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Faculty of Agricultural Technology
Universitas Gadjah Mada

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Yogyakarta, August 28-29

The International Symposium on Agricultural and Biosystem Engineering

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Toward Food & Energi Self-Sufficiency and Sustainable Agriculture

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Message from The Chairperson Of Isabe 2013

It is my honor to welcome you to the International Symposium on Agricultural and Biosystem Engineering 2013. Thank you all for gather here today at the Faculty of Agricultural Technology for attending this important meeting. The ISABE 2013 is held in August 28-29 organized by Department of Agricultural Engineering, Faculty of Agricultural Technology, Universitas Gadjah Mada and the Indonesian Society of Agricultural Engineering (PERTETA). The theme of ISABE 2013 is "Improving the role of agricultural and biosystem engineering toward food & energy self-sufficiency and sustainable agriculture". The objectives of the symposium are to disseminate knowledge, to promote research and development, to obtain the latest information, as well as to exchange technical information in agricultural and biosystem engineering innovation. Moreover, the symposium will provide opportunity to strengthen networking among Indonesia and international academia, government and industries. The meeting will feature a series of keynote speech in plenary sessions, presentations in technical sessions, poster sessions, cultural night, as well as excursion.

I am very pleased to welcome all the guest speakers: Prof. Dongil Chang (Chungnam National University, Korea), Dr. Takashi Okayasu (Kyushu University, Japan), Prof. Vinod Jindal (Mahidol University, Thailand), Ir. Patrick van Schijndel (Eindhoven University of Technology, Netherlands), Prof. Kenan Peker (Selcuk University, Turkey), Prof. Fajrettin Korkmaz (Ataturk University, Turkey), as well as Dr. Lilik Sutiarso (Universitas Gadjah Mada, Indonesia). And joining us to deliver a congratulatory speech is Prof. Seung-Je Park (President of Korean Society for Agricultural Machinery, KSAM). Thank you very much for all of you for your contribution in this symposium.

I am also pleased to greet participants of 92 selected papers, among them are 8 papers from Korea, 6 from Japan, 1 from Taiwan, 1 from Austria, 1 from Thailand, and the remaining 75 papers are from Indonesia, as well as 3 posters. For delegates who do not present papers, thank you for your participants. I hope you can enjoy all the agenda.

I would like to express my sincere gratitude to all colleagues, sponsors, organizing committee, steering committee for their support and cooperation for making this event succesfully performed.

Finally, thank you again for your participation and welcome to the ISABE 2013 meeting.

Chairperson of ISABE 2013
Dr. Rudiati Evi Masithoh

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Design of Farm Road Construction at The Tertiary Plot of Paddy Field

Asep Sapei [1] Erizal [2] and Tatang Sumarna [3]

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Abstract

Farm roads are needed for transportation of agricultural inputs (seeds, fertilizers, pesticides and agricultural machinery and equipment), for transportation of agricultural products and for the operation and maintenance of paddy field's infrastructure. The objective of this research was to design the farm road construction which integrated with tertiary channels and to develop its prototype. The design of farm road construction was based on the specification of vehicle/equipment, the farm roads criteria, the tertiary channels criteria, and the characteristics of road's sub-grade. The compaction of road's sub-grade on prototype development was done by using tamping rammer,and the strength of prototype was measured by using dynamic cone penetrometer (DCP). The design of farm road in the tertiary plot are:2 m top width , 0.90msub-grade height, 1:1.2 side slope, 7 cm pavement thick, and 0:50 m pipeline depth. The strength of prototype sub-grade represented by CBR were ranged from 7.62-21.90 %. These values satisfy the strength requirements of farm road (CBR minimum 5.70 %).

Keywords: farm road, paddy field, tertiary plot

Introduction

Farm roads is one of important factors in agriculture development. The farm road is needed for agricultural inputs transportation such as seeds, fertilizers, pesticides and farm machinery/ equipment. Agricultural production is also often must be transported for further processing in order to reduce damage or yield loss. Farm roads are also used to carry out the operation and maintenance of irrigation and drainage facilities.

UnderAct38of 2004 about theroad, farm roadcan be classified into a special road,i.ethe roadthat its construction and maintenanceis under the responsibility ofthe relevant department.

Nakagawa(1970) state that the farm road of the paddy field is classified into three classes, namely: the main road that connects the village or agricultural facilities center with the field, the branch road that connects one field lot to the other one and the small road which is the road in a field lot.

In general, farm roads in Indonesia are not sufficient, so that cannot be used optimally. Therefore it is necessary to develop a good farm road that meet the technical standards (Ministry of Agriculture, 2008)

During this time, irrigation channel in paddy fields isin the form ofan open channel. Tosave the land, open channelcan be replacedwitha closedchannel(pipe). The upper part can be use as a farm road. With thereplacement ofthe openchannelwithclosed channels (pipe), water losscan also beminimized.

This research aims to design and construct a prototype farm road that integrated with irrigation pipeline at tertiary plot of paddy field.

Materials and methods

Place and Time

The research was conducted at the Cikarawang Experimental Station, Bogor Agricultural University as in Figure 1. Tests on soil characteristics and Soil Mechanics were carried out at Laboratory of Physics, Institut Pertanian Bogor. This research was conducted from June to October 2011.

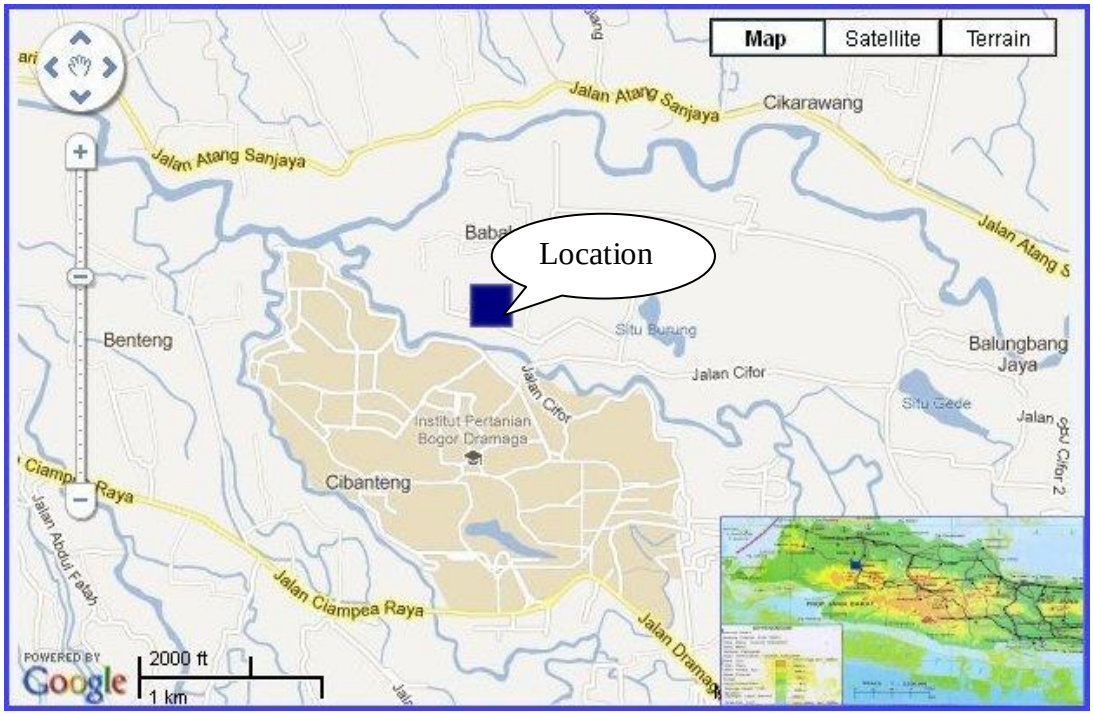

Figure 1. Research location

Materials and Equipment

Materials used in this research were soil from Cikarawang experimental field, Bogor Agricultural University and 6-inch PVC pipe. The characteristics of soil are listed on Table 1.

Table 1. The characteristics of soil

Parameter	Depth (cm)		
	0 - 25	25 - 55	55 - 110
Particle density, Gs	2.66	2.73	2.81
Liquid limit (%), LL	78.85	72.95	78.71
Plastic limit (%), PL	50.23	44.73	42.71
Optimum water content on compaction test (%)	38.38	37.30	37.61
Maximum dry density on compaction test, ρd (ton/m³)	1.24	1.29	1.30
CBR soaked (%)		5.7	

The equipment usedin this research were: 1). soilsampler. 2). water content. 3). specific gravity. 4). particle size distribution. 5). consistency. 6). compactiontesting/Proctorstandard. 7). CaliforniaBearingRatio(CBR). 8). DynamicConePenetrometer(DCP). 9) Soil compactors(tamping rammerwith shoe size285mmx340mm, 690impactsper minute, the impactforce1300kg/impact, self weight64kg).

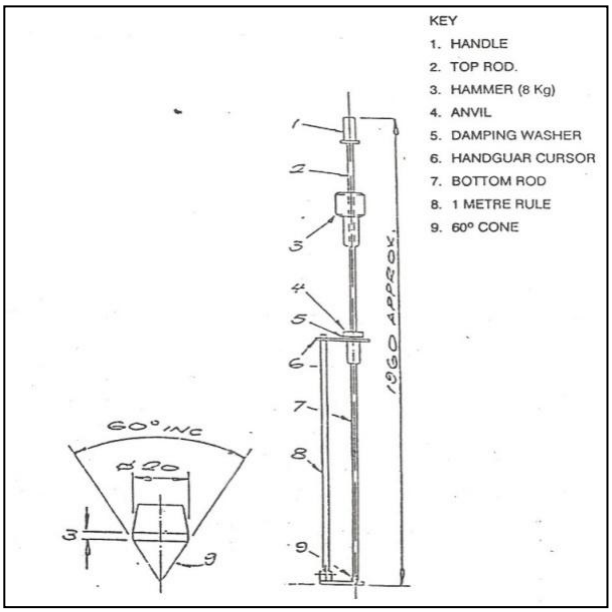

Figure 2. Dynamic Cone Penetrometer(DCP)

Methodology

This research were conducted by several step as shown on Figure 3.

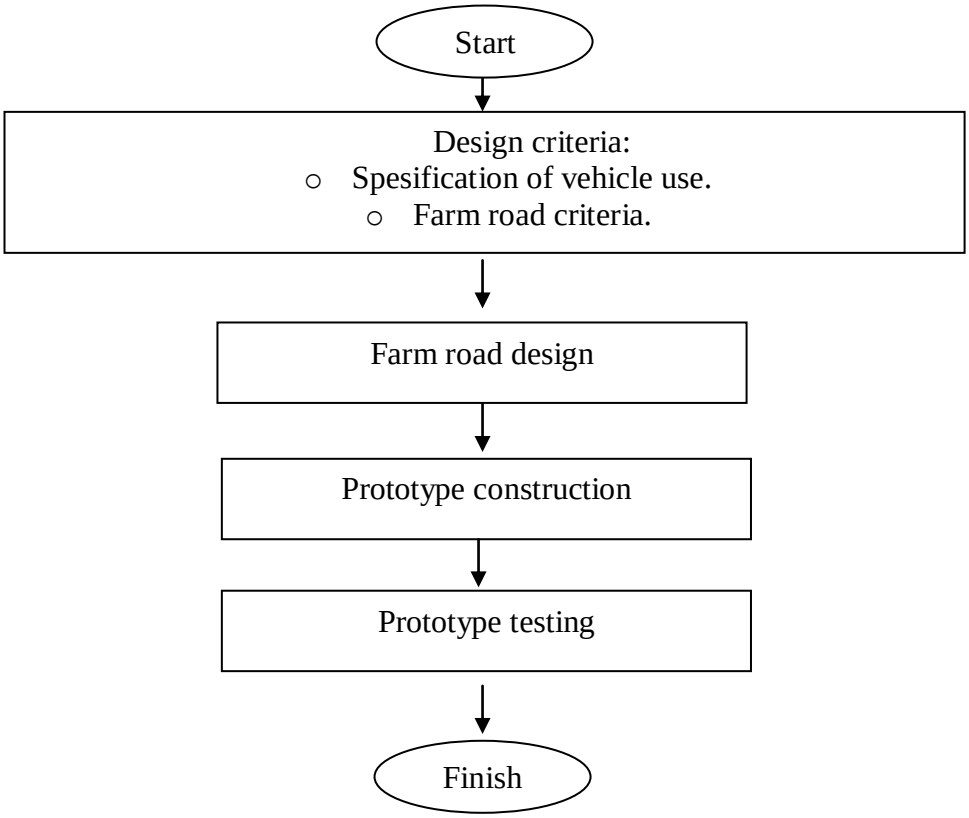

Figure 3. Research steps

Result and discussion

Farm Road Design

Vehicle specification refers to: a). Type of vehicle or conveyance is equipped with a hand tractor wagon. b). Width dimensions of the left and right tires vehicle is 0.86m to1.1m. c). Long-haul vehicles front tires with the rear tire wheel barrow 2.5m to 3m. d). Vehicles and cargo load of 1 tonas shown in Figure 4.

Figure 4. Vehicle

1. Top width of Farm Road

In farm road dimension determination, the road cross section refersto thespecifications ofthe vehiclethatwill pass through thefarm roads

a) The maximumvehiclewidthis110cmor1:10m.
b) The distanceofthe twosides ofthe vehicleisset45cmor0:45m each.
c) Then the top width ofthe farm roadis1:10mplus2x0:45mis 2m.

2. High of farm road

High of farm road depends on site condition. Base on high of pipe irrigation inlet (0.2 m from plot surface) and depth of the pipe (0.5 m), therefore the high of farm road from surface of paddy plot is 0.7 m.

3. Side slope

Base on Ministry of Public Work (2006), for the road with A-7-5 soil and high < 5 m, the side slope is 1:1.2.

4. Irrigation pipeline

Irrigationpipeline was installedonat a depth of0.5mbelow the surface offarm roads. The dead load(overburden) andlive load(load vehiclesand cargo) which act to the pipe is f436kg/m. The strength of the PVC pipe is 504 kg/m.

Design of farm road construction on tertiary plot is shown in Figure 5.

Construction of Subgrade Prototype

Construction of subgrade prototype of farm road was donelayer by layer. Each layer of soil, about 20 cm thick and at optimum water content, was compacted by tampingrammeras much as 5 times, as shown in Figure 6.

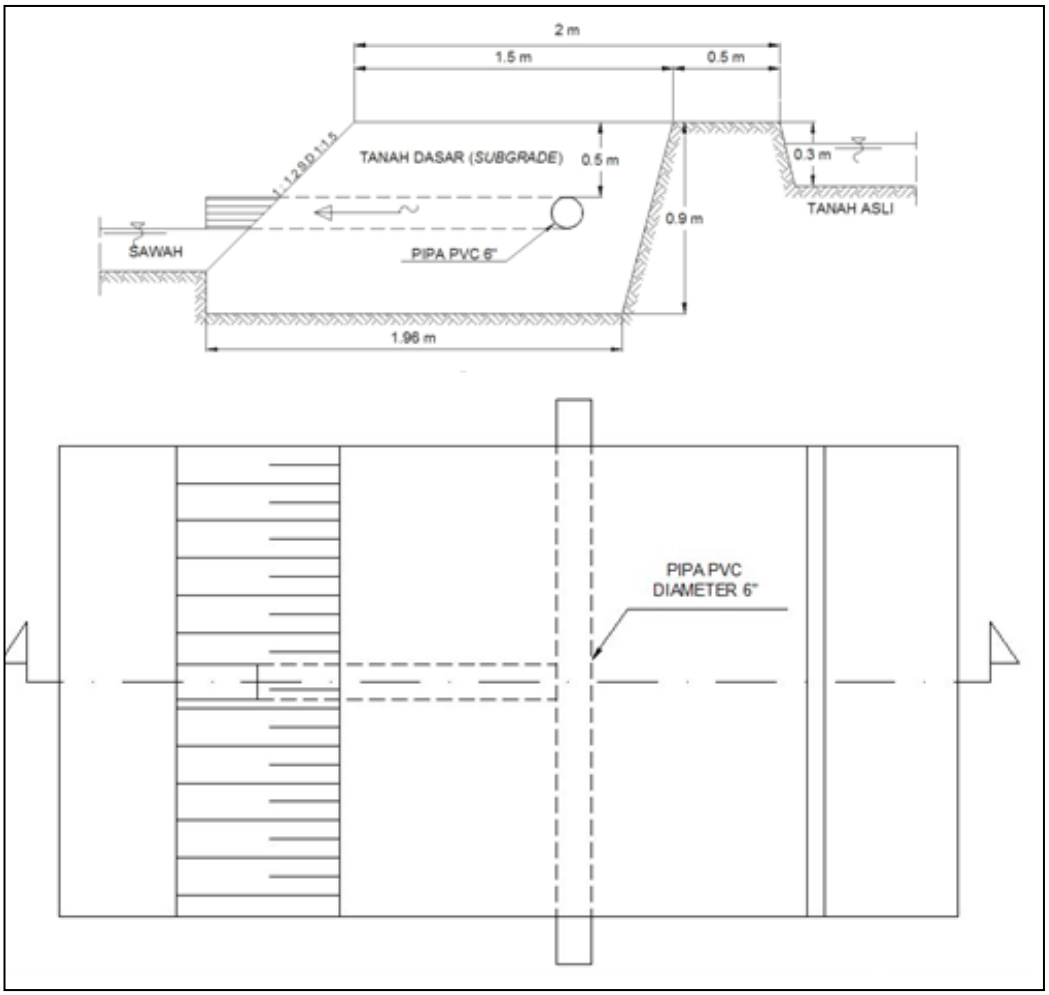

Figure 5. Design of farm road construction on tertiary plot

Figure 6. Construction of subgrade prototype

Once theprototypeachievingthe planneddimensions, the irrigationpipeline(PVC) was installed at a depth of0.5m. Then, soil compaction was continued as shown in Figure 7.

Figure 7. Irrigation pipeline installment

The final formofthe subgrade prototypeof farm roadsintegrated with irrigation pipelineis shownin Figure 8.

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Figure 8. Subgrade prototype of farm road integrated with irrigation pipeline

The Strength of Subgrade Prototype

The strength of subgrade prototype of farm road was measuredusingDCP(Dynamic ConePenetrometer) andcorrelatedwiththe value ofCBR(California BearingRatio) as shown in Table 2. The relation of DCP with CBRfollowsthe formula(Transport and Road ResearchLaboratory, 1990 in Dahlan, 2000).

logCBR=2.48 to 1.057(LogDCP)

Table 2. The CBR values of subgrade prototype

Layer	Depth (m)	CBR (%)
A	0 - 0.34	7.62
B	0.34–0.59	19.67
C	0.59–0.95	21.91

Table 2 showsthatthe CBRvaluesobtained were7.62%, 19.67% and21.91%. Those CBRvaluesaregreater than thevalue ofthe designed CBR (5.7%). This is recognized that the strength of subgrade prototype of farm roadwas fulfilling the requirement.

Conclussion

The dimension of farm road at tertiary plot of paddy fields, there are : the top width is 2 m, the high is 0.90 m, the side slope is 1:1.2, the thickness of pavement layer is 7 cm. The CBRvaluesobtained were7.62%, 19.67% and21.91%. Those CBRvaluesaregreater than thevalue ofthe designed CBR (5.7%). This is recognized that the strength of subgrade prototype of farm roadwas fulfilling the requirement

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