

要約（英文）

**Feasibility Survey with the Private Sector
for Utilizing Japanese Technologies
in ODA Projects
“Feasibility Survey for the Pavement Recycling
Technology with Asphalt Wastes”**

Summary Report

Republic of Indonesia

April 2018

Sugawara Industry Co., Ltd.

1. Purpose of the Survey

A survey conducted to examine the potential use of Japanese companies' products and technologies for Japanese ODA projects. The scope of the survey includes network building and information gathering to develop ODA projects.

2. Concerned Development Issues

(1) Road Development Plan

Local development is raised as one of the priority measures in the government's National Medium Term Development Plan (RJPMN2015-2019). The government is planning to improve the connectivity by developing roads and infrastructure to promote local development. According to Bina Marga's (Directorate General of Highways, Ministry of Public Works) strategic plan (RENSTRA 2015-2019) a road-related budget of 278 trillion IDR (18.7 billion USD) has been set aside for 2,650km of roads, 1,000 km in toll roads, 3,073 km in road repairs and 47,017 km of road maintenance. West Java's Government Vision 2013-2018 also talks about their plan to develop infrastructure in order to improve inter-regional connectivity and economic growth.

Looking at the current situation, 50% of the budgets to develop infrastructure is unprocured, while construction costs are also regarded as a problem. Additionally, Table 1 shows the damages to state and city roads (about 40%) are an obstacle to smooth local traffic flow. Furthermore, ramps should also be repaired for safety reasons.

Table 1 Road Pavement Condition (2012)

	National Road		State Road		City Road	
	%	km	%	km	%	km
Good	58	22,360	32	15,756	32	121,444
Normal	33	12,671	28	14,014	23	86,134
Minor Damage	6	2,371	18	8,670	22	82,372
Major Damage	3	1,168	22	10,638	23	86,455
Total	100	38,570	100	49,078	100	376,405
Road Length Ratio	8%		11%		81%	

Source : Directorate General of Highways, Ministry of Public Works



Picture 1
Unpaved Road in West Java

(2) Asphalt Recycling Policy

An asphalt regeneration plant has been introduced in the project that has been managed by a national enterprise since 2007 as shown in Picture 2. Recycled asphalt has been of low quality and high cost, because the mix formula of recycled asphalt was not standardized and the plant had an inefficient design. From this experience, government officials in Indonesia have the impression of asphalt recycling being high cost when done in Indonesia.



Picture 2
Asphalt regeneration plant

(3) Road Maintenance Policy

Indonesia has IRMS (Indonesia Road Management System), but due to the reasons below, maintenance costs are high and state and city road maintenances are delayed.

- a) Monitoring is only done for newly constructed roads as older roads that need repair are not priority.
- b) Lack of planning is causing them to be busy with emergency treatments, as conditions for unrepaired roads worsen.
- c) Repair costs are done cheaply as an initial response, but does become expensive over time as roads worsen.

3. Products and Technologies

(1) Product and Technology Features

As Figure 1 shows, proposed technology is pavement recycling technology. This technology includes asphalt regeneration, paving and maintenance using the regenerated asphalt, and PMS (Pavement Management System). This paving technology will offer paving cost reduction of 10-20%, lead to roads without ramps, promote maintenance cost reduction of more than 14%, and lead to a steady supply of asphalt waste.

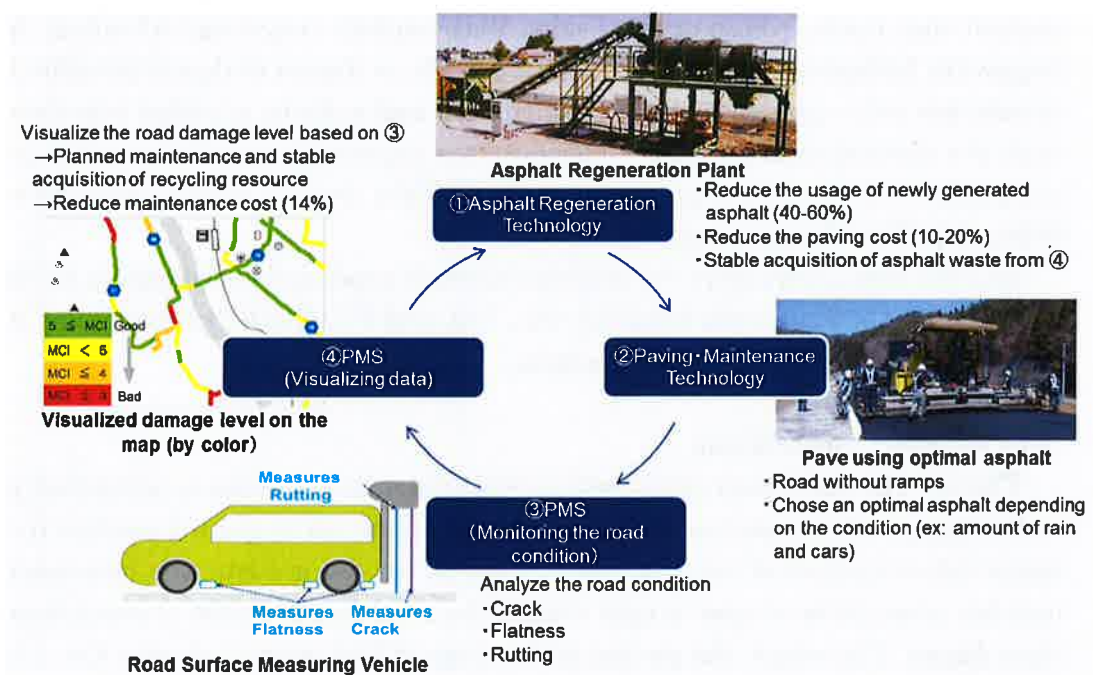


Figure 1 Pavement Recycling Technology

(2) Product and Technology Specifications

Specifications of a proposed crushing plant and recycle unit is shown below in

Table 2. The crushing plant will be procured in Indonesia and the recycling unit will be procured in Japan. The equipment will be utilized to train engineers and experiment with recycled asphalt standards. Additives will be also procured from Japan.

Table 2 Product and Technology Specifications

Product	Capacity	Type	Quantity	Price (JPY)
Crushing plant	80-100 t/h	batch	1 unit	20,000,000
Recycle Unit	30 t/h	continuous	1 unit	40,000,000
Additive	N/A	-	6,000kg	1,150,000

4. Survey Outline

The F/S was conducted from April 2017 to June 2018 in Indonesia. Activities and results to prepare for the Official Development Assistance (ODA) project are as follows.

(1) Pavement recycling technology

a) Asphalt recycling

The conventional hot mix asphalt recycling in plants has been implemented in Indonesia but was not dispersed widely due to high costs compared to virgin asphalt that made from new materials. With asphalt recycling technology from Sugawara Industry Co., Ltd., an additive made in Japan makes it possible to recycle not only aggregates but also bitumen, and achieve a higher recycle rate than the conventional method. Therefore, the expectation is that recycled asphalt is paved at a lower cost than virgin asphalt, if the asphalt waste recycling system is developed by the government.

Quality test shows that the recycled asphalt produced in Indonesia by the joint venture of Sugawara Industry Co., Ltd. and PT. KADI International, meets the existing standard of wearing course.

b) Pavement construction

Though the local road construction companies have access to advanced paving technology, such companies do not pay much attention to quality control (i.e. temperature control of hot mix). With regards to paving costs, the necessary number of workers to pave a unit area of the road in Indonesia is much more than Japan. Therefore, the paving technology of Sugawara Industry Co., Ltd. contributes to quality control and paving cost.

c) Road maintenance and management

Although PMS has been installed in Bina Marga since the 1990s and another system named RAMS is currently operational, the system has some operational

challenges such as difficulties prioritizing the budget allocation and addressing the shortage of accumulated data. Bina Marga has a policy that they consign the operation of monitoring road conditions to third parties (private inspection organizations) so that public monitoring vehicles are not necessary. Taking into account the above situation in Indonesia, it is realistic to provide software support rather than hardware support (such as a monitoring vehicle). By providing monitoring data of recycled asphalt roads to Bina Marga for highways, it is expected that the effectiveness of asphalt recycling is verified and disseminated by the Indonesian government.

(2) Knowledge co-creation program in Japan

To understand the current situation that more than 90% of the asphalt wastes are recycled in Japan, 5 trainees (i.e. 4 trainees from Bina Marga and 1 trainee from State Polytechnic of Jakarta), who are familiar with road construction, visited Japan in November, 2017. Outline of the knowledge co-creation program schedule is described in Table 3. The trainees learned about the advantage, system and method of asphalt recycling technology that is being handled by the Japanese government through visiting asphalt recycling plants, national institutions, and road construction sites.

Furthermore, one of the trainees made a presentation about the trip in the seminar that was co-organized by Bina Marga and JICA, in December, 2017. Understanding and credibility of Indonesian participants about this technology were also improved by explaining the merits of asphalt recycling.

Table 3 Outline of knowledge co-creation program schedule

	Contents	
Number of trainees	5 trainees (4 trainees from Bina Marga and 1 trainee from state polytechnic of Jakarta)	
Period	Nov. 12 th to Nov. 18 th in 2017	
	Activities	Places
Nov. 13 th	<ul style="list-style-type: none"> Road construction sites Infrastructure in Miyagi Sugawara Industry 	Kesennuma city
Nov. 14 th	<ul style="list-style-type: none"> Asphalt recycling plant (flow from collection of asphalt waste and regeneration to shipment) 	Kesennuma city
Nov. 15 th	<ul style="list-style-type: none"> Introduction of the standards for pavement and asphalt materials at Public Works Research Institute and at a private company 	Tsukuba city
Nov. 16 th	<ul style="list-style-type: none"> Introduction of asphalt proportioning test Moving to Tokyo 	Tsukuba city
Nov. 17 th	<ul style="list-style-type: none"> JICA courtesy call Visit of popular infrastructure sites in Tokyo Follow-up meeting 	Tokyo

(3) Seminar

A seminar on “Future Project for the Dissemination of the Pavement Recycling Technology with Asphalt Wastes” was co-hosted by Bina Marga and Sugawara Industry Co., Ltd. on December 12th, 2017. Major topics included expected ODA project, introduction of the pavement recycling technology in Japan, pavement technology and experience in Indonesia and training program in Japan. 111 participants attended the seminar (i.e. 87 from Indonesia, 8 from Japan and 16 seminar organizers). At the end of the seminar, a survey questionnaire was conducted and answers were obtained from 38 participants. The results are shown below.

- ✓ More than 95% of respondents expect this project will proceed to the next phase (verification survey).
- ✓ For the next phase, most of the respondents expressed interest and highly recommended “Establishing specification of recycled asphalt for wearing course”, “Training staff and preparing manual for asphalt recycling”, “Establishing RAP collection and distribution system” and “Holding seminars of asphalt recycling technology for general constructors”.
- ✓ There were also some comments that requested more details be provided such as “how to select the additive for asphalt recycling”, “details of income and expenditure” and “how to install asphalt recycling technology in rural area”.

5. Proposed ODA Projects and Expected Impact

(1) Proposed ODA Projects

a) Title

After the completion of this feasibility study, the following phase for ODA project, ‘Verification survey for the pavement recycling technology with asphalt wastes’, will be implemented.

b) Candidates for counterpart positions

Bina Marga is a candidate as a counterpart for this project. Pusjatan (Institute of Road Engineering, Agency for Research and Development, Ministry of Public Works and Housing) is also candidate that would serve as a support agency.

c) The outline of the ODA project

The ODA project consists of three activities (i.e. technology verification of pavement recycling with asphalt wastes, its technology transfer, and its dissemination) to achieve the project’s purpose as shown in Figure 2.

[Project Purpose] Effectiveness of pavement recycling technology is recognized, and sustainable system is developed	
Output	Activity
1. Verification Verify the manufacturing, constructing and maintenance cost reduction of pavement recycling technology	1-1 Transport and install equipment 1-2 Produce the recycled asphalt and test the quality 1-3 Conduct pilot road construction at national road 1-4 Monitor the condition of the road paved by the recycled asphalt 1-5 Evaluate economy and superiority of the pavement recycling technology
2. Technology Transfer Establish a sustainable environment for pavement recycling technology	2-1 Evaluate the skill level and prepare the manual for the pavement recycling 2-2 Transfer the pavement recycling technology (Train 10 instructor at Bina Marga and Pusjatan) (1) 1 st Program: Collection, storage and crushing of RAP (2) 2 nd Program: Quality control, regeneration, paving and monitoring (3) 3 rd Program: OJT (Karawang, and/or Japan) 2-3 Evaluate after the training
3. Dissemination Disseminate the superiority of pavement recycling technology	3-1 Hold periodical steering committees with stakeholders 3-2 Run a seminar on introduction of the pavement recycling technology against stakeholders 3-3 Examine a business model to promote the dissemination of the pavement recycling technology

Figure 2 Outline of the ODA project

d) Overview of relevant stakeholders

The relationships of relevant stakeholders (e.g. C/P candidates, supervisory organizations, private companies) are described in Figure 3.

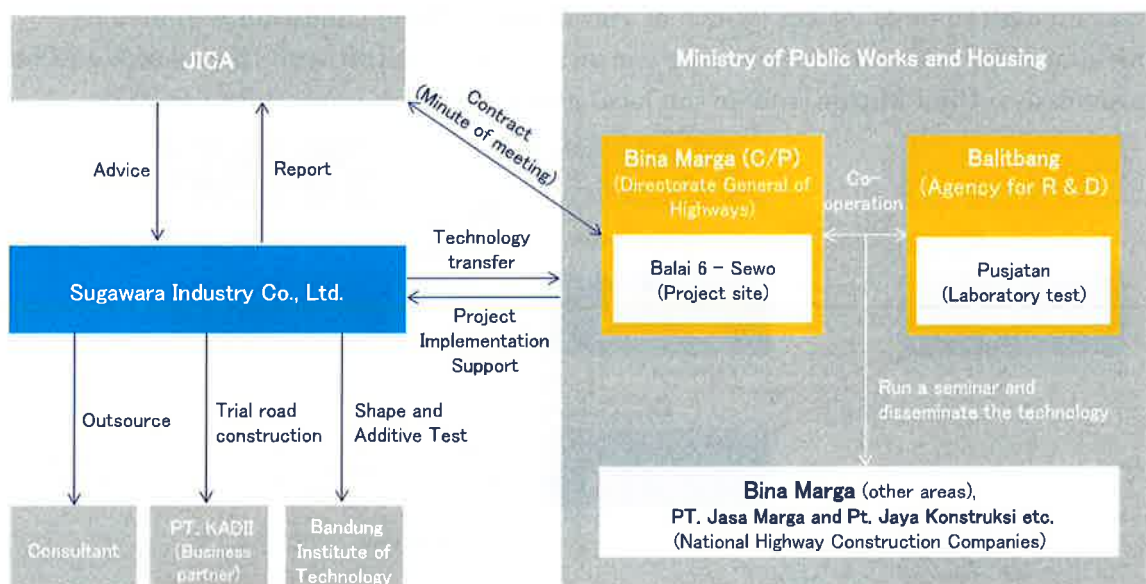


Figure 3 Relation of relevant stakeholders

(2) Expected Impact

Compared to newly generated asphalt, Indonesia can reduce up to 54 million IDR/km (3,999 USD/km). Suppose 102 km can be paved per year (plant operation rate of 60%), 5.57 billion IDR (409 thousand USD) in costs can also be reduced per year. If applied to 2,650 km stated on RENSTA 2015-2019, cost reduction of 145 billion IDR (11 million USD) is possible. Payout time is calculated to be four years. From the information above, asphalt recycle can accelerate road construction (connectivity), reduce inter-regional discrepancy, and offer balanced development. Also, local people will experience increased safety, smooth traffic and fuel efficiency.

6. Intended Business Development

(1) Business model

Business model of Sugawara Industry Co., Ltd is shown in Figure 4. Firstly, Balai 6 in Bina Marga collects asphalt wastes from road construction sites, and manufactures recycled aggregates by crushing them. Secondly, the joint venture of Sugawara Industry and PT. KADI International heats the recycled aggregate and supplies them to KADII's asphalt mixing plant. Finally, KADII manufactures the recycled asphalt with the heated recycled aggregate and uses such asphalt for road construction works or sells it to other road construction companies. In addition, Sugawara Industry Co., Ltd. offers technical assistance to KADII.

The asphalt regeneration plant was constructed at PT.KADI's Karawang site in October 2017. 30 thousand tons of asphalt were planned for production, which was enough to pave 34 km (width of 7m) of roads. Road condition will also be measured by using the monitoring car owned by Pusjatan, and the results will be provided to Bina Marga and/or the local government as input data for PMS.

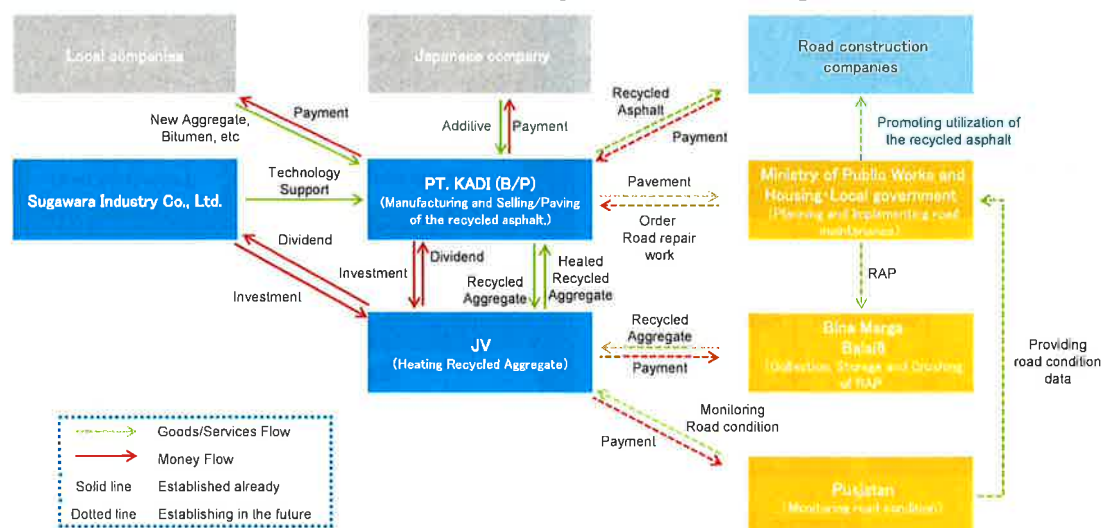


Figure 4 Overview of business development

(2) Schedule for business development

Project schedule is shown in Figure 5 below. Already in action to acquire the SNI certification is in place.

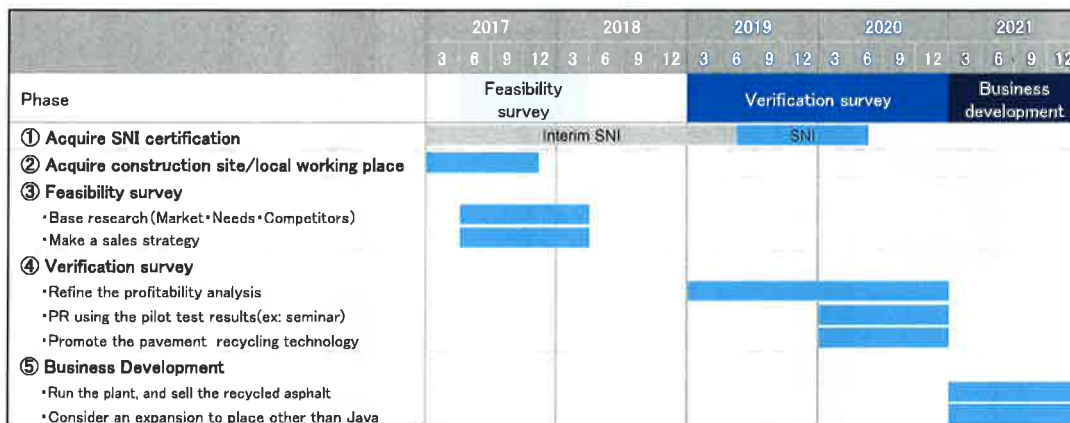


Figure 5 Project Schedule

Feasibility Survey for the Pavement Recycling Technology with Asphalt Wastes

