PANDUAN PENGGUNAAN IDEAL FLOW NETWORK REVOLEDU SECARA MICROSCOPIC
LABORATORIUM TEKNIK LALU LINTAS DAN PERENCANAAN TRANSPORTASI
UNIVERSITAS KRISTEN PETRA

Dosen :
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PROGRAM STUDI TEKNIK SIPIL

FAKULTAS TEKNIK SIPIL DAN PERENCANAAN
UNIVERSITAS KRISTEN PETRA
SURABAYA
2023

KATA PENGANTAR

Panduan ini bertujuan untuk memberikan petunjuk mengenai penggunaan program IFN Transport yang ada di website https://people.revoledu.com/kardi/tutorial/IFN/IFN-transport.html Program ini digunakan untuk menganalisa *Base Scenario* serta skenario lainnya yang diusulkan sebagai solusi untuk mengurangi kemacetan. Panduan ini pertama kali diterjemahkan oleh Angel (asisten laboratorium Teknik Lalu Lintas dan Perencanaan Transportasi 2023/2024). Apabila setelah membaca panduan ini pembaca masih kebingungan, pembaca dapat bertanya kepada Asisten Laboratorium Teknik Lalu Lintas mengenai cara penggunaan program IFN. Apabila terdapat tambahan informasi, panduan ini dapat dilengkapi sesuai dengan kebutuhan Laboratorium Teknik Lalu Lintas dan Perencanaan Transportasi Universitas Kristen Petra.

Langkah langkah membuat IFN transport

1. Menu **Network Data** :

   A. Buatlah Node Matrix (letak koordinat suatu titik) dengan format :

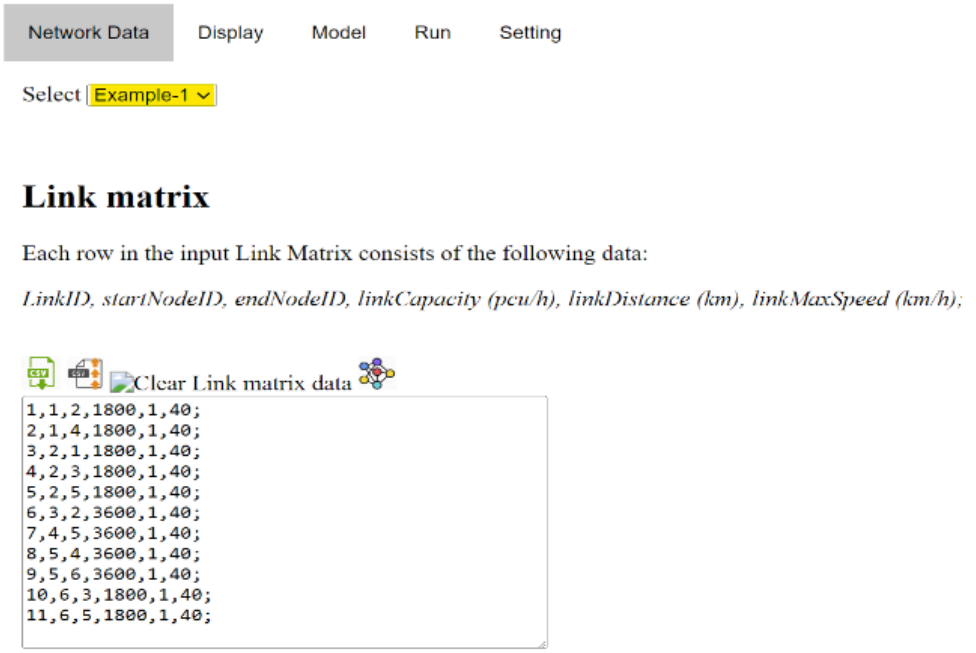
   NodeID,X-Coordinate, Y-Coordinate;

   (Jika jaringannya tidak Strongly Connected maka buat 1 titik tambahan sebagai Cloud Node agar menjadi jaringan jalan yang Strongly Connected)

   B. Buatlah Link Matrix (alur jalan dari 1 titik ke titik lainnya) sesuai dengan format :

   LinkID, startNodeID, endNodeID, linkCapacity (pcu/h), linkDistance (km), linkMaxSpeed (km/h);

   - Link ID : Nomor yang digunakan untuk identifikasi arah arus lalu lintas. (Jika jalannya dua arah, perlu membuat dua tautan, satu untuk setiap arah)
   - Start Node ID : Nomor identifikasi node posisi awal dari link.
   - End Node ID : Nomor identifikasi node posisi akhir dari link.
   - Kapasitas jalur diberikan berdasarkan standar (seperti HCM) dalam *pcu/hour*, atau diperkirakan berdasarkan lebar jalan (dalam meter) atau jumlah jalur/jalur/arah
   - Link Distance : Panjang jalan per link, dalam km.
   - Link Max Speed (kecepatan aliran bebas) dalam km/jam.



Node matrix

Node matrix is useful for drawing the network. The link distance is not computed based on nodes data. Each row in the input Node Matrix consists of the following data:

NodeID,X-Coordinate, Y-Coordinate;

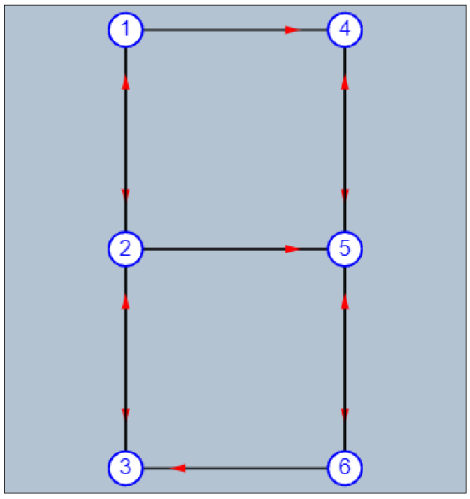
Clear Node matrix data

```
1,100,20;
2,100,120;
3,100,220;
4,200,20;
5,200,120;
6,200,220;
```

2. Menu **Display** klik gambar untuk memunculkan gambar jaringan yang telah diatur melalui link dan node. (Skalanya antara 1-600)

Network Data | Display | Model | Run | Setting

If you upload or change your data, you need to press button to redraw. The best performance happens when the coordinates is scaled between 1 to 600 in both x and y directions. You can also zoom in, zoom out and pan the drawing.

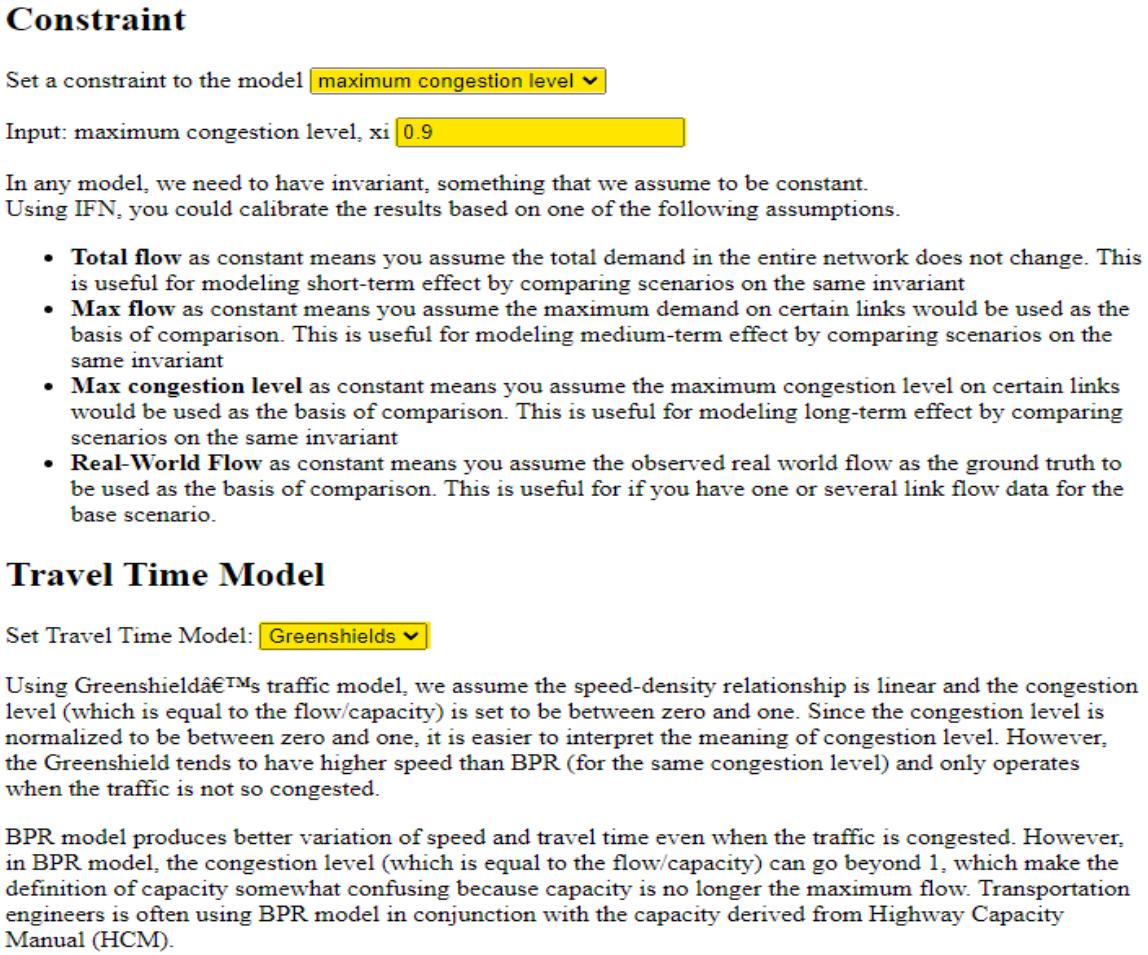


3. Menu **Model** :

   A. Atur Constraint ke model **Max congestion** (0.9).

   B. Travel Time Model bisa diatur menjadi **Greenshields/ BPR**.

      - Greenshields, nilai Max Congestion < 1
      - BPR, nilai Max Congestion > 1



Constraint

Set a constraint to the model maximum congestion level

Input: maximum congestion level, xi 0.9

In any model, we need to have invariant, something that we assume to be constant.
Using IFN, you could calibrate the results based on one of the following assumptions.

- **Total flow** as constant means you assume the total demand in the entire network does not change. This is useful for modeling short-term effect by comparing scenarios on the same invariant
- **Max flow** as constant means you assume the maximum demand on certain links would be used as the basis of comparison. This is useful for modeling medium-term effect by comparing scenarios on the same invariant
- **Max congestion level** as constant means you assume the maximum congestion level on certain links would be used as the basis of comparison. This is useful for modeling long-term effect by comparing scenarios on the same invariant
- **Real-World Flow** as constant means you assume the observed real world flow as the ground truth to be used as the basis of comparison. This is useful for if you have one or several link flow data for the base scenario.

Travel Time Model

Set Travel Time Model: Greenshields

Using Greenshieldâ€™s traffic model, we assume the speed-density relationship is linear and the congestion level (which is equal to the flow/capacity) is set to be between zero and one. Since the congestion level is normalized to be between zero and one, it is easier to interpret the meaning of congestion level. However, the Greenshield tends to have higher speed than BPR (for the same congestion level) and only operates when the traffic is not so congested.

BPR model produces better variation of speed and travel time even when the traffic is congested. However, in BPR model, the congestion level (which is equal to the flow/capacity) can go beyond 1, which make the definition of capacity somewhat confusing because capacity is no longer the maximum flow. Transportation engineers is often using BPR model in conjunction with the capacity derived from Highway Capacity Manual (HCM).

4. Menu **Setting** :

   A. Atur Values Capacity ke ***pcu/hour***.

   B. Atur Cloud idnya, **nama cloud ID** dan tambahkan dummy link dengan cara mengubah computation of network performance menjadi **include**. (jika ada)

Capacity

Set the values in link capacity to represent pcu/hour
Optional input: set capacity multiplier 1 vehicle/hour

You can set the link capacity is either given based on standard in passenger car unit per hour (pcu/hour). Alternatively, it is sometimes easier to approximate the link capacity based on road width (in meter) or number of lanes per link per direction.

Capacity multiplier is used when the link capacity unit is not in pcu/hour. The capacity multiplier would change as you change the meaning of link capacity. You can change the default value of capacity multiplier.

Cloud Node Reporting

IFN requires the network to be strongly connected. If it happens that your network is weakly connected, then you need to create a cloud node and connect each of the source node (or source component) in the network into the cloud node through dummy links and connect the cloud node to each of the sink node (or sink component) in the network using dummy links.

Specify the cloud node ID (if exists): z

Do you want to include or exclude all dummy links related to cloud node from the computation of network performances? Include

In most practical purposes, you want to exclude the links related to the cloud nodes from the computation of network performances. For theoretical purposes, the inclusion of links related to the cloud node would guarantee that the ideal flow matrix is premagic.

5. Menu **Run,** tekan **calculate** untuk menemukan output/ hasil jaringan yang diteliti.

Network Data | Display | Model | Run | Setting

Run the Scenario

If you upload or change your data or your model, you need to press Calculate button to recalculate.

Calculate

Output:

Network Performances
Total Flow = 17588.57
Network Entropy = 2.2186
Network Entropy Ratio = 0.9252
Network Max Entropy = 2.3979

Statistics	Average	Standard Deviation	Minimum	Maximum	Coef. Variation
Flow (pcu/hour)	1598.9610	953.9725	462.8571	3240.0000	0.5966
Congestion Level (%)	60.7792	20.5794	25.7143	90.0000	0.3386
Network Travel Distance (km/link)	1.0000	0.0000	1.0000	1.0000	0.0000
Network Travel Time (seconds/link)	113.4646	11.8596	96.6759	136.7544	0.1045
Network Speed (km/hour)	32.0742	3.3313	26.3246	37.2378	0.1039
Network Delay (seconds/link)	23.4646	11.8596	6.6759	46.7544	0.5054

Number of Links on computation =11
Number of Links on the data =11
Number of Nodes on computation =6
Number of Nodes on data =6

Report Table

Link Table

linkID	StartNode	EndNode	Distance	Capacity	MaxSpeed	Flow	Congestion	AvgSpeed	MinTravelTime	TravelTime	Delay	Probability	Stochastic
1	1	2	1.000	1800	40	462.86	25.714	37.24	90.00	96.68	6.6759	2.6316	50.00
2	1	4	1.000	1800	40	462.86	25.714	37.24	90.00	96.68	6.6759	2.6316	50.00
3	2	1	1.000	1800	40	925.71	51.429	33.94	90.00	106.07	16.0738	5.2632	33.33
4	2	3	1.000	1800	40	925.71	51.429	33.94	90.00	106.07	16.0738	5.2632	33.33
5	2	5	1.000	1800	40	925.71	51.429	33.94	90.00	106.07	16.0738	5.2632	33.33
6	3	2	1.000	3600	40	2314.29	64.286	31.95	90.00	112.67	22.6680	13.1579	100.00
7	4	5	1.000	3600	40	3240.00	90.000	26.32	90.00	136.75	46.7544	18.4211	100.00
8	5	4	1.000	3600	40	2777.14	77.143	29.56	90.00	121.78	31.7787	15.7895	50.00
9	5	6	1.000	3600	40	2777.14	77.143	29.56	90.00	121.78	31.7787	15.7895	50.00
10	6	3	1.000	1800	40	1388.57	77.143	29.56	90.00	121.78	31.7787	7.8947	50.00
11	6	5	1.000	1800	40	1388.57	77.143	29.56	90.00	121.78	31.7787	7.8947	50.00

Meaning of the table columns:
0. link ID: identity number of the link,
1. Start Node: identity number of start node of the link,
2. End Node: identity number of end node of the link,
3. Link distance: length of the link in km,
4. link capacity: maximum flow in the link in pcu/hour,
5. link max speed: allowable maximum speed in the link in km/hour,
6. link flow: computed ideal link flow in pcu/hour,
7. link congestion: link flow/link capacity in percent
8. link average speed: link average speed in km/hour,
9. link min travel time: link minimum travel time in seconds,
10. link travel time: link average travel time in seconds,
11. link delay: travel time minus min travel time in seconds,
12. link probability: probability such that the total probability in all links is one in percent
13. link stochastic: outflow probability from previous node to this link.

Catatan Tambahan :

1. Di Indonesia menggunakan Lajur Kiri.
2. Dalam membuat Dummy Link perhatikan alur keluar masuk.
3. Perhatikan yang diminta skalanya secara microscopic/ macroscopic.
4. Node pada web arah Y miror jadi bisa tukar posisi titiknya agar gambarnya sesuai dengan yang diminta.
5. Untuk memudahkan pembuatan Node dan Link sebaiknya digambar dahulu di kertas.

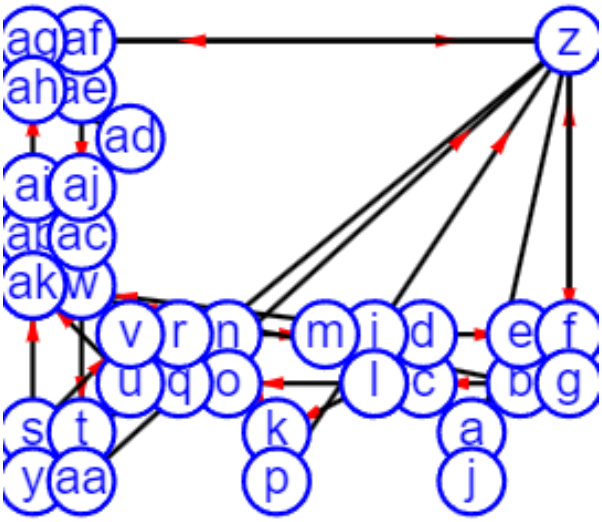
Contoh Kasus Persimpangan

1. **5 Persimpangan Jalan Universitas Kristen Petra**

NETWORK DATA :

Link Matrix		Node Matrix	
1,z,j,1500,1,25; 2,j,a,1500,1,25; 3,a,e,1500,1,25; 4,a,c,1500,1,25; 5,e,f,1500,1,25; 6,f,z,1500,1,25; 7,z,g,1500,1,25; 8,g,b,1500,1,25; 9,b,c,1500,1,25; 10,c,h,1500,1,25; 11,h,l,1500,1,25; 12,l,k,1500,1,25; 13,k,p,1500,1,25; 14,p,z,1500,1,25; 15,l,o,1500,1,25; 16,o,q,1500,1,25; 17,q,u,1500,1,25; 18,u,t,1500,1,25; 19,t,aa,1500,1,25; 20,aa,z,1500,1,25; 21,u,x,1500,1,25; 22,z,y,1500,1,25; 23,y,s,1500,1,25; 24,s,x,1500,1,25; 25,x,ab,1500,1,25;	26,ab,ai,1500,1,25; 27,ai,ah,1500,1,25; 28,ah,ag,1500,1,25; 29,ag,z,1500,1,25; 30,z,af,1500,1,25; 31,af,ae,1500,1,25; 32,ae,aj,1500,1,25; 33,aj,ac,1500,1,25; 34,ac,w,1500,1,25; 35,w,t,1500,1,25; 36,w,v,1500,1,25; 37,s,v,1500,1,25; 38,v,r,1500,1,25; 39,r,n,1500,1,25; 40,n,k,1500,1,25; 41,n,m,1500,1,25; 42,m,i,1500,1,25; 43,i,d,1500,1,25; 44,d,e,1500,1,25; 45,d,ak,1500,1,25; 46,ak,ad,1500,1,25; 47,ad,aj,1500,1,25; 48,ad,ah,1500,1,25; 49,b,ak,1500,1,25;	a,100,90; b,110,80; c,90,80; d,90,70; e,110,70; f,120,70; g,120,80; h,80,80; i,80,70; j,100,100; k,60,90; l,80,80; m,70,70; n,50,70; o,50,80; p,60,100; q,40,80; r,40,70; s,10,90;	t,20,90; u,30,80; v,30,70; w,20,60; x,10,60; y,10,100; z,120,10; aa,20,100; ab,10,50; ac,20,50; ad,30,30; ae,20,20; af,20,10; ag,10,10; ah,10,20; ai,10,40; aj,20,40; ak,10,60;

DISPLAY :



MODEL :

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RUN :

Run the Scenario

If you upload or change your data or your model, you need to press Calculate button to recalculate.

Calculate

Output:

Network Performances
Total Flow = 36594.64
Network Entropy = 3.8131
Network Entropy Ratio = 0.9798
Network Max Entropy = 3.8918

Statistics	Average	Standard Deviation	Minimum	Maximum	Coef. Variation
Flow (pcu/hour)	746.8294	289.9610	241.0714	1350.0000	0.3883
Congestion Level (%)	49.7886	19.3307	16.0714	90.0000	0.3883
Network Travel Distance (km/link)	1.0000	0.0000	1.0000	1.0000	0.0000
Network Travel Time (seconds/link)	171.4427	15.8541	150.3033	218.8071	0.0925
Network Speed (km/hour)	21.1664	1.8301	16.4528	23.9516	0.0865
Network Delay (seconds/link)	27.4427	15.8541	6.3033	74.8071	0.5777

Number of Links on computation =49
Number of Links on the data =49
Number of Nodes on computation =37
Number of Nodes on data =37

Report Table

Link Table

linkID	StartNode	EndNode	Distance	Capacity	MaxSpeed	Flow	Congestion	AvgSpeed	MinTravelTime	TravelTime	Delay	Probability	Stochastic
1	z	j	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	25.00
2	j	a	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	100.00
3	a	e	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00
4	a	c	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00
5	e	f	1.000	1500	25	771.43	51.429	21.21	144.00	169.72	25.7181	2.1080	100.00
6	f	z	1.000	1500	25	771.43	51.429	21.21	144.00	169.72	25.7181	2.1080	100.00
7	z	g	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	25.00
8	g	b	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	100.00
9	b	c	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00
10	c	h	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	100.00
11	h	l	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	100.00
12	l	k	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00
13	k	p	1.000	1500	25	1060.71	70.714	19.26	144.00	186.87	42.8719	2.8986	100.00
14	p	z	1.000	1500	25	1060.71	70.714	19.26	144.00	186.87	42.8719	2.8986	100.00
15	l	o	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00
16	o	q	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	100.00
17	q	u	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	100.00
18	u	t	1.000	1500	25	241.07	16.071	23.95	144.00	150.30	6.3033	0.6588	50.00
19	t	aa	1.000	1500	25	916.07	61.071	20.30	144.00	177.35	33.3478	2.5033	100.00
20	aa	z	1.000	1500	25	916.07	61.071	20.30	144.00	177.35	33.3478	2.5033	100.00
21	u	x	1.000	1500	25	241.07	16.071	23.95	144.00	150.30	6.3033	0.6588	50.00
22	z	y	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	25.00
23	y	s	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	100.00
24	s	x	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00
25	x	ab	1.000	1500	25	723.21	48.214	21.50	144.00	167.48	23.4786	1.9763	100.00
26	ab	ai	1.000	1500	25	723.21	48.214	21.50	144.00	167.48	23.4786	1.9763	100.00
27	ai	ah	1.000	1500	25	723.21	48.214	21.50	144.00	167.48	23.4786	1.9763	100.00
28	ah	ag	1.000	1500	25	1108.93	73.929	18.88	144.00	190.65	46.6525	3.0303	100.00
29	ag	z	1.000	1500	25	1108.93	73.929	18.88	144.00	190.65	46.6525	3.0303	100.00
30	z	af	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	25.00
31	af	ae	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	100.00
32	ae	aj	1.000	1500	25	964.29	64.286	19.97	144.00	180.27	36.2688	2.6350	100.00
33	aj	ac	1.000	1500	25	1350.00	90.000	16.45	144.00	218.81	74.8071	3.6891	100.00
34	ac	w	1.000	1500	25	1350.00	90.000	16.45	144.00	218.81	74.8071	3.6891	100.00
35	w	t	1.000	1500	25	675.00	45.000	21.77	144.00	165.36	21.3633	1.8445	50.00
36	w	v	1.000	1500	25	675.00	45.000	21.77	144.00	165.36	21.3633	1.8445	50.00
37	s	v	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00
38	v	r	1.000	1500	25	1157.14	77.143	18.48	144.00	194.85	50.8459	3.1621	100.00
39	r	n	1.000	1500	25	1157.14	77.143	18.48	144.00	194.85	50.8459	3.1621	100.00
40	n	k	1.000	1500	25	578.57	38.571	22.30	144.00	161.46	17.4564	1.5810	50.00
41	n	m	1.000	1500	25	578.57	38.571	22.30	144.00	161.46	17.4564	1.5810	50.00
42	m	i	1.000	1500	25	578.57	38.571	22.30	144.00	161.46	17.4564	1.5810	100.00
43	i	d	1.000	1500	25	578.57	38.571	22.30	144.00	161.46	17.4564	1.5810	100.00
44	d	e	1.000	1500	25	289.29	19.286	23.73	144.00	151.71	7.7058	0.7905	50.00
45	d	ak	1.000	1500	25	289.29	19.286	23.73	144.00	151.71	7.7058	0.7905	50.00
46	ak	ad	1.000	1500	25	771.43	51.429	21.21	144.00	169.72	25.7181	2.1080	100.00
47	ad	aj	1.000	1500	25	385.71	25.714	23.27	144.00	154.68	10.6814	1.0540	50.00
48	ad	ah	1.000	1500	25	385.71	25.714	23.27	144.00	154.68	10.6814	1.0540	50.00
49	b	ak	1.000	1500	25	482.14	32.143	22.80	144.00	157.92	13.9160	1.3175	50.00

Meaning of the table columns:
0. link ID: identity number of the link,
1. Start Node: identity number of start node of the link,
2. End Node: identity number of end node of the link,
3. Link distance: length of the link in km,
4. link capacity: maximum flow in the link in pcu/hour,
5. link max speed: allowable maximum speed in the link in km/hour,
6. link flow: computed ideal link flow in pcu/hour,
7. link congestion: link flow/link capacity in percent
8. link average speed: link average speed in km/hour,
9. link min travel time: link minimum travel time in seconds,
10. link travel time: link average travel time in seconds,
11. link delay: travel time minus min travel time in seconds,
12. link probability: probability such that the total probability in all links is one in percent
13. link stochastic: outflow probability from previous node to this link.