



FII FEMINISM IN INDIA

# USAID CLEAN AIR CATALYST: GENDER ANALYSIS OF AIR POLLUTION AND VEHICLE TRANSPORT, INDIA

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## ACRONYMS

ADS	Automated Directives System
APM	Ambient particulate matter
BRTS	Bus rapid transit system
CAC	Clean Air Catalyst
CPCB	Central Pollution Control Board
CNG	Compressed natural gas
CSR	Corporate social responsibility
GBV	Gender-based violence
GDP	Gross domestic product
IPT	Informal public transport
ITDP	Institute for Transport and Development Policy
KII	Key informant interview
MP	Madhya Pradesh
NMT	Non-motorized transport
OMI	Ola Mobility Institute
PM	Particulate matter
SEWA	Self-Employed Women's Association
USAID	U.S. Agency for International Development
WE3	Women's economic empowerment and equality
WIEGO	Women in Informal Employment Globalizing and Organizing
WHO	World Health Organization
WRI	World Resources Institute

## EXECUTIVE SUMMARY

The purpose of the gender analysis is to inform USAID’s recently launched global air pollution program—Clean Air Catalyst (CAC) in India. The CAC is a five-year long program being implemented by the World Resources Institute, the Environmental Defense Fund, and a consortium of partners seeking to understand local pollution sources and identify sustainable solutions for clean, healthy air for better health, climate, and development outcomes.<sup>1</sup>

Evidence shows that, in some ways, air pollution impacts women and girls differently than men and boys. Factors involved may include biological differences, socioeconomic disparities, and unequal gender norms that affect exposure and types, as well as access to and impact of mitigation solutions. It is possible that general improvements in ambient air quality may not sufficiently address the particular sources that affect women’s exposure, and ultimately their health. Seeking to ensure that CAC’s clean air solutions are effective and inclusive, this gender analysis aims to obtain understanding of gender differences in issues, concerns, barriers, and opportunities in potential pollution reduction strategies, specifically, reduction of the impact of vehicular emissions on women and girls. The geographic scope of the review is at the country level for India with a focus, wherever possible, on Indore, Madhya Pradesh (MP). The analysis broadly addresses the following two questions:

1. How do vehicle emissions impact women and girls differently (considering mobility patterns, street life, and street work) due to power dynamics, occupational differences, socioeconomics, cultural barriers, and political barriers?
2. What are the opportunities for and barriers to women’s leadership, decision-making, entrepreneurship, employment, and meaningful participation in catalyzing clean air action to lower vehicle emissions and/or exposure to these emissions ?

The research methodology involved primary and secondary data collection. The research team initially reviewed 68 academic and policy documents and program reports found through Google Scholar, Web of Science, and Academia and supplemented with other literature as the need arose (see Annex B for a list of key documents). Primary data collection involved eight key informant interviews (KIIs), including a total of 13 people, as some respondents brought colleagues with them. Interviews involved researchers, activists, community workers, and women and men in gender, air quality, and transport (see Annex C for the List of Interviews). Key findings and recommendations are summarized in Table 1, 2, and 3, which are structured around three detailed research questions.

**TABLE 1. KEY FINDINGS AND RECOMMENDATIONS: WHAT ARE EXPOSURE DIFFERENCES AMONG WOMEN AND GIRLS, MEN AND BOYS TO AIR POLLUTION FROM VEHICLE TRANSPORT IN INDORE? WHAT ARE THE GAPS IN GENDER DATA FOR AIR POLLUTION EXPOSURE AND TRANSPORT?**

FINDING	RECOMMENDATIONS
In undertaking planned surveys, CAC should note that a household-level analysis does not always yield gender-specific information.	In CAC, planned landscape analysis, and other surveys, conduct individualized (not household - level) data collection and analysis to determine women- and men-specific information and differences between them, e.g., on transport use and emission health effects [CAC, USAID]

Women’s restricted mobility may be a key factor in declining labor force participation at all income levels, more in urban than rural areas, and more worrisome among low-income women.	Consider a study on how much transport-related mobility restrictions impact women’s labor force participation. [USAID]
Women are generally absent as staff and leaders in transport and municipal agencies, but quantitative data on this are unavailable.	In the political diagnosis, carry out an inventory of leaders and staff of transport department and broad range of public, private, and community decision-makers that shape the transport sector in Indore, by sex. [CAC, USAID].
Indore data on women’s employment overall and in high-emissions-exposure occupations are not readily available. However, country-level trends highlight high levels of women’s engagement in informal employment. <sup>2</sup> COVID-19 is also affecting women’s work in this type of employment. <sup>3</sup>	Obtain Indore data on women’s employment overall and especially in occupations with high exposure to toxic emissions, e.g., street cleaning, brick manufacturing, and construction. Use this information to identify targeted communities and high-impact clean air actions for exposure reduction. [CAC, USAID]
Indore data on women’s transport use and needs are not readily available.	Obtain Indore data on women’s transport use and needs. [CAC, USAID]
Some data on gender issues in e-mobility were obtained for this study. Obtaining more information may be useful.	Obtain more details on who’s doing what in e-mobility on gender issues research, employment, and entrepreneurship overall and in Indore. [CAC, USAID]
Data on environmental and women’s organizations in Indore working on air pollution, transport, gender, and women’s rights and empowerment were not readily available.	Carry out a rapid scan of women’s, environmental, and other civil society and research organizations in Indore to determine potential partners on air pollution, gender, and transport issues. [CAC]
Women’s Self-Help Groups (SHGs) may be useful as community-level partners; their number, roles, and capacities are worth exploring further.	Scan women’s self-help groups as potential community-based partners for air quality monitoring, entrepreneurship, and clean air advocacy and link to Government of India Urban Women’s Livelihoods Mission. [CAC, USAID]

**TABLE 2. KEY FINDINGS AND RECOMMENDATIONS: WHAT ARE THE POLICIES, LAWS, AND REGULATIONS THAT SHAPE TRANSPORTATION EMISSIONS—BOTH INTENDED AND UNINTENDED—AND HOW MIGHT THESE LEGAL INSTRUMENTS AFFECT MEN’S AND WOMEN’S EXPOSURE DIFFERENTLY? WHAT ARE GENDER CONSIDERATIONS IN DESIGNING TRANSPORT-RELATED CLEAN AIR SOLUTIONS?**

FINDING	RECOMMENDATIONS
Walking is the most common commute to work for women and men in India, followed by bus for women and cycling and scooter for men. Cost, personal and road safety, convenience, and reliability are the major factors impacting women’s mobility. Constrained mobility may play a part in women’s declining labor force participation in India and be a key barrier to women’s empowerment.	Take into account women’s expressed valuation for affordability, personal security, road safety, convenience, and reliability. [CAC, USAID]
To fulfill their multiple responsibilities, women work closer to home than men or not at all. Low-income women, especially, value work being close by and involving a short commute. <sup>4</sup>	Take into account women’s paid work, additional care responsibilities, and time poverty in designing systems. [CAC, USAID]
Women more than men walk and use non-motorized transport (NMT); use all forms of transport less than men; and rely on all forms of	Reflect women’s priorities along with those of men to design public transport and improvements in NMT facilities and in urban planning more broadly

public transport more than men—reliance on specific vehicles depends on income level.	and throughout institutional and operational systems. [CAC, USAID]
Women’s mobility restrictions, a key indicator of agency and empowerment, are intensified because of public harassment and violence against them.	Reinforce women’s safety, including police-verified drivers and conductors; working and continuously monitored CCTVs; safe, well-lit, well-maintained footpaths to get to and from public transport, and gender sensitization trainings and redressal protocols—technological solutions should be complemented by human-centered solutions [USAID]
Municipal, transport, and MP Pollution Control Board planning, including action plans, do not adopt gender inclusive benchmarks & targets.	Adopt gender-inclusive benchmarks and indicators in municipal, transport, and air pollution control board planning in MP that are not just sex-disaggregated but also reflect women’s priorities. [CAC, USAID]
Street closures to motorized traffic (car-free days or times) to promote NMT use and raise public awareness of the benefits.	Support the adoption of permanent and partial street closures to motorized traffic in Indore to benefit everyone.
Congestion pricing policy research does not typically disaggregate by gender.	Policy research studies should disaggregate by gender; may yield actionable information [CAC, USAID]

**TABLE 3. KEY FINDINGS AND RECOMMENDATIONS: WHAT HIGH IMPACT OPPORTUNITIES/ACTIONS SHOULD THE CAC CONSIDER SUPPORTING TO REDUCE VEHICLE EMISSIONS WHILE ADVANCING GENDER EQUALITY AND WOMEN’S EMPOWERMENT?**

FINDING	RECOMMENDATIONS
The wide gender gap in transport policy, planning, and operations at all levels may be hindering consideration of gender issues. Specific gender-responsive policy guidance for clean air and transport for India is available in Shah et al. (2017). <sup>5</sup>	Continue in a systematic and consistent way to work with government agencies in city planning and transport in Indore to integrate gender needs into design, implementation, and evaluation of clean air projects.  Consult Shah et al. (2017) for gender-inclusive comprehensive and institutionalized transport plans, recommendations, benchmarks and indicators to apply in Indore. [CAC]
Action is needed as follow-up on transport safety studies (like the one WRI did in Bhopal) <sup>6</sup> to demonstrate how to design a system component with gender inclusivity in mind.	Leverage partnership with Indore urban planning agencies to take action on a transport-related infrastructure improvement in a gender-responsive way as, for example, by using Safetipin’s social audit to guide planned street lights installation. [CAC]
Women are contributing as advocacy leaders, scientists, and private sector researchers in important and highly visible ways to mitigate air pollution and improve public transport.	Consider partnering with these leaders and citizens, scientists, private sector, and advocacy efforts on clean air, clean and safe transport and improved mobility and public safety for women [CAC, USAID].  Hold a workshop in Indore drawing on scientists, technical experts, policy advocates and policy makers (women and men) to identify gender issues, co-create solutions, and develop an Action Plan for gender aware air quality management and clean transport planning. Use Shah et al, (2017) as reference guide (CAC). <sup>7</sup>
Women’s and private and civil society organizations and women leaders and citizens are actively involved	Identify civil society and private sector organizations and individuals working on gender in air quality and transport, and consider partnering with them on specific research, awareness raising, planning and

<p>as advocates for clean air and improvements in clean and safe transport.</p>	<p>implementation activities, e.g., Ola Mobility Institute (OMI), Self-Employed Women's Association (SEWA), Centre for Science and Environment (CSE), Safetipin, Institute for Transport and Development Policy (ITDP). (CAC)</p> <p>In CAC Workplan (CAC-WP) Objective I, put women experts on the scientific advisory committee and project committee for.<sup>8</sup> Obtain sex-disaggregated data in CAC studies for committee members to act on. (CAC)</p>
<p>Private sector e-mobility and social entrepreneurs are increasingly interested in women's use and safety needs and in employing women as entrepreneurs and workers.</p>	<p>Consider partnering with private sector manufacturing firms (e.g., E-Ride), social entrepreneurs (e.g., SNV Green Solutions), and research organizations (e.g., OMI) to include Indore in studies and surveys. [CAC, USAID]</p>
<p>There is a need to identify and assess capacity of Indore-based NGOs, women's organizations, and private firms in Indore for potential partnerships.</p>	<p>In CAC-WP Objective I, carry out landscape mapping, and assess the competency and willingness of actors on gender. Include women and women's organizations.</p> <p>Consider partnerships with local Indore organizations, including, if necessary, by helping to build their capacity through linkages with nationally recognized organizations with gender capacity in "learning by doing" activities. [CAC, USAID]</p>

## I. PURPOSE

The purpose of this gender analysis is to inform the U.S. Agency for International Development (USAID)'s recently launched global air pollution program—the Clean Air Catalyst (CAC) in India. CAC, a five-year long program, is developing a data-to-impact methodology to accelerate inclusive clean air action in Addis Ababa, Ethiopia, Jakarta, Indonesia, and Indore in India. The World Resources Institute (WRI) and the Environmental Defense Fund are leading a consortium of partners to implement the program that seeks to understand local pollution sources and identify sustainable solutions for clean, healthy air for better health, climate, and development outcomes.<sup>9</sup>

Evidence shows that air pollution impacts women and girls differently and, in some cases, more severely than men and boys. Factors involved may include biological differences, socioeconomic disparities, and unequal gender norms that affect both exposure and solutions. It is possible that general improvements in ambient air quality may not sufficiently address the particular sources that affect women's exposure, and ultimately their health—an issue discussed in more detail below.

Seeking to ensure that CAC's clean air solutions are effective and support women's economic empowerment, this gender analysis aims to inform the program by obtaining a better understanding of gender differences in issues, concerns, barriers, and opportunities in potential pollution reduction strategies, specifically, reduction of vehicular emissions. The geographic scope of the review is at the country level for India with a focus, wherever possible, on Indore, and the state of Madhya Pradesh (MP) in which Indore is the second largest city. Indore was selected because transport emissions are high in the city and the municipal government has a commitment to reducing them.

The analysis broadly addresses the following two questions:



1. How do vehicle emissions impact women and girls differently (considering mobility patterns, street life, and street work) due to power dynamics, occupational differences, socioeconomics, cultural barriers, and political barriers?
2. What are the opportunities for and barriers to women’s leadership, decision-making, entrepreneurship, employment, and meaningful participation in catalyzing clean air action to reduce vehicle emissions and/or exposure to these emissions?

Table 4 includes additional, more detailed research questions, which the analysis addresses in greater detail. The questions in the table were at first designed to be answered by interviewing five key informants, experts, and stakeholders with more specialized local knowledge of Indore. In the end, respondents did not always have Indore-specific information. Therefore, findings reported here present combined data and evidence from the interviews and the secondary literature, wherever it was available, or by relying on India-wide or global information where it was not.

**TABLE 4. DETAILED QUESTIONS FOR THE GENDER ANALYSIS**

RESEARCH QUESTION	SUB-QUESTIONS
<b>Question 1:</b> What are the vehicle transport exposure differences among women and girls, men and boys to air pollution from vehicle transport in Indore (or India)?	<ol style="list-style-type: none"> <li>a. What social, political, and/or economic factors shape exposure differences (e.g., mobility patterns, transportation networks, division of labor, street life, and street work)?</li> <li>b. What populations are most vulnerable to exposure from vehicle emissions in Indore (e.g., women, men, socioeconomic class, caste, labor sector)?</li> <li>c. What are the key data gaps at the intersection of gender and transportation emissions? What data should CAC consider collecting to fill this gap and to improve the project's understanding of exposure differences in Indore?</li> </ol>
<b>Question 2:</b> What are the policies, laws, and regulations that shape transportation emissions—both intended and unintended (e.g., designated transport corridors, economic growth policies that encourage more traffic, air pollution control regulations), and how might these legal instruments affect men and women’s exposure differently?	<ol style="list-style-type: none"> <li>a. What must governments and institutions consider when designing clean air solutions to equally protect women and girls, men and boys from toxic vehicle emissions?</li> </ol>
<b>Question 3:</b> What high-impact opportunities/actions should CAC consider supporting to reduce vehicle emissions while advancing gender equality and women’s empowerment?	<ol style="list-style-type: none"> <li>a. What opportunities are present (or already in action) for women to be empowered as leaders in advancing clean air solutions in the vehicle transport sector in India?</li> <li>b. What opportunities does CAC have to partner with government institutions, the private sector, and/or other donors to advance clean air solutions and women’s empowerment in the clean air sector?</li> </ol>

## 2. METHODOLOGY AND LIMITATIONS

The research methodology involved primary and secondary data collection. It started with a literature review of secondary sources involving an initial selection of 68 documents, mostly published since 2019 or, depending on the yield, going back further to 2016 and earlier. Keywords used (in multiple

combinations) were: air pollution, traffic, women, India, Indore, gender, street vendor, street sweeper, exposure, children, and commute. Most of the documents were found through Google Scholar and Web of Science, followed by searches using Academia. Global reports and factsheets provided by USAID and its implementing partners were also included. The initial set of documents were supplemented with others as the need arose and additional documents were identified during the course of the research.

Primary data collection involved eight key informant interviews (KIIs), including a total of 13 people who participated in the interviews as some brought colleagues with them. As data are fairly restricted on gender differences in aspects of air pollution and transportation in Indore, KIIs were designed to obtain a deeper understanding of the issues and potential solutions in Indore and Madhya Pradesh and, more broadly across India. Informants were selected from an initial list of key stakeholders provided by WRI and supplemented with additional names recommended by KIIs. Interviews involved researchers, activists, a community worker, and women and men in gender, air quality, and transport (see Annex C for List of Interviews and Annex D for question guides).

The main limitation of the methodology was remote primary data collection and the compressed timeframe for completing the analysis—about four weeks from start of research to completion of the initial draft. This is a short time to consider gender and inclusivity issues at the intersection of issues of great urgency, namely, air pollution, transport, and economic growth, and development in India. Trade-offs involving clean air and economic growth are not unique but uniquely urgent and, especially, for women whose lagging labor force participation in India results in productivity and development losses, and the role of transport in women’s mobility and access to employment are also pertinent.

### **3. BACKGROUND AND CONTEXT**

#### **3.1 AIR POLLUTION FROM URBAN TRANSPORT IN INDIA**

In 2019, 14 of 20 cities with the worst air pollution in the world were in India.<sup>10</sup> The main sources of ambient particulate matter (APM) causing air pollution are residential and commercial biomass burning, windblown mineral dust, coal burning for energy generation, industrial emissions, agricultural stubble burning, waste burning, construction activities, brick kilns, transport vehicles, and diesel generators.<sup>11</sup> High levels of particulate matter (PM) affect both the environment and human health. Very fine particles (PM<sub>2.5</sub>) can penetrate the lungs, causing cardiovascular and neurological problems and are often cited as the primary cause of air pollution-related health issues.<sup>12</sup> Ultrafine particles (PM<sub>1</sub>) are also health damaging but not often measured. Traffic congestion is commonplace in a city like Indore. It consists of a mix of pedestrians, bicycles, cars, and buses all using the same roads and posing health and safety hazards, vulnerability to injury, and noise and air pollution. Rising incomes and motor vehicle ownership contribute to a transport crisis, as do rapid urbanization, population density, and suburban sprawl. Financial constraints result in using transport vehicles well beyond their designed capacity, and in turn, deteriorated services and unhealthy emissions.

Transport’s contribution to air pollution (PM<sub>10</sub>) in Tier 2 cities was 7 percent in Pune and 15 percent in Kanpur. In the same study, in three of the Tier 1 cities (Delhi, Mumbai, and Bangalore), transport’s contribution ranged from 14 to 18 percent, though in Chennai it was 43 percent.<sup>13</sup> The main air pollutants affecting health are particles (PM<sub>2.5</sub> and PM<sub>10</sub>), carbon monoxide, oxides of nitrogen, ground-level ozone, and benzene. Small particles (PM<sub>2.5</sub>) are most worrisome and hazardous to health

because they penetrate deep into the respiratory system, bypassing usual defenses against dust.<sup>14</sup> Emissions from residential energy use are the most significant source of ambient PM2.5 in India, followed by power generation, industry (16 percent), and land transport (10 percent).<sup>15</sup>

In 2017, one in eight deaths in India was due to air pollution. Exposure to APM in India was one of the highest in the world—a population-weighted mean PM2.5 of 89 micrograms/cubic meter. No Indian state met the World Health Organization (WHO)-recommended criterion of APM air quality of less than 10 micrograms/cubic meter. More than three-fourths of India’s population was exposed to PM2.5 greater than 40 micrograms/cubic meter in 2017, the maximum level recommended by its own National Ambient Air Quality Standards.<sup>16</sup>

High levels of air pollution contribute significantly to disease and death and economic losses. An estimated one quarter of global deaths attributed to ambient PM2.5 occur in India.<sup>17</sup> In 2016, air pollution was, after malnutrition, the second-largest risk factor contributing to disease. Diseases commonly associated with air pollution include heart and lung diseases, stroke, and diabetes. In 2017, India had 18 percent of the world’s population but 26 percent of the world’s disability-adjusted life years attributable to air pollution. Eight percent of the total disease burden and 11 percent of premature deaths in people under 70 years old were due to air pollution. Estimated life expectancy in India would be 1.7 years greater if air pollution levels were lower than minimum risk exposure levels associated with loss of health. Sex-disaggregated data were not available for the impacts of air pollution on deaths.

As shown in Table 5, in 2017, 1.24 million deaths in India were attributable to air pollution—or one of every eight deaths as mentioned above. Nationally, there were more deaths from APM (0.67 million) than household pollution, and more than half in people younger than 70 years old. In MP, the death rate due to air pollution (97 per 100,000 population) was higher than the national average and a larger number of deaths was due to household emissions rather than APM. Estimated life expectancy in MP would be 1.9 years higher if air pollution levels were lower than minimum risk exposure levels associated with loss of health.

**TABLE 5. IMPACTS OF AIR POLLUTION IN INDIA AND MP, 2017**

DEATHS ATTRIBUTABLE TO AIR POLLUTION	INDIA	MP
Death rate per 100,000 population due to air pollution	89.9	97
Number of deaths	1,240,530	83,045
% of total deaths in people younger than 70 years	51.4	50
Number of deaths due to ambient particulate matter pollution	673,129	37,745
Number of deaths due to household air pollution	481,738	39,895

Source: India State-Level Disease Burden Initiative Air Pollution Collaborators. 2019.

The public and media typically focus on the acute health effects of very high ambient air pollution levels during the winter in north India. However, as some researchers note, the more serious issue is the long-term health effects of chronic high pollution levels throughout the year.<sup>18</sup>

Economic losses from premature death and disease due to air pollution are consequential, and more serious for poorer states like MP. In 2019, these losses were estimated at USD 36.8 billion, or the equivalent of 1.36 percent of India's gross domestic product (GDP). As a proportion of state GDP, output losses ranged from 0.67 percent to 2.15 percent and were highest in low per-capita GDP states like MP.<sup>19</sup>

### **3.2 AIR POLLUTION FROM URBAN TRANSPORT IN INDORE**

Indore, with a population of two million, is an important commercial center in MP. The main economic activities are manufacturing and services, including soybean processing, automobiles, software, and pharmaceuticals. The city is becoming a transport and logistics hub as three national and two state highways pass through it.<sup>20</sup> It has high levels of air pollution, and the World Health Organization (WHO) once ranked it as the most polluted city in MP. The average PM2.5 concentration in 2015 was more than six times the WHO guidelines, though pollution levels have since been declining.<sup>21</sup> Sources of pollution (specifically, PM2.5 concentrations) in Indore are transport, including road dust (27 percent), domestic cooking and heating, and open waste burning. About 27.8 percent of the PM2.5 originates outside the city from industries, and coal-fired power plants and brick kilns.<sup>22</sup>

Fortunately, pollution levels in Indore have been declining of late. Though measured only since 2016, PM2.5 concentration levels in 2017 were lower than the previous year.<sup>23</sup> Based on air quality data from 2011–15, the Green Tribunal found Indore to be a “non-attainment” city and required it to submit Action Plans to remedy the problem. An Action Plan completed in 2018 committed the city to take transport-related and other steps to reduce emissions.<sup>24</sup> Measures included night-time mechanical sweeping of city roads, free left loop roads<sup>25</sup> to reduce traffic congestion, and systematic collection and disposal of solid waste.<sup>26</sup> A critical next step is to determine how these trends can be sustained and how they may impact the future health of Indore's people.<sup>27</sup>

### **3.3 GENDER CONTEXT OF AIR POLLUTION FROM URBAN TRANSPORT**

The USAID Automated Directives System 205 (ADS 205) provides a framework for understanding the context underlying gender differences in exposure to air pollution and for devising and implementing clean air transport solutions. As Indore-specific data on these domains are limited, the discussion here relies mainly on India-wide data.

#### **3.3.1 LAWS, POLICIES, REGULATIONS, AND INSTITUTIONAL PRACTICES**

Air pollution in India is governed by three main laws nationally—the Air Prevention and Control of Pollution Act (1981), the Environmental Protection Act (1986), and the Central Motor Vehicles Act and Rule that governs vehicular emissions separately. Under the Vehicles Act, state transport departments enforce tailpipe emissions from in-use vehicles and are also responsible for phasing out old vehicles and promoting the use of clean fuels like compressed natural gas (CNG). However, the states do not have an overall framework or a single pollution monitoring agency to oversee vehicle-related pollution control measures.<sup>28</sup> Overlapping jurisdictions of the three laws sometimes compete with each other and hamper enforcement.

The Air Pollution and Environmental Acts are administered by the Central Pollution Control Board (CPCB), the State Pollution Control Boards, and since 2010, the National Green Tribunal created to

expeditiously handle environmental cases.<sup>29</sup> State boards have the responsibility to prevent, control, and abate pollution and are accountable to the Central government. Operationally, they can set air quality standards and emission levels and issue directions for implementation but the boards are mostly ineffective due to many factors, not the least of which are technical, capacity, lack of accountability, and financial constraints. Also, women's representation on the Boards is minimal.<sup>30</sup> Just two women are on the Madhya Pradesh Pollution Control Board, designed to have up to a total of 16 full- or part-time members.<sup>31</sup>

In 2009, the CPCB set air quality emission standards for 12 pollutants specifying that they should be met 98 percent of days in the year and should not be exceeded on two consecutive days. Most of the 263 cities in India do not meet these standards and pollution levels continue to rise. Mostly, states do not have clean air targets and Action Plans being implemented in 17 cities under Supreme Court directives have no timeframes or ways to even gauge compliance.<sup>32</sup> Several recent efforts have sought to change the laws but without success. The need for change is also disputed, the argument being that existing laws are adequate but not effectively enforced.<sup>33</sup>

### 3.3.2 CULTURAL NORMS AND BELIEFS

Strongly held patriarchal values, unequal cultural norms, and the widespread belief in men's authority over women govern daily actions and perpetuate women's disempowerment. These beliefs have significant negative effects on girls and women including limited opportunities for paid employment, and vulnerability to gender-based violence (GBV) at home and in public spaces, the latter a significant factor influencing and often restricting women's mobility and transport use. More broadly, in India, unequal norms underpin skewed birth-rates, greater undernutrition among girls than boys, social pressure on women to bear a male child, and the persistence of child marriage. Approximately 60 percent of girls are married by age 18 and many by the age of 15.<sup>34</sup> The high cultural value placed on marriage causes some women who have jobs to drop out in response to family pressure. Women's work outside the home is still regarded unfavorably and can be a source of strife within households, sometimes contributing to GBV; a woman staying home is viewed favorably and is valued as a sign of economic and social status.<sup>35</sup>

### 3.3.3 GENDER ROLES, RESPONSIBILITIES, AND TIME USE

Gender differences in roles and responsibilities are marked and influence virtually all aspects of the lives of women and men, including patterns of transport use, exposure to toxic vehicle emissions, and time availability to participate in mitigating air pollution as, for example, through advocacy campaigns. Most Indian households have a strict division of labor, and gender roles and responsibilities are clearly defined. Men are almost exclusively responsible for the economic support of families while women have primary responsibility for household maintenance and care-related tasks such as cooking, cleaning, and caring for children, elders, and the sick. Women, on average, perform six hours of household work daily compared to 52 minutes for men.<sup>36</sup> Whereas higher-income women can afford domestic help, low-income women must do the work themselves. Their tasks are often burdensome and time-consuming such as transporting young children to school and, because of the shortcomings in urban services, low-income women spend much time and walk up to 0.5 kilometers to fetch, wait in line, and carry water for household use.<sup>37</sup>

### 3.3.4 ACCESS TO AND CONTROL OVER RESOURCES

Access to and control over income and other productive assets such as savings and property are key components of women's economic empowerment, along with agency, or the ability for women to make and act on their own choices.<sup>38</sup> Evidence from around the world shows that income in women's hands benefits women themselves and improves children's education, health, and nutrition.<sup>39</sup> However, women's paid employment in India is already among the lowest in the world (24 percent) and steadily declining. India ranked 112 out of 153 countries in the Global Gender Gap Index 2020 and even lower (149) in economic participation and opportunity, having fallen from 110 in 2006.<sup>40</sup> Post-COVID-19, women confront a shrinking labor market.<sup>41</sup> Still, for low-income women, work is a necessity. In cities like Indore, they are generally employed in low-wage and hazardous work in the informal and formal sectors, as home-based workers and in occupations with high exposure to air pollution such as street cleaners, construction workers, and in brick manufacturing.

Though women and men have equal rights to own and inherit property in India (Hindu Succession Act, 2005), just 10 percent of women own land, a factor that limits access to bank loans and can dampen entrepreneurship.<sup>42</sup> On the other hand, many laws and policies are favorable for working women, including maternity leave and equal wages for some types of work, though enforcement can be weak. Initiatives like the National Urban Livelihoods Mission, along with women having personal bank accounts, expanding their access to micro-financial services, and participating in SHGs support women's economic empowerment.

### 3.3.5 PATTERNS OF POWER AND DECISION-MAKING

As noted above, men's authority over women is widely accepted, a factor that reinforces male power and limits women's decision-making within households and their ability to participate in and influence policy as leaders and civil society members. Women lack representation at all levels in the political and economic spheres, despite some favorable laws such as in *Panchayati Raj* or local government institutions where up to 50 percent of seats are reserved for women. In 2017, women constituted 44.2 percent of elected representatives and 43 percent of *sarpanches* or heads of village *panchayats*.<sup>43</sup> They are not, however, well represented in city or municipal government institutions including Indore. Women also have limited decision-making power at the household level, a factor that has implications for all aspects of women's and girls' lives, especially when combined with lack of income. In fact, lack of ability to make their own decisions constrains women's mobility, access to jobs, health care, and other government services.<sup>44</sup>

Patriarchal power and unequal power relations are reflected in GBV and the threat of GBV in the home and in public. They are serious issues for women and gender non-conforming people. Transgender people (*hijras*), for instance, experience discrimination and suffer from ridicule and stigma. One-third of all women in India experience GBV in their lifetimes, and a woman is subjected to intimate partner violence every 4.4 minutes (though abuse is greatly underreported, at less than 1 percent).<sup>45</sup> Domestic violence is both a criminal and civil offense, the latter under the National Protection of Women Against Domestic Violence Act of 2005. However, women seldom report it for reasons that include fear for their safety, police reluctance to register complaints, and shame in the victim rather than the perpetrator.

Women’s mobility and ability to participate in work and public life more broadly are undermined by threats to their safety in public spaces. Surveys in India show that females of all ages are harassed and assaulted in daylight, at night, in crowded and secluded places in cities, and especially slums.<sup>46</sup> The tragic and highly publicized Nirbhaya Case of public violence, the beating, torture, gang rape, and subsequent death of Jyoti Singh, a physiotherapy intern, occurred on a private bus in Delhi. Common responses to reports of increased public violence serve only to further restrict women’s mobility instead of addressing their causes. They include curfews for female students at colleges, universities, parental curfews on daughters, and women choosing work hours that do not extend into the evening after dark.<sup>47</sup> The lack of safety in transport may be contributing to the decline in women’s participation in the workforce despite gains in female education and economic growth.<sup>48</sup>

## 4. FINDINGS AND RECOMMENDATIONS, BY RESEARCH QUESTION

### 4.1 RESEARCH QUESTION 1: WHAT ARE THE EXPOSURE DIFFERENCES AMONG WOMEN AND GIRLS, MEN AND BOYS TO AIR POLLUTION FROM VEHICLE TRANSPORT IN INDORE (OR INDIA)?

WHICH SOCIAL, POLITICAL, AND/OR ECONOMIC FACTORS SHAPE EXPOSURE DIFFERENCES (E.G., MOBILITY PATTERNS, TRANSPORTATION NETWORKS, DIVISION OF LABOR, STREET LIFE, AND STREET WORK)?

Gender, class, age, and occupational differences in mobility patterns differentially affect exposure to vehicle emissions in Indian cities, including Indore. Evidence shows that gender inequalities often shape women’s and men’s mobility and use of transport, globally and in India. Women more than men rely on public transport.<sup>49</sup> In India, if a family owns a car, the male head is more likely to use it whereas women and children must depend on alternatives, mainly walking and public transport.

For both men and women across India, walking is the most common means of commuting to work. Women usually travel shorter distances to work or work from home (45 percent) and are more financially constrained in paying for transport. For women, buses are the next most common mode of transport in contrast to men for whom, after walking, cycling and riding a scooter or motorbike to work are most common. Low-income women in Delhi slums spent more time traveling on slower modes of transport to get to work for reasons of affordability.<sup>50</sup>

Further, women’s mobility more than men’s is shaped by their care duties requiring them to travel with dependents, in off-peak hours when services are infrequent, and to “chain” trips together involving multiple stops, as they often do several errands or activities in one trip.<sup>51</sup> They make shorter, more frequent trips and on off-peak hours including in Tier 2 cities.<sup>52</sup> Travel is likely to be costlier for many trips, a particular concern for women. Trip timing may afford women some protection from vehicle emissions, likely to be highest during peak travel times, although quantitative evidence for this is currently lacking.

A survey in Bhopal, the capital of MP and a city comparable to Indore in size and characteristics, showed 60 percent of men’s versus 33 percent of women’s trips were for work; 30 percent of women traveled

with dependents compared with less than 16 percent of men; most men (60 percent) traveled directly from origin to destination while half of women “trip chained.”<sup>53</sup>

As cost is often a key consideration for women, especially low-income women, they walk more than men and use intermediate modes of transport such as rickshaws and shared taxis.<sup>54</sup> A gendered comparison of five large cities in India showed, on average, 37 percent of women walked to work compared with 27 percent of men.<sup>55</sup> In smaller cities, like Ranchi and Hazaribagh, women were even more reliant on walking to work or an educational institution, 59 percent in Ranchi, and 76 percent in Hazaribagh.<sup>56</sup> Low-income women, particularly, are “no-choice walkers,” a factor that exacerbates their already constrained time and energy poverty.<sup>57</sup> Further, as incomes rise, women transition more slowly than men from non-motorized to motorized transport. They are also more likely to use the informal public transport (IPT) system that can include rickshaws, autorickshaws, and Tata Magic (microvans). In Bhopal, the IPT carries 20 percent more passengers than the formal public transport system.<sup>58</sup> In Indore, women use IPT more than men. The informal system is often preferred not only because of its lower cost but also because of its flexibility and frequency. However, as the sector is unregulated, it has many problems, including low-quality vehicles, unpredictable schedules, and lack of accountability and safety.<sup>59</sup>

Data from Delhi morning rush hour demonstrate the extent of women’s exposure to harmful vehicular emissions due to their mobility choice or lack of choices. Measurements of on-road PM<sub>2.5</sub> exposures in 11 transport microenvironments showed walking resulted in 40 percent higher exposure than in an off-road location, and traveling in an auto rickshaw, 30 percent higher exposure. The exposure rate was lowest inside air-conditioned cars and metro carriages generally affordable only by middle- and high-income women, while PM<sub>2.5</sub> mass inhaled per km was nine times higher for cycling compared to inside of an air-conditioned car.<sup>60</sup>

#### WHICH POPULATIONS ARE MOST VULNERABLE TO EXPOSURE FROM VEHICLE EMISSIONS IN INDORE/OR INDIA (E.G., WOMEN, MEN, SOCIOECONOMIC CLASS, CASTE, LABOR SECTOR)?

The types of occupations in which low-income women are often employed enhance exposure to air pollution. For instance, most street sweepers in India are women. They are vulnerable to respiratory tract irritations and health issues such as asthma and bronchitis because of occupational exposure to street dust that is a mix of soil, sand particles, dust, motor vehicle emissions, bioaerosols, and plant particles. A small sample study of 30 female sweepers matched with 30 healthy females found street sweeping reduced lung function among the former along several parameters. Findings showed decreasing lung function was related to extent and duration of exposure to street dust. A related cross-sectional study found the risk of chronic respiratory morbidity among street sweepers was 4.24 times higher than that in the comparison group and the risk increased significantly with increasing length of service. Similar studies among street sweepers in Chennai, Nigeria, and Bangalore obtained similar results.<sup>61</sup>

Although the number of women who are street sweepers in Indore was not readily available, it is important to determine the number of both women and men employed and their levels of exposure since the health effects are so serious and they are borne by the poorest and most vulnerable people most likely to have the least access to health care. In the interim, simple protective measures can be readily adopted, namely, provision and use of protective equipment like a simple face mask, long brooms that create distance from stirred dust, and periodic lung function tests.



Construction work, brick manufacture, and stone quarrying are other occupations in which low-income women work in Indore and are disproportionately exposed to air pollution including vehicle emissions.<sup>62</sup> Studies on the links between air pollution and health effects in India's Tier 2 cities are few and mostly focus on men, so differential gender effects are difficult to determine. Available studies like Prabhu et al. (2019) compared the health effects of traffic-related air pollution in Dehradun, a Tier 2 city, on 130 male street vendors whose businesses were located in commercial and residential sites. They found respiratory disorders such as colds, coughs, breathlessness, and chest pain were higher among vendors located in commercial sites where the number of vehicles was 3.6 times higher than in the residential locations.<sup>63</sup> Similarly, Mullur et al. (2020) in a study in Vijayapura, a Tier 3 city in Karnataka, found male shopkeepers in a heavily trafficked commercial area (1,200–1,500 vehicles/hour) had reduced lung function efficiency compared with those in a residential area where there were just 10–20 vehicles/hour.<sup>64</sup> Among traffic police, another high-exposure occupation, a comparison of 114 traffic and 114 non-traffic males in Tier 2 city Solapur, Maharashtra, found chronic rhinitis and chronic bronchitis were significantly higher among traffic police, as was cardiovascular risk in those over 40 years old.<sup>65</sup>

Women in the informal sector often also work in street vending<sup>66</sup> or minding small retail shops that are often located in high-traffic roadsides where they have greater exposure to emissions. Data on women's representation in these activities in Indore were not readily available but given the high exposure they entail to vehicle emissions, it would be useful to know through future research as evidence for policy-making and ameliorative actions. As well, low-income women may be forced to expose themselves to higher levels of pollution as informal vendors along busy roads to mitigate the risk of GBV that might occur in less transited areas.<sup>67</sup> More data are needed on the potential correlation between these two factors.

Some epidemiologic studies show air pollution has stronger effects on women than men. Women appear to be more susceptible to inflammatory lung disease induced by air pollution and show worse adverse pulmonary health outcomes than men.<sup>68</sup> Air pollution is also a risk factor for breast cancer<sup>69</sup> and links were found between pollutants and preterm births. In 2010, an estimated 18 percent of all preterm births (2.7 million globally) were associated with outdoor exposure to PM<sub>2.5</sub>.<sup>70</sup> A study in Tamilnadu, India, found 10-microgram/cubic meter increase in exposure to PM<sub>2.5</sub> during pregnancy was associated with lower birthweight and 2 percent increase in prevalence of low birthweight.<sup>71</sup>

Studies in India also show strong association of air pollutants with respiratory health and women are more vulnerable to roadway/transport emissions because they already have reduced lung function due to greater exposure to indoor air pollution. Women disproportionately experience respiratory health problems attributed to dual exposure to air pollutants from ambient and household toxins, the latter from cooking with biomass fuel. A comparative study of lower middle-income residents of a peri-urban area of Delhi found women were at higher risk than men to obstruction-related lung function abnormality due to ambient PM<sub>10</sub> and PM<sub>2.5</sub> exposure. Exposure to indoor air pollution was not measured but as women in the study cooked with liquified petroleum gas (LPG) and not biofuels, the differences in outcomes were attributed to outdoor pollution.<sup>72</sup>

## WHAT ARE THE KEY DATA GAPS AT THE INTERSECTION OF GENDER AND TRANSPORTATION EMISSIONS?

Several issues are related to gender and transport emissions for which data gaps exist. They include gaps in sex-disaggregated data on exposure to air pollution, the disease burden due to toxic emissions,

acceptability of alternate policy and regulatory options, and transport usage.<sup>73</sup> A common problem with household-level data on transport usage is that it does not provide information about women-specific usage, which differs greatly from that of men.<sup>74</sup> This is a common and long-standing shortcoming in social science research as household level surveys are often administered to the household head who is generally a man; women’s responses are not typically sought unless they happen to head households.

The CAC team is currently conducting research in Indore that will fill gaps about air quality. Their goal is to understand the sources and root causes of air pollution to inform the intervention design. Initially, researchers will build a quantitative model followed by validation and other surveys (e.g., to determine public perceptions, understand traffic patterns, waste burning, and to identify a coalition of partners to seek solutions and help make changes).<sup>75</sup> The modeling exercise does not have scope for gender integration though the results are likely to be broadly applicable to all people. Some of the surveys that the researchers plan to implement will have a greater scope for gender analysis. It will be important, especially if household surveys are planned, to be mindful that household level data will not sufficiently disaggregate information. Proper representation of women and men’s perceptions, views, and needs will require individuals are surveyed—men and women separately. CAC should consider filling the types of data gaps listed in Table 6.

**TABLE 6. SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS - I. WHAT ARE EXPOSURE DIFFERENCES AMONG WOMEN AND GIRLS, MEN AND BOYS TO AIR POLLUTION FROM VEHICLE TRANSPORT IN INDORE? WHAT ARE GENDER DATA GAPS IN AIR POLLUTION EXPOSURE AND TRANSPORT?**

FINDINGS	RECOMMENDATIONS
In undertaking planned surveys, CAC should note that a household-level analysis does not always yield gender-specific information.	In the CAC planned landscape analysis and other surveys, conduct individualized (not household-level) data collection and analysis to determine women- and men-specific information and differences between them, e.g., on transport use and emission health effects [CAC, USAID]
Women’s restricted mobility may be a key factor in declining labor force participation at all income levels, more in urban than rural areas, and more worrisome among low-income women.	Consider a study on how much transport-related mobility restrictions impact women’s labor force participation. [USAID]
Women are generally absent as staff and leaders in transport and municipal agencies, but quantitative data on this fact are unavailable.	In the political diagnosis, carry out an inventory of leaders and staff of transport department and broad range of public, private, and community decision-makers that shape the transport sector in Indore, by sex. [CAC, USAID].
Indore data on women’s employment overall and in high- emissions exposure occupations are not readily available.	Obtain Indore data on women’s employment overall and especially in occupations with high exposure to toxic emissions, e.g., street cleaning, brick manufacturing, and construction. Use this information in identifying targeted communities and high-impact clean air actions for exposure reduction [CAC, USAID]
Indore data on women’s transport use and needs are not readily available.	Obtain Indore data on women’s transport use and needs. [CAC, USAID]

Some data on gender issues in e-mobility were obtained for this study. Obtaining more information may be useful.	Obtain more details on who's doing what in e-mobility on gender issues research, employment, and entrepreneurship overall and in Indore. [CAC, USAID]
Data on environmental and women's organizations in Indore working on air pollution, transport, gender, and women's rights and empowerment were not readily available.	Carry out a rapid scan of women's, environmental, and other organizations in Indore to determine potential partners on air pollution, gender, and transport issues. [CAC]
Women's Self-Help Groups (SHGs) may be useful as community-level partners; their number, roles, and capacities are worth exploring further.	Conduct a scan of women's self-help groups as potential community-based partners for air quality monitoring, entrepreneurship, and clean air advocacy and link to the Government of India (GOI) Urban Women's Livelihoods Mission. [CAC, USAID]

**4.2 RESEARCH QUESTION 2: WHAT ARE THE POLICIES, LAWS, AND REGULATIONS THAT SHAPE TRANSPORTATION EMISSIONS—BOTH INTENDED AND UNINTENDED (E.G., DESIGNATED TRANSPORT CORRIDORS, ECONOMIC GROWTH POLICIES THAT ENCOURAGE MORE TRAFFIC, AIR POLLUTION CONTROL REGULATIONS), AND HOW MIGHT THESE LEGAL INSTRUMENTS AFFECT MEN'S AND WOMEN'S EXPOSURE DIFFERENTLY?**

**WHAT ARE LEGAL FRAMEWORK AND ADDITIONAL REGULATIONS AND POLICIES ON TRANSPORTATION EMISSIONS?**

The overarching legal framework shaping air pollution broadly and transportation emissions, specifically, were discussed in Section 3 above. The three main laws are the Air Prevention and Control of Pollution Act (1981) and the Environmental Protection Act (1986), and the Central Motor Vehicles Act and Rule that governs vehicular emissions separately. As noted above, implementation and enforcement have significant deficiencies and, to the extent the laws can be made to work better, they would benefit everyone—women and girls, men and boys. Improvements would also make it safer for people, including women, in occupations and in slum locations that have greater exposure.

In addition, India's National Urban Transport Policy (2014) has a broad vision guiding future urban transport development. Its objectives are to bring about a more equitable allocation of road space, focusing on people, rather than vehicles and to encourage greater use of public transport and NMT by offering central financial assistance. It addresses women's concerns primarily through the lens of safety, mainly technological solutions such as CCTVs and GPS devices in public transport and universal accessibility for user groups including women and children. Shah et al. (2017) urge adoption of gender-inclusive, institutionalized and comprehensive mobility plans for cities of different sizes including creation of Gender Advisory Committees for urban transit authorities. They offer specific recommendations for adopting or modifying service benchmarks and indicators such as pedestrian infrastructure, parking facilities, pollution levels, land-use and transport integration to reflect gender differences and considerations.<sup>76</sup>

Some Indian cities, like many others around the world, have adopted traffic control regulations to address congestion and air pollution. Delhi, for instance, has since 2016 restricted motorized traffic (cars but not two-wheelers) allowing vehicles on the road only on odd or even dates as they

correspond with the odd or even last digit in the registration number. However, women driving alone or cars with all women occupants and those with children under 12 years of age were exempt, along with vehicles transporting school children, or people with medical emergencies.<sup>77</sup>

Street closures have also been used more positively to incentivize and raise awareness about clean air. For instance, Raahgiri Day, co-founded in 2013 by Sarika Panda Bhatt of the Raahgiri Foundation, involves closing streets to motorized traffic on Sunday mornings. People are encouraged to walk, bicycle, and exercise, the idea being to foster cleaner air, physical activity, road safety, and community building. Organizers used media and social media to raise awareness and attract participants. The first Raahgiri Day was organized in Gurugram in November 2013. The concept has now expanded to more than 70 cities and won national and international awards, including from the Ministry of Urban Development as a best practice for promoting non-motorized transport. In MP, Bhopal and Indore have organized Raahgiri Days in the past (2014-15).

Other cities around the world use congestion-pricing policies to establish low-emission zones in high-traffic areas during peak hours by charging fees for motorized vehicles and encouraging walking, bicycling, and use of public transport. Both restrictive “command and control” and pricing policies require public acceptance and support to succeed. A study in 11 cities of Latin America that examined acceptance levels with a view to policymaking found having a young child with respiratory problems increased support for either type of policy as did residents of cities with higher levels of median annual particulate matter. Cities with greater income inequality supported only driving restrictions while cities with higher per capita income had lower support for congestion pricing. Gender-differentiated responses were not examined.<sup>78</sup> Other measures adopted in some Indian cities include motorized traffic closures on designated days and areas for specified time periods. While the effects of such policies on air pollution may be limited, they are important for awareness raising.

In recent years, state governments in India have adopted policies to incentivize the manufacture, ownership, and use of electric vehicles and associated infrastructure such as batteries and recharging stations. Telengana, for instance, adopted the Energy Storage and Electric Vehicle Policy (October 2020) that provides 100 percent exemption from road tax and registration fees for the first few purchases of six types of electric vehicles including two-wheelers, three-wheeler, commercial passenger cars, taxis and buses.<sup>79</sup> To the extent these and other similar policies foster investments in and expansion of e-mobility, they may offer opportunities for women’s leadership, entrepreneurship, and employment in an emerging sector. Additional details and examples of these activities are provided in Section 4.3.

### **WHAT MUST GOVERNMENTS AND INSTITUTIONS CONSIDER WHEN DESIGNING CLEAN AIR SOLUTIONS TO EQUALLY PROTECT WOMEN AND GIRLS, MEN AND BOYS FROM TOXIC VEHICLE EMISSIONS?**

Encouraging greater use of public transport and enhanced energy efficiency in vehicles are key features in India’s National Action Plan for Climate Change and are critical to protecting everyone. However, in the case of women and girls, it requires changing transport policies to suit women’s behavior and needs.<sup>80</sup> As women for socio-cultural reasons already have a low ecological footprint in Indian cities, making public transport both clean and equitable requires expanding women’s mobility while maintaining their low ecological impact. It requires changing transport policies to suit women’s behavior and needs.

Clean air solutions will require improvements in public transport like the bus rapid transit system (BRTS), that Indore adopted in 2013, standard public transport, and informal public transport like Magics and autorickshaws. Improvements are needed, for example, in vehicle maintenance to reduce toxic emissions and in shifts to use of less polluting fuels like CNG that would benefit everyone. They are needed across many modes of transport because each meets the needs of women and girls at varying income levels. Although a study in Mexico showed lower exposure to PM2.5 in BRTS commuters, a relatively small percentage of women can afford the service.<sup>81</sup> In Ahmedabad, for instance, 27.5 percent of BRTS riders were women and just 3.3 percent were low-income women.<sup>82</sup> Other improvements required are in Street Design and solutions like public bicycle sharing systems, and walking and cycling infrastructure—as women are more dependent on these modes and COVID-19 may help accelerate women’s adoption of cycling for short commutes.<sup>83</sup> The Smart Cities Mission is incentivizing cities to adopt bicycling via the [Cycles4change Challenge](#) launched in 2020. Indore is one of 25 cities selected for the challenge is now implementing infrastructure and other changes to promote bicycling.

Across all modes, women represent a smaller share of riders than men. Yet women and low-income women are more affected than men when work, school, services are located at a distance from home. Safe, comfortable, and affordable transport is critical for women to facilitate access to economic opportunities. Lack of reliable and affordable access to transport influences women’s employment and increases time poverty. For instance, relocation of people from central Delhi to a squatter settlement in the periphery increased unemployment among women by 27 percent and men by 5 percent.<sup>84</sup>

Importantly, women fear using public transport due to violence and the threat of violence. Women experience harassment and abuse on public transport, on the street, and at bus stops. A study in Delhi found 90 percent of women reported facing sexual harassment in public spaces overall, 51 percent of women faced harassment in public transport, and 42 percent more while waiting for transport. More disturbing, harassment is “normalized”—it is ordinary and continuous.<sup>85</sup> Special provisions are often made on public transport including reserved seats and women-only buses (including Indore) or compartments for women and children in trains but this is not enough and is a band-aid for the systemic factors that continue to restrict women’s public safety and should be addressed.<sup>86</sup>

In 2013, data with the National Crime Records Bureau showed MP was one of the least safe states for women with the highest number of rapes and molestations. In Bhopal, forty percent of surveyed women reported being harassed on public transport on a regular basis, 88 percent at least once, and just 12 percent never.<sup>87</sup> Yet they were reluctant to report these crimes due to lack of trust in police and concern for personal reputation. Bus drivers and conductors are mostly oblivious to women’s safety issues—100 percent of bus drivers surveyed in Bhopal did not believe women were harassed and 30 percent felt they were equally responsible for harassment.<sup>88</sup> Women wanted staff to be trained to enforce women-only seats and to intervene to support women when harassed. Gender sensitization trainings are important, especially for staff in transport related departments. Such trainings should be made compulsory and should be carried out periodically to assess changes on ground.<sup>89</sup>

Following the Nirbhaya case, in 2015, the government sought to increase safety in public transport in 32 large Indian cities, installing CCTVs, global positioning system, and panic buttons. Actions were mostly ad hoc and, even when taken, riders lack information about where to report harassment. In many cases, the equipment was soon found to be damaged.

Factors that should be considered when designing gender equitable clean air transport solutions are shown in Table 7 below.

**TABLE 7. SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS: WHAT ARE THE POLICIES, LAWS, AND REGULATIONS THAT SHAPE TRANSPORTATION EMISSIONS—BOTH INTENDED AND UNINTENDED—AND HOW MIGHT THESE LEGAL INSTRUMENTS AFFECT MEN AND WOMEN’S EXPOSURE DIFFERENTLY? WHAT ARE GENDER CONSIDERATIONS IN DESIGNING TRANSPORT-RELATED CLEAN AIR SOLUTIONS?**

FINDING	RECOMMENDATIONS
Walking is the most common commute to work for women and men in India, followed by bus for women and cycling and scooter for men. Cost, personal and road safety, convenience, and reliability are the major factors impacting women’s mobility. Constrained mobility may play a part in women’s declining labor force participation in India and may be a key barrier to their empowerment.	Take into account women’s expressed valuation for affordability, personal security, road safety, convenience, and reliability. [CAC, USAID]
To fulfill their multiple responsibilities, women work closer to home than men or not at all. Low-income women, especially, value work being close by and involving a short commute. <sup>90</sup>	Take into account women’s paid work, additional care responsibilities, and time poverty in designing systems. [CAC, USAID]
Women more than men walk and use non-motorized transport (NMT); use all forms of transport less than men; and rely on all forms of public transport more than men—reliance on specific vehicles depends on income level.	Reflect women’s priorities along with those of men to design public transport and improvements in NMT facilities and in urban planning more broadly and throughout institutional and operational systems. [CAC, USAID]
Women’s mobility restrictions, a key indicator of agency and empowerment, are intensified because of public harassment and violence against them.	Reinforce women’s safety, including police-verified drivers and conductors; working and continuously monitored closed-circuit televisions (CCTVs); safe, well-lit, well-maintained footpaths to get to and from public transport; conduct gender sensitization trainings and establish redressal protocols—technological solutions should be complemented with human-centered solutions [USAID]
Municipal, transport and MP Pollution Control Board planning, including action plans, do not adopt gender-inclusive benchmarks and targets.	Adopt gender-inclusive benchmarks and indicators in municipal, transport, and air pollution control board planning that are not only sex-disaggregated but also reflect women’s priorities. [CAC, USAID]
Street closures to motorized traffic (car-free days or times) to promote NMT use and raise public awareness of the benefits.	Support adopting permanent and partial street closures to motorized traffic in Indore to benefit everyone.
Congestion pricing policy research does not typically disaggregate by gender.	Disaggregate policy research studies by gender; may yield actionable information [CAC, USAID]

### **4.3 RESEARCH QUESTION 3: WHAT HIGH-IMPACT OPPORTUNITIES/ACTIONS SHOULD CAC CONSIDER SUPPORTING TO REDUCE VEHICLE EMISSIONS WHILE ADVANCING GENDER EQUALITY AND WOMEN'S EMPOWERMENT?**

**A. WHAT OPPORTUNITIES ARE PRESENT (OR ALREADY IN ACTION) FOR WOMEN TO BE EMPOWERED AS LEADERS IN ADVANCING CLEAN AIR SOLUTIONS IN THE VEHICLE TRANSPORT SECTOR IN INDIA?**

**B. WHAT OPPORTUNITIES DOES CAC HAVE TO PARTNER WITH GOVERNMENT INSTITUTIONS, THE PRIVATE SECTOR, AND/OR OTHER DONORS TO ADVANCE CLEAN AIR SOLUTIONS AND WOMEN'S EMPOWERMENT IN THE CLEAN AIR SECTOR?**

#### *Barriers to women's representation in transport policy and planning*

The International Labor Organization found transport is one of a number of sectors traditionally unfavorable for women's employment. A World Bank report found women comprised 12.5 percent of Mumbai's Brihanmumbai Electric and Transport (BEST) Committee and an estimated 5–10 of 500 engineers in 2010. Overall, BEST has few women leaders in senior positions.<sup>91</sup> While data are scarce, it is unlikely that women's representation is much better in Tier 2 cities and important to determine the actual status through research. Municipal governments have practically no women, except for the Indian Administrative Service officers who tend to be in leadership positions.<sup>92</sup> For instance, the current chief executive officer of Smart City Development Limited, Indore, is a woman, as is the head of the Indore Municipal Corporation. Women are less well represented, if at all, in middle management or technical roles unless they are consultants. However, women do hold some clerical positions. Though a barrier to gender equity, the dearth of women in transport planning is not unusual. Globally, transport and transport-related workers are predominantly male—in road construction and maintenance, transport services, and transport agencies. Like other infrastructure sectors, most transport planning agencies, boards, and advisory committees at all levels are mostly managed by males.<sup>93</sup>

Typically, a woman attending a meeting of any of these state or city government planning sessions is the only one present, a factor that can be very constraining. The need for women's participation and leadership in these forums is critical. Their presence “definitely matters.”<sup>94</sup> Men sometimes have difficulty understanding the issues women face, particularly those having to do with harassment. A case in point is the finding that bus drivers and conductors in Bhopal claimed there was no harassment on their vehicles when the evidence shows otherwise.<sup>95</sup> Across the board, widening women's representation and leadership is needed, to raise awareness about gender gaps on a host of clean transport issues and to change cultural thought processes underlying them.

CAC may not be in a position to influence government hiring decisions but may be in a position to advise on policy incentives such as setting female employment targets in the transport sector for bus conductors, drivers, engineers, planners etc.; complement these targets with provision of conducive working environment like rest rooms, childcare facilities, maternity leaves, etc.; implement training programs for women to ready them for positions such as driving. Nirbhaya funding can be used for such programs. CAC can be deliberate about being gender inclusive in its own activities as, for example, in capacity building trainings in terms of male-female participation, building the pipeline of technically trained women (leaders, experts and technicians), and in teaching the importance of considering male

and female perspectives in solution design. CAC can appoint women on its scientific advisory and project committees and ensure that both women and men are included in community-level activities.

Fortunately, also, having worked previously in Indore and well-acquainted with city government and Smart City officials, CAC staff are well-positioned to continue to systematically and consistently raise and bring attention to gender issues in its own interactions with government and facilitate connections with potential civil society partners. In planned capacity- building trainings, CAC should set targets to achieve gender parity among participants with a view to increasing the pipeline of qualified women in air quality management. It should teach participants to consider both male and female perspectives. CAC partners can themselves employ and engage women wherever feasible, as they are already doing, for their own activities.

### *Opportunities/women's contributions*

Many organizations throughout India are working on clean air, transport issues, and gender issues in the private sector, civil society, research institutions, and a group of women mayors who advocate for women's rights (see Annex E for details). Since 2014, more than 40 environmental organizations were started in India with the goal of combating air pollution.<sup>96</sup> Donors are also involved including the World Bank, UN Women, the Bill and Melinda Gates Foundation, the Asian Development Bank (metro station safety), and GIZ's Women Mobilize Women Initiative. These and other organizations described below offer a diverse set of options for potential CAC partnerships.

Some organizations working on these issues are focused on women and gender issues and some are led by women. They are too many to name but include well-known organizations such as the Centre for Science and Environment (Sunita Narain, Director General); public safety (e.g., Safetipin, Jagori, Breakthrough, and Sanghini working on GBV, mobility, and public safety); Self Employed Women's Association (SEWA) a trade union of women informal sector workers; Women in Informal Employment Globalizing and Organizing (WIEGO) working on urban and economic issues; and a group of women mayors advocating for women's rights.

Women working on air pollution can be found in Women in Air Quality in South Asia at <https://twitter.com/waqsouthasia>. They include scientists, engineers, environmental and public health specialists. New organizations and activities on air pollution led by women continue to emerge like **Warrior Moms**, an example of citizen action launched nation-wide on September 7, 2020, the first International Clean Air Day. It is a voluntary social media platform (@warriormomsin) advocating for clean air solutions to address the ill-effects of air pollution on children's health and well-being, namely, asthma and lung issues. Children cannot go out to play on many days because of pollution. Warrior Moms is also promoting the use of AirVeda, an App-enabled real-time air quality monitor, among village women.<sup>97</sup>

Young women and young men may be interested and well-suited to working on efforts to raise community awareness. Some students of the Indore School of Social Work are currently involved in doing so having been recruited by USAID's Building Healthy Cities Program to be clean air guides. They help monitor air quality via 20 monitoring devices installed throughout the city, maintain the monitoring devices and engage with awareness raising in the surrounding community. Eleven of 20 guides are women, some students and some older women in the community. It is a part-time activity that offers a small honorarium. Our respondent, a young woman, was excited and proud to participate in an activity



that had social benefits. She also appreciated the opportunity to learn, build confidence, and interact with the larger group of professionals and experts.<sup>98</sup>

Opportunities for women’s leadership, entrepreneurship, and employment are growing in the emerging electric vehicle (e-vehicle) industry. E-vehicles emit fewer greenhouse gases and pollutants than gas-powered vehicles and are thus better for human and environmental health. Various types of e-vehicles are emerging in India mirroring the variety of gas-powered vehicles currently in use as private and public modes of transport. They include e-buses, e-scooters (two-wheelers), and e-rickshaws.<sup>99</sup> In 2020, India had an estimated 1.5 million e-rickshaws—an important and growing niche market.<sup>100</sup> Private sector organizations are often interested in partnerships that are mutually beneficial and help them meet their corporate social responsibility (CSR) obligations. Since April 2014, corporations of a specified size have been legally required to spend 2 percent of average net profit of the past three years on CSR. Examples of private sector leaders and entrepreneurs and efforts to promote women’s employment and research are as follows:

- **Electric bicycles/scooters/trolleys:** [Ampere](#), a leading e-vehicle manufacturer in India, is led and developed by Hemalatha Annamalai, a female entrepreneur who seeks to make low-cost electric bicycles, scooters, and load carriers. She wants to “create a whole new manufacturing sector [and] wants a lot of women to come into this sector.”<sup>101</sup> Since inception, women’s empowerment has been the driving force for Ampere with more than 30 percent of its manufacturing workforce being women. The aim is to double that percentage in the near future to achieve a majority-women manufacturing workforce. Ampere also aims to play a significant role in helping the government achieve its electric vehicle and air pollution targets by producing 15–20 percent of the country’s desired 7 million electric vehicles.
- **Electric she-rickshaws:** Eride E-mobility ([www.eride.co.in](http://www.eride.co.in)) is a Hyderabad-based electric vehicle company manufacturing a variety of eco-friendly products such as rickshaws and trucks. One of its goals is to expand entrepreneurship and employment opportunities for women in transport. It is doing so through by creating “She-rickshaws” for working women commuters, driven exclusively by women. The company trains women to drive, service, and maintain the vehicles, and on self-defense. So far it has trained 30 women. It is now identifying bankers willing to make loans to women to purchase the vehicles and set themselves up in business.<sup>102</sup>
- **Electric taxis:** The Association of Lady Entrepreneurs in Hyderabad is launching an initiative to provide self-sustaining employment for women that reduces air pollution. The goal is to have female entrepreneurs driving electric taxis in the city. The company is run by women for women to address female safety concerns regarding conventional taxis and public transport.
- **Vahini:** Social entrepreneurs are also involved in promoting e-transport among low-income people, as is SMV Green Solutions. Founded in 2015, SMV Green Solutions is facilitating conversion of manual rickshaw pullers to e-rickshaws to reduce drudgery and promote clean and safe transport. Vahini is the company’s effort to promote micro-entrepreneurship among low-income women. It helps them obtain bank financing to invest in the vehicle, offers driver training, support to obtain licenses, and equips them with smart phones for safety. It is cultivating a market for them among students of girls’ schools and colleges. It is based in Varanasi and also works in Allahabad.<sup>103</sup> SEWA is also training drivers and facilitating e-rickshaws as a women’s enterprise.<sup>104</sup>

- **Ola Mobility Institute (OMI)** is a policy research and social innovation think tank founded in 2018. Its main topic areas for research are the future of work, urban mobility, electric mobility, accessibility and inclusion. OMI currently has a five-person staff consisting of a mix of urban planners, sociologists, and economists. It developed the “Ease of Moving Index” by surveying 43,486 respondents in 20 Indian cities, Indore and Bhopal among them. It examined 52 mobility parameters such as first- and last-mile connectivity, safety perceptions, transport use, and modes.<sup>105</sup> OMI later re-analyzed the data from 9,935 female respondents to determine and report on women’s views in 11 cities (including Indore, though the data from Indore were not discretely reported).<sup>106</sup> It is conducting research now on transport use with a goal of understanding gender differences. Recognizing that household level data are not sufficient to determine gender differences in transport use, it plans to obtain individualized data from women and men. OMI is planning future studies on air pollution and on gender and women’s empowerment considerations, including:
  - The role of e-mobility in curbing air pollution
  - Women as service providers with a focus on understanding the structural barriers to women becoming operators
  - Women’s asset ownership and asset transfers to women with the goal of determining how women can invest in becoming independent taxi drivers
  - Bike-taxi use, asking questions such as: Are women comfortable riding pillion behind men?

Most organizations described in this section were working at national and international levels or as local affiliates in Indore (e.g., SEWA). Indore-based women’s organizations and those working on clean air and transport issues were not readily identifiable. Many women’s organizations are listed on the Web but additional research is needed to determine their focus, capacity, and suitability for partnering with CAC. CAC should consider organizations and individuals described in Section 4.3.B and others for the political diagnosis and stakeholder mapping activities.

#### *Potential actions*

Some interview respondents pointed out the need to follow up on a number of gender and transport safety studies to demonstrate how to design a system component with gender inclusivity in mind. They thought the next step to make progress on findings from these studies was to go beyond women’s safety issues and plan and implement another type of recommendation, e.g., improved city lighting infrastructure, or timed multiple-ride bus passes to respond to women’s cost constraints and “chaining” ride needs.

In Indore, there may be an opportunity to work with Smart City Development, Ltd., on an infrastructure issue like street lighting. Action could involve bringing Safetipin in to partner with WRI and Indore Smart City to use the My Safetipin App for a social audit to prioritize which stretches of the city should have improved lighting based on where women’s safety would be of great concern. Created in 2013, My Safetipin provides information about a location based on scorecards to help users identify its relative safety.<sup>107</sup> It is free and can be downloaded onto phones. It uses crowdsource data to measure an area’s safety and conduct a safety audit based on data reported on nine parameters. The audit results in a pin on a map for the area in which it was conducted with a date and time stamp. The safety score can

help guide an individual’s on-road security and can also be used to identify road safety problems and issues so they can be acted upon. It has already been used to improve street lighting in Delhi and Bogota, Colombia, and could be used in Indore as well as a demonstration of gender integration in city planning and infrastructure development.

Another option is for CAC to partner with a citizen program like Warrior Moms to advocate for clean air. A quantitative and qualitative study on how much transport-related mobility restrictions impact women’s labor force participation in the context of clean air solutions would be a valuable contribution to understanding the problem and identifying ways to empower women.

**TABLE 8. SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS: WHAT HIGH-IMPACT OPPORTUNITIES/ACTIONS SHOULD CAC CONSIDER SUPPORTING TO REDUCE VEHICLE EMISSIONS WHILE ADVANCING GENDER EQUALITY AND WOMEN’S EMPOWERMENT?**

FINDING	RECOMMENDATIONS
The wide gender gap in transport policy, planning, and operations at all levels may be hindering consideration of gender issues. Specific gender-responsive policy guidance for clean air and transport for India is available in Shah et al. (2017). <sup>108</sup>	<p>Continue in a systematic and consistent way to work with government agencies in city planning and transport in Indore to integrate gender needs into design, implementation, and evaluation of clean air projects.</p> <p>Consult Shah et al. (2017) for gender-inclusive, comprehensive, and institutionalized transport plans, recommendations, benchmarks, and indicators to apply in Indore. [CAC]</p>
Action is needed as follow-up on transport safety studies (like the one WRI did in Bhopal) to demonstrate how to design a system component with gender inclusivity in mind.	Leverage partnership with Indore urban planning agencies to take action on a transport-related infrastructure improvement in a gender-responsive way as, for example, by using Safetipin’s social audit to guide planned street lights installation. [CAC]
Women are contributing as advocacy leaders, scientists, and private sector researchers in important and highly visible ways to mitigating air pollution and improving public transport.	<p>Consider partnering with these leaders and with citizens, scientists, the private sector, and advocacy efforts on clean air, clean and safe transport, and improved mobility and public safety for women [CAC, USAID].</p> <p>Hold a workshop in Indore drawing on scientists, technical experts, policy advocates, and policy-makers (women and men) to identify gender issues, co-create solutions, and develop an Action Plan for gender-aware air quality management and clean transport planning. Use Shah et al, (2017) as a reference guide (CAC).</p>
Women’s and private and civil society organizations and women leaders and citizens are actively involved as advocates for clean air and improvements in clean and safe transport.	<p>Identify civil society and private sector organizations and individuals working on gender in air quality and transport, and consider partnering with them on specific research, awareness raising, planning and implementation activities, e.g., Ola Mobility Institute (OMI), Self-Employed Women’s Association (SEWA), Centre for Science and Environment, Safetipin, Institute for Transport and Development Policy (ITDP). (CAC)</p> <p>In CAC Workplan (CAC-WP) Objective I, put women experts on the scientific advisory committee.<sup>109</sup> Obtain sex-disaggregated data in</p>

	CAC studies for committee members to act on. (CAC)
Private sector e-mobility and social entrepreneurs are increasingly interested in women’s use and safety needs and in employing women as entrepreneurs and workers.	Consider partnering with private sector manufacturing firms (e.g., E-Ride), social entrepreneurs (e.g., SNV Green Solutions), and research organizations (e.g., OMI) to include Indore in studies and surveys. [CAC, USAID]
There is a need to identify and assess capacity of Indore-based NGOs, women’s organizations, and private firms in Indore for potential partnerships.	In CAC-WP Objective I, carry out landscape mapping and assess the competency and willingness of actors on gender. Include women and women’s organizations.  Consider partnerships with local Indore organizations, including, if necessary, by helping to build their capacity through linkages with nationally recognized organizations with gender capacity in “learning by doing” activities. [CAC, USAID]

## 5. GENDER INTEGRATION IN THE CAC WORKPLAN

Table 9 identifies opportunities and makes recommendations for gender integration and women’s empowerment in the CAC Workplan by objective. The more detailed recommendations for Objective I reflect the greater detail in which it is described in the Workplan. As CAC activities evolve, additional details should be added, targets set as recommended, monitored, and used to fine-tune activities to achieve women’s empowerment goals. Technical advice from a gender advisor with skills in air quality management and transport would facilitate implementation.

**TABLE 9. GENDER INTEGRATION OPPORTUNITIES IN CAC WORKPLAN**

FINDING	RECOMMENDATIONS
Objective I: There are opportunities for gender integration and women’s empowerment in data collection and analysis, training programs, advisory committee memberships, and awareness-raising programs.	<ul style="list-style-type: none"> <li>In the political economy diagnosis, carry out an inventory of leaders and staff of the transport department and a broad range of public, private, and community decision-makers that shape the transport sector in Indore, by sex.</li> <li>In landscape analysis and other surveys, conduct individualized (not household-level) data collection and analysis to determine women- and men-specific information and differences between them, e.g., on transport use and emission health effects.</li> <li>On the scientific advisory committee and project committee, set gender parity targets and actively recruit women members; obtain sex-disaggregated data in CAC studies for committee members to act on.</li> <li>In all training programs (e.g., short course on scientific methods, journalist training), set gender parity targets for participants and actively recruit women participants. Raise gender issues relevant to the topic in the training program based on data collected by CAC or through other research.</li> <li>In the Rumor Tracking study, obtain sex-disaggregated data by deliberately including women and men, analyzing differences in their views, and acting suitably on the revealed differences.</li> <li>In awareness-raising programs, recognize gender differences in where women and men obtain information, along with relative access to sources and devices (e.g.,</li> </ul>

	women have less access to mobile phones), and devise appropriate strategies and use methods that reach women and girls, men and boys. Devise appropriate strategies to reach low-income communities; involve women.
Objective 2: There are opportunities for gender integration and women's empowerment in the root cause analysis, training materials, and sector engagement.	<ul style="list-style-type: none"> <li>• Identify and include gender issues in the root-cause analysis and training materials.</li> <li>• When a sector is identified, identify and address gender issues. If the choice is the transport sector, adopt gender guidance as indicated in this report, including key stakeholders on this issue in India.</li> </ul>
Objective 3. Recognize that gender differences are likely in policy and financial incentives to discourage emissions.	<ul style="list-style-type: none"> <li>• Policy and financial incentive analytics should examine gender differences and devise solutions based on findings.</li> <li>• Seek diverse coalitions that include gender-aware and responsive groups.</li> </ul>
Coalitions that include a diverse set of gender-aware and women's organizations are likely to be more effective.	
Objective 4. Empowering women as clean air catalysts has great potential if addressed systematically throughout the CAC program	<ul style="list-style-type: none"> <li>• Identify opportunities to include women in all CAC activities</li> <li>• Set inclusion targets for trainings, advisory groups, and committees, among communities</li> <li>• Take deliberate actions to achieve gender inclusion targets</li> </ul>

### **(Preliminary) CAC Illustrative Gender Indicators**

The indicators below are preliminary and should be fine-tuned to the specific CAC sub-activities implemented.

- #/% women/men in CAC short courses/trainings
- #/% women/men on CAC advisory groups, committees, research teams
- Air quality information available to women and girls through targeted methods known to reach them at various income levels.
- Gender-differentiated content in training materials
- Multiple-ride bus pass for women (affordability for “chaining” travel)
- #/% women/men transport mode use gender-differentiated transport user study
- Gender-differentiated emission exposure in high-exposure occupations (e.g., construction and vendors)

## ANNEX A: SCOPE OF WORK

### BACKGROUND

USAID'S Center for Environment, Energy, and Infrastructure (EEI)/Green Cities Team recently launched USAID's new global air pollution program—Clean Air Catalyst (CAC). CAC aims to develop a data-to-impact methodology to accelerate inclusive clean air action in cities in low- and middle-income countries (LMICs). Women and girls are extremely vulnerable to the negative effects of air pollution due to biological differences, socioeconomic disparities, gender norms, and power imbalances. Air pollution impacts women and girls differently than men and boys in terms of exposure and solutions.

Understanding the gender issues is critical to determining which challenges and negative impacts should be prioritized, which solutions will reach women and girls and other vulnerable populations, and what the exposure patterns are.

Reducing air pollution and addressing its negative impacts has great potential for reducing gender inequalities and increasing women's economic participation and empowerment. The economic transitions required to deliver cleaner air offer an opportunity to amplify female contributions to society and economies. However, clean air policies and solutions aimed at general improvements in ambient air may not sufficiently address the particular sources that affect women's exposure, and ultimately their health. Also, general solutions may not take into account the needs and priorities of women and girls, which may stall their uptake and full adoption. CAC aims to ensure clean air solutions are inclusive; therefore, we seek to 1) better understand how different emission reduction strategies may affect women and girls differently than men and boys and 2) identify opportunities for women to act as leaders in designing, implementing, and adopting emission reduction strategies.

### Gender Analysis Objective, Vehicle Transport

USAID is seeking a desk review gender analysis on air pollution from vehicle transport to better understand the opportunities, challenges, and innovative ways of integrating and strengthening women's economic empowerment and equality (WE3) in key clean air sectors. We selected vehicle transport for this gender analysis, considering: (1) its relative importance as a major source of air pollution in all three CAC pilot cities; (2) the impact of vehicle emissions on women's and girls' health; (3) the feasibility of implementing impactful interventions in each pilot city; and (4) the potential for advancing gender equality and women's economic participation in the pilot cities.

The vehicle transport sector (car, bus, motorcycle, trucks, etc.) is a major source of urban air pollution in LMICs. Vehicular transport is responsible for a multitude of air pollutants (e.g., PM<sub>2.5</sub>, NO<sub>x</sub>, CO<sub>2</sub>, O<sub>3</sub>) due to fossil fuel combustion, road dust, tire wear, and brake wear. In particular, epidemiology studies have found adverse respiratory and cardiovascular effects for populations living near and/or working along major roadways.<sup>111</sup> Air pollution from the vehicle transport sector has multiple gender dimensions due to male and female differences in occupations, mobility restrictions, transport preferences, and mobility patterns. Gendered norms and responsibilities affect the mobility of women and girls, men and boys differently, therefore leading to differences in exposure from vehicle emissions. In India, women and low-income groups generally have low mobility due to deep socioeconomic and cultural constraints. Walking remains the main mode of transport for most Indian women due to safety concerns, cultural norms, and economic limitations.<sup>112</sup> As women's incomes increase, women often shift to public transport, but this is often either unavailable or inefficient in its reliability and reach in Indian cities.

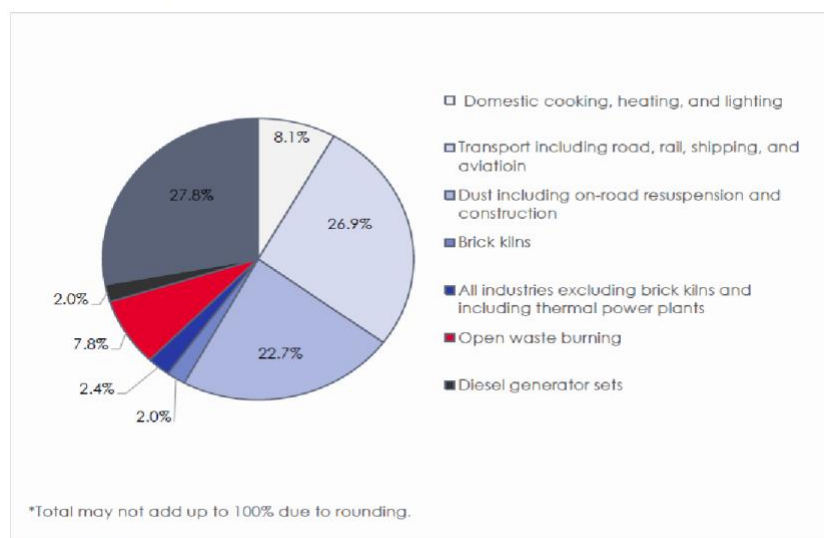
Affordable, dependable, and safe transportation options would encourage both gender equity and women’s economic participation while strengthening support for sustainable and clean transport in India.

Street workers and the urban poor who live on the street are high-risk populations to vehicle emissions. Women, young people, and migrant workers are disproportionately represented in the informal economy of street work, and often lack information on their rights and health and safety. While substantial research has been conducted on gendered exposure to air pollution in the home from cooking fuels, research is minimal on how air pollution from vehicle transport impacts men and boys differently than women and girls.

USAID is recommending the geographic scope of the review be conducted at the country level for India with a focus on Indore and the Madhya Pradesh region. CAC will use the desk review to guide CAC activities in India, and the questions and approach will guide similar analyses for Indonesia and Ethiopia.

Based on a preliminary emission inventory of Indore (Figure 1), scientists estimate 27 percent of transport emissions contribute to Indore’s ambient PM2.5 concentrations. Traffic is a problem in Indore, but the municipal government is working to clean up road dust, reduce idling vehicles, and expand public transport.

Figure 1. Average Annual Source Contributions to PM2.5 Concentrations in Indore



Source: Guttikunda et al.

The Indian government is also implementing national reforms and making substantial financial investments in electric vehicles in India<sup>113</sup> to reduce air pollution and advance economic growth. It is increasingly focused on advancing WE3 and reducing air pollution in India by growing the country’s electric vehicle market.

- **Electric bicycles/scooters/trolleys:** Ampere is one of the leading electric vehicle manufacturers in India, which is led and developed by Hemalatha Annamalai, a female entrepreneur who seeks to make low-cost electric bicycles, scooters, and load carriers. She wants to “create a whole new manufacturing sector [and] wants a lot of women to come into this sector.”<sup>114</sup> Since inception women’s empowerment has been the driving force for Ampere with more than 30 percent of its manufacturing workforce being women. The aim is to double that percentage in the near future to achieve a majority of women in the manufacturing workforce. Ampere also aims to play a significant

role in helping the government achieve its electric vehicle and air pollution targets by producing 15–20 percent of the country’s desired 7 million electric vehicles.

- **Electric she-rickshaws:** Eride E-mobility ([www.eride.co.in](http://www.eride.co.in)) is a Hyderabad-based electric vehicle manufacturing company that aims to advance women’s empowerment, boost livelihoods, and reduce pollution by electrifying doorstep bulk delivery in the city. The aim is to create ‘She-rickshaws’ in Hyderabad, where most of the employees are women. The company trains women on how to drive, service, and maintain the vehicles, along with self-defense techniques to ensure women can protect themselves while working.
- **Electric taxis:** The Association of Lady Entrepreneurs in Hyderabad is launching an initiative to provide self-sustaining employment for women that reduces air pollution. The goal is to have female entrepreneurs driving electric taxis in the city. The company is run by women for women to address female safety concerns regarding conventional taxis and public transport.

## METHODOLOGY

The research team will conduct a desk review gender analysis on vehicle transport aimed at answering two core questions:

1. How are women and girls impacted differently than men and boys from vehicle emissions (considering mobility patterns, street life, and street work) due to power dynamics, occupational differences, socioeconomics, cultural barriers, and political barriers?
2. What are the opportunities for and barriers to women’s leadership, decision-making, entrepreneurship, employment, and meaningful participation in catalyzing clean air action?

The geographic scope of the review will be conducted at the country level for India with a focus on Indore and the Madhya Pradesh region.

## Literature Review, Secondary Data

USAID and CAC compiled a detailed [literature list](#) of reports and research studies on air pollution, vehicle transport, and gender. The studies are categorized by: (1) geographic scope (e.g., global, India, or Indore), (2) sector (e.g., traffic/air pollution), and (3) gender/vulnerable groups (e.g., men, women, street workers). During this stage, Banyan will conduct a brief literature review using the literature list and any additional sources. The objective of this phase is to summarize key findings from the literature to address the core research questions outlined above.

## Interviews, Primary Data

However, due to the lack of available literature examining the gender dynamics of air pollution from vehicle transport, Banyan will conduct five interviews to gather primary data for the gender analysis. USAID and CAC will create a list of key informants for Banyan to interview (put the names and contact information under the “Interview List” tab on this Google sheet). Our aim is to gather information from a diversity of perspectives: (1) municipal government, (2) civil society, (3) private sector, (4) academia, (5) local citizens, and/or (6) other donors.

From the interviews, we seek to better understand the following:



1. What are the exposure differences among women and girls, men and boys to air pollution from vehicle transport in Indore (or India)?
  - a. What social, political, and/or economic factors shape exposure differences (e.g., mobility patterns, transportation networks, division of labor, street life, and street work)?
  - b. What populations are most vulnerable to exposure from vehicle emissions in Indore (e.g., women, men, socioeconomic class, caste, labor sector)?
  - c. What are the key data gaps at the intersection of gender and transportation emissions? What data should CAC consider collecting to fill this gap and to improve the project's understanding of exposure differences in Indore?
2. What are the policies, laws, and regulations that shape transportation emissions—both intended and unintended (e.g., designated transport corridors, economic growth policies that encourage more traffic, air pollution control regulations), and how might these legal instruments affect men and women's exposure differently?
  - a. What must governments and institutions consider when designing clean air solutions to equally protect women and girls, men and boys from toxic vehicle emissions?
3. What high-impact opportunities/actions should CAC consider supporting to reduce vehicle emissions while advancing gender equality and women's empowerment?
  - a. What opportunities are present (or already in action) for women to be empowered as leaders in advancing clean air solutions in the vehicle transport sector in India?
  - b. What opportunities does CAC have to partner with government institutions, the private sector, and/or other donors to advance clean air solutions and women's empowerment in the clean air sector?

Banyan's consultant will use the above framing questions to create a list of specific interview questions for each informant since the types of questions will differ depending on the expertise and sector of the informant. The team, augmented by relevant technical office staff members, will conduct discussions and interviews with key informants following standard protocols. All interviews will be transcribed and placed in the Google drive that all members of the Gender Analysis team can access for review and analysis.

### Deliverables/Timeline

Deliverables	Responsible	Date
Compile literature: a short list of relevant reports and publications ( <a href="#">USAID list</a> )	USAID/CAC	January 13, 2021
Prepare a list of key stakeholders for the interviews, representing leading experts and female leaders working at the intersection of transport and air pollution (entrepreneurs, citizens, private sector leaders, etc.)	USAID/CAC	January 22, 2021
Develop interview questions	Banyan Global with support	February 10–21, 2020

Carry out key informant interviews with leading experts in the vehicle transport sector	from the CAC transportation expert	
Draft Gender Analysis Report, a summary of primary data and literature with program recommendations for CAC based on the analysis of the vehicle transport sector (25 pages)	Banyan Global	March 3, 2020
Feedback on the draft gender analysis report	USAID/CAC	March 12, 2020
Submit final gender analysis report	Banyan Global with support from the CAC transportation expert	March 19, 2020

USAID/CAC inputs

- Share relevant reports from Indore, the Madhya Pradesh region, and India
- Provide a list of key experts and female clean air champions in Indore to interview; finalize by January 22, 2021
- Review and finalize the literature list and interview questions
- Review Desk Review Report and provide feedback

**TEAM COMPOSITION**

The research team will include a senior women’s economic empowerment expert and a transportation sector expert. The Banyan Global senior women’s economic empowerment expert will lead the research efforts including data collection and analysis, and report preparation. The CAC transportation sector expert will contribute to the compilation of relevant literature, review and contribute to the interview questions, participate in key stakeholder interviews, and review draft sections of the report that the senior women’s economic empowerment expert prepares.

**Senior Women’s Economic Empowerment Expert (15 days)**

- Minimum of 10 years of experience in research, policy formulation, and program design in gender or social inclusion.
- At least six years of experience in carrying out gender analyses.
- Demonstrated expertise in women’s economic empowerment.
- Excellent English language speaking and writing skills.
- Master’s degree in sociology, anthropology, economics, or other relevant social science field.

## CAC Transport Experts (6 days)

Two CAC experts will work with the Banyan consultant:

1. Professor Jacqueline (Jackie) Klopp, Columbia University Clean Air Toolbox Team: Jackie Klopp
2. Azra Khan, Project Associate, WRI India: Azra Khan [azra.khan@wri.org](mailto:azra.khan@wri.org)

- Minimum of five years of experience in research on air pollution.
- Excellent English language speaking and writing skills.
- Master's degree in sociology, anthropology, economics, or other relevant social science field.

## FINAL REPORT AND SUPPORTING DATA

### The Gender Analysis Report

The findings of the gender analysis must be reflected in a written report. The Gender Analysis final report should not exceed 25 pages, excluding cover page, table of contents, and annexes/attachments.

The report must be written in English and should include the following sections:

- **Executive summary (2.5 pages):** Synthesizes main findings, recommendations, and lessons learned.
- **Introduction (1 page):** Clearly specifies the purpose of the analysis.
- **Methodology (1–2 pages):** Specifies the methodology used for the analysis.
- **Gender Analysis Findings and Recommendations (up to 2 pages):** This is the main section of the report. It will include detailed key gender analysis findings and recommendations. The structure of this section will be determined before beginning data collection.
- **Appendices** must include: a) a scope of work of the analysis, b) methodology and limitations, c) a reference list, d) an interview guide, and e) a list of key interviewees. Other appendices may be added as applicable.

### Interview notes and resource documents

The Contractor must provide summaries of all key meetings, workshops, discussions, and any data collection exercises conducted in the course of the analysis. These summaries must be submitted to the USAID ADVANTAGE IDIQ WE3 Technical Assistance Task Order Manager, along with copies of any background documents and reports gathered in the course of the assessment. All information must be provided in an electronic format, organized and fully documented for use.

### Datasets

Should the Contractor use quantitative data, all datasets generated during the performance of the assessment must be submitted in a machine-readable, non-proprietary format and excluding any personally identifiable information, with supporting documentation describing the dataset, such as code books, data dictionaries, data gathering tools, notes on data quality, and explanations of redactions. All datasets created during the performance of the task order must be submitted to the Development Data

Library per open data requirements found in ADS 579, USAID Development Data, and per the instructions outlined in ADS 302mas (302.3.5.22). The Contractor must submit the dataset and supporting documentation within thirty (30) calendar days after the dataset is first used to produce an Intellectual Work or is of sufficient quality to produce an Intellectual Work.

### **Submission to the Development Experience Clearinghouse**

The final approved report (or a sanitized version of it) must be a public document to be submitted to the Development Experience Clearinghouse (DEC) ([www.dec.org](http://www.dec.org)) following the required Office of GenDev format. The contractor must make the final gender analysis report publicly available through the DEC within 30 calendar days of final approval of the formatted report.

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## ANNEX C: LIST OF INTERVIEWS

### LIST OF KEY STAKEHOLDERS

NAME	POSITION AND ORGANIZATION
January 19, 2021	Shikha Joshi, General Secretary, Self Employed Women's Association, Madhya Pradesh. Interview done by Kaushik Hazarika and notes provided.
February 23, 2021	Kalpna Viswanath, CEO and Co-founder, Safetipin
February 25, 2021	Anjali Mahendra, Director, Global Research, WRI
March 1, 2021	Julian Marshall, John R. Kiely Endowed Professor, Associate Chair for Justice, Equity, Diversity, and Inclusion, Department of Civil & Environmental Engineering  Director, Grand Challenges Impact Lab Adjunct Professor, Global Health University of Washington
March 5, 2021	Kaushik Hazarika, CAC Project Manager, Environmental Defense Fund/India  Bhavay Sharma, CAC Project Manager, WRI/India
March 5, 2021	Vani Joshi, Clean Air Guide  Minakshi Kar, Assistant Professor, Indore School of Social Work (ISSW)  Neeraj Mishra, Building Healthy Cities (BHC-JSI), City Project Officer  Rajendra Sharma, Professor, ISSW
March 5, 2021	Aishwariya Raman, Associate Director, Head of Research, OMI
March 16, 2021	Anumita Roy Chowdhury, Executive Director, Research and Advocacy, Centre for Science and Environment

## **ANNEX D: KEY STAKEHOLDER INTERVIEW GUIDE**

### **GUIDE I: CLEAN AIR CATALYST GENDER ANALYSIS INTERVIEW GUIDE (TECHNICAL EXPERTS—AIR POLLUTION/TRANSPORT)**

#### **Introductions**

Project Description: The United States Agency for International Development (USAID) has asked Banyan Global and the World Resources Institute (WRI) to undertake a gender analysis on air pollution from vehicle transport. It is part of the Clean Air Catalyst (CAC) program being implemented by WRI over the next five years in three Asian cities, one of which is Indore. The focus on Indore is due to high levels of transport emissions and municipal government commitment to reducing them.

One of CAC's goals is to design high-impact solutions to reduce emissions. Vehicle transport was selected for the gender analysis, considering the:

1. Relative importance of transport as a major source of air pollution in Indore
2. Impact of vehicle emissions on women's and girls' health
3. Feasibility of implementing impactful interventions in Indore
4. Potential for involving women in solutions and advancing gender equality

While the focus is on Indore, we can draw insights and lessons more broadly from across India and globally.

We want to better understand each of these issues and help USAID design solutions that are responsive to gender differences, involve women particularly low-income women, and promote gender equality. We will also consider other marginalized groups as possible. We will produce a gender analysis report on our findings and recommendations.

Please feel free to respond to the questions or parts of questions with which you are most comfortable.

#### **Interview Questions**

##### **Differences in exposure to air pollution from vehicle transport:**

1. Factors that shape differences in exposure to air pollution from vehicle transport between men/women/girls/boys, low-income/high income, and other marginalized groups (other, hereafter) include:
  - Mobility patterns
  - Transportation systems
  - Division of labor
  - Location of employment/street work

- Location of residence
2. In your view, is there any other factor we've left out of this list that should be considered, with reference to Indore/India?
  3. What are the key data gaps that, if addressed, could help us understand gender/class/other differences in exposure to transport-related air pollution?

### **Actions underway and needed for clean air solutions in transport**

4. What are current policies/regulations that address gender/class/other differences in exposure to air pollution from transport? How effective are they?
5. What are ongoing initiatives to better meet differing and less-polluting transport needs by gender/class/other? With particular reference to Indore?
  - City governments? Indore?
  - NGOs and advocacy groups
  - Women's groups
  - Have you any recommendations for USAID to partner with organizations to advance clean air solutions? In Indore?
6. What are two to three top priority actions that should be taken to advance clean air transport solutions responsive to differing needs by gender/class/other? With particular reference to Indore?
7. What are ways for women to become empowered as leaders and workers in advancing clean air transport solutions in Indore/India?
8. Any other people we should speak with or research we should examine?

## **GUIDE 2: CAC GENDER ANALYSIS INTERVIEW GUIDE (TECHNICAL EXPERTS: TRANSPORT/GENDER)**

### **Introductions and Project Description**

#### **Interview Questions**

1. Please tell us about yourself and your work.
2. What are the driving factors for choices women make when it comes to transport usage (that may lead to differential exposure)—list/talk about two to three key factors in your view?
3. What are ongoing initiatives (e.g., of city governments/ NGOs/advocacy groups, etc.) to better meet differing (and less-polluting) transport needs of women/men?

4. What are ways for women to become leaders and workers in transport?
5. Do you have any recommendations for CAC to partner with organizations working on gender and transport issues? (In Indore?)
6. What are the key data gaps that, if addressed, could help us better understand gender differences in transport use?
7. Do you have recommendations for any other people we should speak with on these issues?

### **GUIDE 3: CAC INTERVIEW GUIDE (CLEAN AIR GUIDE)**

#### Introductions and Project Description

#### **Interview Questions**

1. Please tell us about your work as a clean air guide.
2. How did you become involved in this work?
3. What do you hope to accomplish?
4. Would you recommend this work to other women? Why or why not?

### **GUIDE 4: CAC GENDER ANALYSIS INTERVIEW GUIDE (CAC RESEARCH TEAM)**

#### **Introduction**

Project Description: We're working with Banyan Global, a consulting firm, on the USAID-funded Clean Air Catalyst project implemented by WRI and partners. We're now doing a gender analysis to inform implementation of the CAC project, we are focused on transport. One of CAC's goals, as we understand, is to design high-impact solutions to reduce emissions. Vehicle transport was selected for the gender analysis, considering the:

1. Relative importance of transport as a major source of air pollution in Indore
2. Impact of vehicle emissions on women's and girls' health
3. Feasibility of implementing impactful interventions in Indore
4. Potential for involving women in solutions and advancing gender equality

We want to better understand each of these issues and help USAID design solutions that are responsive to gender differences; involve women, particularly low-income women; and promote gender equality. We will also consider other marginalized groups as possible. We will produce a gender analysis report on our findings and recommendations.

Please feel free to respond to the questions or parts of questions with which you are most comfortable.

## Interview Questions

1. Please describe the project team.
2. Please explain your roles in the project.
3. Your research has a focus on source awareness, which involves a scientific review and consultation to identify likely sources and distribution of their impacts. Probe on gender dimensions.
4. Assessment of current understanding of pollution sources and ways that people get pollution-related information. Probe on gender dimensions.
5. Relationship-building with clean air champions whom we will seek to support and complement over the coming years. Are you considering women clean air champions for support? Who?

## **ANNEX E: POTENTIAL PARTNER ORGANIZATIONS FOR GENDER, AIR QUALITY MANAGEMENT, AND TRANSPORT**

### **NGOs:**

#### **GBV, mobility, and public safety:**

1. Breakthrough
2. Jagori
3. Safetipin
4. Sanghini
5. In informal sector
6. National Association of Street Vendors of India—activities in Indore
7. SEWA—affiliate in Indore
8. WIEGO

#### **Environmental research, gender, and advocacy:**

9. Centre for Science and Environment (Sunita Narain, Director General)
10. Warrior Moms (citizen advocacy platform)
11. Women in Air Quality in South Asia: <https://twitter.com/waqsouthasia>. (Scientists, engineers, environmental and public health specialists).

#### **Transport:**

12. Ampere (private sector)
13. E-Ride (private sector)
14. ITDP (research and advocacy)
15. Ola Mobility Institute (research)
16. The Raahgiri Foundation

#### **Donors:**

17. Asian Development Bank (metro station safety)
18. Bill and Melinda Gates Foundation

19. GIZ: Women Mobilize Women Initiative

20. UN Women

21. The World Bank (gender, transport, and infrastructure studies)

## ENDNOTES

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