

## **CRITERIA FOR LOCATION OF HIGH SCHOOLS IN DACCA CITY**

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**Introduction :** The paper is a result of an investigation into the locational aspects of the high schools in the city of Dacca, the commutation pattern of the students and the cost implications, the attitudes and opinions of the students, teachers and the guardians in that locational and environmental context.

The admission problem in the city schools has reached a crisis point. This is primarily because of great shortage of schools in relation to the demand for places in them. Most schools are greatly overcrowded, from 50% to 200% over the capacity which may be considered ideal under the given circumstances.<sup>1</sup> Also it appears that a large number of the existing schools are not properly located which adds to the problem of schooling in the city. It is on this background that the investigation was undertaken. It is felt that as the capital of Bangladesh, the city of Dacca needs a fast expanding school systems and hopefully the results of the investigation will make useful contribution in the planning and development of new schools in the city.

### **Methodology of Investigation**

Intensive field work involving reconnaissance of a cross section of the city schools was undertaken. This was supplemented by a detailed questionnaire survey. Three sets of questionnaires were used, one each for the students, their guardians and the teachers. In addition to relevant data concerning the family of the students, the questionnaires also gathered information on school distance, travel time, travel mode, surrounding environment and quality of the schools. The findings of the survey were analyzed in simple two way tables (Ap-I). A set of sixteen appropriate and relevant variables was chosen (Ap-II) and a correlation analysis between the variables was done to show the degree of association of some of the findings in the table. The correlation coefficients ( $r$ ) larger than  $\pm 0.50$  (this being significant at 1% level) were considered for the analysis. The indices of correlation coefficients had been worked out by IBM 1620 model computer using Pearson's Product Moment Correlation technique.

### **Distribution pattern of the High Schools**

There are 129 high schools in Dacca City. The address of all high schools in the city were obtained and each of them was located on a map (scale 1.35"=1 mile) using different symbols for each kind of school (i.e., govt. boys/girls and private boys/girls high school; Ap-III).

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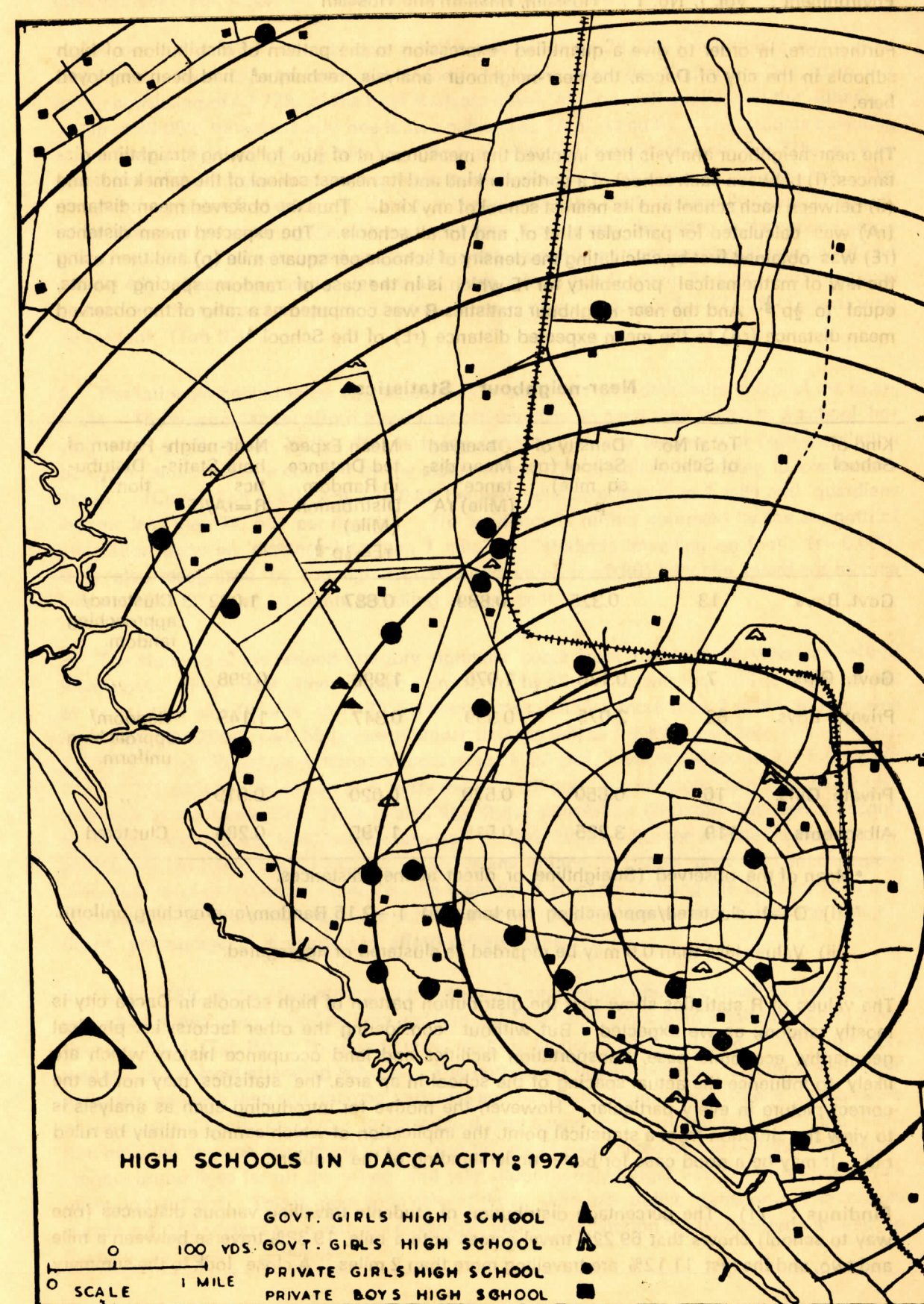
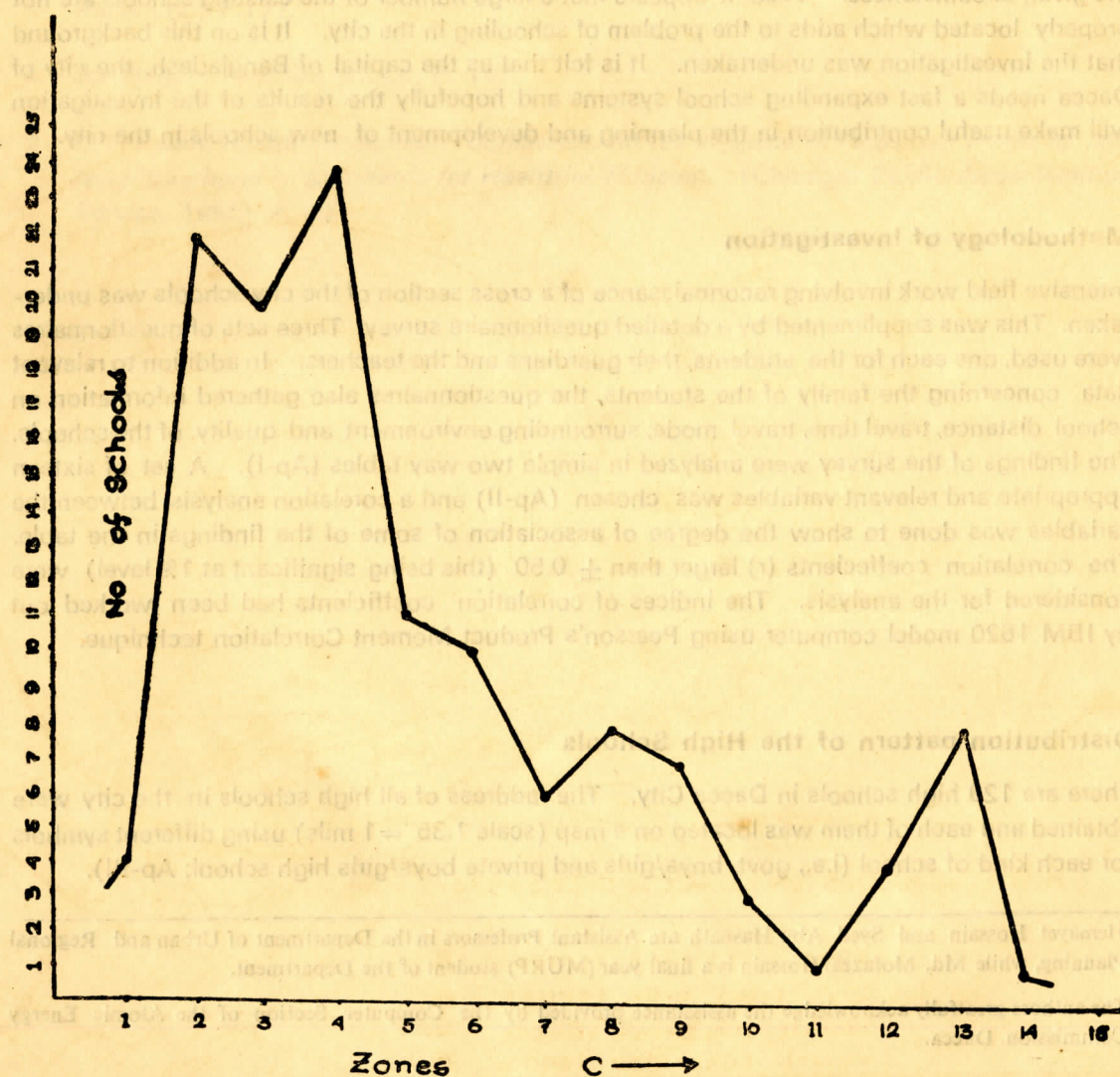


In order to find out the locational frequency of the schools in terms of the distances from the city centre, a series of (total 14) rings were drawn to cover the metropolitan limits of Dacca city.<sup>2</sup> The circles were drawn with the Dacca Stadium as the centre and the radius of successive circles increasing by half a mile. The number of schools in each successive zones were determined as follows :

Zones	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>	C <sub>9</sub>	C <sub>10</sub>	C <sub>11</sub>	C <sub>12</sub>	C <sub>13</sub>	C <sub>14</sub>
No. of Schools	4	22	20	24	11	10	6	8	7	3	1	4	8	1

It is apparent from the above table that the locational pattern varies in magnitude from one area to another depending upon the variation of other related factors, including population base. The frequency curve shows a peak around the CBD sloping down towards periphery. However, the frequency graph rises slenderly in the 13th ring, possibility because of newly developed residential neighbourhood over there.

Fig. 1





Furthermore, in order to give a quantified expression to the pattern of distribution of high schools in the city of Dacca, the near-neighbour analysis technique<sup>3</sup> had been employed here.

The near-neighbour analysis here involved the measurement of the following straightline distances: (i) between each school of a particular kind and its nearest school of the same kind; and (ii) between each school and its nearest school of any kind. Thus the observed mean distance (rA) was calculated for particular kind of, and for all schools. The expected mean distance (rE) was obtained first by calculating the density of schools per square mile (p) and then using the law of mathematical probability for rE which is in the case of random spacing points, equal to  $\frac{1}{2}p^{-\frac{1}{2}}$ . And the near-neighbour statistics R was computed as a ratio of the observed mean distance (rA) to the mean expected distance (rE) of the School.<sup>4</sup>

Near-neighbour Statistics

Kind of School	Total No. of School	Density of School (per sq. mile). p	Observed Mean distance* (Mile) rA	Mean Expected Distance in Random Distribution (Mile) $rE = \frac{1}{2}p^{-\frac{1}{2}}$	Near-neighbour Statistics $R = rA/rE$	Pattern of Distribution**
Govt. Boys	13	0.325	0.889	0.887	1.002	Clustered/ approaching random.
Govt. Girls	7	0.175	1.075	1.996	0.898	"
Private Boys.	83	2.075	0.399	0.347	1.149	Random/ approaching uniform.
Private Girls.	16	0.650	0.570	0.620	0.919	"
All schools	119	3.225	0.515	1.795	0.286	Clustered

\*Mean of the observed (Straightline or direct airline) distances.

\*\* (i) 0—1 clustered/approaching random. (ii) 1—2.15 Random/approaching uniform.

(iii) Values less than 0.5 may be regarded as clustered or aggregated.

The values of R statistics show that the distribution pattern of high schools in Dacca city is mostly random, as we expected. But without considering the other factors; i.e. physical geography, economic base, transportation facilities and land occupancy history which are likely to influence the actual spacing of the school in an area, the statistics may not be the correct picture in every particular. However, the motive for introducing such an analysis is to view the situation from a statistical point, the implication of which cannot entirely be ruled out. It may be a good case for better understanding of the problem.

**Findings :** (1) The percentage distribution of students travelling various distances (one way to school) shows that 69.22% travel across upto a mile, 19.38% traverse between a mile and two, and the rest 11.12% are travelling more than 2 miles. A close look to the summary

tables reveals that 43.77% travel upto a half a mile of whom 28.06% live within a distance of less  $\frac{1}{2}$  mile. Two major tendencies are comprehensible from the findings. One, there is a group consisting of 43.77% of the total students travel around half a mile; and the other is a group of 39.06% traverse nearly one to two miles (Tab 1/col. 4 and 5). The students travelling for an intermediate range ( $\frac{1}{2}$  mile to  $\frac{3}{4}$  mile) of distance constitute only 0.5.77%, may be called the take-off group who are crossing, most likely, the maximum walking distance. We may put them to the first category. Just past that distance, the students usually go by transport. While the students covering the distance more than 2 miles may be added to the second group (Tab. I. col. 6). The two broad groups share the students' percentage almost equally (49.54 and 50.46). These two tendencies are also visible from Tab II where 54.91% students travel on foot and the rest on transports. The travel time is also a minimum for 47.90% students who go on foot (Tab III).

2. The rationale behind these two tendencies is obvious : economic differences of the guardians. Those who cannot afford travel cost are reluctant to send their wards to a school beyond half a mile (Tab XIV). This is being confirmed by the tendency of high correlation between 'short distance covered by the students' and the guardians belonging to low income group'. (Correlation coefficient, r is 0.65 between 'distance less than 1 mile and 'guardians income less than Tk. 501 per month'). The tendency is further approved by the strength of correlation between 'distance less than 1 mile' and 'students travelling on foot' ( $r=0.68$ ). It is also recognised by the high degree of correlation ( $r=0.86$ ) between 'guardians income less than Tk. 501' and 'students travelling at zero cost.'

3. The students of the second category normally come from the families who can afford travel cost. They travel either public transport or by private conveyance. The high values of correlation coefficients ( $r=0.77$  between 'travel distance more than 2 miles' and 'income more than Tk. 2000';  $r=0.55$  between 'travel distance within 1-2 mile' and 'income more than Tk. 2000',  $r=0.55$  between 'transport cost upto Tk. 30 and 'income between Tk. 501-2000; and  $r=0.67$  between 'transport cost more than Tk. 30' and 'income more than Tk. 2.000') give credence to the tendency. Their is also significant correlation ( $r=0.55$ ) between 'transport cost more than Tk. 30' and 'income between Tk. 501-2000'. So, the middle income group, particularly the lower middle income group, seems to incur transport cost not commensurate with their level of income. However, the majority of students among the upper middle and high income groups bank largely on public transport (Tab II), the reason being the insignificant percentage of students can afford private transport.

4. About 48% of the students spend less than 15 minutes for one way travel to their school, while 34% spend almost half an hour and the rest 18% travel more than a half an hour to more than an hour (Tab III). The trend shows that the higher is the travel time, lower is the percentage of students attending schools. The correlation figures between 'distance' and 'time' variables, between time and 'income' variables and between 'income and distance' variables are observed significantly positive. Implausible it may sound that there exists a positive correlation between 'income' and 'travel time'. But this may be explained by the fact that the higher income group lives far off the school and take proportionally longer time, even though they move on transport. This is more so in case of those who use public transport. The simple reason is that transport system is not developed enough to shorten the time period required to traverse the physical distance.



5. Certain factors have preponderant influence than other in case of the choice of school. Of those, quality of the school, nearness to residence, good transportation, and congenial surrounding environment are the predominant ones. While those factors may be mutually inclusive, quality of the school is favoured by 66.46% of the guardians, nearness to residence by 61.58%, pleasant surrounding environment by 53.24%, and good transportation system connecting the school by 52.38% as important criteria for selecting the school (Tab V). To note a few more findings in this regard, while selecting school about 33% of the guardians are influenced by the choice of their wards, and 20% of them are constrained by the high tuition fees.

6. To half of the student population, the school seems to be distant from their residence. And another 50% of the students do not think their school that far off. About 50% of the students feel their journey to and from the school to be tedious. On being asked 89% of the students express their desire of seeing the introduction of school bussing soon (Tab XIII).

7. The guardians are of the opinions that transportation network, surrounding environment (more important in case of girls school) and distance from residence to the school to be the most important decisive variables in the choice of location of school (Tab XI). The same is the reaction while they are asked about the reasons of their disliking for a particular school. However, they are found to be almost unanimous in support of planned location of the school (Tab IX) and the introduction of school bussing (Tab VIII).

8. Another important finding is that about 70% of the guardians fall under lower-middle and middle income bracket (Tab XII, col. 1 to 4) who can ill-afford transport cost for schooling their wards. This is also reflected in their opinions about the desirable distance of the school (Tab VI). About 51% of them go in favour of a school-location within half a mile distance, 34% for within  $\frac{1}{2}$  to 1 mile and the rest for 'within 1 to 2 miles'. The teachers of the schools are found to be equally alert in replying of 'the factors to be considered for new location of a school'. They also attach due importance to the transport network, distance from residential area, and surrounding environment of the school (Tab XV. opinions are mutually inclusive). About 61% of the students favour that their school should be located within a half a mile distance from their residence, while 28.89% students do not mind to travel up to a mile distance to attend school. And those who can afford travel cost may be willing to travel a longer distance (Tab. XIV).

9. Lastly, an examination of factors related to the quality of the schools reveals interesting results. The significant correlations between the variables 'quality of school' and travel by car; 'guardians income above Tk. 2000 p.m.' and 'maximum transportation cost' indicate that mostly the wards of high income families go to better quality school<sup>5</sup> and can afford to have a private car to transport them.

**Conclusion :** In summary we offer the following conclusions. Two potential locational criteria are identified :

- a) Distance related criteria, and
- b) Income related criteria.

The first one offers that the school should be located within half a mile distance so that students can walk down to the school. If the distance is around a mile, good transport should be provided. The most troublesome distance is  $\frac{1}{2}$  to  $\frac{3}{4}$  mile, and that should be avoided as far as possible, because neither walking is pleasant to cover the distance, nor the introduction of bussing is economical for that.

Keeping in view of the resource gap and unequal capacity of the guardians, we can map out a strategy of providing two types of location for high school : (i) residential location, based on distance criteria; and (ii) central location based on income related criteria. The school for those who can afford transport cost should be located within the radius of 1 to 2 miles. These schools are expected to attract students from a greater area in a larger number which will make the management of the school less costly and the entry of the quality students possible.

It should be kept in mind that at the time of location of new schools, instead of one, we should employ both the criteria at micro and macro level region. The environmental quality as another important criterion is equally applicable to the first and the second.

Given the existing socio-economic environment, there is hardly any scope of checking the emergence of differential quality of schools. This may lead to the attainment of two types of optimum solution: (a) Lower level optima (residential location) and, (b) top level optima (centrally located schools). The overall question of uniform academic standard at both the level should be faced squarely by the relevant authorities to meet the ends of distributive justice.

However, in the absence of any well defined high school district, its size, the expected number of schools to be located and their enrolment capacities, which are the parameters of interest, though not one of criteria, our conclusions are open to dispute. But this much we can say that these criteria seem to have some degree of validity and hence these are rational, as they are developed in a quantitative, rather than on a speculative basis as it is done at present.

#### Notes and References :

1. Bangladesh Times : April 1, 1976 and January 15, 1977.
2. Approximately 44 sq. Miles.
3. The approach is based upon modern statistical theory and the notions of probability. Statistical analysis of the near-neighbour measure, which is, as the name suggests, a straightline measurement of the distance separating any phenomenon and its nearest neighbour in space. Near neighbour analysis indicates the *degree* to which any observed distribution of points deviates from what might be expected if the points were distributed in a random manner within the same area. From the laws of mathematical probability, it can be demonstrated that the mean expected distance ( $r_E$ ) between each point and its nearest neighbour which could be expected in such a random distribution is equal to  $\frac{1}{2p^{1/2}}$ , where  $p$  is the observed density of points in the area under consideration. The ratio of the observed mean distance ( $r_A$ ) to this expected value ( $r_E$ ) is termed the 'near-neighbour statistics' ( $R$ ). This ratio has a range in value from zero, when there is maximum aggregation (or cluster) of all points in one location, through 1, which represents



a random distribution, upto 2.15 which is expressive of a pattern of maximum spacing analogous (or uniform). The mean distance between nearest neighbour is maxized in a hexagonal distribution where each point has six equidistant nearest neighbours. In this case it can be shown that maximum value of  $R=2.15$ .

J.P. Clark and F.C. Evans : "Distance to Nearest Neighbour as a Measure of Spatial Relationships in Population," in *Ecology*, No. 35. (1954) pp. 445-53.

4. Leslie J. King : "A Quantitative Expression of the Pattern of Urban Settlement in Selected Areas of the United States", in *Spatial Analysis : A Reader in Statistical Geography* ed. Brain J.L. Berry and Duane F. Marble; Prentice-Hall Inc.; New Jercey, 1968.
5. Quality of School is quantitatively defined as : Twice the No. of teachers having Masters Degree plus No. of teachers having Bachelors Degree/No. of students. (M.A./M.Sc./M.Ed.=2); /B.A./ B.Sc. B.Ed.=1).

$$\frac{(\text{Masters} \times 2) + (\text{Bachelor} \times 1)}{\text{No. of Students}}$$

## APPENDIX I

### Summary of Tables (Average Results in per cent) and the key to the Tables :

Table	1	2	3	4	5	6
I.	28.06	15.71	05.77	19.68	19.38	11.12
II.	54.91	01.00	25.63	04.44	13.67	—
III.	47.90	34.50	13.91	03.69	—	—
IV.	42.14	18.97	14.58	24.72	—	—
V.	61.58	52.38	11.46	66.46	54.34	20.50
VI.	18.97	31.95	13.54	20.60	07.83	—
VII.	23.16	18.11	24.61	05.12	26.38	—
VIII.	88.88	08.06	03.06	—	—	—
IX.	95.13	01.09	03.04	—	—	—
X.	43.79	54.05	02.16	—	—	—
XI.	89.01	88.97	66.05	—	—	—
XII.	00.30	03.50	36.62	29.50	27.60	02.50
XIII.	52.50	47.50	46.90	53.10	89.32	07.26
XIV.	30.42	30.00	16.79	12.11	07.52	03.07
XV.	28.42	20.58	26.00	13.37	10.63	01.00

### Key :

Table I : Distances of schools from the residences of the students.

- Column 1 : Within  $\frac{1}{4}$  mile.  
 2 : Within  $\frac{1}{4}$  to  $\frac{1}{2}$  mile  
 3 : Within  $\frac{1}{2}$  to  $\frac{3}{4}$  mile.  
 4 : Within  $\frac{3}{4}$  to 1 mile.  
 5 : Within 1 to 2 miles.  
 6 : 2miles and above.

Table II : Students' mode of transportation.

- Column 1 : On foot.  
 2 : By bi-cycle.  
 3 : By rickshaw.  
 4 : By car.  
 5 : By bus.



Table III : Students' travel time (one way)

- Column 1 : Less than  $\frac{1}{2}$  hour.  
2 : Within  $\frac{1}{2}$  to  $\frac{1}{2}$  hour.  
3 : Within  $\frac{1}{2}$  to 1 hour.  
4 : 1 hour and above.

Table IV : Students' monthly transportation cost.

- Column 1 : No expense.  
2 : Upto Tk. 30/-  
3 : Tk. 31/- to Tk. 60/-  
4 : Tk. 61/- and above.

Table V : Reasons for a guardians' choice of a school.

- Column 1 : Near to residence.  
2 : Good transportation system.  
3 : School busing facility.  
4 : Good education.  
5 : Good environment.  
6 : Minimum tuition fees.

Table VI : Guardians' opinion about the desirable distance of the school.

Column : Same as Table I.

Table VII : Reasons for guardians' dislikes of particular school.

- Column 1 : Far away from home.  
2 : Bad transportation.  
3 : Bad environment (academic and physical)  
4 : Other reasons.  
5 : No. response.

Table VIII : Guardians' opinion whether there should be school bussing.

- Column 1 : Yes.  
2 : No.  
3 : No response.

Table IX : Guardians' opinion about the need for judicious planing of location of high schools.

Columns: Same as Table VIII.

Table X : Guardians' opinion about the location of the existing schools.

- Column 1 : Properly located/convenient.  
2 : Not properly located/inconvenient.  
3 : No response.

Table XI : Guardians' opinion regarding factors to be considered for location of schools.

- Column 1 : Transportation network  
2 : Environment (academic as well as physical)  
3 : Distance from the residential area.

Table XII : Guardians' annual income.

- Column 1 : Below Tk. 1000/-  
2 : Between Tk. 1000/- and 2000/-  
3 : Between Tk.3000/- and 6000/-  
4 : Between Tk.6000/- and 12000/-  
5 : Between Tk. 12000/- and 24000/-  
6 : Tk.24000/- and above.

Table XIII: Students feeling about the distance of schools, travel with/without trouble and travel by bus.

- Column 1 : Very far away.  
2 : Reasonably near.  
3 : Travel with trouble  
4 : Travel without trouble.  
5 : In favour of school bussing.  
6 : Against school bussing.

Table XIV : Students' opinion about the desirable distance of their school

Column : Same as Table I.

Table XV : Teachers' opinions regarding the factors to be considered for new location of schools.

- Column 1 : Transport network  
2 : Environment.  
3 : Distance from residential area.  
4 : Sufficient space for future expansion play field etc.  
5 : No response.



APPENDIX II

Correlation Coefficient Matrix

Sl.No.	Name of variable	Sl.No.	Name of variable	Sl.No.	Name of variable										
1.	Travel Distance : Less than one mile	7.	Mode of Travel : By bus.	13.	Guardians, Monthly Income: Upto Tk.500										
2.	Travel Distance : Within 1-2 miles.	8.	Monthly Transportation Cost : No cost.	14.	Guardians, Monthly Income: Between Tk. 501-20,00.										
3.	Travel Distance : More than 2 miles.	9.	Monthly Transportation Cost : Upto Tk. 30												
4.	Mode of Travel : On foot.	10.	Monthly Transportation Cost :More than Tk. 30												
5.	Mode of Travel : By ickshaw.	11.	Travel Time : Upto $\frac{1}{2}$ hr.	15.	Guardians, Monthly Income:Above Tk.2000										
6.	Mode of Travel : By car.	12.	Travel Time. : $\frac{1}{2}$ hr. and above.	16.	Quality of School.										
1	2	3	4	5	6	7	8	9	10	11	11	13	14	15	16
1.	1.00														
2.	.13	1.00													
3.	-.27	.17	1.00												
4.	.68	.29	-.12	1.00											
5.	.04	.41	.24	-.20	1.00										
6.	-.11	.52	.49	-.26	.44	1.00									
7.	.04	.01	.71	-.01	-.12	.13	1.00								
8.	.64	.19	-.20	.84	-.32	-.26	.03	1.00							
9.	.59	.11	.16	.12	.28	.26	.35	.09	1.00						
10.	-.10	.51	.76	.07	.54	.64	.42	.33	.11	1.00					
11.	.69	.42	.13	.71	-.09	.26	.28	.69	.52	.21	1.00				
12.	.02	.38	.58	-.05	.53	.30	.48	.19	.13	.77	.01	1.00			
13.	.65	.25	-.19	.89	-.33	-.29	.00	.86	.01	-.13	.70	.14	1.00		
14.	.57	.55	.42	.35	.55	.36	.42	.21	.65	.55	.55	.66	.51	1.00	
15.	-.03	.44	.77	-.21	.50	.73	.48	.22	.43	.67	.29	-.34	.51	.54	1.00
16.	-.44	.35	.44	.37	-.30	.52	.21	.35	.02	.42	-.12	.33	-.41	.09	

N=26 (No. of Sample Schools)

r larger than  $\pm .50$  is significant at 1 % level.