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Options of Transport during Parali Burning Period: A Case of Saharanpur Town in Western Uttar Pradesh, India

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Abstract – The swift rise of private motor vehicle use in high-income countries has triggered significant congestion problems in most cities and has also led to high reliance on gasoline, air pollution and high greenhouse gas per capita emissions. However, high increases in car usage and congestion and air pollution are still visible in towns around low-income countries – which have struggled to tackle this increase in traffic transport infrastructure and management. This article discusses the issues facing a relatively small town in India, Saharanpur, with rapid growth in private cars coupled with restricted local potential for expenditure and a high utilization of vehicles not driven by motor cars. The outcomes of field surveys for the five major roads of the city were presented and the high levels of congestion and air quality were highlighted. The paper also provides an alternate scenario that illustrates public transit promotion.

Key Words – Air Pollution / Congestion / Transport.

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INTRODUCTION

The urban population of India is increasing quickly and now accounts for about one-third of the total population of the world. Cities with more than 100,000 residents (called Indian Class I cities) have over 65% of Indian urban population, and Indian is now the second largest urban population in all countries. India (China having the largest). Rapid development in every town's population results in major land use shifts, including residential, commercial and industrial land transition, and a rise in transport demand. The increased usage of motored vehicles has been inextricably related to urbanization in India, as in most other countries in recent decades. Urban mobility is of special concern since there is always pollution in the form of small areas and large densities of land-intensive human travel types (cars, motorcycles / scooters and three-wheel motor vehicles like auto rickshaws). The root causes and effects of pollution in both cities are close. However, cities in India are distinguished by the following relative to cities in high-income nations:

- slightly lower levels of motorized transport and travel criteria, with many driving on or off the road;
- higher economic growth rates, more population growth and more motor vehicle growth;
- greater densities of population;
- much smaller electricity per capita than carbon dioxide emissions per capita;
- Limited access to finance and new infrastructure for the climate.

Although the number of cities in India has become much lower, the rates of trips and fossil-fuel use per person are lower, most suffer from elevated road traffic, overcrowded public facilities, bad conditions for pedestrians and bikers, and many are impacted by the air and by accidents caused by high levels of automobile emissions. This concerns not only the exponential rise of the number of motor vehicles, which between 1990 and 2000 rose from 21 million to 43 million, but also the lack of interest in infrastructure transport. Traffic congestion implies lower rates of traffic, longer journeying periods and higher fuel demand, air emissions and road users' inconvenience. Providing an effective and environmentally friendly transport infrastructure is now an important problem for Indian cities to boost both the standard of urban life and the development of their inhabitants. Naturally, in various urban centres the pattern of transport varies, as it depends on variables like community scale, shape and function, job characteristics, industrialisation, economic development and topography. But in several towns, the number of motor cars has risen exponentially, coupled with limited availability of public transit facilities and badly controlled economic growth. Congestion and air quality issues are expected to escalate without improved control. These problems are discussed in the small town of Saharanpur in this article. It summarises the results of a transport study of the five major roads in the region and considers an alternate scenario for congestion and emission control.

Cities and cities play an important role in cultivating economic development and growth. Though less than 1/3 of citizens in India reside in cities and towns, they make up over 2/3 of the country's income and account for 90% of government revenues. In the next several years, with India rapidly urbanised, urban cities will play a key role in maintaining high growth rates. But economic momentum can be maintained only by leveraging their energy to increase the metropolitan contribution to national incomes, if cities are running effectively. The effectiveness of its transport systems, that means the effectiveness with which people and goods are transported throughout the city depends largely on city quality. Weak transport systems hinder economic growth and development, and the net impact can cause both domestic and foreign markets to lose competition. While Indian cities in developing countries have a lower rate of automobile ownership, the amount of cars per capita than their peers, the figures are worse than those in industrialised cities. This paper offers an analysis of the concerns and difficulties of urban transport in India. It focuses mainly on the regions that are relevant strategically, rather than addressing any part of urban transport. The paper explores the patterns of vehicle development and transport facilities availability in India's cities for the first time. This is accompanied by a conversation about the existence and scale of the issues related to urban mobility including congestion, noise and traffic injuries. The paper offers policy steps for developing urban transport in India, drawing on this context.

The urbanisation rate has not even postponed, not to mention stopped in view of all the objections. There is a continuous recognition of any inevitability regarding the method. Urbanization is now thought to be important to share new technologies for the development and evolution of the national economy as a whole. More than sixty percent of national income is contributed by metropolitan areas in India. In the next several years, with India rapidly urbanised, urban cities will play a key role in maintaining high growth rates. But economic momentum can be maintained only by leveraging their energy to increase the metropolitan contribution to national incomes, if cities are running effectively. Mobility or lack of it directly impact the economy of cities and the well-being of their citizens. The effectiveness of its transport systems, that means the effectiveness with which people and goods are transported throughout the city depends largely on city quality. Weak transport systems hinder economic growth and development, and the net impact can cause both domestic and foreign markets to lose competition. Though Indian cities in developing countries are at lower rates of car ownership than their hometowns, they suffer worse than cities in developed countries, delay, emissions and accidents. The crisis in transport also has a human effect. The figures suggest that the main cause of injury deaths in Indian cities is road crashes. The predominant cause for all of this is the prevalent modal mismatch, aside from the shortage of transportation facilities and its improper use. In recent years, public transit services in cities have struggled to keep pace with a rapid and important rise in demand. In response, individual modes, such as bicycles, scooters, motorcycles, automobiles and intermediate public transit, such as rickshakes, tempos and taxis, have been channelled into. It should be understood, in general, that strategies should be structured in such a way that the need to travele in individual modes is minimised and in particular, the need to utilise the bus system, encouraged by public transit. Many would be achieved to take a big part in the life of a community by mass transit. Forms are required to increase the standard and quantity and enforce limits on the usage of private cars.

A holistic approach is required to address crop residue burning. This includes a multi-disciplinary and multi-agency setting involving technical agencies, market-based economic tools, supporting agricultural and environmental policies, and awareness and capacity building for farmers.

In the short term, misconceptions among farmers regarding paddy straw management needs to be resolved. These misconceptions include improvement in soil fertility due to stubble burning and reduction in yield due to use of in situ machines. Even though national schemes provide for establishing farm machinery banks to provide hiring services to farmers, there are serious issues of timely availability of machines to farmers. To address the issue of paddy straw burning, crop residue management needs to be made cost-effective for the farmers. This is another priority action that concerned agencies need to deliver on.

In the medium term (the next seven years), there is a need to encourage crop diversification and rotation. While technological interventions for the management of crop residue may be useful in the short term, crop diversification as a policy intervention needs to be emphasized by the government given the multiple environmental externalities of present cropping patterns, such as depleting groundwater, poor soil quality and air pollution. Crop diversification can improve resilience from the effects of greater climate variability and extreme events. It can be implemented in various ways such as crop rotation, poly-cultures, increased structural diversity, or agroforestry.

There also needs to be a central coordinating mechanism for paddy stubble management and crop diversification with adequate resources, and a clear assignment of responsibilities between national and sub-national agencies. The target should be putting a stop on crop residue burning at any cost, especially during the COVID-19 pandemic.

A detailed study involving all stakeholders is required to understand slow progress towards crop diversification in spite of regulatory policy nudges and fiscal policy incentives announced by both central and state governments. A push towards crop diversification package should be a mix of policy measures such as encouragement of agro-business enterprises – possibly under Aatmanirbhar Bharat Abhiyan (Self-reliant India) – farmer awareness campaigns, economic incentives such as minimum support prices for alternative crops, along with infrastructure support such as agricultural inputs for identified alternative crops, cold storage facilities and market promotion mechanisms.

Public transit systems- It is therefore important to allow citizens to use non-powered carriage and to improve the protection of this investment. The main players in economic development are towns and cities, and mobility within and between towns are important for the enhancement of quality of life.

Introduction to Saharanpur

Saharanpur is located on the west side of the most heavily populated state of India, Uttar Pradesh between the Uttaranchal hilly state (to the north) and Uttar Pradesh plains (to the south). It is the second largest city in its region, and the headquarters of the district. According to the 2001 census, 455,000 residents reside within municipal areas (the population density is 239 per hectare), although a population of 600,000 is estimated for 2005 by the Town & Country Planning Agency. Located between the two main Indian rivers Ganga and the Yamuna, the city is located on a productive land with a well-developed agro-based commodity industry. It also serves the residents of the hilly area of Uttaranchal as a service hub for the surrounding towns. Several factories have been developing in Saharanpur over the past 25 years and this has changed the town's economic fabric. The region has booming industries such as the paper sector, straw board industry, tobacco and cigarettes as well as several medium-sized agriculture, automobile and hosiery industries. The city is also renowned for its wood sculptures sold to many nations. Saharanpur has been linked with other sections of the world by five major roads that converge on Ghanta Ghar, nearly in the middle of the city (Figure 1): This economic success helps understand how rapid change has taken hold in and around the city:

- **Delhi Road:** the highway links the city with the capital of India. It brings a strong traffic flow since the bulk of traffic is in and out of the area. It is moving from the southwest.

- **Ambala Road:** Another significant route that links Punjab, Haryana and Jammu-Kasmir.

- **Aambala Road:** It reaches the city from the west and several farm items, inputs and machinery pass along the way.

- **Chilkana Road:** it links the town of Chilkana with numerous rural settlements as a means of entering the north. It acts as an agricultural goods transport path from the surrounding areas.

- **Chakrata Road:** it links the town to Chakrata city and several villages on entering from northeast. The town joins through this road with farm produce and building materials from surrounding regions.

- **Dehradun Road:** from the west, this connects the town with Uttaranchal hill state, and commodities and tou rists cross this path to Massourie and Dehradun hill stations.

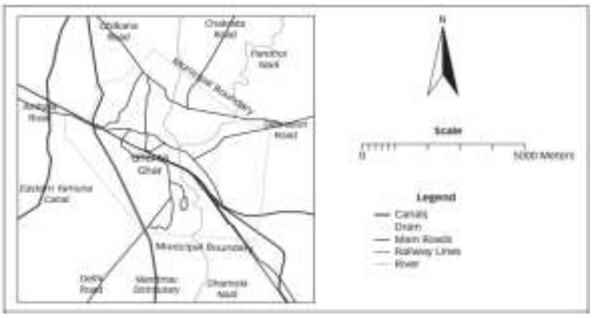

FIGURE 1 Saharanpur City surveyed roads

TABLE 1 Volume of vehicles on important roads of Saharanpur, 2003

Roads/vehicles		Heavy vehicle	Light motor vehicle	Two-wheeler	Three-wheeler	Cycle	Cycle rickshaw	Bullock driven cart	Total motorized vehicles	Total non-motorized vehicles	Total
Delhi Road	Vehicles/hour	6	21.3	63.3	11	106	31	1.9	107.6	137.9	245.5
	Vehicles/day	145	313	1567	361	2516	565	46	2,384	3,308	5,692
Ambala Road	Vehicles/hour	9	14.2	37.8	10	126	30	1.8	87	137.8	224.8
	Vehicles/day	171	342	1,388	241	3,026	722	41	2,092	3,787	5,879
Chilkana Road	Vehicles/hour	2	9.1	53.5	8	88	23	1.1	73.6	112.1	185.7
	Vehicles/day	47	217	1,284	193	2,112	551	26	1,745	2,689	4,429
Chakrata Road	Vehicles/hour	3	6.9	41.1	6	74	18	0.5	57	92.5	149.5
	Vehicles/day	77	167	986	145	1,776	432	13	1,369	2,220	3,589
Dehradun Road	Vehicles/hour	5.2	20.5	60	12	97	34	1.2	97.2	132.2	229.9
	Vehicles/day	124	492	1,440	289	2,328	815	29	2,347	3,172	5,519

SOURCE: Based on field survey, 2003.

DATA AND METHODOLOGY

This paper mainly draws on field surveys carried out in September 2003 for the five main roads in town which measure traffic congestion, traffic volume, traffic mobility and transport pollution. This was complemented by secondary evidence, primarily from state documents. Data on vehicles were registered on the 3 usual working days, at four-hour intervals for a total of 1 hour, i.e. at 00:00, 4:00, 8:00, 12:00, 16:00 and 20:00. The traffic information was obtained on a daily basis. The total flow of vehicles for the whole day was calculated on the basis of this evidence. The vehicle emission is estimated in line with TERI's average emissions (The Energy and Resources Institute).

Burning crop stubble

With the onset of winter, farm fires become rampant in northern India, particularly in the states of Punjab, Haryana and western Uttar Pradesh. The problem of poor air quality is exacerbated in the already disadvantageous landlocked Delhi, where pollutants get trapped, unlike in coastal cities where they are swept out to sea.

Over the years, parts of Punjab, Haryana and Uttar Pradesh have moved to specialized short-duration varieties of rice-wheat cropping systems. With the adoption of these varieties – rice crops (June/July to October/November) followed by wheat crops (November/December to March/April) – rotation has become popular in areas which earlier produced only wheat or rice in any one farming year. However, this cropping system – perceived as “efficient” – has come at a huge environmental and health cost.

The main reason for paddy (rice crop) stubble burning is the short time available between rice harvesting and sowing of wheat; a delay in sowing wheat adversely affects the wheat crop. The short timeframe available between rice and wheat crops can also be attributed partly to the 2009 U.P Preservation of Subsoil Act, where paddy transplantation date is fixed for June 20 which pushes ahead the harvesting of rice crop. As a result farmers get less than 20-25 days between two crops, and hence the quickest and easiest solution is to burn the crop residue. It is estimated that 20 million tonnes of rice stubble are produced every year in U.P, out of which 80% is burnt on the farm. This is unlikely to contain stubble burning.

Stubble burning creates a negative externality in the form of emissions, with implications for climate change and health costs to people in affected regions, as well as disruptions in economic activity (cancellation/delays in flights and trains, and slow road traffic and accidents). Stubble burning emits fine particulate matter (PM2.5), an air pollutant that is a concern for people's health when levels in the air are high; the particles can get trapped inside the lungs and increase the risk of lung cancer by 36%. The cost of air pollution due to stubble burning in India is estimated to be $30 billion annually. Burning 1 tonne of rice accounts for a loss of nitrogen (5.5kg), phosphorous (2.3 kg), potassium (25 kg) and sulphur (1.2 kg) in the soil. Moreover, the heat from burning crop residue kills critical bacterial and fungal populations in the soil, apart from organic carbon.

Since air quality is a public good, central coordination to tackle the problem becomes even more important, implying that the government would need to either share the cost of compensation or the cost of abatement (reducing stubble burning), or both in different measures. Broadly, the application of incentive-based regulation can be a potential cost-effective way to control air pollution.

Car traffic in Saharanpur Characteristics

The number of vehicles in Saharanpur increased four-fold over 30 years, from an approximate sixteen thousand in 1971 to sixty-four thousand in 2001[10] due to rises in wages, weak public transportation service and uncomplicated urban growth. In 2001 alone, Saharanpur Road Transport Office had 82,371 bikes, 76.5% of which were two-wheelers and 16.1% were tractors. The road infrastructure has little upgraded, considering the growing number of automobiles in the area. Traffic of vehicles on the Saharanpur's main roads was graded as:

- **Motor vehicles,** including large diesel-powered (including buses and trucks), medium heavy-duty vehicles, four-wheel private car, jeep, etc.) vehicles, three-wheelers and two-wheelers;
- **Non-motor vehicles**, covering bikes, rickshaws cycles and bullock-driven carts.

The survey showed Saharanpur's main roads had a high flow of traffic (estimated at 25,308 trucks every day but more non-motorized cars than motorised vehicles were important. The maximum traffic flow on Delhi Route, averaged 5892 cars daily followed by Ampalah Road, Dehradun Road and Chakrata Road, followed by Ambala Road (5879 cars daily) and Dehradun Road (5519 vehicles daily), and Chilkana Road (3,589 vehicles per day). On all highways, the proportion of non-motorized cars (70%) was higher that of motorised cars (Table 1). The roads of Delhi, Dehradun and Ambala were connected with their relation between the town and the important areas of resource. Their numbers were higher. The streets of Chilkana and Chakrata connect the town with rural towns and have a higher number of non-motorized vehicles. The two- and three-wheelers were notable in the motorised vehicles and the proportion of motorcycles and rickshaws was similarly wide in the non-motorised vehicles.

Saharanpur road jams

Different modes of transport have been transformed into passenger car units (PCU) to assess the degree of pollution on the Saharanpur highways.

TABLE 2 Passenger Car Unit (PCU) equivalents for different vehicles

TABLE 2
Passenger Car Unit (PCU) equivalents for different vehicles

Vehicle	Equivalent PCU factor	Type of vehicle
Bus/truck	3	Motorized
Light motor vehicle	1	Motorized
Auto rickshaw	1	Motorized
Two-wheeler	0.5	Motorized
Cycle rickshaw	1.5	Non-motorized
Bicycle	0.5	Non-motorized
Bullock cart	6	Non-motorized

on dimension, pace and radius rotation (Table 2). Owing to their higher speeds and slower acceleration, the non-motorized vehicles also earned a greater PCU factor. Bullock carts, as a consequence of their sluggish speed, weak acceleration, higher frequency and larger turning radius, have been given a maximum PCU factor. The survey found that strong motorised and unmotorized traffic movements existed throughout the day but not so often in the night, on the main roads of Saharanpur. During peak business hours, congestion is notable, Delhi Road becoming the most congested (Table 3). It was 4,837 CPUs per day, accompanied by Ambala Road (4,563 CPUs per day), Dehradun Road (3,329 CPU per day and Chakrata Road (3,282 CPU per day) (2,450 PCU per day). The major cause in pollution was the large proportion of non-motor vehicles on all highways. On Delhi Road at midday, the highest congestion was 987 PCUs an hour, and on the Chakrata Road at 00:400, it was a minimum of six PCUs per hour.

Saharanpur trip length

This survey also calculated an average journey length, indicating high variance in time and distance. In the morning and evening there were longer ride periods, with shorter journey lengths at noon. The roads of Chakrata and Chilkana were longer, while the road in Delhi was the largest proportion of the trips (Table 4). Due to the fact that various citizens come to the town for work and promotion, the trip lasted longer on Chakrata and Chilkana highways. During the day the duration of the journey was shorter and more travel was pushed inside the region by the people.

Saharanpur pollution rate

The primary cause of air pollution in the Saharanpur is motor vehicles. Motor vehicles produce carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide, particulate suspended and plumb for petroleum-powered vehicles. Carbon monoxide and hydrocarbon levels are more pronounced when vehicles hurry and when automobiles speed up, the overall suspended and the concentrations of nitrogen dioxide are greater. All.

TABLE 3 Traffic congestion on the important roads of Saharanpur, 2003

Roads/vehicles	Passenger Car Units (PCU)	Heavy vehicle	Light motor vehicle	Two-wheeler	Three-wheeler	Cycle	Cycle rickshaw	Bullock driven cart	Total motorized vehicles	Total non-motorized vehicles	Total
Delhi Road	PCUs/hour	18	21.3	32.7	15	52.5	46.5	15.3	87	114.3	201.3
	PCU/day	435	513	783.5	361	1,259	1,117.5	368	2,092.5	2744.5	4837
Ambala Road	PCUs/hour	15	14.3	28.9	10	63	45	14	68.2	122	190.2
	PCU/day	363	342	694	241	1,512	1,083	328	1,640	2,923	4,563
Chilkana Road	PCUs/hour	6	9	26.8	8	44	34.5	8.6	49.8	87.1	136.9
	PCU/day	141	217	642	192	1,056	826.5	208	1,192	2,090.5	3,282.5
Chakrata Road	PCUs/hour	9	6.9	28.5	6	37	27	4	42.4	68	110.4
	PCU/day	213	167	693	145	688	648	96	1,018	1,432	2,450
Dehradun Road	PCUs/hour	15.5	20.5	30	12	48.5	51	9.7	78	109.2	187.2
	PCU/day	372	479	721	289	1,164	1,122.5	232	1,811	1,518.5	3,329.5

TABLE 4 Average trip lengths on important roads in Saharanpur, 2003

Roads	<15 km	10–15 km	5–10 km	2.5–5 km	>2.5 km
Delhi	12	11	20	17	40
Ambala	8	15	22	30	25
Chilkana	35	20	10	15	20
Chakrata	40	22	17	8	13
Dehradun	15	17	24	20	24

These pollutants are harmful not just to human health but also to the atmosphere in different degrees. Vehicle emissions are especially alarming as they are produced on the ground and are exposed to automobile contaminants so many individuals work, travel and function along the way. Such pollutants often lead to broader ecological concerns, for example nitrogen oxides and hydrocarbons, which contribute to the contamination of photochemical oxidants and nitrogen oxides to the acid rain. The high proportion of older and badly maintained motor vehicles (with higher emission levels) is significantly affecting traffic congestion in Indian cities (Table 5). Higher number of automobiles that produce 10 times more hydrocarbons and fumes with two-stroke motors (motorcycles and scooters) and adulterated diesel.

Monoxide in petroleum. Average carbon monoxide in the essential roads of Saharanpur is 197,626 g/day (Table 6). The emissions for this pollutant are greater from 2-wheel, 3-wheel drive (automatic fuel rickshaw) and older car and jeep types, both of which are the most used. Delhi Road receives maximum carbon monoxide emissions on major highways, an average of 51,528gm/day followed by Dehradun Road, Ambala Road (40,500gm/day) and Chakrata Road (25,359gm/day). Amongst the most important routes, the highest carbon monoxide emissions are the Chilkana Road.

Carbon dioxide. Emissions of hydrocarbons resulting from both gasoline and combustion. Emission ratios of the two-wheelers three-wheelers and older cars and jeeps are higher. On average, hydrocarbons on the major roads of Saharanpur are 73,893 g/day. The maximum emissions are on the Delhi Route, with an average of 21,675 gm/day followed by Dehradun Road, Ambala Road, Chilkana Road, 16,929 gm/day and Chakrata Road (13,041 gm/day). The other frequent roads include the Delhi Road.

TABLE 5 Pollutant emissions (gm/km) in Indian vehicles

Type of vehicle	SO_2	NO_2	PM	HC	CO
Two-wheeler	0.02	0.07	0.2	10.0	17.0
Light motor vehicle	1.0	3.2	0.33	6.0	40.0
Auto rickshaw	0.25	0.60	1.3	14	7
Heavy vehicle (diesel-operated)	1.5	21.0	3.0	2.1	12.7

SOURCE: Based on Central Pollution Control Board specifications. See CPCB (1999), "Central Pollution Control Board – auto emissions", *Parivesh Newsletter* Vol 6, No 1, June, New Delhi.

Particulate matter. Emissions in heavier diesel engines are larger. The total regular route on the main roads in Saharanpur is 5,025 gm. The maximum emissions from Delhi road are attributed to a higher number of heavy vehicles, followed on the roads of Dehradun Road (1198 gm/day), Ambalan Road (1067 gm/day), Chilkana Road (718 gm/day) and Chakrata Road (654 gm/day). On the other the highest particle emissions are due to a greater number of roads.

Dioxide in acid. Sulfur dioxide, the respiratory irritant, is the cause of atmospheric amounts, often by the usage of high-sulfur gasoline. Heavy cars have higher pollution standards and automotive emissions alone indicate sulphur dioxide on the main roads of Saharanpur at an average of 2,933 g/day. The largest emissions on the major roads include Delhi Road (an average 852 gm/ day), Dehradun Road (779 gm/day), Ambala Road (612 gm/day), Chilkana Road (362 gm/day) and Chakrata Road (329 gm/day).

Nitrogen dioxide In metropolitan environments, traffic leads primarily to the emissions of nitrogen dioxide. Higher pollution levels are seen in heavy vehicles and vehicle emissions on main highways in Saharanpur average about 17411 gm/day. The maximum emissions on the main roads include Delhi Road (5 013 g/day on average) and then Dehradun Road (4,453 g/day), Ambala Road (3,877 g/day), Chakrata Road (2,181 gsm/day) and Chilkana Road (1,886 gsm/day).

TABLE 6 Emission of vehicular pollutants on important roads of Saharanpur City, 2003

Pollutants	Emission	Delhi Road	Ambala Road	Chilkana Road	Chakrata Road	Dehradun Road	Total roads
Sulphur dioxide	gm/hour	35.4	25.7	15.2	13.7	29.9	119.9
(SO_2)	gm/day	852.1	611.5	361.2	329.5	779.1	2,933.4
Nitrogen dioxide	gm/hour	207.7	160.6	79.6	91.6	84.7	624.2
(NO_2)	gm/day	5,012.9	3,877.2	1,886.5	2,181.4	4,452.7	17,410.7
Particulate matter	gm/hour	57.6	44.3	30.1	27.3	142.7	302
(PM)	gm/day	1,387	1,066.8	718.5	653.8	1,198.5	5,024.6
Hydrocarbons	gm/hour	1,003.4	813.5	705.7	548.6	918.5	3,989.7
(HC)	gm/day	2,684.7	19,560.1	16,928.7	13,041.1	21,678.4	73,893
Carbon monoxide	gm/hour	9,811.7	1,685.3	1,354.1	1,064.9	1,934.8	15,840.8
(CO)	gm/day	51,527.5	40,499.7	32,448.9	25,358.7	47,791.8	197,626.6

SOURCE: Based on Field Survey, 2003.

MITIGATION STRATEGIES FOR STRESSED ROADS IN SAHARANPUR CITY

The threshold of a rising pollution problem for Indian cities such as Saharanpur is raising air poisoning. Though greenhouse gas emissions per citizen continue to be low by international standards, fast rising development and increasing road traffic in urban settlements such as Saharanpur help render India a big source of greenhouse gas emissions. Currently, the issue of congestion and emissions in smaller communities has no focussed emphasis or coherent approach. Some attempts were made to resolve automobile pollution in a haphazard and timid way, in particular after the involvement of the Supreme Court of India, without leading to full gain or having a discernible effect on mobility demand and vehicle emissions. The reduction in pollution by cars per kms travelled and the reduction in the overall amount of kilometres journeys are two fundamental approaches. In other terms, air quality regulation and greenhouse gas mitigation policies should strive for reduction and management of pollutant emissions from motor vehicles and for more effective usage of motor vehicles. Around the same period, more effective usage of cars leads to congestion reduction. The more efficient method to minimise emissions has been proposed by carbon tax, as this offers an opportunity for customers to go for the least-cost option for these two methods. However in fact, this tax should be supplemented by successful control of pollution that in India is difficult to impose. A more realistic approach will be a combination of command and control instruments and market-based instruments to mitigate pollution and pollutants. These comprise:

- petrol, automobile and parking taxes;
- incentives and rules on possession, use and transportation of vehicles;
- control of traffic;
- Provision of alternatives to public transit.

In order to maintain the design requirements for cars in accordance with emissions, for instance the implementation of vehicles built to follow tighter pollution standards and retrofits of other forms of fuel amendments, there are many ways to accomplish the first goal of lowering automobile emissions per km of vehicles driven, such as implementing improved maintenance standards on current vehicles Secondly, the loss in gross kilometres of cars driven. This can be done either by reducing overall travel demand or by changing the combination of vehicles required for passenger transport. Partially, the first choice is to raise travel costs. However the overall demand for travel is more significant. Altering the vehicle mix used for transporting passengers calls for policies which exclude individuals from the use of private cars for public transport. A two-way approach is required in the Indian sense. The first is to improve the expense of driving private vehicles. Options involve traffic administration (e.g. one-way networks, shutting sidewalks, pedestrian areas solely downtown and providing buses only and market management (such as increased parking fees, road tolls, fuel taxes and car-pooling programmes). The second attempts to provide alternatives to private cars that can support, in the first case motorcycles, either larger cars (fleeting vehicles, buses or public transit). Without suitable transport choices, higher road charges will contribute to a substantial decline in actual traffic prices and higher financial costs. In the Saharanpur case an alternate traffic scenario is suggested here, with its present average transport demand of 40.526 passenger kilometres per day. This situation underlines the recent movement towards growing the usage of commuter travel by public transport which does not alter the way non-motor vehicles are used – in part due to the economic situations of the citizens who use these vehicles. In order to cover each kilometre of passenger transport requires, the literature indicates that a vehicle absorbs almost five times more energy than a 52-seat bus with an average load factor of 82 percent. A automobile is more than 38 times more than a bus; for 2 and 3-wheelers 54 and 15 are the equivalent estimates. The petrol per km of passenger transport costs 6.8 times, 7 times and 11.8 times more for a two-wheeler, 3-wheel drive and a sedan relative to a truck. For two and three-wheelers, the average cost of service per kilometre is 9.5 times greater than for a truck and 9.5 times more for a vehicle than for a bus.

Personalized transport which would not alter the use in part owing to the economic conditions of the community utilising non-motorized automobiles. The literature available shows that a car requires almost five times more energy to satisfy a kilometre of passenger transport demand than a 52-seat bus with an average charge factor of 82 per cent, whereas a 2/6 wheelers and a 3-wheelers consume three times more energy. A truck has more than 38 times more traffic than a bus; 54 and 15 are respectively of the equivalent numbers for two- and three-wheelers. The petrol per km of passenger transport costs 6.8 times, 7 times and 11.8 times more for a two-wheeler, 3-wheel drive and a sedan relative to a truck. For two and three-wheelers, the average cost of service per kilometre is 9.5 times greater than for a truck and 9.5 times more for a vehicle than for a bus. On the basis of the survey results, the alternative Saharanpur scenario was established.

- **Current demand on the surveyed roads:** the number of automobiles on the surveyed roads has increased dramatically. During everyday rush hours, car number was strong and here individual forms of transport could be supplemented by mass transport.

- **Duration of travel:** the survey revealed a difference in length of trip on multiple routes. Public transit could be prioritised in the alternate situation that it takes longer to drive, but still those who travel shorter should still be given the chance of public transport by recognising exits at large road junctions.

- **Congestion:** The report illustrated the substantial congestion contribution owing to the growing usage of personal modes of transport (in particular double-wheelers, which are conveniently operative in heavy traffic). Alternatively, mass transit will be encouraged to alleviate road pollution at high speed.

- **Road carry power:** the traffic level was outside their capacity on all roads surveyed for a long period of time. The only way to smooth traffic will be the decrease of volume.

- **Pollution levels:** greater usage of lower emission-driven public transit vehicles may help minimise the volume of road contaminants.

The alternative scenario indicates that improving public transport would mean a 53 percent decrease in the overall vehicles used on the roads under survey and might raise heavy vehicles between 179 and the present intensity of 508 (Table 7). The number of light motor cars will be 62% lower, the number of two-wheelers will be 57% lower and the number of three-wheels will be 68% lower. This will decrease transport pollution by 40%, and major reduction of pollutants from cars including decreases in sulphur dioxide and particulate matter by 30 to 36% and reduction in carbon monoxide and hydrocarbon emissions will also be expected. The greater provision of public transit is inadequate, though to draw citizens to public transport and to automobiles or motorcycles. In order to obtain greater riding for public transit, disincentives are important for the usage of private cars. In the same manner, the provision of alternate public transit is not enough to minimise pollution or pollutants. When vehicles turn to public transport, some start to drive despite getting a small decline in congestion. Therefore a holistic solution – both traffic regulation and pricing – which also decreases vehicle use, is often necessary to attack urban congestion.

TABLE 7 Saharanpur: implications of promoting public transport in place of individual mode of transportation

	As per present trends					As per alternative scenario				
	HV	LMV	2-wh	3-wh	Total	HV	LMV	2-wh	3-wh	Total
Total travel demand (in passenger km/day)	25,400	6,924	6,667	1,535	40,526	34,358	2,636	2,889	651	40,526
Modal split	5%	17.1%	65.8%	12.1%	100%	84.4%	13.9%	60.7%	11%	100%
Number of vehicles	508	1,731	6,667	1,228	10,134	687	659	2,889	521	4,756
Passenger Car Units	1,524	1,731	3,333	1,228	7,816	2,061	659	1,444	521	4,685
Composite air pollution loading (all vehicles)	SO_2	NO_2	PM	HC	CO	SO_2	NO_2	PM	HC	CO
Emission per day – gm/km	2,933.3	17,450.7	5,005	95,314.8	198,126	1877.5	17050.6	3533.6	41328.7	87844.9

CONCLUSION

Transport demand has significantly increased in most of the Indian cities due to the population rise, both as a consequence of natural growth and migration from rural and smaller towns. It has been further enhanced by the provision of motor transport, household income rises and the rise of economic and manufacturing activities. The Indian towns, sadly, have struggled to maintain pace with the fast and important rise in travel demand in public transport networks. City train networks and well-organized bus services are restricted to just a number of large municipalities. Qualitatively, there is an overcrowding of public transit facilities at busy hours and lengthy waiting times. This leads to a huge shift into customised transport, especially cars and double-wheeled automobiles, and also a rise in the number of different intermediate forms of public transportation, such as cars and taxis. The growing usage of private cars in cities has modified their modal structure rapidly. The motorization of high-income sectors of the metropolitan communities could have brought a better mobility, but their detrimental effect is still important in the context of congestion, air pollution and traffic accidents. Though motorization-inherent, these impacts have a great deal to do with unfitness to successful public policy in many Indian cities. The town cannot continue to handle only private vehicles and two-wheelers and it must be understood that towns in particular will not be feasible without public transit in general and bus transport in particular. Although the people's wages are one of the big factors for the structure's transition in split models, the other reasons are the public transit infrastructure itself. The adoption of private mode as principal mode of transport is preferred by speed, standard of operation, comfort, versatility and availability. Given this incentive, there are widespread disclosures of transit interests, but local councils in several areas fund essential public transport systems. Special programmes, such as premium or guaranteed seats in exchange for higher prices, are also called in equalitarian. As a result, many who are willing to buy private cars abandon public transit successively. The key role of public transport was until recently to address the particular needs of poorer community citizens, but now it has to lead to the relief of pollution and the protection of the environment. In order for it to serve its new purpose, enough people are to be drawn away from the vehicles, two-wheelers, auto-rickshaws and taxi. A severe dimension is also taken up by the issue of acute traffic delays, rised air pollution and high risk accident in metropolitan India, and the standard of life of the people is degrading. This dilemma will escalate without vigorous intervention, as the rising demographic in the coming decades is placing further strain on the system and the target of the economic growth. A holistic policy is needed to reduce traffic congestion, pollution from cars and danger of accidents. Sustainable high quality connections for citizens, products and services to form and inside the city should be a key priority of this policy. Strategy can be planned to reduce the need for customized forms of travel and encourage the infrastructure of public transport. This not only calls for ever more strict pollution requirements, clean fuel specifications, adequate in-use car servicing, maximum transport market pricing, supply side control steps and even for a full redesign of the public transport system. Now is the time for action. The urbanisation phase in Saharanpur is marked by a severely strained infrastructure resulting from rapid population growth and road traffic growth and a lack of coordination of the planning and construction of infrastructure facilities between different government authorities. Road transport is the most critical transport form in the region, and undoubtedly will remain so, marked by congestion and high air pollution. An investigation of traffic on major roads in Saharanpur has concluded that public transport promotion could be the most successful form of reducing both noise and congestion in the region.

Various policy measures at the national and sub-national levels seek to resolve the problem of crop stubble burning in India. A National Policy for Management of Crop Residues is in place, along with a Crop Diversification Programme. According to the law, violators can be charged for non-compliance under the Air (Prevention and Control of Pollution) Act. There are also schemes to promote in situ and ex situ crop residue management through such farm equipment as the “happy seeder”, rotavator and baler. However, there are many gaps in terms of policy design, implementation and awareness.

In terms of policy design, the national programme on crop diversification does not have clear provisions on outreach activities to inform farmers about alternate crop options. Similarly, there is insufficient convergence with other programmes, such as the National Rural Employment Guarantee Scheme, National Rural Livelihood Mission and agro-enterprise related schemes, which could help with the management of paddy stubble or crop diversification. In terms of implementation, much-needed equipment is still unaffordable to many farmers despite subsidy provisions. Constraints in the supply chain and rental markets are other issues impacting the adoption of the happy seeder and other farm machines, and there is little awareness about new technologies and alternate cropping patterns. However this is suggested by recognising that no single measure will be adequate to tackle this complex problem and that more complete management methods would be needed.

REFERENCES

1. United Nations (2004). World Urbanization Prospects: The 2003 Revision, Population Division, Department for Economic and Social Affairs, ESA/P/WP190, New York, 323 pages.

2. Vasconcellos, E. A. (2001). Urban Transport, Environment and Equity: The Case for Developing Countries, Earthscan Publications, London.

3. TERI (2000), Cleaner Air and Better Transport: Making Informed Choices, TERI Press, New Delhi.

4. CPCB (1999), “Central Pollution Control Board – auto emissions”, Parivesh Newsletter Vol 6, No 1, New Delhi, June.

5. TERI (1998), Air Pollution with Special Reference to Vehicular Pollution in Urban Cities, TERI Press, New Delhi.

6. CSE (1989), “The environmental problems associated with India’s major cities”, Environment and Urbanization Vol 1, No 1, April, IIED, London, pages 7–15.

7. Bhattacharya, M (1977), “Role of municipal government in pollution control”, Environmental Pollution and Urban Administration, New Delhi, pages 62–65.

8. Fazal, S (2000), “Urban expansion and loss of agricultural land. A GIS-based study of Saharanpur city, India”, Environment and Urbanization Vol. 12, No 2, October, IIED, London, pages 133–149.

9. Evteev, S A (editor) (1989). “Environmental problems in cities of developing countries”, UNEP/USSR/IGU, Moscow.

10. Biswas, D K and S A Dutta (1994). “Vehicular pollution – combating the smog and noise in cities”, The Hindu, Survey of the Environment, Chennai, pages 41–45.

11. TERI (1998). Vehicle Emission Control Strategies to Protect the Local and Global Environment: Challenges and Opportunities in India, TERI Press, New Delhi.

12. TERI (1996). CO2 Mitigation and the Indian Transport Sector, TERI Press, New Delhi.

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