

How to Maintain the Rural Road by Ourselves

Civil Engineer
Geotechnical Engineering

**Foundations,
Tunneling,
Retaining wall,
New structures**



**Community
Road
Empowerment**

Makoto KIMURA

Executive Director, Bond Engineering Co., Ltd, Osaka JAPAN

Emeritus Professor, Kyoto University, JAPAN

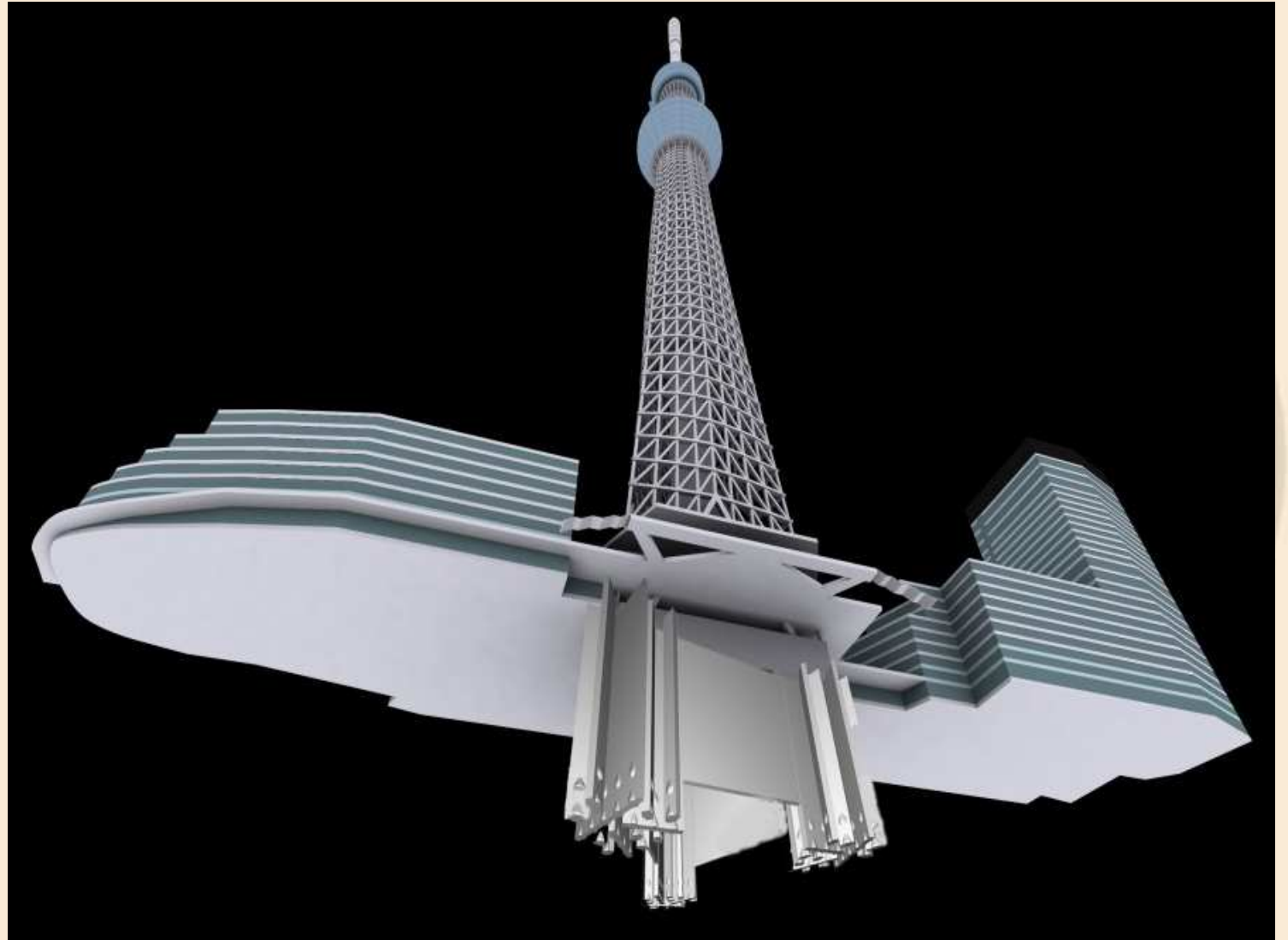
Chairperson of Board, Community Road Empowerment (NGO)

masai6315masai@gmail.com

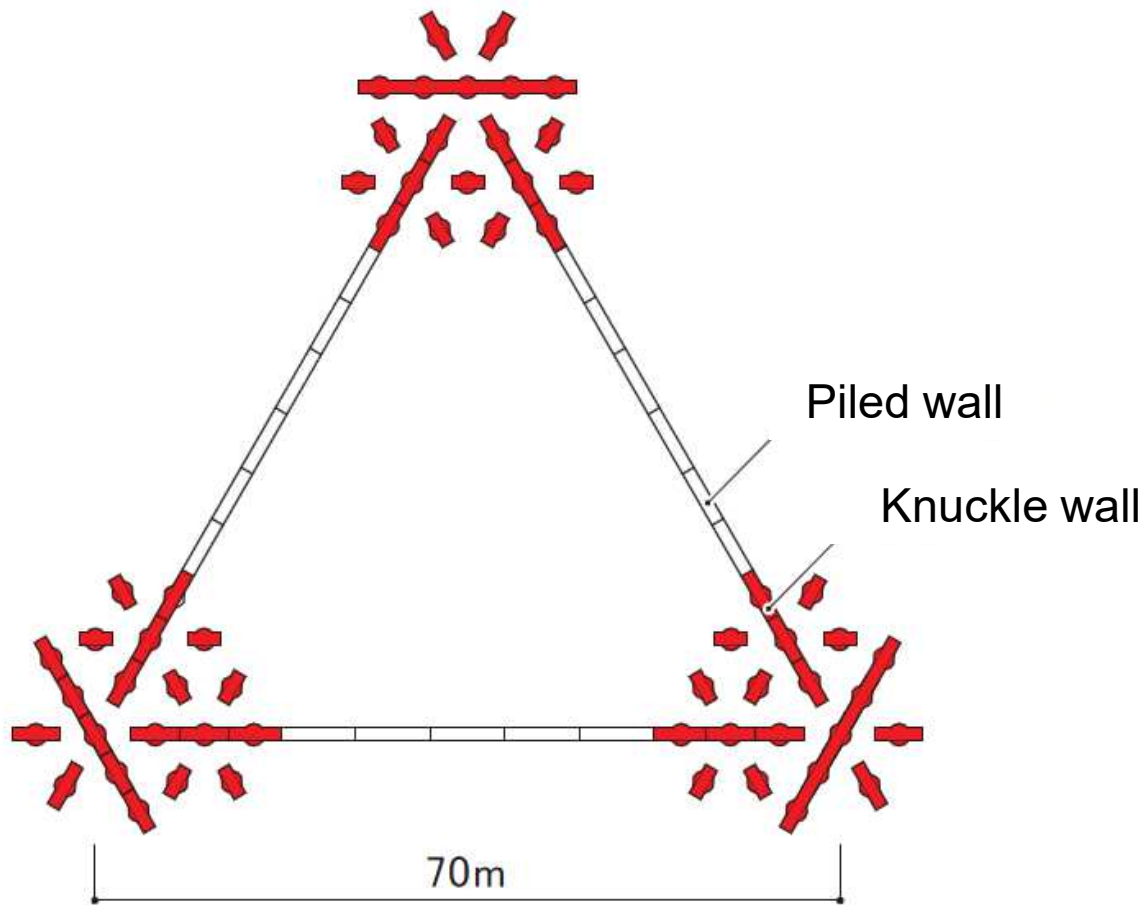
Tokyo Sky Tree 634 m high

Foundation

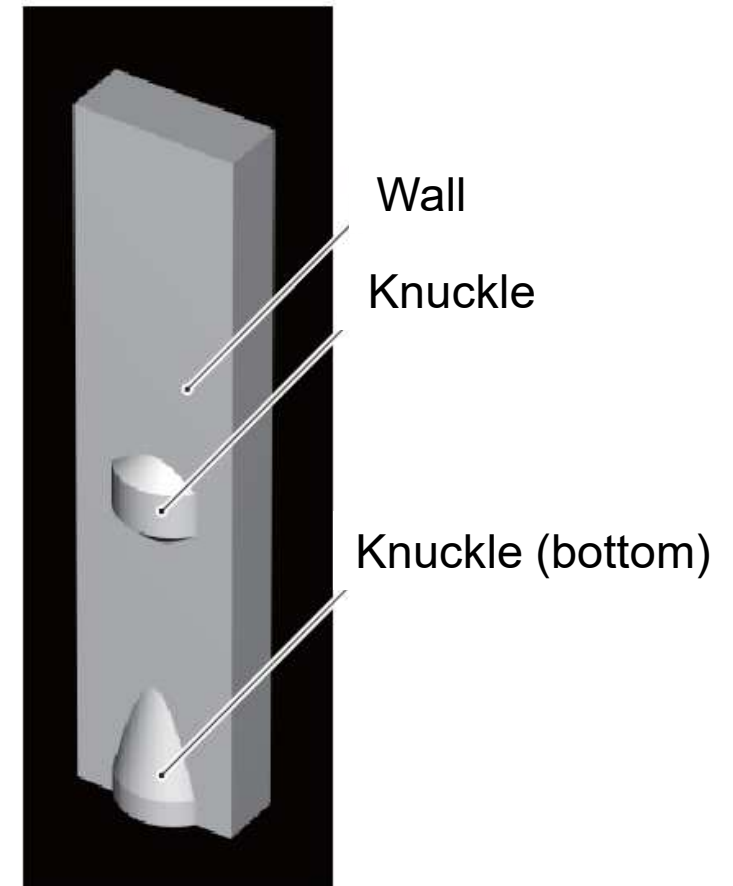
Earthquake force, Wind force



New technology - Knuckle wall method -



Pile arrangement



Knuckle wall



What is a road for you?

Transport

No development
without a road

Life

Access

Very important

To carry farming
products

Network

To see the friends

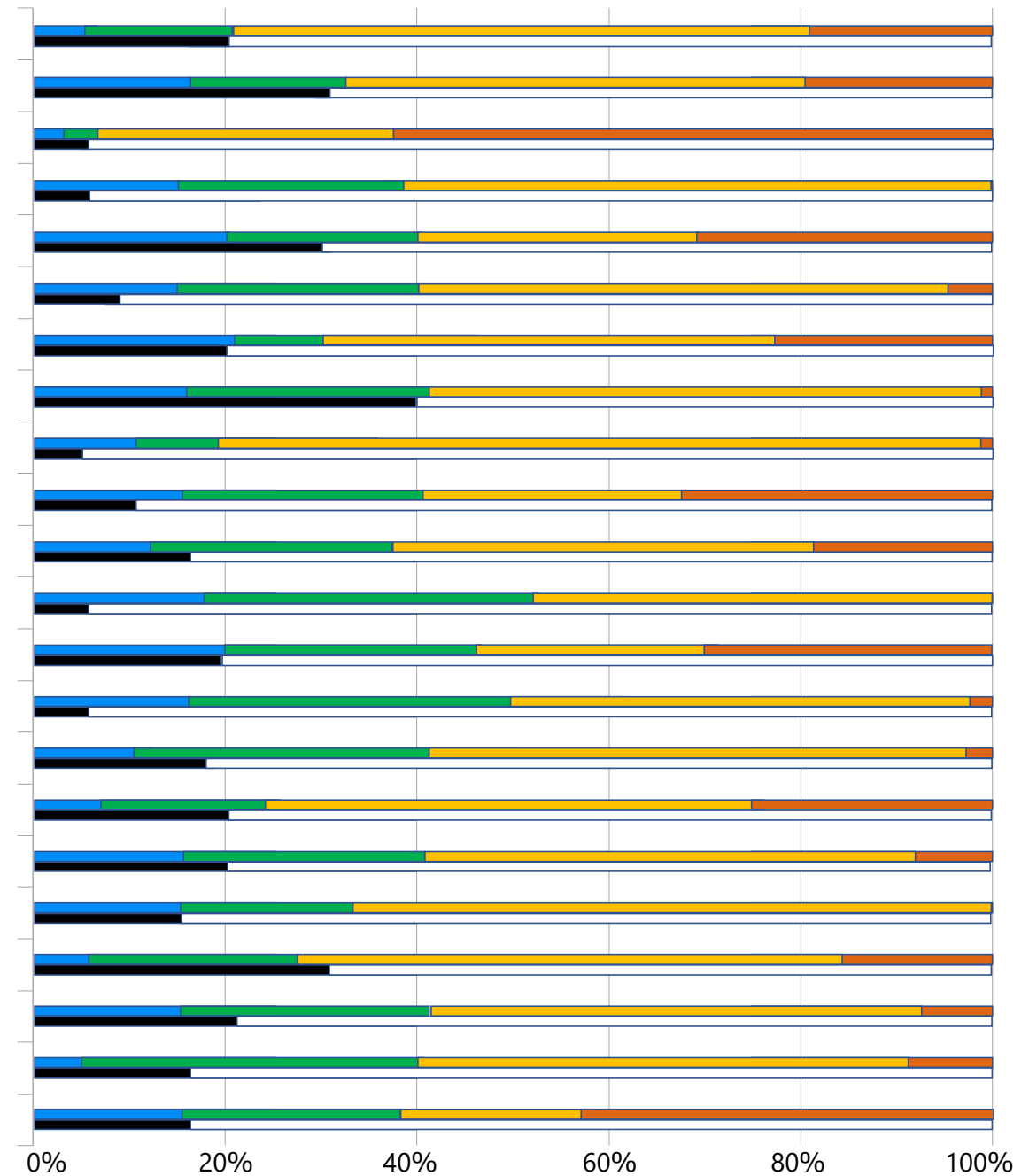
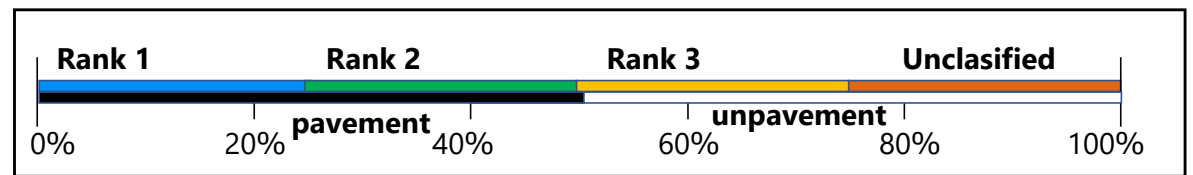
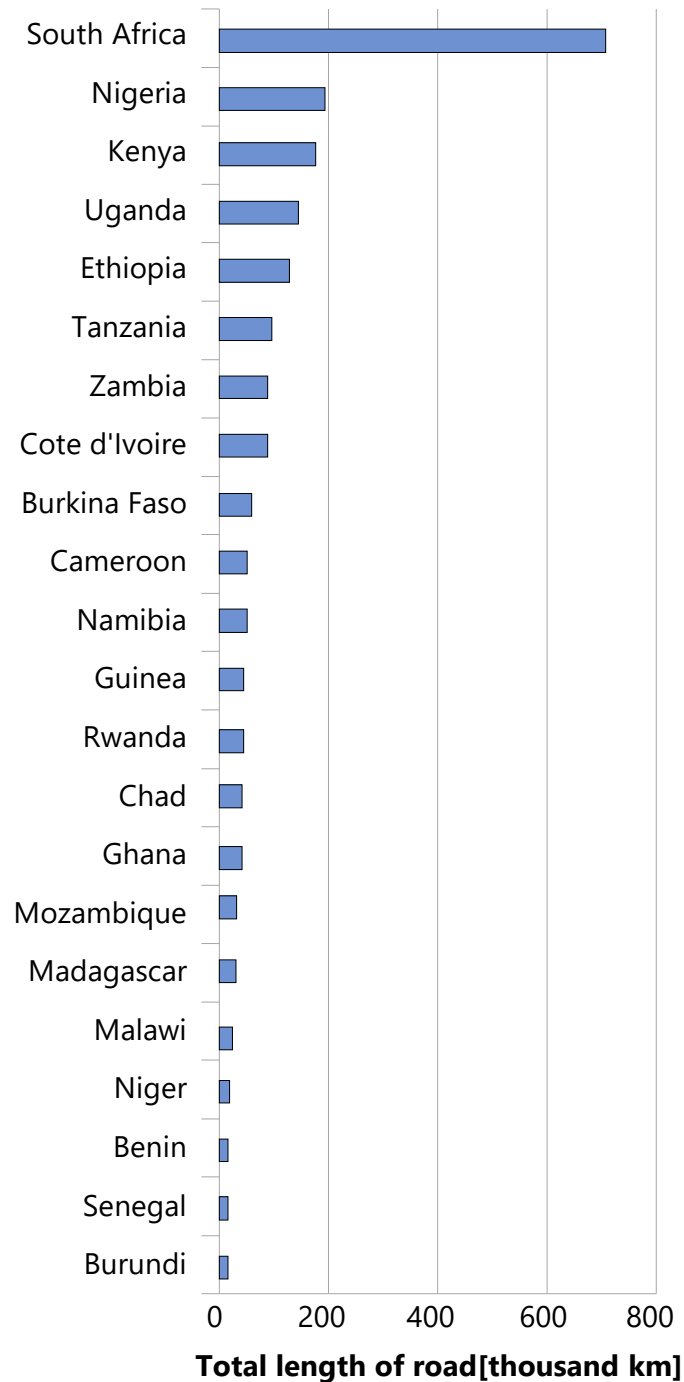
Faida

Like water

Communication

Above those are the answers from the group members. "What is a road for you?"

Road in Africa



How do we repair rural roads without any machine ?

What can I do for rural people as a Civil Engineer.

Challenges and
Good Solutions



Vehicle per day < 50

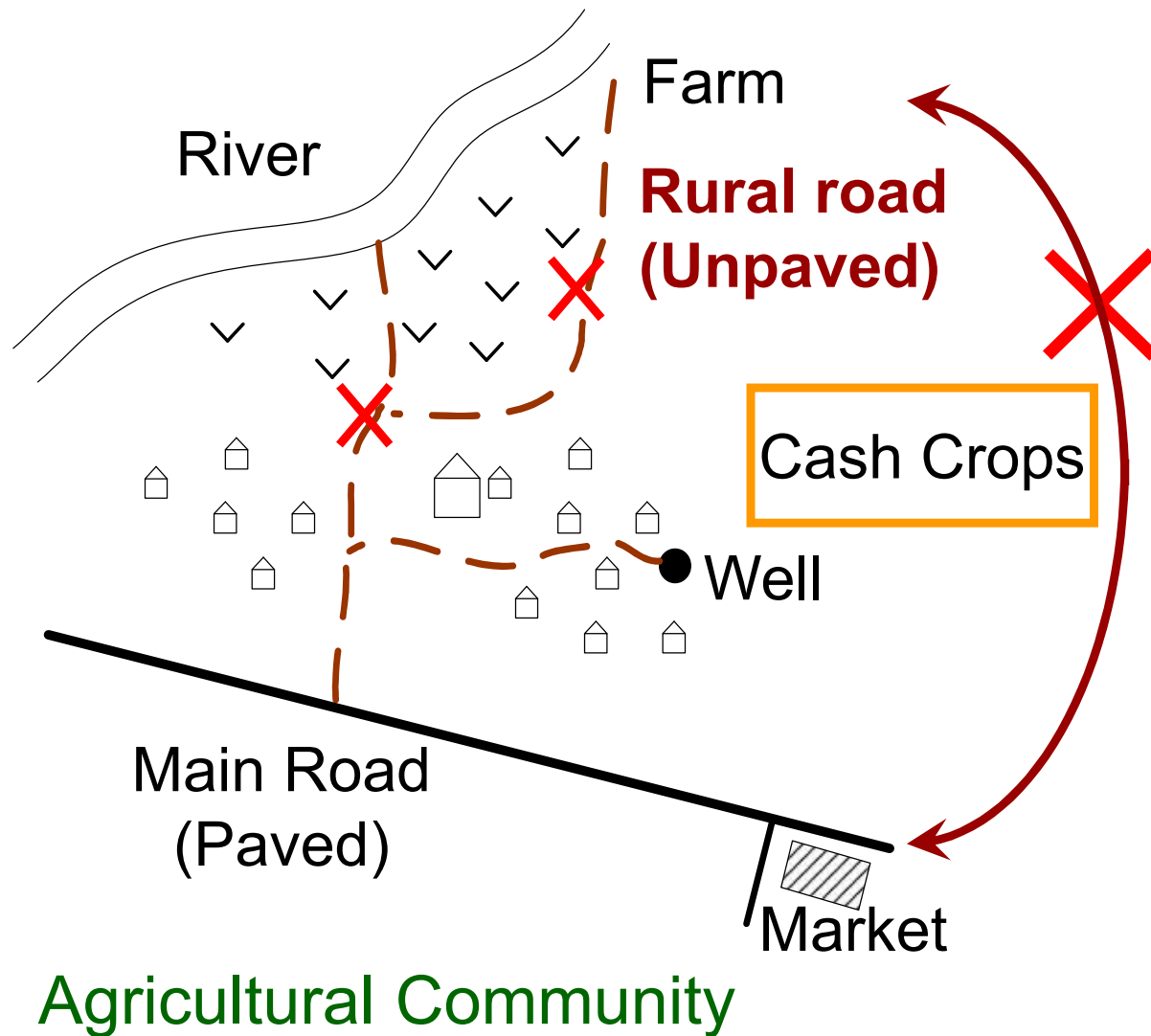


September, 2007

Practical construction in East Uganda

May, 2008

Problems in rural area (Cause of the poverty)



Can't Transport
Agricultural Product
during Rainy Season



Crops are
spoiled



Can't get
money

SOLUTIONS TO IMPROVE UNCLASSIFIED ROAD?

Road network in Kenya

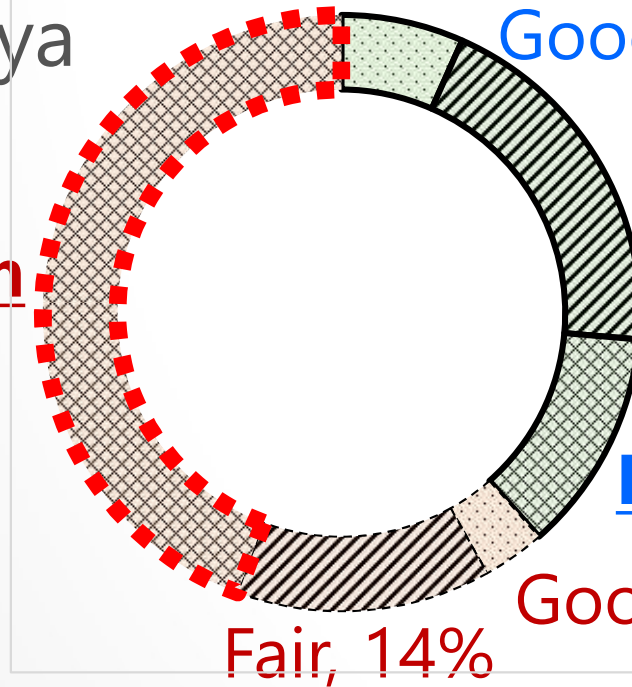
Poor
44%
71,345 km

Unclassified
98,950 km

Vehicle per day
<100



?



Good, 7%

Classified
61,936 km

Fair, 20%

Poor, 12%, 19,438 km

Good, 3%

Fair, 14%



Contractor basis

Always waiting heavy machine !!



How to empower rural communities?



STANDARD CROSS SECTION VIEW WITH DO-NOU METHOD

Do-nou: GEOTEXTILE

(Japanese term for soilbag)

400



400



Prevent floodwaters from
going over dikes



Building firm **BASE**
Surface layer
 $t = 150$

Covering layer
 $t = 50$

Do-nou 2 layers
 $t = 200$

Base
 $t = 100$

Unit: mm

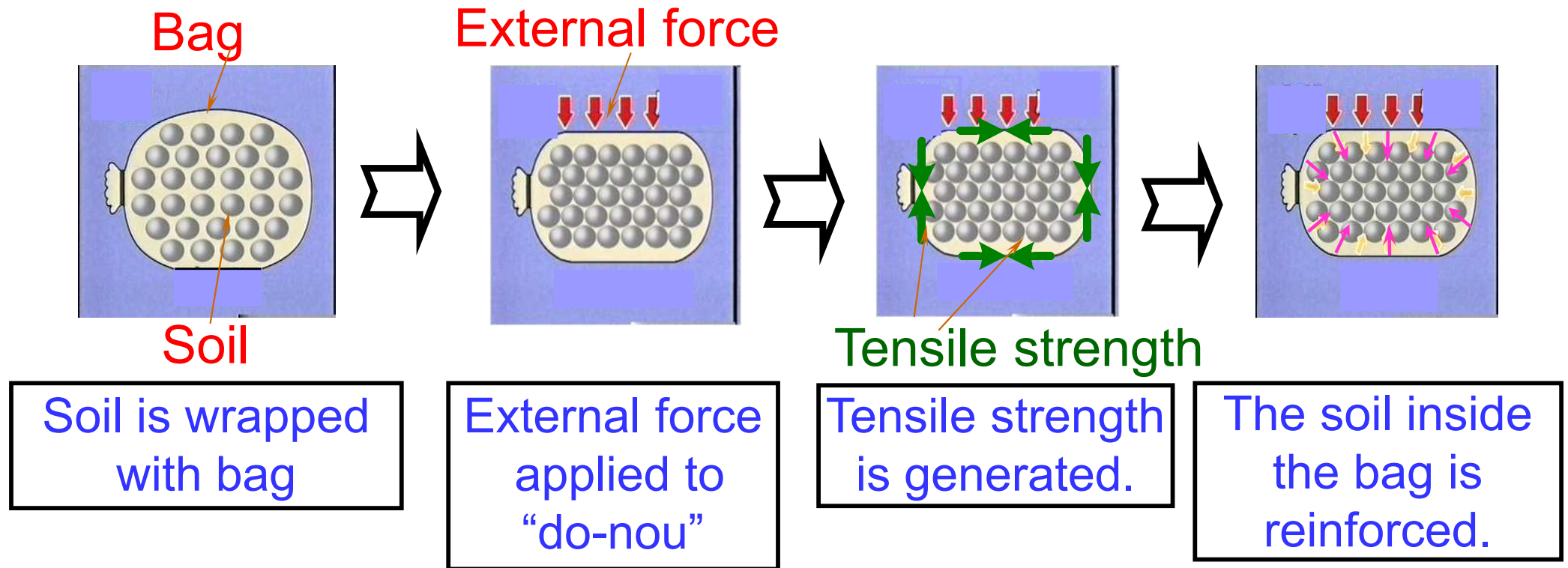
1. Locally available material
2. Labor based
3. Low cost
4. Low technology

“Do-nou” technology!!

Compaction



How to Generate the Strength of the "Do-nou"?



Mechanism is simple.

Do-nou is the ultimate geotextile.

Careful work (compaction) is necessary.

Characteristics of “Do-nou” 40 cm x 40 cm, 10 cm, 20-25 kg

Material



Plastic (polypropylene)



Low cost
material

“Do-nou” bag ← Bags for sugar/maize

Material put inside the bag ← the site

Construction



Labor based

Simple

No curing period

Wooden mallet

Compressive
pressure

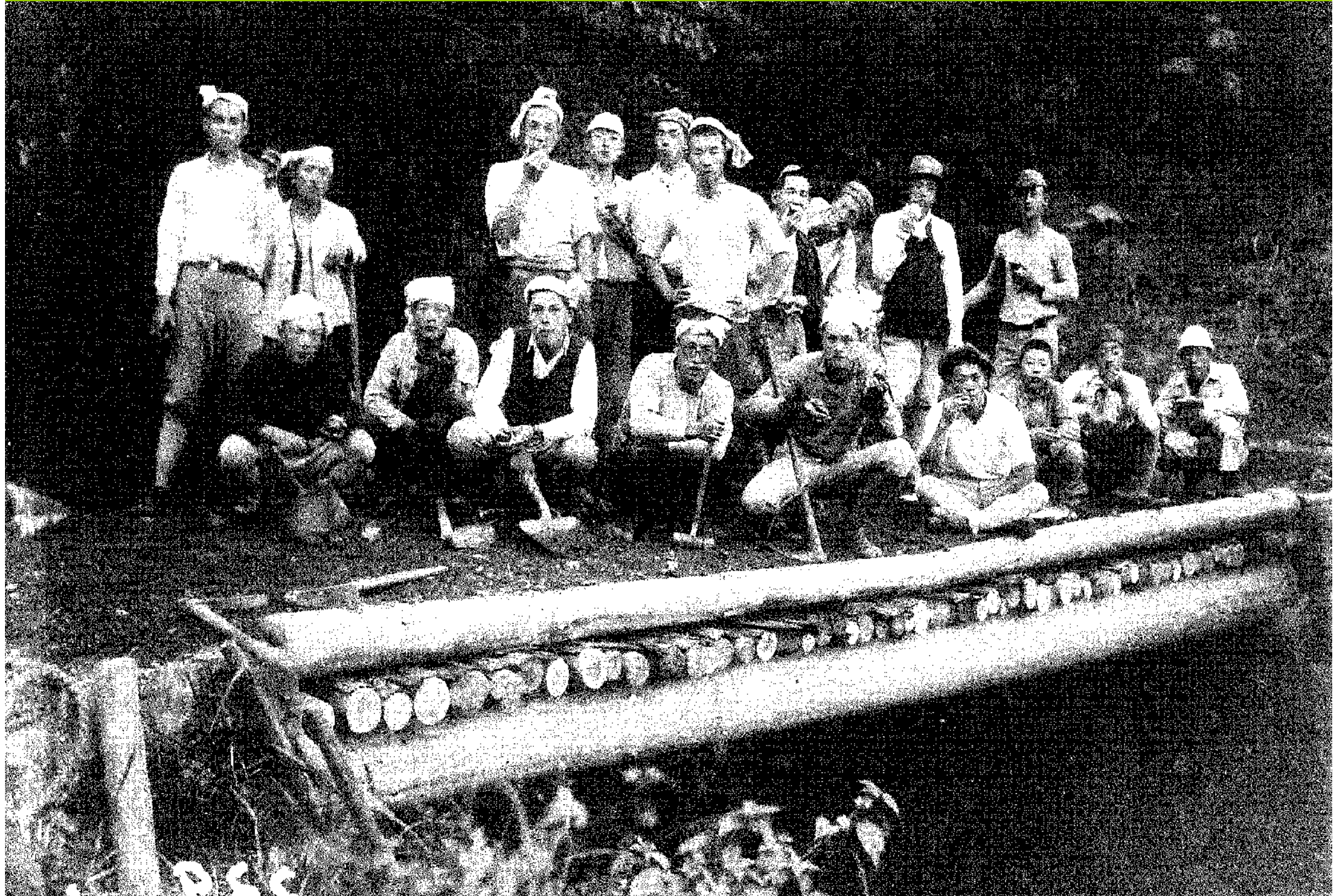


Bearing
Capacity
(250 kN)

1957, National route 19th



1952 Bridge construction in Japan



Voice of the people who experienced road maintenance using Do-nou

- *Now I am confident I can maintain the road. Initially I was not very sure I could.*
- *I am very happy because the road has brought about good positive changes to our community.*
- *Initially I felt it was a difficult job needing a lot of energy but in the end I realized it was easy.*
- *In the beginning we did not have idea about maintaining roads but now we have learned.*
- *Big improvement of the road, I got knowledge.*
- *I have got technology, idea and murram road. I can do it by myself.*
- *I believed that the technology works on road maintenance.*

IMPACT OF THE ROAD MAINTENANCE USING DO-NOU TECHNOLOGY


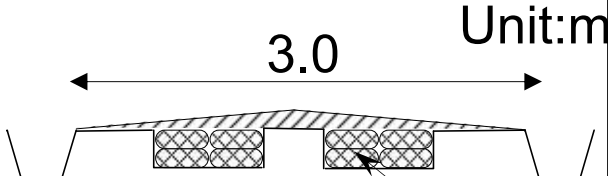
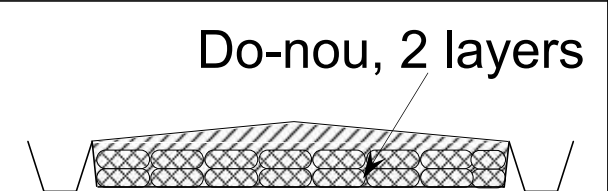
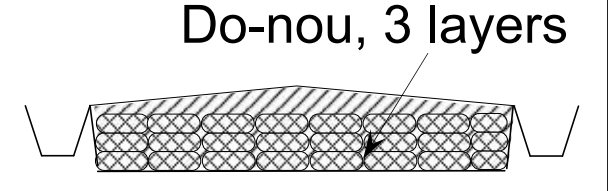
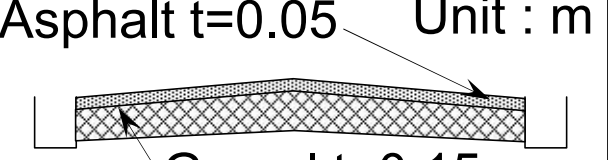
1. The buyers come to the village more frequently.
2. The price of the crops, vegetable and passion fruits, have raised.
3. The income of the farmers has increased.
4. The farmers were motivated and expanded their farm.
5. The farmers became able to reach the market more early in the morning, when the price was set more highly.
6. The extension officers visit the village more frequently, then the farmers get more skill and information of the markets from them.
7. The farmers started to new project for income generation, such as fish pond.



Matrix for traffic, material, maintenance and cost

Cost per meter (US\$)

Coarse material \longleftrightarrow Fine material

| Design Amount of traffic | Material put in bag Cross section | Purchase material | | | Available material | | |
|---|---|--------------------------------|-------------------|--------------------|--------------------|------|--------|
| | | Asphalt | Crusher | Murram | Gravel | Sand | Clay |
| | | | 18/m ³ | 4.4/m ³ | 0 | | |
| 20  100 (Per day) | Unit:m  Do-nou, 2 layers | 8.3 | 5.5 | 4.0 | 4.0 | 4.0 | Target |
| |  Do-nou, 2 layers | 21.0 | 10.8 | 7.5 | 7.5 | | |
| |  Do-nou, 3 layers | 28.5 | 14.8 | 10.5 | | | |
| | Asphalt t=0.05 Unit : m  Gravel t=0.15 | 51.0 | | | | | |
| Frequency of maintenance | | Low \longleftrightarrow High | | | | | |

CORE's work in the worldwide, By Mar. 2024, 31 Countries



| Region | Cent. A. | S. A | Africa | Asia | Pacific | Total |
|-----------------|----------|------|---------|--------|---------|---------|
| No. of Coun. | 1 | 1 | 20 | 5 | 4 | 31 |
| Length (m) | 0 | 20 | 127,887 | 34,906 | 90,604 | 253,417 |
| No. of trainees | 200 | 30 | 16,854 | 3,948 | 3,225 | 24,257 |

Case of road improvement with Do-nou in Kenya

Training/demo of unpaved road maintenance

L = 200 m W = 3 m, 25 person/day x 10 days, USD 9,000 /km





2017/06/29

Case of road improvement with Do-nou in Tanzania

Concrete pavement at the steep slope with communities

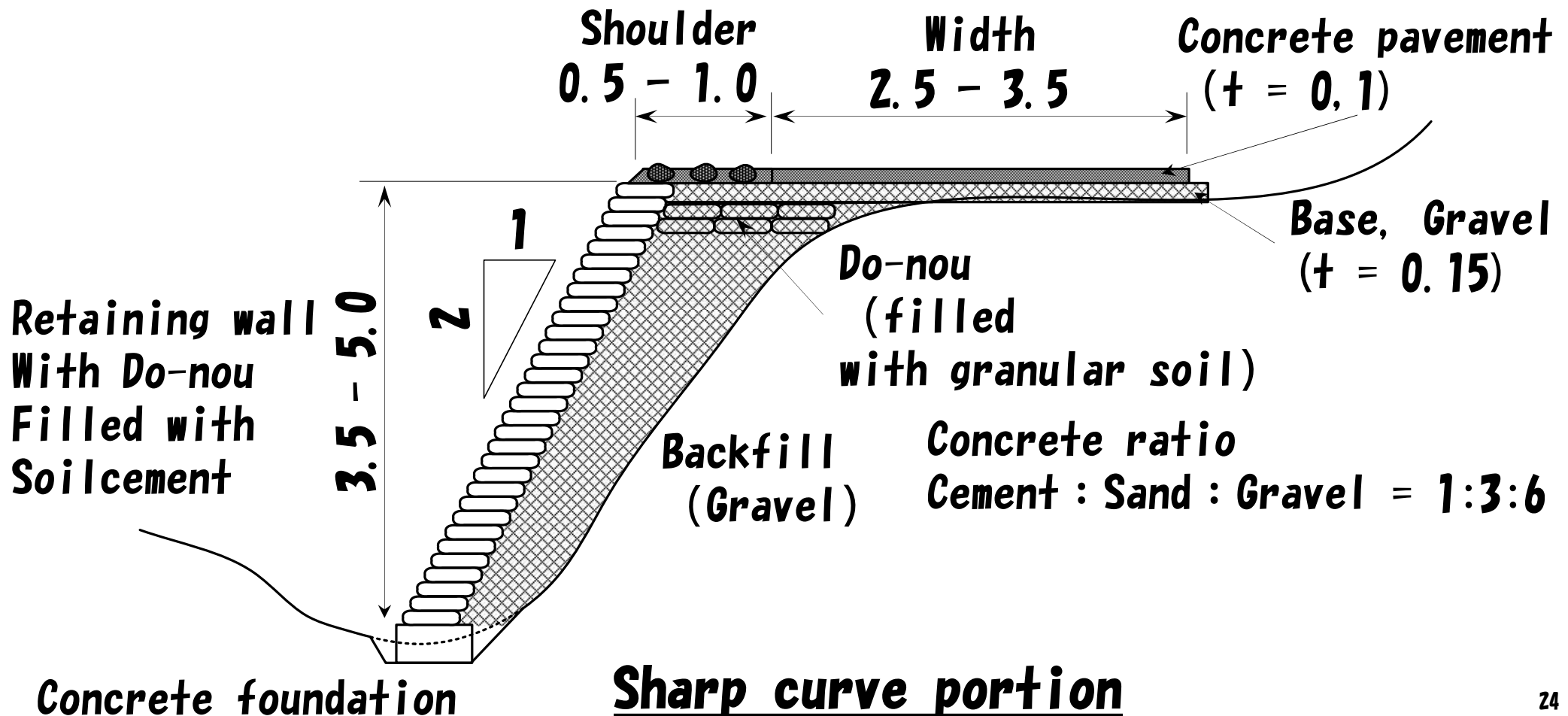
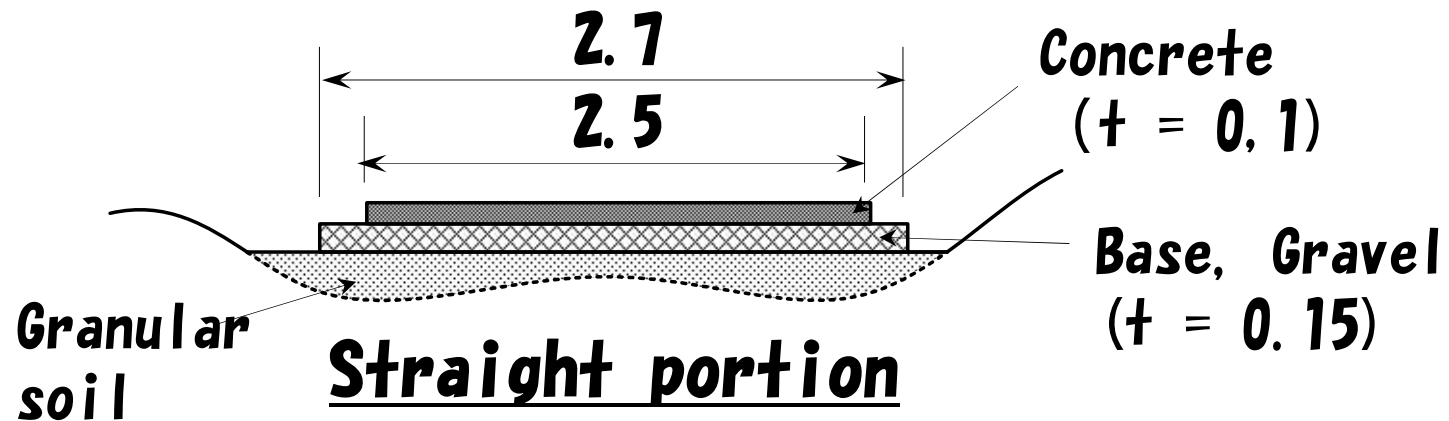
$L = 530 \text{ m}$ $W = 2.5 \text{ m}$, 30 person/day x 150 days, USD 100,000 /km

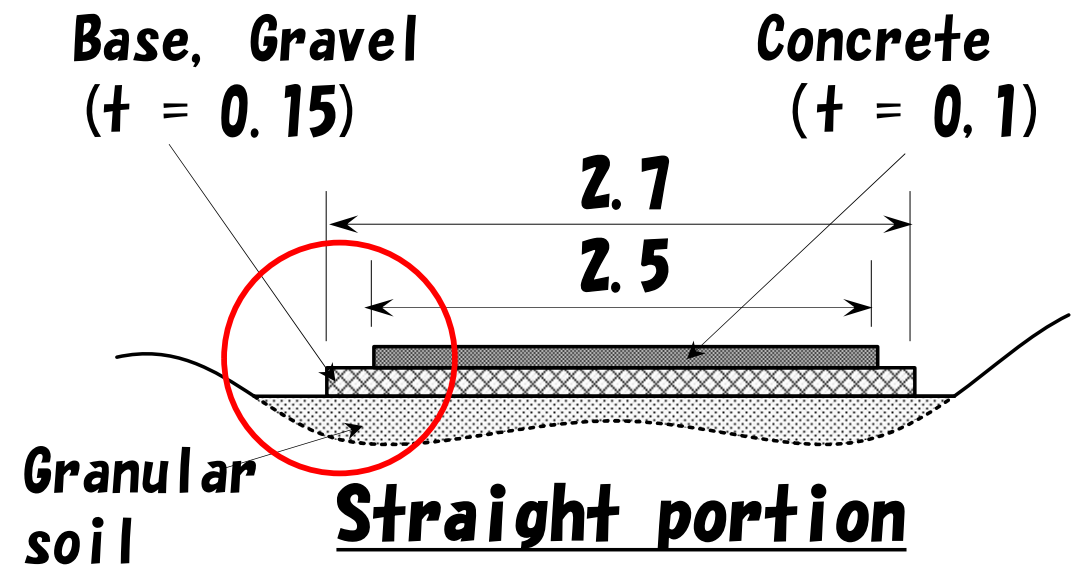


Standard cross section

Unit : m

Traffic :
Bike, Bicycle
4WD
(Ambulance)







Road Problems to the Communities

Irrawady Division in Myanmar

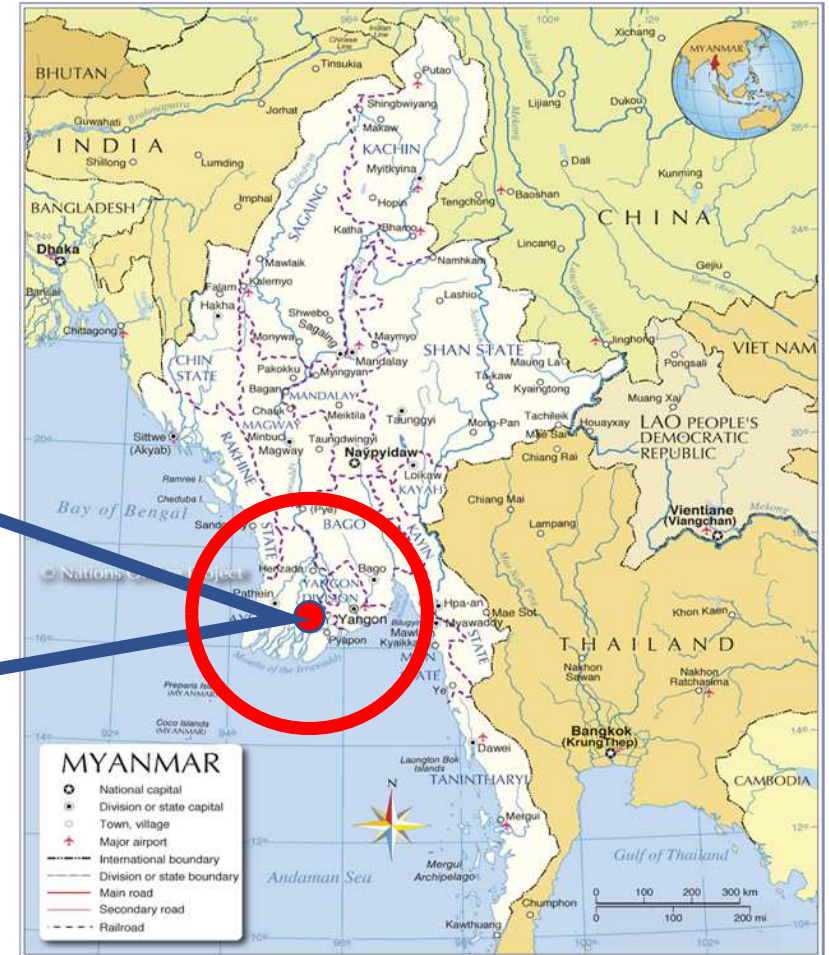
- ① **Falling accidents in rainy season because of slippery and muddy road surface.**
- ② **Bad road and bridge are Impassable for vehicles**
- ③ **No availability of suitable soil and stone for road maintenance because of Delta area.**



Khan Thar village, Pyapon, Irrawady



Population: 13,000



Project period : October 2013 – October 2014

Design : Tire Path Concrete Pavement (Thickness 10 cm)

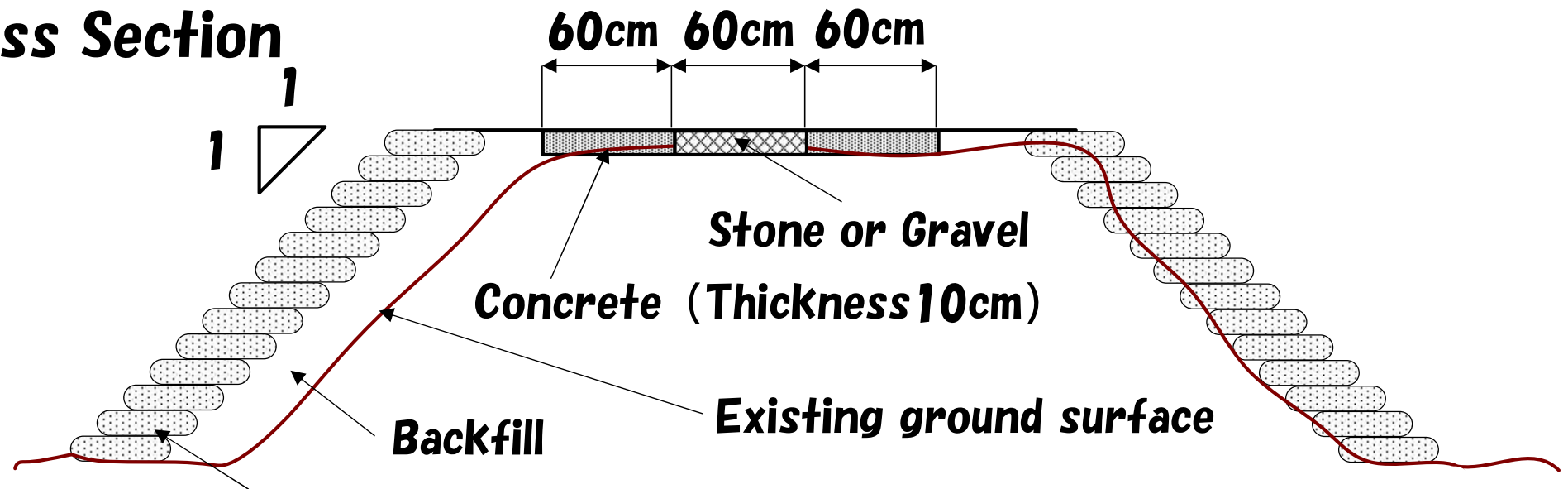
Length • Unit Cost : 1,200 m • 13,000 Kyat / m (13 USD / m)

Number of participants in average : 50 person / days

Number of Working days : 64 days

Traffic : Bike, Motorbike, Toraji

Cross Section



Before

**Do-nou filled with
in-situ clay**

After



Impact of the project

Travel time

| Traffic means | Before | After |
|----------------------|-------------------|----------------|
| Walk | 45 min. | 17 min. |
| Bicycle | Impassable | 8 min. |
| Motorbike | Impassable | 4 min. |

The motivated and trained community has repaired the other road by themselves.



- 1. The road become passable even in rainy season.**
- 2. The patients are transported to the hospital timely.**
- 3. Students are no longer hampered going schools due to the road conditions.**
- 4. Some villagers started bike taxi business.**
- 5. The community themselves repaired the other road with the fund donated by the other NGO in February 2015.**

Sounding with local auger



Casting concrete for pile



Assembling steel bar



Form work for the beam



Before

-View along bridge axis-

After



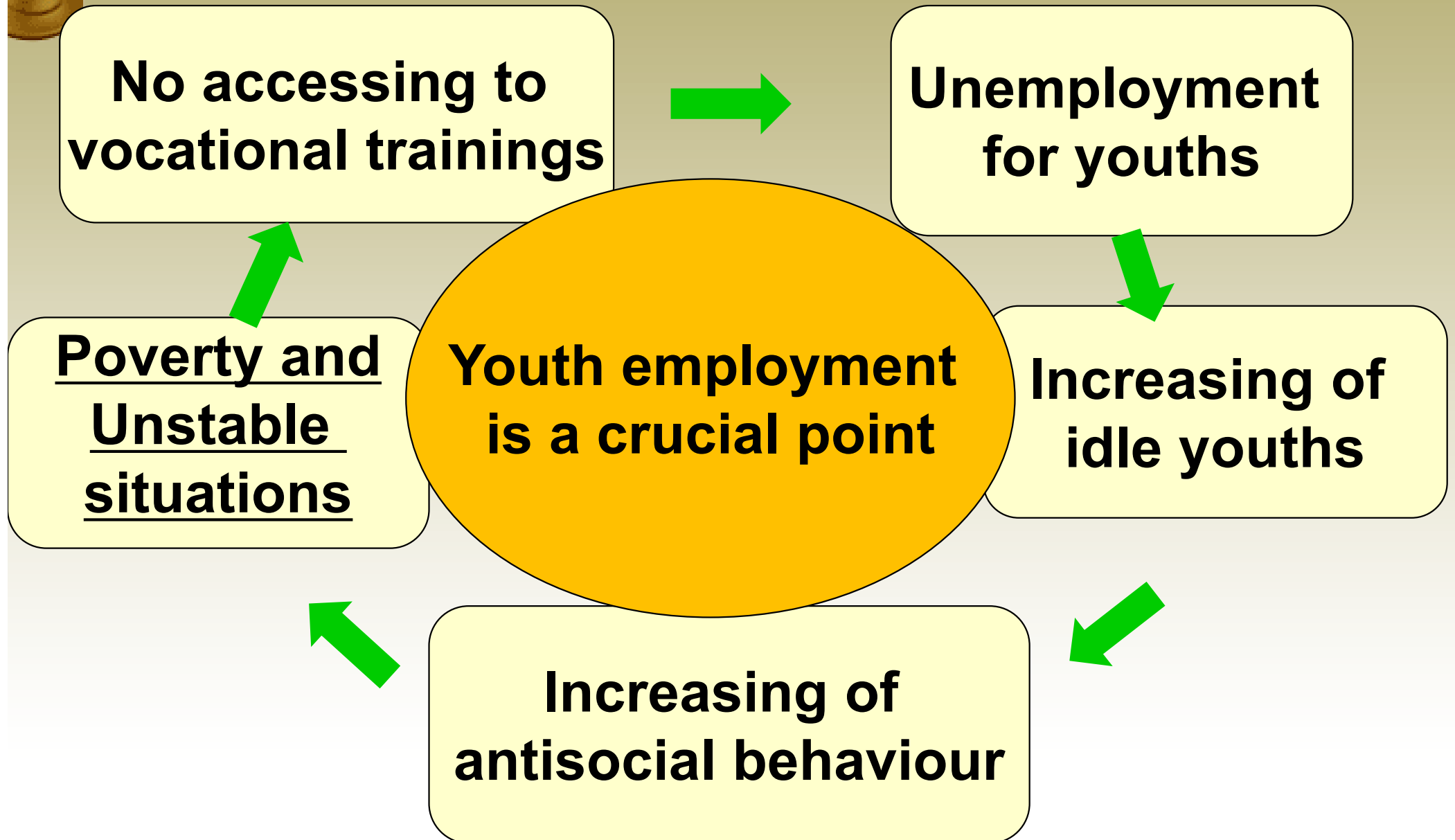
Before

-View from right-angle of bridge axis-

After



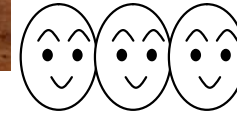
Importance of Youth Employment



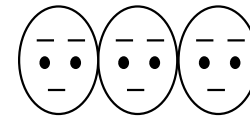
Sustainability (Kenya)



Improvement of
rural road



↑ Sustainable
maintenance



Business
Potential

CHARITY TO
JOB
CREATION

Association formed
for rural road
maintenance



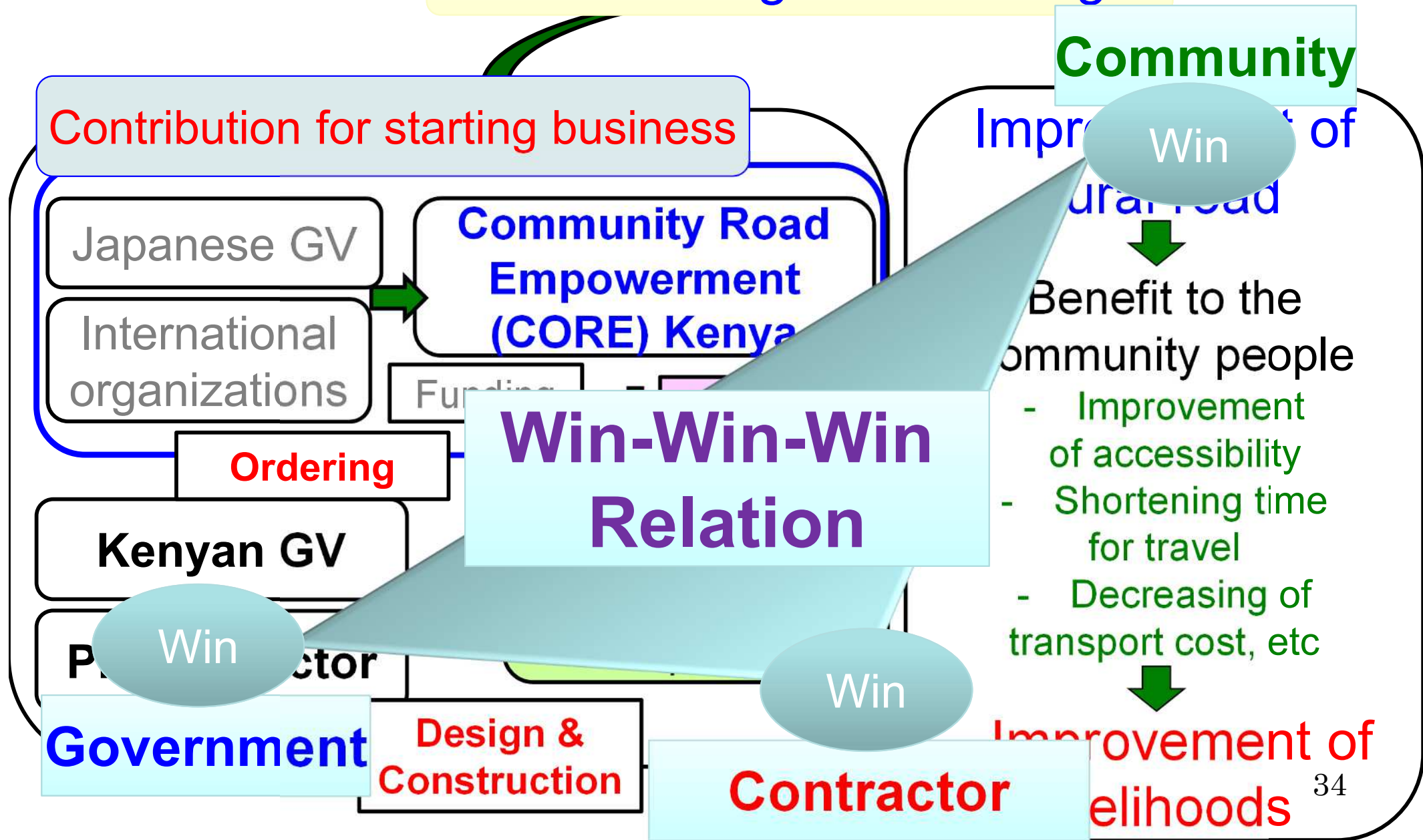
Training for “Do-nou”
technology (CHARITY)

Recognition by the government

CHARITY TO JOB CREATION

Kenya Version

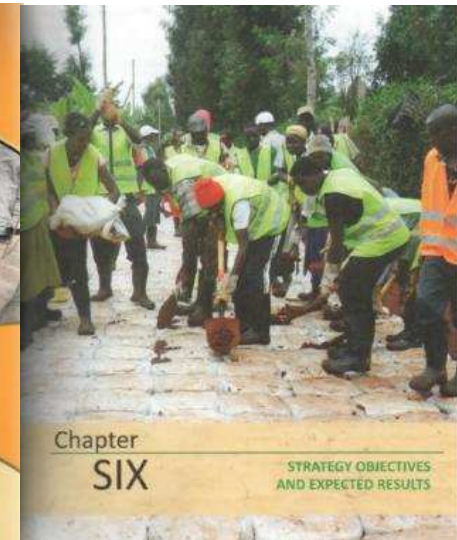
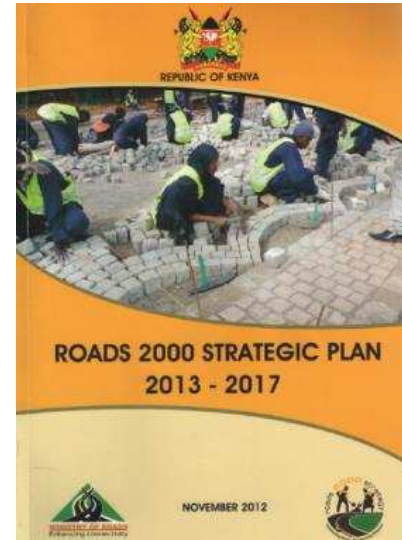
Benefit brought wider range



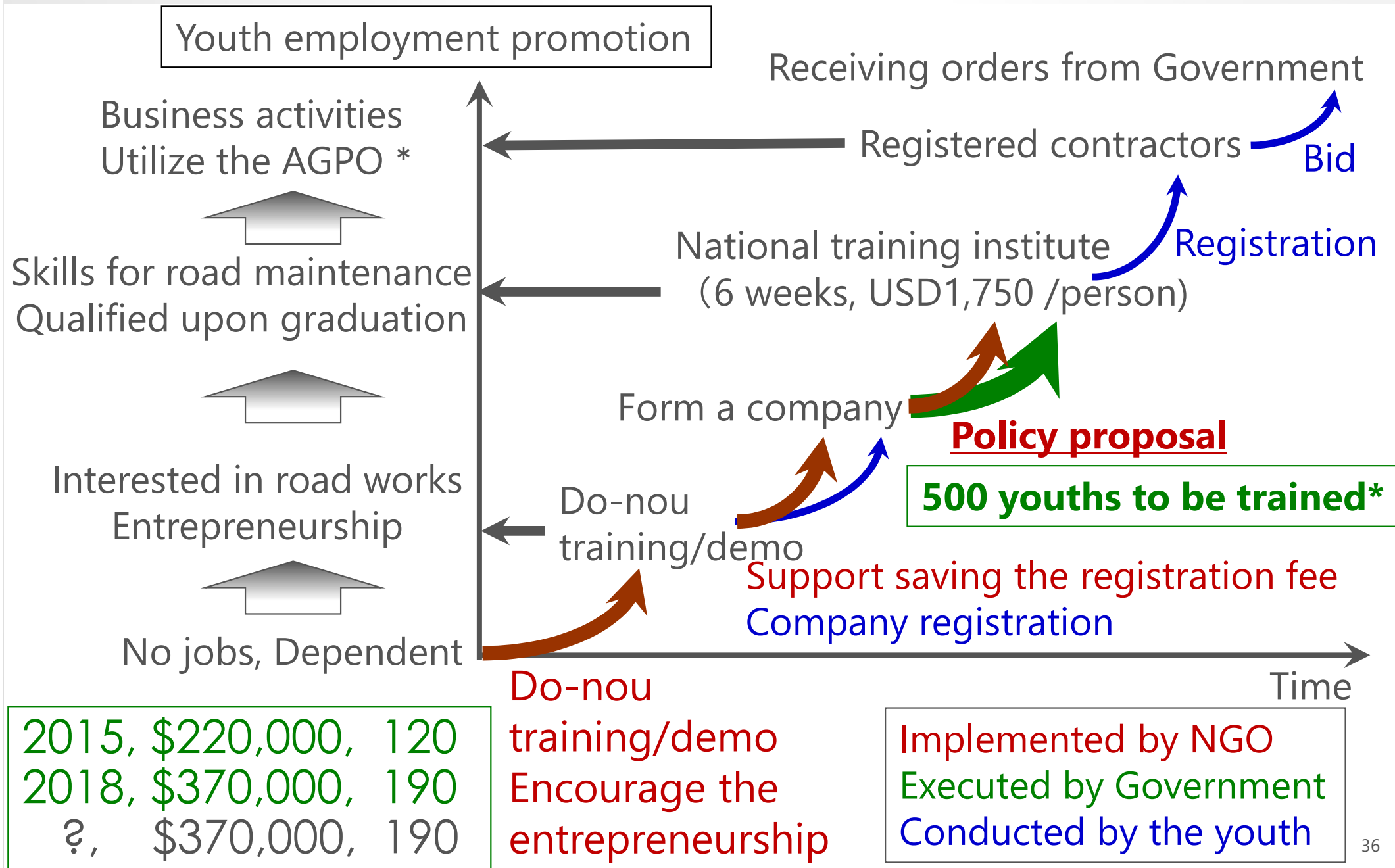
Bottom up & Top down approach

Policy proposals to Local Authorities & Road Administrators/Line Ministry

- A. Do-nou Demo, **B. Budget allocations to the trainings for the youth**
- C. Manual & Guideline of Do-nou technology to be certified



Youth employment promotion model through trainings on Do-nou technology



YOUNG LEADERS VOICE

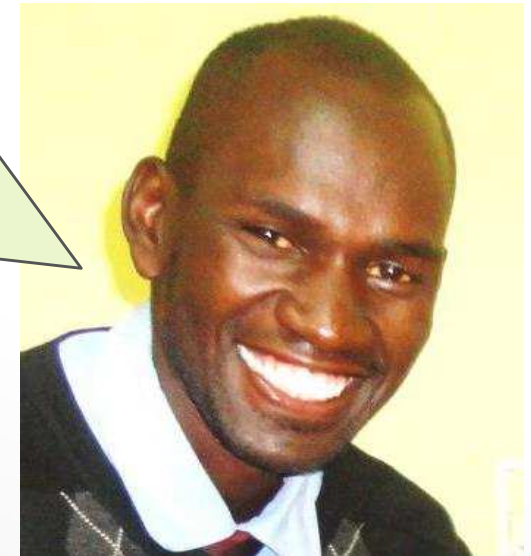


After the Do-nou technology training, my mind attitude changed. I am capable of working on construction sector. I can pay my basic needs, house rent and food for my family.

*(Paul Njahia ,Director,
Eldo fist construction Co. Ltd)*

I was jobless for 3 years and was hopeless to get job. During the Do-nou training, I was keen in learning the road skills. Now, awarded the tender from national and local government. I am happy man since I have married.

(Mike Kosgei , Director, Race-shine Co. Ltd)



CORE Introduced in the Prime Minister's Speech " Japan's Diplomacy towards Africa : Strengthen Each Individual, One by One"



Photo from Ministry of Foreign Affairs Japan, Homepage

His Excellency Mr. Shinzo Abe,
Prime Minister of Japan

*(Bringing a
bright future to
youth)*

A Japanese NGO
called "CORE",
provides an excellent
illustration of this.....

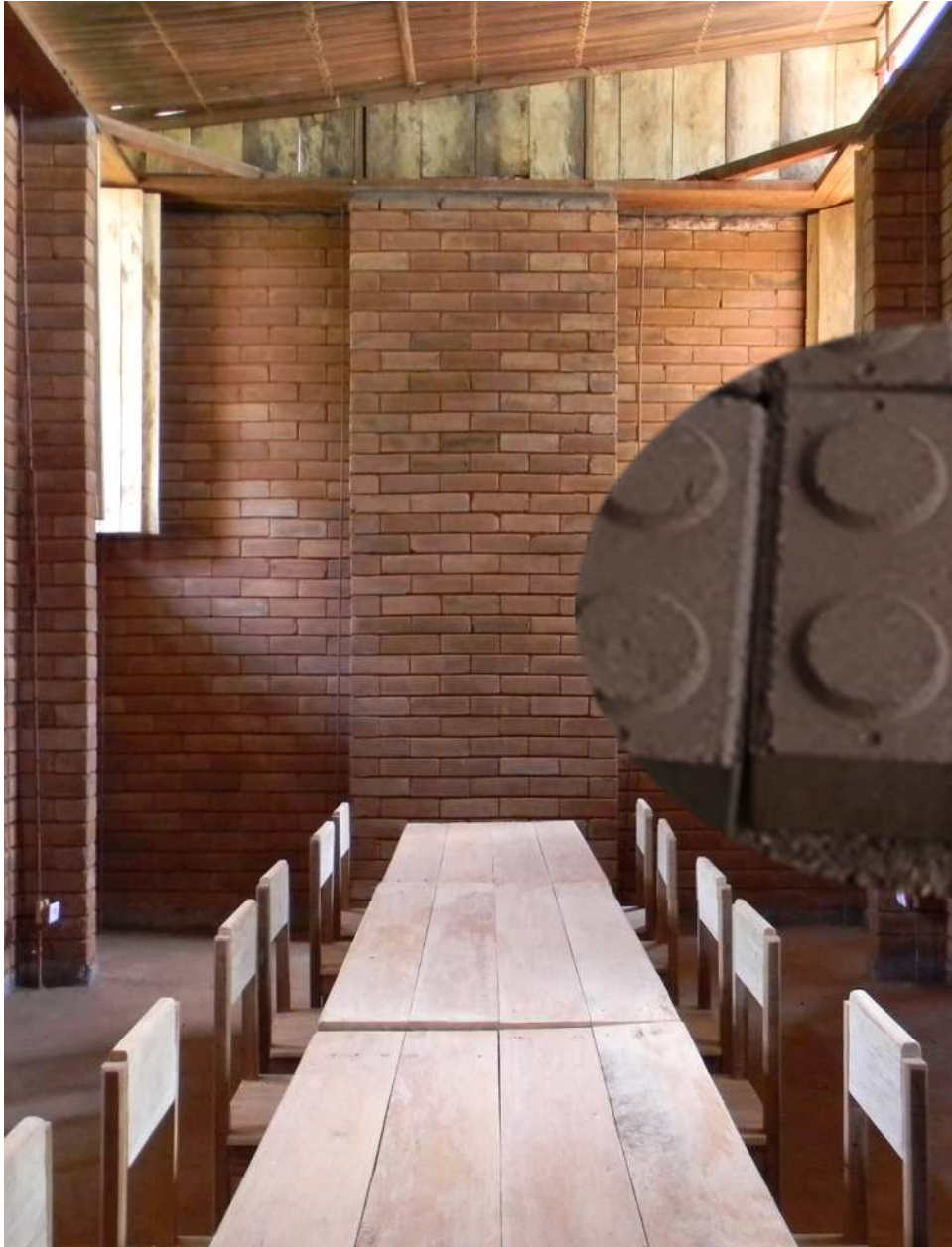
At HQ of African Union in JAN. 2014



Bridge constructions



Field station 1 in Cameroon





Make a good road for rural peoples!
Thank you for your attention!

