Welcome to the 1st ICOIACT 2018

The emergence of Intelligent Systems Technology as a ubiquitous platform for innovations has laid the foundation for the rapid growth of the Information in the future innovation. The purpose of the 1st ICOIACT 2018 is to promote discussion and interaction among academics, researchers, and professionals in the field of information and technologies. In this conference, the author types that we got came from a student, academia, and government. We deeply thank the authors for their participation and high contribution in this conference.

The theme of The 1st ICOIACT 2018 "Opportunities and Challenges on Intelligent Systems Future Innovation"

The 1st ICOIACT 2018 (ICOIACT 2018) held on 6-7 March 2018 in Grand Zuri, Yogyakarta, Indonesia.

This conference provides an international forum for the presentation and showcase of recent advances on various aspects of ubiquitous technology. It will reflect the state-of-the-art of the methods, involving theory, algorithm, numerical simulation, error and uncertainty analysis and/or novel application of new processing techniques in engineering, science, and other disciplines related to ubiquitous computing. In this conference, several topics on the specific themes for intensive discussions are also planned according to the areas of interest.

We would like to extend our gratitude to the Technical Program Committee that has been reviewed the papers and conducted very interesting conference program as well as the invited and plenary speakers.

Finally, we would like to thank the steering committee members, the conference chairman, the organizing committee, the IEEE Student Branch of Universitas Amikom Yogyakarta, and the financial support from the conference sponsors that conducted the success of The 1st ICOIACT 2018.

The Editor of The 1st ICOIACT 2018

Ferry Wahyu Wibowo (Universitas Amikom Yogyakarta)

Arief Setyanto

Chair

Arief Setyanto (Universitas AMIKOM Yogyakarta, Indonesia)

Akhmad Dahlan

Akhmad Dahlan (Universitas Amikom Yogyakarta, Indonesia)

Nila Feby Puspitasari

15747

Nila Puspitasari (Universitas AMIKOM Yogyakarta, Indonesia)

Sumarni Adi (University of Amikom Yogyakarta, Indonesia)
Kusrini Kusrini (AMIKOM Yogyakarta University, Indonesia)
Emha Taufiq Luthfi (Universitas AMIKOM Yogyakarta, Indonesia)

Ferry Wahyu Wibowo (Universitas AMIKOM Yogyakarta, Indonesia)

Browse Conferences > Information and Communications... > 2018 International Conference ...

Information and Communications Technology (ICOIACT), International Conference on

2018 International Conference on Information and Communications Technology (ICOIACT) DOI: 10.1109/ICOIACT41508.2018

Showing 26-50 of 177

Metrics analysis of risk profile: A perspective on business aspects
Prajna Deshanta Ibnugraha ; Lukito Edi Nugroho ; Paulus Insap Santosa
Publication Year: 2018, Page(s): 275 - 279
Abstract (279 Kb)

Metrics analysis of risk profile: A perspective on business aspects
Prajna Deshanta Ibnugraha ; Lukito Edi Nugroho ; Paulus Insap Santosa
2018 International Conference on Information and Communications Technology (ICOIACT)
Year: 2018

Solving inverse kinematics trajectory tracking of planar manipulator using neural network
Nurani Lathifah ; Anik Nur Handayani ; Heru Wahyu Herwanto ; Siti Sendari
Publication Year: 2018, Page(s): 483 - 488
Abstract (447 Kb)

Solving inverse kinematics trajectory tracking of planar manipulator using neural network
Nurani Lathifah ; Anik Nur Handayani ; Heru Wahyu Herwanto ; Siti Sendari
2018 International Conference on Information and Communications Technology (ICOIACT)
Year: 2018

Spatial optimization on placement BTS and MCP by utilizing data coordinates existing tower
Prasetyo Yuliantoro ; Endroyono ; Achmad Affandi
Publication Year: 2018, Page(s): 911 - 914

Abstract (415 Kb)

Spatial optimization on placement BTS and MCP by utilizing data coordinates existing tower

Prasetyo Yuliantoro ; Endroyono ; Achmad Affandi
2018 International Conference on Information and Communications Technology (ICOIACT)
Year: 2018

Spoiled meat classification using semiconductor gas sensors, image processing and neural network

Vinda Setya Kartika ; Muhammad Rivai ; Djoko Purwanto
Publication Year: 2018, Page(s): 418 - 423
Cited by: Papers (4)

Abstract (752 Kb)

Spoiled meat classification using semiconductor gas sensors, image processing and neural network

Vinda Setya Kartika ; Muhammad Rivai ; Djoko Purwanto
2018 International Conference on Information and Communications Technology (ICOIACT)
Year: 2018

Adaptive DOCR coordination in loop distribution system with distributed generation using firefly algorithm-artificial neural network

Destina S. Lestari ; Margo Pujiantara ; Mauridhi Hery Purnomo ; Daeng Rahmatullah
Publication Year: 2018, Page(s): 579 - 584
Cited by: Papers (1)

Abstract (512 Kb)

Adaptive DOCR coordination in loop distribution system with distributed generation using firefly algorithm-artificial neural network

Destina S. Lestari ; Margo Pujiantara ; Mauridhi Hery Purnomo ; Daeng Rahmatullah
2018 International Conference on Information and Communications Technology (ICOIACT)
Year: 2018

Implementation of hot-wire anemometer on olfactory mobile robot to localize gas source

Gamma Aditya Rahardi ; Muhammad Rivai ; Djoko Purwanto
Publication Year: 2018, Page(s): 412 - 417
Cited by: Papers (2)

Abstract (908 Kb)

Implementation of hot-wire anemometer on olfactory mobile robot to localize gas source

Gamma Aditya Rahardi ; Muhammad Rivai ; Djoko Purwanto
2018 International Conference on Information and Communications Technology (ICOIACT)
Year: 2018

Detection of organic solvent compounds using optical fiber interferometer array and neural network pattern recognition

Dwi Sasmita Aji Pambudi ; Muhammad Rivai ; Achmad Arifin
Publication Year: 2018, Page(s): 477 - 482

Abstract (1060 Kb)

Detection of organic solvent compounds using optical fiber interferometer array and neural network pattern recognition

Dwi Sasmita Aji Pambudi ; Muhammad Rivai ; Achmad Arifin
2018 International Conference on Information and Communications Technology (ICOIACT)
Year: 2018

The development of quail eggs smart incubator for hatching

Model development of students' scholarship status at first asia institute of technology and humanities (Faith)

Jonalyn Joy B. Labayne ; Lester L. Mercado ; Jheanel Espiritu Estrada

2018 International Conference on Information and Communications Technology (ICOIACT)

Year: 2018

Design of land optical fiber backbone communication network in North Sumatera

Yudiansyah ; Prita Dewi Mariyam ; Arie Pangesti Aji ; Novietasari Chisnariandini ; Catur Apriono

Publication Year: 2018, Page(s): 915 - 918

Cited by: Papers (2)

Abstract (197 Kb)

Design of land optical fiber backbone communication network in North Sumatera

Yudiansyah ; Prita Dewi Mariyam ; Arie Pangesti Aji ; Novietasari Chisnariandini ; Catur Apriono

2018 International Conference on Information and Communications Technology (ICOIACT)

Year: 2018

LINGO-based optimization problem of cloud computing of bandwidth consumption in the Internet

Indrawati ; **Fitri** Maya Puspita ; Sri Erlita ; Inosensius Nadeak ; Bella Arisha

Publication Year: 2018, Page(s): 436 - 441

Abstract (221 Kb)

LINGO-based optimization problem of cloud computing of bandwidth consumption in the Internet

Indrawati ; Fitri Maya Puspita ; Sri Erlita ; Inosensius Nadeak ; Bella Arisha

2018 International Conference on Information and Communications Technology (ICOIACT)

Year: 2018

LINGO-based on robust counterpart open capacitated vehicle routing problem (RC-OCVRP) model of waste transportation in Palembang

Yusuf Hartono ; **Fitri** Maya Puspita ; Desi Indah Permatasari ; Bella Arisha

Publication Year: 2018, Page(s): 429 - 435

Abstract (235 Kb)

LINGO-based on robust counterpart open capacitated vehicle routing problem (RC-OCVRP) model of waste transportation in Palembang

Yusuf Hartono ; Fitri Maya Puspita ; Desi Indah Permatasari ; Bella Arisha

2018 International Conference on Information and Communications Technology (ICOIACT)

Year: 2018

Failover mechanism during upgrading process for software-defined networking

Siew-Hoon Lim ; Yung-Wey Chong ; Qi-Guan Ng ; Khong-Lim Yap

Publication Year: 2018, Page(s): 591 - 596

Abstract (330 Kb)

Failover mechanism during upgrading process for software-defined networking

Siew-Hoon Lim ; Yung-Wey Chong ; Qi-Guan Ng ; Khong-Lim Yap

2018 International Conference on Information and Communications Technology (ICOIACT)

Year: 2018

LINGO-Based on Robust Counterpart Open Capacitated Vehicle Routing Problem (RC-OCVRP) Model of Waste Transportation in Palembang

Yusuf Hartono
Education and Teacher Training
Sriwijaya University
South Sumatra, Indonesia
yhartono@unsri.ac.id

Fitri Maya Puspita*, Desi Indah Permatasari, Bella Arisha
Mathematics and Natural Sciences
Sriwijaya University
South Sumatra, Indonesia
*fitrimayapuspita@unsri.ac.id
desiindahpermatasari90@gmail.com

***Abstract*—In this paper, Robust Counterpart Model of Open Capacitated Vehicle Routing Problem (RC-OCVRP) has been established to optimize waste transport in Seberang Ulu II Subdistrict and Plaju Sub-District, Palembang City. The models are designed to solve the robustness in demand in every working area.The models then are solved using LINGO 13.0 that utilizing Branch and Bound solver to obtain the optimal routes. The contribution will be the choice of optimal route that can be offered to government in dealing with the waste control in every subdistrict. For Seberang Ulu II, it was found that the optimal route of distance in WK(Working Area) I was 34.28 km, WK II 35.31 km, WK III 13.56 km, WK IV 11.1 km and WK V 12.86 km, and for Plaju obtained that the optimal route distance at WK I is 46.78, WK II 43.97 and WK III 42.53.**

Keywords—Robust Counterpart, OCVRP, Optimal Rute

I. INTRODUCTION

Palembang is a Metropolitan City, the city's population is clear if we look at high sting. Various diverse problems arise such as household waste (garbage). The garbage transportation system in Palembang City is done gradually. Garbage is collected at the nearest Temporary Disposal Site (TPS) provided by City Sanitation Department (DKK) transport waste from households. Furthermore, garbage in the TPS is transported by officers from DKK by using dump-truck, arm-roll vehicles to the one of the two final disposal sites namely TPA Sukawinatan and TPA Karya Jaya. Transport of solid waste from TPS to TPA is done based on the division of Work Area (WK)[1-3].

On the conventional CVRP (Capacitated Vehicle Routing Problem) issues as discussed in commodity transport vehicles are required to return to the depot after completing their work (as in the discussion). However, for some problems such as open vehicle route problems, route of solid waste transport vehicle, the above mentioned conditions cannot be performed [4].

The garbage transportation activity is one example of the problem form of Vehicle Routing Problem (VRP) related to minimum route search. VRP can be defined as a way of collecting or delivering goods from one or more depots to a city or customer in such a way that the cost and travel routes are minimized or minimum. VRP focused on one depot and the capacity of a public vehicle is called a Capacitated Vehicle Routing Problem (CVRP).

On conventional CVRP (Capacitated Vehicle Routing Problem) issues as discussed in commodity transport vehicles are required to return back to the depot after completing their journey. In its development, after completing the journey, the vehicle does not have to return to the depot. As a result, the vehicle path is not closed but is open, i.e. the vehicle starts at the depot and ends on one of the customers [5].

It also happened on garbage transportation problem in Palembang City. The carrier usually does not return to the depot after performing its duties, but returns to another place, such as the driver's house. In this kind of problem, the trajectory that is formed is not closed but the open path. Therefore, it is called Open Capacitated Vehicle Routing Problem (OCVRP). When OCVRP is focused on one depot and the capacity of a public vehicle then the problem is called the Open Capacitated Vehicle Routing Problem (OCVRP).

The research that has been conducted in 2009 has discussed Open CVRP (OCVRP) model with unclosed route condition for solid waste management problem through periodic waste transportation. Based on the previous results, testing for OCVRP also needs to be done primarily to prove that the model made is really able to get the optimal route desired.

This research is part of a research that focuses on the searching of garbage transport routes in 16 sub districts. The research object is taken from 8 sub-districts namely Seberang Ulu II Sub district, Seberang Ulu I Sub-district, Ilir Barat I District, Ilir Barat II Sub-district, Bukit Kecil District, Sematang Borang Sub district, Plaju Sub-District and

978-1-5386-0954-5/18/$31.00 ©2018 IEEE

Kertapati Sub-District. Based on data from City Sanitation Department (DKK) of Palembang City, each WK has one garbage transport car to transport garbage from TPS located in its working area to TPA Karya Jaya.

The emergence of robust optimization as a modelling methodology is considered capable of resolving the uncertainty of existing data. In the robust optimization methodology, it must always be related to robust counterpart[6]. Based on these facts, try to find Demand Robust Counterpart (DRC) in demand in each TPS from CVRP issues of garbage transport problem, its settlement is MILP (Mixed Integer Linear Programming) with the help of LINGO 13.0 which can be determined by its DRC.

Based on the research [3] about the optimal modelling and solution of OCVRP problem in the transportation of garbage transportation in Palembang City, it is found that 25% of 25 TPS in Seberang Ulu 1 District are the problems of OCVRP. In addition, based on the research [7] on Robust Counterpart Open Capacitated Vehicle Routing Problem (RC-OCVRP) obtained optimal solution of total travel cost, total mileage and total minimum transport cost.

One way to examine the OCVRP model is by using probing and preprocessing techniques. Zulfia, et. al [8] previously discussed rubbish transportation for SCVRP model. Those techniques are discussed in this paper for OCVRP model. Those techniques involve constraint bound strengthening phase, eliminating the redundant constraints and fixing variables. Based on the application of [9], we develop probing and preprocessing techniques by identifying the nonfeasible constraints and redundant constraints, improving the bound and coefficients, and also setting up variable values. OCVRP model have been previously discussed in [10], [11], [12], and [13]. Then, we examine validity of the model.

II. RESEARCH METHOD

The research is a case study, utilizing the garbage transportation data in two sub-districts in Palembang City, Alang-Alang Lebar and Ilir Timur Subdistrict II. Data obtained from DKK Kota Palembang and field survey in the form of direct interview with DKK drivers. We conduct measurement of distance between TPS and TPS to TPA.

The steps taken are followings

1. Collect data in the form of: the number of vehicles operating in District Seberang Ulu II and Plaju District along with the volume of vehicles' capacity, the route through each vehicle and the volume transported from each TPS, the distance traveled from the TPS to TPS and to TPA.
2. Determine the distance matrices.
3. Model the data into Robust Counterpart Model.
4. Establish Models by determining WK in each district in OCVRP and CVRP issues.
5. Apply the model of each WK into LINGO 13.0.
6. Look for optimal integer solution from non optimal integer solution by using Branch and bound solver method on LINGO 13.0.
7. Determine the optimal route on WK for the case of garbage transportation by Branch and Bound solver method on LINGO 13.0.

III. RESULT AND DISCUSSIONS

A. Data

The research data was obtained by interviewing DKK Palembang City officials and field survey to see the condition of TPS and TPA and garbage transportation path in each work area so that the distance data (in km) is arranged. For example for working area I in Seberang Ulu II is as explained in Table I.

TABLE I DISTANCE ON WORK AREAS 1 DISTRICT SEBERANG ULU II

	TPA	**TPS 1**	**TPS 2**	**TPS 3**	**TPS 4**
TPA	0	11.6	10.8	11.1	11.0
TPS 1	11.6	0	0.78	0.86	0.62
TPS 2	10.8	0.78	0	0.59	0.17
TPS 3	11.1	0.86	0.59	0	0.6
TPS 4	11.0	0.62	0.17	0.6	0

where
TPA - Karya Jaya
TPS 1 -Tangga Takat
TPS 2 -Yaktapena
TPS 3 -Nagaswidak
TPS 4 -Jl. AYani

B. Robust Counterpart

The Robust Counterpart (RC) model is one of the available methodologies to handle the uncertainties in the data optimization problem. The challenge that exists in this methodology is how to formulate the RC model of the existing problem as an optimal solution because the RC model is heavily dependent on the selection of data uncertainty.

Robust Vehicle Routing Problem (RVRP) can be a minimum or maximum. The main focus of this research is to search for mathematical methods for robust problems, i.e. problems related to finding the optimal solution of problems involving indeterminate data. This research uses RC model which has been developed by[14].

In this methodology, the RC represents the worst-case oriented approach, i.e. a solution called robust is feasible only if it meets the technical constraints for all possible values of candidate solutions of indeterminate data. In this case, the RC of a linear optimization problem is a problem in a special form that is a quadratic conical problem, which can be solved efficiently using the method of interior point

.

C. Model of Open Symetric Capacitated VehicleRoutingProblems(OCVRP)

OVRP and VRP have differences that lie in the travel route. At VRP, the vehicle starts the journey from the depot and will return to the depot when it has completed its task. However, on the OVRP the vehicle starts the journey from the depot but has completed its task of not having to return to the depot for example to one of the driver's houses.

D. Robust Counterpart OCVRP Model

This model is a combined model of the Robust Counterpart model proposed by [8] and the OCVRP model proposed by [6].

Min = δ

Subject to

$10.4y_{01}+14.4y_{02}+13.8y_{03}+10.4y_{10}+4.78x_{12}+4.33x_{13}+14.4y_{20}+4.78x_{21}+0.65x_{23}+13.8y_{30}+4.33x_{31}+0.65x_{32} \leq \delta$

$x_{12}=1$

$y_{02}+y_{20}=1$

$y_{03}+y_{30}=1$

$y_{01}+y_{02}+y_{03}+x_{12}+x_{13}+x_{21}+x_{23}+x_{31}+x_{32} \geq 1.19$

$y_{10}+y_{20}+y_{30}+x_{12}+x_{13}+x_{21}+x_{23}+x_{31}+x_{32} \geq 1$

$y_{01}+y_{02}+y_{03}=1$

$3500 \leq l_1 < 8000$

$2000 \leq l_2 < 8000$

$4000 \leq l_3 < 8000$

$l_1-l_2+8000(x_{12}) \leq 6000$

$l_1-l_3+8000(x_{13}) \leq 4000$

$l_2-l_1+8000(x_{21}) \leq 4500$

$l_2-l_3+8000(x_{23}) \leq 4000$

$l_3-l_1+8000(x_{31}) \leq 4500$

$l_3-l_2+8000(x_{32}) \leq 6000$

ä ≥ 0

$y_{01}, y_{02}, y_{03} \geq 0$

$x_{12}, x_{13}, x_{21}, x_{23}, x_{31}, x_{32} \geq 0$

Table II. Represents the solution table of the Robust Counterpart OCVRP model in Seberang Ulu II. From the table, it can be found that the optimal route distance for WK I is 34.28 km, WK II 35.31 km, WK III 13.56 km, WK IV 11.1 km and WK V 12.86 km. Table III shows the value of decision variable for WK I, Table IV shows the value of the decision variable for WK II, Table V shows the value of the decision variable for WK III, Table VI indicates the value of the decision variable for WK IV and Table VII ndicates the value of the decision variable for WK V.i

The solution of the waste transport route from WK I of Seberang Ulu II District with the help of LINGO 13.0 is shown in Fig 1 as follows. Thr optimal route is TPS 1(Tangga Takat) - TPS 2(Yaktapena) - TPA Karya Jaya - TPS 3(Nagaswidak) - TPS 4(Jl. A.Yani) - TPA Karya Jaya.

TABLE II. SOLUTIONS OF ROBUST COUNTERPART OCVRP AT SEBERANG ULU II SUBDISTRICT

Solver Status	**WK I**	**WK II**	**WK III**	**WK IV**	**WK V**
Model Class	*MILP*	*MILP*	*MILP*	*MILP*	*MILP*
State	*Global Optimal*	*Global Optimal*	*Global Optimal*	*Global Optimal*	*Global Optimal*
Objective	34.28	35.31	13.56	11.1	12.86
Infeasibility	0	0	0	0	0
Iterations	0	0	0	0	0
Solver Type	*Branch and Bound*	*Branch and Bound*	*Branch and Bound*	*Branch and Bound*	*Branch and Bound*
Steps	0	0	0	0	0
Update Interval	2	2	2	2	2
GMU	31	25	21	19	22
ER	0	0	0	0	0

Based on data in Table I WK 1 District Seberang Ulu II has four TPS that must be passed, while the vehicle capacity is 4 tons. With the number of vehicles equal to 1, then the RC-OCVRP model on WK 1 is:

Minimize $z =$

$11{,}6y_{01}+10{,}8y_{02}+11{,}1y_{03}+11{,}0y_{04}+11{,}6y_{10}+0{,}78x_{12}+0{,}86x_{13}+0{,}62x_{14}+10{,}8y_{20}+0{,}78x_{21}+0{,}59x_{23}+0{,}17x_{24}+11{,}1y_{30}+0{,}86x_{31}+0{,}59x_{32}+0{,}6x_{34}+11{,}0y_{40}+0{,}62x_{41}+0{,}17x_{42}+0{,}6x_{43}$

Subject to

$y_{01}+y_{10}+x_{12}+x_{13}+x_{14} = 2$

$y_{02}+y_{20}+x_{21}+x_{23}+x_{24} = 2$

$y_{03}+y_{30}+x_{31}+x_{32}+x_{34} = 2$

$y_{04}+y_{40}+x_{41}+x_{42}+x_{43} = 2$

$y_{01}+y_{02}+y_{03}+y_{04}+y_{10}+y_{20}+y_{30}+y_{40}+x_{12}+x_{13}+x_{14}+x_{21}+x_{23}+x_{24}+x_{31}+x_{32}+x_{34}+x_{41}+x_{42}+x_{43} \geq 4$

$y_{01}+y_{02}+y_{03}+y_{04}+y_{10}+y_{20}+y_{30}+y_{40}+x_{12}+x_{13}+x_{14}+x_{21}+x_{23}+x_{24}+x_{31}+x_{32}+x_{34}+x_{41}+x_{42}+x_{43} \geq 4$

$y_{01}+y_{02}+y_{03}+y_{04} = 1$

$2000 \leq l_1 < 4000$

$2000 \leq l_2 < 4000$

$3000 \leq l_3 < 4000$

$1000 \leq l_4 < 4000$

$l_1 - l_2 + 4000x_{12} \leq 2000$

$l_1 - l_3 + 4000x_{13} \leq 1000$

$l_1 - l_4 + 4000x_{14} \leq 3000$

$l_2 - l_1 + 4000x_{21} \leq 2000$

$l_2 - l_3 + 4000x_{23} \leq 1000$

$l_2 - l_4 + 4000x_{24} \leq 3000$

$l_3 - l_1 + 4000x_{31} \leq 2000$

$l_3 - l_2 + 4000x_{32} \leq 2000$

$l_3 - l_4 + 4000x_{34} \leq 1000$

$l_4 - l_1 + 4000x_{41} \leq 2000$

$l_4 - l_2 + 4000x_{42} \leq 2000$

$l_4 - l_3 + 4000x_{43} \leq 1000$

y_{01}, y_{02}, y_{03},y_{04}, x_{12}, x_{13}, x_{14}, x_{21}, x_{23}, x_{24}, x_{31}, $x_{32}, x_{34}, x_{41}, x_{42}, x_{43} \geq 0$

After that the route obtained in Figure 1, value shown on l_1,l_2, l_3, l_4 is the volume of waste (kg) transported upon leaving TPS-i ($i = 1,2,3,4$) and will be described further in Table III as follows:

TABLE III. VARIABEL VALUES OF ROBUST COUNTERPART OCVRP AT WK I SEBERANG ULU II SUBDISTRICT

Variable	Working Area I
δ	34.28
Y_{01}	0
Y_{02}	0
Y_{03}	1
Y_{04}	0
Y_{10}	0
X_{12}	1
X_{13}	0
X_{14}	0
Y_{20}	1
X_{21}	0
X_{23}	0
X_{24}	0
Y_{30}	0
X_{31}	0
X_{32}	0
X_{34}	1
Y_{40}	1
X_{41}	0
X_{42}	0
X_{43}	0
L_1	4000
L_2	8000
L_3	4000
L_4	7800

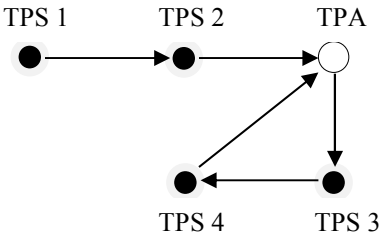

Fig 1.Routes that must be passed by Dump Truck for garbage transport at WK I

Based on the results obtained in Figure 1, the route is the optimal distance in WK 1 District Seberang Ulu II that is as far as 34.28 km with TPS Tangga Takat - TPS Yaktapena - TPA Karya Jaya - TPS Nagaswidak - TPS Jl. A.Yani - TPA Karya Jaya.

TABLE IV. VARIABLE VALUES OF ROBUST COUNTERPART OCVRP AT WK II SEBERANG ULU II SUBDISTRICT

Variable	Working Area I
δ	35.31
Y_{01}	0
Y_{02}	0
Y_{03}	1
Y_{10}	0
X_{12}	1
X_{13}	0
Y_{20}	1
X_{21}	0
X_{23}	0
Y_{30}	1
X_{31}	0
X_{32}	0
L_1	4000
L_2	8000
L_3	4000

The solution of the waste transport route from WK II of Seberang Ulu II District with the help of LINGO 13.0 is shown in Fig 2 as follows with the optimal route of TPS 1(Halte Simpang Tangga Takat) - TPS 2(Patra Jaya) - TPA Karya Jaya - TPS 3(Yaktapena) - TPA Karya Jaya.

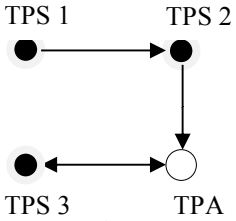

Fig 2. Routes that must be passed by Dump Truck for garbage transport at WK II

Routes that must be passed by Dump Truck for garbage transport at WK II is TPS 1(Halte Simpang Tangga Takat) - TPS 2(Patra Jaya) - TPA Karya Jaya - TPS 3(Yaktapena) - TPA Karya Jaya according to the model solution.

TABLE V. VARIABEL VALUES OF ROBUST COUNTERPART OCVRP AT WK III SEBERANG ULU II SUBDISTRICT

Variable	Working Area III
δ	13.56
Y_{01}	0
Y_{02}	0
Y_{10}	0
X_{12}	1
Y_{20}	1
X_{21}	0
L_1	4000

L_2	8000

The solution of the waste transport route from WK III of Seberang Ulu II District with the help of LINGO 13.0 is shown in Fig 3 as follows with the optimal route chosen is TPS 1(SMA Vetran Plaju) - TPS 2(Yaktapena) - TPA Karya Jaya.

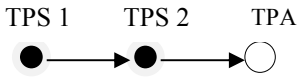

Fig 3. Routes that must be passed by Dump Truck for garbage transport at WK III

TABEL VI. VARIABLE VALUES OF ROBUST COUNTERPART OCVRP AT WK IV SEBERANG ULU II SUBDISTRICT

Variable	Working Area III
δ	11.1
Y_{01}	0
Y_{10}	1
L_1	4000

The solution of the waste transport route from WK IV Seberang Ulu II District with the help of LINGO 13.0 is shown in Fig. 4 as follows. The optimal route for the waste collection is TPS 1(Nagaswidak) - TPA Karya Jaya.

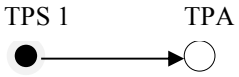

Fig 4. Routes that must be passed by Dump Truck for garbage transport at WK IV

The solution of the waste transport route from WK V Seberang Ulu II Sub-district with the help of LINGO 13.0 is shown in Fig. 5 as follows with the route of TPS 1(PasarJakabaring) - TPS 2(Pasar 10 Ulu) - TPA Karya Jaya.

TABLE VII. VARIABLE VALUES OF ROBUST COUNTERPART OCVRP AT WK V SEBERANG ULU II SUBDISTRICT

Variable	Working Area III
δ	12.86
Y_{01}	0
Y_{02}	0
Y_{10}	0
X_{12}	1
Y_{20}	1
X_{21}	0
L_1	4000
L_2	8000

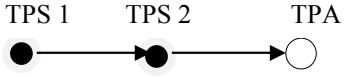

Fig 5.Routes that must be passed by Dump Truck for garbage transport at WK V

TABLE VIII. SOLUTIONS OF ROBUST COUNTERPART OCVRP AT PLAJU SUBDISTRICT

Solver Status	**WK I**	**WK II**	**WK III**
Model Class	*MILP*	*MILP*	*MILP*
State	*Global Optimal*	*Global Optimal*	*Global Optimal*
Objective	46.78	43.97	42.53
Infeasibility	0	0	0
Iterations	0	0	0
Solver Type	*Branch and Bound*	*Branch and Bound*	*Branch and Bound*
Steps	0	0	0
Update Interval	2	2	2
GMU	25	31	25
ER	0	0	0

Table VIII explained the solver status of LINGO for obtaining the optimal route for Plaju Subdistrict.Each working area shows the optimal solution with optimal routes obtained. Next in Table IX-XI, the variable values of each route in each working area are explained.

TABEL IX. VARIABLE VALUES OF ROBUST COUNTERPART OCVRP AT WK I KECAMATAN PLAJU SUBDISTRICT

Variable	Working Area I
δ	46.78
Y_{01}	0
Y_{02}	0
Y_{03}	1
Y_{10}	0
X_{12}	1
X_{13}	0
Y_{20}	1
X_{21}	0
X_{23}	0
Y_{30}	1
X_{31}	0
X_{32}	0
L_1	3500
L_2	5500
L_3	4000

The solution of the waste transport route from WK I of Plaju District with the help of LINGO 13.0 is shown in Fig 6 as follows.The selected route is TPS 1(UMP) - TPS 2(Pintu Masuk Komperta) - TPA Karya Jaya - TPS 3(Pasar Plaju) - TPA Karya Jaya.

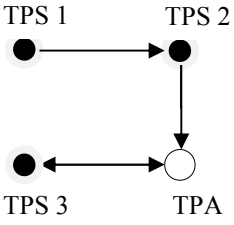

Fig 6. Routes that must be passed by Dump Truck for garbage transport at WK I

TABLE X. VARIABLE VALUES OF ROBUST COUNTERPART OCVRP AT WK II PLAJU SUBDISTRICT

Variable	Working Area I
δ	43.97
Y_{01}	0
Y_{02}	0
Y_{03}	1
Y_{04}	0
Y_{10}	0
X_{12}	1
X_{13}	0
X_{14}	0
Y_{20}	1
X_{21}	0
X_{23}	0
X_{24}	0
Y_{30}	0
X_{31}	0
X_{32}	0
X_{34}	1
Y_{40}	1
X_{41}	0
X_{42}	0
X_{43}	0
L_1	4000
L_2	7800
L_3	3800
L_4	7800

The solution of the waste transport route from WK II of Plaju District with the help of LINGO 13.0 is shown in Fig 7 as follows with the route of TPS 1(Bagus Kuning) - TPS 2(Depan Simpang 3 Jl. Panjaitan) - TPA Karya Jaya - TPS 3(Kantor Camat Plaju) - TPS 4(Sentosa Plaju) - TPA Karya Jaya.

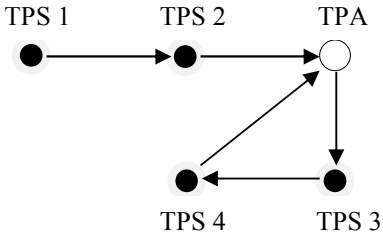

Fig 7. Routes that must be passed by Dump Truck for garbage transport at WK II

The solution of the waste transport route from WK III of Plaju District with the help of LINGO 13.0 is shown in Fig 8 as follows. The optimal route is i.e. TPS 1(Depan BCA Kapten Abdullah) - TPA Karya Jaya - TPS 2(PulauLayang) – TPS 3(Pasar Plaju) - TPA Karya Jaya.

TABLE XI. VARIABLE VALUES OF ROBUST COUNTERPART OCVRP AT WK III PLAJU SUBDISTRICT

Variable	Working Area I
δ	42.53
Y_{01}	0
Y_{02}	1
Y_{03}	0
Y_{10}	1
X_{12}	0
X_{13}	0
Y_{20}	0
X_{21}	0
X_{23}	1
Y_{30}	1
X_{31}	0
X_{32}	0
L_1	3500
L_2	5500
L_3	4000

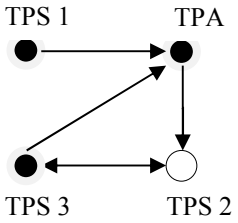

Fig 8. Routes that must be passed by Dump Truck for garbage transport at WK I

IV. CONCLUSION

From the results of the discussion above, it can be concluded the optimal solution of the RC-OCVRP model is the route with the optimum distance obtained as follows:

Seberang Ulu II Subdistrict

1) Working Area 1: TPS 1 – TPS 2 – TPA Karya Jaya – TPS 3 – TPS 4 – TPA Karya Jaya with optimal distance so far 34,28 km.
2) Working Area 2: TPS 1 – TPS 2 – TPA Karya Jaya – TPS 3 – TPA Karya Jaya with optimal distance so far 35,31 km.
3) Working Area 3: TPS 1 – TPS 2 – TPA Karya Jaya with optimal distance so far 13,56 km.
4) Working Area 4: TPS 1 – TPA Karya Jaya with optimal distance so far 11,1 km.
5) Working Area 5: TPS 1 – TPS 2 – TPA Karya Jaya with optimal distance so far 12,86 km.

Plaju Subdistrict

6) Working Area 1: TPS 1 – TPS 2 – TPA Karya Jaya – TPS 3 – TPA Karya Jaya with optimal distance so far 46,78 km.

7) Working Area 2: TPS 1 – TPS 2 – TPA Karya Jaya – TPS 3 – TPS 4 – TPA Karya Jaya with optimal distance so far 43,97 km.
8) Working Area 3: TPS 1 – TPA Karya Jaya – TPS 2 – TPS 3 – TPA Karya Jaya with optimal distance so far 42,53 km.

ACKNOWLEDGMENT

The research leading to this study was financially supported by Sriwijaya University for support through Hibah Penelitian Unggulan KompetitifTahun 2017.

REFERENCES

[1] Irmeilyana, Puspita, F. M., Indrawati, Proceeding Konferensi Nasional Teknologi Informasi dan Aplikasinya, Fak. Ilmu Komputer UNSRI 2009.

[2] Irmeilyana, Puspita, F. M., Indrawati, Proceeding of International Conference on Applied Analysis and Algebra (ICAAA) 2011, Yildiz University, Istanbul 2011.

[3] Irmeilyana, Puspita, F. M., Indrawati, Rizta, A., Modeling and Optimal Solution of Open Capacitated Vehicle Routing Problem (OCVRP) in Garbage Transportation in Kecamatan Seberang Ulu I Kota Palembang. *Australian Journal of Basic and Applied Sciences* 2011, *5*, 9-17.

[4] Puspita, F. M., Cahyono, E. S., Yunita, Metode Branch and Cut dalam Menyelesaikan Capacitated Vehicle Routing Problem (CVRP). *Jurnal Ilmiah Matematika dan Terapan, Jurusan Matematika MIPA Universitas Tadulako* 2006, 102-112.

[5] Lysgaard, J., Letchford, A. N., Eglese, R. W., A new branch and cut algorithm for the capacitated vehicle routing problem. *Math. Program* 2003, *100*, 423-445.

[6] Chaerani, D., *Research workshop on Operations Research and Optimization Modeling,* Universitas Padjajaran. Bandung 2007.

[7] Wulandari, Y., *Fakultas Matematika dan Ilmu Pengetahuan Alam*, Universitas Sriwijaya, Palembang 2017.

[8] Zulfia, F., F.M. Puspita, and Indrawati, *Teknik Preprocessing dalam Penyederhanaan Model SCVRP" dengan mengambil contoh kasus masalah pengangkutan sampah di Kecamatan Ilir Barat II*, Kota Palembang, in Jurusan Matematika FMIPA. 2008, Universitas Sriwijaya: Indralaya.

[9] Savelsbergh, M.W.P., Preprocessing and probing techniques for mixed integer programming problems. *ORSA J. on Computing*, 1994. **6**: p. 445-454.

[10] Irmeilyana, F.M. Puspita, and Indrawati, *Analisis Model dan Solusi Eksak Open Capacitated Vehicle Routing Problem dengan Split dan Time Deadline (OCVRP-st) Pada Pengangkutan Sampah Palembang* Laporan Hibah Bersaing tahun Pertama. 2009, Universitas Sriwijaya: Indralaya.

[11] Nuratika, Indrawati, and Irmeilyana, *Penentuan Rute Minimum Open capacitated Vehicle Routing Problem (OCVRP) Pada Masalah Transportasi Sampah Di Kota Palembang" dengan mengambil contoh kasus masalah pengamgkutan sampah di Kecamatan Seberang Ulu II Kota Palembang*, in Jurusan Matematika FMIPA 2009, Universitas Sriwijaya: Indralaya.

[12] Mayasari, Y., Indrawati, and Irmeilyana, *Penentuan Rute Minimum Open capacitated Vehicle Routing Problem (OCVRP) Pada Masalah Transportasi Sampah Di Kota Palembang dengan mengambil contoh kasus masalah pengamgkutan sampah di Kecamatan Seberang Ulu II Kota Palembang,* in Jurusan Matematika FMIPA 2009, Universitas Sriwijaya: Indralaya.

[13] Rizta, A., Indrawati, and Irmeilyana, *Pemodelan dan Solusi Optimal Masalah Open Capacitated Vehicle Routing Problem (OCVRP) pada Transportasi Pengangkutan Sampah di Kecamatan Seberang Ulu I Kota Palembang*, in Jurusan Matematika FMIPA 2010, Universitas Sriwijaya: Indralaya.

[14] Ben-Tal, A., Nemirovski, A., *Lectures on Modern Convex Optimization:Analysis, Algorithms, and Engineering Applications*, Society for Industrial and Applied Mathematics 2001.

IEEE
Conference Number #41508

UNIVERSITAS AMIKOM YOGYAKARTA

Certificate of Participation

This certificate is awarded to

FITRI MAYA PUSPITA

who has participated in The International Conference on
INFORMATION AND COMMUNICATIONS TECHNOLOGY 2018 (ICOIACT-2018)
Yogyakarta - Indonesia, 6-8 March 2018

General Chair of ICOIACT 2018

Arief Setyanto, S.Si., M.T., Ph.D.

Organized by:
UNIVERSITAS AMIKOM YOGYAKARTA

Sponsored by:
IEEE Indonesia Section
IEEE Xplore Digital Library
GITSolution, P.T.
time excelindo
Amikom

ICOIACT.ORG
www.icoiact.amikom.ac.id