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Transportation Research Procedia 24 (2017) 197–203

Transportation Research Procedia

www.elsevier.com/locate/procedia

3rd Conference on Sustainable Urban Mobility, 3rd CSUM 2016, 26 – 27 May 2016, Volos, Greece

The importance of intelligent transport systems in the preservation of the environment and reduction of harmful gases

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Abstract

This study explores the role of using Intelligent Transportation Systems ITS to solve environmental problems, caused mainly by traffic congestion, within the city of Baghdad. The issues of congestion stem from the lack of street capacity, facilities to accommodate the increase in means of transport, absence of proper management based on modern transport and technical development, lack of efficient and convenient public transportation services and, dependence on private cars. This leading to increased traffic density, and changes in speed of traffic flow which causes an increase in energy consumption and gas emissions such as carbon monoxide, lead, nitrogen dioxide, soot, and particulate pollutants. This research studies the pollution rates caused by congestion in the streets connected to the intersection of Jadriya, which is located near Baghdad University. The proportion of gases emitted by vehicles was calculated using regression equations and this calculation has depended on the traffic volume. In addition, other factors that contributed to the calculation some of this equations include: speed of traffic flow, street capacity, the height of neighbouring buildings, and forestation intensity. The final results demonstrate the types and proportion of gases that pollute the environment as compared with the international health standards to determine the percentage of the encroachment of polluting gases in the area. The possibility of applying ITS was discussed, by reusing regression equations to estimate emissions depending on the variation of future traffic volume and speed. Future traffic volume was estimated by a percentage of views of a group of experts in the field of transportation. The results indicate a significant decrease in emissions if ITS applied.

Peer-review under responsibility of the organizing committee of the 3rd CSUM 2016.

Keywords: Baghdad; Transportation; Intelligent Transportation System (ITS); Air Pollution.
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1. Introduction - Preface

The main question this paper proposes is whether or not ITS are related to air quality enhancement? Most studies indicate that the application of these systems reduced travel time and frequency. For example, variable message signs VMS reduced the interruptions of traffic by 53% and enhanced travel times by 44% (Al-Jarallah, 2012). Applying split cycle offset optimization techniques SCOOT, for traffic's network monitor and management in urban areas, helped to reduce congestion by 20% (William, 2008). The charging system applied in London in 2003 reduced trips by 30% (Charles, 2005). Advanced control of information systems in arterial roads reduced delay rates by 40-50% (Robert, 2005). Closed-circuit television CCTV and VMS Systems have a key role in reducing the proportion of congestion by 30-40% (Black, 2010) (Abdel-Rahim, 2012). Also, other benefits related to ITS includes increased reliability of public transport and reduced rates of fuel consumption which leads to the reduction of emissions rate.

2352-1465
Peer-review under responsibility of the organizing committee of the 3rd CSUM 2016.
10.1016/j.trpro.2017.05.108

The use of ITS, which was developed during the past two decades, has had a significant role in reducing environmental pollutants by providing greater flexibility in traffic. (Yokota, 2004).

"ITS helps to optimize trips, eliminate unnecessary travel miles and reduce time spent caught in traffic. Altogether, ITS helps to contain fuel consumption and noxious emissions, reduce dependence on foreign energy supplies and safeguard the quality of the air. The goal is to save a minimum of one billion gallons of gasoline each year and to reduce emissions at least in proportion to this fuel saving." (ITS America 2002)

It was found that the application of ITS in some countries such as traffic management systems, traveller information systems, public transport systems, commercial vehicle management systems, roadside VMS and CCTV systems, helped in reducing harmful exhausts emissions and fuel consumption by vehicles by as much as 22 % (Sandor, 2013). The application of ITS underlines the importance of taking into account the benefit of ITS in planning solutions for many environmental pollution and traffic jam problems.

It is important to keep this discourse open, and not to confirm prematurely on the issue of ITS and its potential environmental impacts. Since ITS may reduce traffic and increase irregular acceleration, It may or may not increase emissions depends on a drivers' behavior as shown in Figure 1 (Dodder,2006).

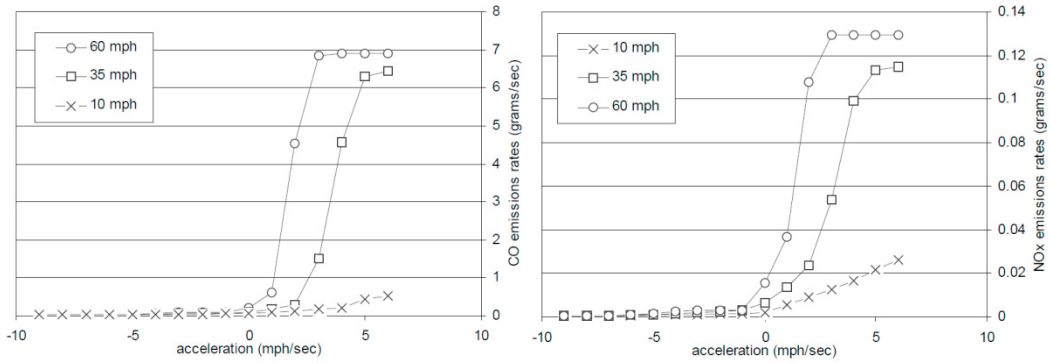

Figure 1 CO and NOx emissions factors by acceleration at 10, 35, 60 mph (from CMEM)

2. Materials and Methods

2.1 Site description

The study was conducted at the intersection of Jadriya near Baghdad University, which is in one of the main areas of Rusafa side in Baghdad. This intersection uses traffic lights and serves the major arterial road and connects the ring highways No. 1 and No. 3, and connects Sadda collector road with Azwia arterial road. Figure 2 shows the intersection location within the area. The estimated number of vehicles served by this intersection was more than 12 million vehicles per year, (Consulting Engineering Office, no data) and thus, the intersection suffers from severe traffic jams during rush hours and this increases delay for its users.