Abridgment

Transportation Planning for the 1980 Winter Olympic Games

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Lake Placid, the site of the 1980 Winter Olympic Games, is a small community in the heart of the Adirondack Mountains of upstate New York, 160 km (100 miles) south of Montreal and 400 km (250 miles) north of New York City. The area has a permanent population of less than 3000, and lodging for guests in the immediate area is limited. However, an influx of more than 25 000 visitors is expected each day during the Olympic period.

Highway access to Lake Placid is limited to two routes: NY-86, which enters Lake Placid from both the northwest and northeast, and NY-73, which enters from the southeast. These roads are two-lane highways with numerous steep grades and sharp turns. Several stretches have low capacities and are potential areas for severe congestion under heavy traffic conditions. The problem, then, is to provide needed transportation for a large number of daily visitors over a low-capacity road network under possibly severe weather conditions.

This paper summarizes part of the transportation planning effort for the Olympics. Inventory data and standard demand techniques were used to develop peak-hour travel forecasts. Based on this analysis (and the limited funds available), the Olympic Transportation Committee proposes a bus circulation plan for Olympic visitors. This plan restricts automobile travel in the immediate area to official, resident, and other authorized use.

INITIAL PLANNING EFFORTS

The stated policy of the Lake Placid Olympic Organizing Committee is to organize the Olympics for the athletes and to return the games to a more traditional scale. This policy is being executed through four planning guidelines (1).

1. Plans must be sensitive to the environment and be prepared in consultation with local officials, environmentalists, and the Adirondack Park Agency (responsible for Adirondack Park within which Lake Placid is located).
2. No major highway or additional road capacity will be constructed exclusively for the games.
3. Known techniques will be used. The success of the Olympics is too critical to experiment with untested methods.
4. All permanent capital projects will be designed and constructed to satisfy future needs of the area.

Transportation planning responsibility was delegated by the Lake Placid Olympic Organizing Committee to the Olympic Transportation Committee. The Transportation Committee's reponsibilities include highway system analysis, public transportation coordination, traffic control, ice and snow removal, parking, and emergency services.

The first major task completed by the Transportation Committee was an inventory (2) of transportation-related facilities and services in the Olympic area. This inventory included items such as area population; overnight lodging accommodations; parking; freight handling and storage facilities; highway conditions and volume capacities; highway maintenance facilities and equipment; and airport, bus, and railroad facilities. This inventory highlighted major problems that should be analyzed in greater detail.

The next stage was to develop an estimate of the distribution of person trips by mode and direction of travel to the Olympics. These trip estimates were used to determine the highways leading to the Olympic area that would bear the greatest travel burden and to assess the approximate number and locations of peripheral parking sites that might be needed. Results indicate that about 50 percent of the visitors will use the south approach, the Adirondack Northway, and NY-73. Approximately 25 percent of the visitors will come from the north, and the remaining 25 percent will come from the west (4). If a policy of restricted ticket sales is implemented, approximately 30 000 person trips/d will be made to the Olympic area.

The New York State Department of Transportation was asked to develop a peak-hour forecast for the Olympics and to propose a feasible transportation system to handle these movements. The first step in designing a transportation system was to determine the peak hour of travel. The following assumptions were made:

1. A tentative schedule would be used,
2. A maximum of 10 000 people could enter or leave a site in an hour,
3. All events would be attended by a full-capacity crowd, and
4. The hour of maximum travel to or from the Olympic events would be the maximum travel period.

The Olympic events are expected to be held at four major locations (Figure 1). All of the skating events are to be held in Lake Placid Village. Intervale, 2.4 km (1.5 miles) south of the village, is to be the site for ski jumping. Mt. Van Hoevenberg, about 9.6 km (6 miles) south of the village, is to be the site for cross-country ski racing, biathalon, and bobsled and luge events. Whiteface Mountain Ski Center, the location of all downhill ski events, is about 12.8 km (8 miles) northeast of Lake Placid Village.

The procedure used to determine peak-hour volume was to add the number of trips made by people traveling to or from an event to the number of trips made by other people. The determination of event-generated trips could not be made merely by adding arrivals and departures from events because this procedure would double the number traveling directly from one event to another. Thus, a procedure was developed to correct for double counting.

To estimate the number of nonevent trips, we divided the people in the Olympic area into subgroups. These subgroups were permanent residents, guests of permanent residents, commercial lodgers, campers, and daily visitors. We determined the trip rates for each subgroup subjectively. We felt that daily visitors, having more places to go but fewer places to stay, would make the most trips; other visitors staying in the area

Figure 1. Locations of Olympic events.

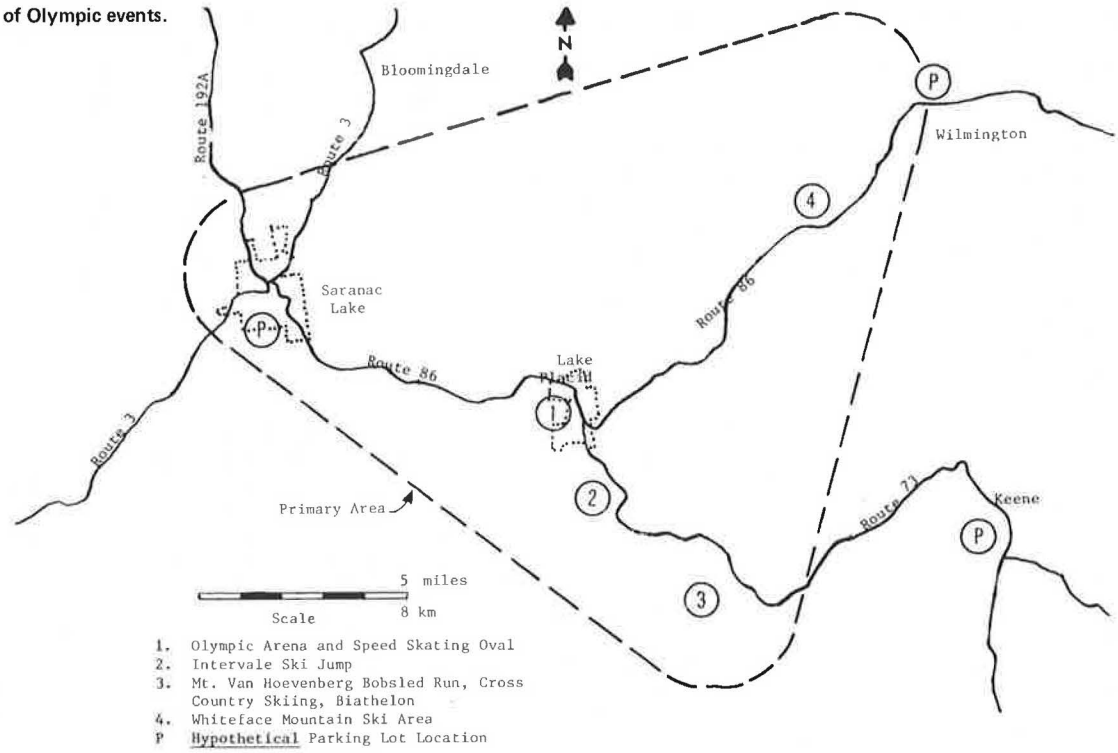
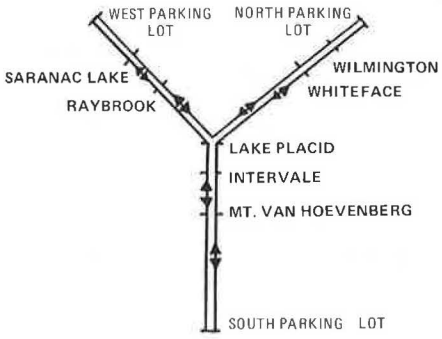


Figure 2. Double-directional bus service plan for primary area.



would make fewer trips; and permanent residents would make substantially fewer trips.

Total peak-hour travel (event and nonevent trips) was determined for the peak hour in each of five periods for every day of the Olympics. The peak hour will be Monday, February 18, between 3 and 4 p.m. During this period approximately 10 000 people will depart from the ski jump event at Intervale. In addition, many of the 8000 people who have attended hockey or figure skating events in the village of Lake Placid will also wish to travel to another event site, village, or parking lot. Nearly 24 000 trips will be made during the peak hour. To meet this demand will require 450 circulating buses. Use of automobiles must be limited to Olympic officials and service personnel. Parking lots will be provided on the edge of the primary area: southeast of Lake Placid Village on NY-73, near Saranac Lake Village west of Lake Placid on NY-86, and near the village of Wilmington also on NY-86 northeast of Lake Placid.

Once peak-hour travel was determined, a bus circulation system was designed to serve that peak travel. The design was based on the following assumptions (6):

1. Average bus occupancy will be 40 people;
2. Average bus trip will be 40 min;
3. Each bus will serve an average of 60 persons/h;
4. When trips are allocated to the parking lots, 50 percent of the trips will be to a proposed southern parking lot on NY-73 south of Mt. Van Hoevenberg and the remaining trips will be divided evenly between western and northern parking lots (based on previous analysis of direction of travel to the Olympics);
5. Of the 8000 persons departing from events held in Lake Placid during the peak hour, 2700 will remain at Lake Placid for at least 1 h, and these people will not require bus service in the peak hour; and
6. Of the people at a site where an event has just ended, 22.5 percent will wish to go to the parking lots.

Under these assumptions, a preliminary peak-hour bus system was developed that would offer the following types of service:

Type of Service	Number of Buses
From parking lot to event site	100
Express between event sites at event times	34
Local to site where event is beginning or ending	217

In addition, service for travelers who do not attend events will require 100 buses.

Each bus will make 60 trips/h; fifty will travel clockwise and 50 counterclockwise around the system (Figure 2). A counterclockwise bus, for example, will travel from the south parking lot to Mt. Van Hoevenberg, to the ski jump, to Lake Placid, to Whiteface Mountain, Wilmington, and to the north lot. The bus will return through Lake Placid to Saranac Lake and the west lot. Turning around, the bus will go to Lake Placid, the ski jump, Mt. Van Hoevenberg, and the south parking lot. These two routes should provide particularly good service for trips ending in Lake Placid. Buses will run on headways of 6 min in each direction so that a bus can

pass a given location approximately every 3 min.

BUS VERSUS CAR AND SYSTEM CAPACITY

Peak-hour travel demand between Intervale and Lake Placid Village, the highest trip demand encountered on any link, will be about 10 000 person trips. An automobile occupancy of 3 persons and a bus occupancy of 40 persons would mean 3300 cars or 250 buses during the peak hour. Without restrictions, volumes of over 1000 cars/h could be expected to occur regularly on this and other routes. The limiting automobile capacities in one direction of the routes from Lake Placid to Intervale, Whiteface Mountain, and Saranac Lake respectively are 450, 450, and 560 vehicles/h in summer weather (2). Automobile demand three or four times greater than capacity and complicated further by the large number of pedestrians and adverse weather conditions would lead to an impossible traffic situation.

The person-carrying capacity of the highway network is a function of automobile capacity, proportion of buses in traffic, average vehicle occupancy, and terrain. The Highway Capacity Manual does not provide for cases in which there is an exceptionally high proportion of buses in the traffic stream (3). Therefore, we had to estimate road capacity. If buses are obtained that can maintain speed on hills and if buses maintain 80 percent or higher occupancy level, we believe that the roads are adequate for the bus system (although low system speed and high traffic density can be expected). Hence, adequacy of highway capacity to meet travel demand will be an important, perhaps critical, factor in designing an Olympic transportation system.

BUS LOADING FACILITY REQUIREMENTS

The ski jump site will have the greatest attendance capacity: 15 000 people at each event. Assuming that 1.5 h are needed for all these people to leave, approximately 10 000 people will get on or off the buses during peak 1-h periods. Based on available literature (5), 3 s/person are required to load a bus. Thus, a bus can be loaded in 2 min. Assuming an additional 1 min dead time each bus will require 3 min in a berth, and each berth will handle 20 buses/h. Since 10 000 people require 250 buses, about 13 loading and unloading points will be required. Similar estimates for other sites are given below.

Site	Peak-Hour Trips	Required Buses	Required Loading and Unloading Points
Ski jump	10 000	250	13
Mt. Van Hoevenberg	8 000	200	10
Whiteface	8 000	200	10
Lake Placid (stadium)	7 000	175	9

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Abridgment

An Aggregate Supply Model for Urban Bus Transit

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The need to reduce air pollution, energy consumption, and traffic congestion caused by automobiles has stimulated widespread discussion of the feasibility and desirability of diverting large numbers of urban area automobile travelers to transit and car pools. Much of this discussion has been concerned with the problem of identifying measures that are effective in reducing the demand for automobile travel. The problem of characterizing transit systems that could carry a large fraction of current urban area automobile trips has received less attention than demand-related issues. Transit system characteristics that might affect the feasibility of diverting large numbers of automobile users to transit include the number of transit vehicles required, the geographical area served by the transit system, the relative travel times of transit and automobile trips, the relative costs of transit and automobile service, and the mode split that the transit system must achieve.

A possible reason for the relative neglect of these