

MELOGIC PROJECT ESHFP input data and results for the case study in the Province of Teruel, Spain

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M.E. Fragkos

The practical case study focuses on an emergency situation at the Province of Teruel. The emergency is caused by a forest fire which evolves dynamically. Under these circumstances, and due to the fact that some villages need to be evacuated to a shelter while intervention groups take action, a plan for providing the aforementioned population categories with the necessary supplies needs to be developed. Two different scenarios are considered in this case study. The first one deals with solving ESHFP by using the proposed heuristic algorithm only for the first day of the forest fire. Note that this scenario was examined in the Pilot Test Event which was held in Teruel in September 2016. In the second scenario, the solution of ESHFP is presented for day-to-day supply, taking into account that the forest fire lasts for seven days. In this case evacuees, but also intervention groups, have to be supplied with provisions during the entire seven-day period.

I. Input Data for the case study for the Province of Teruel, Spain

The following tables present the necessary data in terms of a) type of commodities that will be offered to the evacuees and the intervention groups for the 1st day at the shelters of Teruel and Villel, b) the available supermarkets that will supply the commodities, c) the shelters that will be used by the evacuees and the intervention groups, d) the transportation network that links the supermarkets with the shelters, e) the private and public fleet of vehicles available for the transportation of goods, for the ESHFP. Further details about the input data are given in the following sections.

1. Commodities

Table I.1, presents the type of commodities, characterized by an ID number, that will be offered to the evacuees and the intervention groups. The table presents also their characteristics (e.g. storage unit, number of items per storage unit, etc).

Table I1. Type of commodities and unit characteristics

Type	Commodity 's ID	Dimensions (m) per item (commodity)			Storage unit (item, carton, pallet)	Number of items (commodity) per storage unit	Volume (in m ³ and in lt) per storage unit	Number of storage units per europallet
		Length	Width	Height				
1. Agua mineral (1,5lt)	C1	0.065	0.070	0.340	carton (plastic stretch film)	6	0.009 (9)	84
2. Dairy products. juices	C2	0.090	0.060	0.210	carton(plastic stretch film)	6	0.007 (7)	125
3. Fruits (oranges, apples)	C3	0.100	0.100	0.100	wooden or cardboard fruit Box	6	0.006 (6)	40
4. Sandwiches	C4	0.300	0.070	0.060	cardboard box	15	0.019 (19)	40
5. Hygiene kits	C5	0.200	0.180	0.050	Box	18	0.032 (32)	52
6. Mattress or landing mat	C6	1.800	0.600	0.050	Warp plastic	2	0.108 (108)	48

2. Supermarkets (suuply points)

Table I.2, presents the exact location of each supermarket (i.e. address and coordinates) that will supply both the evacuees and the intervention groups along with their corresponding IDs. Furthermore, the daily stock per commodity in units is also presented.

Table I.2. Location of supermarkets and daily stock per commodity (in units)

Supermarket's ID	Detailed Address	Coordinates		Supplies (Stock in Units) Per Commodities' ID					
		Latitude	Longitude	C1	C2	C3	C4	C5	C6
S1	Alvimar SCL. Don Jate SA. Polígono La Paz, Calle Berlín, 128. 44195 Teruel	40.3617	-1.1521	1260	1725	2400	0	0	0
S2	Amela y Martín, SL. Polígono La Paz, Calle Irún, Parcela 177 Izq. 44195 Teruel	40.3634	-1.15536	13306	1200	0	0	0	0
S3	Bebinter SA. Polígono La Paz, Calle Estocolmo, 55. 44195 Teruel	40.3589	-1.14533	12096	0	0	0	0	0
S4	Coaliment Aragón SAU. Polígono La Paz, Calle Berlín-Dublín, 42. 44195 Teruel	40.3578	-1.14294	2318	375	2400	0	0	0
S5	Conpol SL. Polígono La Paz, Calle Berlín, 81. 44195 Teruel	40.3609	-1.14923	0	3075	0	0	0	0
S6	Frigoríficos Cervera SL. Polígono La Paz, Calle Génova, Parcela 139. 44195 Teruel	40.3628	-1.15156	29736	7125	0	0	0	0
S7	Frigoríficos La Perla, SL. Polígono La Paz, Calle Colonia, Parcela 62. 44195 Teruel	40.3588	-1.14684	0	26925	0	0	0	0

Supermarket's ID	Detailed Address	Coordinates		Supplies (Stock in Units) Per Commodities' ID					
		Latitude	Longitude	C1	C2	C3	C4	C5	C6
S8	Horno Paco Sanz SL. Carretera de Cubla, 4. Puerta 5. 44001 Teruel	40.3344	-1.11112	0	75	0	0	0	0
S9	José Galo SL. Polígono La Paz, Calle Génova, 142. 44195 Teruel	40.3639	-1.15116	0	0	0	0	0	0
S10	Logística Terdibe SL. Polígono La Paz, Parcela 246. 44195 Teruel	40.3679	-1.15295	655	1725	0	0	0	0
S11	Distribuciones Manuel Borque SL. Parque Industrial Carretera de San Blas, 10. 44195 Teruel	40.3545	-1.13249	7812	1725	0	0	0	0
S12	Hipermercado Simply. Avenida de Sagunto, s/n. 44002 Teruel	40.3338	-1.08859	958	900	2400	0	0	0
S13	Juancivi SL. Hotel Isabel de Segura. Ronda del Turia, 2. 44002 Teruel	40.3339	-1.10787	0	0	0	600	0	0
S14	Taller Cocina de Teruel SL. Carretera de Cubla, 4. 44001 Teruel	40.335	-1.1108	0	0	0	600	0	0
S15	Asociados Hosteleros de Teruel SL. Carretera Sagunto-Burgos, km 123. 44195 Teruel	40.3591	-1.13831	0	0	0	600	0	0
S16	Cruz Roja Teruel. Polígono Industrial La Paz. 162A. 44195 Teruel	40.3577	-1.13463	0	0	0	0	187	100

3. Shelters (demand points)

Table I.3, presents the exact location of each shelter as well as the demand per commodity per person for the first day and its ID.

Table I.3. Location of shelter and daily demand per commodity per person

Location	ID	Coordinates		Total Demand (units) Per Commodities' ID					
		Latitude	Longitude	C1	C2	C3	C4	C4	C5
Teruel	D1	40.33302	-1.08217	480	192	288	288	96	96
Villel	D2	40.23628	-1.19423	1370	0	548	274	0	0

For Shelter in Teruel, the demand of supplies should be calculated for 96 citizens that will stay at the shelter for 36 hours (Days 1 and 2).

4. Public Vehicles

Table I.4, presents the fleet of public vehicles that are available for the transportation of commodities from the aforementioned supermarkets to the two (2) shelters. As it can be seen, only one vehicle with hydraulic door is available. The table provides the capacity of the vehicle (in m³) as well as the information about the starting point (depot) of the vehicle.

5. Private Vehicles

Table I.5, presents the fleet of private vehicles that are available for the transportation of commodities from the aforementioned supermarkets to the two (2) shelters. As it can be seen, seven (7) trucks with hydraulic doors are available. The table provides the capacity of the vehicles (in m³) as well as the information about the starting point (depot) of the vehicle.

6. Network

Table I.6, presents the transport network (arcs) that connect the shelters with the supermarkets and the supermarkets themselves.

Table I.4. Public vehicles for supply transportation

Type of Vehicle	ID	Number of Each Type of Vehicle	Capacity (in m ³)	Model	Technical Characteristics	Hydraulic Door	Starting Point					Coordinates	
							Company Name	Address	ID	Number	City	Latitude	Longitude
Truck	V1	1	7.68	-	-	Yes	Diputación de Teruel	Polígono La Paz, Calle Berlín	66546	N/A	Teruel	40.33302	-1.08217

Table I.5. Private vehicles for supply transportation

Type of Vehicle	ID	Number of Each Type of Vehicle	Capacity (in m ³)	Model	Technical Characteristics	Hydraulic Door	Starting Point					Coordinates	
							Company Name	Address	ID	Number	City	Latitude	Longitude
Truck	V2	1	7.68	Iveco Eurocargo	Refrigerator Reinforced Isothermal	Yes	Alvimar SCL. Don Jate S.A.	Polígono La Paz, Berlín	66546	128	Teruel	40.33302	-1.08217
Truck	V3	1	11.52	Iveco Eurocargo		Yes	Alvimar SCL. Don Jate S.A.	Polígono La Paz, Berlín	66546	128	Teruel	40.33302	-1.08217
Truck	V4	1	5.76	Ebro L80	Refrigerator - Isothermal	Yes	Frigoríficos La Perla S.L.	Polígono La Paz, Colonia. Parcela 62	66546	16	Teruel	40.33302	-1.08217
Truck	V5	1	5.76	Nissan Cabstar	Isothermal	Yes	Frigoríficos Cervera SL	Polígono La Paz, Génova. Parcela 139	66546	-	Teruel	40.33302	-1.08217
Truck	V6	1	5.76	Mercedes Benz	Isothermal	Yes	Frigoríficos Cervera SL	Polígono La Paz, Génova. Parcela 139	66546	-	Teruel	40.33302	-1.08217
Truck	V7	1	5.76	-	-	Yes	Bebinter SA	Polígono La Paz, Estocolmo	66546	55	Teruel	40.33302	-1.08217
Truck	v8	1	5.76	Nissan Trade	-	Yes	Bebinter SA	Polígono La Paz, Estocolmo	66546	55	Teruel	40.33302	-1.08217

Table I.4. Travel times between shelters and supermarkets

From	To	Network (min)																									
		Public Vehicles	D1							Shelter		Supermarket															
	IDs	D1	D1	D1	D1	D1	D1	D1	D1	D1	D2	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
Public Vehicles Starting Point	D1	0	-	-	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
Private Vehicles' Starting Point	D1	-	0	-	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	0	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	0	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	-	0	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	-	-	0	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	-	-	-	0	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
Shelter	D1	-	-	-	-	-	-	-	-	0	19	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D2	-	-	-	-	-	-	-	-	20	0	22	22	21	20	21	22	22	18	22	21	19	19	20	18	20	20
Supermarket	S1	-	-	-	-	-	-	-	-	12	22	0	2	2	2	1	1	3	8	1	3	5	12	11	10	5	5
	S2	-	-	-	-	-	-	-	-	12	22	2	0	5	7	3	3	5	10	1	3	4	12	11	10	5	5
	S3	-	-	-	-	-	-	-	-	11	21	2	5	0	2	3	4	1	9	2	3	3	11	10	9	4	4
	S4	-	-	-	-	-	-	-	-	10	20	2	6	2	0	4	5	2	8	2	3	2	10	9	8	3	3
	S5	-	-	-	-	-	-	-	-	11	21	1	2	3	4	0	1	2	9	2	2	3	11	10	9	4	4
	S6	-	-	-	-	-	-	-	-	11	21	1	2	4	5	1	0	3	9	1	2	3	11	10	9	4	4
	S7	-	-	-	-	-	-	-	-	12	21	3	4	1	2	2	3	0	9	3	3	4	11	10	10	4	5
	S8	-	-	-	-	-	-	-	-	8	16	8	9	8	7	8	9	8	0	8	8	7	7	2	1	7	7
	S9	-	-	-	-	-	-	-	-	11	21	1	1	2	2	2	1	3	9	0	3	3	11	10	9	4	4
	S10	-	-	-	-	-	-	-	-	11	20	3	3	3	3	2	2	3	8	3	0	3	10	9	9	3	4
	S11	-	-	-	-	-	-	-	-	10	17	3	4	3	2	3	4	3	6	4	4	0	9	7	7	2	3
	S12	-	-	-	-	-	-	-	-	2	19	11	12	13	10	11	11	13	9	11	11	11	0	9	8	12	9
	S13	-	-	-	-	-	-	-	-	9	19	11	12	10	9	10	11	11	5	11	11	9	8	0	5	9	9
	S14	-	-	-	-	-	-	-	-	9	19	9	10	9	8	9	10	10	1	10	9	7	8	4	0	8	8
	S15	-	-	-	-	-	-	-	-	10	19	3	3	2	1	2	2	3	7	2	2	2	9	8	8	0	3
	S16	-	-	-	-	-	-	-	-	10	20	4	5	4	3	4	4	4	4	8	4	4	2	9	8	8	2

II. ESHFP: Solution for Day 1 for scenario A

Table II.1 Provisions supply plan for Day 1

Trips						
	1			2		
Vehicle	V1			V3		
Starting Time	0			0		
Ending Time (min)	88			68		
	Supply/Demand Point	SKU	Quantity (in m ³)	ID of Supply Point / Shelter	SKU	Quantity (in m ³)
Supply Points	S1	C1	0	S2	C1	0
		C2	0		C2	0
		C3	0		C3	0
		C4	0.363		C4	0.345
		C5	0		C5	0
		C6	0		C6	0
	S2	C1	0.743	S1	C1	2.119
		C2	0.218		C2	0
		C3	0.288		C3	0.548
		C4	0		C4	0
		C5	0		C5	0
		C6	0		C6	0
	S3	C1	0	-	-	-
		C2	0		-	-
		C3	0		-	-
		C4	0		-	-
		C5	0.173		-	-
		C6	5.184		-	-
Demand points	D1	C1	0.743	D2	C1	2.119
		C2	0.218		C2	0
		C3	0.288		C3	0.548
		C4	0.363		C4	0.345
		C5	0.173		C5	0
		C6	5.184		C6	0

III. ESHFP: Additional input data for the case study of daily supply (7-days)

In this scenario, it is assumed that the fire evolves for seven days. During this period, firstly the population of all affected villages around the area of the fire needs to be evacuated. The evacuees are transported to a safe shelter at Teruel, where they need to be supplied with consumable and non-consumable provisions. Simultaneously, intervention groups, responsible for fire extinguishing, will also use shelters for their accommodation. These shelters need to be supplied with the appropriate provisions as well. Therefore, ESHFP addresses the case of supplying consumable and non-consumable provisions to evacuees as well as to intervention groups during their stay to an accommodation site. Provisions for the intervention groups need to be supplied for the entire simulated period of seven days. As a consequence, a daily supply plan needs to be determined. Table III.1 includes the shelters involved into the provisions supply problem per day. According to this, we have derived the daily demand per commodity for each shelter (in m³), in order to identify the provisions to be supplied on a daily basis to evacuees and intervention groups. The corresponding daily demand is provided in the following, along with the rest of the required input data.

1. Shelters

Table III.1, presents the exact location of each shelter as well as the demand per commodity per person for the first day and its ID.

Table III.1. Location of shelter and daily demand per commodity per person

Location	ID	Coordinates		Total Demand (units) Per Commodities' ID					
		Latitude	Longitude	C1	C2	C3	C4	C4	C5
Day 1									
Teruel	D1	40.33302	-1.08217	480	192	288	288	96	96
Mas De la Cabrera	D3	40.1553	-1.2428	513	0	171	171	0	0
Villel	D2	40.23628	-1.19423	1370	0	548	274	0	0
Day 2									
Teruel	D1	40.33302	-1.08217	288	96	192	192	0	0
Villel	D2	40.23628	-1.19423	915	0	366	183	0	0
Days 3 & 4 (per day)									
San Blas	D4	40.35815	-1.17850	915	0	366	183	0	0
Days 5, 6 & 7 (per day)									
San Blas	D4	40.35815	-1.17850	705	0	282	141	0	0

Table III.2, presents the daily number of the staff of the intervention groups (Shelters Mas de la Cabrera, Ville and, San Blas) that will be served.

Table III.2 *Total staff of intervention groups per shelter (in daily basis)*

Day	People/Day	Mas de la Cabrera	Villel	San Blas	Total people/day
1st	139	341	-	-	432
1st	202		-	-	
1st	91	-	274	-	183
2nd	183	-		-	
3rd	183	-	-	789	183
4th	183	-	-		183
5th	141	-	-		141
6th	141	-	-		141
7th	141	-	-		141

2. Network

Table III.3, presents the transport network (arcs) that connect the shelters with the supermarkets and the supermarkets themselves.

Table III.3. Travel times between shelters and supermarkets

From	To	Network (min)																											
		Public Vehicles'	Private Vehicle								Shelter				Supermarket														
		IDs	D1	D1	D1	D1	D1	D1	D1	D1	D1	D3	D2	D4	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
Public Vehicles' Starting Point	D1	0	-	-	-	-	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
Private Vehicles' Starting Point	D1	-	0	-	-	-	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	0	-	-	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	0	-	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	-	0	-	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	-	-	0	-	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	-	-	-	0	-	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
	D1	-	-	-	-	-	-	-	0	-	-	-	-	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9
Shelter	D1	-	-	-	-	-	-	-	0	32	19	11	13	12	13	12	13	11	13	8	11	11	11	2	9	8	11	9	
	D3								33	0	19	35	35	35	34	33	34	35	35	31	35	35	33	32	33	31	33	33	
	D2	-	-	-	-	-	-	-	20	19	0	21	22	22	21	20	21	22	22	18	22	21	19	19	20	18	20	20	
	D4	-	-	-	-	-	-	-	11	34	20	0	5	4	6	5	6	5	6	9	5	4	5	11	10	9	5	6	
Supermarket	S1	-	-	-	-	-	-	-	12	35	22	6	0	2	2	2	1	1	3	8	1	3	5	12	11	10	5	5	
	S2	-	-	-	-	-	-	-	12	35	22	5	2	0	5	7	3	3	5	10	1	3	4	12	11	10	5	5	
	S3	-	-	-	-	-	-	-	11	34	21	6	2	5	0	2	3	4	1	9	2	3	3	11	10	9	4	4	
	S4	-	-	-	-	-	-	-	10	33	20	5	2	6	2	0	4	5	2	8	2	3	2	10	9	8	3	3	
	S5	-	-	-	-	-	-	-	11	34	21	6	1	2	3	4	0	1	2	9	2	2	3	11	10	9	4	4	
	S6	-	-	-	-	-	-	-	11	34	21	5	1	2	4	5	1	0	3	9	1	2	3	11	10	9	4	4	
	S7	-	-	-	-	-	-	-	12	34	21	6	3	4	1	2	2	3	0	9	3	3	4	11	10	10	4	5	
	S8	-	-	-	-	-	-	-	8	29	16	9	8	9	8	7	8	9	8	0	8	8	7	7	2	1	7	7	
	S9	-	-	-	-	-	-	-	11	34	21	5	1	1	2	2	2	1	3	9	0	3	3	11	10	9	4	4	
	S10	-	-	-	-	-	-	-	11	33	20	5	3	3	3	3	2	2	3	8	3	0	3	10	9	9	3	4	
	S11	-	-	-	-	-	-	-	10	30	17	4	3	4	3	2	3	4	3	6	4	4	0	9	7	7	2	3	
	S12	-	-	-	-	-	-	-	2	32	19	12	11	12	13	10	11	11	13	9	11	11	11	0	9	8	12	9	
	S13	-	-	-	-	-	-	-	9	32	19	11	11	12	10	9	10	11	11	5	11	11	9	8	0	5	9	9	
	S14	-	-	-	-	-	-	-	9	30	19	10	9	10	9	8	9	10	10	1	10	9	7	8	4	0	8	8	
	S15	-	-	-	-	-	-	-	10	32	19	6	3	3	2	1	2	2	3	7	2	2	2	9	8	8	0	3	
	S16	-	-	-	-	-	-	-	10	32	20	5	4	5	4	3	4	4	4	8	4	4	2	9	8	8	2	0	

IV. ESHFP: Solution for Days 2-7 for scenario B

Table IV.1. Provisions supply plan for Day 2

Trips						
	1			2		
Vehicle	V1			V1		
Starting Time	0			0		
Ending Time (min)	56			49		
	Supply/Demand Point	SKU	Quantity (in m ³)	ID of Supply Point / Shelter	SKU	Quantity (in m ³)
Supply Points	S12	C1	1.416	S15	C1	0
		C2	0		C2	0
		C3	0.366		C3	0
		C4	0		C4	0.242
		C5	0		C5	0
		C6	0		C6	0
	S14	C1	0	S4	C1	0.446
		C2	0		C2	0.109
		C3	0		C3	0.192
		C4	0.231		C4	0
		C5	0		C5	0
		C6	0		C6	0
Demand points	D2	C1	1.416	D1	C1	0,446
		C2	0		C2	0,109
		C3	0.366		C3	0,192
		C4	0.231		C4	0.242
		C5	0		C5	0
		C6	0		C6	0

Table IV.2. Provisions supply plan for Days 3 &4

Trips			
	1		
Vehicle	V1		
Starting Time	0		
Ending Time (min)	47		
	Supply/Demand Point	SKU	Quantity (in m³)
Supply Points	S12	C1	1.416
		C2	0
		C3	0.366
		C4	0
		C5	0
		C6	0
	S14	C1	0
		C2	0
		C3	0
		C4	0.231
		C5	0
		C6	0
Demand points	D4	C1	1.416
		C2	0
		C3	0.366
		C4	0.231
		C5	0
		C6	0

Table IV.3. Provisions supply plan for Days 5,6 &7

Trips			
	1		
Vehicle	V1		
Starting Time	0		
Ending Time (min)	47		
	Supply/Demand Point	SKU	Quantity (in m³)
Supply Points	S12	C1	1.091
		C2	0
		C3	0.282
		C4	0
		C5	0
		C6	0
	S14	C1	0
		C2	0
		C3	0
		C4	0.178
		C5	0
		C6	0
Demand points	D4	C1	1.091
		C2	0
		C3	0.282
		C4	0.178
		C5	0
		C6	0