

# **REFLECTIONS OF RESEARCH ON THE USE OF TECHNOLOGY FOR TRAFFIC SAFETY MANAGEMENT**

**Prof. Yasser  
Hawas**

**International  
Symposium on  
“The Impact of Law  
Enforcement and  
Monitoring on  
Traffic Safety.”**

# OUTLINE

- **Assessment of Traffic Safety in UAE (concerns, mitigations, and priorities)**
- **UAEU-RTTSRC Solutions to address safety concerns**
  - Understanding
  - Design of Effective Technological Solutions
  - Implementation or deployment testing
- **Systems of Advanced Technologies for Traffic Safety Monitoring, Enforcement and Control**
  - Systems for Data Storage, Retrieval and Analysis
  - Systems for Incident Detection
  - Systems for Incident Management and Signal Control
  - Vehicle to Vehicle Communication Systems for Autonomous Driving
- **Conclusions**

# UAE SAFETY ASSESSMENT

Accident Analysis and Prevention 45 (2012) 554–564



Contents lists available at SciVerse ScienceDirect

Accident Analysis and Prevention

journal homepage: [www.elsevier.com/locate/aap](http://www.elsevier.com/locate/aap)



## A holistic approach for assessing traffic safety in the United Arab Emirates

Mohammad Nurul Hassan<sup>a,1</sup>, Yaser E. Hawas<sup>a,b,\*</sup>, Munjed A. Maraqa<sup>a,b,1</sup>

<sup>a</sup> Roadway Transportation and Traffic Safety Research Center (RTTSRC), United Arab Emirates University, Al Ain, United Arab Emirates

<sup>b</sup> Department of Civil and Environmental Engineering, United Arab Emirates University, Al Ain, United Arab Emirates

# OVERALL ASSESSMENT OF FACTORS AFFECTING TRAFFIC SAFETY IN THE UAE

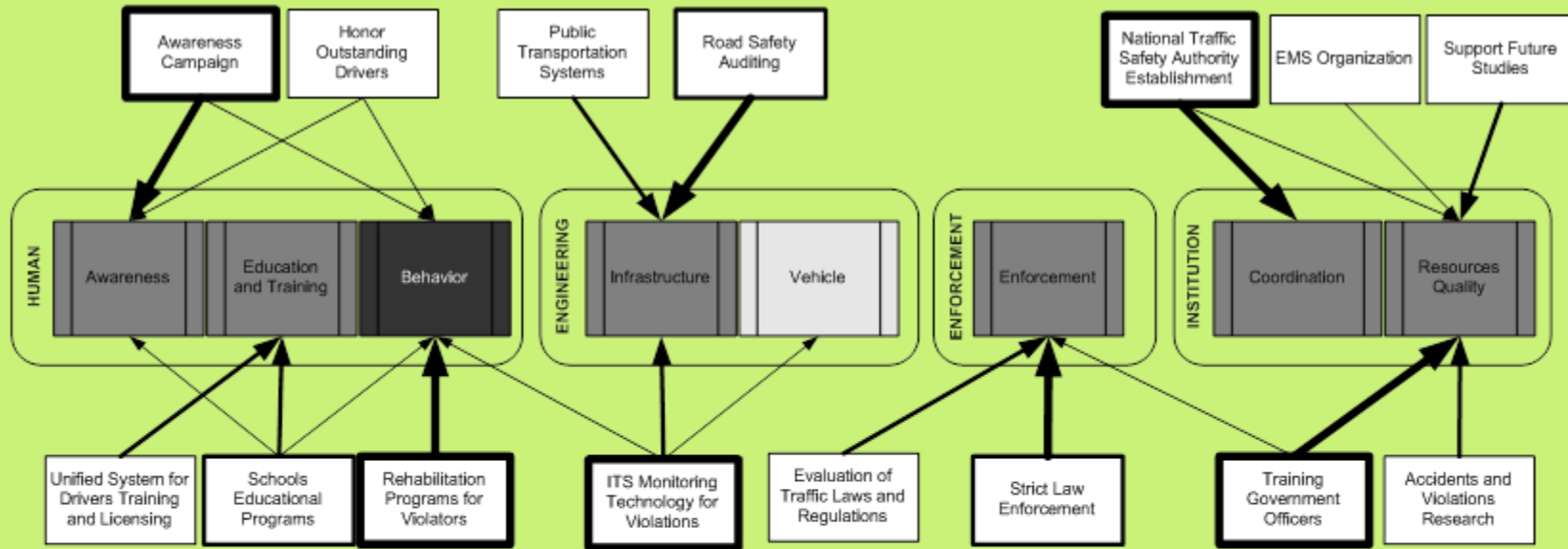
Item studied	Human			Engineering		Enforcement	Institution	
	Awareness	Education and training	Driving behaviour	Infrastructure	Vehicle		Coordination	Quality of resources
Traffic accidents and fatalities			☒		☒		☒	☒
Traffic violation			☒					
Traffic safety education and awareness	⊕	⊕						⊕
Effectiveness of traffic law	⊕					⊕		
Vehicle safety					⊕			
Behavioural issue			⊕					
Road infrastructure				⊕				
Supporting institutions								⊕
Emergency medical service				⊕				⊕
Coordination among stakeholders							⊕	
Accident and violation analysis								⊕
Drivers' training and licensing		⊕						⊕
Deficiency in traffic safety*	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<b>Overall deficiency</b>	Moderate	Moderate	<b>Major</b>	Moderate	Minor	Moderate	Moderate	Moderate

## Data sources for evaluation:

☒ Statistics, ⊕ Road-users Opinion, ⊕ Expert Opinion (shade represents deficiency)

\* This assessment is based on the results presented in Section 3.2

# RECOMMENDATIONS OF MITIGATIONS AND PRIORITIES



## LEGEND

### DEFICIENCY LEVEL OF TRAFFIC SAFETY FACTOR

Minor Deficiency

Moderate Deficiency

Major Deficiency

### RECOMMENDATION PRIORITY OF DEPLOYMENT

Low Priority

Moderate Priority

High Priority

### EXPECTED IMPACT LEVEL OF RECOMMENDATION ON FACTOR

Low Impact

Moderate Impact

High Impact

# UAEU-RTT SRC SOLUTIONS TO ADDRESS SAFETY CONCERNS

- **Solution Development:**
  - Start with UNDERSTANDING
  - Design OF EFFECTIVE TECHNOLOGICAL SOLUTIONS
  - OPERATIONAL TESTING

**UNDERSTANDING**

# RESEARCH TO UNDERSTAND ISSUES, CONCERNS

- Understanding driver's behavior



## Journal of Transportation Safety & Security

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/utss20>

## Characterizing Driver Behaviors Relevant to Traffic Safety: A Multistage Approach

Nada B. Al Naser<sup>a</sup>, Yaser E. Hawas<sup>a b</sup> & Munjed A. Maraqa<sup>a b</sup>

<sup>a</sup> Roadway, Transportation and Traffic Safety Research Center, United Arab Emirates University, Al Ain, United Arab Emirates

<sup>b</sup> Department of Civil and Environmental Engineering, United Arab



# RESEARCH TO UNDERSTAND ISSUES, CONCERNS



## Transportation Planning and Technology

Publication details, including instructions for authors and subscription information:  
<http://www.informaworld.com/smpp/title~content=t713653693>

### A Microscopic Simulation Model for Incident Modeling in Urban Networks

To cite this Article: Hawas, Yaser E. , 'A Microscopic Simulation Model for Incident  
Modeling in Urban Networks', Transportation Planning and Technology, 30:2, 289 -  
309

To link to this article: DOI: 10.1080/03081060701398117  
URL: <http://dx.doi.org/10.1080/03081060701398117>

- Understanding the evolution and effects of incidents in the network. For this purpose we developed a sophisticated simulator. The system is fully developed, validated and tested



## Transportation Planning and Technology

Publication details, including instructions for authors and subscription information:  
<http://www.informaworld.com/smpp/title~content=t713653693>

### A multi-stage procedure for validating microscopic traffic simulation models

Yaser E. Hawas <sup>a</sup>; Mutahar Abdel Hameed <sup>a</sup>

<sup>a</sup> Roadway, Transportation and Traffic Safety Research Center (RTT SRC), UAE University, Al-Ain, UAE

Online Publication Date: 01 February 2009


# RESEARCH TO UNDERSTAND ISSUES, CONCERNS

**RUTS Roadway, Transportation & Traffic Safety Research Center**  
GOOGLE MAP ACCIDENT GUIDE

[User Logged: mareh] Arabic [Logout]

Select city: All Amn | Show Intersections | Show Traffic Congestion | Show Cameras

Info News Map Satellite Hybrid



Eight people died in the accident that involved as many as 200 vehicles on ...  
<http://drivearabia.com>

Map data ©2010 Google, LeadDog Consulting - Terms of Use

**Categories**

- Age: 26 to 35, Gender: Female, Education Level: Read and Write
- Age: 26 to 35, Gender: Female, Education Level: Intermediate
- Age: 26 to 35, Gender: Female, Education Level: University
- Age: 36 to 45, Gender: Female, Education Level: Read and Write
- Age: 36 to 45, Gender: Female, Education Level: University
- Age: 46 to 60, Gender: Female, Education Level: Read and Write
- Age: 46 to 60, Gender: Female, Education Level: Intermediate

**Driver Details**

Age (Years):	Gender:	Educ. Level:	Injury Level:
<input type="checkbox"/> Below 18	<input type="radio"/> Male	<input type="checkbox"/> Illiterate	<input type="checkbox"/> No Injury
<input type="checkbox"/> 18 to 25	<input type="radio"/> Female	<input checked="" type="checkbox"/> Intermediate	<input type="checkbox"/> Minor
<input checked="" type="checkbox"/> 26 to 35	<input type="radio"/> Both	<input checked="" type="checkbox"/> Read and write	<input type="checkbox"/> Moderate
<input type="checkbox"/> 36 to 45		<input checked="" type="checkbox"/> University	<input type="checkbox"/> Serious
<input type="checkbox"/> 46 to 60		<input type="checkbox"/> Check All	<input type="checkbox"/> Fatal
<input type="checkbox"/> Above 60			

**Vehicle Details**

**Crash Details**

View On Map | Clear Entry | Reports

Windows Internet Explorer

http://localhost:3142/frmmaplogin.php

RUTS Roadway, Transportation & Traffic Safety Research Center  
GOOGLE MAP ACCIDENT GUIDE

User Name:   
Password:   
Login

Categories:

- Age: 26 to 35, Gender: Female, Education Level: Read and Write
- Age: 26 to 35, Gender: Female, Education Level: Intermediate
- Age: 26 to 35, Gender: Female, Education Level: University
- Age: 36 to 45, Gender: Female, Education Level: Read and Write
- Age: 36 to 45, Gender: Female, Education Level: University
- Age: 46 to 60, Gender: Female, Education Level: Read and Write
- Age: 46 to 60, Gender: Female, Education Level: Intermediate

**RUTS Roadway, Transportation & Traffic Safety Research Center**  
GOOGLE MAP ACCIDENT GUIDE

[User Logged: yhawas] Arabic [Logout]

ID: 945  
Case: [22227] Case 22227  
Location: NA  
Age: 35  
Gender: Male  
Education Level: Read and Write  
Injury Level: Moderate  
Crash Time: 21:30:00  
latlong: 24.586013 | 55.74333

**Categories**

- Age: 19 to 25, Gender: Male, Injury Level: Moderate, Crash Type: Rollover collision
- Age: 19 to 25, Gender: Male, Injury Level: Serious, Crash Type: Rollover collision
- Age: 19 to 25, Gender: Male, Injury Level: Fatal, Crash Type: Rollover collision
- Age: 26 to 35, Gender: Male, Injury Level: Moderate, Crash Type: Rollover collision
- Age: 26 to 35, Gender: Male, Injury Level: Serious, Crash Type: Rollover collision
- Age: 26 to 35, Gender: Male, Injury Level: Fatal, Crash Type: Rollover collision

**19 Record/s**

NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA

**Driver details**

Age (Years):	Gender:	Educ. Level:	Injury Level:
<input type="checkbox"/> Below 18	<input type="radio"/> Male	<input type="checkbox"/> Illiterate	<input type="checkbox"/> No Injury
<input checked="" type="checkbox"/> 18 to 25	<input type="radio"/> Female	<input type="checkbox"/> Intermediate	<input type="checkbox"/> Minor
<input type="checkbox"/> 26 to 35	<input type="radio"/> Both	<input type="checkbox"/> Read and write	<input checked="" type="checkbox"/> Moderate
<input type="checkbox"/> 36 to 45		<input type="checkbox"/> University	<input type="checkbox"/> Serious
<input type="checkbox"/> 46 to 60			<input checked="" type="checkbox"/> Fatal
<input type="checkbox"/> Above 60			

**Vehicle details**

Type:   
Specification:   
Model:

**Crash details**

Type: Rollover collision  
Cause:   
Speed:

**RUTS Roadway, Transportation & Traffic Safety Research Center**  
GOOGLE MAP ACCIDENT GUIDE

[User Logged: yhawas] Arabic [Logout]

Map Satellite Hybrid

**Categories**

- Gender: Male, Injury Level: Minor
- Gender: Male, Injury Level: Moderate
- Gender: Male, Injury Level: Serious
- Gender: Male, Injury Level: Fatal
- Gender: Female, Injury Level: Minor
- Gender: Female, Injury Level: Moderate
- Gender: Female, Injury Level: Serious
- Gender: Female, Injury Level: Fatal

**Driver details**

Age (Years):	Gender:	Educ. Level:	Injury Level:
<input type="checkbox"/> Below 18	<input type="radio"/> Male	<input type="checkbox"/> Illiterate	<input type="checkbox"/> No Injury
<input type="checkbox"/> 18 to 25	<input type="radio"/> Female	<input type="checkbox"/> Intermediate	<input type="checkbox"/> Minor
<input type="checkbox"/> 26 to 35	<input type="radio"/> Both	<input type="checkbox"/> Read and write	<input checked="" type="checkbox"/> Moderate
<input type="checkbox"/> 36 to 45		<input type="checkbox"/> University	<input type="checkbox"/> Serious
<input type="checkbox"/> 46 to 60			<input checked="" type="checkbox"/> Fatal
<input type="checkbox"/> Above 60			

**Vehicle details**

Type:   
Specification:   
Model:

**Crash details**

Type:   
Cause:   
Speed:

[User Logged: marcn] Arabic [Logout]

Select city: Al Ain  Intersection. Link Control  Link Congestion Status  Cameras

Map Satellite Hybrid

**Categories**

**Int. Link Control**

- Pre-timed
- Semi-Actuated
- Actuated
- STOP Sign
- Yield Sign
- Roundabout

**Link Congestion Stat**

- Not Congested
- Slightly Congested
- Congested

**Cameras:**

- Fixed
- Mobile
- Red-light

**Driver Details**

Age (Years):  Below 18  18 to 25  26 to 35  36 to 45  46 to 60  Over 60

Gender:  Male  Female  Both

Educ. Level:  Illiterate  Intermediate  Read/write  University  Check All

Injury Level:  Unknown  Minor  Moderate  Serious  Fatal  Check All

[User Logged: marcn] Arabic [Logout]

Select city: Al Ain  Intersection. Link Control  Link Congestion Status  Cameras

Map Satellite Hybrid

Code: 019  
 Name: Int 019  
 Type: Stop Sign  
 Date Installed: 2010-01-01  
 Date Last Maintained: 2010-10-01  
 Controller Type: Test Controller Type  
 Provider: Test Provider  
 # of legs: 4  
 Lat.Long: 24.230999,55.719395

**Categories**

**Int. Link Control**

- Pre-timed
- Semi-Actuated
- Actuated
- STOP Sign
- Yield Sign
- Roundabout

**Driver Details**

[User Logged: marcn] Arabic [Logout]

Select city: Al Ain  Intersection. Link Control  Link Congestion Status  Cameras

Map Satellite Hybrid

Code: 002  
 Name: Int 002  
 Type: Roundabout  
 Date Installed: 2010-08-25  
 Date Last Maintained: 2010-11-04  
 Controller Type: RA-Controller Type  
 Provider: RA-Provider  
 Diameter: 30m.  
 # of lanes: 3  
 Lat.Long: 24.246338,55.752525

**Categories**

**Int. Link Control**

- Pre-timed
- Semi-Actuated
- Actuated
- STOP Sign
- Yield Sign
- Roundabout

**Driver Details**

[User Logged: marcn] Arabic [Logout]

Select city: Al Ain  Int. Link Control  Link Congestion Stat  Show Cameras

Map Satellite Hybrid

Code: 047  
 Name: Int 047  
 Type: Actuated  
 Date Installed: 2010-01-01  
 Date Last Maintained: 2010-11-01  
 Controller Type: Test Controller type  
 Provider: Test Provider  
 Phases: 4  
 Min. Green Split: 5sec.  
 Max. Green Split: 30sec.  
 Vehicle Unit Ext.: 2sec.  
 Amber Time: 3sec.  
 All Red Time: 2sec.  
 Phase Splits: 20sec.  
 Lat.Long: 24.224737,55.756989

**Categories**

**Int. Link Control**

- Pre-timed
- Semi-Actuated
- Actuated
- STOP Sign
- Yield Sign
- Roundabout

**Driver Details**

Age (Years):  Below 18  18 to 25  26 to 35  36 to 45  46 to 60  Over 60

Gender:  Male  Female  Both

Educ. Level:  Illiterate  Intermediate  Read/write  University  Check All

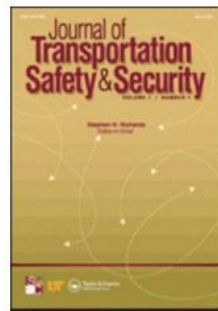
Injury Level:  Unknown  Minor  Moderate  Serious  Fatal  Check All

**Vehicle Details**

**Crash Details**

# RESEARCH TO UNDERSTAND ISSUES, CONCERNS

- The main objectives of this paper are to explore the characteristics of rollover crashes, to establish the contribution of vehicle types to rollover crashes; and to identify the rollover occurrence rate after hitting the barriers. The analysis entails the three stages; one stage is designated to assessing all rollover crashes, one for the general assessment of rollover crashes after hitting all barriers, and one for the assessment after hitting the Armco/W-beam barrier in particular



# RESEARCH TO UNDERSTAND ISSUES, CONCERNS

- study the effectiveness of these two restraints in the UAE based on comparing the observed injuries and fatalities for occupants. This will help identifying most life threatening combinations and as such forming policies to reduce injury severity. Detailed crash data analysis was used to assess the seatbelt effectiveness with the two airbag conditions of deployed or not deployed.

*Journal of Traffic and Logistics Engineering Vol. 3, No. 2, December 2015*

## Evaluation of Seatbelt and Airbag Effectiveness in Reducing Severe and Fatal Injuries in the UAE

Yaser E. Hawas  
Roadway Transportation and Traffic Safety Research Center (RTTSRC), UAE University, Al Ain, United Arab  
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Md. Didarul Alam  
RTTSRC, UAE University  
E-mail: didarul@uaeu.ac.ae

**DESIGN OF  
EFFECTIVE  
TECHNOLOGICAL  
SOLUTIONS**

**SYSTEMS FOR ATMS-  
ATIS INTEGRATED  
CONTROL**

# ATIS-ATMS INTEGRATION

- This system can be used to integrate any two existing systems. For instance, it can integrate the decisions of traffic control centers (e.g. signals or real-time routing), with systems for advanced traveler information (VMS, vehicle navigation, speed alerting systems). It can be used very effectively for incident management



ELSEVIER

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

SCIENCE @ DIRECT®

Fuzzy Sets and Systems 144 (2004) 313–343

**FUZZY**  
sets and systems

[www.elsevier.com/locate/fss](http://www.elsevier.com/locate/fss)

A non-cooperative neuro-fuzzy system for integrating ATIS  
and ATMS decisions

Yaser E. Hawas\*

*Civil Engineering Department, United Arab Emirates University, P.O. Box 17555, Al-Ain,  
United Arab Emirates*

Received 19 April 2002; received in revised form 23 February 2003; accepted 7 March 2003



**SYSTEMS FOR INCIDENT  
DETECTION FOR  
EFFECTIVE IMMEDIATE  
RESPONSE**

# ONLINE INCIDENT DETECTION



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



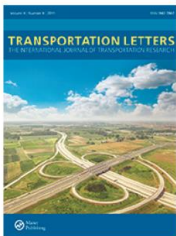
Transportation Research Part C 15 (2007) 69–95

TRANSPORTATION  
RESEARCH  
PART C

[www.elsevier.com/locate/trc](http://www.elsevier.com/locate/trc)

A fuzzy-based system for incident detection  
in urban street networks

Yaser E. Hawas \*



Transportation Letters

The International Journal of Transportation Research



ISSN: 1942-7867 (Print) 1942-7875 (Online) Journal homepage: <http://www.tandfonline.com/loi/ytrl20>

A binary logit-based incident detection model for  
urban traffic networks

Yaser E. Hawas & Faisal Ahmed

- In order to enable fast reaction to incidents (including vehicular crashes) several models and systems were developed to detect incidents at intersections. Very effective and fast systems to detect short time incidents

# A System for Incident Detection in Urban Traffic Networks

Yaser E. Hawas

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Mohammad Sherif Mohammad

Roadway, Transportation and Traffic Safety Research  
Center  
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sherif@uaeu.ac.ae

**THE SYSTEM WAS RECENTLY  
UPGRADED FOR INCIDENT  
DETECTION AND MANAGEMENT  
FOR URBAN NETWORKS, NOT  
ONLY ISOLATED  
INTERSECTIONS**

**SYSTEMS TO OVERCOME  
CENTRALIZED CONTROL  
ISSUES**

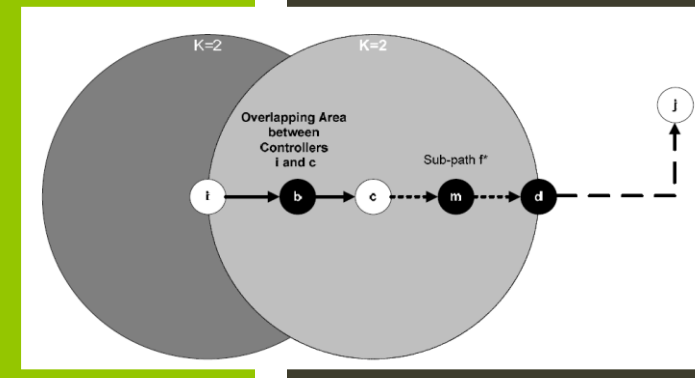
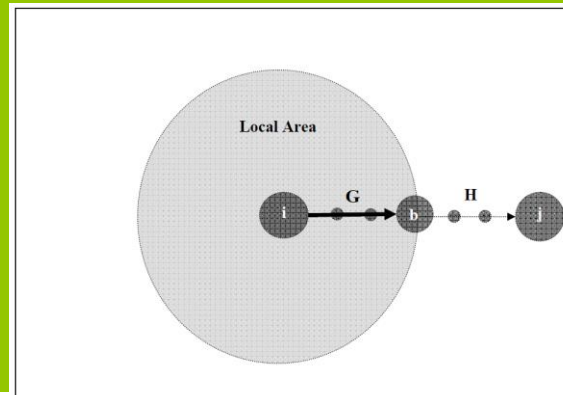
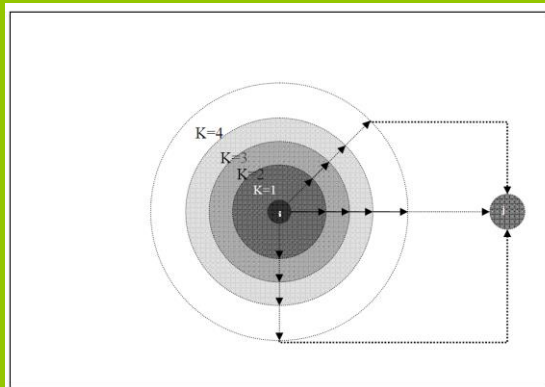
# A Cooperative Distributed System for Real-Time Route Guidance

Yaser E. Hawas

Civil and Environmental Engineering Department, UAE University, Al Ain, UAE  
Email: [y.hawas@uaeu.ac.ae](mailto:y.hawas@uaeu.ac.ae)

Received March 22, 2012; revised April 25, 2012; accepted May 20, 2012

IT CAN ALSO BE USED AS A  
DECENTRALIZED SYSTEM FOR  
REAL TIME ROUTE GUIDANCE  
(VEHICLE TO INFRASTRUCTURE  
COMMUNICATION)



**SYSTEMS THAT WILL  
ENABLE TRAFFIC  
SIGNALS TO REACT TO  
INCIDENTS**



## Transportmetrica

Publication details, including instructions for authors and subscription information:  
<http://www.informaworld.com/smpp/title~content=t903636850>

### An integrated simulation-based fuzzy logic model for real-time traffic signal control

Y. E. Hawas<sup>a</sup>

<sup>a</sup> Roadway, Transportation and Traffic Safety Research Center (RTTSRC), UAE University, UAE

First published on: 28 July 2010

# THE SYSTEM IS FULLY FUNCTIONAL AS A TRAFFIC SIGNAL CONTROL

## A FUZZY LOGIC MODEL FOR NETWORK SIGNAL CONTROL AND TRANSIT PREEMPTION

Yaser E. Hawas

*Civil and Environmental Engineering Department, UAE University, Al Ain, U.A.E.*

# **CONFLICT OF CONTROL OBJECTIVES**

**ULTIMATE INTEGRATION:  
SYSTEMS THAT WILL  
CONTROL SIGNALS,  
REACT TO INCIDENTS  
AND ENABLE TRANSIT  
PRIORITY ALL  
TOGETHER**





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Contents lists available at [ScienceDirect](#)

## Transportation Research Part C

journal homepage: [www.elsevier.com/locate/trc](http://www.elsevier.com/locate/trc)



An integrated real-time traffic signal system for transit signal priority, incident detection and congestion management

F. Ahmed, Y.E. Hawas\*

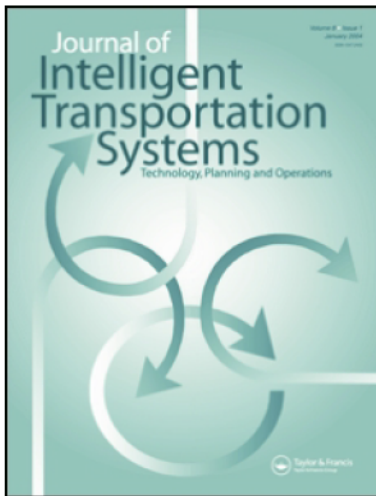
*United Arab Emirates University, United Arab Emirates*



**SYSTEM IS NOW FULLY INTEGRATED TO  
ENABLE SEVERAL SIMULTANEOUS  
FUNCTIONALITIES: SIGNAL CONTROL,  
BUS PRIORITY, INCIDENT DETECTION AND  
MANAGEMENT FOR ALL TYPES OF  
SIGNALS; PRE-TIMED, ACTUATED (SPLIT,  
DUAL AND PROTECTED)**

**WORLD IS SHIFTING TO  
VEHICULAR  
COMMUNICATION**

**A SYSTEM TO ENABLE  
VEHICULAR  
COMMUNICATION AND  
USE FOR REROUTING  
AROUND INCIDENTS**



## Journal of Intelligent Transportation Systems

Publication details, including instructions for authors and subscription information:

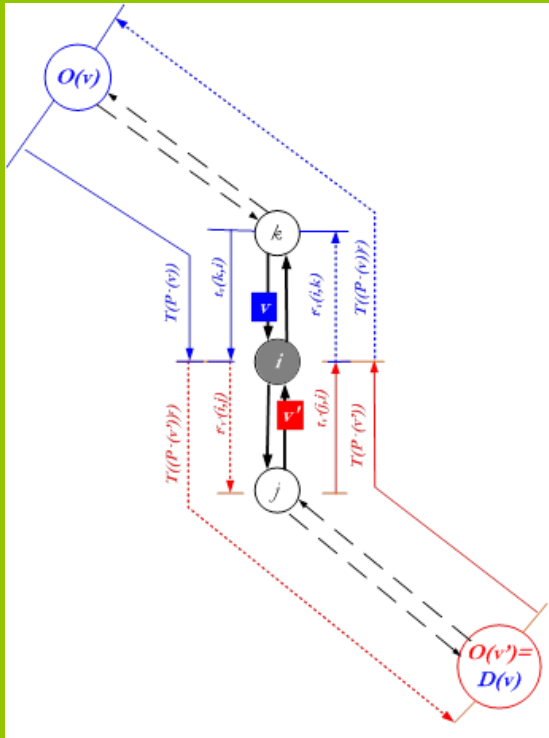
<http://www.informaworld.com/smpp/title~content=t713398522>

### Comparative Assessment of Intervehicular Communication Algorithms for Real-Time Traffic Route Guidance

Yaser E. Hawas <sup>a</sup>; Marc Joseph B. Napeñas <sup>b</sup>; Younes Hamdouch <sup>c</sup>

<sup>a</sup> Civil and Environmental Engineering Department, Director, Roadway, Transportation and Traffic Safety Research Center (RTTSCR), UAE University, Al-Ain, UAE <sup>b</sup> Roadway, Transportation and Traffic Safety Research Center (RTTSCR), UAE University, Al-Ain, UAE <sup>c</sup> College of Business and Economics, UAE University, Al-Ain, UAE

Online Publication Date: 01 October 2009



THE SYSTEM IS  
WELL DEVELOPED  
ALSO FOR VEHICLE  
TO VEHICLE  
COMMUNICATION  
FOR REAL TIME  
ROUTE GUIDANCE

**DUBAI VISION:  
AUTONOMOUS DRIVING  
A SYSTEM TO ENABLE  
AUTONOMOUS DRIVING.  
IN A TRAFFIC MIX  
(AUTONOMOUS AND  
MAN DRIVEN).  
REPORTING INCIDENTS  
AND USE FOR  
REROUTING AROUND**



Contents lists available at [ScienceDirect](http://ScienceDirect)

Vehicular Communications

[www.elsevier.com/locate/vehcom](http://www.elsevier.com/locate/vehcom)



## Autonomous real time route guidance in inter-vehicular communication urban networks



Yaser E. Hawas<sup>a,\*</sup>, Hesham El-Sayed<sup>b</sup>

<sup>a</sup> *Civil and Environmental Engineering, College of Engineering, United Arab Emirates University, United Arab Emirates*

<sup>b</sup> *College of Information Technology, United Arab Emirates University, United Arab Emirates*

SYSTEM IS DEVELOPED FURTHER  
FOR **AUTONOMOUS DRIVING** BY  
VEHICLE TO VEHICLE  
COMMUNICATION FOR REAL TIME  
ROUTING AND CONGESTION  
MANAGEMENT

**IMPLEMENTATION  
AND DEPLOYMENT  
TESTING**

# UAEU-TATA COOPERATION ON VEHICLE TO VEHICLE COMMUNICATION



- In Al Ain, in January 2017 we will be running a deployment test of 6 vehicles communicating to each other while driving as a test. The communication between the vehicles will be used for many autonomous driving functions and safety applications

**UAEU**

**TATA**

# CONCLUSIONS

- A sample of strategic safety related research is presented
- Research is an arm of the society development without which no one can fully understand or judge effectiveness of solutions
- UAE is moving towards innovations in all aspects of life including the technologies and systems
- There is an urgent need to link practitioners with researchers to boost the underutilized capabilities. Strong collaboration initiatives can be established



THANK YOU