Scanning Tour of Japan

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Presentation Outline

- Industry Dynamics
- Japanese Research & Technology
- Recycling Practices - plant equipment, laydown operations and laboratory testing
- Applications in the United States

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Technology Transfer

How does a visit to Japan relate to sustainability?

The focus of the scanning tour was specifically intended to better understand Japanese advancements in use of recycled asphalt pavement (RAP)

Recycled Asphalt Pavement (RAP)

Societal

- Natural Resource Conservation

Economic

- Reuse Aggregate and Asphalt Binder

Environmental

- Reduced Emissions
- Reduced Landfill Space
- Closes Life Cycle Circle

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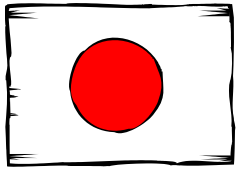
Why Visit Japan?



- The National Asphalt Pavement Association (NAPA) learned that, on average, Japan recycles 45+ percent in their asphalt mixtures.
- NAPA promotes the increased use of recycled products here in the United States and therefore organized a scanning trip with Japanese counterparts to understand their practices.

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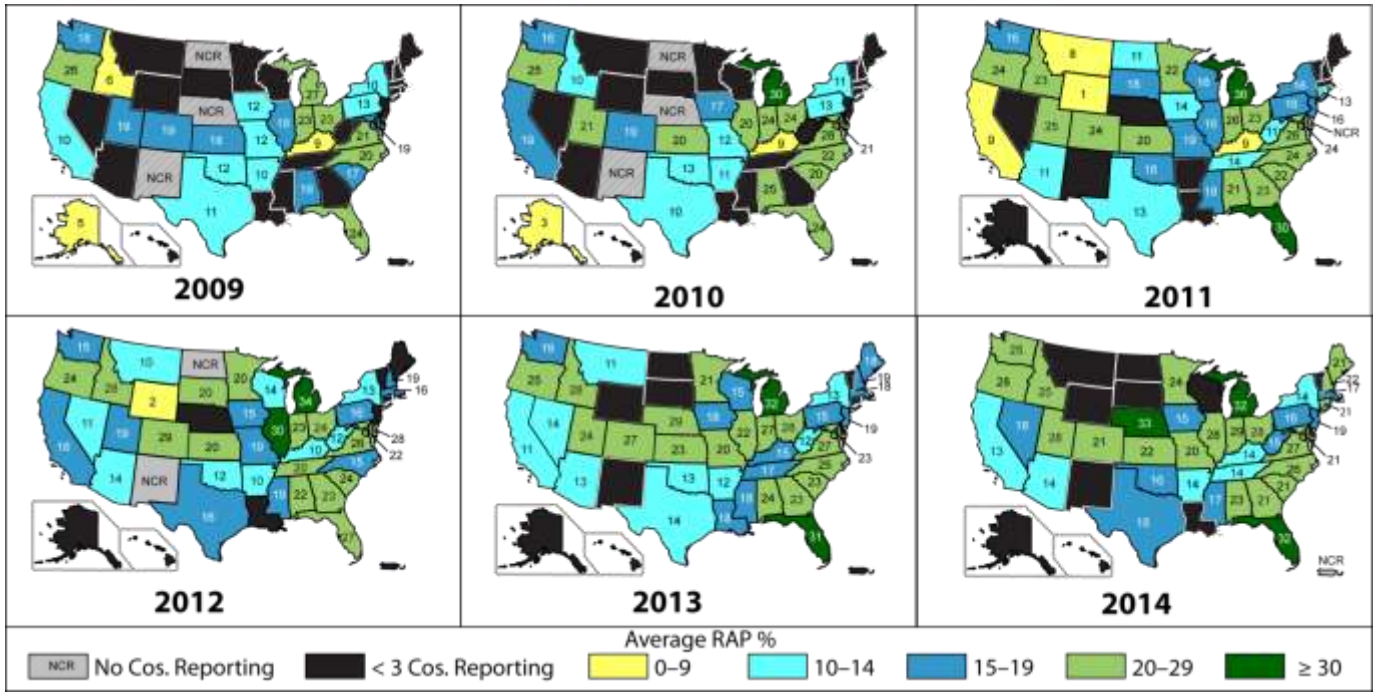
NAPA RAP Survey



Tremendous Benefits of RAP

19 million barrels conserved!
Savings of $2.04 billion!!

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Scanning Trip Planned

- The trip was planned from December 1-10, 2014
- The US Delegation included 19 individuals representing NAPA contractor members, four (4) state DOT representatives, the National Center for Asphalt Technology (NCAT), NAPA staff, and a representative from the State Asphalt Pavement Associations (me)
- Everyone arrived in Tokyo on December 2nd

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Japan Scanning Tour – United States Delegation

Flight Path and Time Change

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Arrival at Narita

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Busy Schedule

- Asphalt Plant Tour and Paving Site Visit
- Seminar on Recycling
- Technical Tour of Expressway (porous)
- Sightseeing in Kyoto
- Bullet Train to Tokyo
- Asphalt Plant Tour and visit to the Public Works Research Institute (PWRI)
- Contractor lab visit

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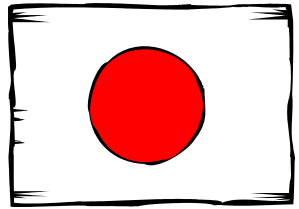
Industry Dynamics

Putting it all into context

Japan 101

- Island nation in East Asia with the worlds 10th largest population (over 126 million people)
- Greater Tokyo area and surrounding prefectures is the largest metropolitan area in the world with over 30 million residents
- Japan consists of 6,852 islands, has108 volcanos, and experience earthquakes and tsunamis



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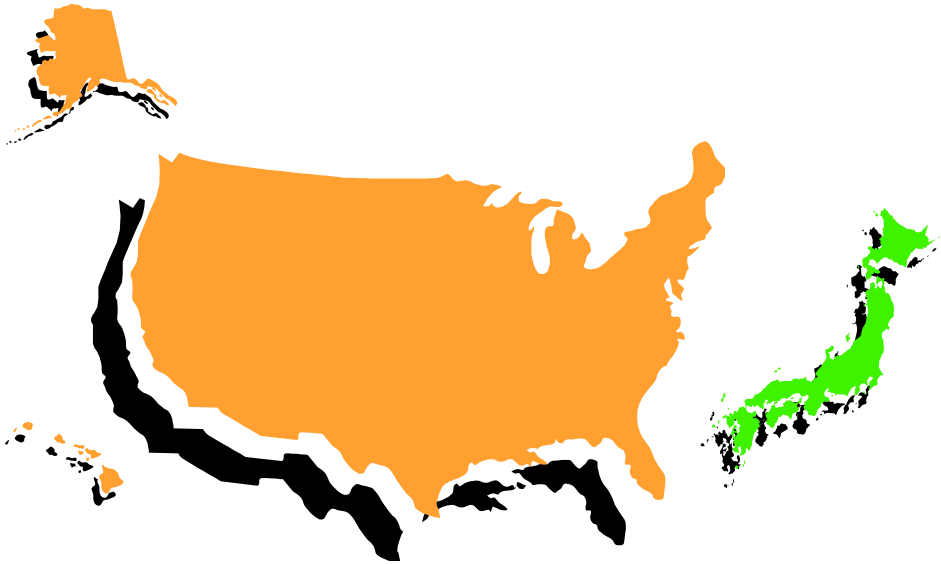
Size and scale compared to U.S.

- Japan has roughly half the population and only about 4% of the land area of the U.S.
  - Production is about 50 million tons with about 1,000 plants
- Unites States production is 350 million tons with about 3,000 Plants



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General Observations

- Japanese culture is an interesting blend of old traditions and new technology
  - **That contrast between old and new extends into their asphalt paving operations as well**
- In some specific areas – the Japanese would appear to be more advanced than the US but in many ways, they are decades behind

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Asphalt in Japan Versus U.S.

Advanced

- Recycling over 45% RAP and use of rejuvenators
- Performance-based specifications
- Workmanship & Safety

Lagging Behind

- Batch plants with low production
- Small projects with high unit costs
- Mix designs and materials

Language Barriers

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Table Height

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Technical Presentations

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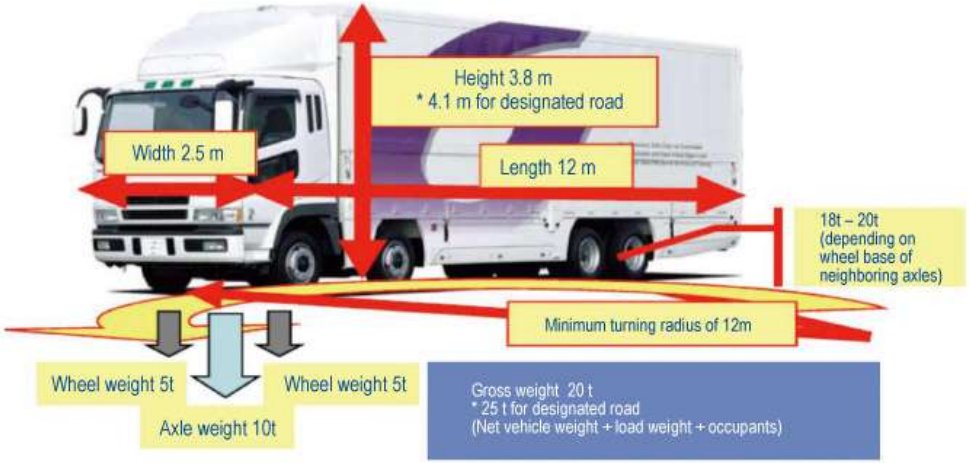
Maximum Axle Weight = 11,000lbs



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Recycling in Japan

- Government mandate
  - Legislation on recycling construction waste is stringent and fully implemented
  - Japanese concluded in 1992 that RAP mixtures were as good as virgin mixes
- Japan is a small country with large urban areas so waste disposal is an important issue

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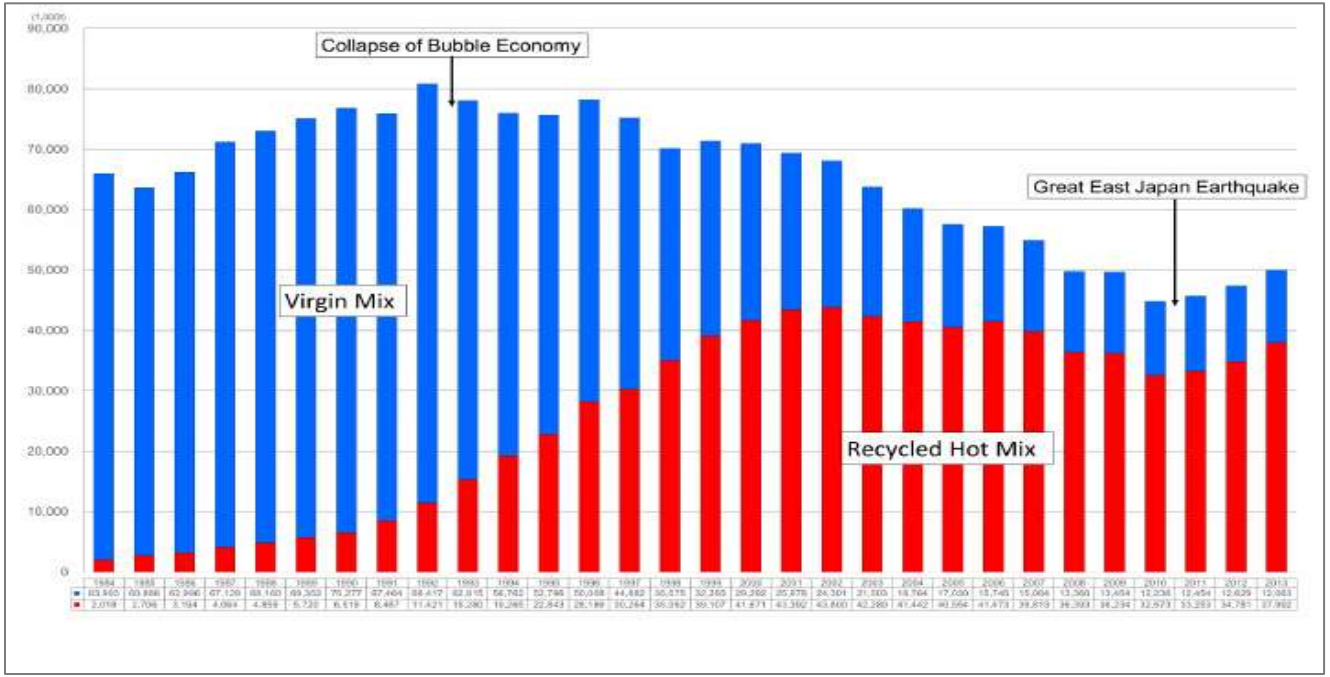
Japanese Asphalt Mix Products



Government Research

Similar to Turner Fairbanks and NCAT

Test Track with Driverless Trucks

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Test Track @ 35 degree banking

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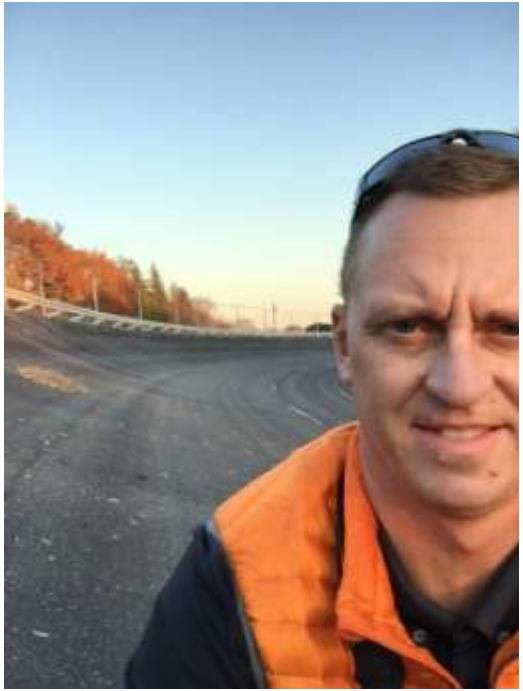
High Bank by Bus!



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Nippo Facility Tour

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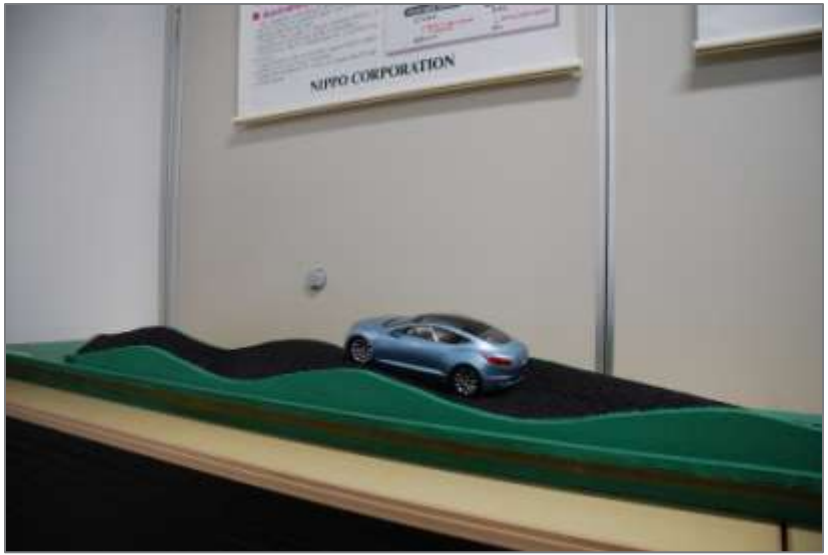
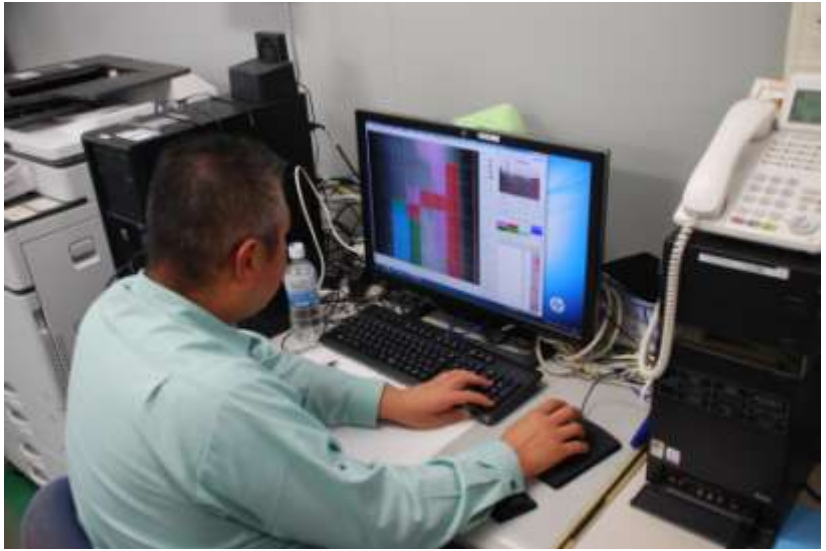
Research Laboratory @ Nippo





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High RAP Mixtures

Typical Asphalt Plant in Japan

Visited Two Plants

Taisei Rotec

Maeda Road

Classroom Element

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Cultural Differences

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Plant Safety

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Virgin Materials

- Handled and processed similar to the United States
- Mostly sandstone
- Covered cold feed bins to maintain low moisture content

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Clean and Covered

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Processing RAP

- Most of the RAP we saw was delivered in pieces (not milled)
- Delivered to the asphalt plant for processing
- Crushed, sized & screened

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Indoor Processing Facility

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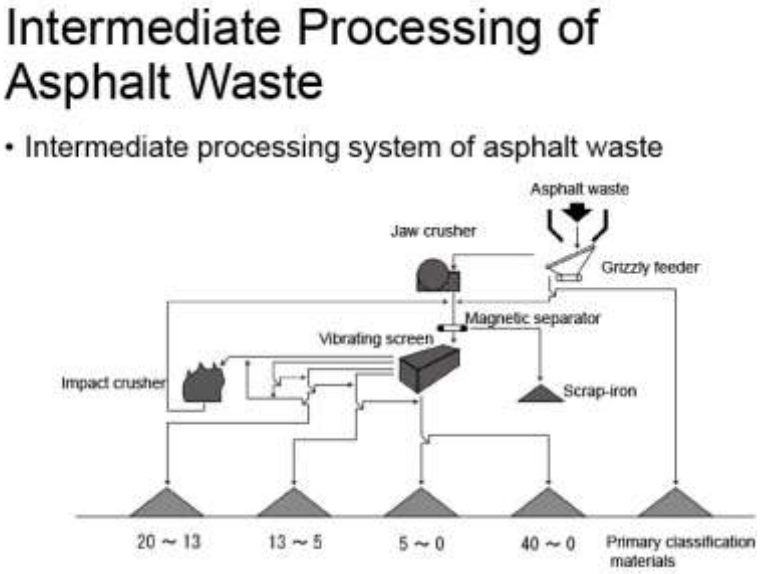
Rap Processing

- RAP is fractionated much like it is here in the U.S.
- The RAP processing facility we visited was indoors (strict dust and pollution requirements)



RAP Processing Facility

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Managing Materials

- Covered processing and bin storage
  - They keep RAP dry… reported at 1.5%-2.0% moisture
- RAP is tested for penetration grade

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RAP Parameters

- Liquid in RAP must have a penetration of 20 or more or it will be discarded
- Fractionated into 2 or 3 sizes to develop proper blend

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Mix Design – Randy West (NCAT)

- Japan has established simple mix tests to evaluate mix designs
  - Those tests are the indirect tensile modulus (peak stress/deformation) and a wheel tracking test (dynamic stability)
- This allows the mix designer (contractor) to be innovative in developing combinations of materials (e.g. RAP, softer virgin binders, and rejuvenators) to meet the mix design criteria.

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Japanese Experience

- Mixes seemed to be “reverse-engineered”
- Found a combination of materials that performed well in the field and used them again and again…

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Rejuvenators

- The key to using high RAP mixtures is the introduction of a rejuvenating agent to condition the RAP
- It softens the hardened binder and activates the liquid

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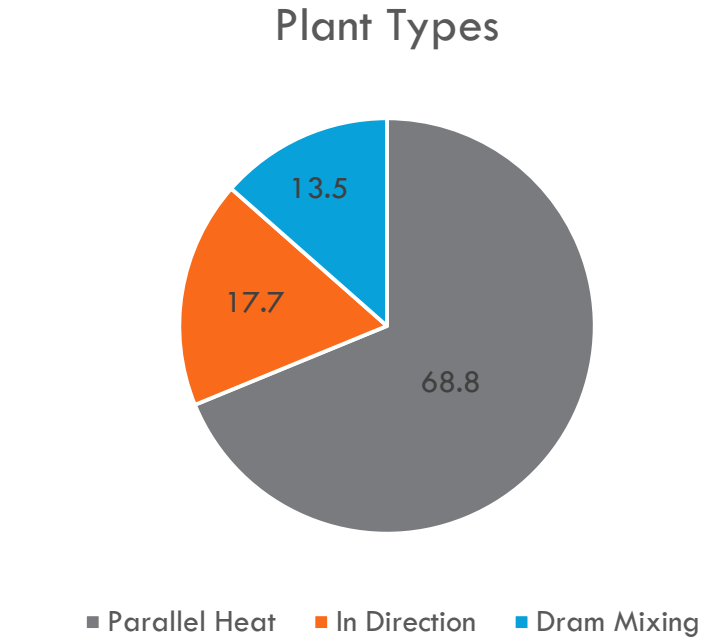
Recycling Methods in Asphalt Plants



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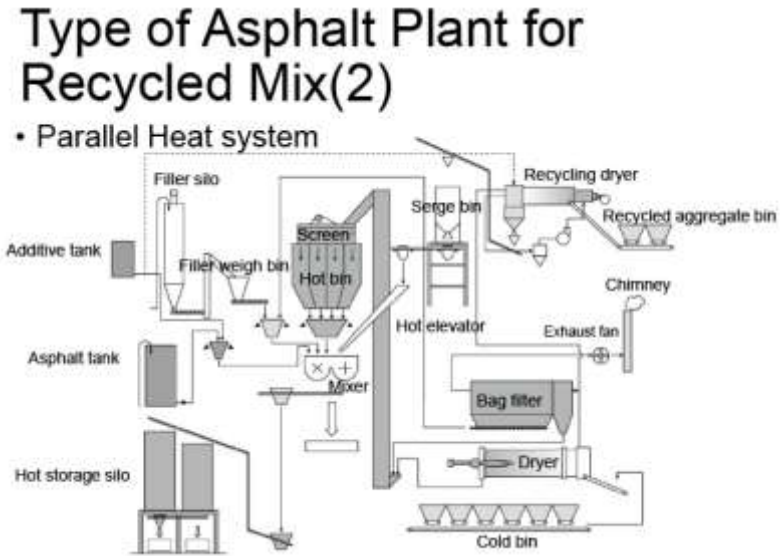
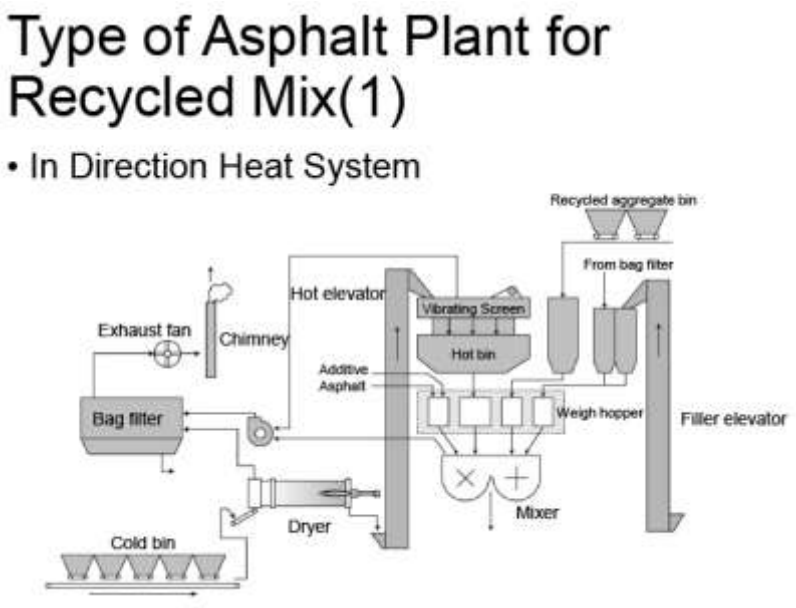
Parallel Heat System

- Most common plant type (68.8%) and the type we visited while on our tour
- Parallel dryers… one for recycle and one for virgin materials



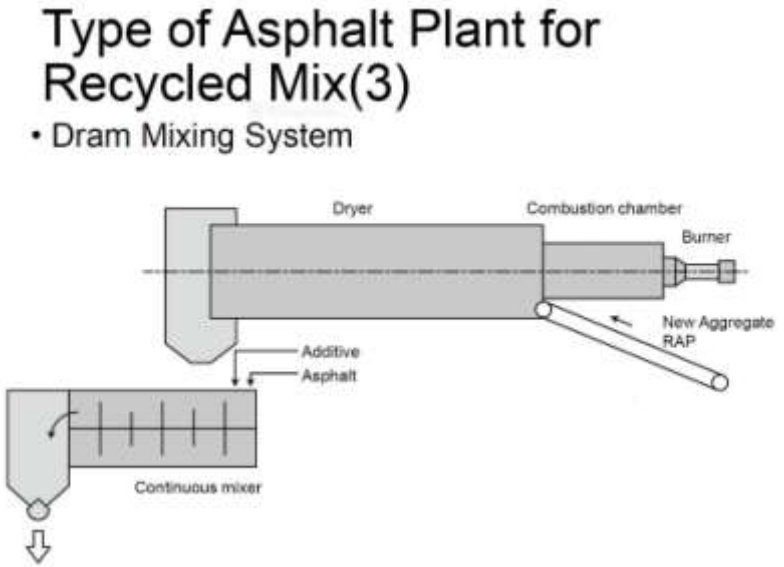
“In Direction” Heat System

- Appears most similar to a U.S. style batch plant utilizing superheated virgin aggregate to transfer to heat and dry the RAP
- Approximately 17.7% of the plants utilize this method but we did not visit one while there



“Dram Mixing” System

- RAP is added into a parallel flow dryer away from the flame Not very common in Japan (13.5% of plants) and did not visit on our tour



TaiseiRotec Plant

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Maeda Road Plant

- Parallel Heat System
- Batch plant producing 180 tons/hour
  - 270,000 tons/year
- 32 employees with dorm so that mix available 24 hours

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Inside the Plant

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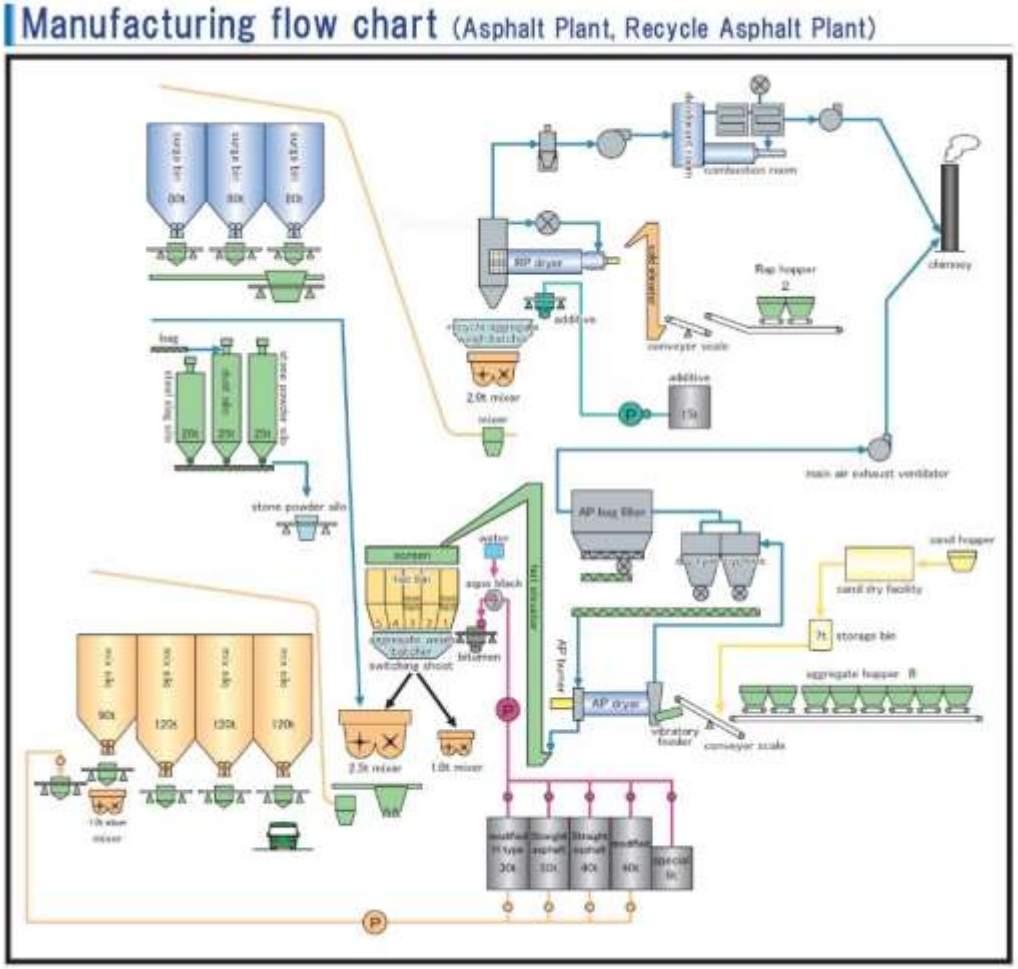
Material Flow

- RAP to dryer, pugmill with rejuvenator, and to surge bin (3 hours)
- Virgin materials dried and moved over screens (typical)
- RAP mixed with virgin aggregates and AC in the mixer



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Rejuvenators

- Proprietary!
- One plant we visited indicated that their product was generally classified as a paraffinic oil

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RAP Dryer/Drum

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Mix Types

- They keep mix types to a minimum and simple descriptions
- Batched a virgin mix along with 45% and 60% RAP mixes for our inspection

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Loading Operations

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Maximum Asphalt Load = 9 tons

Shifting Gears… Visited Plants in France in November

Colas Plant Near Paris

- Another large, vertical, enclosed batch plant
- Colas is a huge company yet the average project size is 80,000 euros
- Average 12% RAP

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Covered Stockpiles

- Emphasis on moisture
- 10 cold feed bins
- Plant was very versatile
  - RAP & WMA
  - Decorative (glass, clear and colored binders, colored aggregates)
- Produce hot mix by day and mastic at night

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Decorative Options

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Eiffage Plant Near Tours, France

- 6,000# Batch plant with two driers
  - Parallel flow for RAP
  - Counterflow for virgin aggregates
- Routinely produces 40 percent RAP

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RAP Drier at the Top

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RAP Processing & Storage

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Sophisticated Operations

French specifications drive innovation

Back to Japan…. Field Operations

Asphalt Paving Project

Trucking Operations

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Paving Operations

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Compaction

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Tight Joints

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Excellent workmanship

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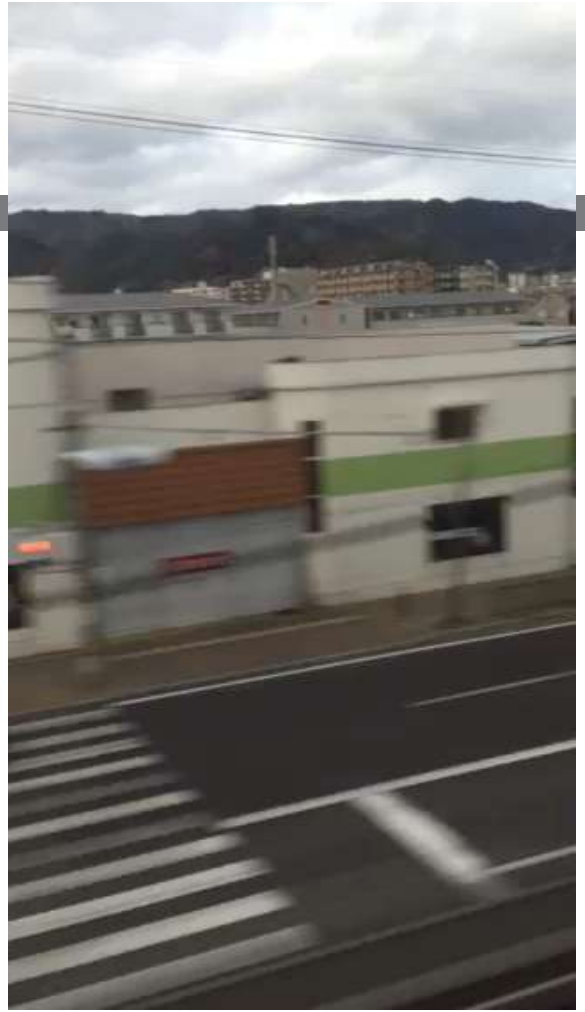
Clean and precise operations

Alternative forms of transportation

165 mph by train



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Bicycles

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At 50% of all distance traveled… car usage is the lowest of all G8 countries

Vehicles

- New and used cars are expensive, car ownership fees and fuel levies are used to promote energy efficiency
- Parking

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Experience the Culture

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Gifts and Business Cards

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Closing Reception

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Takeaways

Observations

- Performance-based specifications
- Emphasis on quality workmanship
- Use of rejuvenators to increase RAP percentage

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We can do more in the US with RAP

- We should not be afraid of high RAP mixtures
- If properly designed and incorporated – the can provide equal or greater performance

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Modern US Plants

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Parallel Heating

- Heating and isolating the RAP with the rejuvenator makes a lot of sense
  - Adaptations would be required in US for drum plants and for higher production
  - Foaming the rejuvenator may be more feasible to minimize or eliminate conditioning times
- Potential for mixtures with higher RAP that demonstrate equivalent or better quality and performance

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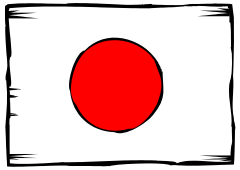
Big Picture Takeaways



- SIMPLICITY & focus on performance in mix designs and testing
- Cooperation and TRUST between government & industry
- Attention to QUALITY & details
- Overwhelming commitment to SAFETY
- SUSTAINABILITY is imbedded in their culture

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Questions?

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