

DSS-RESPOND-O
R-X
RESilient
Emergency
Preparedness for
Natural Disaster
Response
through
Operational
Research

- Joint projects : Lancaster Univ,
Universitas Indonesia Team (UI, Yarsi,
IPB), National Board for Disaster
Management

- Heru Suhartanto (UI)

- Presented at PRAGMA 39, 22-24 June
2023

The modules developed and need advises

- Network generators (used open street maps data)
- Assisted Evacuation Planning
- Personal Routing and Scheduling

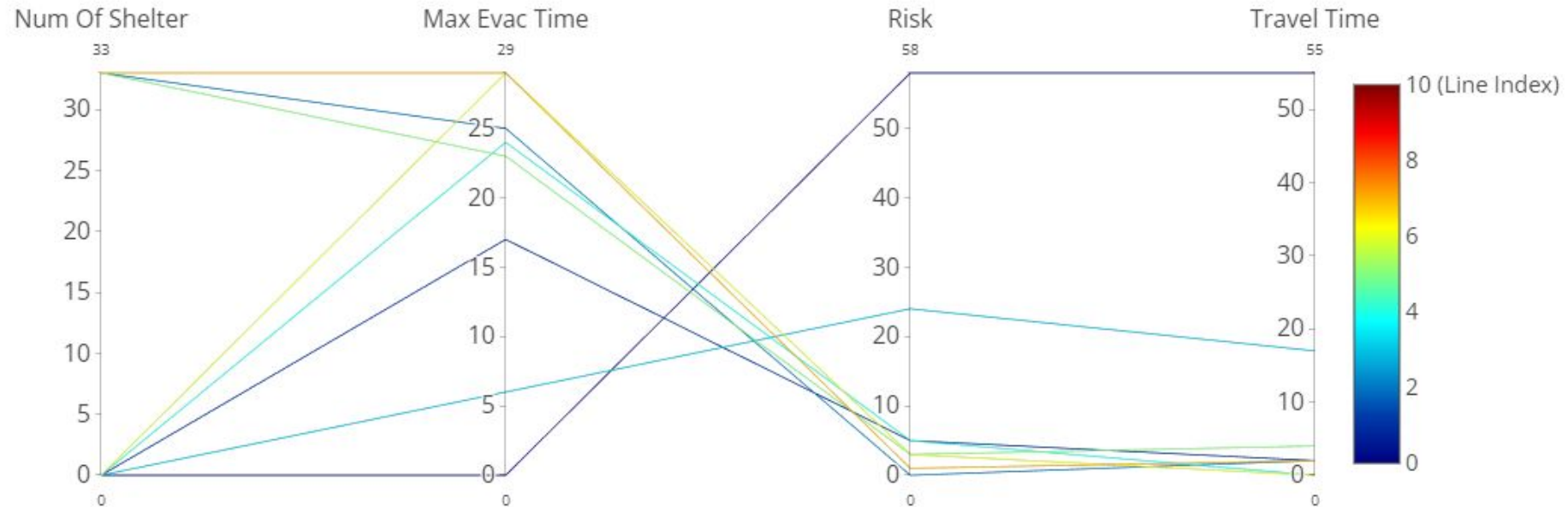
modules

- Assisted Evacuation Planning ,
- given Zone – points where population of persons and live stocks to be evacuated, Shelters – points for evacuated person and live stocks, Depots – points where the vehicles are kept (called Point of Interests- POIs) , networks connecting the POIs (risk value and maximum speeds between points) –
- will provide some optimal solutions minimizing the objects (Num of Shelter to be opened, Max-Evac-Time, Risk, and Travel Time).

Output example

Basic Information

AEP Code	NG230531071340_NUSA_TENGGARA_BARAT_3_1.00
Disaster	Gempa Bumi
Date	02 Jun 2023
Alpha	1.00
Speed	40
Network Code	NG230531071340_NUSA_TENGGARA_BARAT
Poin Of Interest	17
Evac. Percentage(%)	100



 More Info ▾

 Advance Filter

 Graph Filter

-- Column ▾ -- Directi ▾  

#	No.	Problem Type	Obj Order	Number Of Shelter	Max Evacuation Time (hr)	Risk	Total Time Travel (hr)	Fleet Cost	Optimal Solution	Line Index	Action
<input checked="" type="checkbox"/>	1	FSC	1234	3	5.92	3784.5	30.31	2000000.0	 Yes	0	 Detail ▾
	2	FSC	1243	3	6.69	3065.41	24.08	2000000.0	× No		 Detail ▾
	3	FSC	1324	4	7.82	2543.17	20.88	1600000.0	× No		 Detail ▾
	4	FSC	1342	4	7.47	2409.87	20.22	1600000.0	× No		 Detail ▾
<input checked="" type="checkbox"/>	5	FSC	1423	3	6.94	2512.12	19.96	1800000.0	 Yes	1	 Detail ▾

Evac Dispatch

More Info

-- Column --

-- Direction --

No.	Obj Order	Vehicle	Type	Dispatched To
1	1234	DPBD-CAR - VC1	Pickup Truck	ABIAN TUBUH
2	1234	DPBD-CAR - VC2	Pickup Truck	AIK BERIK
3	1234	DPBD-CAR - VC3	Pickup Truck	ABIAN TUBUH
4	1234	DPBD-CAR - VC4	Pickup Truck	AIK BERIK
5	1234	DPBD-CAR - VC5	Pickup Truck	AIK BERIK
6	1234	LING-CAR - VC1	Military Truck	AIK DAREK
7	1234	LING-CAR - VC2	Military Truck	AIK BERIK
8	1234	LING-CAR - VC3	Military Truck	AIK BERIK

Evac Open Shelter

More Info

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-- Direction --

No.	Shelter Id	Shelter
1	0	ORARI NTB
2	2	LAPANGAN RINJANI
3	6	LAP SUELA

Evac Path



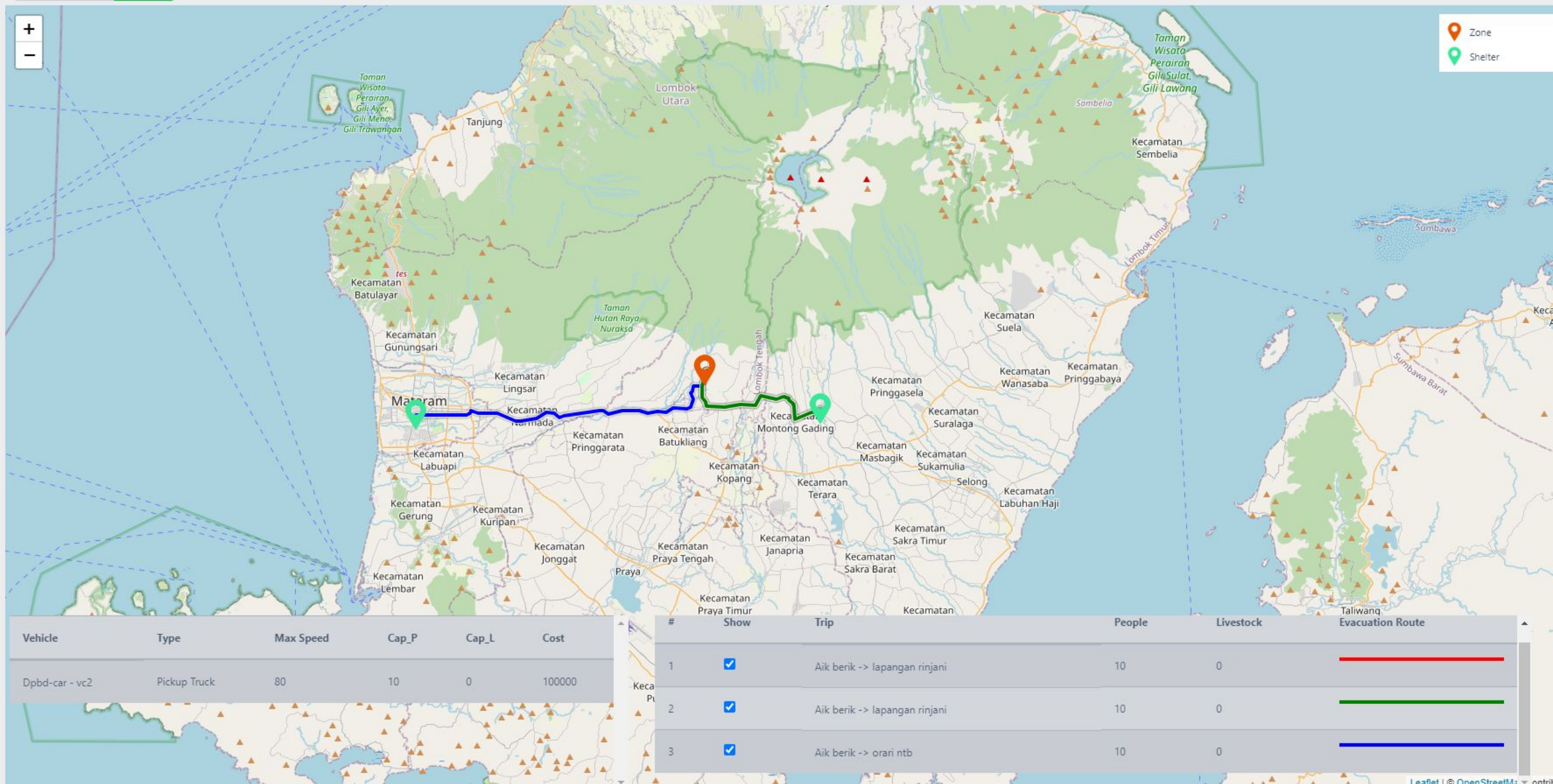
More Info ▾

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-- Direction -- ▾



No.	Type Id	Time (hr)	Trips	Map
1	Pickup Truck	5.0974	ABIAN TUBUH -> ORARI NTB (P = 10 : L = 0) AIK DAREK -> ORARI NTB (P = 10 : L = 0) AIK BERIK -> ORARI NTB (P = 10 : L = 0)	map view
2	Pickup Truck	3.6336	AIK BERIK -> LAPANGAN RINJANI (P = 10 : L = 0) AIK BERIK -> LAPANGAN RINJANI (P = 10 : L = 0) AIK BERIK -> ORARI NTB (P = 10 : L = 0)	map view
3	Pickup Truck	1.4147	ABIAN TUBUH -> ORARI NTB (P = 10 : L = 0)	map view
4	Pickup Truck	4.4501	AIK BERIK -> LAP SUELA (P = 10 : L = 0) AIKMEL UTARA -> LAP SUELA (P = 10 : L = 0) AIKMEL UTARA -> LAP SUELA (P = 10 : L = 0) AIKMEL UTARA -> LAP SUELA (P = 10 : L = 0) AIKMEL UTARA -> LAP SUELA (P = 10 : L = 0)	map view



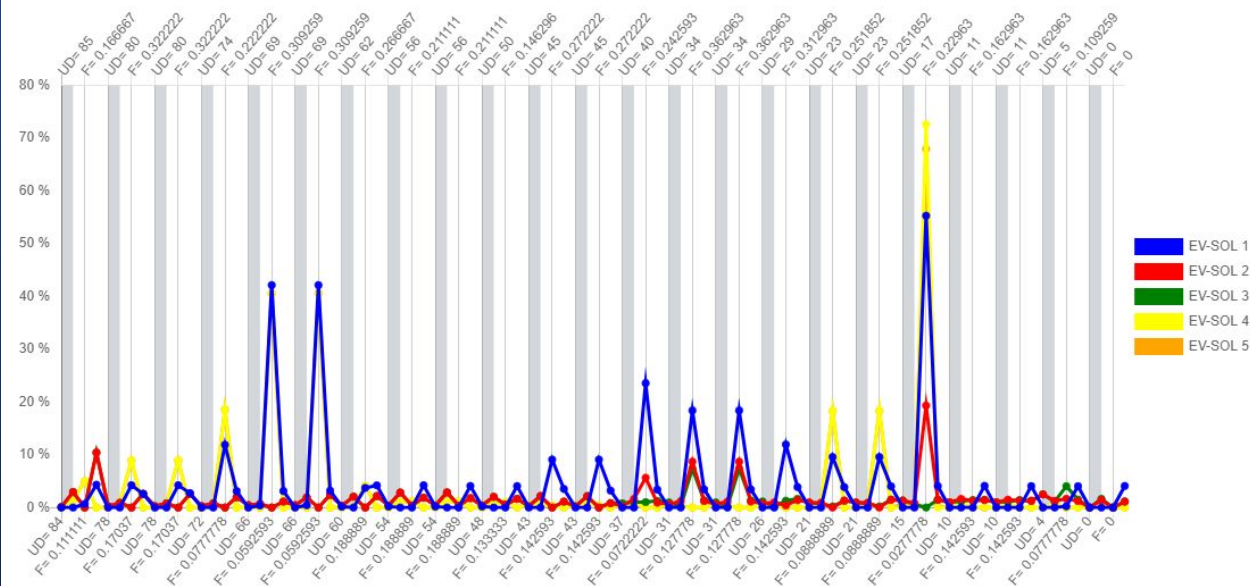
Modules – Personal Routing and Scheduling

Given services (and the settings), Depots, Demand Points, Resting Points, Network Alpha, Demand, Personal (conducting the services)

Will provide Optimal Personal Routing and Scheduling solution by minimizing UD (unsatisfied Demand), ACT (Average demand Completion Time), F (Fairness), and TR (transportation risk)

Basic Information

PR <i>S</i> Code	NG230531071340_NUSA_TENGGARA_BARAT_3
Disaster	Gempa Bumi
Date	05 Jun 2023
Network Code	NG230531071340_NUSA_TENGGARA_BARAT
Poin Of Interest	17
Evac. Percentage(%)	100



UD = Unsatisfied Demand, ACT = Average demand Completion Time, F = Fairness, TR = Transportation Risk

[illegible]

 More Info ▾

 Advance filter

 Team Schedule

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-- Direction -- ▾



Solution_id	Service Name	Planning Horizon Length	Average Demand Completion Time (hr)	Transportation Risk	Action
0	evacuation	541.123	229.784	2.211e+16	 Detail
1	evacuation	550.06	262.171	1.7416e+16	 Detail
2	evacuation	549.233	267.828	1.75363e+16	 Detail
3	evacuation	544.708	244.943	1.56893e+16	 Detail
4	evacuation	544.72	239.151	1.57198e+16	 Detail

Showing 1 to 5 of 5 entries

Previous

1

Next

List of Solution Info Per Day



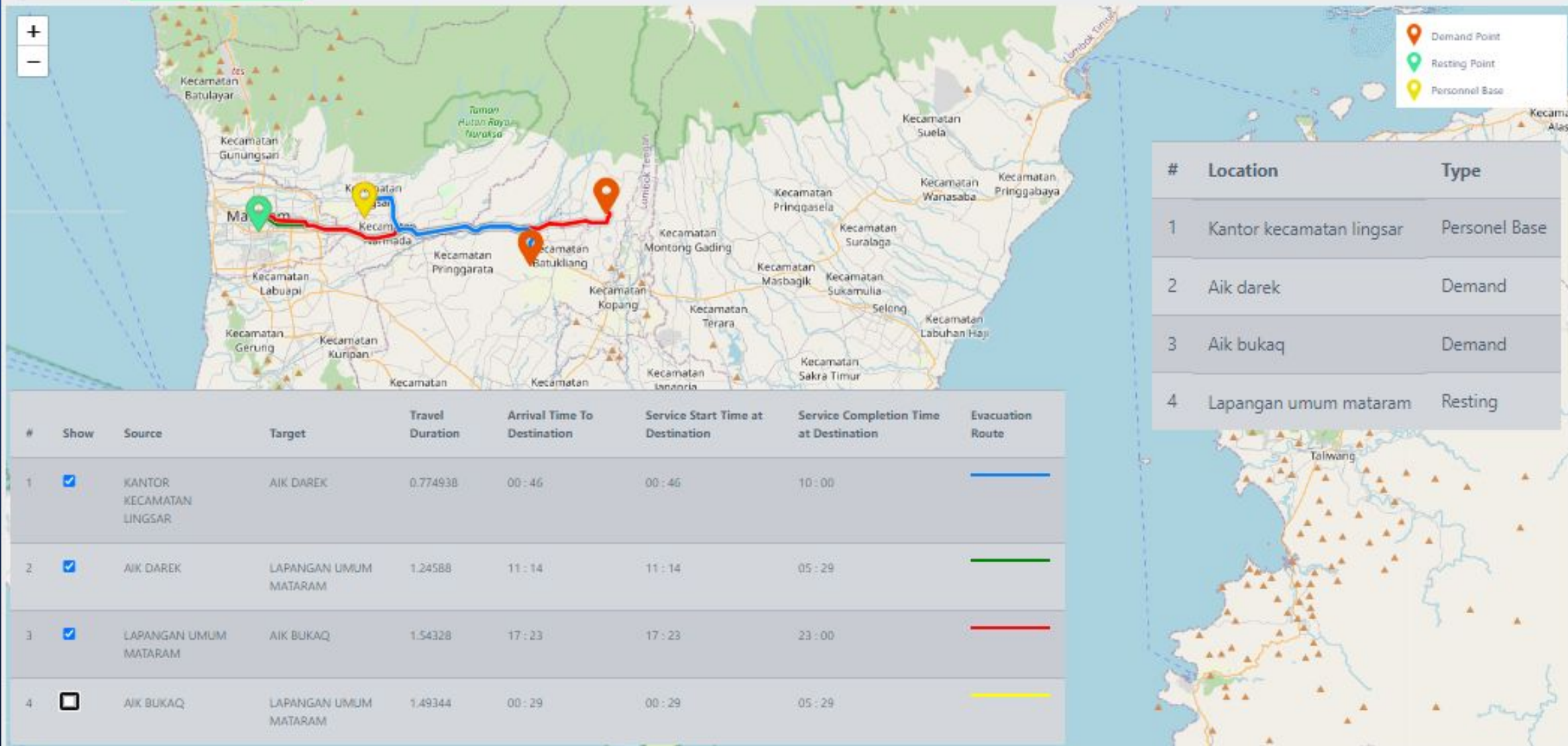
Solution_id	Service Name	Period	Unsatisfied Demand	Average Demand Completion Time (hr)	Fairness	Transportation Risk	Detail
0	evacuation	0	84	9.76661	0.118519	55.0718	Detail
0	evacuation	1	78	22.5476	0.242593	380.578	Detail
0	evacuation	2	78	23.6427	0.242593	1995.31	Detail
0	evacuation	3	72	42.0871	0.17037	6117.87	Detail

search

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-- Direction --

Service Name	Period	Personnel_id	Team Member	Work Status	Resting Start Time	Working Start Time	Resting Finish Time	working Finish Time	Starting Location	Final Location
evacuation	0	0	Toto-Aby	1	10 : 00	00 : 00	15 : 00	10 : 00	KANTOR BUPATI LOMBOK UTARA	LAPANGAN UMUM MATARAM
evacuation	0	1	anto-dewi	1	00 : 29	00 : 00	05 : 29	23 : 00	KANTOR KECAMATAN LINGSAR	LAPANGAN UMUM MATARAM
evacuation	0	2	dr ponco - dr siti	1	00 : 29	00 : 00	05 : 29	23 : 00	KANTOR KECAMATAN LINGSAR	KANTOR YSLPP



Challenges and need advises

The prototype system is now under user testing, stage 2 (some improvements made after stage 1)

The system (the web apps and module codes) deployed in one machine with 32 cores, but still too slow for processing networks generation, AEP and PRS modules with more than 15 POIs;

The system will be tested with data from all provinces, at least on network generations where the networks will be used by AEP and PRS modules.