

Table 1
Literature for the period between 2004 and 2006.

Author(s) and Date ¹	Area	Traffic	Prediction		Data	Methodology						
		Parameter	Step (min)	Horizon (steps)	Collection	Approach	Problem ²	Model ³	Comparison	Inputs	State-Space	Optimization ⁴
Cetin and Comert (2006)	Motorway	Speed	1	1	Detectors	Univariate	TS	Statistical	■	Single	■	
Dion and Rakha (2006)	Motorway	Travel Time	1	2	AVI	Univariate	FA	Statistical		Single		
Innamaa (2006)	Motorway	Travel Time	1	1	Detectors	Univariate	FA	NN		Multiple	✓	
Lam et al. (2006)	Motorway	Volume	day	day	Detectors	Univariate	FA	Statistical	✓	Single		
Liu et al. (2006)	Arterial	Volume	1	1	Simulation	Univariate	FA	Statistical		Single		
Quek et al. (2006)	Motorway	Density	1	60	Detectors	Univariate	FA	NN	✓	Multiple		Fuzzy
Shekhar and Williams (2008)	Motorway	Volume	15	1	Detectors	Univariate	TS	Statistical	✓	Multiple		M
Tsekeris and Stathopoulos (2010)	Arterial	Volume	3	1	Detectors	Univariate	TS	Statistical	✓	Single		
Turochy (2006)	Motorway	Volume	15	1	Detectors	Univariate	PR	Statistical		Single		
van Lint (2006)	Motorway	Travel Time	1	1	Detectors	Univariate	TS	NN	✓	Multiple	✓	
Wang et al. (2006a)	Motorway(U)	Travel Time	1	20	Simulation	Univariate	FA	Statistical	✓	Multiple	✓	
Xie and Zhang (2006)	Motorway(U)	Volume	5	1	Detectors	Univariate	PR	Hybrid**	✓	Multiple	✓	Wavelets
Zheng et al. (2006)	Motorway(U)	Volume	15	1	Detectors	Univariate	FA	Hybrid**/C	✓	Multiple		Bayesian
Innamaa (2005)	Motorway	Travel Time	1	1	Detectors	Univariate	FA	NN		Multiple	✓	O
Jiang and Adeli (2005)	Motorway(U)	Volume	60	1	Detectors	Univariate	TS	Hybrid**		Multiple		Wavelets
Kamarianakis et al. (2005)	Arterial	State	7.5	1	Detectors	Univariate	TS	Statistical	✓	Single		M
Kwon and Petty (2005)	Motorway(U)	Travel Time	15	1	Detectors	Univariate	FA	Statistical		Single		
Oh et al. (2005)	Motorway	Travel Time	1	1	Detectors	Univariate	TS	NN	✓	Single		Genetic
Shang et al. (2005)	Motorway	Speed	2	1	Detectors	Univariate	TS	Statistical		Multiple		M
van Lint and van Zulen (2005)	Motorway	Travel Time	1	1	Detectors	Univariate	FA	NN		Multiple		
van Lint et al. (2005)	Motorway	Travel Time	1	1	Detectors	Univariate	TS	NN		Multiple	✓	
Vlahogianni et al. (2005)	Arterial	Volume	3	5	Detectors	Multivariate	FA	NN	✓	Multiple	✓	Genetic
Zhong et al. (2005)	Motorway	Volume	60	60	Detectors	Univariate	FA	NN	✓	Multiple		Genetic
Alecsandru and Ishak (2004)	Motorway(U)	Speed	5	4	Detectors	Univariate	FA	Hybrid**	✓	Multiple	✓	Genetic
Chrobok et al. (2004)	Arterial	Volume	1	60	Detectors	Univariate	PR	Statistical/C	✓	Single		I
Ishak and Alecsandru (2004)	Motorway(U)	Speed	5	4	Detectors	Univariate	TS	Hybrid**	✓	Multiple	✓	Fuzzy
Lin et al. (2004)	Arterial	Travel Time	1	1	Simulation	Univariate	FA	Bayesian		Multiple		I
Rice and van Zwet (2004)	Motorway	Speed	5	1	Detectors	Univariate	PR	Statistical		Single		
Wu et al. (2004)	Motorway	Travel Time	3	1	Detectors	Univariate	FA	Statistical	✓	Multiple		
Yang et al. (2004)	Motorway	Speed	5	10	Detectors	Univariate	TS	Statistical	✓	Single		
Zhong et al. (2004)	Motorway	Volume	60	60	Detectors	Univariate	FA	NN	✓	Multiple	■	Genetic

¹ U: urban.

² TS: time series, FA: function approximation, O: optimization, PR: pattern recognition, CL: clustering.

³ NN: neural network, Hybrid*/**: statistical/computational intelligence model as the basis, /C: combined forecasts.

⁴ Optimization of M: model parameters, I: input space, S: smoothing.

Table 2

Literature for the period between 2007 and 2009.

Author(s) and Date	Area ¹	Traffic	Prediction		Data	Methodology						
		Parameter	Step (min)	Horizon (steps)	Collection	Approach	Problem ²	Model ³	Comparison	Inputs	State-Space	Optimization ⁴
Castro-Neto et al. (2009)	Motorway(U)	Volume	5	1	Detectors	Univariate	FA	Statistical	✓	Single		
Chandra and Al-Deek (2009)	Motorway	Speed	5	1	Detectors	Multivariate	TS	Statistical	✓	Multiple	✓	
Ghosh et al. (2009)	Arterial	Volume	15	50	Detectors	Multivariate	TS	Statistical	✓	Multiple	✓	
Hamad et al. (2009)	Motorway	Speed	5	5	Detectors	Univariate	FA	NN		Multiple	✓	Spectral
Huang and Sadek (2009)	Arterial	Volume	5	1	Detectors	Univariate	PR	NN	✓	Single		I/S
Innamaa (2009)	Motorway	Travel Time	5	4	Detectors	Multivariate	PR	NN		Multiple		
Jintanakul et al. (2009)	Motorway	Travel Time	5	1	Simulation	Univariate	FA	Bayesian		Single		
Karlaftis and Vlahogianni (2009)	Arterial	Volume/Occupancy	1.5	1	Detectors	Univariate	TS	Statistical	✓	Single		
Sheu et al. (2009)	Motorway	Volume	1	1	Detectors	Multivariate	TS	NN	✓	Multiple		
Srinivasan et al. (2009)	Arterial	Volume	15	1	Detectors	Univariate	FA	NN	✓	Multiple	Fuzzy	I
Szeto et al. (2009)	Arterial	Volume	15	1	Detectors	Univariate	TS	Statistical		Single		
Tan et al. (2009)	Motorway	Volume	60	3	Detectors	Univariate	FA	Hybrid*/C	✓	Multiple	NN	O
van Hinsbergen et al. (2009)	Motorway	Travel Time	5	3	Detectors	Univariate	TS	NN	✓	Multiple	✓	Bayesian
Vlahogianni (2009)	Arterial	Volume	1.5	1	Detectors	Univariate	TS	NN	✓	Multiple	✓	M
Wang and Shi (2012)	Motorway	Travel Time	1	1	Detectors	Univariate	FA	Bayesian		Multiple		Genetic
Zou et al. (2009)	Motorway	Travel Time	5	1	Detectors	Univariate	FA	NN	✓	Multiple	✓	
Chandra and Al-Deek (2008)	Motorway	Speed	5	1	Detectors	Multivariate	TS	Statistical	✓	Multiple	✓	
Dimitriou et al. (2008)	Arterial	Volume	1.5	1	Detectors	Univariate	FA	Fuzzy/C	✓	Multiple	✓	Genetic
Guo et al. (2008)	Motorway(U)	Volume	1	1	Detectors	Univariate	TS	Statistical		Single		
Li (2008)	Motorway	Travel Time	5	1	Detectors/AVI	Univariate	FA	Bayesian		Multiple		
Stathopoulos et al. (2008)	Arterial	Volume	3	1	Detectors	Univariate	FA	Fuzzy/C	✓	Multiple		
van Lint (2008)	Motorway	Travel Time	1	1	Detectors	Univariate	TS	Hybrid**		Multiple	✓	Kalman
Vlahogianni (2008)	Arterial	State	1.5	1	Detectors	Multivariate	FA	NN	✓	Multiple		
Zhang and Ye (2008)	Motorway	Volume	15	1	Detectors	Univariate	FA	Hybrid**	✓	Single		Fuzzy
Ghosh et al. (2007)	Arterial	Volume	15	1	Detectors	Univariate	TS	Bayesian		Single		
Innamaa (2009)	Motorway	Travel Time	1	1	Detectors	Univariate	FA	NN		Multiple	✓	
Juri et al. (2007)	Motorway	Travel Time	1	1	Simulation	Univariate	TS	Statistical		Single		
Sun and Zhang (2007)	Network	Volume	15	1	Detectors	Univariate	FA	Statistical		Multiple	✓	
Vlahogianni (2007)	Arterial	State	1.5	1	Detectors	Univariate	FA	NN	✓	Multiple		Genetic
Vlahogianni et al. (2007)	Arterial	Volume	1.5	1	Detectors	Multivariate	TS	Hybrid**	✓	Multiple	✓	I
Xie et al. (2007)	Motorway(U)	Volume	5	1	Detectors	Univariate	FA	Statistical	✓	Multiple	✓	Wavelets
Zhang and Xie (2007)	Motorway	Volume	15	1	Detectors	Univariate	FA	Statistical	✓	Single		M

¹ U: urban.² TS: time series, FA: function approximation, O: optimization, PR: pattern recognition, CL: clustering.³ NN: neural network, Hybrid*/**: statistical/computational intelligence model as the basis, /C: combined forecasts.⁴ Optimization of M: model parameters, I: input space, S: smoothing.

Table 3

Literature for the period between 2010 and 2011.

Author(s) and Date	Area ¹	Traffic	Prediction		Data	Methodology							
		Parameter	Step(min)	Horizon (Steps)	Collection	Approach	Problem ²	Model ³	Comparison	Inputs	State-Space	Optimization ⁴	
Abu-Lebdeh and Singh (2011)	Arterial	Travel Time	5	1	Simulation	Multivariate	FA	Hybrid**		Multiple	✓	Bayesian	I
Bustillos and Chiu (2011)	Motorway	Travel Time	15	1	Simulation	Univariate	PR	Statistical	✓	Single			
Chang et al. (2011)	Arterial	Volume	5	1	Detectors	Univariate	TS	Statistical		Multiple			
Chen et al. (2011)	Arterial	Volume	0.1	1	Detectors	Univariate	PR	Hybrid*	✓	Single		Nature Inspired	M
Djuric et al. (2011)	Motorway	Speed	5	6	Detectors	Univariate	FA	Statistical	✓	Multiple	✓		
Fei et al. (2011)	Motorway(U)	Travel Time	1	1	Detectors	Univariate	TS	Bayesian	✓	Single			
Heilmann et al. (2011)	Motorway(U)	Speed	15	8	ETC.	Univariate	FA	Statistical		Single			
Hong (2011)	Arterial	Volume	60	1	Detectors	Univariate	TS	Hybrid**	✓	Single		Sim. Annealing	M
Hong et al. (2011a)	Arterial	Volume	60	1	Detectors	Univariate	FA	Hybrid*	✓	Single		Nature Inspired	M
Hong et al. (2011b)	Arterial	Volume	60	1	Detectors	Univariate	FA	Hybrid*	✓	Single		Genetic	M
Ishak et al. (2010)	Motorway	Speed	0.5	1	Detectors	Univariate	FA	Statistical		Single			O
Khosravi et al. (2011)	Motorway(U)	Travel Time	5	1	Detectors	Univariate	FA	Hybrid**	✓	Multiple	✓	Bayesian	M
Kuhn and Nicholson (2011)	Motorway	Volume	1	1	Detectors	Univariate	TS	Statistical	✓	Single			
Li and Rose (2011)	Motorway	Travel Time	10	6	AVI	Univariate	FA	NN		Multiple			
Min and Wynter (2011)	Motorway(U)	Volume/Speed	5	12	Detectors	Multivariate	TS	Statistical		Multiple	✓		
Myung et al. (2011)	Motorway	Travel Time	5	1	Detectors/ AVI	Univariate	PR	Statistical		Multiple	✓		
Oh and Park (2011)	Motorway	Travel Time	1	1	AVI	Univariate	TS	NN	✓	Single		Genetic / Wavelets	M/I/ S
Simroth and Zähle (2011)	Motorway	Travel Time	1	1	GPS	Univariate	FA	Statistical		Single			
Soriguera and Robusté (2011)	Motorway(U)	Travel Time	5	1	Detectors / AVI	Univariate	FA	Statistical/ C		Single			
Vlahogianni and Karlaftis (2011)	Arterial	Volume/Occupancy	1.5	1	Detectors	Univariate	TS	Statistical	✓	Single			
Wang et al. (2011)	Motorway	Speed	5	1	Detectors	Univariate	PR	Hybrid**	✓	Single		Bayesian	I
Xia et al. (2011)	Motorway	Travel Time	15	1	Detectors	Multivariate	TS	Statistical		Multiple		Kalman	O
Zhang et al. (2011a)	Motorway	Volume	5	1	Detectors	Univariate	FA	Statistical	✓	Single		Nature Inspired	M
Sun and Xu (2011)	Arterial	Volume	15	1	Detectors	Univariate	FA	Statistical	✓	Single			
Boto-Giralda et al. (2010)	Motorway	Volume	5	2	Detectors	Multivariate	PR	Hybrid**	✓	Multiple	✓	Fuzzy/wavelets	M/I/ S
Ghosh et al. (2010)	Arterial	Volume	5	1	Detectors	Univariate	TS	Hubrid**		Single		Wavelets	I/S
Guo and Williams (2010)	Motorway(U)	Speed	5	1	Detectors	Univariate	TS	Hybrid*		Single		Kalman	O
Kamarianakis et al. (2010)	Arterial	Volume/Speed/ Occupancy	1.5	1	Detectors	Univariate	TS	Statistical	✓	Single			
McCrea and Moutari (2010)	Motorway	Volume	15	1	Detectors	Univariate	FA	Hybrid**		Multiple	✓		
Stathopoulos et al. (2010)	Arterial	Volume	3	1	Detectors	Univariate	FA	Fuzzy/C	✓	Multiple			
Stathopoulos et al. (2010)	Arterial	volume	3	1	Detectors	Univariate	FA	Hybrid*/C		Single		Fuzzy	O
Thomas et al. (2008)	Arterial	Volume	5	2	Detectors	Univariate	TS	Statistical		Single			
Tsekeris and Stathopoulos (2010)	Arterial	Volume	3	1	Detectors	Multivariate	TS	Statistical	✓	Multiple			
Xie and Zhao (2010)	Motorway(U)	Volume	15	2	Detectors	Univariate	FA	Statistical	✓	Single			
Yang et al. (2010)	Motorway	Travel Time	15	1	AVI	Univariate	TS	Statistical		Single			
Zargari et al. (2010)	Motorway	Volume	5	1	Detectors	Univariate	FA	NN	✓	Single		Fuzzy/ Genetic	M/I

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Table 4

Literature for the period between 2012 and 2013.

Author(s) and Date	Area ¹	Traffic	Prediction		Data	Methodology						
		Parameter	Step(min)	Horizon (Steps)	Collection	Approach	Problem ²	Model ³	Comparison	Inputs	State-Space	Optimization ⁴
Celikoglu (2013)	Motorway(U)	Density	2	1	Detectors	Univariate	FA	Hybrid**	✓	Multiple	✓	
Wang and Shi (2012)	Motorway(U)	Speed	5	1	Detectors	Univariate	FA	NN	✓	Single		Chaos/Wavelets
Mu et al. (2012)	Motorway	Travel Time	1	1	Simulation	Univariate	FA	Statistical		Single		
Chan et al. (2013)	Motorway(U)	Speed	1	5	Detectors	Univariate	FA	Hybrid**	✓	Multiple	✓	Nature Inspired
Guo et al. (2013)	Arterial	Volume	15	1	Detectors	Univariate	TS	Statistical	✓	Single		Singular Value Decomp. Genetic
Vlahogianni and Karlaftis (2013)	Motorway(U)	Speed	1	1	Detectors	Multivariate	TS	Hybrid**	✓	Multiple		
Abdi et al. (2012)	Motorway	Volume	1	1	Detectors	Univariate	TS	Hybrid**	✓	Multiple		Fuzzy/Wavelets
Chan et al. (2012a)	Motorway(U)	Speed	1	1	Detectors	Univariate	FA	Statistical	✓	Multiple	✓	Exponential
Chan et al. (2012b)	Motorway(U)	Speed	1	1	Detectors	Univariate	FA	NN	✓	Multiple	✓	n/a
Chang et al. (2012a)	Motorway	Volume	15	4	Detectors	Univariate	PR	Hybrid*		Multiple		k-nearest neighbors
Chen et al. (2012)	Motorway(U)	Volume	3	1	Detectors	Univariate	FA	Statistical	✓	Single		Principal Comp.
Cheng et al. (2012)	Arterial	Volume	5	1	Detectors	Univariate	TS	Statistical		Multiple	✓	
Du et al. (2012)	Network	Travel Time	2	1	Simulation	Univariate	O	Statistical		Multiple	✓	
Dunne and Ghosh (2012)	Motorway	Volume/Speed	1	1	Detectors	Multivariate	FA	NN	✓	Multiple		
Guo et al. (2012)	Motorway	Volume	15	1	Detectors	Univariate	TS	Statistical		Single		
Haworth and Cheng (2012)	Network	Travel Time	5	1	AVI	Univariate	FA	Statistical/C	✓	Multiple	✓	
Hong (2012)	Arterial	Volume	60	1	Detectors	Univariate	FA	Statistical	✓	Single		Sim. Annealing
Kamarianakis et al. (2012)	Motorway(U)	Speed	5	5	Detectors	Univariate	TS	Statistical	✓	Multiple	✓	penalized estimation
Khan (2012)	Motorway	Travel Time	5	1	GPS	Univariate	FA	Bayesian		Single		
Li and Chen (2013)	Motorway	Travel Time	5	1	Detectors/AVI	Univariate	FA	NN		Multiple		
Lu (2012)	Motorway	Travel Time	5	1	Detectors	Univariate	FA	Bayesian	✓	Single		
Ma et al. (2012)	Motorway	Travel Time	1	1	Simulation	Univariate	PR	Statistical	✓	Single		
Qiao et al. (2012)	Motorway	Travel Time	5	1	Bluetooth	Univariate	PR	Statistical	✓	Single		
Sun et al. (2012)	Network	Volume	15	1	Detectors	Multivariate	PR	NN	✓	Multiple	✓	penalized estimation
Tchraikian et al. (2012)	Motorway	Volume	15	5	Detectors	Univariate	TS	Statistical	✓	Multiple		
Tsirigotis et al. (2012)	Motorway(U)	Speed	10	1	Detectors	multivariate	TS	Statistical	✓	Multiple		
	Arterial	Volume	5	1	Detectors	Univariate	FA	Statistical		Single		
Xia et al. (2012)	Motorway	State	5	1	Detectors	Multivariate	CL	Statistical		Multiple		
Ye et al. (2012)	Motorway(U)	Speed	0.01	60	GPS	Univariate	FA	NN	✓	Multiple		
Zheng and Van Zuylen (2012)	Arterial	Travel Time	1	1	GPS	Univariate	FA	NN		Multiple	✓	

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