

THE EFFECT OF URBANISATION ON WIND AT BOMBAY AIRPORT

1. In the present study, an attempt has been made to investigate the effect of urbanization activity taken place around Santacruz Observatory, Bombay Airport on the frequencies of calm and variable wind components and the visibility recorded at 03 GMT. Frequencies of calm and variable wind recorded at 03 GMT at Colaba have been taken for comparison, since Colaba area is much less affected due to urbanization as compared to that of Santacruz, in recent years.

2. Frequencies of monthly mean of calm and variable wind components recorded at 03 GMT at Santacruz and Colaba for the representative months, viz., January, April, July and October have been taken from Monthly Meteorological Registers of the respective stations from the

year 1952 to 1975. The visibility values at 03 GMT for January for the period 1960 to 1976 have been taken from Current Weather Registers of Bombay Airport.

3. Five year running means and their differences of the frequencies of monthly mean of calm and variable wind components for Santacruz and Colaba have been worked out for the representative months, viz., January, April, July and October and is presented in Fig. 1.

January and October — The increasing trend in the wind curve for Colaba (Fig. 1) can be explained by increased friction due to building activity in Navy Nagar between 1957 and 1962 which was mainly residential buildings and again in 1966 to 1971 which was mainly due to Naval Club, Central School and expansion of Naval Hospital. However, since the construction activity at Colaba as compared to Santacruz is less, the trends in Colaba

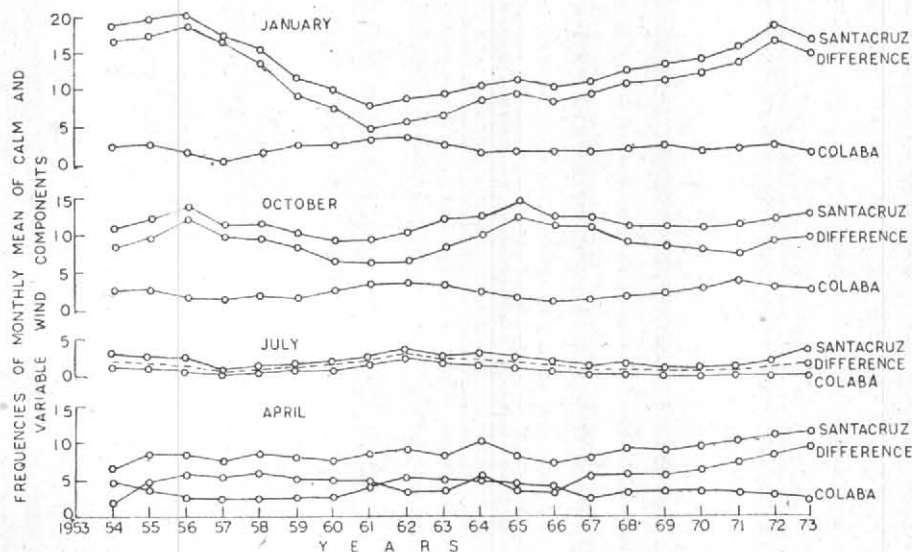


Fig. 1. 5-year running mean and this difference of monthly mean for representative months of calm and variable wind components

curves have been taken for comparison purposes though these cannot be regarded as "Control factors".

On examination of Santacruz curves for January and October, it is seen that the two curves resemble with each other to a large extent. There are increasing trends from the year 1954 to 1956, 1961 to 1965 and 1966 to 1972 (1969 to 1972 in case of October). In October curve, this increasing trend is maintained even after 1972, but in January curve there is a decreasing trend after 1972. There is a decreasing trend from the year 1956 to 1961 (1960 in case of October) and slight decreasing trend from 1965 to 1966. The first decreasing trend (1956 to 1961) and also the last increasing trend (1966-1972) are more prominent in January.

July and April—It will be further seen that in July curves for Santacruz and Colaba there is an increasing trend between 1957 and 1962, a decreasing trend between 1962 and 1968 and thereafter a steady trend, in Colaba but the Santacruz curve showing increasing trend particularly from 1969 onwards. Similar trends in Santacruz and Colaba curves are also seen in April.

The significant and interesting trends in frequency of calm and variable wind components are visible in the months of January and October. In the January difference curve, the increasing trend is observed from 1954 to 1956, 1961 to about 1965 and again from 1966 to 1972 and a significant decreasing trend from 1956 to 1961 and again from 1972. The difference curve of October broadly agrees with January curve, except that the increasing trend from 1966 onwards is not well marked as is seen in January curve.

To explain the increasing trend, in the year 1954 to 1955, 1961 to 1965 and again from 1966 to 1972, there was house building activities in the vicinity of the airport, construction of New Terminal Building for Bombay Airport in the year 1955, Indian Airlines New Hangar in the year 1970, New Airport Colony in the year 1956, P & T, Colony in the year 1970. This has resulted in increased roughness and friction, thereby resulting in increased frequency of calm or light variable wind components.

The decreasing trend in the difference curve for the period 1956 to 1961 and again from 1972 onwards (January) can be explained by the fact that in order to provide safe air navigation, some hills around Bombay Airport situated in the NE to ESE direction were cut in two phases, during the years 1957 to 1963 and again during 1971 to 1972, the second phase of hill cutting being of lesser order. This cutting of hills resulted in decreased roughness and friction and flow of

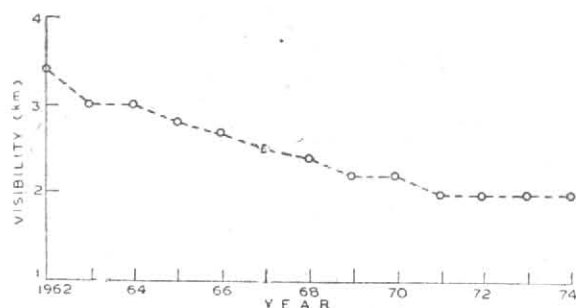


Fig. 2. 5-year running mean of visibility (03 GMT) at Santacruz airport during January for the period 1960-1974

TABLE I

Average increase or decrease of calm and light variable wind components (%) for January difference curve

Period	From difference curve of January			Average per year	Increase/Decrease from initial value (%)	Remarks
	Initial value	Final value	Difference			
1956-1961 (5 yr)	18.6	4.8	-13.8	-2.8	-15	Mainly due to hill cutting phase I.
1961-1965 (4 yr)	4.8	9.4	4.6	1.2	25	Due to construction activity.
1966-1972 (6 yr)	8.4	16.2	7.8	1.3	15.5	Due to construction activity. 1st phase of hill cutting.
1972-1973 (1 yr)	16.2	14.8	-1.4	-1.4	-8.5	Due to construction activity. IInd phase of hill cutting.

more air, thereby resulting in decreased frequency of calm and light variable wind components. However, Santacruz actual curves as well as the difference curves for January and October show that the pronounced effect of first phase of cutting of hills on the calm and light variable wind components was nearly made up by the opposing effect of subsequent construction activity around the airport. The effect of the second hill cutting operation is seen only in January.

To get a rough idea of percentage increase or decrease in calm and variable wind components, recorded at 03 GMT due to various urbanization activity, computation has been carried out

TABLE 2
Percentage frequency of mean component of prevailing wind direction during the representative months recorded at 03 GMT over Santa cruz

Direction	Percentage Frequency			
	Jan	Apr	Jul	Oct
N	4	6	1	1
NNE	6	6	0	2
NE	10	9	1	12
ENE	26	10	1	20
E	23	11	1	22
ESE	5	5	1	11
SE	2	6	2	4
SSE	0	1	1	1
S	0	5	1	3
SSW	0	1	2	0
SW	0	1	11	2
WSW	0	0	27	1
W	0	1	30	0
WNW	0	0	13	0
NW	0	2	2	1
NNW	1	4	1	0

for January difference curve and is presented in Table 1. It is seen from the table that due to two phases of cutting of hills, there was an average decrease in calm/variable wind components by about 15 and 8.5 per cent respectively. On the other hand due to construction and other urbanization activity, there was an increase of the order of about 25 and 15.5 per cent.

It is of interest to note that the curves for April and July do not reflect the effect of cutting of hills which are situated to the NE to ESE direction of the airport, on the other hand there is an increasing trend which is seen prominently in July. In this connection Table 2, which gives the directional frequencies of the prevailing

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winds during the four representative months may be referred. It will be seen from Table 2 that the directional frequency from NE/ESE sectors are least in July followed by April whereas in January and October these are the prevailing wind directions. Therefore, the cutting of the hills situated in NE/ESE direction had no effect on the calm and light variable wind components during the month of July. On the other hand the influence of construction activity resulting in increase of calm and light variable wind component had noticeable effect in July.

This increase of calm and light variable wind components in the month of January and October due to urbanization activity has direct bearing on pollution problem.

Taking visibility as a measure of pollution, five-year running mean of poor visibility recorded at 03 GMT at Santacruz Airport during the months of January for the period 1960-1976 is presented in Fig. 2. It is clear from the figure that there is a decreasing trend in the visibility curve from the year 1961 confirming that urbanization activity has altered the microclimate of Bombay Airport.

The effect of the first phase of hill cutting so spectacular in case of Santacruz, is not reflected in the Colaba curve. On the contrary, it is felt that the simultaneous construction activities in the Colaba areas during 1957-1962 had more pronounced effects. However, the second phase of hill cutting operation has perhaps affected favourably both Santacruz and Colaba areas in the same manner, as is indicated in the downward trends in the January curves.

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