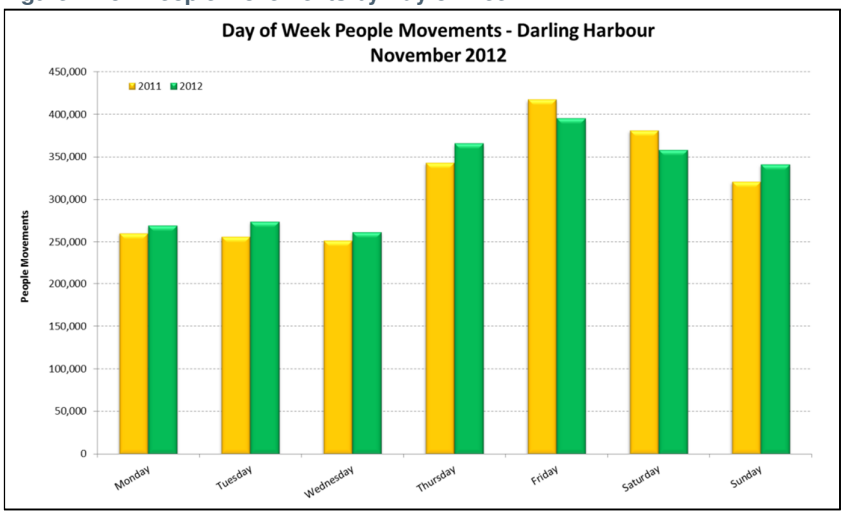
7 PEDESTRIAN MOVEMENTS AND ANALYSIS

7.1 SFHA PEOPLE MOVEMENT COUNTS

The Sydney Harbour Foreshore Authority (SHFA) has electronic counters installed in key locations in Darling Harbour. The counters emit an infrared beam and records people movements each time the beam is intercepted. The electronic people counters provide pedestrian count data for the precinct and is used as a means to monitor visitor numbers to the precinct on regular days and on special event days.

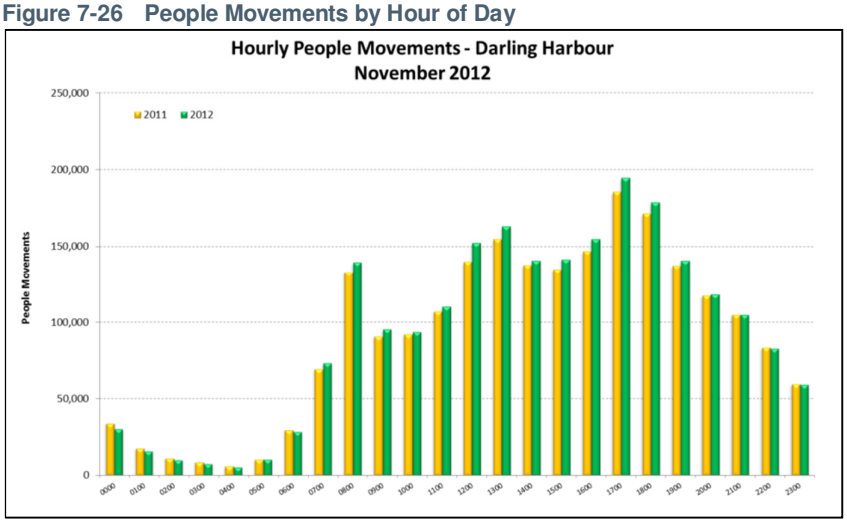
As presented in Figure 7-25 and Figure 7-26, SHFA provided a summary of data collected for the month of November in 2011 and 2012, to provide indication of daily and hourly trends. It is noted that Friday is observed to have the peak volume of pedestrians during a regular 7-day week and for a weekend day; Saturday manifested a higher count compared to a Sunday. In terms of hourly volume, the time period with the highest pedestrian volume was observed to be at 5:00-6:00 p.m.).

Figure 7-25 People Movements by Day of Week



Source: SHFA

Figure 7-26 People Movements by Hour of Day



Source: SHFA

The above trends were used as an indicative guide to determine time of day and day of week most appropriate to undertake pedestrian count surveys within the precinct.

7.2 PEDESTRIAN SURVEYS

Pedestrian surveys were undertaken during a Friday and a Saturday over a two hour period each for both AM and PM peak periods. The counts were recorded in 15-min intervals and by directional flow. The pedestrian counts revealed:

- Friday AM peak was observed to occur at 8:15-9:15 AM;
- Friday PM peak was observed to occur at 5:00-6:00 PM;
- Saturday AM peak was observed to occur at 12:00-13:00;
- Saturday PM peak was observed to occur at 6:00-7:00 PM
- Saturday survey hours manifested higher pedestrian movements per hour when compared to Friday with Saturday PM showing the highest volume.

Some survey locations formed a cordon around Darling Harbour precinct and provided indication of number of entering and exiting pedestrians. A total of 11,500 pedestrian movements were counted around the cordon during the Saturday PM peak hour. Approximately 6,800 pedestrians were entering Darling Harbour and 4,700 pedestrians were exiting Darling Harbour

Figure 7-27 summarises peak directional hourly flow at selected locations on a Saturday afternoon peak

Figure 7-27 Pedestrian Counts

7.3 PEDESTRIAN ANALYSIS OF THE PUBLIC REALM SPACE

Pedestrian analysis was undertaken for the public realm space. The time-space method was applied to assess the levels of service and test the design layout of the public realm. This method is based on pedestrian Level of Service (LoS) standards developed by John Fruin in *Pedestrian Planning and Design* (1987). The concept involves developing a spreadsheet model of the pedestrian movements for each of the floor layouts being assessed.

Pedestrian levels of service (LOS) are measures of pedestrian density and congestion used for evaluating the capacity of infrastructure for pedestrian activity. John Fruin developed levels of service for walkways and stairways which continue to be used today as the industry standard for analysing pedestrian congestion and determining capacity thresholds. It is noted, however, that Fruin's LoS measures may not always apply, particularly for disciplined crowds or in panic conditions.

Fruin's LoS assessment approach focusses on conditions at spaces with many different activities or multi-directional flows, such as walkways, building spaces, rail station platforms, waiting areas, vertical circulation vestibules, payment collection zones, bus stop areas, footpath corners and pedestrian crossings. The overall concept of the time-space method considers pedestrian facilities as time-space zones with moving and standing pedestrians requiring different amounts of space and occupying the zones for different periods of time. Time-space is the product of an area (or space) and a time period. The time-space concept considers the type of activities occurring in a space within a given time period and the number of people who are involved in each activity. The amounts of time-space required for each activity are summed and compared to the time-space available in the defined zones proposed within the facility.

Pedestrian capacity analysis is typically based on peak 15-minute flow. A peak 5-minute sensitivity test is usually undertaken to assess the ability of a design to cope with a surge in pedestrian activity. This represents a "worst case" scenario. The areas being assessed are then expected to perform at higher levels of service during the remainder of the peak period and during off-peak conditions.

A time-space spreadsheet model that includes walk paths, entrances, queue and waiting areas, stairs, escalators and lifts, and represents both the inbound and outbound movements for the peak 15-minutes on a typical average day and typical event day was developed for the proposed open space.

The time-space method considers pedestrian facilities as time-space zones with moving and standing pedestrians requiring different amounts of space, and occupying zones for different periods of time. The walk-time space requirement is a function of the walking distance, walk speed and the number of people in that space. Walk speed is affected by the amount of space available per person, which is a function of the total amount of space available, and the number of people using that space. The total space required for waiting / processing within a facility is a function of the space required per person, the amount of time spent waiting, and the number of people waiting. Waiting would include queues formed at registration areas, information booths, queuing for lifts or other activities. For the public realm space, queues are formed in open gathering space where street performances are held.

Table 7-31 presents the level of service criteria for walk and wait.

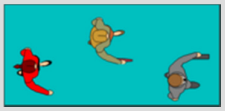
Table 7-31 Level of Service Criteria for Walk and Wait (Persons/metre/minute)

Level of Service	Walkways		Waiting/Queuing Areas	
	Pedestrian Area Occupancy (m^2)	Average Flow Volume (PMM)	Pedestrian Area Occupancy (m^2)	Average Inter Person Spacing
A	>3.3	<23	>1.9	>1.2
B	2.3-3.3	23-33	1.4-1.9	1.1-1.2
C	1.4-2.3	33-49	0.9- 1.4	0.9-1.1
D	0.9-1.4	49-66	0.7-0.9	0.6-0.9
E	0.5-0.9	66-82	0.4-0.7	<0.6
F	<0.5	>82	<0.4	-

Source: Adopted from Pedestrian Planning and Design, John Fruin, 1987

Table 7-32 below describes the flow conditions for each Level of Service.

Table 7-32 Fruin Level of Service Diagrammatic Representations and Description

Visual	Level of Service	Flow Rate (ped/m/min)	Density (sq.m./ped)	Description
	A	<23.0	>3.25	Free circulation
	B	23.0 – 32.9	3.25 – 2.30	Free circulation for one direction of flow; minor conflict for reverse and crossing flows.
	C	32.8 – 49.2	2.30 – 1.39	Some restriction in the selection of walking speed and the ability to pass others; high probability of conflict.
	D	49.2 – 65.6	1.39 – 0.93	Restricted and reduced walking speed for most pedestrians; difficulties in passing; multiple conflicts with momentary stoppages of flow.
	E	65.6 – 82.0	0.93 – 0.46	Restricted and reduced walking speed for all pedestrians; shuffling progress at higher densities; extreme difficulties in reverse and cross flows.
	F	>82.0	0.46	Circulation reduced to shuffling; reverse and cross flows almost impossible; frequent contact; sporadic forward flow.

7.4 EVENT RELATED PEDESTRIAN MOVEMENTS

Similar to the estimation of peak parking demand, the peak pedestrian movements can be estimated by considering event-related demand scenarios, as noted in Section 5.5.2.

Three peak demand scenarios have been considered:

a) Daytime weekday – Medium exhibition plus three conferences in the ICC;

b) Daytime weekend – Large consumer exhibition plus three conferences in the ICC; and

c) Evening – Large banquet plus a concert in The Theatre.

The above scenarios are expected to occur infrequently. In the 2010 and 2011 calendar years, SCEC had greater than 20,000 attendees on only 8 days, or 1% of total days. Three quarters of these occasions fell on weekends. As noted in the table below, the peak attendees are anticipated to be in the order of 23,576 in the afternoon.

Table 7-33 Peak Event-Related Pedestrian Demand Estimates

Facility	Maximum number of persons		
	Morning	Afternoon	Evening
ICC			
Plenary Space / Meeting Space[1]	4,250	4,250	-
Banqueting Space[1]	-	-	2,500
Sub-Total	4,250	4,250	2,500
ICC Exhibition			
Lower Exhibition Halls	12,690	17,951	-
Upper Exhibition Halls	1,075	1,075	-
Sub-Total	13,765	19,026	-
The Theatre			
Plenary	-	-	8,040
Sub-Total	-	-	8,040
Total for the day[2]	**18,015**	**23,576**	**10,540**

[1] This is in accordance with the populations density outlined in the NSW Project Brief.

[2] Peak Demand 1 and 2 assumes that 26.3% of attendees are present at any one time as the demand is spread throughout the day. Peak Demand 3 assumes that 100% of attendees are present at the one time, reflecting the nature of the concerts and banquets

From Table 7-33, it is estimated that the peak pedestrian volume associated with events occurring at the PPP is anticipated to occur in the afternoon with a maximum of approximately 23,576 persons at the site. Although a proportion of this demand would be using the carparks, it is assumed for the purpose of this analysis that this peak demand of pedestrians would occur in the public realm over a 15 minute period.

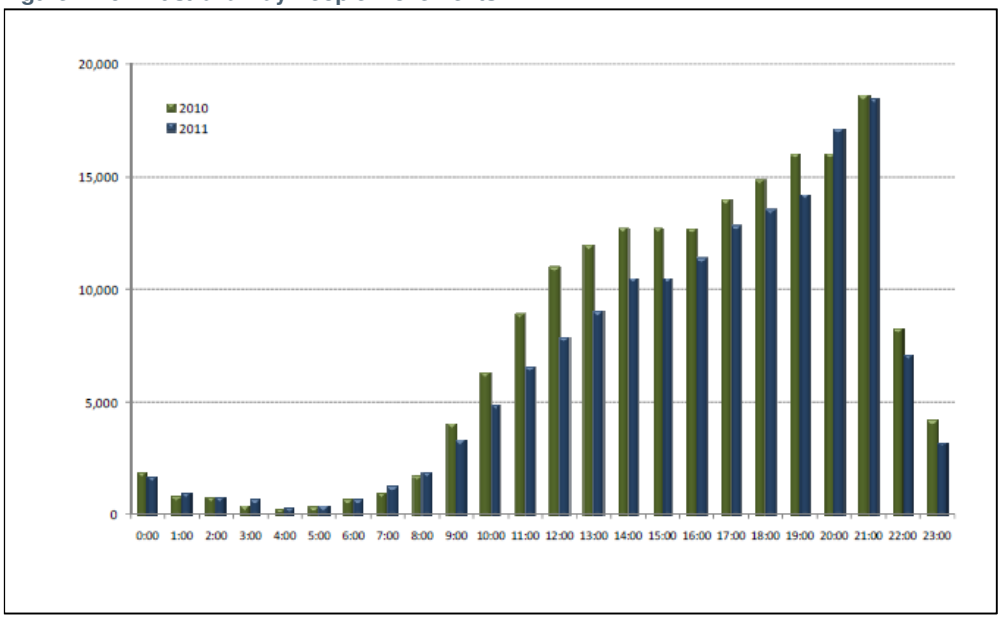
An assessment of the level of service of the walkways is undertaken by assuming this peak volume of attendees will be walking to and from the site during a 15-minute period with the same pedestrian movement distribution observed from the surveys. Figure 7-28 shows the forecast peak demand for pedestrian movements.

Figure 7-28 Event Related Pedestrian Volumes

7.5 OUTDOOR EVENTS

Major annual celebrations held at the Darling Harbour usually attract more than 150,000 people to the Precinct. Such events include Australia Day and New Year's Day. The celebrations are held throughout the day with various activities scheduled and located at various parts of the precinct but usually in the areas surrounding Cockle Bay. A snapshot of the people movements recorded for previous years provide indication of the magnitude of pedestrian volumes expected at the precinct (See Figure 7-29).

Figure 7-29 Australia Day People Movements



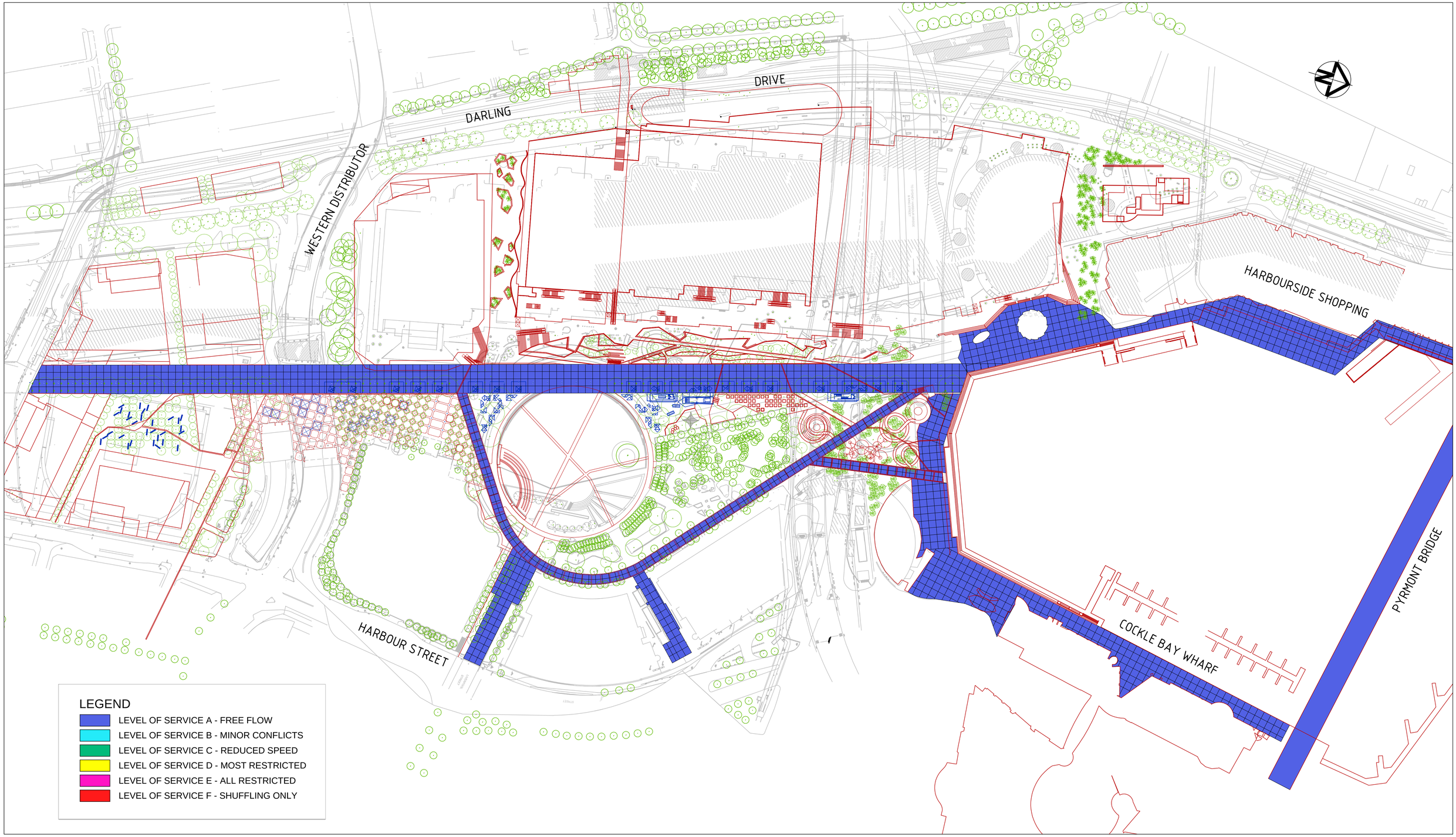
Source: SHFA Event Management Plan for Australia Day 2012.

Figure 7-29 shows that the hourly volume of people movements gradually increases from 7:00 a.m. and peaks between 9:00-10:00 p.m. in the order of approximately 18,000 people. This volume of pedestrians is relatively in the same range of pedestrian volumes expected during events held at the PPP facilities. The main difference would be that people would tend to gather around Cockle Bay as most festivities and key attractions are likely to occur in that area. In terms of required capacity to accommodate the pedestrian movements, there would be limitations in the open space areas surrounding Cockle Bay. These limitations are managed by Event Management Plans to ensure that the attractions that are included in the programme for the day are appropriately located with consideration of the required open space to cater for people movements. The proposed layout of the Central area of the precinct provides more flexibility and open space capacity to accommodate pedestrian movements.

7.6 FINDINGS

The modelling results indicate that the public realm will generally be operating at a level of service "A" with the weekday pedestrian volumes and the event related pedestrian volumes. The incorporation of a wide 20m boulevard significantly improves pedestrian access and mobility within the precinct.

A sensitivity test was carried out to determine potential impact of increased pedestrian activity during events and the results indicate the level of service to decrease to "B" with small patches of areas performing at a LoS "C", mostly at crosspoints and mostly fronting commercial areas.



REFERENCE MAP

NOTES:

1. DO NOT SCALE FROM DRAWINGS. WORK TO WRITTEN DIMENSIONS ONLY.
2. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
3. ALL COORDINATES TO MGA. ALL LEVELS TO AHD.
4. ALL DIMENSIONS, COORDINATES AND LEVELS TO BE VERIFIED ON SITE BEFORE PROCEEDING WITH WORK. HYDER SHALL BE NOTIFIED IN WRITING OF ANY DISCREPANCIES.
5. THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL RELEVANT CONTRACTS, SPECIFICATIONS AND DRAWINGS.
6. PRECINCT BOUNDARIES ARE INDICATIVE ONLY AND ARE SUBJECT TO CHANGE.

0 25 50 75 100 125m

1 : 1250

DRAFT

REV	DESCRIPTION	DATE
P1	FOR INFORMATION	08.02.13

CLIENT

Lend Lease — **PROJECT MANAGEMENT & CONSTRUCTION**
LEVEL 4, THE BOND, 30 HICKSON RD
MILLERS POINT, NSW 2000

CONSULTANTS

AECOM — **MECHANICAL / ELECTRICAL / FIRE SERVICES**
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www.hyderconsulting.com

Hyder

PROJECT

SICEEP
DARLING HARBOUR
PROJECT PRECINCT

DRAWING TITLE

PEDESTRIAN LEVEL OF SERVICE (WHOLE OF PRECINCT)

Figure 7-30 Average Day

STATUS

PRELIMINARY

SCALE @ A1	DRAWN	DESIGNED	REVIEWED	APPROVED
1250	RT	SM		

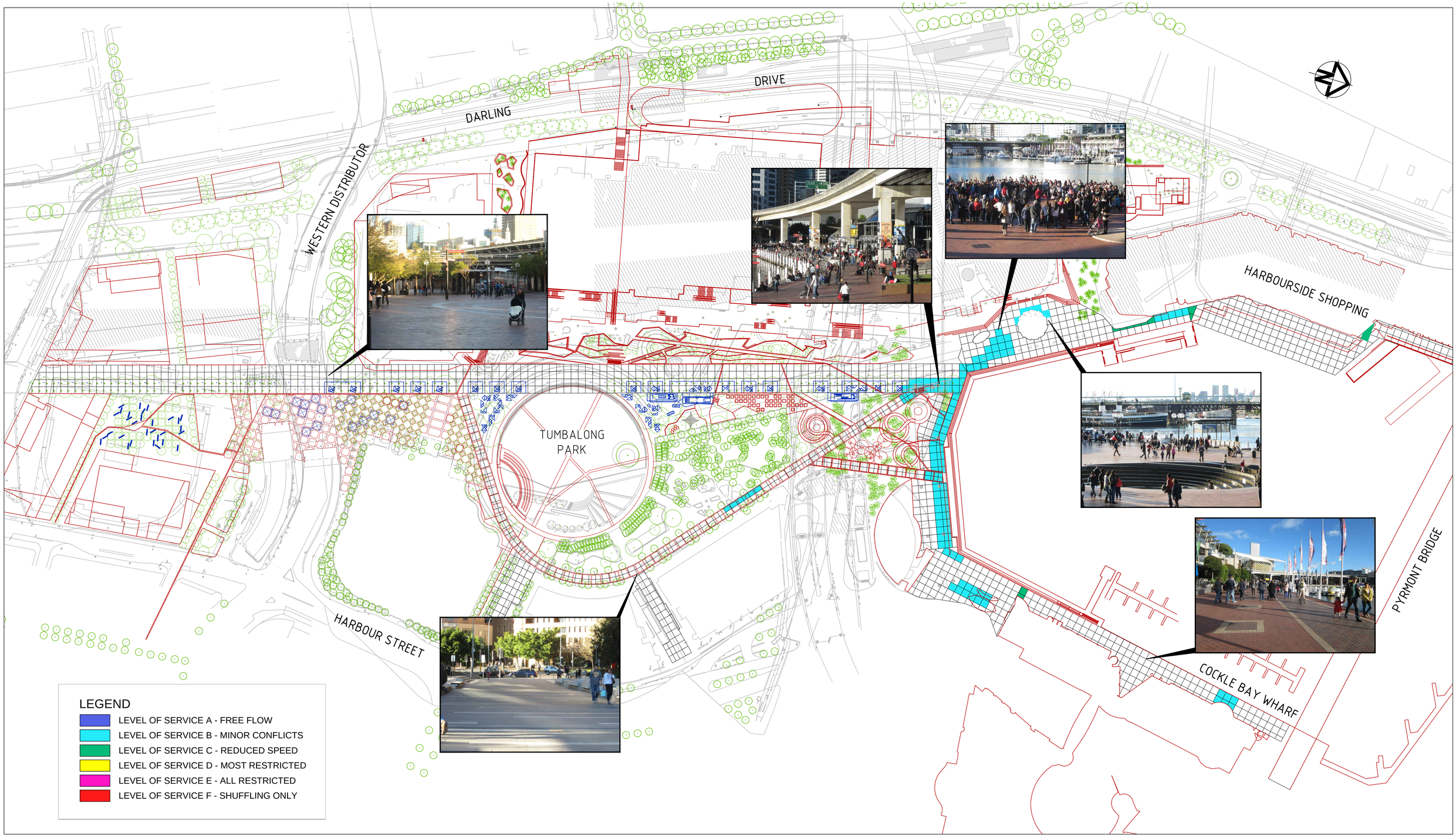
PROJECT NUMBER	DRAWING NUMBER	REV
AA004399	SKC001	P1

Date Plotted: 8 Feb 2013 - 11:41AM File Name: F:\AA004399\F-Reports\Pedestrian Analysis\CAD\SKC001-AA004399-NSD-00-PEDESTRIAN.dwg

Original Sheet Size A1 - 841 x 594mm

SYDNEY INTERNATIONAL CONVENTION, EXHIBITION AND ENTERTAINMENT PRECINCT

DARLING HARBOUR LIVE



REFERENCE MAP

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0 25 50 75 100 125m

1 : 1250

DRAFT

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P1	FOR INFORMATION	08.02.13

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Hyder

PROJECT

SICEEP
DARLING HARBOUR
PROJECT PRECINCT

DRAWING TITLE

PEDESTRIAN LEVEL OF SERVICE
PINCH POINTS DURING AN EVENT
(with photos of existing conditions)
Figure 7-31

STATUS

PRELIMINARY

SCALE @ A1	DRAWN	DESIGNED	REVIEWED	APPROVED
1250	RT	SM		

PROJECT NUMBER	DRAWING NUMBER	REV
AA004399	SKC003	P1

Date Plotted: 19 Feb 2013 - 12:36PM File Name: F:\AA004399\F-Reports\Pedestrian Analysis\CAD\SKC003-AA004399-NSD-00-PEDESTRIAN.dwg

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