

The Lake Harriet-Har Mar Tornado of June 14, 1981

Situation, Timeline, Impacts

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A strong (F-3) tornado tracked from Edina, through Minneapolis, and into Roseville, producing heavy damage, killing one person, and injuring over 83. The tornado was part of a very active day that included other tornadoes and extreme straight-line winds.

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Overview

During the late afternoon of June 14, 1981, a tornado began in the 50th and France neighborhood of Edina, crossed the northwestern ½ of Lake Harriet, and tracked through heavily residential sections of south Minneapolis, before weakening briefly in the vicinity of the East Bank of the University of Minnesota. The tornado re-intensified in Roseville, where it did heavy damage to the Har Mar mall, Central Park, and the residential neighborhood south and east of Lake Owasso.

The tornado killed one person directly along the southwestern shore of Lake Harriet, one indirectly during clean-up, injured at least 83 along its track, and produced over \$124 M in damages (2016 dollars), including to more than 50 businesses. Heavy injuries were sustained at the Roseville Applebaum's grocery store, and both the Har Mar Target and Sound of Music (now Best Buy) were damaged extensively. The tornado destroyed dozens of acres of public park property in Minneapolis and Roseville.

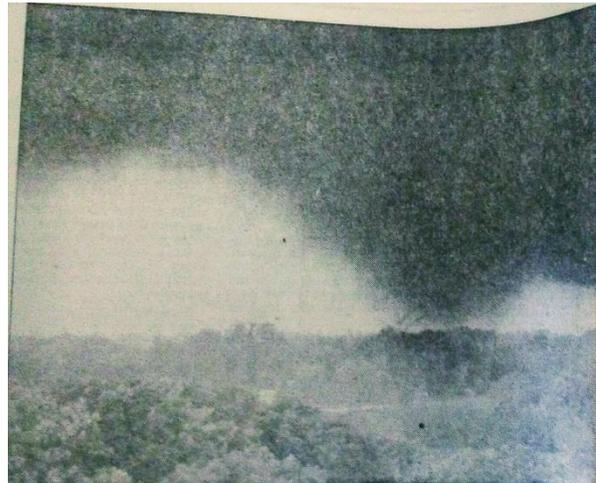


Figure 1. Tornado seen over Roseville, approaching Rice St. and Larpenteur Ave from the southwest. Source: St. Paul Dispatch, June 15, 1981



Figure 2. Extensive tree damage to parkland adjacent to the cosmetically-damaged Theodore Wirth home and Minneapolis Park Commissioner's residence, 40th and Bryant. Image source: Hennepin County Library, Minneapolis Collection.

The tornado struck during what had already been a stormy weekend. Heavy rains on the 12th and 13th had caused minor flooding, and an outbreak of thunderstorms on the morning of the 14th produced two tornadoes in far southern Minnesota, along with thunderstorm winds in excess of 100 mph in Dakota County. Immediately prior to the tornado forming, golfball-to-baseball-sized hail had been reported near Mound, and large hail continued to be associated with the parent thunderstorm during and after the tornado's passage. As the tornado was entering Minneapolis, another tornado from a different thunderstorm struck a

portion of Mankato. Later in the evening, a separate tornado hit Maple Lake (Wright County).

Snapshot

What	Tornado from eastern Edina, through South Minneapolis, into St. Paul and Roseville
Magnitude	Final damage rating was F-3
Human toll	1 direct fatality, 1 secondary fatality, 6 serious injuries, 77+ minor injuries
Damage	<ul style="list-style-type: none"> • 1,300+ homes damaged or destroyed • 50+ businesses damaged or destroyed • 400+ vehicles damaged or destroyed • 3,500+ trees killed • 30,000+ customers without power
Frequency/Recurrence	<ul style="list-style-type: none"> • Tornadoes of this intensity or impact have affected Minneapolis every 10-15 years historically, and Hennepin County every 3-7 years.
Considerations	Tornado was shrouded in ground clutter from NWS/MSP radar, but easily detected by KSTP-TV's Doppler radar; staff, however, were not yet adequately trained to read the radar skillfully.

About this report

The purpose of this short report is to provide Emergency Management with insights into a major, high-impact tornado that crossed through the center of the Twin Cities Metropolitan Area. This tornado event is relatively straightforward: severe weather had been anticipated that day, the tornado was produced by a single, classic supercell with a “textbook” hook echo on radar, and the impacts were confined to that supercell.

Information for this report comes from the following sources: dozens of articles in the Minneapolis Star, the Minneapolis Tribune, the St. Paul Pioneer Press, and the St. Paul Dispatch; archived footage from KSTP television; archived WCCO 830 AM radio recordings; the NOAA publications *Daily Weather Maps* and *Storm Data* from June of 1981, and various holdings of the Minnesota State Climatology Office, which was heavily involved in the damage survey.

Background

A weather pattern conducive to severe storms developed on June 13th, 1981, as a strong low pressure area formed in northeastern Colorado and pushed into South Dakota and Nebraska. A warm front stretching across northern Iowa eventually surged northward through much of eastern Minnesota, placing the Twin Cities area in a warm and unstable air mass. Heavy rain and thunderstorms developed in the vicinity of the warm front on the 13th and 14th, with some minor flooding reports.



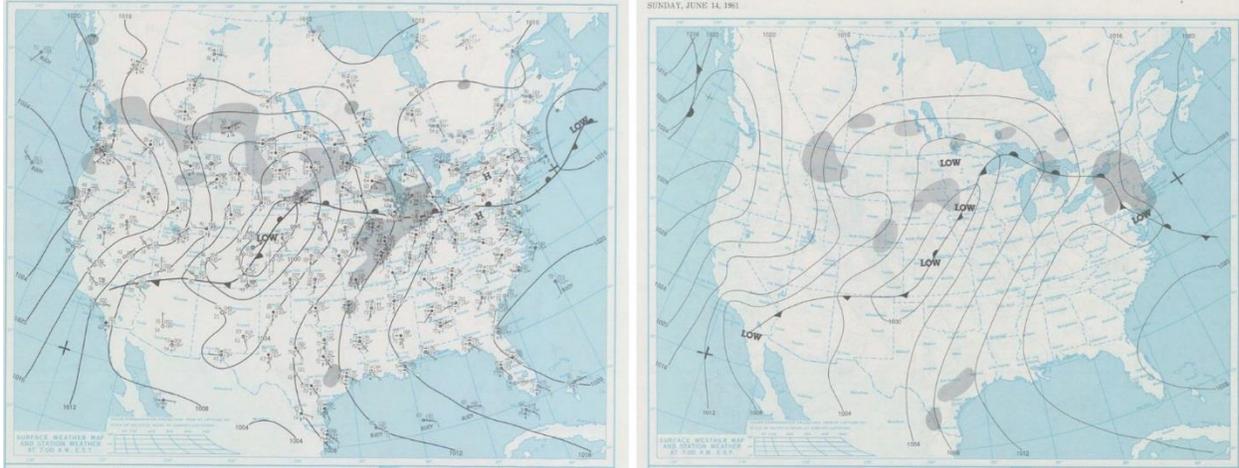


Figure 3. Daily weather maps from 7 AM CDT on Saturday June 13 (left) and Sunday June 14 (right), 1981. Cold front right image likely retrograded (moved westward 50-100 miles during the day, as the low circulation in northern Minnesota intensified). Image source: NOAA *Daily Weather Maps*.

Storms from southwestern Minnesota through the far southern Twin Cities area on the morning of the 14th were especially severe. Straight-line winds tore roofs off of barns and uprooted trees in Jackson and Nobles around 5 AM CDT, as wind-driven golf ball-sized hail damaged thousands of acres of crops; shortly after that, a tornado damaged buildings in Lake Crystal (Blue Earth County); straight-line winds then produced measured 60-70 mph gusts in Mankato; another tornado significantly damaged homes and businesses in Le Center (Le Sueur County) at 6 AM. The storms then formed a ferocious bow echo with winds estimated by the National Weather Service to be up to 120 mph in Rice and Dakota counties, where barns were destroyed, outbuildings collapsed, over 100 cattle were killed, roofs of homes were torn off and blown for hundreds of yards, and where crop damage from wind-driven hail was extensive. By 7 AM, the most severe storms had passed into Wisconsin, but scattered thunderstorms with heavy rains persisted over the Twin Cities area. Storm survey damage estimates from the morning storms exceeded \$90 M (2016), with much of that damage coming to agricultural buildings and crops.

During Sunday the 14th, the low pressure area elongated, moved into Iowa and Minnesota, and began moving north-northeastward along a cold front stalled across the southeastern third of Minnesota. The advancement of this low, in combination with the cold front, led to the development of severe thunderstorms during the afternoon and evening of June 14 from. These thunderstorms developed periodically from Mankato through the Twin Cities, and up towards St. Cloud, between 2 PM and 10 PM, in association with the cold front and the low pressure area itself. The storm that produced the Lake Harriet-Har Mar tornado formed as an isolated thunderstorm in Scott and Carver counties prior to 3 PM CDT.

Timeline

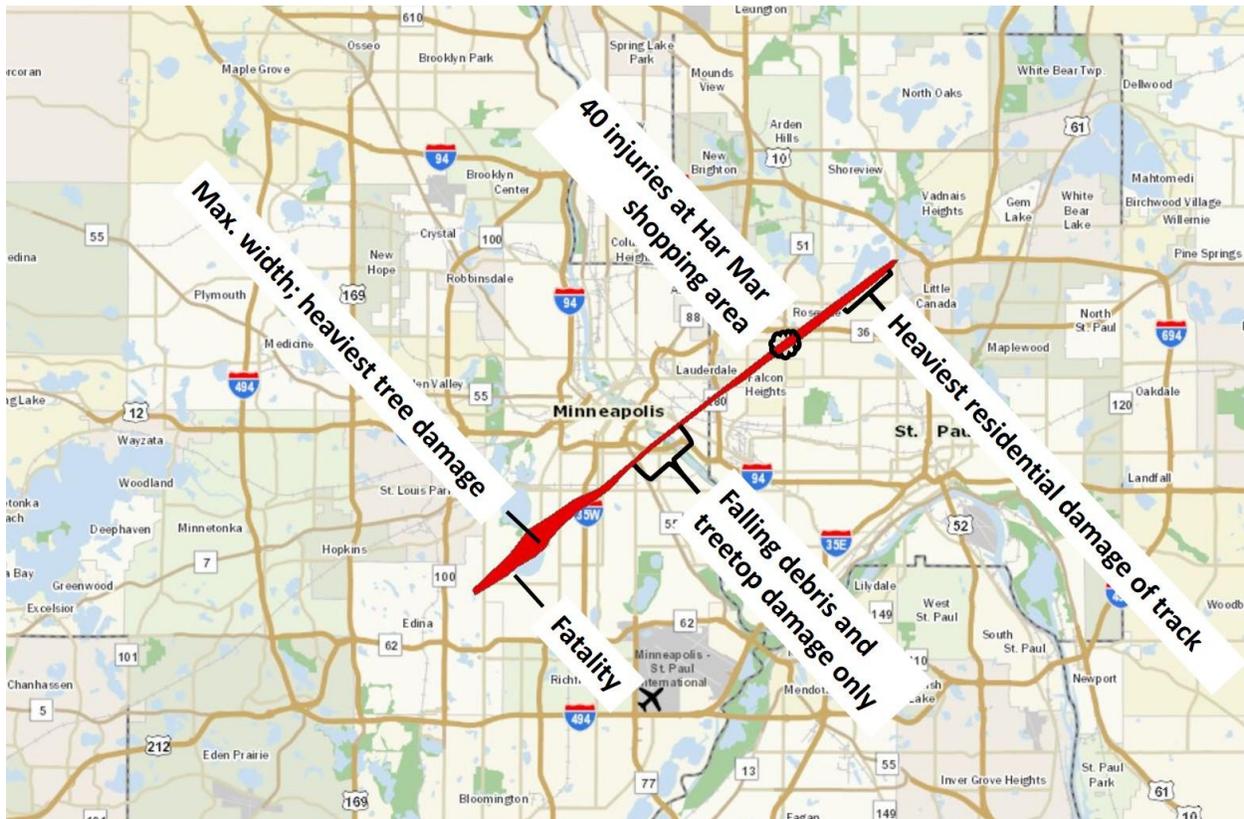


Figure 4. Annotated track of June 14, 1981 tornado. Unique shapefile created from information gathered for this report.

The following timeline summarizes the evolution of the storm and tornado track through the Twin Cities.

Prior to 3:00 PM: thunderstorm develops over Scott and Carver counties, moving northeastward.

3:00 PM: National Severe Storms Forecast Center (now Storm Prediction Center) issues Tornado Watch for southern and eastern Minnesota, far western Wisconsin, northwestern Iowa, and eastern Nebraska, valid from 3:30 pM to 9 PM CDT.

3:24 PM: Heavy thunderstorm with small hail reported in Lake Minnetonka area

3:39 PM: Severe Thunderstorm Warning issued until 4 PM for Hennepin County, with reports of golf ball to baseball-sized hail in Lake Minnetonka area.

3:42-3:45 PM: Scattered damage reported in Shakopee

3:46 PM: Golf ball-sized hail reported in north Minneapolis, Brooklyn Park, and Brooklyn Center

3:46 PM: Tornado forms ½ mi southwest of 50th and France intersection, moving northeast (*not yet reported or warned*)

3:49 PM: Tornado strikes Edina 1-2-3 Cinema directly with full loss of power during two movies, and damages residences and businesses in a 200-300 yard-wide swath.

3:50-3:54 PM: Tornado moves into southwest Minneapolis at 50th St, strikes west side of Lake Harriet. Roof of pavilion at Beard's Plaisance Park tossed hundreds of yards into lake. Man on southwest side of lake sustains fatal head injury. Tornado grows to over a half-mile-wide, reaching a maximum width of 1200 yards (2/3 of a mile), covering the northern 1/3 of Lake Harriet while simultaneously damaging the public bandshell on northwest side of the lake, the Roberts Bird Sanctuary, Rose Gardens, Lakewood Cemetery, and Lyndale Farmstead park (all on north and northeast sides of lake). Tornado then passes to area around 38th and Grand Ave. During this time, an off-duty Minneapolis police officer relays the first tornado report to the National Weather Service. ***Tornado warning issued until 4:35 PM, sirens activated county-wide.***

3:55-3:59 PM: Tornado continues northeastward through southern and central Minneapolis, crossing I-35 between 32nd and 37th Streets, and then crossing Lake Street, centered on Chicago Ave. Tornado remains large, even as path width narrows to between a 1/4 and 1/3 mile, and continues northeastward towards southern and eastern portions of University of Minnesota Twin Cities East Bank campus. Contact with ground intermittent at this point.

4:00-4:04 PM: Tornado crosses Prospect Park neighborhood of Minneapolis, crosses hwy 280 at Energy Park Drive, and hits homes in St. Anthony Park neighborhood of St. Paul. Crosses Cleveland Ave just south of Larpenteur Ave, grazing the St. Paul campus of the University of Minnesota.

4:05-4:07 PM: Tornado intensifies at Roselawn and Fairview Ave in Roseville, with residential damage increasing northeastward through County Road B and Snelling Ave intersection, where extensive damage to businesses occurs in vicinity of Har Mar mall. Flying glass and other debris causes over 20 injuries in Applebaum's grocery store, and over one dozen other injuries elsewhere in the Har Mar area.

4:08-4:12 PM: Tornado continues northeastward through Roseville's Central Park, and to south/east side of Lake Owasso, where it causes more injuries and heaviest residential damage of entire track, before dissipating rapidly near Rice St.

Impacts

The tornado killed one man who sustained head injuries from a falling tree limb along the shore of Lake Harriet. Another man died of cardiac arrest during clean-up immediately following the tornado. An additional six injuries were considered serious, with 77 minor injuries officially reported by the National Weather Service. However, newspapers had reported anywhere from 80 to over 100 injuries, noting that some of the more minor ones involving small cuts from glass were treated at home.

Damage from the ranged from \$124M and \$138 M (2016 dollars), about 65% of which occurred in Roseville, with the remainder occurring in Hennepin County, primarily in Minneapolis . Over 85% of the damages were insured losses to private residences or businesses. Much of the public damage total was

related to extensive tree removal and planting, landscaping, road clearing, search and rescue, and additional enforcement in damaged areas. Following are some specific damages from the tornado.

- 24 homes completely destroyed (23 in Roseville)
- 131 homes with major damage requiring extensive repair
- 1,153 with minor damage (roof and windows)
- 227 apartments damaged in Hennepin County
- Over 3,500 trees snapped or uprooted on public property
 - Tree mortality was heavily concentrated on public property near Lake Harriet in Minneapolis, including Beard's Plaisance, Roberts Bird Sanctuary, the Rose Garden, the western and northern shores of the lake, and Lyndale Farmstead Park. This high-greenspace area accounted for only 5% of the tornado track, but over 25% of the tree mortality.
 - Tree mortality was also extensive in Roseville's large Central Park
- Damage to over 50 business, in three main areas: near 50th and France in Edina, along Lake Street in Minneapolis, and in and around Har Mar mall in Roseville.
- Damage to over 400 vehicles, though undercounting is likely. The heaviest damages were in the Har Mar area parking lots, where over 150 cars were destroyed or damaged, with many thrown or rolled 25-100 yards. Many damages also occurred in residential areas where trees fell on vehicles.
- Over 30,000 power outages from the tornado alone; other storms that day and later in the week knocked out two times more power in the Twin Cities.

Initially, the tornado was thought to be a high-end F-4, but the first submitted rating was at F-2, eventually changed to F-3. No evidence exists to support an F-4 rating, but this was a very large tornado. In articles and writings, National Weather Service staff repeatedly referred to the tornado as "mini," to differentiate it from the larger, "maxi" tornadoes. However, with a mean path width of 600 yards (roughly 1/3 mi.), this tornado was more than two times larger than the mean and above the 85th percentile for F₃ tornadoes, and near the 95th percentile for all tornadoes, as reported by Brooks (2004).

Detection and Warning

Many newspaper quotes from after the event indicate that severe weather was very well anticipated that day. The storm itself, however, was not understood the way it would (likely) be today, and as a result the warning for the tornado came after the tornado had already been on the ground for several minutes, doing heavy damage and causing its one direct fatality.

Even though the US Weather Bureau had great success detecting hook echoes and issuing tornado warnings during the May 6, 1965 event, radar operator skill was still highly variable and most forecasters had not learned much since that event about the nature of supercell thunderstorms that are responsible for tornadoes. As operated, the NWS radar at the MSP airport could not properly "see" the June 14, 1981 storm because of ground clutter near Minneapolis. The NWS warning process was

therefore pre-destined to be reliant on observer reports, which would make it difficult to provide lead-time in a built-up, urban area.

Incidentally, KSTP-TV had recently acquired its own radar that was sited high enough to avoid ground clutter issues. This radar also had Doppler capabilities, but as a new purchase, KSTP's meteorologists were not sufficiently trained to read it yet. Thus, even though the conventional radar from KSTP showed what today would be recognizable immediately as a supercell with a hook echo, the tornado was not recognized and detected.

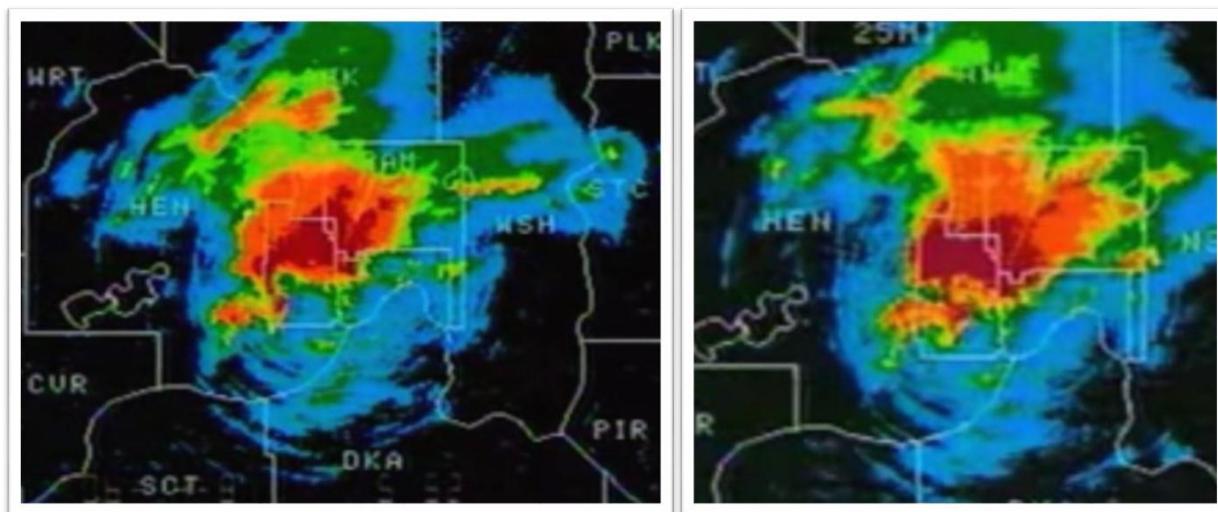


Figure 5. Radar stills from KSTP-TV's conventional radar at approximately 3:52 and 3:58 PM CDT. Image stills taken from archived news footage at <https://www.youtube.com/watch?v=4tUQ2sVdWok>

Other storms

The Lake Harriet – Har Mar tornado was by no means the only weather event of the day. The severe storm outbreak during the morning produced extensive damage, consistent with what in many years would be the state's worst severe weather event.

Additionally, the storm that produced the tornado was not a lone actor. Instead, other very intense and tornadic storms exploded across southern and central Minnesota that afternoon and evening. Tornadoes produced heavy damage in Mankato and Maple Lake, and other thunderstorms caused additional straight-line wind and hail damage in parts of the Twin Cities and into western Wisconsin. Adding up the morning storms, and all of the afternoon/evening storms, the damages exceed \$250 M (2016 dollars), making June 14, 1981 one of the costliest severe weather days on record in Minnesota.

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