

Users' Evaluation of Rail Systems in Mass Events

Case Study in Mecca, Saudi Arabia

Isam Kaysi, Baha Alshalalfah, Amer Shalaby, Arwa Sayegh, Mounira Sayour, and Adnan Gutub

Each year during the ninth month of the Muslim lunar calendar, more than 2 million Muslim pilgrims from around the world travel to the Holy City of Mecca in Saudi Arabia for Hajj, an annual religious pilgrimage. A significant milestone in the effort to improve the existing transport system in the Holy City was the introduction of the Southern Masha'er Rail Line during the 2010 pilgrimage season. In the first year of operation, the line operated at only 30% of its full capacity before full implementation in the following year, when the line operated at full capacity of 72,000 passengers per hour. Results are presented of a users' survey that aimed to assess the performance of the rail line from the perspective of its users. The analysis revealed that rail users faced longer access, waiting, and egress times compared with regular rail operations standards. However, survey results showed that the majority of pilgrims found these times to be tolerable. Moreover, the majority of users found the rail line and its stations to be of excellent quality and gave positive recommendations for using the rail line in the future. The analysis also produced some interesting observations that may be of relevance to rail operation in similar crowded events. Those observations are highlighted.

Each year, more than 2 million Muslims from around the world gather in the city of Mecca in Saudi Arabia for a short period of time during the ninth month of the Muslim lunar year to perform the annual pilgrimage (Hajj). Pilgrimage rituals take place at two specific locations in Mecca: the Grand Mosque (Haram), located in the Mecca central area; and Holy Environs of Al-Masha'er Al-Mugadassah (also called Masha'er). These locations lie to the southeast of Mecca and include three distinct religious areas: Mina (6 km from the Haram); Muzdalifah (13 km from the Haram); and Arafat (20 km from the Haram), as shown in Figure 1.

The number of visiting pilgrims is expected to increase in future years as a result of several economic and social factors. Chief among

these factors is the ongoing third expansion of the Grand Mosque, expected to increase the Mosque's capacity to 1.2 million worshippers, more than double its existing capacity. This growth in the number of pilgrims will result in more congestion and bigger crowds on the streets of Mecca and the holy sites, and they are already suffering from extreme traffic congestion during the pilgrimage season. To cope with this situation, Saudi Arabian authorities aim at increasing the capacity of the Mecca transport network by supplementing the traditional modes of transport currently used in the area, such as buses, private vehicles, and walking. A joint effort among several government agencies, including the Ministry of Transport, Ministry of Municipal and Rural Affairs, Mecca Municipality, and the Ministry of Pilgrimage, concluded that heavy rail transit is necessary and perhaps the only solution for accommodating the growing number of pilgrims currently and in the future. It was determined that five rail lines were required in the holy sites area, to handle the expected pilgrim volumes in the future. The first line to be constructed was the Southern Masha'er Rail Line (SMR), a significant milestone in the effort to improve the existing transport conditions in the area; the decision on the construction of the four other lines will be made in future years.

The SMR line has unique design and operational features that distinguish it from other heavy rail systems around the world. So it was important to assess the unique design and operations of the rail line from users' viewpoints, to identify what measures, if any, need to be taken to improve performance of the line in future years, and to inform the decision-making process for the four other lines. Accordingly, this paper presents the results of a survey, conducted during the 2010 pilgrimage season, of users' opinions of the rail line and its features.

LITERATURE REVIEW

Since this line was introduced to serve people during a specific event in which millions of people gather at the same place for a short period of time, it is important to look at similar experiences from around the world. Indeed, public transport systems are generally evaluated based on a multicriteria system that assesses how the service is increased or ameliorated and what incentives are provided for people to use this public transport. Included would be user-based criteria that measure comfort levels, security and health levels, fare collection systems, reliability, and so on; as well as non-user-based criteria, such as emissions and environmental impact, cost-benefit ratio, and so on (*J*). Moreover, performance evaluation of public transport systems increases in importance in mega-events, since the success of such events is greatly influenced by how people access event venues and other places of attraction. One study explored the

I. Kaysi, Department of Civil and Environmental Engineering, Transport Research Unit, American University of Beirut, P.O. Box 11-0236, Beirut 1107 2020, Lebanon. B. Alshalalfah, A. Sayegh, and M. Sayour, SETS International, Hamra Square, Block A, 2nd Floor, Hamra Street, P.O. Box 113-7442, Beirut 2034 4605, Lebanon. A. Shalaby, Urban Transportation Research and Advancement Centre, Department of Civil Engineering, University of Toronto, 35 Saint George Street, Toronto, Ontario M5S 1A4, Canada. A. Gutub, Center of Research Excellence in Hajj and Omrah, Umm Al-Qura University, P.O. Box 6287, Mecca 24382, Saudi Arabia. Corresponding author: B. Alshalalfah, balshalalfah@setsintl.net.

Transportation Research Record: Journal of the Transportation Research Board, No. 2350, Transportation Research Board of the National Academies, Washington, D.C., 2013, pp. 111–118.
DOI: 10.3141/2350-13