resulting analysis, entitled City of Chicago Downtown Bascule Bridge Traffic Delay Study, was completed on June 9, 1995 and transmitted to the U.S. Coast Guard Ninth District.

The study was presented and discussed during the negotiated rulemaking process summarized above. In response to questions raised during a review of this document by the City of Chicago, the U.S. Coast Guard, and other parties participating in the negotiated rulemaking, the traffic consultants prepared an addendum to the original study. This addendum was completed on July 20, 1995. Following a review by the City of Chicago, the addendum was transmitted to the U.S. Coast Guard Ninth District, but was not received in time for its findings to be reflected in the Federal Register Notice of August 2, 1995 that announced the proposed regulations. The addendum to the traffic study was entered into the public docket along with the traffic study report of June 9. While the addendum provided greater detail on calculations of delay time, placement of traffic counters (including those on Lakeshore Drive), documentation of delays to emergency vehicles, and other areas addressed in the June 9 report, the addendum did not present findings that were either significant additions to, or contradictory to, the basic findings set forth in the June 9 report.

The traffic study findings presented in this section were summarized from information contained in both the June 9 report and the addendum to that report. The traffic study analyzed more than 35 traffic counts during the Fall of 1994 and Spring of 1995, and avoided collecting any data during holiday and special event periods that may have skewed the data. The Spring, 1995 survey monitored 31 of the 35 boat runs that were scheduled (2 weekend runs and 2 weekday evening runs were not monitored). Of the total number of boat runs that took place during the study period, 22 runs occurred on weekends, 11 runs occurred on weekdays during daytime hours, and only 2 took place on weekday evenings.

To identify average durations of bridge opening and closing cycles during the 1995 Spring Breakout period, nearly 600 individual bridge openings were monitored. The study also attempted to quantify the effect of bridge openings on emergency vehicles by documenting their presence in traffic queues during boat runs. In addition, pedestrian counts were taken on four days at the eleven bridge locations to augment the vehicle traffic data.

The traffic study found that the majority of bridges in downtown

Chicago are not exposed to traffic surges normally associated with commuter traffic and instead have traffic volumes that peak sharply on weekday mornings, then decline by an average of only 15 percent and remain at elevated levels into the early evening. By contrast, bridges on major commuter routes such as Lakeshore Drive carried larger volumes of vehicles and experienced traffic surges which peaked sharply in the morning and afternoon rush hours and returned to more moderate flows during off-peak hours. The traffic data collected for this study are consistent with data collected through other planning activities such as the Chicago Area Transportation Study.

Vehicular traffic counts were obtained by using mechanical "road tube" counters with electronic timers and by conducting on-site manual counts. Vehicular traffic counts were taken manually when mechanical counting stations could not be placed in close proximity to bridges, or when existing stations could not record traffic that might enter or exit the roadway prior to reaching the bridge or the counting station. Manual counting stations were established at Lakeshore Drive, the Ohio/Ontario Feeder Ramp, and Congress Parkway to record the substantial traffic volumes that actually passed over these bridges.

The Lakeshore Drive bridge, which carries the most vehicles of any structure in this study, had mechanical traffic counters installed at the bridge approaches to confirm the historical traffic counts recorded for this major commuter route. Data from mechanical counting stations for the Lakeshore Drive bridge were consistent with those previously recorded by the Illinois DOT for weekday, weekend, and weekly traffic conditions. The study consultant also performed aerial video surveillance of traffic on several dates during the study period to augment the observations of on-site ground crews monitoring vehicle and pedestrian traffic.

At the time of the Coast Guard's proposed rule, traffic counts for Lakeshore Drive were tentatively discounted by 50 percent while the Coast Guard awaited additional submissions from Chicago concerning whether the reported counts were artificially high due to placement of the mechanical traffic counters in a manner that would have recorded vehicles that did not in fact pass over the bridge. The detailed description of the data collection procedures that was documented in the traffic study addendum revealed that traffic counts were taken by observers actually

stationed at the Lakeshore Drive bridge, and supplemented with data from mechanical "road tube" counters, thereby confirming the original counts in the traffic study report of June 9.

Pedestrian traffic counts were conducted at the eleven study bridges between 10 a.m. and 4 p.m. on "typical" (i.e., no special events) Mondays, Wednesdays, Fridays, and Saturdays. An average of 3,050 pedestrians were counted crossing the eleven study bridges during a typical, non-rush hour, 15-minute period on weekdays. By comparison, only 690 pedestrians were counted crossing these bridges during an average typical weekend 15-minute period. By multiplying these pedestrian counts by the average delays associated with the bridge openings discussed below, it was possible to determine the percentage of total delay experienced by pedestrians as opposed to delays for vehicle occupants.

## B. Estimates of Delay

To calculate total person-hours of delay associated with bridge openings, the traffic study measured delays to vehicle occupants and pedestrians at 11 of the downtown bridges during 5 weekday and 3 weekend boat runs. The analysis of traffic delay utilized a computer program (TRAF-NETSIM) developed by the Federal Highway Administration that is a nationally and internationally accepted model for traffic simulation and evaluation. The study did not attempt to calculate the delays incurred by vehicles or pedestrians that took alternative routes to avoid waiting for bridges to close, or the delays which these diversions created for other traffic. Thus, the total city-wide delays associated with bridge openings are likely to be somewhat greater than those reported in the study.

The traffic study monitored bridge openings to determine the effect of flotilla size on the duration of bridge openings and traffic delays. The act of opening a bridge involves sounding a warning, lowering safety gates, and clearing the bridge deck before the leaf(s) can be raised. Once boats have cleared the bridge, the leaf(s) must be lowered and locked and the gates raised before ground-based traffic can resume. In assessing the effect of flotilla size on average bridge "gate down" time, the study found that passage of a single boat produced 6.7 minutes of gate down time, while accommodating flotillas of up to 5 boats took one minute longer. Flotillas of up to 10 boats and more than 10 boats had respective gate down times of 8.2 and 9.4 minutes. The study concluded that the majority of time required to open a bridge is attributable