

Pasadena Windstorm Tree Failure Analysis

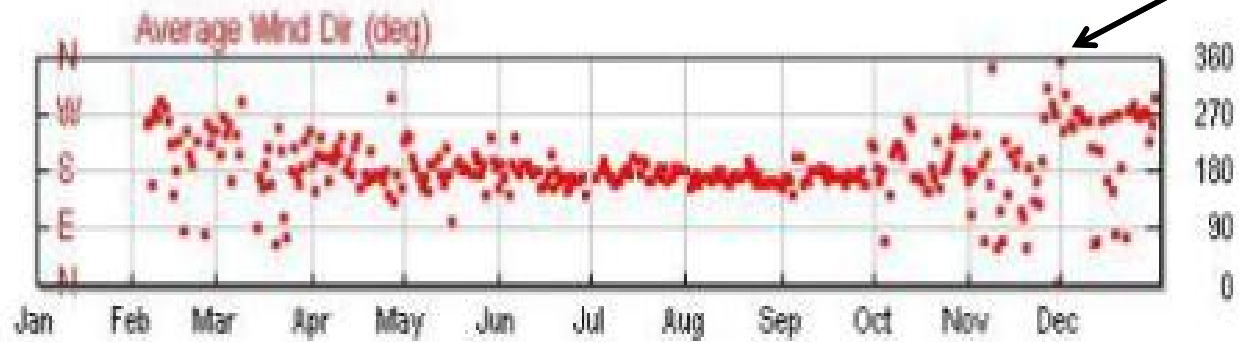
**Presented by the
Davey Resource Group
in conjunction with
The City of Pasadena, Department of
Public Works**



Unique Wind Event

November 30 – December 1, 2011

- **Combination of sustained high winds and direction**
- **Official wind speeds of 60 MPH (Hill Ave)**
- **Unofficial wind speeds approaching 160 MPH (Henninger Flats)**
- **Wind direction directly from the north with extremely high gusts out of Eaton Wash**

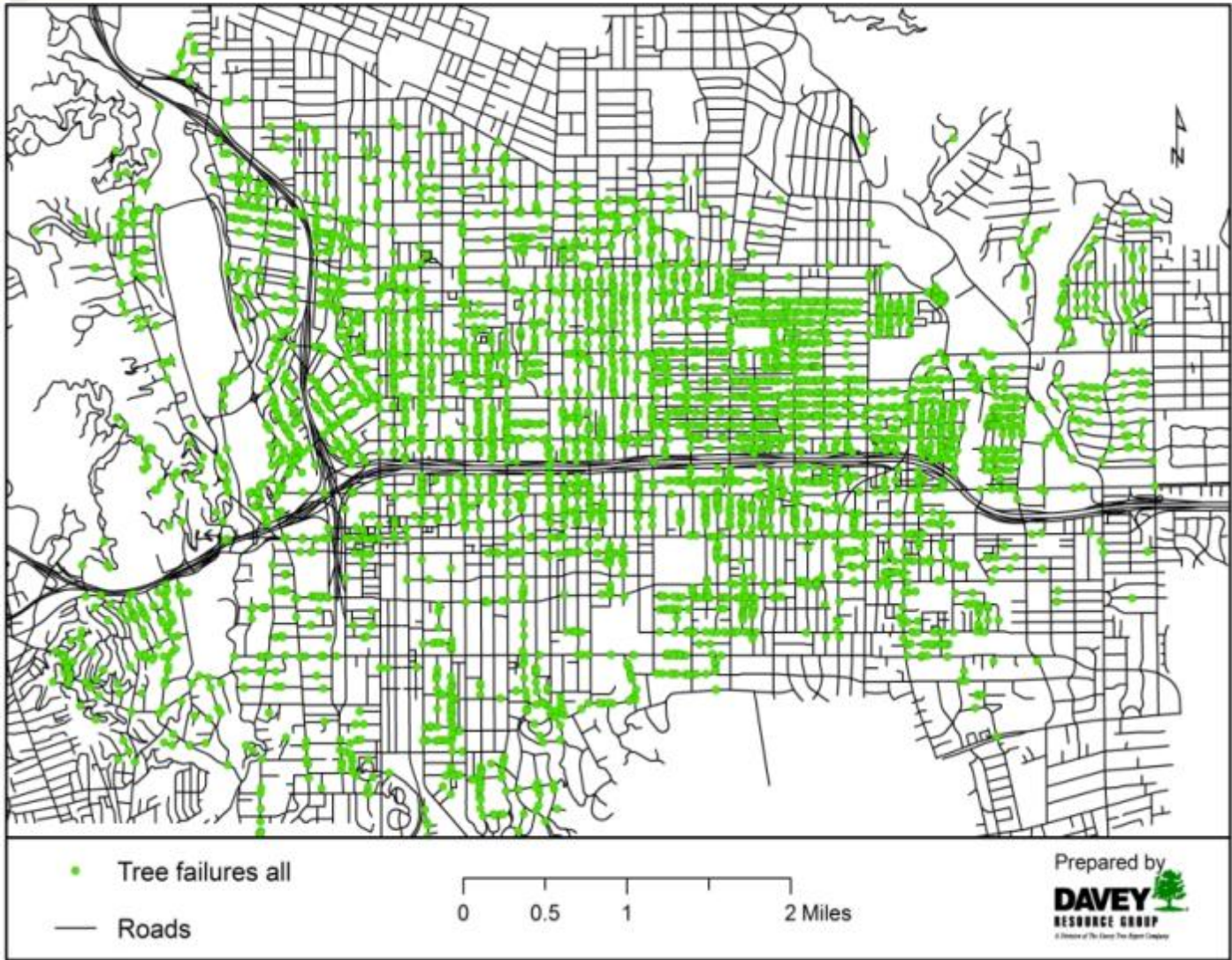


Annual Wind Data for Pasadena – 2011



Damage Analysis

- **Approximately 5,500 reports of tree related damage**
- **Approximately 2,000 total failures**
- **Approximately 9% of the City's 57,500 trees affected**
- **Davey Resource Group to investigate contributing factors**
- **Limitations to assignment:**
 - **Aggressive clean up activities**
 - **No tissue, soil or trunk decay analysis**
 - **Geocoding conflicts**



Tree Failure Overview



Methods

- **City generated report tracking spreadsheet**
- **Geocoding sites vs. current inventory**
- **February field observations**
- **Failure type classification analysis**
- **Species trends**
- **Location of failures within street segments**



Failure Classifications

- **Branch**
 - **Minor limbs < 4"**
- **Major Limb**
 - **Large (> 4") scaffold**
- **Whole Tree**
 - **Root or soil**
- **Other**
 - **Debris on ground, powerline conflict**



Other



Branch

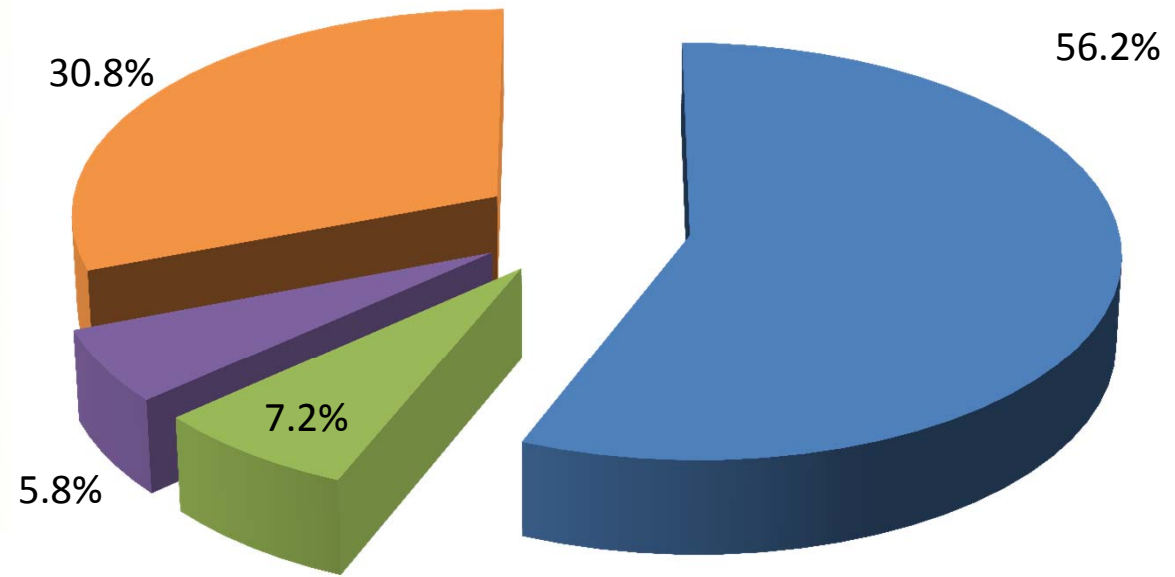


Major Limb



Whole Tree

Examples of Failure Types



■ Branch Failure

■ Major Limb Failure

■ Other

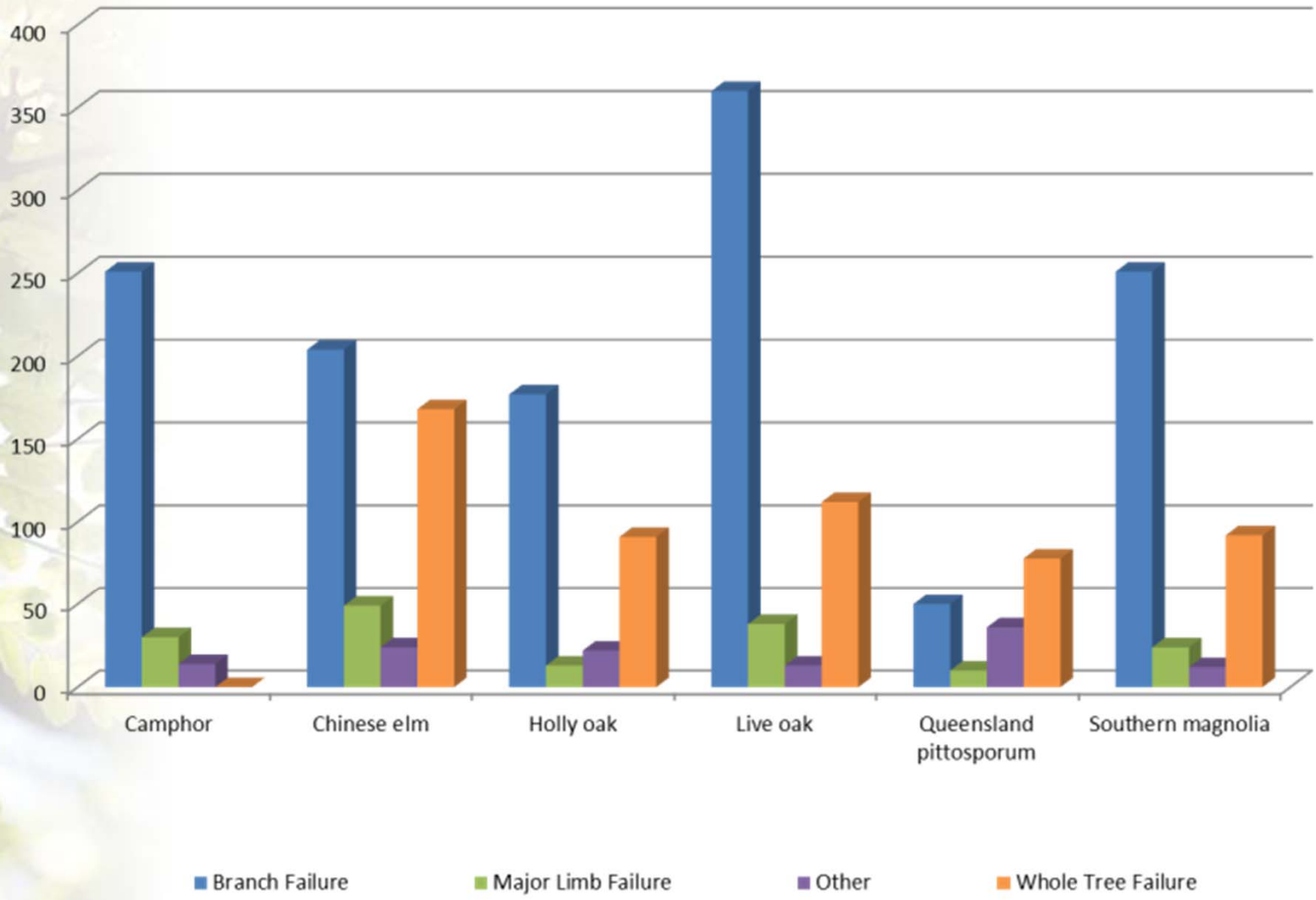
■ Whole Tree Failure

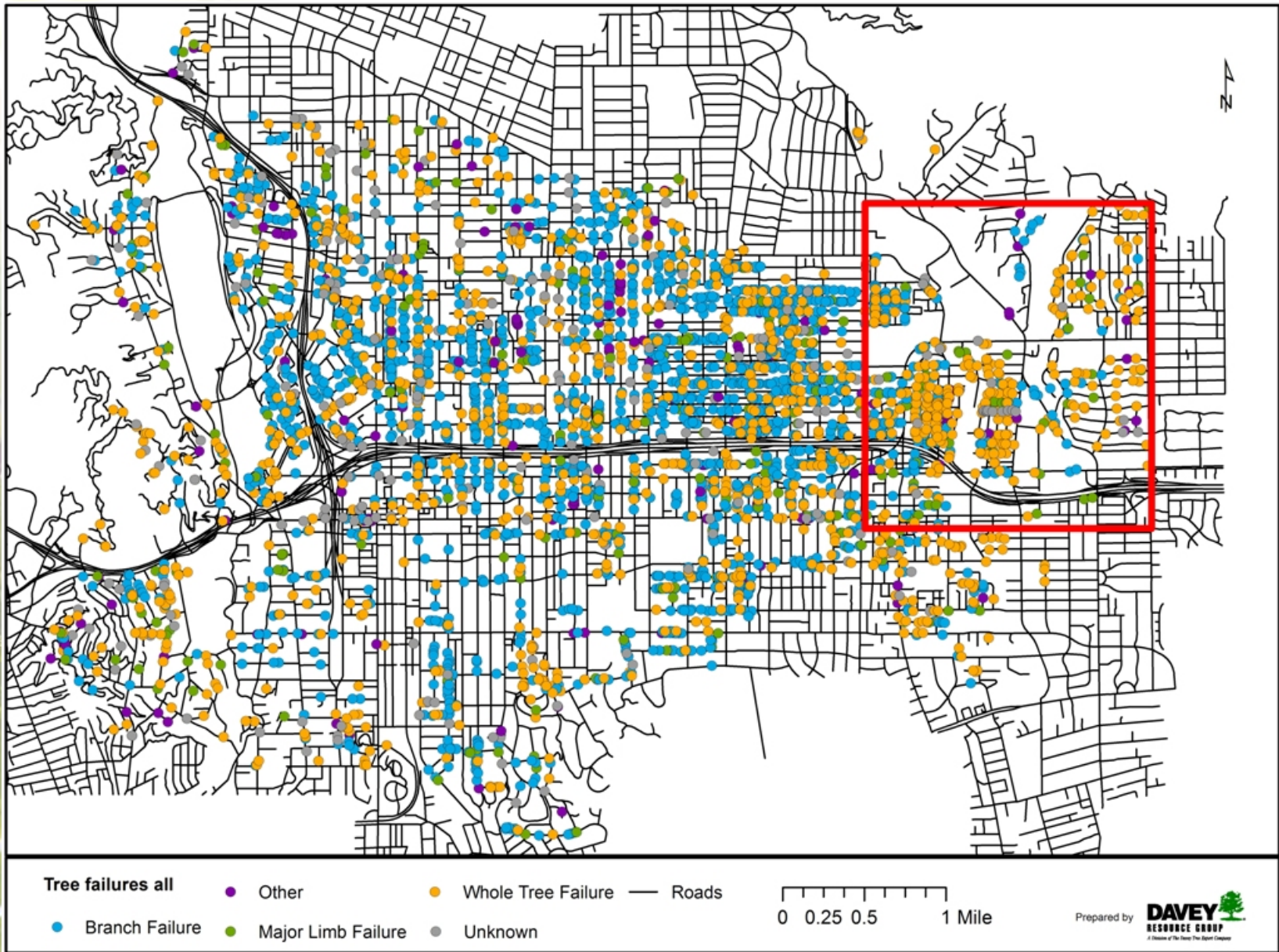
Summary of Failure Types

Species	Failure Count	Percent of Whole Tree Failure	Percent of Species Failures	Percent of Total Overall Population
Queensland pittosporum	174	4.37%	50.73%	0.59%
Chinese elm	445	11.19%	13.65%	5.64%
Indian laurel fig	65	1.63%	13.16%	0.85%
Carrotwood	126	3.17%	11.39%	1.92%
Western sycamore	46	1.16%	10.90%	0.75%
Jacaranda	166	4.17%	10.74%	2.76%
Live oak	523	13.15%	9.25%	10.12%
Carob	90	2.26%	9.09%	1.64%
Brisbane box	113	2.84%	8.94%	2.22%
Holly oak	303	7.62%	8.19%	6.34%
Bottle tree	79	1.99%	8.18%	1.67%
Southern magnolia	379	9.53%	7.30%	8.95%
Italian cypress	46	1.16%	6.53%	1.22%
Canary island date palm	56	1.41%	6.21%	1.56%
American sweetgum	73	1.84%	6.12%	2.12%
Camphor tree	295	7.42%	5.61%	9.19%
Crape myrtle	65	1.63%	3.28%	3.54%
Mexican fan palm	110	2.77%	2.43%	7.88%

Species Failure Percentages

Top 6 Species With Failure Classes





Area of Concentrated Whole Tree Failures

Whole Tree Failure Types



Root Failure



Soil Failure

Condition Class	Failure Class	Count	Percent of Condition Class	Percent of Total Population
Very Good	Branch Failure	1	0.83%	0.00%
Very Good	Whole Tree Failure	1	0.83%	0.00%
Good	Branch Failure	890	3.80%	1.59%
Good	Major Limb Failure	111	0.47%	0.20%
Good	Other	126	0.54%	0.22%
Good	Whole Tree Failure	500	2.14%	0.89%
Fair	Branch Failure	975	4.49%	1.74%
Fair	Major Limb Failure	126	0.58%	0.22%
Fair	Other	73	0.34%	0.13%
Fair	Whole Tree Failure	493	2.27%	0.88%
Poor	Branch Failure	127	5.02%	0.23%
Poor	Major Limb Failure	14	0.55%	0.02%
Poor	Other	6	0.24%	0.01%
Poor	Whole Tree Failure	56	2.21%	0.10%
Critical	Branch Failure	4	4.71%	0.01%
Critical	Whole Tree Failure	2	2.35%	0.00%
Dead	Branch Failure	6	2.23%	0.01%
Dead	Other	1	0.37%	0.00%
Dead	Whole Tree Failure	6	2.23%	0.01%

Tree Condition and Failure Types

Tree Form (Growth Habit)



Excurrent tree.



Decurrent tree.

Site Conditions

- **Soil condition**
- **Forest canopy density**
- **Fringe trees**
- **Location within a street segment**
- **Protection from structures**



No protection for this fig tree that suffered from major limb failure.



Pruning Practices

- **Natural structural pruning for 25 years**
- **5-year cycles**
- **No direct impact**
- **City benefited from proper pruning**



Conclusions

- **Live oak, Chinese elm, southern magnolia, camphor, Queensland pittosporum and holly oak were the top six species with the most damage**
- **Branch failure most common damage**
- **Condition not a major factor**
- **Location and protection minor factor**
- **Pruning practices not a factor**
- **Wind speed and direction was determined to be the major contributing factor**