



Scanning Tour of Japan

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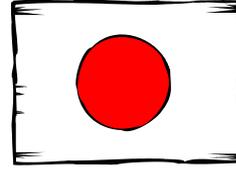
Pavement Condition Survey



Presentation Outline

1. Background & context -compare & contrast U.S. & Japan business practices
2. Research and Technology
3. History and Culture
4. **Recycling Practices - plant equipment, laydown operations and laboratory testing**

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 facilitate this technology transfer.

RAP Rhetoric in Kentucky

- RAP has been blamed for some mix performance issues in Kentucky
 - ▣ Falsely accused?
- Performance of RAP Vs. Virgin mixes
- RAP-starved rural areas
 - ▣ Tug of War with KYTC
- Abundance in the urban centers
 - ▣ Pushing higher and higher percentages

Back Home in Kentucky

- As the current Chairman of the State Asphalt Pavement Association (SAPA), I was excited and honored to be extended an invitation to represent the state execs
- A trip of this magnitude requires approval from the Board of Directors due to the cost and time away
- The PAIKY board members were very supportive and quickly approved my participation on the scanning trip

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



US Delegation

TaiseiTotec Plant Visit

Departure

- ❑ Departed December 1st @ 8:00am from Kentucky and connected through Detroit, Michigan
- ❑ Flight from Detroit to Narita airport (Tokyo) was 13 hours and 30 minutes
- ❑ Time change = 14 hours



Flight Path



Arrival at Narita



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

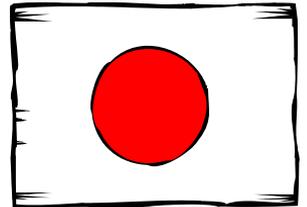


Industry Dynamics

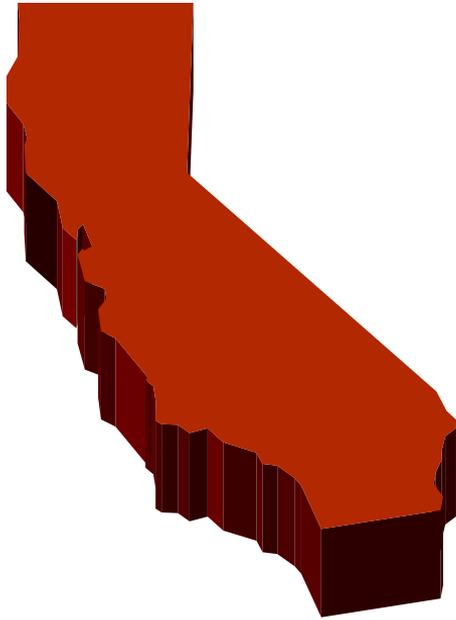
Putting it all into context

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, has 108 volcanos, and experience earthquakes and tsunamis



Size and scale



Japan's land area is 145,925 square miles - slightly smaller than the state of California at 163,696 square miles



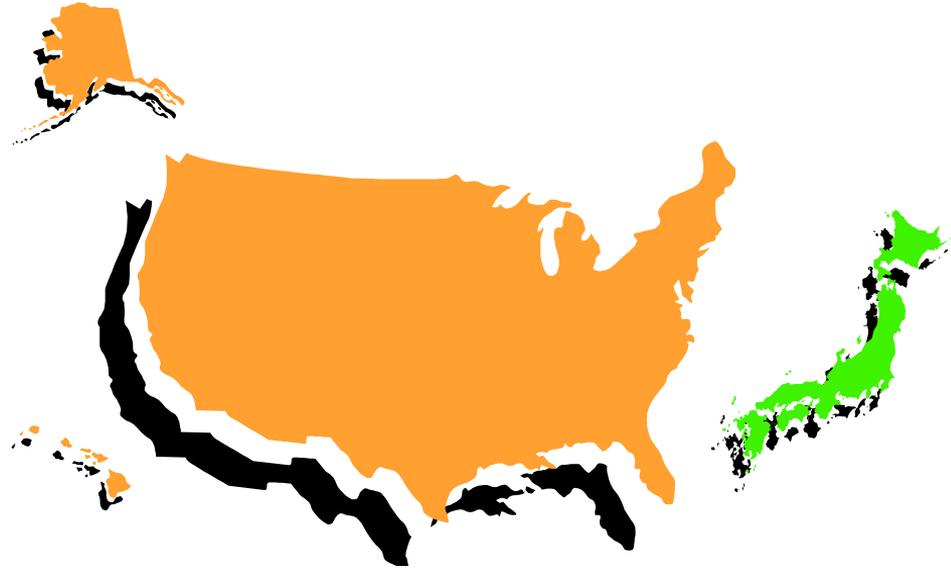
Climate

- 32° - 47° North Latitude (mainland)
 - ▣ Roughly San Diego to Seattle Washington
- Temperature averages between 41.2° F (winter) and 77.4° F (summer)



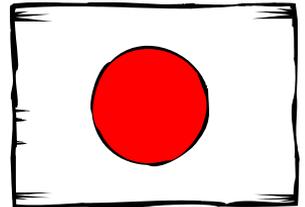
Size and scale compared to U.S.

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



Japan's Roadbuilding (NY Times Article)

- “Japan’s road spending has been extensive. It’s 1.2 million kilometers of paved roads are the main means of transportation.”
- “Japan spends more on public construction, about \$300 billion, than the Pentagon spends on defense.”
- “Japan's construction industry, with 500,000 companies and 6.6 million workers, accounts for 10 percent of the country's employment compared with 5 to 7 percent in other advanced nations.”



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

Asphalt in Japan Versus U.S.

Advanced

- ❑ Recycling over 45% 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



Seminar & Opening Reception

Information Exchange

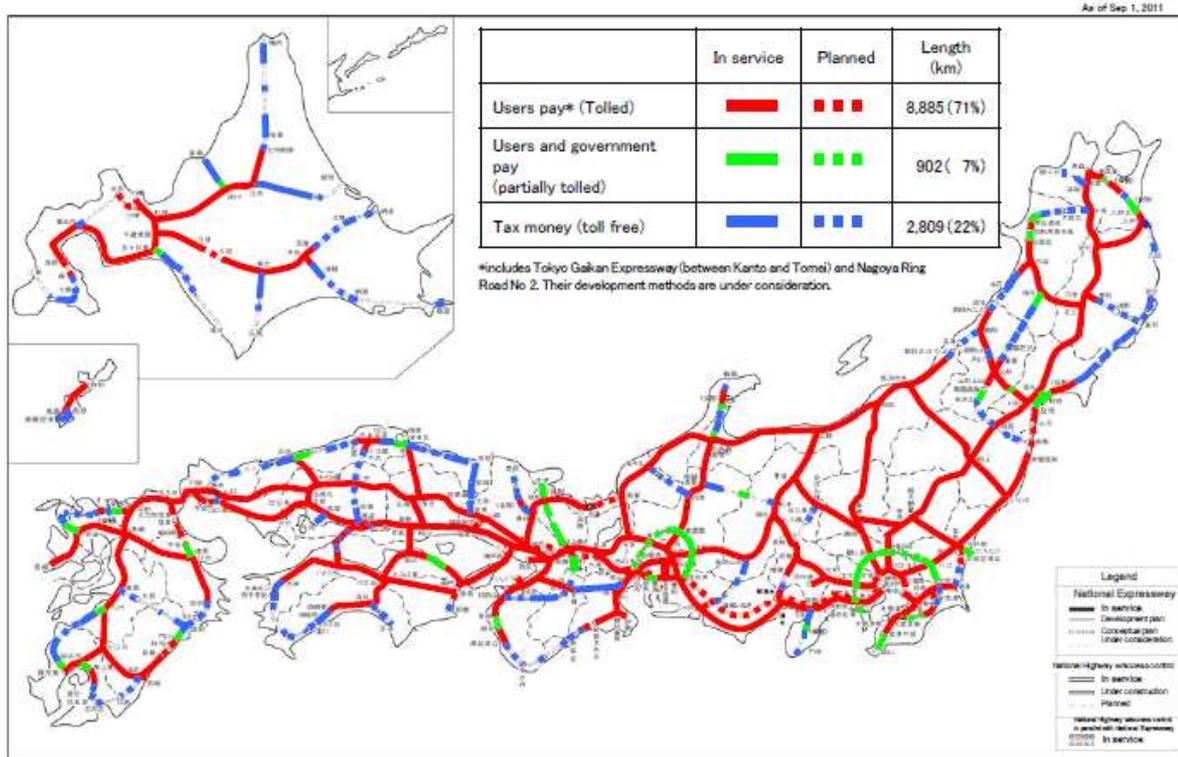
Language Barriers



Technical Presentations



Japan's Highway Network



Maximum Axle Weight = 11,000lbs



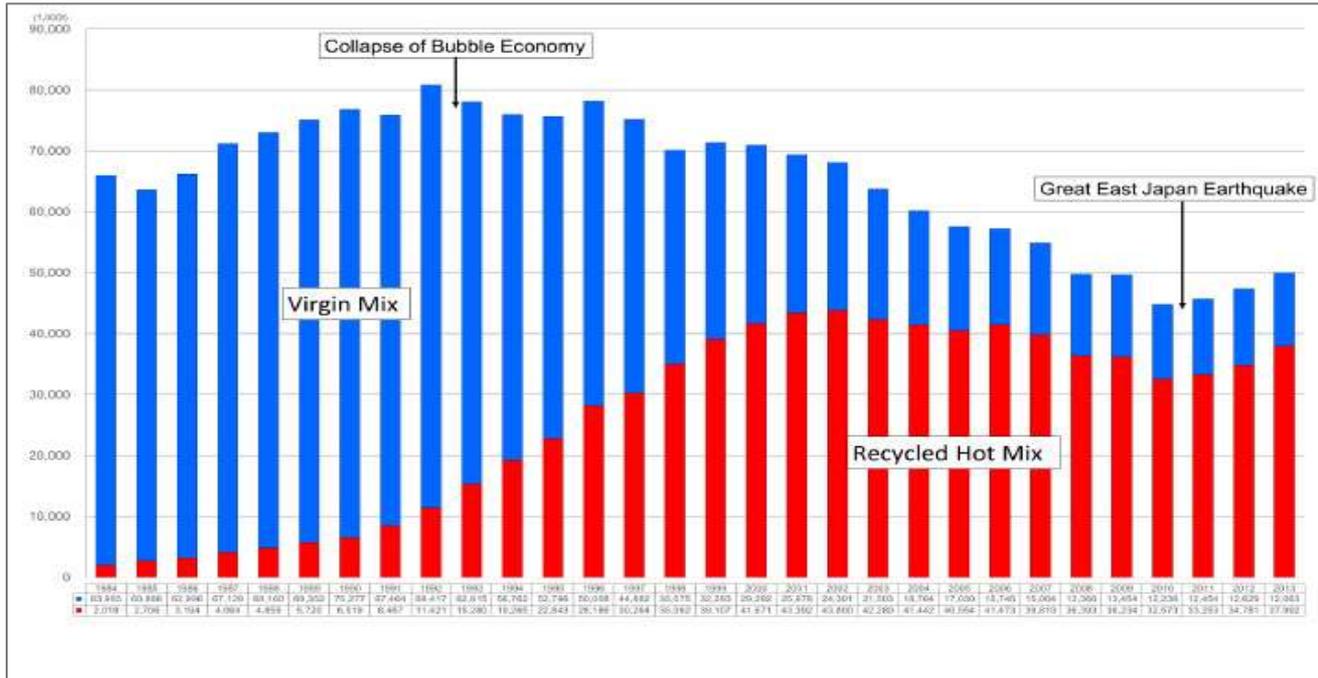
Recycling in Japan

- 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

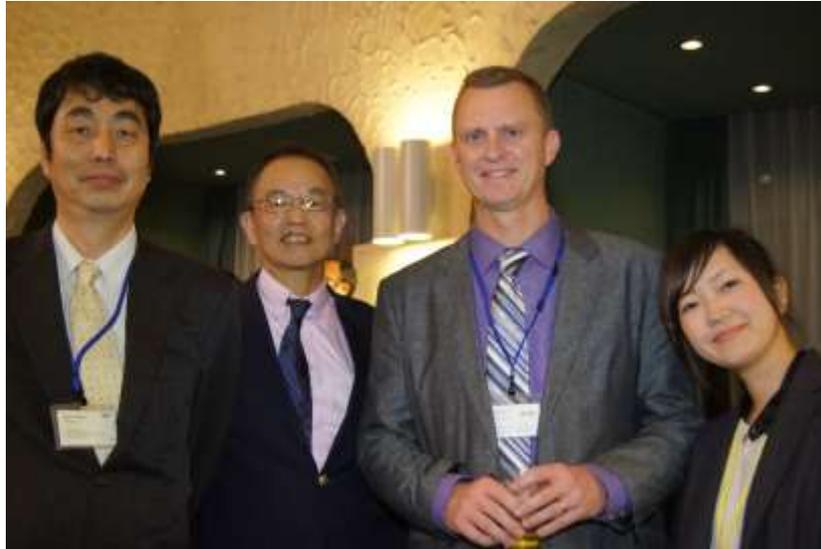
アスファルト合材工場ガイドブック

一般社団法人
日本アスファルト合材協会

Japanese Asphalt Mix Products



Opening Reception



Opening Reception





Research and Technology

Public Works Research Institute



Japanese Name Plate



Table Height



Presentations and discussions



Test Track with Driverless Trucks

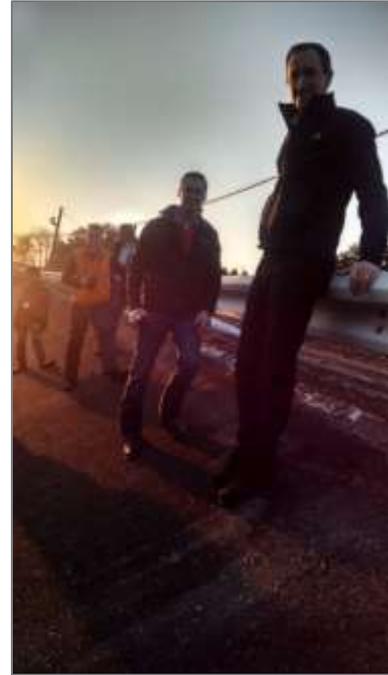




Government Research

Similar to Turner Fairbanks and NCAT

Test Track @ 35 degree banking



High Bank by Bus!



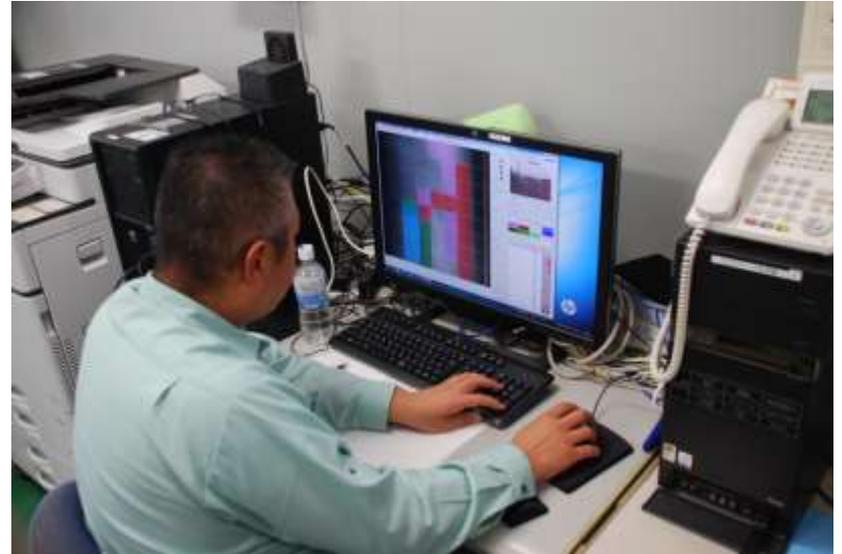
Nippo Visit



Facility Tour



Research Laboratory @ Nippo



Innovation



Ice-breaking pavement using rubber aggregates



High RAP Mixtures

Typical Asphalt Plant in Japan

Visited Two Plants

Taisei Rotec



Maeda Road



Classroom Element



Cultural Differences



Plant Safety



Virgin Materials

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



Clean and Covered



Processing RAP

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



Indoor Processing Facility

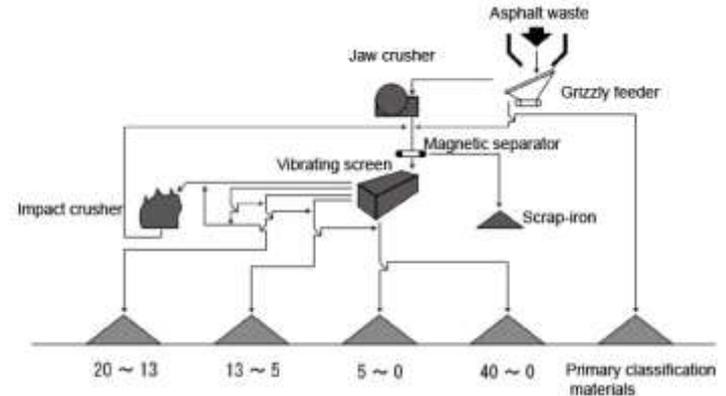


Rap Processing

- 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)

Intermediate Processing of Asphalt Waste

- Intermediate processing system of asphalt waste



RAP Processing Facility



Managing Materials

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



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



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.

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...



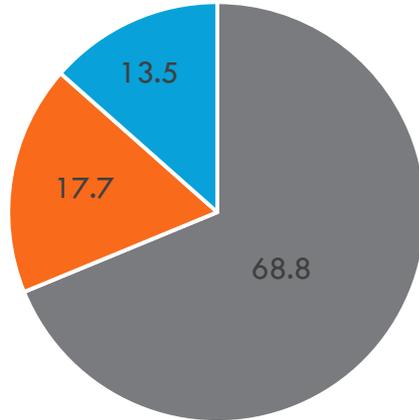
Rejuvenators

- 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

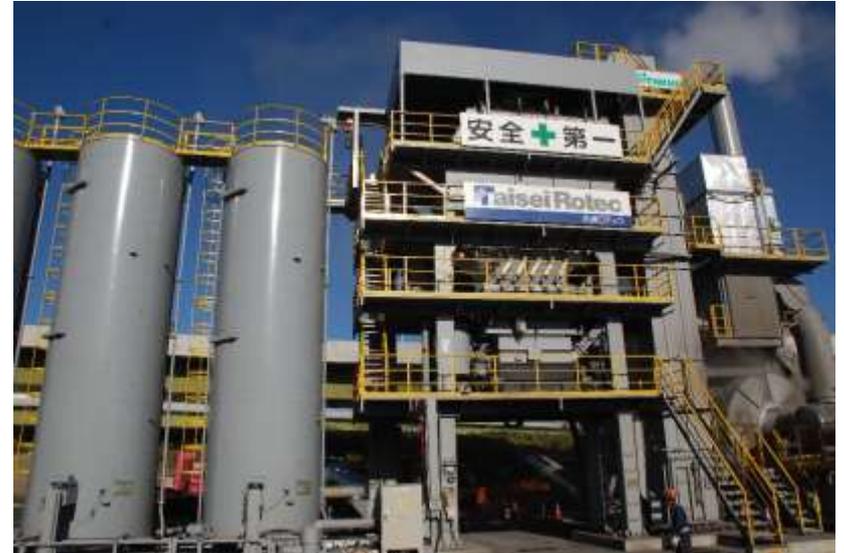


Recycling Methods in Asphalt Plants

Plant Types



■ Parallel Heat ■ In Direction ■ Dram Mixing

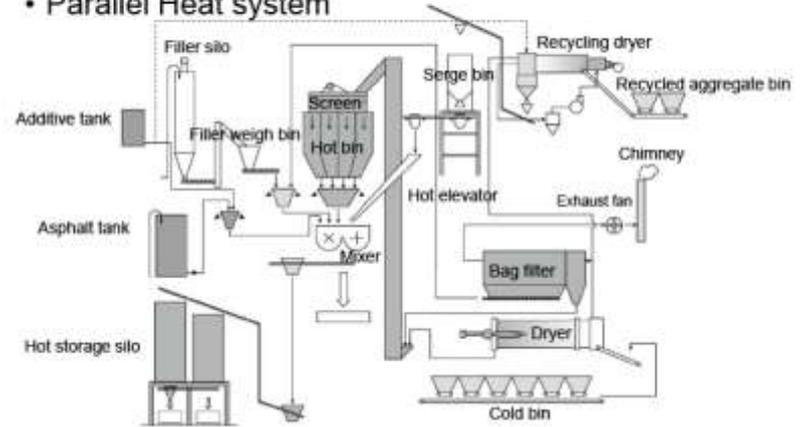


Parallel Heat System

- 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

Type of Asphalt Plant for Recycled Mix(2)

- Parallel Heat system

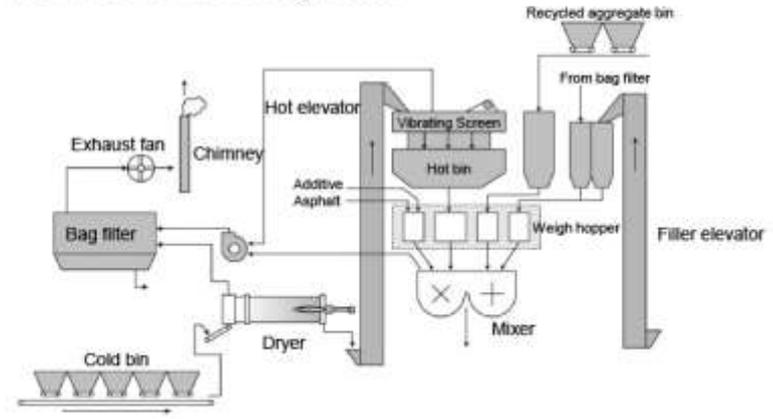


“In Direction” Heat System

- 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

Type of Asphalt Plant for Recycled Mix(1)

- In Direction Heat System

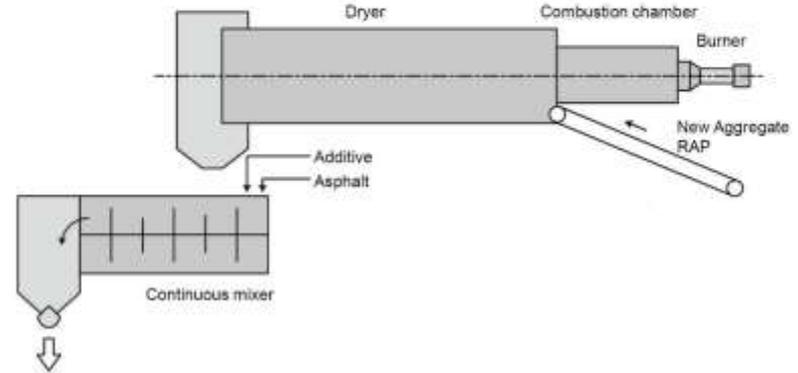


“Dram Mixing” System

- 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

Type of Asphalt Plant for Recycled Mix(3)

- Dram Mixing System



TaiseiRotec Plant



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



Inside the Plant



Rejuvenators

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



RAP Dryer/Drum



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



Plant Controls



Loading Operations



“Portable” Plant





Field Operations

Asphalt Paving Project

Trucking Operations



Paving Operations



Compaction



Tight Joints



Excellent workmanship



Clear Sound Walls





Clean and precise operations



Finished Product

Excellent Performance

“Porous” Pavements = OGFC



Double Layer Porous





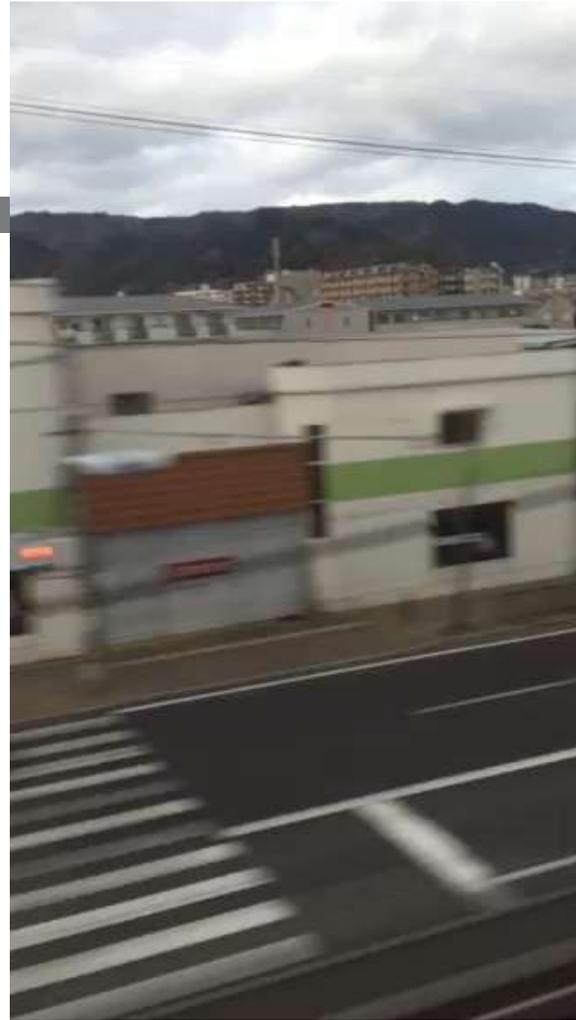
From roads to high speed rail...

Bullet Train

First trip on a high-speed train



165 mph by train





Alternative forms of transportation

Bikes



Vehicles

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



Closing Dinner & Reception



Gifts and Business Cards



Closing Reception





Sightseeing in Japan

Video

Tokyo Skytree Tower (634 meters)



Final hours before flying home...



And there was Japanese Karaoke...





Takeaways

Observations

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



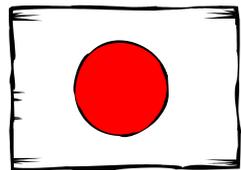
Don't Blame it on the RAP

- Let's not be scared or afraid of high RAP mixtures
- If properly designed and incorporated – they can provide equal or greater performance



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



Big Picture Takeaways

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



Questions?

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