REVISED DRAFT

TRAFFIC STUDY
FOR THE
MAYFIELD SENIOR HIGH SCHOOL
MASTER PLAN

PASADENA, CALIFORNIA

SEPTEMBER 2006

PREPARED FOR

PICA & SULLIVAN ARCHITECTS, LTD.

PREPARED BY

KAKU ASSOCIATES
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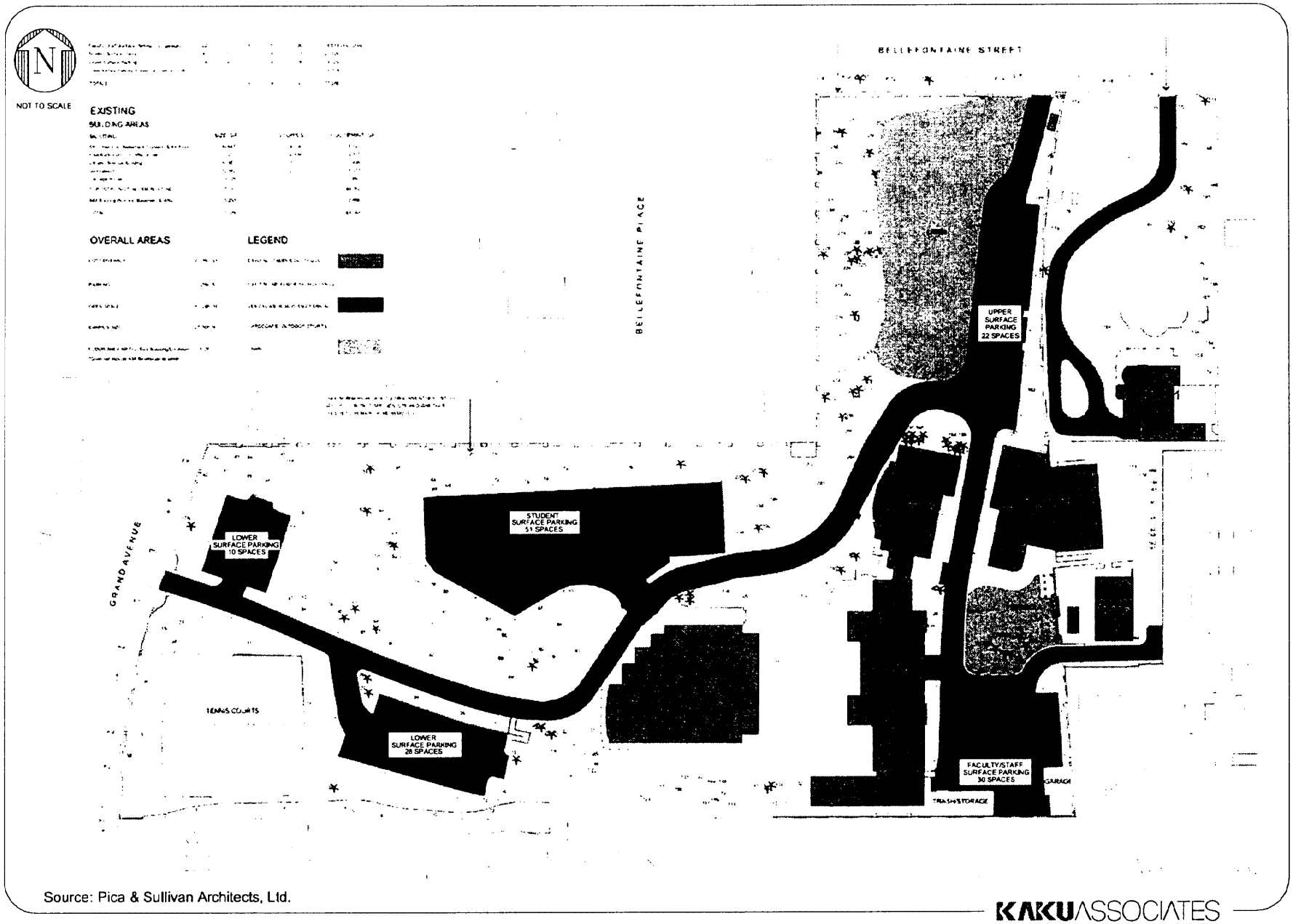
I. INTRODUCTION

This report documents the results of a traffic study conducted by Kaku Associates, Inc. to evaluate the potential traffic impact of the proposed Mayfield Senior High School Master Plan (project). Student enrollment would increase from the current 300 students to 310 students in the short term and then ultimately to 330 students with the implementation of the Master Plan. Circulation improvements would be made to facilitate traffic flow on and around the Mayfield Senior High School campus in the City of Pasadena, California.

PROJECT DESCRIPTION

Mayfield Senior High School is a private Catholic college preparatory school for young women in grades 9-12, sponsored by the Society of the Holy Child Jesus. The school, which has a current enrollment of 300, is located at 500 Bellefontaine Street in the City of Pasadena, and is bounded by Bellefontaine Street on the north, residential uses along Orange Grove Boulevard on the east, Orange Grove Circle on the south, and Bellefontaine Place and Grand Avenue on the west. Figure 1 shows the location of the school in relation to the surrounding street system. Mayfield Senior High School has a driveway located on Bellefontaine Street and another driveway located on Grand Avenue. The existing school site plan, shown in Figure 2, includes a one-way flow operation that requires all vehicles to enter the school from the guarded entrance on the Bellefontaine Street driveway, pass through the campus, and exit from the gated Grand Avenue driveway. A total of 141 existing surface parking spaces are provided on campus for staff and faculty members, students, and visitors.

The proposed Master Plan involves the reconfiguration (project) of the school circulation pattern and construction of new Educational Center in the southeast corner of the campus adjacent to Orange Grove Circle, as shown in Figure 3. One single-family house on Orange Grove Circle would be demolished for the construction of the proposed Educational Center.



Source: Pica & Sullivan Architects, Ltd.

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FIGURE 2
EXISTING SITE PLAN

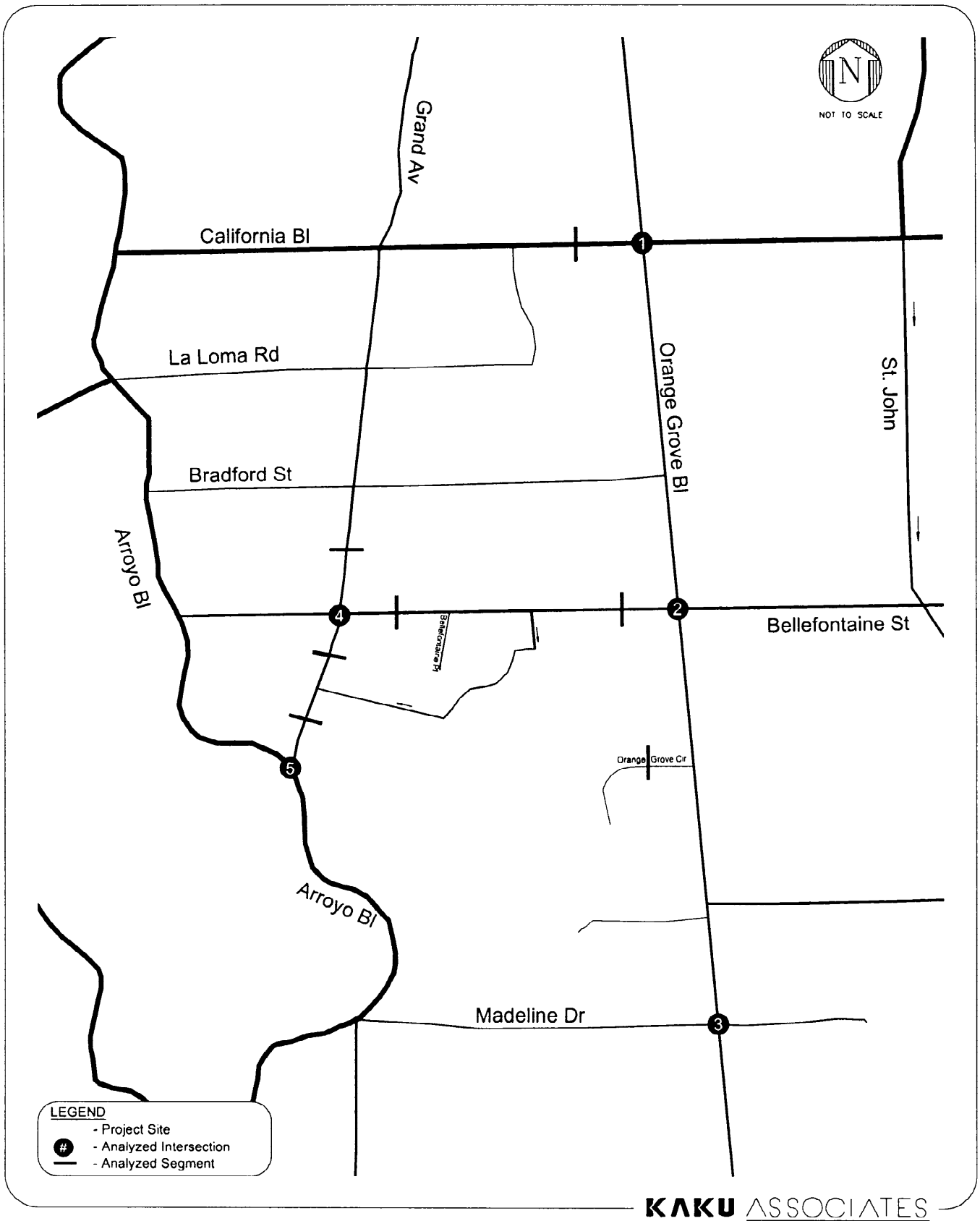
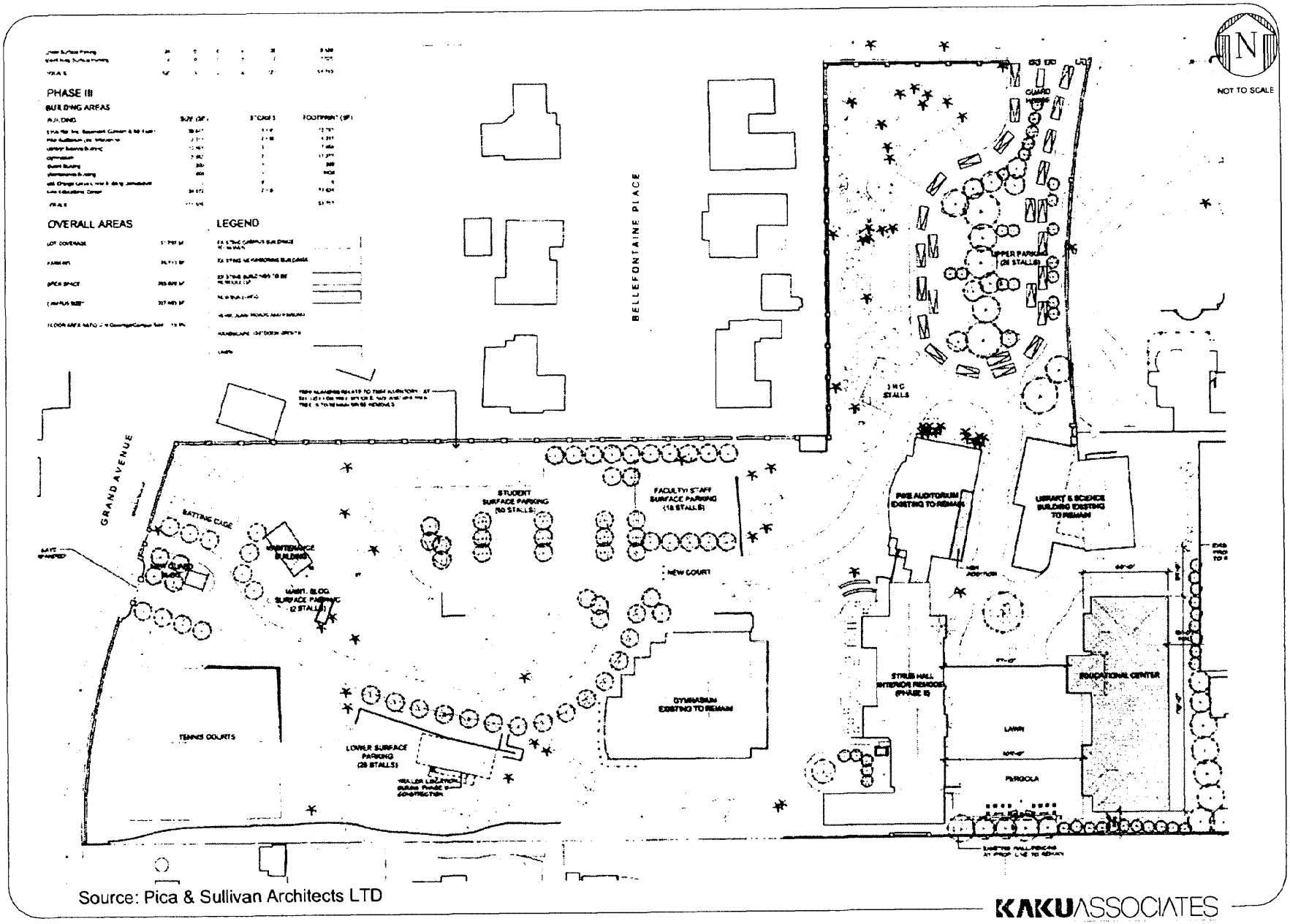


FIGURE 1
STUDY AREA AND ANALYZED LOCATIONS



Source: Pica & Sullivan Architects LTD

KAKU ASSOCIATES

FIGURE 3
PROPOSED SITE PLAN

As part of the School Master Plan, student enrollment would increase from the current 300 students to 310 students by 2008 and then again to 330 students with the completion of the Master Plan by year 2013. The Bellefontaine driveway would be reconfigured to include a centrally located pick-up/drop-off area and the driveway on Bellefontaine Street would be reconfigured to accommodate two-way traffic. Future circulation in this area would be one-way in a counterclockwise direction. Vehicles would no longer have access to Grand Avenue from the Bellefontaine entrance, removing vehicular traffic from the middle of the campus. Future pick up and drop off of students would be made at the south end of the circular Bellefontaine driveway. Grand Avenue, which is currently an exit-only driveway, would allow both inbound and outbound flow for student and faculty/staff parking. A new driveway with two-way operations would be constructed on Orange Grove Circle to provide access to a new small surface parking facility (four spaces) adjacent to the proposed Educational Center.

Existing parking facilities would be reconfigured and parking spaces would be redistributed. The Grand Avenue driveway would provide access to 98 parking spaces (approximately two-thirds of the campus parking spaces) and the Bellefontaine driveway would serve 29 spaces, a totaling 127 spaces for future parking supply under the proposed Master Plan. School traffic shifts would occur due to the proposed reconfiguration of the driveways, the redistribution of parking lots, and the addition of new parking facility. These proposed changes to the circulation pattern are intended to improve traffic operation conditions on both Bellefontaine Street and Grand Avenue and to remove vehicular traffic from the center of the campus.

STUDY SCOPE

The scope of this study was developed in conjunction with the City of Pasadena. The base assumptions and technical methodologies were discussed as part of the study approach. The study analyzed the potential impacts of the incremental changes in school-generated traffic on the adjacent street system due to the proposed reconfiguration project. As the proposed completion date of the full buildout of the project is the year 2013, the analysis of future year traffic forecasts is based on projected conditions in year 2013 both with and without the addition of incremental changes in school-generated traffic due to the increased student enrollments from 300 students to 330 students and the traffic shifts resulting from the proposed driveway reconfigurations. The scenarios tested are as follows:

- Existing (2006) Conditions - The analysis of existing traffic conditions provides a basis for the remainder of the study. The existing conditions analysis includes an assessment of streets, traffic volumes, and the school circulation pattern and operating conditions.

- Cumulative Base (2013) Conditions - Future traffic conditions without the proposed reconfiguration project were developed for the year 2013. The objective of this analysis is to project future traffic growth and operating conditions that could be expected to result from regional growth and related projects in the vicinity of the project site by the year 2013.

- Cumulative plus Project Conditions - Future school-only traffic patterns were developed for the proposed project. All existing parking lots would be reconfigured and parking spaces would be redistributed under the proposed site access plan. The future school traffic pattern was compared with the existing school traffic pattern to obtain the future project-only traffic volumes (the incremental changes in school-only volumes resulting from the proposed student enrollment increases and the proposed driveway reconfiguration and traffic shifts). Future project-only traffic was then added to the cumulative base traffic forecasts. The impacts of the proposed project on future traffic operating conditions were then identified.

Traffic impacts on five intersections were evaluated during three time periods: weekday morning peak hour (7 to 9 a.m.), weekday midday peak hour (2 to 4 p.m.), and afternoon commute peak hour (4 to 6 p.m.). The locations of the five analyzed intersections are shown in Figure 1:

1. Orange Grove Boulevard and California Boulevard
2. Orange Grove Boulevard and Bellefontaine Street
3. Orange Grove Boulevard and Madeline Drive
4. Grand Avenue and Bellefontaine Street
5. Arroyo Boulevard and Grand Avenue

In addition, as illustrated in Figure 1, project traffic impacts (incremental change in traffic due to student enrollment increase and traffic shifts) were measured on the following seven street segments that currently (or would) serve the school site:

1. Bellefontaine Street between Orange Grove Boulevard and the existing school entrance driveway
2. Bellefontaine Street between Grand Avenue and the existing school entrance driveway
3. Grand Avenue between the existing school driveway and Arroyo Boulevard
4. Grand Avenue between Bellefontaine Street and the existing school driveway
5. Grand Avenue between Bellefontaine Street and California Boulevard
6. California Boulevard between Grand Avenue and Orange Grove Boulevard
7. Orange Grove Circle west of Orange Grove Boulevard

The study evaluated the speed survey results for existing traffic on Bellefontaine Street and Grand Avenue in the vicinity of the school. The study also examined the adequacy of the existing on-campus parking supply and the proposed future on-campus parking supply to accommodate projected parking demands associated with the school reconfiguration plan and increase in student enrollment. Finally, the study analyzed potential project impacts in accordance with the requirements of the Los Angeles County Congestion Management Program (CMP).

ORGANIZATION OF REPORT

This report is divided into seven chapters. Chapter I is the introduction. Chapter II describes the existing circulation system, traffic volumes, and traffic operating conditions within the study area. The methodologies used to forecast future cumulative and project traffic volumes and the

resultant forecasts are described in Chapter III. Chapter IV presents an assessment of potential project traffic impacts on the adjacent street system and segments. Chapter V includes a parking analysis and the recommendations on future student pick-up/drop-off procedures. Chapter VI presents the results of the CMP regional transportation system impact analysis. Finally, the conclusions and recommendations of the study are summarized in Chapter VII. Appendices to this report include details of the technical analysis.

II. EXISTING CONDITIONS

A comprehensive data collection effort was undertaken to develop a detailed description of existing conditions in the study area. The assessment of conditions relevant to this study includes an inventory of the street system, traffic volumes on these facilities, operating conditions and transit services at analyzed intersections.

EXISTING STREET SYSTEM

The study area of the proposed project and the adjacent street system, as illustrated in Figure 1, is bounded by California Boulevard to the north, Orange Grove Boulevard to the east, Grand Avenue and Arroyo Boulevard to the west, and Madeline Drive to the south. Access to Mayfield Senior High School is currently provided by an entrance driveway on Bellefontaine Street and an exit driveway on Grand Avenue. Bellefontaine Street intersects with Orange Grove Boulevard, which in turn connects with the regional freeway system (I-710, I-210, and SR 134), as shown in Figure 1. The following briefly describes the key streets serving Mayfield Senior High School:

- Bellefontaine Street - Bellefontaine Street is an east-west collector on the north side of the school that provides one travel lane in each direction between Grand Avenue and Orange Grove Boulevard. Unrestricted parking is allowed along the street. The speed limit is 25 miles per hour (mph).

- Grand Avenue - Grand Avenue is a north-south local road on the west side of the school that provides direct access for school outbound traffic. One lane is provided in each direction, and the speed limit is 25 mph. Unrestricted parking is allowed along the street.

- Orange Grove Boulevard - Orange Grove Boulevard is a north-south street east of the school that provides regional and local access to the school. Two lanes are provided in each direction and parking is prohibited during the 7-9 a.m. peak period and the 4-6 p.m. peak period. The speed limit is 35 mph.

- California Boulevard - California Boulevard is an east-west street north of the school. One lane is provided in each direction and the speed limit is 30 mph. Unrestricted

parking is allowed along the roadway segment between Grand Avenue and Orange Grove Boulevard. Parking is time-restricted, however, along the roadway segment between Orange Grove Boulevard and Saint John.

- Arroyo Boulevard - Arroyo Boulevard is a north-south collector west of the school. One lane is provided in each direction and the speed limit is generally 25 mph. Parking is allowed along the northbound segment between Grand Avenue and Westover Place, but parking is prohibited at any time for the southbound direction of the same segment. The segment between Westover Place and Madeline Drive has unrestricted parking.

- Madeline Drive - Madeline Drive is an east-west local road south of the school. One lane is provided in each direction and the speed limit is generally 25 mph. Unrestricted parking is provided along the westbound segment between Grand Avenue and Orange Grove Boulevard, while parking is prohibited along the eastbound segment.

Table 1 includes a description of the key roadways in the vicinity of the site. Diagrams of the existing lane configurations at the five analyzed intersections are provided in Appendix A.

EXISTING TRAFFIC VOLUMES AND OPERATING CONDITIONS

The following sections present the existing intersection peak hour traffic volumes, daily street segment traffic volumes, a description of the methodology utilized to analyze operating conditions, and the resulting level of service at each of the study intersections.

Existing Peak Hour Traffic Volumes

The Mayfield Senior School academic year 2005-2006 ended in late May 2006. For the purpose of evaluating existing traffic conditions in the school vicinity, turning movement counts collected in year 2003 and 2004 were factored upward to represent existing 2006 conditions at the five analyzed intersections. An annual growth rate of 1.5% was used to adjust previous traffic counts at the three analyzed locations on Orange Grove Boulevard, including: Orange Grove Boulevard & California Boulevard, Orange Grove Boulevard & Bellefontaine Street, and Orange Grove Boulevard & Madeline Drive. Given the land uses on Grand Avenue in the vicinity of the project are mostly residential, single family housing or lower-rise apartments, a lower figure of 1.0% per year was used to factor the previous turning movement counts on

TABLE 1
EXISTING SURFACE STREET CHARACTERISTICS

SEGMENT	FROM	TO	LANE		MEDIAN	PARKING RESTRICTIONS		SPEED
			NB/EB	SB/WB	TYPE	NB/EB	SB/WB	LIMIT
Bellefontaine St	Grand Av	Existing Mayfield Entrance Driveway	1	1	UD	PA	PA	25
	Existing Mayfield Entrance Driveway	Orange Grove Bl	1	1	UD	PA	PA	25
	Orange Grove Bl	Saint John Dr	1	1	UD	PA	PA	25
Grand Av	Bellefontaine St	Existing Mayfield Exit Driveway	1	1	UD	PA	PA	25
	Existing Mayfield Exit Driveway	Arroyo Bl	1	1	UD	PA	PA	25
Orange Grove Bl	Columbia St	Madeline Dr	2	2	DY	NS 7-9A,4-6P	NS 7-9A,4-6P	35
	Madeline Dr	Bellefontaine St	2	2	DY	NS 7-9A,4-6P	NS 7-9A,4-6P	35
	Bellefontaine St	California Bl	2	2	DY	NS 7-9A,4-6P	NS 7-9A,4-6P	35
	California Bl	Palmetto Dr	2	2	DY	NS 7-9A,4-6P / 2hr 9A-4P	NS 7-9A,4-6P / 2hr 9A-4P	35
Arroyo Bl	Grand Av	Westover Pl	1	1	DY	PA	NSAT	25
	Westover Pl	Madeline Dr	1	1	DY	PA	PA	25
California Bl	Grand Av	Orange Grove Bl	1	1	SDY	PA	PA	30
	Orange Grove Bl	Saint John Dr	1	1	2LT	NP 8A-12noon (2nd & 4th Monday) / NP 6A-9A	NP 8A-12noon (2nd & 4th Monday) / NP 2A-6A on city streets except by permit	30
Madeline Dr	Grand Av	Orange Grove Bl	1	1	UD	NPAT	PA	25
	Orange Grove Bl	END	1	1	UD	PA	PA	25
Orange Grove Circle	Orange Grove Bl	END	1	1	UD	PA	PA	25

Notes:

MEDIAN TYPE: DY = Double Yellow Centerline
SDY = Single Dashed Yellow Centerline
2LT = Dual Left-turn Centerline
RM = Raised Median
UD = Undivided Lane

PARKING: PA = Parking Allowed
NS = No Stopping
LANES: # = Number of lanes

Grand Avenue, including Grand Avenue & Bellefontaine Street and Arroyo Boulevard & Grand Avenue.

During school year 2005–2006, the school implemented a traffic control program at the Bellefontaine Driveway to discourage westbound left turns into the school driveway. The existing one-way circulation drive on campus provides a temporary queuing capacity for up to 30 vehicles. When the number of early arrivals exceeds the on-site queuing capacity (which typically occurs only during the afternoon dismissal time), the late-arriving vehicles on Bellefontaine Street have been directed to line up along the frontage of the school west of the school entrance driveway and to enter the school by making eastbound right turns on Bellefontaine Street. Before the school implemented this traffic control program, the majority of the school traffic was observed to enter the school driveway by making westbound left-turn maneuvers on Bellefontaine.

With the implementation of the traffic control, approximately 2/3 of school traffic was observed to enter the school driveway on Bellefontaine Street by making eastbound right turns while the remaining 1/3 of school traffic was observed to travel in the westbound direction on Bellefontaine Street to enter the school. Therefore, adjustments were made to the estimated 2006 traffic volumes that were developed from previous traffic count data to reflect the change in school traffic pattern because of the traffic access control at the Bellefontaine Driveway. Figure 4 illustrates these turning movement counts, representing the existing 2006 traffic volumes. In addition, Appendix B illustrates the then-existing (year 2004) school traffic distribution patterns and volumes before the implementation of access control in Bellefontaine Street.

Existing Daily Street Segment Traffic Volumes

New 24-hour machine counts were conducted at Orange Grove Circle on May 16, 2006. Previous 24-hour machine count data counted on Tuesday, April 27, 2004 were obtained for the following four study street segments: Bellefontaine Street between Orange Grove Boulevard and the existing school entrance driveway, Bellefontaine Street between Grand Avenue and the existing school entrance driveway, Grand Avenue between Bellefontaine Street and the existing school exit driveway, and Grand Avenue between the existing school exit driveway and Arroyo Boulevard. Daily traffic volumes on Grand Avenue north of Bellefontaine Street and on

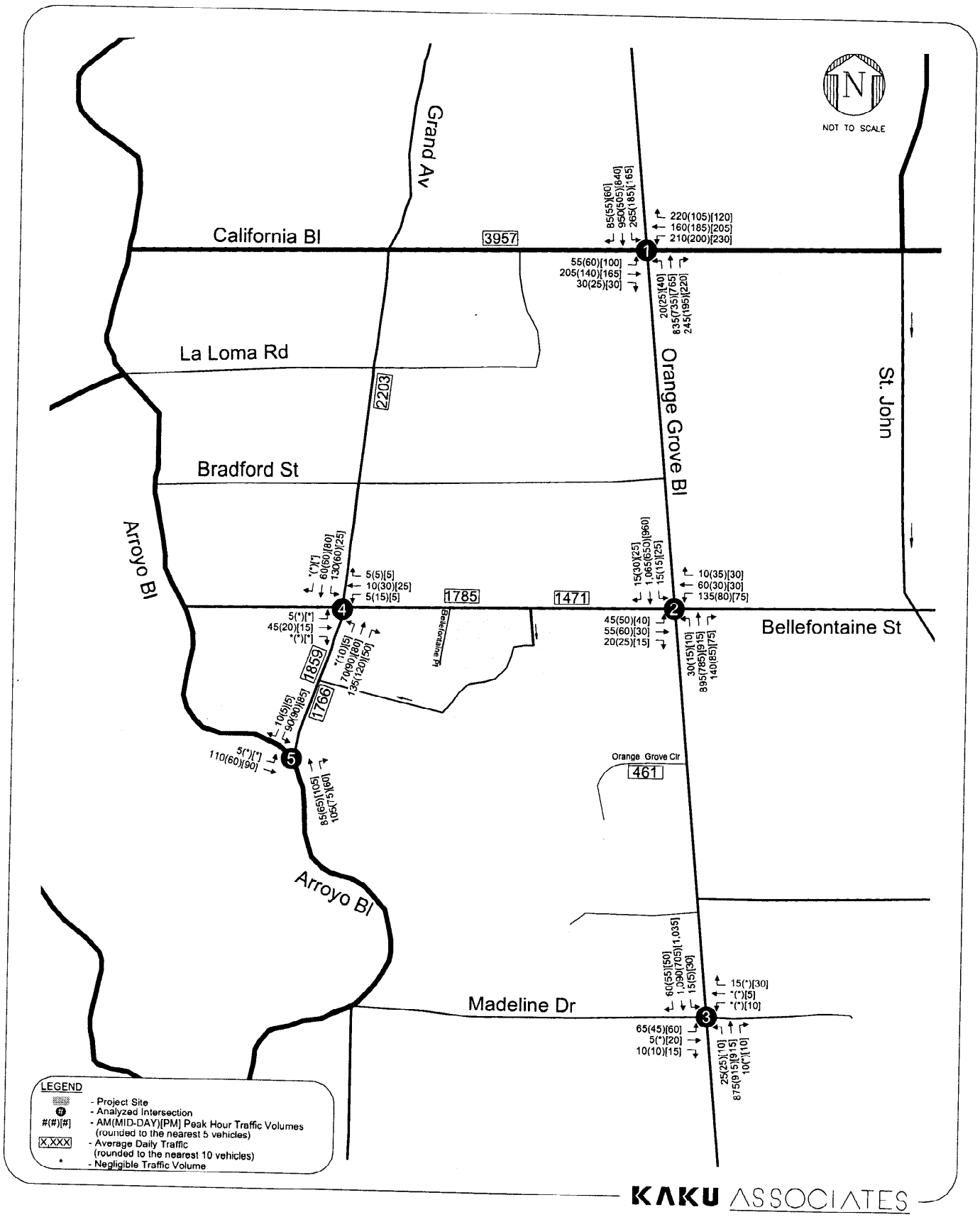


FIGURE 4
EXISTING WEEKDAY TRAFFIC VOLUMES

California Boulevard west of Orange Grove Boulevard were estimated based on adjacent peak hour traffic volumes. Like the development of existing turning movement volumes at the analyzed intersection, previous traffic count data collected in year 2003 and 2004 were factored upward by 1% per year to represent existing 2006 conditions and were adjusted to reflect changes in school traffic patterns due to the school access control program at the school driveway on Bellefontaine Street. Figure 4 illustrates the resultant existing 2006 daily traffic volumes on the adjacent neighborhood street segments.

Level of Service Methodology

Level of service (LOS) is a qualitative measure used to describe the condition of traffic flow ranging from excellent conditions at LOS A to overload conditions at LOS F. Level of service definitions for signalized and unsignalized intersections are provided in Tables 2 and 3.

Three of the five analyzed intersections on Orange Grove Boulevard are controlled by traffic signals. The "Intersection Capacity Utilization" (ICU) method of intersection analysis, per the City of Pasadena's requirement for analyzing intersection conditions, was used to determine the intersection's volume-to-capacity (V/C) ratio and corresponding level of service for each study intersection. Table 2 defines the ranges of V/C ratios and corresponding LOS for signalized intersections.

Based on recent field studies of saturation flow through Pasadena intersections, the City has established updated lane capacity criteria for use in intersection capacity calculations. These studies showed that intersections in the City are currently operating with saturation flows (i.e., capacity) in excess of 1,700 vehicles per hour per lane (vphpl). Saturation flows were measured at eight locations in the City and the average across all the intersections was calculated to be slightly above 1,750 vphpl. Examples of other cities that use saturation flows of 1,700 vphpl or more include Santa Ana, Simi Valley, Santa Clarita and Tustin. The City of Los Angeles uses a lane capacity of 1,760 vehicles per lane per hour for those intersections controlled by their computer signal system. The City of Arcadia uses a similar lane capacity for those intersections along the city's Intelligent Transportation System (ITS) corridors. In previous traffic impact studies, the ICU methodology used, per the City's traffic study guidelines, was a default capacity of 1,600 vphpl. In order to reflect the actual operation of intersections in

TABLE 2
LEVEL OF SERVICE DEFINITIONS FOR SIGNALIZED INTERSECTIONS
(CRITICAL MOVEMENT ANALYSIS METHOD)

LEVEL OF SERVICE	VOLUME/CAPACITY RATIO (V/C)	DEFINITION
A	≤ 0.600	EXCELLENT. No vehicle waits longer than one red light, and no approach phase is fully used.
B	$> 0.600 \leq 0.700$	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.
C	$> 0.700 \leq 0.800$	GOOD. Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.
D	$> 0.800 \leq 0.900$	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.
E	$> 0.900 \leq 1.000$	POOR. Represents the most vehicles intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.
F	> 1.000	FAILURE. Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersectin approaches. Tremendous delays with continuously increasing queue lengths.

SOURCE: Transportation Research Board, *Transportation Research Circular No. 212, Interim Materials on Highway Capacity*, 1980.