W13196

"SCHOOL CHALEY HUM:"[1] OPTIMIZING STUDENTS' COMMUTE TO KPS

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On his way home after a particularly hectic day at work in January 2012, Ashutosh Tripathi, director of Krishna Public School (KPS)[2] in Raipur, pondered a request made by several parents at the parent-teacher meeting (PTM) that morning. "Our children waste so much time commuting to school. Can the authorities do something about this?," a parent had asked him. Overall the meeting had been a successful one. Tripathi had taken the opportunity to highlight the school's achievements over the past year and to elaborate on plans for the next academic year. Parents were clearly pleased to learn about the number of students who had passed prestigious entrance exams such as the IIT JEE[3] and PMT,[4] the school's new hostel facility, social activities and other accomplishments.

However, when Tripathi began to talk about the importance of effective time management, parents raised their concerns about the long commute their children endured every day, with some students spending up to an hour and a half in transit. The time spent on their commute to and from school left students tired and with very little time left for sports and other activities essential to their overall development. Some parents pointed out that students in class 10 and 12, who were preparing for tough competitive entrance exams, needed more time for study.

Tripathi had addressed their concerns over the increase in transportation fees, explaining that it was an unavoidable result of rising fuel prices. With regard to transportation, the school was operating on a no profit, no loss basis, he added. Parents nevertheless urged him to look into some innovative ways of reducing students' commute time and, if possible, transportation fees as well. The PTM ended with Tripathi assuring parents that the management would seriously consider the matter. He decided to raise the issue with the principal of the school.

[1] *School Chaley Hum" is an idiomatic phrase in the Hindi language meaning "Off we go to school."*
[2] *Krishna Public School: http://www.kpsraipur.com/, accessed May 9, 2013.*
[3] *IIT JEE is a joint entrance exam for the engineering program at the Indian Institutes of Technology, leading to a Bachelor of Technology (B.Tech) degree.*
[4] *PMT, or pre-medical test, is the entrance exam for graduate programs in medicine and surgery at various medical institutes in India, leading to a Bachelor of Medicine, Bachelor of Surgery (MBBS) degree.*

EDUCATION IN INDIA

In India, education historically held a place of great value and importance, especially among middle- and upper-class families. The increasingly competitive global environment further fuelled the demand for excellence in education, contributing to the rapid growth of privately managed schools in India.[5] However, in spite of the availability of a large pool of students and schools in most cities and towns, the hunt for good students (from the school management's perspective) and for a good school (from parent/student's perspective) was no simple matter. School managements were prepared to make proactive strategic decisions to attract young talent, and parents made calculated decisions when choosing a particular school for their children.

ABOUT KRISHNA PUBLIC SCHOOL

KPS was a privately managed school in Raipur, the capital of the central Indian state of Chhattisgarh. Established in 1993, KPS began on a small scale with 89 students and 12 teaching staff. By 2011, it had grown considerably, running classes in two shifts for 2,600 students. KPS's goal was to provide a quality education to students and, at the same time, support their holistic development. It prepared students to be "global citizens" of the future.

KPS had hostel facilities for needy students and also provided school bus transportation for students to and from their respective residences. The distance covered and travel time were dependent on the route taken by a given bus. As bus routes covered many different localities, assigning a student to a bus was a challenge. The problem was further complicated by the fact that the capacity of the available buses varied. As the number of students from different localities increased, managing and coordinating transportation efficiently assumed critical importance.

A MEETING WITH THE PRINCIPAL AND TRANSPORT MANAGER

The day after the PTM, Tripathi met the school's principal, Priyanka Tripathi, and filled her in on the parents' concerns regarding their children's commute time and cost. He included Sanjeev Nanhe, KPS's transportation manager, in the meeting.

Principal: Given the fact that the school is some distance away from the main city, I can understand the parents' concerns about the long commute time. If students waste time commuting to school, they won't have enough time for other activities. It should be minimized as much as possible.

Tripathi: True. Students spend approximately six hours in school every day. Supposing it takes them approximately an hour and a half to commute to and from school, it means that 25 per cent of their time is taken up by non-value-adding activities. Parents are not quibbling over the fee we are charging for transportation — their concern is mainly about the time their children spend commuting.

Nanhe: We designed the bus routes during the school's early years and have been following the same routes for more than six years. We only make changes at the time of new admissions when we try to match the location of a student with one of the bus routes. Once the route is fixed, it is not changed for the entire year.

Principal: Can you please elaborate?

[5] *Sarmistha Pal and Geeta Kingdon, "Private School Growth and Universal Literacy in India — Panel District-Level Analysis," 2009, www.isid.ac.in/~pu/conference/dec_09_conf/Papers/SarmisthaPal.pdf, accessed June 18, 2012.*

Nanhe: In the case of the morning shift, each year class 12 students graduate and leave the school and a new batch of class 9 students joins this shift. In the afternoon shift, the former batch of class 8 students leaves (and joins the morning shift) and a new batch of class 5 students joins the shift. I look at the deletions from each of the buses and try to manually adjust the pickups and drop-offs from the same or nearby locality.

Principal: Isn't it difficult to get a perfect match?

Nanhe: Yes, particularly to accommodate a student who is outside an existing route. In such cases, I try to adjust the route of the bus that will need to make the least possible diversion, subject to the availability of a seat.

Principal: What is the most efficient system in terms of travel and cost?

Nanhe: The shortest route, and hence most efficient, for a bus would be to assign it to a particular location (node) where it would pick up a full load of students. In that case, the bus would travel the minimum distance. There are a few such buses. The capacity of the bus, in these cases, is less or equal to the number of students picked up from a location. Additional students from that location, if any, are assigned to another bus plying through the same area. Assigning a dedicated bus to a location is possible only if the number of students to be picked up (or dropped off) is exactly equal to the capacity of the bus.

Tripathi: I understand. It would be easy if we asked parents to send their children to a centralized location, where the bus can pick them up and drop them off.

Principal: That would certainly reduce the commute time. However, the safety of our students may be at stake, because they will have to reach that location on their own.

Tripathi: I agree. I don't think we should deviate from our original plan of providing pickup and drop-off services at students' residences. What would be the longest possible route?

Principal: Can you make improvements to the existing arrangements?

Nanhe: I have been trying to do that for a long time. I have taken suggestions from the bus drivers and friends. I have also tried to implement suggestions made by a few parents. However, the problem appears to be a major one, and I think we may require an expert to develop a better solution.

Nanhe showed the principal and Tripathi the routes followed by the buses on a map of Raipur. After carefully studying the routes and noting the constraints they faced with regard to the number of buses and their varying capacities, they decided to seek the help of a consultant to optimize the bus routes. KPS selected Nirupam Consultants for this task because of their expertise in supply chain modelling. They hoped that a solution could be found that would reduce not only students' travel times but also fuel consumption and the greenhouse gases emitted by the buses, thereby reducing the school's carbon footprint.

CONSULTANTS TAKE CHARGE

Two weeks later, Tripathi and Nanhe met with Oscar Gonsalves and Ramesh Pandey of Nirupam Consultants.[6] Tripathi explained that the school's student body had grown considerably since 1993 as its reputation as a high-quality educational institution grew. The school now catered to students from all over the city, and the existing transportation arrangements were a matter of concern. Tripathi hoped that Gonsalves and Pandey could find a solution that would minimize the students' commute time to and from school. Gonsalves explained that the firm had handled similar cases in the corporate sector, adding that he saw several similarities between this case and one that involved a call centre in which they had optimized the bus commute for its employees.

[6] *Names changed.*

Nanhe proceeded to give the consultants a broad outline of the issue. The total distance travelled each day was 601.8 kilometres (one way), he explained. The bus routes had been designed some years ago, when there were fewer students, and were later modified as the need arose. "Now that the number of students at KPS has increased, we need to revamp the whole structure and come up with new routes so that students have to spend as little time as possible travelling to and from school," Nanhe explained.

He also noted that because classes at KPS began early in the morning, they did not have to contend with typical rush hour issues, such as traffic jams and diversions. In fact, road and traffic conditions were reasonably good in Raipur, and commute time really depended only on the distance travelled.

This was good news for the consultants. Pandey summarized the issue thus: "If we optimize the distance, we will be able to optimize the time." He asked Nanhe to provide them with an Excel sheet of the routes followed by the buses.

Tripathi agreed with Pandey's assessment, adding that minimizing the distance travelled would not only minimize the time spent commuting but would automatically bring down operating costs. He did point out that the route plan needed to allow buses to pick up and drop students off as close to their residences as possible because of safety concerns.

Nanhe agreed to collect detailed information from bus drivers about their routes and their buses. Each bus driver would complete a form detailing the vehicle and the pickup locations for each student. The data from the forms would then be compiled into an Excel spreadsheet, which Nanhe would share with Gonsalves and Pandey.

On receiving the spreadsheet, the consultants printed out a detailed map of Raipur City, which they took with them on their next visit to KPS. Together with Nanhe and the bus drivers, they marked out the pickup/drop-off points on the map.

Additional Data Provided to the Consultants

Nanhe provided the following information to the consultants.

During the morning shift, 1,348 students were picked up from 239 locations around Raipur City. The school had 37 buses of varying capacity, ranging from 12 seats to 63 seats.

Since the problem area was very large, i.e., 239 locations (+1 including the school), and because there were very few one-way streets in Raipur, the total number of routes needed for the study was $(240 \times 239) \div 2 = 28{,}680$. Identifying so many routes was a tedious task; therefore, the consultants decided to look closely at the locations (nodes) and, if possible, merge a few nodes. They merged nodes located very close to each other into a single node.

They eventually reduced the number of nodes to 80 (+1 including the school). That left them with $(81 \times 80) \div 2 = 3{,}240$ routes to calculate, which they did using Google maps. A sample of these routes was then physically verified. For details of the distances under consideration, see Exhibit 1.

The next task was to identify the number of students to be picked up and dropped off at different nodes (see Exhibit 2). KPS was labelled node 1. In total, 37 buses of various capacities (see Exhibit 3) were used to transport students to and from school.

With a view to reduce the complexity of the problem, the team decided to closely look at the capacity of buses and number of students to be picked up (or dropped off) at each node. They soon realized that few dedicated bus services may be assigned at some of the nodes. For instance, a 36 seat bus may be dedicatedly assigned to node 4 (since the total number of students to be picked up at node 4 are 36). This assignment took care of filling the capacity of the bus and also made sure that at the selected node each and every student is picked up (or dropped off). A total of 15 buses of various capacities were assigned to 10 nodes. Exhibit 4 shows the nodes with dedicated bus facilities.

The buses had different fuel efficiencies as well. Only a few newly acquired buses were fuel efficient. The fuel consumed by each bus was shown as distance travelled (in kilometres) per litre of diesel consumed (see Exhibit 5).

In total, the buses consumed 88.68 litres per day (one way). At that time, the cost of diesel in Raipur City stood at INR45.63 per litre. The consultants took this into careful consideration as they were also interested in calculating cost savings after optimization.

EXHIBIT 1: DISTANCES IN KILOMETRES FROM ALL NODES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
1	0	9.5	9.2	11.6	12.5	11.1	12	9.9	8.2	11.1	9.7	6.1	9.7	10.1	9.4	5.7	5.2	8.4	7.8	9.5	9.7	8.1	8.1	7.8	6.6	9	13	13.1	12.6	11.5	10.6	10.3	10.3	15.1	16.6	12.9	7.8	7	7.3	6	15.3
2	9.5	0	1	4.6	4.6	3.2	4	0.7	2.5	3.9	3.3	3.2	4.6	4.2	3.8	4.2	4.1	5.8	1.6	2.7	1.8	1.5	1.3	1.4	2.4	2.2	7	6.1	6.8	8.1	6.2	5.5	5.9	5.4	5.7	3.8	2	2.1	2.6	5.2	7.3
3	9.2	1	0	2.8	5.2	3.9	4.7	1.4	2.1	3.2	3	2.7	4.1	3.7	3.4	4.2	3.8	4.4	1.7	1.6	1.1	1.1	1.5	1.5	2.8	2.8	6.9	7	6.5	7	6.2	5.5	5.5	5.3	6	3.9	1.9	2	2.6	4.8	6.9
4	11.6	4.6	2.8	0	2.6	2.2	2.8	1.5	1.9	6.1	5.7	2.6	7.1	2.6	5.6	4.9	5	6.8	4.1	4.1	2.9	3.4	3.3	2.6	3.5	1.6	4.3	4.4	4.3	7.4	3.6	2.8	4.3	6.8	8.4	5.7	4.8	3.2	2.7	4.9	9.6
5	12.5	4.6	5.2	2.6	0	2.3	1.3	4	4.9	8.5	7.6	4.3	8.7	8.3	8	7.5	7.3	7.2	4.5	4.2	6.1	5.7	5.4	4.9	5.9	4.2	6.6	7	6.5	8.9	8.6	6	7.1	5.1	8.5	6.4	6	5.5	5.9	6.3	8.4
6	11.1	3.2	3.9	2.2	2.3	0	1.5	2.6	3.5	7.1	6.1	6.4	7.3	6.9	6.6	6.1	6.2	5.8	2.1	2.1	4.7	4.3	4	3.5	4.5	2.8	5.3	5.8	5.3	6.6	5.9	4.7	6.9	4	7.3	3.2	4.6	4	4.5	7.2	8.2
7	12	4	4.7	2.8	1.3	1.5	0	3.5	4.4	8	7	7.1	8.2	7.8	7.5	7	6.7	6.7	6.2	5.9	5.6	5.2	4.9	4.4	5.4	3.7	6	6.5	6.1	8.4	6.6	5.5	6.6	7.2	8	5.8	5.5	4.9	5.4	7	10.2
8	9.9	0.7	1.4	1.5	4	2.6	3.5	0	2.3	4.4	4	3.8	5.2	4.8	4.5	4.9	4.6	4.6	2.9	2.6	2.2	2.2	2.2	1.6	3.3	1.6	5.1	5.6	5.5	7.2	5.9	4.4	5.7	4.5	6.1	3.9	2.6	2.8	3.3	4.7	7.1
9	8.2	2.5	2.1	1.9	4.9	3.5	4.4	2.3	0	4.6	4.5	3	4.8	4.4	4.1	3.3	3	2.4	3	4	3.2	1.8	1.5	1	1.7	0.75	4.8	4.9	4.3	5	3.8	3.3	3.4	6.3	7.1	5.9	1.9	1.2	1	2.7	8
10	11.1	3.9	3.2	6.1	8.5	7.1	8	4.4	4.6	0	0.9	5	1.4	1	1.4	5.6	5.3	7.3	2.1	2.4	2.5	3.2	3.5	4	4.3	5.4	9.5	9.6	9.1	11.3	8.7	8	8.4	3.6	3.1	3.6	3.9	4.2	4.7	5.7	4.8
11	9.7	3.3	3	5.7	7.6	6.1	7	4	4.5	0.9	0	3.9	1.1	0.75	0.45	4.6	4.3	6.6	3.2	2.9	2.7	2	2.7	3.2	3.3	4.7	8.7	8.8	8.3	9.4	8	7.2	7.6	5.2	4.9	4.6	3	3.3	3.8	5.2	5.9
12	6.1	3.2	2.7	2.6	4.3	6.4	7.1	3.8	3	5	3.9	0	4.1	3.7	3.4	1.6	1.7	4.4	2.4	4.2	3.4	1.7	1.8	2.2	1.6	3.8	7.9	8	7.5	7	5.8	6.4	5.5	3.9	8.8	6.6	1.7	1.9	2.4	6.8	8
13	9.7	4.6	4.1	7.1	8.7	7.3	8.2	5.2	4.8	1.4	1.1	4.1	0	0.5	1.4	5	5.4	7.2	3.2	3.3	3.3	3	3.3	3.9	4.4	5.3	9.3	9.4	9	11.3	9.5	7.9	8.2	5.8	5.7	5	3.7	4.4	4.9	6.2	5.7
14	10.1	4.2	3.7	2.6	8.3	6.9	7.8	4.8	4.4	1	0.75	3.7	0.5	0	0.75	5.6	5	6.9	2.7	2.5	3.1	2.8	3.1	3.6	4.1	5	9.1	9.1	8.7	9.5	8.3	7.6	8	6.1	4.2	4.6	3.7	4	4.5	2.5	6.2
15	9.4	3.8	3.4	5.6	8	6.6	7.5	4.5	4.1	1.4	0.45	3.4	1.4	0.75	0	4.9	4.7	6.6	1.9	5	3.1	2.5	3.2	3.2	3.7	4.7	8.7	8.8	8.4	9.2	8	7.3	7.7	4.3	4.6	5	3.4	3.7	4.2	5.2	7.1
16	5.7	4.2	4.2	4.9	7.5	6.1	7	4.9	3.3	5.6	4.6	1.6	5	5.6	4.9	0	0.7	4.4	4.9	5.2	4.7	3.1	3.1	2.9	1.6	4	8.1	8.1	7.7	7	5.8	5.5	5.5	7.3	8.7	7.9	2.8	2.1	2.4	2	9.7
17	5.2	4.1	3.8	5	7.3	6.2	6.7	4.6	3	5.3	4.3	1.7	5.4	5	4.7	0.7	0	4.4	4.7	7	4.8	3.2	3.2	2.9	1.6	4	8.1	8.2	7.7	7	5.8	5.5	5.5	7.5	8.5	7.8	2.8	2.1	2.4	1	9.4
18	8.4	5.8	4.4	6.8	7.2	5.8	6.7	4.6	2.4	7.3	6.6	4.4	7.2	6.9	6.6	4.4	4.4	0	6.6	6.8	5.5	4.2	3.9	3.3	4	3.1	5.9	5.4	4.9	4.1	3.2	3	2.9	9.3	9.4	8.2	4.3	3.6	2.8	2.2	10.4
19	7.8	1.6	1.7	4.1	4.5	2.1	6.2	2.9	3	2.1	3.2	2.4	3.2	2.7	1.9	4.9	4.7	6.6	0	2.5	2.8	2.8	2.4	3.3	3.9	4.7	8.8	8.9	8.6	7.2	8.3	7.4	7.7	4.3	5.2	5.2	4.1	3.3	3.9	5.2	7.1
20	9.5	2.7	1.6	4.1	4.2	2.1	5.9	2.6	4	2.4	2.9	4.2	3.3	2.5	5	5.2	7	6.8	2.5	0	1.8	2	2.3	4	4.4	8.6	8.8	8.7	7.5	8.2	7	7.1	3.4	3.4	4.1	4.5	3.2	3.3	5.3	5.7	2.7
21	9.7	1.8	1.1	2.9	6.1	4.7	5.6	2.2	3.2	2.5	2.7	3.4	3.3	3.1	3.1	4.7	4.8	5.5	2.8	1.8	0	1.6	1.9	2.1	3.1	3.6	7.4	8	7.5	8.4	7.2	6.4	6.8	4.8	4.7	4	2.3	2.7	3.2	4.7	5.7
22	8.1	1.5	1.1	3.4	5.7	4.3	5.2	2.2	1.8	3.2	2	1.7	3	2.8	2.5	3.1	3.2	4.2	2.8	2	1.6	0	0.4	0.85	1.5	2.3	6.3	6.4	5.9	6.8	5.6	4.9	5.2	4.7	5.3	5	0.65	1	1.6	4	6.2
23	8.1	1.3	1.5	3.3	5.4	4	4.9	2.2	1.5	3.5	2.7	1.8	3.3	3.1	3.2	3.1	3.2	3.9	2.4	2.3	1.9	0.4	0	0.5	1.5	2	6	6.1	5.6	6.5	5.2	4.5	4.9	4.6	5.8	5.1	0.9	1.2	1.6	3.2	6.8
24	7.8	1.4	1.5	2.6	4.9	3.5	4.4	1.6	1	4	3.2	2.2	3.9	3.6	3.2	2.9	2.9	3.3	3.3	4	2.1	0.85	0.5	0	1.2	1.4	5.5	5.6	5.1	6	4.7	4	4.4	5.2	6.1	4.9	1	0.75	1.3	3.4	7.1
25	6.6	2.4	2.8	3.5	5.9	4.5	5.4	3.3	1.7	4.3	3.3	1.6	4.4	4.1	3.7	1.6	1.6	4	3.9	4.4	3.1	1.5	1.5	1.2	0	2.4	6.5	6.6	6.1	6.6	5.4	5	5	6.6	6.8	5.6	1.1	0.45	0.75	1.6	7.7
26	9	2.2	2.8	1.6	4.2	2.8	3.7	1.6	0.75	5.4	4.7	3.8	5.3	5	4.7	4	4	3.1	4.7	8.6	3.6	2.3	2	1.4	2.4	0	4.6	4.9	4.4	5.7	4.4	3.3	4.3	6.8	7.3	5.1	2.6	1.9	1.7	4.6	8.3
27	13	7	6.9	4.3	6.6	5.3	6	5.1	4.8	9.5	8.7	7.9	9.3	9.1	8.7	8.1	8.1	5.9	8.8	8.8	7.4	6.3	6	5.5	6.5	4.6	0	0.4	1.1	3.4	2.6	2.9	3.3	10.9	11.6	10	6.8	6	5.8	7.1	12.5
28	13.1	6.1	7	4.4	7	5.8	6.5	5.6	4.9	9.6	8.8	8	9.4	9.1	8.8	8.1	8.2	5.4	8.9	8.7	8	6.4	6.1	5.6	6.6	4.9	0.4	0	0.75	3	2.2	3	3	11.2	11.7	6.8	6.8	6.1	5.8	7.3	12.6
29	12.6	6.8	6.5	4.3	6.5	5.3	6.1	5.5	4.3	9.1	8.3	7.5	9	8.7	8.4	7.7	7.7	4.9	8.6	7.5	7.5	5.9	5.6	5.1	6.1	4.4	1.1	0.75	0	1.8	1.7	2.5	2.5	11	11.2	8.7	6.3	5.6	5.4	6.6	12.2
30	11.5	8.1	7	7.4	8.9	6.6	8.4	7.2	5	11.3	9.4	7	11.3	9.5	9.2	7	7	4.1	7.2	8.2	8.4	6.8	6.5	6	6.6	5.7	3.4	3	1.8	0	1.4	2.4	2.1	9.8	12.1	10.7	7.2	6.5	6	3.1	13
31	10.6	6.2	6.2	3.6	8.6	5.9	6.6	5.9	3.8	8.7	8	5.8	9.5	8.3	8	5.8	5.8	3.2	8.3	7	7.2	5.6	5.2	4.7	5.4	4.4	2.6	2.2	1.7	1.4	0	1.1	0.9	10.5	10.8	9.6	6	5.3	4.8	5.1	11.8
32	10.3	5.5	5.5	2.8	6	4.7	5.5	4.4	3.3	8	7.2	6.4	7.9	7.6	7.3	5.5	5.5	3	7.4	7.1	6.4	4.9	4.5	4	5	3.3	2.9	3	2.5	2.4	1.1	0	1.3	9.4	10.1	8.5	5.3	4.5	3.8	4.1	11
33	10.3	5.9	5.5	4.3	7.1	6.9	6.6	5.7	3.4	8.4	7.6	5.5	8.2	8	7.7	5.5	5.5	2.9	7.7	3.4	6.8	5.2	4.9	4.4	5	4.3	3.3	3	2.5	2.1	0.9	1.3	0	9.9	10.5	5.7	5.4	4.6	3.8	4.5	11.5
34	15.1	5.4	5.3	6.8	5.1	4	7.2	4.5	6.3	3.6	5.2	3.9	5.8	6.1	4.3	7.3	7.5	9.3	4.3	3.4	4.8	4.7	4.6	5.2	6.6	6.8	10.9	11.2	11	9.8	10.5	9.4	9.9	0	1.4	1.9	6.5	5.5	6.1	7.6	2.7
35	16.6	5.7	6	8.4	8.5	7.3	8	6.1	7.1	3.1	4.9	8.8	5.7	4.2	4.6	8.7	8.5	9.4	5.2	4.1	4.7	5.3	5.8	6.1	6.8	7.3	11.6	11.7	11.2	12.1	10.8	10.1	10.5	1.4	0	2.7	5.9	6.3	6.9	9.4	1.4
36	12.9	3.8	3.9	5.7	6.4	3.2	5.8	3.9	5.9	3.6	4.6	6.6	5	4.6	5	7.9	7.8	8.2	5.2	4.5	4	5	5.1	4.9	5.6	5.1	10	6.8	8.7	10.7	9.6	8.5	5.7	1.9	2.7	0	5.5	5.8	6.2	8.7	3.6
37	7.8	2	1.9	4.8	6	4.6	5.5	2.6	1.9	3.9	3	1.7	3.7	3.7	3.4	2.8	2.8	4.3	4.1	3.2	2.3	0.65	0.9	1	1.1	2.6	6.8	6.8	6.3	7.2	6	5.3	5.4	6.5	5.9	5.5	0	0.8	1.3	2.4	6.9
38	7	2.1	2	3.2	5.5	4	4.9	2.8	1.2	4.2	3.3	1.9	4.4	4	3.7	2.1	2.1	3.6	3.3	3.3	2.7	1	1.2	0.75	0.45	1.9	6	6.1	5.6	6.5	5.3	4.5	4.6	5.5	6.3	5.8	0.8	0	0.6	2.2	7.3
39	7.3	2.6	2.6	2.7	5.9	4.5	5.4	3.3	1	4.7	3.8	2.4	4.9	4.5	4.2	2.4	2.4	2.8	3.9	5.3	3.2	1.6	1.6	1.3	0.75	1.7	5.8	5.8	5.4	6	4.8	3.8	3.8	6.1	6.9	6.2	1.3	0.6	0	2.6	7.8
40	6	5.2	4.8	4.9	6.3	7.2	7	4.7	2.7	5.7	5.2	6.8	6.2	2.5	5.2	2	1	2.2	5.2	5.7	4.7	4	3.2	3.4	1.6	4.6	7.1	7.3	6.6	3.1	5.1	4.1	4.5	7.6	9.4	8.7	2.4	2.2	2.6	0	10.1
41	15.3	7.3	6.9	9.6	8.4	8.2	10.2	7.1	8	4.8	5.9	8	5.7	6.2	7.1	9.7	9.4	10.4	7.1	2.7	5.7	6.2	6.8	7.1	7.7	8.3	12.5	12.6	12.2	13	11.8	11	11.5	2.7	1.4	3.6	6.9	7.3	7.8	10.1	0

Note: The first column and first row is the code of nodes.

EXHIBIT 1 (CONTINUED)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
42	8.2	2.5	2.2	4.3	6.7	5.4	6.2	3.2	3.1	3	2.1	1.6	3.1	2.9	2.4	2.8	3.1	5.2	2.1	3.3	2.6	1	1.6	1.9	1.9	3.3	7.3	8	7.6	7.8	6.6	5.8	6.3	5	6.3	5.8	1.6	1.9	2.4	3.3	7
43	8.1	4.7	3.7	6	6.2	7.1	7.8	4.6	4.4	2.9	4.9	6.7	2	5.3	3.2	3.6	4.8	5.4	1.8	6.4	3.2	3.2	2.8	3.7	3.7	5.1	10.9	10.6	12.3	6	8.9	7.9	8.3	5.9	6.8	6.8	3.7	3.2	4.4	4.8	8
44	6.5	5.1	4.3	6.5	8.4	6.9	7.8	5.4	4.1	4.2	3.4	1.8	3.6	3.6	3.2	1.7	2.3	5.2	3.8	6.6	5	3.4	3.8	3.7	2.4	4.8	8.9	9	8.5	9.1	8.1	7.5	6.3	7.8	10.3	8.2	3.3	2.9	3.3	3.2	9.4
45	5.2	4.5	4.5	6.4	8.2	6.8	7.3	5.2	3.6	5.5	4.9	2	4.7	5.1	4.7	0.7	1	3.9	5.5	7.2	5	3.4	3.6	3.1	1.9	4.3	8.4	8.4	8	7.6	6.4	6.5	5.8	8.9	8.7	8.2	3.1	2.4	2.7	3.2	10.6
46	4.3	5.7	5.7	7.1	9	8.1	8.5	6.9	4.8	7.2	6.8	3.3	5.9	6.3	5.5	1.9	2.2	5.1	6.9	5.9	6.2	4.6	4.8	4.3	3.1	6	9.5	9.6	9.2	9.3	7.9	7.6	7.3	9.6	12.4	9.4	4.2	3.6	3.9	2.9	11.2
47	12.6	4.7	5.3	2.5	0.5	2.1	1.4	4.1	5	8.2	8	7.3	8.8	8.6	8.4	7.6	7.6	7.3	8	4.4	6.2	5	5.5	4.2	6	4.3	6.6	7.1	6.7	9	7.2	6.1	7.5	7.6	8.4	6.6	6.3	5.5	6	7.5	8.9
48	10.4	2.9	3.6	0.5	4.1	2.9	3.6	2.3	2.2	6.9	5.7	5.3	6.8	6.5	6.2	5.5	5.5	4.2	5.8	4.8	4.5	3.8	3.4	2.9	3.9	1.4	3.3	3.9	3.3	4.7	3.3	2.3	3.5	6.8	8.1	5.9	4.2	3.4	3.2	4.6	9
49	10.3	4.3	3.5	1.3	4.5	3	3.7	2.2	2.2	6.9	6.2	5.2	6.6	6.5	6.2	5.4	5.4	4	5.5	8.6	5.1	3.8	3.3	2.9	3.9	1.4	3.3	3.2	2.6	4.6	3.2	2.2	2.8	7.1	9	6.6	4.2	3.3	3.1	4.6	8.9
50	11.3	5.2	5.2	4.3	5.2	4	4.7	4.1	3	7.7	6.6	6.2	7.6	7.3	7	6.3	6.3	4.2	8.8	4.7	6.2	4.6	4.3	3.8	4.8	3.1	1.7	1.8	1.3	2.7	1.9	1.2	2.3	8.8	9.9	8.2	5	4.2	4	5	10.8
51	10.8	4.5	4.4	2.7	6.5	5.1	6	3.9	2	7	6.8	4.6	6.8	6.5	6.2	4.6	4.7	2.3	5.5	1	5.4	3.8	3.5	2.9	4	2.3	4	4	3.6	3.3	2.1	1.3	1.7	7.6	9.1	7.4	4.2	3.4	3.2	3.5	10
52	4.7	6.2	6.2	4.9	8.1	8.9	7.6	5.5	5.5	7.5	6.5	4.2	7	7.3	6.8	3	2.1	2.6	2.2	5.9	6.7	4.3	4.5	4.8	3.6	4	8	7.3	6.8	6.4	5.2	5	4.9	2.7	10.4	9.9	4.8	3.3	2.7	5.7	11.3
53	8.4	4.8	4.8	4.9	7.2	5.8	6.7	3.7	2.4	7.3	6.2	4.4	7.2	6.9	6.6	4.4	4.4	0	6.5	5.6	5.5	4.2	3.8	3.3	4	3.1	5.8	5.4	4.9	4.4	3.3	3	2.9	8.7	9.4	8.2	4.3	3.3	2.8	2.4	10.4
54	6.1	5.6	5.6	4.9	8.1	6.7	7.5	5.5	3.2	7.8	6.7	4.8	8.2	7.7	8	4.2	3.3	1.2	6.5	6.8	6.6	5	4.6	4.2	4.7	3.9	6.3	6.2	5.7	4.6	3.7	3.5	3.4	8.6	10.3	9	5.4	4.1	3.6	2.6	11.2
55	9.7	5.7	5.7	4.8	7.2	2.6	7.3	5.8	3.5	8.6	6	7.8	9.1	3.3	7.6	5.4	4.7	5.3	7.5	4.7	5.7	5.3	5.2	4.5	4.5	3.8	5	5.2	4.5	5.3	2.2	2.1	1.1	9.6	10.7	9.9	5.2	4.7	4	3.9	11.9
56	17.2	7.5	6.9	8.9	7.1	7.6	8.9	7.2	8.2	5	6	8.2	7.6	6	6.5	9.8	9.6	10.5	5.8	3.9	5.8	6.4	6.9	7.2	7.9	8.4	12.7	12.4	12.3	13.2	11.9	11.2	11.6	1.7	1.7	3.8	7	7.4	8	9.3	2.2
57	15.4	6.5	6.9	7.8	4.4	5.2	6	6	7.9	8.7	9.7	9.3	11.3	9.9	10.2	10.4	10.4	10.2	4.6	6.9	7.7	7.8	7.7	7.3	8.8	7.2	9.4	12.2	9.9	11.8	11.7	10.5	11.7	0.8	5.4	6	8.1	8.3	8.9	8.2	5.9
58	5	4.7	4.5	6.8	7.8	6.4	7.3	5.2	3.7	5.8	5	2.7	6.1	5.9	5.6	1.7	0.9	3.2	6.6	3.3	5.1	3.6	3.6	3.3	1.9	3.7	7.7	8.3	7.8	6.9	5.4	5.8	5.2	9.3	8.7	8.3	3.2	2.4	2.3	2.5	9.7
59	11.1	6.8	5.3	7.9	7.8	6.7	9.6	6.3	6.8	1.5	6.6	6.8	3.5	6.6	2.7	6.7	7.7	8.4	2.9	2.4	4.9	4.9	4.6	5.1	6	6.7	10.9	11.3	11.4	9	11.8	10.9	10.3	3.4	4.7	4.7	6.2	5.1	6	7.2	6
60	8.5	1	1.5	1.6	4.2	2.8	3.7	1.1	1.6	4.8	3.7	3.2	4.6	4.5	4.1	3.6	3.6	4.8	3.8	7	2.1	1.6	1.4	0.9	1.9	1.6	5.2	5.8	5.3	7.4	6.1	5.1	5	5.6	6.7	4.2	2	1.5	2	3.5	7.7
61	9.5	6.8	6.1	4.2	7.3	7.1	6.8	5.9	3.6	9.3	7.4	5.7	8.5	9.3	8.6	5.7	5.6	2.1	7.6	7.3	7.7	5.5	5.1	4.6	5.6	4.4	4	3.5	3	2.2	1.4	1.5	1.4	14.1	11.4	9.8	5.9	4.8	4	4.4	11.7
62	10.6	6.2	6.2	3.1	6.8	5.5	6.3	5.7	4.3	8.8	7.6	5.8	8.7	8.3	8	5.8	5.8	3.3	7.5	7.2	7.2	5.6	5.3	4.8	5.4	4.1	2.5	2.1	1.7	1.5	0.5	0.9	1.1	9.6	10.9	9.3	6	5	4.8	4.3	11.8
63	9.7	5.3	6.3	4.4	7.6	7.4	8.3	6.2	3.7	8.9	7.7	5.9	8.7	8.4	8.1	5.9	5.8	2.3	7.9	5.1	7.3	5.7	5.4	4.7	5.5	5	3.6	3.1	2.6	1.8	1.1	1.7	1.4	10	11	9.7	6.2	5.1	4.3	4.7	11.9
64	8.3	4.1	4.1	3.1	6.5	5.1	6	3.9	1.6	6.6	5.5	4	6.8	6.2	5.9	4.1	4.1	1.7	5.3	20.7	4.8	3.5	3.5	2.6	3.3	2.4	4.9	4.7	4.3	3.6	2.4	1.9	2.1	7.4	8.7	7.5	3.6	2.8	2.6	3.3	10
65	14.9	17.4	16.7	17.4	19.1	17.7	18.6	16.6	14.3	21.1	18.5	16.9	19	18.8	18.5	15.7	14.8	12.3	19.1	8.2	17.7	16.1	15.7	15.3	16.2	14.9	19	19.1	18.6	13	14.4	13.9	13.8	21.2	21.4	20.1	16.5	15.4	15.2	14.9	22.2
66	7.4	6.6	6.7	1.2	9.2	7.8	8.7	6.6	4.3	9.3	9.1	5.2	9.7	9.3	9	5.7	4.8	2.4	9	8.8	7.7	6.1	5.8	5.3	6.3	5	6.7	6.8	6.3	3.5	4.1	3.9	3.8	11.1	11.4	10.1	6.6	5.8	5.3	8.2	12.3
67	4.8	5.9	5.9	6	8.4	9.5	7.9	5.8	4	7.2	6.3	4.1	6.9	7	6.6	2.8	1.9	3.2	2.2	0.7	6.4	4.8	5	4.5	3.3	4.5	8.6	8.4	7.9	7.3	5.7	5.4	5.5	2.8	10.1	9.6	4.4	3.8	3.1	6.1	11.2
68	7.5	5.7	5.6	5.7	7.3	8.3	8	6	3.9	7.3	6.1	7.8	6.5	3.6	6.2	2.5	1.7	2.3	6.3	6.7	5.5	4.8	4.4	4.5	2.7	4.9	8.5	8.5	8	2.8	6.2	5.6	5.2	9	9.8	9.8	3.4	3.3	3.6	1.4	11.1
69	4.6	6	6	6.6	10.6	7.1	8	5.8	4.1	8.3	6.3	4.4	7.2	7.3	6.7	3.2	2.3	2.9	7.7	8.2	6.5	4.9	4.8	4.6	3.4	4.2	8.3	8.2	7.7	6.6	5.4	5	5.2	10.4	10.2	9.7	4.5	3.6	3	2.8	11.5
70	4.7	7.1	7	7.3	8.7	9.6	9.4	7.1	5.3	9	7.4	9.2	9	5.2	8.3	5.1	4.2	3.4	8.9	8.8	7	6.7	6.7	5.8	5	5.8	9.9	9	9.1	3.4	6.6	6.1	5.7	11.5	12	11.3	5.7	5.1	5.3	3.2	13.3
71	11	3.9	3.3	6	8.4	7	7.9	4.4	4.6	1.4	2.3	4.7	2.6	2.4	2.8	6.4	6.1	7.1	2.9	1.9	2.2	2.8	3.5	3.6	4.3	5.2	9.2	9.2	8.7	9.7	8.5	7.7	8	2.1	2.8	2.3	3.4	4	4.5	6.5	3.5
72	9.5	2.8	2.3	5	7.4	6	6.8	3.3	3.5	1.8	2.2	2.9	2.8	2.4	2.6	4.5	4.6	6	1.8	0.95	1.1	1.9	2.4	2.5	3.3	4.1	8.1	8.1	7.7	8.6	7.4	6.6	6.9	3.2	4.2	3.8	2.4	2.9	3.4	4.7	5.2
73	8.9	2.5	1.5	4.4	6.5	5.1	5.9	2.5	2.6	2.6	1.9	2.3	3	2.2	2.3	3.9	3.9	4.9	1.9	1	1.1	0.75	1.3	1.6	2.3	3	7	7.2	6.7	7.5	6.3	5.6	6	3.6	4.7	4.2	1.4	1.8	2.4	5.2	5.7
74	5.8	4.9	4.1	4.2	6.6	5.5	6.4	4.3	2.1	5.9	5.3	3.2	6.6	6.1	5.7	3.2	2.7	1.5	5.4	5.2	4.8	3.2	3.4	2.9	2.2	2.8	6.1	6.2	6.1	4.9	3.7	3.3	3.3	7.5	8.4	7.9	2.9	2.2	1.6	1.1	9.4
75	5.2	4.8	4.9	5	8.2	6.8	7.7	5.6	3.3	6.2	5.3	3	6.2	6	6.1	2	1	3.1	6.1	6	5.4	3.8	4	3.5	2.2	3.8	7.8	8.2	7.7	6.9	5.2	4.9	5.2	8.2	9.1	8.3	3.5	2.7	2.1	0.7	10.1
76	5.8	5.6	5	5	7.5	6.1	7	4.9	3.1	7.8	5.9	3.7	7.6	6.6	7.2	3.6	2.7	1.2	6.3	6	5.3	3.7	3.9	4.1	2.7	3.3	6.7	6.8	6.3	5.1	4.2	3.9	3.7	8.6	10.2	8.5	3.7	2.7	2.1	1.9	9.9
77	2.6	7.3	7.9	9.2	11.2	9.8	10.7	8.6	7	9.2	8.3	6	8.9	9	8.7	4.8	3.9	6.6	8.7	9	8.4	6.8	7	6.5	5.3	7.6	11.7	11.8	11.4	9.6	9.1	8.5	8.4	11.3	12.1	11.6	6.5	5.8	5.9	4.2	13.1
78	7.6	1.9	1.9	3.6	5.7	4.3	5.2	2.6	1.6	3.8	2.8	1.4	3.9	3.5	3.2	2.4	2.5	4.3	3.1	2.9	2.4	0.8	1	0.85	0.75	2.3	6.4	6.6	6.1	6.9	5.7	5	5.1	5.2	6.1	5.5	0.35	0.5	1	2.6	7
79	7.6	1.4	1.4	3.3	5.2	3.8	4.7	2	1.3	3.9	3.1	1.9	3.7	3.9	3.2	2.9	2.9	3.8	3	2.8	2	1	0.4	0.35	1.2	1.8	5.9	5.9	5.5	6.4	5.2	4.5	4.8	5.3	6	4.9	0.75	0.7	1.2	2.9	6.9
80	7.9	1.8	1.8	4	5.9	4.5	5.4	2.5	2	3.1	2.2	1.3	3.4	3	2.7	2.9	2.9	4.6	2.4	2.7	2.1	0.5	1.1	1	1.6	2.7	6.8	7.2	6.1	7.3	6	5.3	5.4	5	5.8	5.3	0.75	1.1	1.7	3.2	6.7
81	8.7	2.6	2.3	6.3	6.8	5.4	6.3	3.3	2.9	1.8	1	2.2	2.2	1.8	1.4	3.8	3.8	5.2	4.3	5.4	2.1	1.1	2.1	1.9	2.5	3.8	7.9	7.5	7	8.4	7.2	6.4	6.3	6.9	5.6	5.1	1.7	2.5	3	4	6.3

EXHIBIT 1 (CONTINUED)

	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
1	8.2	8.1	6.5	5.2	4.3	12.6	10.4	10.3	11.3	10.8	4.7	8.4	6.1	9.7	17.2	15.4	5	11.1	8.5	9.5	10.6	9.7	8.3	14.9	7.4	4.8	7.5	4.6	4.7	11	9.5	8.9	5.8	5.2	5.8	2.6	7.6	7.6	7.9	8.7
2	2.5	4.7	5.1	4.5	5.7	4.7	2.9	4.3	5.2	4.5	6.2	4.8	5.6	5.7	7.5	6.5	4.7	6.8	1	6.8	6.2	5.3	4.1	17.4	6.6	5.9	5.7	6	7.1	3.9	2.8	2.5	4.9	4.8	5.6	7.3	1.9	1.4	1.8	2.6
3	2.2	3.7	4.3	4.5	5.7	5.3	3.6	3.5	5.2	4.4	6.2	4.8	5.6	5.7	6.9	6.9	4.5	5.3	1.5	6.1	6.2	6.3	4.1	16.7	6.7	5.9	5.6	6	7	3.3	2.3	1.5	4.1	4.9	5	7.9	1.9	1.4	1.8	2.3
4	4.3	6	6.5	6.4	7.1	2.5	0.5	1.3	4.3	2.7	4.9	4.9	4.9	4.8	8.9	7.8	6.8	7.9	1.6	4.2	3.1	4.4	3.1	17.4	1.2	6	5.7	6.6	7.3	6	5	4.4	4.2	5	5	9.2	3.6	3.3	4	6.3
5	6.7	6.2	8.4	8.2	9	0.5	4.1	4.5	5.2	6.5	8.1	7.2	8.1	7.2	7.1	4.4	7.8	7.8	4.2	7.3	6.8	7.6	6.5	19.1	9.2	8.4	7.3	10.6	8.7	8.4	7.4	6.5	6.6	8.2	7.5	11.2	5.7	5.2	5.9	6.8
6	5.4	7.1	6.9	6.8	8.1	2.1	2.9	3	4	5.1	8.9	5.8	6.7	2.6	7.6	5.2	6.4	6.7	2.8	7.1	5.5	7.4	5.1	17.7	7.8	9.5	8.3	7.1	9.6	7	6	5.1	5.5	6.8	6.1	9.8	4.3	3.8	4.5	5.4
7	6.2	7.8	7.8	7.3	8.5	1.4	3.6	3.7	4.7	6	7.6	6.7	7.5	7.3	8.9	6	7.3	9.6	3.7	6.8	6.3	8.3	6	18.6	8.7	7.9	8	8	9.4	7.9	6.8	5.9	6.4	7.7	7	10.7	5.2	4.7	5.4	6.3
8	3.2	4.6	5.4	5.2	6.9	4.1	2.3	2.2	4.1	3.9	5.5	3.7	5.5	5.8	7.2	6	5.2	6.3	1.1	5.9	5.7	6.2	3.9	16.6	6.6	5.8	6	5.8	7.1	4.4	3.3	2.5	4.3	5.6	4.9	8.6	2.6	2	2.5	3.3
9	3.1	4.4	4.1	3.6	4.8	5	2.2	2.2	3	2	5.5	2.4	3.2	3.5	8.2	7.9	3.7	6.8	1.6	3.6	4.3	3.7	1.6	14.3	4.3	4	3.9	4.1	5.3	4.6	3.5	2.6	2.1	3.3	3.1	7	1.6	1.3	2	2.9
10	3	2.9	4.2	5.5	7.2	8.2	6.9	6.9	7.7	7	7.5	7.3	7.8	8.6	5	8.7	5.8	1.5	4.8	9.3	8.8	8.9	6.6	21.1	9.3	7.2	7.3	8.3	9	1.4	1.8	2.6	5.9	6.2	7.8	9.2	3.8	3.9	3.1	1.8
11	2.1	4.9	3.4	4.9	6.8	8	5.7	6.2	6.6	6.8	6.5	6.2	6.7	6	6	9.7	5	6.6	3.7	7.4	7.6	7.7	5.5	18.5	9.1	6.3	6.1	6.3	7.4	2.3	2.2	1.9	5.3	5.3	5.9	8.3	2.8	3.1	2.2	1
12	1.6	6.7	1.8	2	3.3	7.3	5.3	5.2	6.2	4.6	4.2	4.4	4.8	7.8	8.2	9.3	2.7	6.8	3.2	5.7	5.8	5.9	4	16.9	5.2	4.1	7.8	4.4	9.2	4.7	2.9	2.3	3.2	3	3.7	6	1.4	1.9	1.3	2.2
13	3.1	2	3.6	4.7	5.9	8.8	6.8	6.6	7.6	6.8	7	7.2	8.2	9.1	7.6	11.3	6.1	3.5	4.6	8.5	8.7	8.7	6.8	19	9.7	6.9	6.5	7.2	9	2.6	2.8	3	6.6	6.2	7.6	8.9	3.9	3.7	3.4	2.2
14	2.9	5.3	3.6	5.1	6.3	8.6	6.5	6.5	7.3	6.5	7.3	6.9	7.7	3.3	6	9.9	5.9	6.6	4.5	9.3	8.3	8.4	6.2	18.8	9.3	7	3.6	7.3	5.2	2.4	2.4	2.2	6.1	6	6.6	9	3.5	3.9	3	1.8
15	2.4	3.2	3.2	4.7	5.5	8.4	6.2	6.2	7	6.2	6.8	6.6	8	7.6	6.5	10.2	5.6	2.7	4.1	8.6	8	8.1	5.9	18.5	9	6.6	6.2	6.7	8.3	2.8	2.6	2.3	5.7	6.1	7.2	8.7	3.2	3.2	2.7	1.4
16	2.8	3.6	1.7	0.7	1.9	7.6	5.5	5.4	6.3	4.6	3	4.4	4.2	5.4	9.8	10.4	1.7	6.7	3.6	5.7	5.8	5.9	4.1	15.7	5.7	2.8	2.5	3.2	5.1	6.4	4.5	3.9	3.2	2	3.6	4.8	2.4	2.9	2.9	3.8
17	3.1	4.8	2.3	1	2.2	7.6	5.5	5.4	6.3	4.7	2.1	4.4	3.3	4.7	9.6	10.4	0.9	7.7	3.6	5.6	5.8	5.8	4.1	14.8	4.8	1.9	1.7	2.3	4.2	6.1	4.6	3.9	2.7	1	2.7	3.9	2.5	2.9	2.9	3.8
18	5.2	5.4	5.2	3.9	5.1	7.3	4.2	4	4.2	2.3	2.6	0	1.2	5.3	10.5	10.2	3.2	8.4	4.8	2.1	3.3	2.3	1.7	12.3	2.4	3.2	2.3	2.9	3.4	7.1	6	4.9	1.5	3.1	1.2	6.6	4.3	3.8	4.6	5.2
19	2.1	1.8	3.8	5.5	6.9	8	5.8	5.5	8.8	5.5	2.2	6.5	6.5	7.5	5.8	4.6	6.6	2.9	3.8	7.6	7.5	7.9	5.3	19.1	9	2.2	6.3	7.7	8.9	2.9	1.8	1.9	5.4	6.1	6.3	8.7	3.1	3	2.4	4.3
20	3.3	6.4	6.6	7.2	5.9	4.4	4.8	8.6	4.7	1	5.9	5.6	6.8	4.7	3.9	6.9	3.3	2.4	7	7.3	7.2	5.1	20.7	8.2	8.8	0.7	6.7	8.2	8.8	1.9	0.95	1	5.2	6	6	9	2.9	2.8	2.7	5.4
21	2.6	3.2	5	5	6.2	6.2	4.5	5.1	6.2	5.4	6.7	5.5	6.6	5.7	5.8	7.7	5.1	4.9	2.1	7.7	7.2	7.3	4.8	17.7	7.7	6.4	5.5	6.5	7	2.2	1.1	1.1	4.8	5.4	5.3	8.4	2.4	2	2.1	2.1
22	1	3.2	3.4	3.4	4.6	5	3.8	3.8	4.6	3.8	4.3	4.2	5	5.3	6.4	7.8	3.6	4.9	1.6	5.5	5.6	5.7	3.5	16.1	6.1	4.8	4.8	4.9	6.7	2.8	1.9	0.75	3.2	3.8	3.7	6.8	0.8	1	0.5	1.1
23	1.6	2.8	3.8	3.6	4.8	5.5	3.4	3.3	4.3	3.5	4.5	3.8	4.6	5.2	6.9	7.7	3.6	4.6	1.4	5.1	5.3	5.4	3.5	15.7	5.8	5	4.4	4.8	6.7	3.5	2.4	1.3	3.4	4	3.9	7	1	0.4	1.1	2.1
24	1.9	3.7	3.7	3.1	4.3	4.2	2.9	2.9	3.8	2.9	4.8	3.3	4.2	4.5	7.2	7.3	3.3	5.1	0.9	4.6	4.8	4.7	2.6	15.3	5.3	4.5	4.5	4.6	5.8	3.6	2.5	1.6	2.9	3.5	4.1	6.5	0.85	0.35	1	1.9
25	1.9	3.7	2.4	1.9	3.1	6	3.9	3.9	4.8	4	3.6	4	4.7	4.5	7.9	8.8	1.9	6	1.9	5.6	5.4	5.5	3.3	16.2	6.3	3.3	2.7	3.4	5	4.3	3.3	2.3	2.2	2.2	2.7	5.3	0.75	1.2	1.6	2.5
26	3.3	5.1	4.8	4.3	6	4.3	1.4	1.4	3.1	2.3	4	3.1	3.9	3.8	8.4	7.2	3.7	6.7	1.6	4.4	4.1	5	2.4	14.9	5	4.5	4.9	4.2	5.8	5.2	4.1	3	2.8	3.8	3.3	7.6	2.3	1.8	2.7	3.8
27	7.3	10.9	8.9	8.4	9.5	6.6	3.3	3.3	1.7	4	8	5.8	6.3	5	12.7	9.4	7.7	10.9	5.2	4	2.5	3.6	4.9	19	6.7	8.6	8.5	8.3	9.9	9.2	8.1	7	6.1	7.8	6.7	11.7	6.4	5.9	6.8	7.9
28	8	10.6	9	8.4	9.6	7.1	3.9	3.2	1.8	4	7.3	5.4	6.2	5.2	12.4	12.2	8.3	11.3	5.8	3.5	2.1	3.1	4.7	19.1	6.8	8.4	8.5	8.2	9	9.2	8.1	7.2	6.2	8.2	6.8	11.8	6.6	5.9	7.2	7.5
29	7.6	12.3	8.5	8	9.2	6.7	3.3	2.6	1.3	3.6	6.8	4.9	5.7	4.5	12.3	9.9	7.8	11.4	5.3	3	1.7	2.6	4.3	18.6	6.3	7.9	8	7.7	9.1	8.7	7.7	6.7	6.1	7.7	6.3	11.4	6.1	5.5	6.1	7
30	7.8	6	9.1	7.6	9.3	9	4.7	4.6	2.7	3.3	6.4	4.4	4.6	5.3	13.2	11.8	6.9	9	7.4	2.2	1.5	1.8	3.6	13	3.5	7.3	2.8	6.6	3.4	9.7	8.6	7.5	4.9	6.9	5.1	9.6	6.9	6.4	7.3	8.4
31	6.6	8.9	8.1	6.4	7.9	7.2	3.3	3.2	1.9	2.1	5.2	3.3	3.7	2.2	11.9	11.7	5.4	11.8	6.1	1.4	0.5	1.1	2.4	14.4	4.1	5.7	6.2	5.4	6.6	8.5	7.4	6.3	3.7	5.2	4.2	9.1	5.7	5.2	6	7.2
32	5.8	7.9	7.5	6.5	7.6	6.1	2.3	2.2	1.2	1.3	5	3	3.5	2.1	11.2	10.5	5.8	10.9	5.1	1.5	0.9	1.7	1.9	13.9	3.9	5.4	5.6	5	6.1	7.7	6.6	5.6	3.3	4.9	3.9	8.5	5	4.5	5.3	6.4
33	6.3	8.3	6.3	5.8	7.3	7.5	3.5	2.8	2.3	1.7	4.9	2.9	3.4	1.1	11.6	11.7	5.2	10.3	5	1.4	1.1	1.4	2.1	13.8	3.8	5.5	5.2	5.2	5.7	8	6.9	6	3.3	5.2	3.7	8.4	5.1	4.8	5.4	6.3
34	5	5.9	7.8	8.9	9.6	7.6	6.8	7.1	8.8	7.6	2.7	8.7	8.6	9.6	1.7	0.8	9.3	3.4	5.6	14.1	9.6	10	7.4	21.2	11.1	2.8	9	10.4	11.5	2.1	3.2	3.6	7.5	8.2	8.6	11.3	5.2	5.3	5	6.9
35	6.3	6.8	10.3	8.7	12.4	8.4	8.1	9	9.9	9.1	10.4	9.4	10.3	10.7	1.7	5.4	8.7	4.7	6.7	11.4	10.9	11	8.7	21.4	11.4	10.1	9.8	10.2	12	2.8	4.2	4.7	8.4	9.1	10.2	12.1	6.1	6	5.8	5.6
36	5.8	6.8	8.2	8.2	9.4	6.6	5.9	6.6	8.2	7.4	9.9	8.2	9	9.9	3.8	6	8.3	4.7	4.2	9.8	9.3	9.7	7.5	20.1	10.1	9.6	9.8	9.7	11.3	2.3	3.8	4.2	7.9	8.3	8.5	11.6	5.5	4.9	5.3	5.1
37	1.6	3.7	3.3	3.1	4.2	6.3	4.2	4.2	5	4.2	4.8	4.3	5.4	5.2	7	8.1	3.2	6.2	2	5.9	6	6.2	3.6	16.5	6.6	4.4	3.4	4.5	5.7	3.4	2.4	1.4	2.9	3.5	3.7	6.5	0.35	0.75	0.75	1.7
38	1.9	3.2	2.9	2.4	3.6	5.5	3.4	3.3	4.2	3.4	3.3	3.3	4.1	4.7	7.4	8.3	2.4	5.1	1.5	4.8	5	5.1	2.8	15.4	5.8	3.8	3.3	3.6	5.1	4	2.9	1.8	2.2	2.7	2.7	5.8	0.5	0.7	1.1	2.5
39	2.4	4.4	3.3	2.7	3.9	6	3.2	3.1	4	3.2	2.7	2.8	3.6	4	8	8.9	2.3	6	2	4	4.8	4.3	2.6	15.2	5.3	3.1	3.6	3	5.3	4.5	3.4	2.4	1.6	2.1	2.1	5.9	1	1.2	1.7	3
40	3.3	4.8	3.2	3.2	2.9	7.5	4.6	4.6	5	3.5	5.7	2.4	2.6	3.9	9.3	8.2	2.5	7.2	3.5	4.4	4.3	4.7	3.3	14.9	8.2	6.1	1.4	2.8	3.2	6.5	4.7	5.2	1.1	0.7	1.9	4.2	2.6	2.9	3.2	4
41	7	8	9.4	10.6	11.2	8.9	9	8.9	10.8	10	11.3	10.4	11.2	11.9	2.2	5.9	9.7	6	7.7	11.7	11.8	11.9	10	22.2	12.3	11.2	11.1	11.5	13.3	3.5	5.2	5.7	9.4	10.1	9.9	13.1	7	6.9	6.7	6.3

EXHIBIT 1 (CONTINUED)

	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
42	0	1.6	2.9	3.5	4.7	6.8	4.7	4.8	5.6	4.8	5.2	5.2	6	6.2	7.2	8.8	3.6	4	2.7	7.1	6.6	6.7	4.5	17.1	7.1	4.9	4.4	5	6.7	3.6	2.1	1.7	4	3.8	4.5	6.9	1.4	1.9	0.9	1.1
43	1.6	0	2.6	4.3	5.8	8.4	6.2	5.9	8.8	8.7	3.8	6.7	7.9	8.2	8.1	7	5.4	5.2	4.2	8.8	8	9.2	6.8	19.2	9	4.6	6.2	7.1	7.7	4.5	2.7	2.7	5.6	4.9	6.3	7.4	2.9	3.1	2.5	1.7
44	2.9	2.6	0	1.5	2.7	8.4	6.4	6.4	7.2	6.4	3.9	5.2	5	6.1	10.9	13.6	2.3	6.4	4.4	7.1	8.2	7.3	5.7	16.6	6.5	3.6	2.2	3.7	5.6	6.1	4.5	4	4.4	2.9	4.2	5.6	2.9	3.4	2.8	3.7
45	3.5	4.3	1.5	0	1.2	7.9	5.8	5.8	6.7	5.8	2.5	3.9	3.5	6	11.2	11.4	0.9	7.2	3.8	5.6	6.4	5.8	5.4	15.1	5.8	2.2	2.9	2.3	5.1	6.2	4.8	4.2	2.9	1.5	2.8	4.2	2.7	3.2	2.9	4.1
46	4.7	5.8	2.7	1.2	0	9.1	7	7.1	7.9	6.5	3.7	5.1	4.8	5.7	13.4	11.9	2.1	8.7	5.1	6.8	7.6	7.1	6.4	16.3	6.3	2.9	2.6	3	4.4	8.6	6	5.4	4.1	2.7	4	4.8	3.9	4.4	4.1	5.3
47	6.8	8.4	8.4	7.9	9.1	0	4.2	4.3	5.3	6.1	8.2	7.3	8.1	7.9	7.5	5.1	7.9	10.1	4.3	7.7	7.1	8.9	6.7	19.2	9.3	8.8	8.1	8.5	9.4	8.7	7.6	6.6	7.2	8.1	7.6	11.3	6	5.4	6.1	7.2
48	4.7	6.2	6.4	5.8	7	4.2	0	0.1	2	1.7	5.4	3.8	4.8	4.8	9.2	7	5.2	8.3	2.5	3.7	3.1	3.9	2.4	16.4	6	6	5.7	5.7	7.1	6.6	5.5	4.5	4.4	5.3	4.8	9.2	3.9	3.4	4.2	5.3
49	4.8	5.9	6.4	5.8	7.1	4.3	0.1	0	1.9	1.6	5.3	3.7	4.7	3.2	9.1	7.2	5	7.6	2.4	3.5	3	3.8	2.2	16.3	5.8	5.9	5.7	5.6	6.5	6.5	5.4	4.3	4.3	5.1	5.2	9.1	3.8	3.2	4.1	5.2
50	5.6	8.8	7.2	6.7	7.9	5.3	2	1.9	0	2.2	6.1	4.2	5	2.9	11	8.6	6.4	9.2	3.9	2.6	1.8	2.8	2.9	17.3	5	6.6	6.4	6.4	6.9	7.4	6.3	5.4	5.1	6.4	5	9.9	4.7	4.1	4.8	5.7
51	4.8	8.7	6.4	5.8	6.5	6.1	1.7	1.6	2.2	0	4.1	2.3	3.1	2.4	10.2	9.5	4.9	7.6	4.1	2	2.1	2.5	0.7	14.2	4.3	4.3	4.9	4.3	5.4	6.6	5.5	4.6	2.5	4.3	2.8	7.6	3.9	3.4	4	4.9
52	5.2	3.8	3.9	2.5	3.7	8.2	5.4	5.3	6.1	4.1	0	2.9	2.3	7.6	13.5	12.2	1.4	3.1	4.8	4.4	5.2	4.6	3.5	13.9	3.7	0.7	6.8	0.35	8.9	7.7	6.4	5.1	1.7	1.5	1.5	3.4	4.2	4	4.4	5.6
53	5.2	6.7	5.2	3.9	5.1	7.3	3.8	3.7	4.2	2.3	2.9	0	1.2	1.1	10.6	10.3	3	9.1	3.9	2.4	3.3	2.6	1.7	12.3	2.4	2.7	2.9	2.4	3.4	7	5.9	4.9	1.5	2.8	1.2	7.1	3.8	3.7	4.4	5.3
54	6	7.9	5	3.5	4.8	8.1	4.8	4.7	5	3.1	2.3	1.2	0	1.4	11.4	11.1	2.7	9.1	5.7	2.6	3.8	2.8	2.6	12.5	2.6	3.2	3.6	2.5	3.6	7.9	6.8	5.7	1.5	2.5	1.2	4.7	5.1	4.6	5.5	6.6
55	6.2	8.2	6.1	6	5.7	7.9	4.8	3.2	2.9	2.4	7.6	1.1	1.4	0	11.2	10	5.3	10.1	5	1	2.2	1.3	2.5	12.9	2.9	3	4.2	4.1	4.7	8.3	7	6.1	3.2	4.1	2.2	6.6	5.2	4.7	5.7	6.9
56	7.2	8.1	10.9	11.2	13.4	7.5	9.2	9.1	11	10.2	13.5	10.6	11.4	11.2	0	4.5	9.8	4.8	7.9	11.8	12	12.1	10.2	22.4	12.5	11.3	9.9	11.3	12.5	3.7	5.3	5.8	9.5	10.2	10.1	13.3	7.2	7.1	6.8	6.5
57	8.8	7	13.6	11.4	11.9	5.1	7	7.2	8.6	9.5	12.2	10.3	11.1	10	4.5	0	10.7	4.1	6.8	10	10.3	11.2	9.6	20	12.2	12.1	9.2	11.9	11.4	7.4	9	8.5	10.1	11.1	11	14.1	8.3	7.5	8	10.2
58	3.6	5.4	2.3	0.9	2.1	7.9	5.2	5	6.4	4.9	1.4	3	2.7	5.3	9.8	10.7	0	8.4	3.9	4.7	6	5	3.9	14.2	4.4	1.3	2.2	1.4	4.1	6.3	4.9	4.3	2.1	0.55	1.9	3.3	2.8	3.2	3.3	4.2
59	4	5.2	6.4	7.2	8.7	10.1	8.3	7.6	9.2	7.6	3.1	9.1	9.1	10.1	4.8	4.1	8.4	0	5.9	10.2	11	11.4	7.4	22.1	11.9	3.1	8.8	9.5	10.6	2.2	3	3.7	7.5	7.8	9.2	10.4	4.8	5.1	4.1	4.6
60	2.7	4.2	4.4	3.8	5.1	4.3	2.5	2.4	3.9	4.1	4.8	3.9	5.7	5	7.9	6.8	3.9	5.9	0	6.1	5.9	6.4	4.1	16.7	6.8	5.3	4.9	5.3	6.5	4.3	3.2	2.3	4.5	4.3	4.2	7.2	1.7	1.3	1.9	2.6
61	7.1	8.8	7.1	5.6	6.8	7.7	3.7	3.5	2.6	2	4.4	2.4	2.6	1	11.8	10	4.7	10.2	6.1	0	1.7	0.4	2.2	13	3	4.5	5	4.2	5.5	8.2	7.2	6.2	3.5	4.8	3.1	8.2	5.3	5	5.6	6.5
62	6.6	8	8.2	6.4	7.6	7.1	3.1	3	1.8	2.1	5.2	3.3	3.8	2.2	12	10.3	6	11	5.9	1.7	0	1.3	2.4	14.2	4.3	5.8	5.7	5.5	6.2	8.4	7.3	6.3	3.7	5.5	4	9.5	5.5	5.1	6.1	6.7
63	6.7	9.2	7.3	5.8	7.1	8.9	3.9	3.8	2.8	2.5	4.6	2.6	2.8	1.3	12.1	11.2	5	11.4	6.4	0.4	1.3	0	2.5	12.4	2.5	5.4	5.3	4.8	5.8	8.6	7.5	6.4	3.7	5.1	3.3	8.3	5.8	5.1	6.2	7.3
64	4.5	6.8	5.7	5.4	6.4	6.7	2.4	2.2	2.9	0.7	3.5	1.7	2.6	2.5	10.2	9.6	3.9	7.4	4.1	2.2	2.4	2.5	0	13.8	3.7	4.1	4.7	3.8	5.2	6.4	5.2	4.2	2	3.5	2.4	7.2	3.3	3.1	3.9	5.1
65	17.1	19.2	16.6	15.1	16.3	19.2	16.4	16.3	17.3	14.2	13.9	12.3	12.5	12.9	22.4	20	14.2	22.1	16.7	13	14.2	12.4	13.8	0	10.7	14.8	15.3	14.1	14	19	17.9	16.8	13.4	14.4	12.9	13.2	16.2	15.7	16.6	17.7
66	7.1	9	6.5	5.8	6.3	9.3	6	5.8	5	4.3	3.7	2.4	2.6	2.9	12.5	12.2	4.4	11.9	6.8	3	4.3	2.5	3.7	10.7	0	4.1	4.6	3.8	2.6	9	7.9	6.9	3.4	4.4	3	5	6.3	5.6	6.6	7.7
67	4.9	4.6	3.6	2.2	2.9	8.8	6	5.9	6.6	4.3	0.7	2.7	3.2	3	11.3	12.1	1.3	3.1	5.3	4.5	5.8	5.4	4.1	14.8	4.1	0	7.1	0.5	9.2	7.8	6.2	5.6	1.8	1.3	1.7	3.5	4.1	4.4	4.6	5.5
68	4.4	6.2	2.2	2.9	2.6	8.1	5.7	5.7	6.4	4.9	6.8	2.9	3.6	4.2	9.9	9.2	2.2	8.8	4.9	5	5.7	5.3	4.7	15.3	4.6	7.1	0	1.6	2.9	7.5	5.7	5.3	2.3	1	2.4	4.1	3.7	4.1	4.3	3.8
69	5	7.1	3.7	2.3	3	8.5	5.7	5.6	6.4	4.3	0.35	2.4	2.5	4.1	11.3	11.9	1.4	9.5	5.3	4.2	5.5	4.8	3.8	14.1	3.8	0.5	1.6	0	2.2	7.8	6.3	5.7	1.5	1.5	1.3	3.3	4.2	4.5	4.7	5.6
70	6.7	7.7	5.6	5.1	4.4	9.4	7.1	6.5	6.9	5.4	8.9	3.4	3.6	4.7	12.5	11.4	4.1	10.6	6.5	5.5	6.2	5.8	5.2	14	2.6	9.2	2.7	2.2	0	9.7	8	7.5	3	3.6	2.9	2.1	5.5	5.4	6.4	6.4
71	3.6	4.5	6.1	6.2	8.6	8.7	6.6	6.5	7.4	6.6	7.7	7	7.9	8.3	3.7	7.4	6.3	2.2	4.3	8.2	8.4	8.6	6.4	19	9	7.8	7.5	7.8	9.7	0	1.9	2.4	6.1	6.8	6.6	9.5	3.7	3.6	3.3	3.1
72	2.1	2.7	4.5	4.8	6	7.6	5.5	5.4	6.3	5.5	6.4	5.9	6.8	7	5.3	9	4.9	3	3.2	7.2	7.3	7.5	5.2	17.9	7.9	6.2	5.7	6.3	8	1.9	0	1.3	5	5.2	5.7	8.2	2.5	2.5	2.1	1.4
73	1.7	2.7	4	4.2	5.4	6.6	4.5	4.3	5.4	4.6	5.1	4.9	5.7	6.1	5.8	8.5	4.3	3.7	2.3	6.2	6.3	6.4	4.2	16.8	6.9	5.6	5.3	5.7	7.5	2.4	1.3	0	3.9	4.6	4.4	7.6	1.6	1.5	1.2	1.1
74	4	5.6	4.4	2.9	4.1	7.2	4.4	4.3	5.1	2.5	1.7	1.5	1.5	3.2	9.5	10.1	2.1	7.5	4.5	3.5	3.7	3.7	2	13.4	3.4	1.8	2.3	1.5	3	6.1	5	3.9	0	1.9	0.6	4.5	2.7	2.7	3.3	4.5
75	3.8	4.9	2.9	1.5	2.7	8.1	5.3	5.1	6.4	4.3	1.5	2.8	2.5	4.1	10.2	11.1	0.55	7.8	4.3	4.8	5.5	5.1	3.5	14.4	4.4	1.3	1	1.5	3.6	6.8	5.2	4.6	1.9	0	1.8	3.9	3	3.5	3.5	4.4
76	4.5	6.3	4.2	2.8	4	7.6	4.8	5.2	5	2.8	1.5	1.2	1.2	2.2	10.1	11	1.9	9.2	4.2	3.1	4	3.3	2.4	12.9	3	1.7	2.4	1.3	2.9	6.6	5.7	4.4	0.6	1.8	0	4.6	3.4	3.2	3.8	5.1
77	6.9	7.4	5.6	4.2	4.8	11.3	9.2	9.1	9.9	7.6	3.4	7.1	4.7	6.6	13.3	14.1	3.3	10.4	7.2	8.2	9.5	8.3	7.2	13.2	5	3.5	4.1	3.3	2.1	9.5	8.2	7.6	4.5	3.9	4.6	0	6.3	6.4	6.6	7.5
78	1.4	2.9	2.9	2.7	3.9	6	3.9	3.8	4.7	3.9	4.2	3.8	5.1	5.2	7.2	8.3	2.8	4.8	1.7	5.3	5.5	5.8	3.3	16.2	6.3	4.1	3.7	4.2	5.5	3.7	2.5	1.6	2.7	3	3.4	6.3	0	0.5	0.9	2
79	1.9	3.1	3.4	3.2	4.4	5.4	3.4	3.2	4.1	3.4	4	3.7	4.6	4.7	7.1	7.5	3.2	5.1	1.3	5	5.1	5.1	3.1	15.7	5.6	4.4	4.1	4.5	5.4	3.6	2.5	1.5	2.7	3.5	3.2	6.4	0.5	0	1	2.4
80	0.9	2.5	2.8	2.9	4.1	6.1	4.2	4.1	4.8	4	4.4	4.4	5.5	5.7	6.8	8	3.3	4.1	1.9	5.6	6.1	6.2	3.9	16.6	6.6	4.6	4.3	4.7	6.4	3.3	2.1	1.2	3.3	3.5	3.8	6.6	0.9	1	0	1.4
81	1.1	1.7	3.7	4.1	5.3	7.2	5.3	5.2	5.7	4.9	5.6	5.3	6.6	6.9	6.5	10.2	4.2	4.6	2.6	6.5	6.7	7.3	5.1	17.7	7.7	5.5	3.8	5.6	6.4	3.1	1.4	1.1	4.5	4.4	5.1	7.5	2	2.4	1.4	0

Source: Created by case authors.

EXHIBIT 2: LOCATIONS AND NUMBER OF STUDENTS TO BE PICKED UP/DROPPED OFF

Code	Location (Node)	Students	Code	Location (Node)	Students
2	Nahar Para	1	42	Purani Basti	31
3	Ram Sagar Para	12	43	Professor Colony	25
4	Timber Market Kapees	36	44	Math Purena	5
5	Umiya Vijay Saw Mill	4	45	Santoshi Nagar	9
6	WRS Cricket Ground	19	46	Bhairav Nagar	15
7	WRS Colony Railway Station	15	47	Khamtrai Pani Tanki	1
8	Railway Station	18	48	Devendra Nagar	4
9	Ghadi Chowk	4	49	Pandri Bus Stand	8
10	Daganiya Market	18	50	Mowa Overbridge	7
11	Sunder Nagar Main Road	8	51	New Shanti Nagar	30
12	Kukuri Talaab	2	52	Mahabir Nagar (Water Tank)	5
13	Maina Bar	44	53	Teli Bandha	12
14	Vijeta Complex	7	54	Shatabdi Nagar	40
15	Sunder Nagar	40	55	Avanti Vihar	48
16	Bhagat Singh Chowk	5	56	Panch Dham Mandir (Hirapur)	11
17	Pujari Palace	31	57	Hirapur Bilaspur Gondwara	8
18	Muskan Residency	29	58	Panchpedi Naka	15
19	Ram Krishna	12	59	Din Dayal Upadhyay Nagar	81
20	Samta Colony	47	60	Maudha Para	3
21	Agrasen Chowk	5	61	Gayatri Nagar Chowk	12
22	Azad Chowk	14	62	Anupam Nagar	6
23	Tatya Para	8	63	Sales Tax Colony	14
24	Sharda Chowk	3	64	Raja Talaab	10
25	Kali Bari	4	65	Mandir Hasaud	8
26	Devendra Nagar (Central Jail)	9	66	Khushi Vatika (on VIP Road)	4
27	Mowa	16	67	Bajaj Colony	11
28	Dubey Colony	3	68	Priyadarshani Nagar	63
29	Friends Nagar (Mowa Talab)	6	69	Rajendra Nagar	15
30	Telephone Colony (VIP Colony)	7	70	Amlidigra Pani Tanki (Amidih)	62
31	Sri Ram Nagar	4	71	Science College	12
32	Shakti Nagar	14	72	Rajkumar College	5
33	Shankar Nagar Pani Tanki	12	73	Ashram (Ramkund)	1
34	Maruti Vihar	36	74	Katora Talab	23
35	Mohba Bazaar	8	75	Tagore Nagar	45
36	Kota	4	76	Shyam Nagar	39
37	Buda Talaab (Buddhapara)	17	77	Devpuri Sai Vatika	8
38	City Kotwali	11	78	Sadar Bazaar	1
39	Byron Bazaar	14	79	Teli Para	4
40	Shailendra Nagar	52	80	Kankali Talaab	1
41	Tatibandh	34	81	Kesri Bageecha (Lakhe Nagar)	13

Source: Krishna Public School records.

EXHIBIT 3: CAPACITY OF BUSES

Capacity	Number of Buses
12	3
19	1
21	2
25	2
34	1
36	14
41	2
43	1
47	9
58	1
63	1
Total	**37**

Source: Krishna Public School records.

EXHIBIT 4: DEDICATED ASSIGNMENT OF THE BUSES TO NODES

Code	Location (Node)	Students	Number of bus assigned	Capacity of bus	Distance of node from school in km
4	Timber Market Kapees	36	1	36	11.6
19	Ram Krishna	12	1	12	7.8
20	Samta Colony	47	1	47	9.5
34	Maruti Vihar	36	1	36	15.1
40	Shailendra Nagar	52	3	12, 19, 21	6.0
43	Professor Colony	25	1	25	8.1
55	Avanti Vihar	48	2	36,12	9.7
59	Din Dayal Upadhayay Nagar	81	2	47, 34	11.1
68	Priyadarshini Nagar	63	1	63	7.5
70	Amlidigra Pani Tanki (Amidih)	62	2	21, 41	4.7

Source: Krishna Public School records.

EXHIBIT 5: FUEL CONSUMPTION BY BUSES

Bus Capacity	Fuel Consumed (km/per litre)
12	15
19	8
21	8
25	7.5
34	7
36	6.5
41	5.5
43	6
47	6.5
58	4
63	3.75

Source: Krishna Public School records.