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Improved Air Quality through Non-disruptive Work Scheduling

A CSIR NISTADS Mission Delhi-2017 Initiative

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Summary

The major source of air pollution in a metropolis like Delhi is vehicular traffic. While the atmospheric circulation and precipitation act as natural and regular sinks, through advection and deposition, they have limits due to various dynamical and seasonal effects. Quite expectedly, the pollution peaks as the week progresses due to the accumulation. Thus a break or reduction in traffic even for a day would enable the natural circulation to clear the air. Such a break in traffic can be now affected non-disruptively through IT-enabled work/school scheduling especially in large metros where there are good infrastructure and access. Our proposal is to implement a 2 +1+2 working week in which the third day (Wednesday) will be a day of Virtual Attendance at work and School (VAWS), with two regular working days before and after. This would allow spike of the air pollution to subside during mid of the week. In addition to reducing air pollution, VAWS will have several other socio-economic benefits like energy saving at work/school, reduction of travel related stress and health hazard, higher efficiency and improved quality life. It is argued and demonstrated that such a VAWS can be easily implemented and monitored through an organised system; a critical success factor is that VAWS should be implemented and synchronized for offices and schools. A comparative analysis is presented for implementability. The solution is shown to be sustainable and non-disruptive without any adverse effects and can be easily replicated in other metros.

Background

With the air pollution levels in Delhi often above permissible levels, concerns, and search for mitigation solutions have risen. The primary source of this pollution in a megacity like Delhi remains vehicular emission. It must be also emphasized that in addition to RSPM, other components of vehicular emission, like SPM, NO_2 and sulphates, also contribute to poor air quality resulting adversely effecting human health.

Mitigation of air pollution is, however, strongly tied to socio-economic issues. In particular, such a mitigation solution needs to address all aspects of socio-economic implications and sustainability. A carefully designed policy mechanism is an urgent need to address control pollution in a sustainable, non-disruptive manner, integrating other important socio-economic parameters like quality of life. While solutions like alternative, Odd-Even Number, (OEN) may provide a temporary solution, it may also have several adverse effects. While the concept of Work from Home (WFH) is not new, its design and formulation in several countries lacked certain essential features. Here we propose a policy solution to mitigate metropolitan air pollution through **Non Disruptive** work scheduling which can be implemented easily, with no adverse effects but with significant socio-economic benefits.

The Proposed Policy Intervention

In the proposed solution, the working week is divided to a 2+1+2 working-day week, with one day as Virtual Attendance in Work and School (VAWS). Under VAWS, parents and the children will work at home on the specified day; the items of work/study will be prescribed the previous day and the work/study report will be submitted on the day following VAWS. A mechanism of internal monitoring will be in place.

Implementation and Feasibility

After the VAWS scheme is announced by the appropriate authorities, the implementation consists of three steps:

1. Identification and organization of work/study items that can be carried out at home in a day's time,
2. Submission of complete work along with a work/study report by the officer/individual,
3. Monitoring (based on report) by organization/school to ensure efficiency; a simple VAWS-Day Monitoring table may be used, **(Appendix A)**

To maintain transparency, accountability and objectivity, the record of work assigned and completed can be placed on institutional/school web portals. It should be made clear that the day of VAWS is NOT a day of leave, and a worker must be available for in station and must report for duty at office in case of an emergency. With an effective IT infrastructure like email and internet and mobile telephone, it is implementable.

Thus VAWS is a viable alternative for the OEN would be adopting a **work-from-home** (WFH) day, preferably in the middle of the week, i.e. Wednesday. As per this rule, all those jobs which do not require supervision or office setup can be managed from home. It will help in reducing a day's transportation and hence pollution. To make this system work, each organization/school can fix a target or set of goals for the employee /Students to achieve on the WFH day, which can be reviewed on the following day.

To make it successful, the VAWS days for offices and schools shall need to be coordinated and synchronized so that parents and children are off the road on the same day and Implementation of VAWS requires a critical level of IT structure. Fortunately, Delhi, and the other metros as well, now have good IT structure. At the same time, rural areas where the IT structure is yet evolving may not require VAWS.

Flexi timings working culture is already in practice across the country but the VAWS system is comparably much better option as it assures the reduction in traffic volume. Former one neither reduces the working hour of employee nor the stress of travelling and pollution level. This will be a Pilot study for a given duration and not zonation and offers completely an optional mechanism

Advantages of VAWS:

- Contrary to Odd-Even Number (OEN), the VAWS limits the plying of all kinds of vehicles including bikes and buses, whose contribution to air pollution are higher than cars.

- This system does not need strict policing as it is self-regulating. On the other hand, cops have to constantly monitor the number plates and stop the cars in odd-even rule.

- As the stress of travelling is prevented, WFH day can be more efficient and time saving, making the day more productive.

Comparative Analysis:

At present, there are several options being proposed for reduction of vehicular emission such as through various bans and restrictions such as through alternative number plates. Of these, the alternative number plate system is likely to be the most effective as it would reduce the number of vehicles approximately by half on any given day. However, there are several issues related to sustainability, disruptiveness and adverse side effects that need to be carefully considered. A comparative analysis of VAWS and OEN is provided in **Appendix B**. It may be concluded that the VAWS scheme is superior to OEN.

Major Shortcomings of OEN

- Enforcing this rule on cars alone may not be effective, unless OEN system is extended to other vehicles like trucks and bikes. Contribution of cars to city air pollution is only 10%, whereas heavy duty vehicle represent just 5 % of motor vehicle but is responsible for 71% of CO_2 emission and & 74% of particulate emission.
- Success of this rule in cities of many countries (**Appendix-C)** is because of its excellent public transport system, whereas Delhi public transport system is neither comfortable nor punctual, leading to inconvenience of commuters, including Metro being limited to few areas and most often congested.
- Main emphasis of the government to develop a good road infrastructure outside Delhi so that these heavy duty truck which usually used to transport various goods from one state to another states use highways instead from inside Delhi road.

Likely Adverse Effects of OEN

- Cost of private transport like cabs and auto rickshaw are likely to increase burdening the poor and middle class commuters,
- Cities like Bogotá and Mexico, people circumvented this rule by buying 2 or more cars leading to opposite result, Mexico air pollution increased by 13%, same situation may repeat in Delhi too,
- Public may resort to buying 2 cheap cars rather than a single high quality car, resulting in more pollution, More congestion/more pollution on account of car parking on roads in many residential areas of Delhi, nullifying the effect of less running cars on the roads with the trend of buying two cars,
- User un-friendly, bring discomfort to old, women and patients with medical conditions who cannot travel on bumpy autos and buses,

- Difficult monitoring, increasing burden on traffic cops, likely to boost the bribery and corruption.

Impact, Outcomes and Outputs

The VAWS scheme would effectively reduce the number of school days by 50 days. The proposed mitigation envisages a non-disruptive solution that enhances quality of life and also efficiency.

Sustainability and Follow up

(a) Based on the feasibility assessment of the initial phase of the project, the process can be refined through precision measurements and surveys to introduce zonal variations.

(b) The traffic scheduling can be further refined through digitization as part of Digital India.

(c) Efficiency of the system can be enhanced through further R&D and synergy.

(d) After the proof of concept over Delhi, the system can be replicated over other urban air basins.

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Appendix- A

Table 1: Format for monitoring virtual Attendance

(a) Name of the Organization

(b) Name of the Officer/Student

(c) Name of the Reporting Officer/Teacher

VAWS Day	Work Assigned	Work Submitted	Signature individual	Signature RO/Teacher
DD/MM/YY	Assignment No	Submission Number	-----	------

Note: The signature RO/Teacher above is for certification & virtual attendance in terms of work report; it is not a certification of the quality of the work; the evaluation of the work will follow normal procedure.

Table 2: Monitoring Parameters and Method for Work on VAWS Days

S.No	Monitoring Parameter	Procedure	Remarks
1	Virtual Presence	e-accessibility	Through Email/mobile phone
2	Work Assignment	Until Previous Day	Recorded through Portal/ email
3	Work Report Submission	Next Day to VAWS	Recorded at Portal/ through email

Appendix - B

Table 3: Comparative Analysis of two Mitigation Measures for Reduction of Air Pollution

Serial No.	**Parameter/Process**	**VAWS (Virtual Attendance at Work/school)**	**OEN (Odd-Even Number)**
1	Implementation	Immediate and Total	Phased and disruptive
2	Effectiveness	Both cars and school buses	Only cars
3	Sustainability	Not effected by increase in vehicles	Becomes ineffective as the number of vehicles keep increasing
4	Acceptability	Optional but welcome	May lead to discontent
5	Quality of life	Enhanced quality time	May create stress
6	Productivity	Increase	Decrease
7	Implementation Process	Non-disruptive	disruptive
8	Cost Saving	Positive	Negative
9	Education Quality	Enhance through self studies	May result in teacher/student absence
10	Monitoring and Enforcement	Not required	Difficult and burdensome
11	Associated Benefits	Decrease in related traffic like taxi, auto	Nil, may lead to mal practices
12	Energy	Effective saving at office/ school	No Saving
13	Working Hours	Effective increase	No Change
14	Economics	No extra burden	Extra Burden
15	Health	Less exposure time to Pollution	Same Exposure time
16	Capital Investment	Nil	Large capital & maintenance investment.
17	Scalability	Easy; easier with advances in IT.	Nil
18	Control	Easily withdrawn when pollution level decreases.	Large investments become redundant.

Appendix- C

Experiences from Other Countries on Traffic Restrictions:

Beijing is the recent case of unsuccessful of policy called “Driving Restriction policy” similar to odd and even policy. Beijing is the first city in China to implement a driving restriction policy in order to control traffic volume and air pollution. But this policy is not new in the world. Early in the 1970s, Buenos Aires, the capital and largest city of Argentina, banned one-half of automobiles from entering the city centre on a given day based on odd or even last digit of the plate number. A similar restriction program was also used in the 1980s in Caracas, the capital and largest city in Venezuela, and then in Athens between 1985 and 1991 (de Grange and Troncoso, 2011, p. 863). In Mexico City, a one-day-per-week driving restriction from 5:00 a.m. to 10:00 p.m. every weekday was introduced in 1989. Sao Paulo in Brazil, Bogota and Medellin in Colombia, and Santiago in Chile all joined Mexico in introducing driving restriction to reduce automobile use. More recently, several Chinese cities from north to south, including Changchun, Lanzhou, Hangzhou, Guiyang, and Chengdu, began to rely on driving restrictions to alleviate traffic congestion.

In Beijing, people have invented “surprising” ways to circumvent the driving restriction program. For example, they covered plates or borrowed plates or cars from others on the day when their cars were prohibited. Some of them set out earlier in the morning to beat the 7:00 a.m. cut-off. Or they simply ignored the restriction rules. In a cross-country comparative study including Beijing, temporal shifting of driving is likely to appear when the restrictions are only effective during certain hours on weekdays. According to the Beijing Transportation Research Centre, the congestion index in Beijing decreased from 7.95 in 2007 to 5.93 in 2009, after the driving restriction policy was formally implemented in 2008. However, this index value quickly jumped back to 7.80 in 2010. The possible reasons might be both non-compliance behaviour and the addition of more vehicles on the road. One survey found that 50% of families with one car planned to purchase a second car to circumvent this policy. The data from the second-hand car market also shows that sales of the cheap used cars valued at less than 80,000 RMB doubled after the restriction policy, and the price increased at least by 15%.


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