

92-380

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TUDOR ENGINEERING COMPANY

Consulting Engineers and Planners

Norton Building  
801 Second Avenue, Suite 516  
Seattle, Washington 98104  
(206) 521-5900  
Fax: (206) 521-5911  
January 13, 1993

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#92-380  
WSH TRAFFIC  
STUDY

Ms. Moya L. McKeehan  
Department of General Administration  
Division of Engineering and Architectural Services  
206 General Administration Building  
P.O. Box 41012  
Olympia, WA 98504-1012

File: 93412.100  
Ser: 5446

Subject: Western State Hospital Traffic Study Final Report

Dear Ms. McKeehan:

Attached to this letter is a copy of the Western State Hospital Traffic Study final letter report and a conceptual level drawing of proposed improvements. This report reflects the comments received at our meeting with you on December 9, 1992, regarding the preliminary report. No additional comments or data has been received to date. The report presents the study findings, rough cost estimates and a conceptual level drawing for the proposed improvement projects. Individual construction items have been identified and a cost estimate has been prepared for each. Items may be constructed independently, or combined into a single project.

The conceptual level drawing was prepared on a basemap that was created from two different sources. These sources include the large-scale mylar that was given to us at the first meeting, as well as the AutoCAD drawing that was given to us shortly after the second meeting. Neither of the two sources were found to be complete enough alone for our purposes. The two sources were compiled into one fairly complete drawing for preparing conceptual level sketches. However, the drawing is not accurate for future engineering work. Any future construction projects will require a survey to create a basemap suitable for roadway and other design activities.

We hope that the attached report will provide the Department of General Administration and Western State Hospital staff valuable information for future planning efforts. Please call us if you have any questions.

Very truly yours,

TUDOR ENGINEERING COMPANY

Einer I. Handeland, P.E.

Vice President

CORPORATE OFFICE  
1800 Harrison St., Oakland, CA 94612  
(510) 419-6100

# WESTERN STATE HOSPITAL TRAFFIC STUDY FINAL LETTER REPORT

## Existing Conditions

### Vehicle and Pedestrian Circulation

The Western State Hospital facilities are located approximately four and one-half miles west of I-5, at the site of old Fort Steilacom. Primary access to the hospital is along Steilacom Boulevard. Steilacom Boulevard is an east-west four lane roadway, that widens to five lanes in some places between South Tacoma Way and the Western State Hospital site. There are several traffic signals along Steilacom Boulevard between South Tacoma Way and the hospital. None of these traffic signals are coordinated (interconnected), so the progression of vehicles along Steilacom Boulevard is frequently interrupted by red indications at these signals.

Where Steilacom Boulevard borders the hospital site on the south side, the roadway is four lanes wide, with no useable shoulders. On the south side of the boulevard, there are large trees, which in some places have less than four feet of clearance between their trunks and the adjacent roadway. On the north side of the boulevard, an old stone wall parallels the roadway. Between the stone wall and the adjacent westbound traffic lane, there is a narrow paved area with a mountable curb. Currently the narrow strips on both the north and south sides of the roadway are used by pedestrians. The lack of adequate clearance from passing vehicles combined with a mountable curb, makes walking along this strip dangerous.

A bus shelter is located on the south side of Steilacom Boulevard, just west of the main gate. A crosswalk on Steilacom Boulevard is provided at the intersection of Steilacom Boulevard and the main gate, which is a signalized intersection with both vehicle and pedestrian actuations. Pedestrians using the bus shelter often cross at this location. A pedestrian tunnel crosses underneath Steilacom Boulevard approximately 350 feet to the west of the intersection. The location of the bus shelter favors the use of the crosswalk rather than the pedestrian tunnel.

Primary access points to the site from Steilacom Boulevard are at the main gate, located approximately halfway between 87th Avenue Southwest and Far West Drive, and at a back gate at Far West Drive located on the west side of the site. Both the Far West Drive/Steilacom Boulevard intersection and Main Gate/Steilacom Boulevard intersection are signalized. There are also two other existing gates along Steilacom Boulevard, the Hollywood Gate and the CSTC Gate. These gates provide secondary access to the site and are not signalized. Another secondary access point is located just to the north of the CSTC site.

Circulation on and around the hospital grounds is primarily along old two-lane roadways, with little or no useable shoulders. The roadways themselves are largely in need of repair. No clear circulation system exists, as the existing roadways meander around buildings, with no definitive

direction. The roadways are shared by trucks, autos, service vehicles and pedestrians, including hospital patients who walk along the roadway centerlines.

Some of the activities generating traffic on the hospital grounds include frequent travel between the hospital kitchen and laundry facilities. The parking lot and shuttle service for McNeil Island is located at the west end of the hospital grounds. Maintenance and other delivery vehicles may require semi-double truck/trailer combinations up to 65 feet in length.

### Levels of Service

Steilacom Boulevard during both the morning and afternoon peak hour is fairly congested due to other neighboring developments. Western State Hospital traffic competes with traffic from Pierce College and Firwood High School to make primarily left hand turns from the hospital site gates onto Steilacom Boulevard in the afternoon. During the morning peak hour, hospital commuters claim that the queue for Pierce College traffic waiting to make left turns from Steilacom Boulevard onto southbound Far West Drive causes hospital and other traffic to backup in the westbound lanes along Steilacom Boulevard.

Traffic volumes and turn movement data was collected for both morning and afternoon peak hours at three locations along Steilacom Boulevard. The morning peak period data was collected between the hours of 6:00 and 9:00 a.m. The evening peak period data was collected between the hours of 2:30 and 5:30 p.m. The peak hours were found to occur between 4:30 and 5:30 p.m. and 7:00 to 8:00 a.m. The intersection level-of-service was then calculated at each of these three intersections. The morning traffic peak hour roughly coincides with the hospital shift change occurring at 7:00 a.m. The evening peak hour however, was found to coincide with the departure of hospital administrative staff, which leaves at approximately 4:30 p.m., instead of the hospital shift change which occurs around 3:00 p.m. The results of the level-of-service calculations are tabulated below:

<u>Intersection</u>	<u>AM LOS</u>	<u>PM LOS</u>
Steilacom Blvd. and 87th Ave. S.W.	B	B
Steilacom Blvd. and Far West Drive	C	B
Steilacom Blvd and Main Gate	A	B

(A table defining each level of service for signalized intersections as discussed in the Highway Capacity Manual, is included at the back of this report.)

### Accident History

Hospital staff reported that accidents at the Hollywood Gate along Steilacom Boulevard were frequent. Due to high vehicle speeds westbound along Steilacom Boulevard and curvature of the roadway, there is often inadequate sight distance for vehicles exiting the Hospital grounds at this point. A three year accident history for the hospital vicinity was obtained from Pierce County in

order to investigate this concern as well as other safety issues. A total of 55 accidents with 27 injuries and property damage totalling \$160,713 was reported for the three year period between 1989 and 1991. Although neither Pierce County or the Washington State Department of Transportation record average accident rates for intersections or roadway segments of this class, the accident rate for this corridor seems high. Specific accident information is discussed in the following paragraphs.

Steilacom Boulevard and Farwest Drive - 1/1/89 - 1/31/91

For the intersection of Steilacom Boulevard and Farwest Drive, a total of 16 accidents were reported for the three year period analyzed. The 16 accidents reported resulted in nine injuries and property damage totalling \$43,450. The sixteen accidents reported included five left turn accidents, four rear-end collisions, three accidents in which vehicles entering the intersection were broad-sided, two fixed object accidents involving collisions with a luminaire, one accident involving a bicycle and one accident involving a right-turn movement.

Steilacom Boulevard and 87th Avenue S.W. - 1/1/89 - 1/31/91

For the intersection of Steilacom Boulevard and 87th Avenue S.W., a total of 13 accidents were reported for the three year period analyzed. The 13 accidents resulted in seven injuries and property damage totaling \$31,023. The 13 accidents included three rear-end collisions, three accidents involving fixed objects, two left turn accidents, one accident involving a pedestrian, and four accidents of various other types.

Steilacom Boulevard and Hospital Main Gate - 1/1/89 - 1/31/91

For the intersection of Steilacom Boulevard and the Western State Hospital Main Gate, a total of eight accidents were reported for the three year period analyzed. A total of three injuries and property damage totalling \$16,720 were reported. The eight accidents included five rear-end collisions, two accidents in which vehicles entering the intersection were broad-sided, and one sideswipe accident.

Non-Intersection-Related Accidents - 1/1/89 - 1/31/91

In addition to accidents related to the three intersections described in the previous paragraphs, 18 accidents were reported to have occurred between 87th Avenue S.W. and FarWest Drive along Steilacom Boulevard which were not intersection-related. The eighteen accidents resulted in eight injuries and property damage totalling \$69,520.

Signing

Directional signing to the hospital from I-5 along South 84th Street and Steilacom Boulevard is limited. Directions to Western State Hospital are somewhat difficult to find, since the directional

signs displaying Western State Hospital information also display information for two or more additional destinations (Pierce College, Clover Park, etc.).

No entry signing exists at any of the access gates to the hospital grounds. Furthermore, there is no indication that any of the access gates are main entrances versus secondary entrances. Once inside the main gate, there is no directional signing for various buildings or facilities. Visitors must aimlessly meander around the hospital site, or ask people on the street for directions, until they find their destination. The situation is very confusing for visitors, since the majority of the buildings are unmarked as well. Parking facilities are also unmarked.

### Parking

The hospital's parking needs are unique, in that there are very short periods in which the parking demand is very high. This occurs during the staff shift changes, since shifts overlap by fifteen minutes in order that the departing shift may brief the arriving shift. Consequently, there are periods of one-half hour or less during which the parking demand is roughly twice as high as it is in the previous or subsequent periods. The patient population is approximately 800, with a total staff of approximately 1600. Virtually all staff commute to work in a single occupancy private vehicle.

Presently there are 1302 parking stalls allocated to Western State Hospital. This includes 1062 paved parking stalls and 240 unimproved (gravel or dirt) parking stalls. Another 139 parking stalls exist for the CSTC facility with 13 parking stalls designated for Oakridge. The total parking supply on the site at the present time is approximately 1454 stalls, according to a recent study conducted by State personnel.

In order to identify the short term parking needs required to accommodate hospital shift changes, the total number of vehicles entering and exiting the site were analyzed during the time frame at which the shift changes were stated to occur. During the two hour period occurring between 2:00 and 4:00 p.m., approximately 720 vehicles exited and 460 vehicles entered the site. Another 610 vehicles exited between 4:00 and 6:00 p.m. If the majority of vehicles moving in and out of the site within the 2:00 to 4:00 period are assumed to be driven by hospital staff who are changing shifts, and the vehicles exiting the site within the 4:00-6:00 period parking during the shift change, a total parking need of approximately 1,790 stalls would be required, compared to the 1,454 stalls that currently exist.

Without more specific information regarding the number of hospital staff leaving and arriving during a particular shift, and the number of administrative, maintenance, CSTC, and other personnel that require parking during work hours, the exact parking requirement cannot be determined. The vehicle counts indicate that there is likely a short term parking problem that may require further study in the future.

### Future Developments and Population Increases

Several changes to the Western State Hospital site are proposed for the future, many of which are discussed in the 1988 Master Plan. The following paragraphs describe some of the future plans for the hospital site and the associated impacts on the existing transportation system and facilities.

Parking currently dominates large portions of the area designated for central open space. Expansion of this area for patient use requires that about 244 parking spaces be displaced. Some of this parking has already been relocated to smaller lots along South Street. Future plans require that 78 remaining spaces in this area be relocated also. Although some short-term parking is required within the central open space for pickup and delivery functions, the lack of long term parking in this area would discourage its use by non-service related traffic, making the area more desirable for patient use. A new service route around the perimeter is needed for delivery and pickup functions. This would ideally include an improved route between the laundry and kitchen facilities. Operations between these two facilities is very frequent.

Construction of the new high school and elementary school within the northeast area of the campus will generate new demand for parking while simultaneously eliminating some existing parking. There will be a need for 100 new parking stalls for the elementary school, and 25 new parking stalls for the high school in addition to the stalls that will be displaced by construction of the elementary school in the existing high school parking lot. The elementary school parking could eventually be provided at the current site of Cottage #4. However, temporary parking will likely be required for some period since the elementary school will be completed prior to the demolition of Cottage #4.

The existing North Hall Wards, which are old and termed "unsuitable for the treatment of patients" by hospital administration, will eventually be demolished. This area could be used for parking or other uses.

Little growth is expected in the patient population. In fact, due to the future implementation of treatment centers in communities throughout the state, the number of patients referred to Western State Hospital should remain relatively stable, with a possible small decline. For the planning purposes of this study, the patient and staff populations of Western State Hospital were assumed to be the same in the future.

In order to determine the total number of vehicle trips made to and from the hospital site during an average day, traffic volumes were measured for a 24 hour period at each of the existing gates. The results of this study indicate that a total of 3,360 vehicles enter the campus and 3,340 vehicles exit the campus within a 24 hour period. The peak hour for traffic entering the campus occurs at approximately 6:30 to 7:30 a.m., during which approximately 520 vehicles enter the campus. The peak hour for traffic exiting the campus occurs at approximately 3:30 to 4:30 p.m., during which time approximately 420 vehicles exit the campus.

Population increases on the hospital and surrounding grounds will be primarily due to the construction of the new elementary and high schools, as well as increased parking for McNeil

Island services. These developments were assumed to add another 100 vehicles to the peak traffic hours. *(This is a very rough estimate, since no data was available for determining what impacts these developments will have on traffic.)*

## Proposed Future Transportation System

### Vehicle and Pedestrian Circulation

In order to alleviate the congestion at the hospital main gate and improve circulation inside the hospital grounds as well as along Steilacom Boulevard, it is proposed that the existing main gate be designated as an exit route from the hospital, and that the existing CSTC gate, located at the southwest corner of the site, be designated as the main entry to the hospital grounds. (Egress would also be provided at this location.) Truck access through this entrance would be discouraged. The primary truck and service access to the site is proposed to be located along FarWest Drive, which is adjacent to the maintenance yard that is the destination for a majority of the large trucks entering the hospital grounds.

The Hollywood gate would remain open to entering and exiting traffic on a "right-in, right-out only" basis. C-Curb or other channelization devices would be placed along the centerline of Steilacom Boulevard to prevent left turns at this location. This revision is anticipated to reduce the number of accidents occurring at this location due to the lack of adequate sight distance to make left hand turns from the driveway, given the speed of travel along Steilacom Boulevard. Both the Hollywood Gate and the gate just to the north of Steilacom Boulevard along FarWest Drive would provide good access to the parking areas just north of Steilacom Boulevard.

The traffic signal at the existing main gate would be modified to accommodate dual left turns from the driveway, and a new traffic signal would be installed at the proposed main gate. A free right turn lane along westbound Steilacom Boulevard is proposed to accommodate the heavy right turn movement into the hospital grounds during peak hours. The addition of the right turn pocket is also anticipated to reduce the number of rear-end accidents that often occur when vehicles slow to make a right turn in a shared lane.

In order to determine the impact of modifying the existing access gates and implementing the vehicle circulation system described in the previous paragraph, traffic volumes were distributed accordingly and intersection levels of service were calculated. Since no data regarding trip origination or destination is available at this time, the redistribution of traffic volumes within the new circulation system was assumed. The intersections calculated are listed below along with the anticipated levels of service.

<u>Intersection</u>	<u>AM LOS</u>	<u>PM LOS</u>
Steilacom Blvd. and 87th Ave. S.W.	B	B
Steilacom Blvd. and Far West Drive	C	B
Steilacom Blvd and Proposed Main Gate	A	B

In general, the proposed improvements are anticipated to improve the individual intersection levels of service along Steilacom Boulevard, however, the delay along the corridor may increase overall, due to the addition of another traffic signal. The level of service during the evening peak hour improves at the existing Main Gate due to the proposed dual left turns exiting the driveway.

In addition to the proposed access changes including signal systems, several other circulation improvements have been identified, as shown in the attached conceptual level drawing. The following is a list of the proposed improvements:

- . New roadway extending from proposed new main entrance northward to link with existing roadway near East Campus Wards
- . Service vehicle route in central hospital area
- . Demolition of roadway from proposed new main entrance to CSTC facilities in order to limit vehicles in areas where children are present
- . Roadway linking existing roadways adjacent to Greenhouse and Morgue, eliminating existing roadway link just to the north of the North Hall Wards
- . Eliminate two roadway links near CSTC cottages to provide separation of hospital and school-related traffic
- . Widen the FarWest Drive/Steilacom Boulevard intersection at the northeast corner
- . Widen FarWest Drive on the east side from Steilacom Boulevard northward to the proposed service entrance to accommodate a total of three 12-foot lanes
- . Provide an 8-foot asphalt path just north of the existing stone wall to provide a protected walkway along the north side of Steilacom Boulevard

### Signing

Effective signing should help to improve vehicle circulation by providing drivers with information indicates the most direct route to a specific destination. This will not only help to reduce the number of vehicles meandering around the hospital site, but should improve traffic flow, since drivers will not have to stop, ask for directions, or look for other directional clues. Effective signing will be especially helpful to visitors, delivery vehicles, and vendors.

Signing at the proposed main gate should give drivers and others a clear indication that this is the primary entrance to Western State Hospital. Landscaping at the proposed main gate could also be used to give visitors and others a clear sense of entry. Secondary signing at this location should direct trucks to continue along Steilacom Boulevard and enter at the gate on Far West Drive.

Once inside the proposed main gate, a sign should be placed at or near the junction of the main gate roadway and the east-west roadway that passes on the south side of the hospital cottages. This sign should direct visitors to the Administration Building, since the hospital administration



currently desires visitors to check-in with administrative staff and request directions to hospital destinations.

### Parking

Although the exact parking requirements for the hospital site cannot be determined without further study, several management strategies may be implemented to improve the short term parking conditions occurring during hospital shift changes. One strategy would include the staggering of hospital shift changes such that all the shift changing did not occur within the same time period. This would reduce the overall number of parking stalls needed within any given time period.

Another strategy to reduce the total parking need would be to encourage the use of carpools and vanpools. This strategy may be required in the future to meet the Growth Management Act and Trip Reduction Law requirements for any new facilities constructed on the site.

### **Cost Estimates for Proposed Improvements**

The following paragraphs briefly describe some of the assumptions made in preparing the cost estimates for each of the construction items. The total cost for the items discussed in the following paragraphs is estimated to be \$944,000. Each work item assumes 10 percent for mobilization of construction equipment, a 15 percent contingency and a 12 percent engineering and/or administrative fee.

The new roadway extending from the proposed new main entrance northward to link with the existing roadway near the East Campus Wards is estimated to be a \$405,000 project. This estimate includes the cost of new paving for a 36-foot wide roadway, the addition of a right turn pocket along Steilacom Boulevard, the installation of a new traffic signal, limited illumination as well as drainage ditches. A budget of \$25,000 for entry landscaping, signing and other entry treatments is also included.

The new roadway linking the existing roadways adjacent to the Greenhouse and Morgue is estimated to be \$136,000. This assumes paving for a 36-foot wide roadway with minimal illumination and drainage ditches.

The traffic revisions required to provide "right-in, right-out only" turn movements at the Hollywood Gate are estimated to cost \$5,000. This would include C-curb along the centerline of Steilacom Boulevard and appropriate signing.

The proposed modifications at the existing Main Gate are estimated to be \$75,000. This would include channelization changes needed to create dual left turns from the driveway, changes and additions to the signal equipment and appropriate signing.

A minimal signing program is estimated to be approximately \$5,000. This would include directional signing for the proposed service/truck route, an advance hospital sign along Steilacom Boulevard, and at least one directional sign for visitors, as shown in the conceptual level drawing.

The proposed roadway widening along FarWest Drive is estimated to be \$98,000. This would include the cost of paving an additional 12 feet in order to create a total of three 12-foot lanes, widening the turn radius at the northeast corner of the FarWest/Steilacom intersection, and relocating the signal equipment as necessary.

The proposed roadway removals are estimated to be <sup>110</sup>~~\$55~~,000. This would include the costs of pavement removal and haul, as well as the costs of topsoil, seeding, mulching and fertilizing these areas. Proposed roadway removals are identified on the conceptual level drawing.

Construction of an 8-foot asphalt path behind the existing stone wall on the north side of Steilacom Boulevard, between the proposed main entrance and FarWest Drive is estimated to be \$85,000.

The service route proposed in the central hospital area is estimated to be \$25,000. This includes the cost of some additional paving, signing and minor resurfacing of existing pavements.

## Level of Service Definitions

Level-of-Service A describes operations with very low delay, i.e., less than 5.0 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-Service B describes operations with delay in the range of 5.1 to 15.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-Service C describes operations with delay in the range of 15.1 to 25.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in the level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-Service D describes operations with delay in the range of 25.1 to 40.0 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume/capacity (v/c) ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-Service E describes operations with delay in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.

Level-of-Service F describes operations with delay in excess of 60.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

TUDOR ENGINEERING COMPANY

LETTER OF TRANSMITTAL

Consulting Engineers and Planners

Norton Building  
 801 Second Avenue, Suite 516  
 Seattle, Washington 98104  
 (206) 521-5900  
 Fax: (206) 521-5911

DATE RECEIVED  
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DATE	6/20/94	FILE NO.	93412.100
ATTENTION			
RE:	Western State Hosp.		

TO Dwayne Harkness  
Dept. of General Administration

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REMARKS \_\_\_\_\_

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\_\_\_\_\_

COPY TO \_\_\_\_\_ SIGNED: Jelly C. Pearson

If enclosures are not as noted, kindly notify us at once.