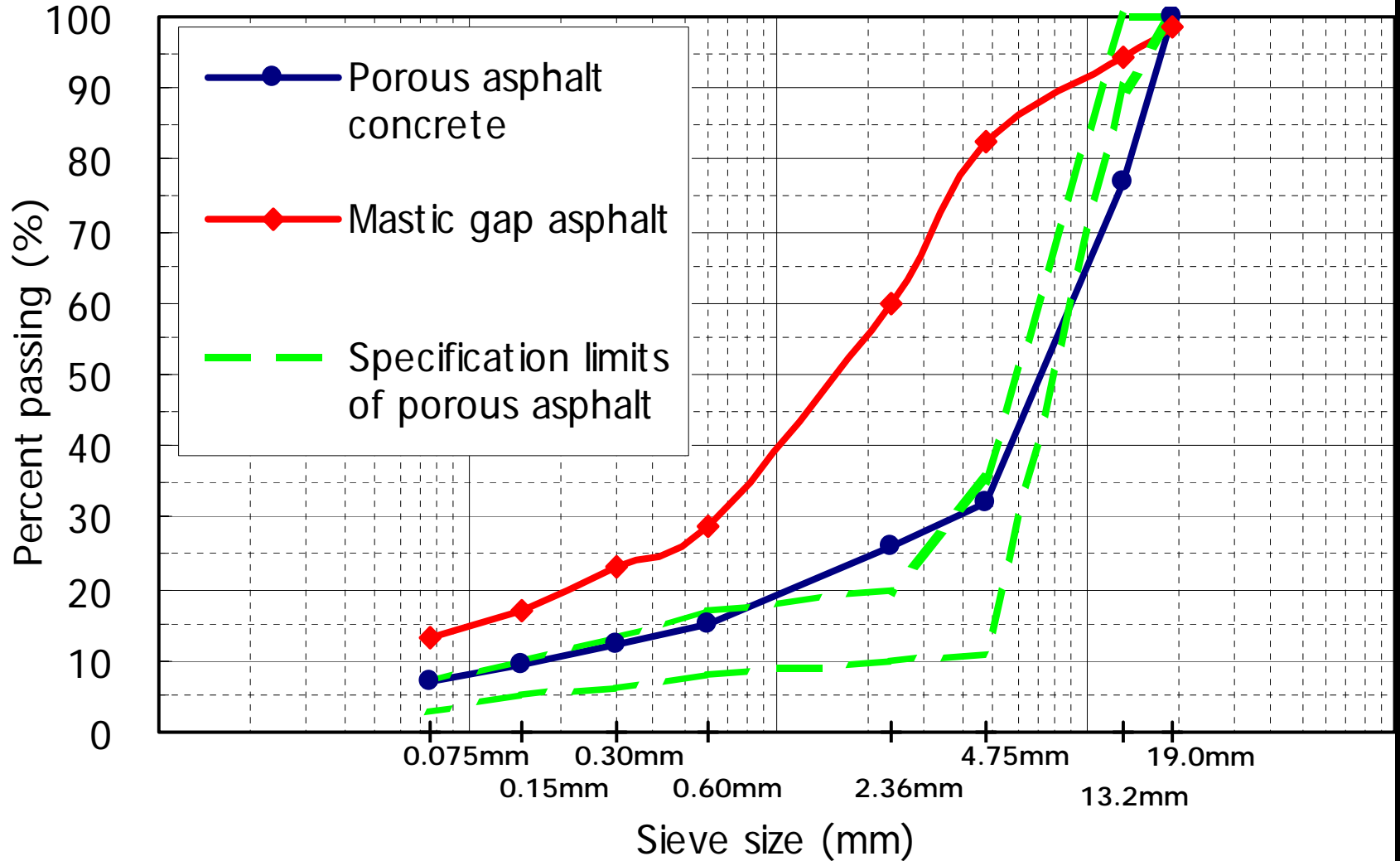


e. 93.5C

f. 127.0C

g. 125.0C

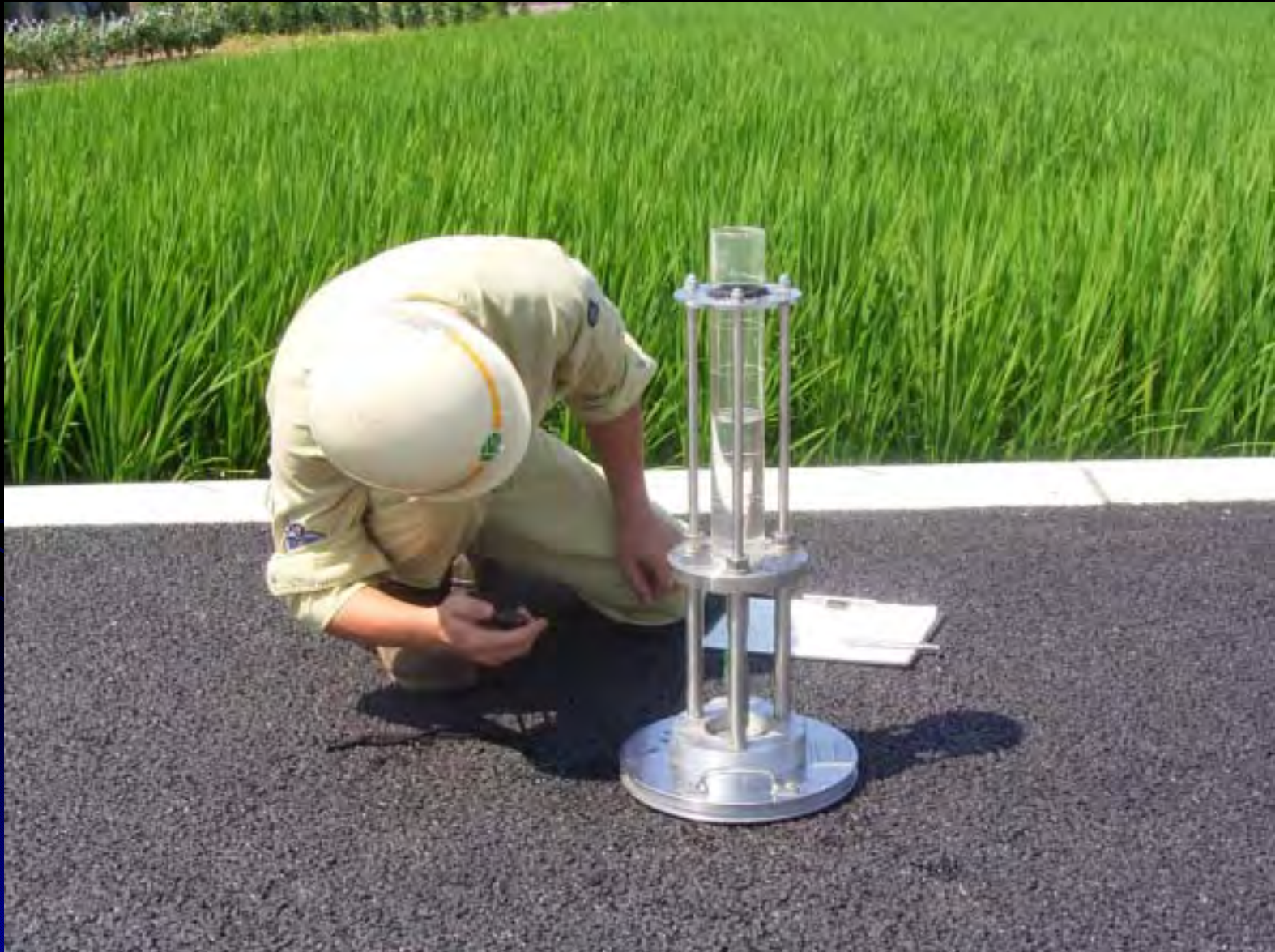
Percent passing (After transforming)



In-situ Permeability Test

Measurement Point		Permeability (ml/15sec)	Standard Value
South bound	No.10	1,310	More than 1,000
	No.20	1,402	
	No.30	1,354	
North bound	No.10	1,354	
	No.20	1,429	
	No.30	1,399	
Ave.		1,375	

Water permeability test



Contribution

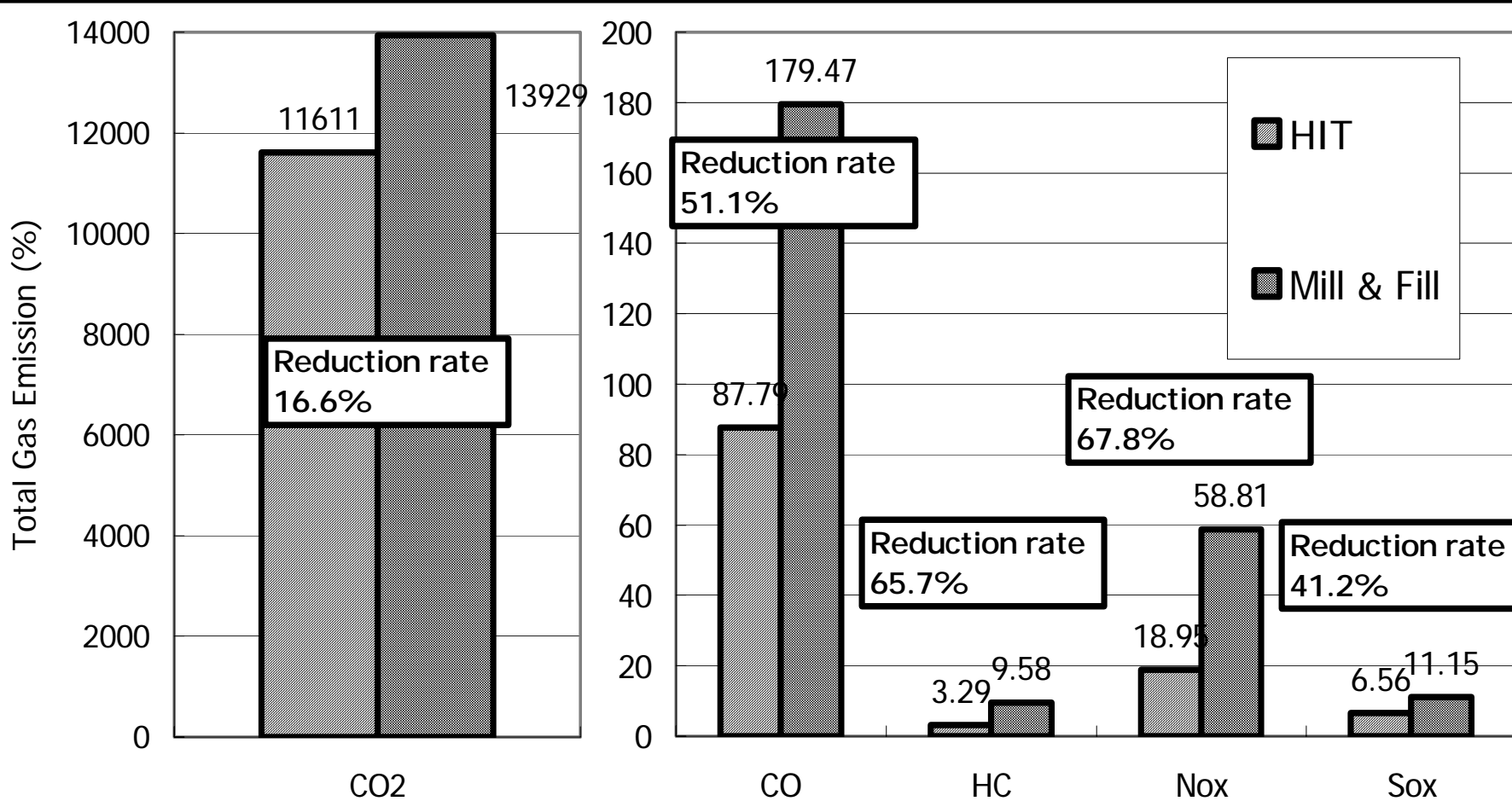
Reducing Gas Emission

Saving Energy



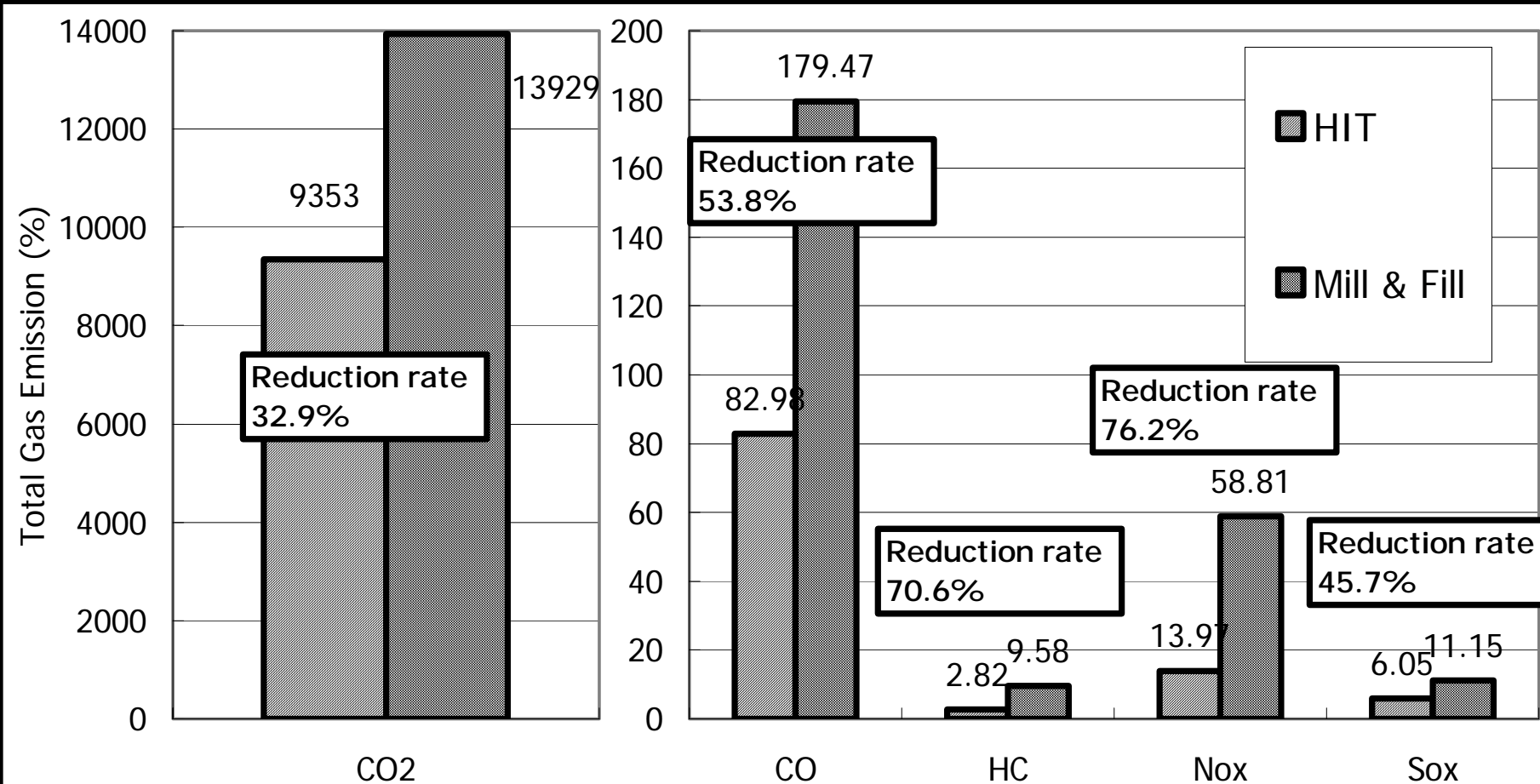
Gas Emission

[Comparison of HIT and Mill & Fill (2m/min)]

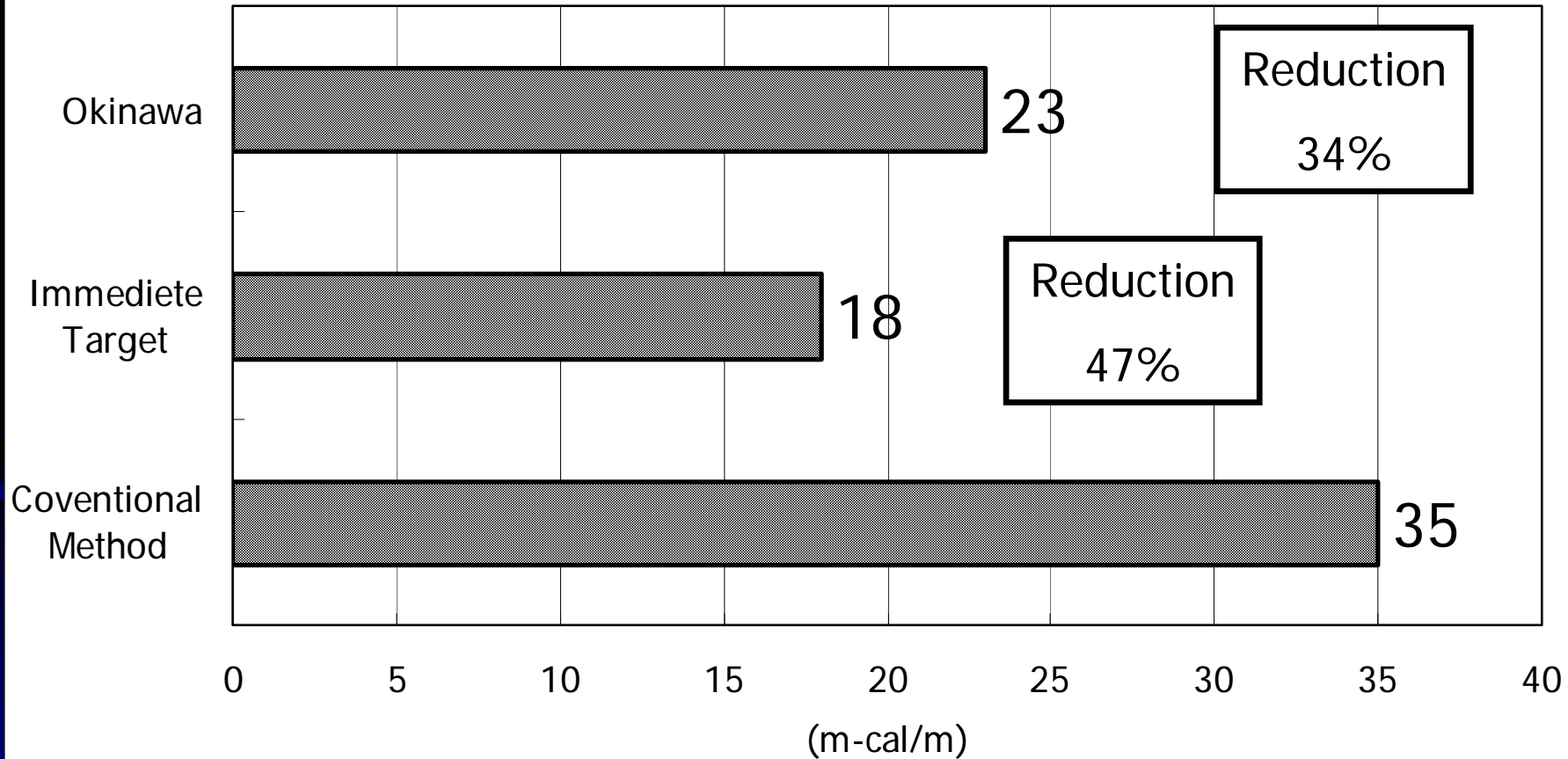


Gas Emission

[Comparison of HIT and Mill & Fill (3m/min)]



Total Energy Consumption



Economics

Unit: ¥1,000

	HIT method	Mill and Fill
Labor	224	270
Material	2,688	3,802
Operator	384	371
On site heating	480	0
Tuck coat	0	70
Waste disposal	0	652
Sub total	3,776	5,165
Machine rental cost	1,270	535
Total	5,046	5,700



Avenir