

An aerial photograph of the I-35W Bridge collapse site. The bridge is a large concrete arch bridge spanning a river. A significant portion of the bridge deck has collapsed into the water, leaving a large gap. Several emergency vehicles, including police cars and ambulances, are visible on the remaining bridge deck and on the surrounding roads. The river is dark, and the surrounding area is green with trees. The text "Medical Response To A Major Freeway Bridge Collapse" is overlaid in a large, yellow, serif font with a black outline.

Medical Response To A Major Freeway Bridge Collapse

I-35W Bridge Collapse

AUGUST 1, 2007



HCMC

3rd Av Br

Stone Arch
Br

I-35W

collapse zone

10th Av Br

500 2nd St SE

Andy King / Polaris

MSP EMS Overview

- 2.8 million 7 County Metro Area
 - 1,152,500 Hennepin County
 - 387,970 Minneapolis
-
- 277,000 runs EMS 7 County Region
 - 57,000 runs Hennepin County EMS
- 19 ambulances in fleet
- 13 crews on duty 6 PM Aug 1, 2007
- 107 Paramedics, 15 EMD, 10 Mgt

Minneapolis Fire Dept.

- Minneapolis Population

- 382,618

- Land Area

- 58.7 square miles

- Resources

- 459 Sworn Members

- 19 Stations

- 19 Engines

- 6 Ladders

- 2 Heavy Rescues

- 1 Command Truck

- Mobile Air Supply

- Hazmat Team

- Technical Rescue Team

- 2006 Responses

- 1,808 Fires

- 22,199 EMS & Rescue

- 9,761 Misc

- Budget

- \$47,663,009



35W Bridge

- Built 1967
- Rated in recent years as: 'structurally deficient, but not in immediate need of replacement'
- 2000 ft span, 64 ft high
- 141,000 cars / day
- Mississippi 390 ft wide, avg 7ft depth





LWR4

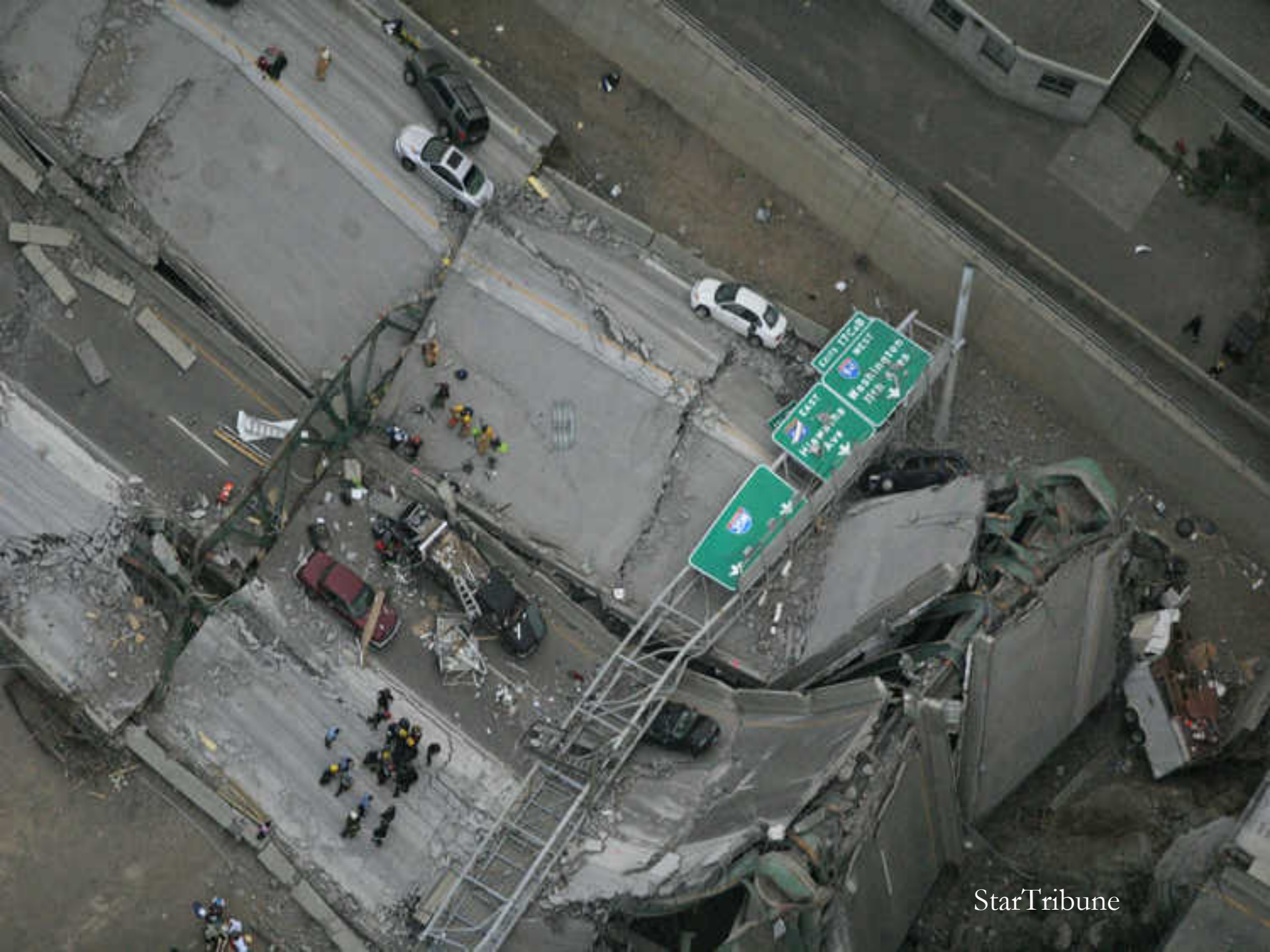


18-01-38 08/01/2007

Army Corps of Engineers











StarTribune





StarTribune





















EMS Challenges

- Understanding the scene
- Maintaining command
- Sustaining essential communications
- Setting priorities: triage / transportation
- Managing mutual aid response
- Maintaining multiple staging sites
- Coordinating and tracking patient movement
- Overcoming hazards
- Contending with volunteers / self assigned personnel

EMS Summary

- Collapse to last patient transported:
 - Initial clearing of all sectors: 1 hr 35 mins
 - Last EMS transport: 2 hrs 6 mins
- 50 patients transported by EMS
- 8-13 casualties via other vehicle
- Over 100 patients treated in 24 hours
- 13 deaths
- No serious injuries to first responders
- 29 ambulances used in first 4 hours

Initial EMS Deployments

X “500 2nd St SE”
Staging

North Operations

485

488

482

421

481

EMS Branch

486

Kanabec Co

482

Lakes Region

EMS Liaison with IC
EMS Branch



EMS Deployment at 40 minutes

Staging 535,707
726

South Operations

486

Kanabec Co

732, 204, 533

535, 411, 656

701

North Operations

485

482, 488, 642

715, 414, 721,

481, 421

482

Lakes Region

EMS Liaison with IC

EMS Branch

20 + ALS / BLS Ambulances

4 Command staff

3 System Medical Directors

Hick, MD

Ho, MD

Conterato, MD

A EMS BRANCH COMMAND/TRANSPORTATION
(Blue Vest—Report to Incident Commander when appropriate)

SCENE SIZE-UP

- ♦ Number of patients: _____
- ♦ Types of injuries: _____
- ♦ Severity of injuries: _____
- ♦ Best route in: _____
- ♦ Best route out: _____
- ♦ Staging location (if needed): _____
- ♦ Advise if there are multiple patient collection sites.
- ♦ Coordinate with Triage Officer.
- ♦ EXPEDITE TRANSPORT

Obtain triaged patient information from Triage Officer

G _____ Y _____ R _____ B _____

Is Supervisor assuming EMS Branch Command?

Yes— Assume role of Transportation Officer or other duties as assigned.

No— Remain EMS Branch Command and assume responsibility of the Transportation Officer.

TRANSPORTATION OFFICER
(Blue Vest— Reports to EMS Branch Commander)

- ♦ Coordinate ambulance movement and loading.
- ♦ In/Out Routes kept open. Keys remain in ignition.
- ♦ Expedite Transport of Patients.

If large incident with delay in moving patients (>30 patients), consider need for Staging and Treatment Officers. Establish Patient Collection Area.

B TRIAGE OFFICER
(Orange Vest-Reports to EMS Branch Commander)

Responsible for all patient care activities

Complete Rapid Assessment: (Report Findings to EMS Branch Command)

- ♦ At small incident, primary role is to identify critical patients.
- ♦ Identify and corral “walking wounded.”
- ♦ Prepare patients for rapid transport.

Organize Patient Care Activities

- ♦ TRIAGE patients, consider triage tags for >10 patients.
- ♦ Perform life-saving treatments only.
- ♦ Early transport of critical patients.
- ♦ Direct First Responders caring for multiple patients.

Coordinate with Transport Officer/transport crews – expedite transport.

TRIAGE

GREEN

- ♦ “Walking Wounded” or injuries treated by first-aid alone.

YELLOW

- ♦ Follows simple commands.
- ♦ Minor injuries but unable to ambulate.

RED

- ♦ Respirations > 30.
- ♦ Perfusion > 2 seconds.
- ♦ Major bleeding.
- ♦ Unable to follow simple commands.

TREATMENT OFFICER/ MEDICAL DIRECTOR
(Orange Vest— Reports to Triage Officer)

- ♦ Triage Officer assumes role of Treatment Officer unless it is assigned to someone else.
- ♦ Organize medical care in treatment area.
- ♦ Determine need for supplies and staff in treatment area.
- ♦ Provide for medical need of all “walking wounded.”

C 2nd IN or LATE ARRIVING AMBULANCES
(Highway Vest-Reports to EMS Branch Commander)

Notification

1. Go to assigned tactical channel.
2. Crews will contact the Communication Center of the agency controlling the event.
3. Once on scene the crew announces their arrival and establishes contact with EMS Branch Command.
4. Outside normal PSA, Mutual Aid crews use “Dept Name & Crew #” to identify themselves.
5. Approach scene using designated route to avoid hazards.

Arrival at the Scene

1. Leave keys in ignition.
2. Stay inside ambulance at Staging Area until assigned.
3. Remember other vehicles, do not block entry/exit routes.
4. Quickly load patients and provide treatment enroute!

Leaving the Scene

1. Notify EMS Branch Commander when leaving scene with number of patients.
2. Contact MRCC for destination hospital. Give age, gender, chief complaint, triage category, and name if available.
3. Contact your Communication Center and advise them of your status. Do NOT use the tactical channel for this.
4. Before clearing hospital, crews must contact MRCC and give patient names and/or identification if not previously given enroute.
5. When clearing hospital, contact your Communication Center for assignment.

STAGING OFFICER

(Blue Vest - Reports to EMS Branch Commander)

- ♦ Respond to requests for ambulances from EMS Branch Command.
- ♦ Direct movement of ambulances from staging area to Patient Collection site(s).
- ♦ Keep EMS Branch Commander updated on resources in staging.
- ♦ In large incident, no difference between ALS and BLS.


HAZARDS



























































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Regional Status	Alert Manager	Command Center	Reports	Logout
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Loaded Tuesday, 21 August, 2007 at 3:23:21

Info ?	Facility ?	Region ?	Diversion Status ?	Diversion Updated ?	Beds Available ?		
 	Abbott Northwestern Hospital - Minneapolis	West Metro	Closed to ED & Trauma for 0:04 of 4:00	08/21/2007 03:18 PM	15	25	50
 	Fairview Ridges Hospital - Burnsville	East Metro	Closed to OB Only for 0:00	08/21/2007 03:22 PM	5	10	25
 	Hennepin County Medical Center	West Metro	Closed to ED Only for 0:00 of 4:00	08/21/2007 03:23 PM	15	25	50
 	Bethesda Rehab Hospital - St. Paul	East Metro	Open	08/21/2007 03:21 PM	0	0	0
 	Children's Hospital - Minneapolis	West Metro	Open	12/03/2006 11:22 PM	5	10	25
 	Children's Hospital - St. Paul	East Metro	Open	09/28/2006 05:54 PM	5	10	25
 	Fairview Riverside Hospital - Minneapolis	West Metro	Open	09/28/2006 06:14 PM	7	15	25
 	Fairview Southdale Hospital - Edina	West Metro	Open	09/27/2006 01:07 PM	2	5	15
 	Fairview University Medical Center - Minneapolis	West Metro	Open	09/28/2006 05:20 PM	5	10	25
 	Gillette Children's - St. Paul	East Metro	Open	04/21/2006 03:45 PM	0	0	0
 	Lakeview Hospital - Stillwater	East Metro	Open	05/24/2006 11:15 AM	5	10	25
 	Mercy Hospital - Coon Rapids	West Metro	Open	05/03/2007 03:06 PM	5	10	25
 	Methodist Hospital - St. Louis Park	West Metro	Open	09/27/2006 01:37 PM	5	15	25
 	North Memorial Medical Center	West Metro	Open	09/27/2006 01:02 PM	15	25	50
 	Northfield Hospital	East Metro	Open	09/23/2005 12:00 AM	2	5	15
 	Queen Of Peace Hospital - New Prague	West Metro	Open	01/18/2006 04:29 PM	2	5	15
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 	Regions Hospital - St. Paul	East Metro	Open	01/02/2007 10:03 AM	15	25	50
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 	St. Francis Regional Medical Center - Shakopee	West Metro	Open	07/25/2006 10:49 AM	5	10	25
 	St. John's Hospital - Maplewood	East Metro	Open	02/09/2006 02:32 PM	5	15	25
 	St. Joseph's Hospital - St. Paul	East Metro	Open	02/09/2006 02:32 PM	5	15	25
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 	Unity Hospital - Fridley	West Metro	Open	09/27/2005 10:57 PM	5	10	25
 	Va Medical Center - Minneapolis	West Metro	Open	09/27/2005 11:03 PM	0	0	0
 	Valley Hospital At Hidden Lakes - Golden Valley	West Metro	Open	09/27/2005 10:49 PM	0	0	0
 	Woodwinds Hospital - Woodbury	East Metro	Open	04/24/2006 10:16 AM	5	10	25

	Open
	Closed to ED Only
	Closed to OB Only
	Closed to Trauma Only
	Closed to ED & OB
	Closed to ED & Trauma
	Closed to ED, Trauma & OB





StarTribune











Stacy Bengs / Reuters



Peter Matthews / Polaris





BFGX
1648

200 400
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Andrew Worrall

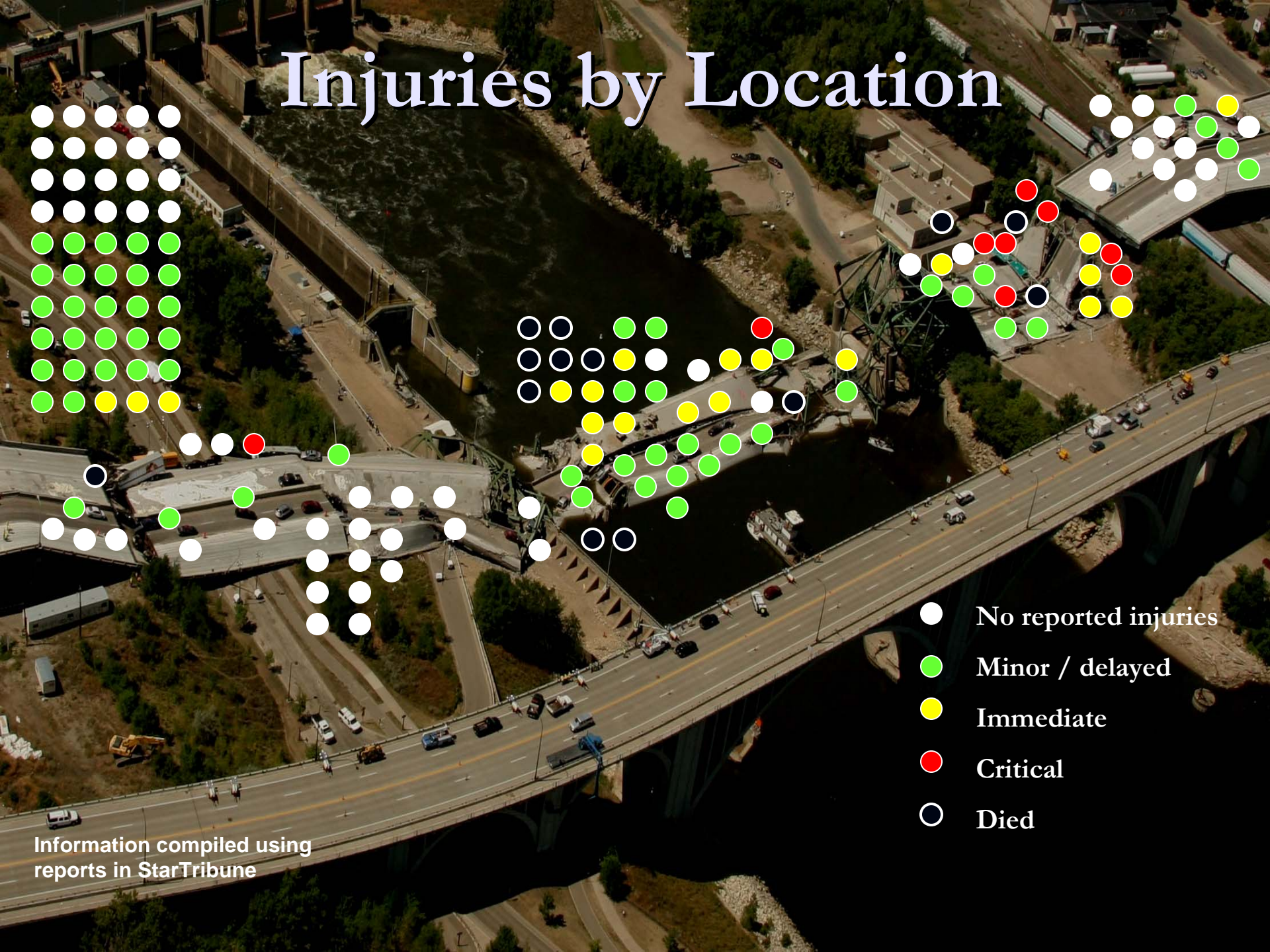


Andrew Worrall

EMS Patient Care

- Priority on rapid extrication and transportation
- 1 intubation
- 3 IVs established
- Most received backboards – less C-collars applied due to lack of ‘short’ collars available
- Only 25% of HCMC transports had sufficient information to bill – all yellow/red patients
- Limited analgesics given

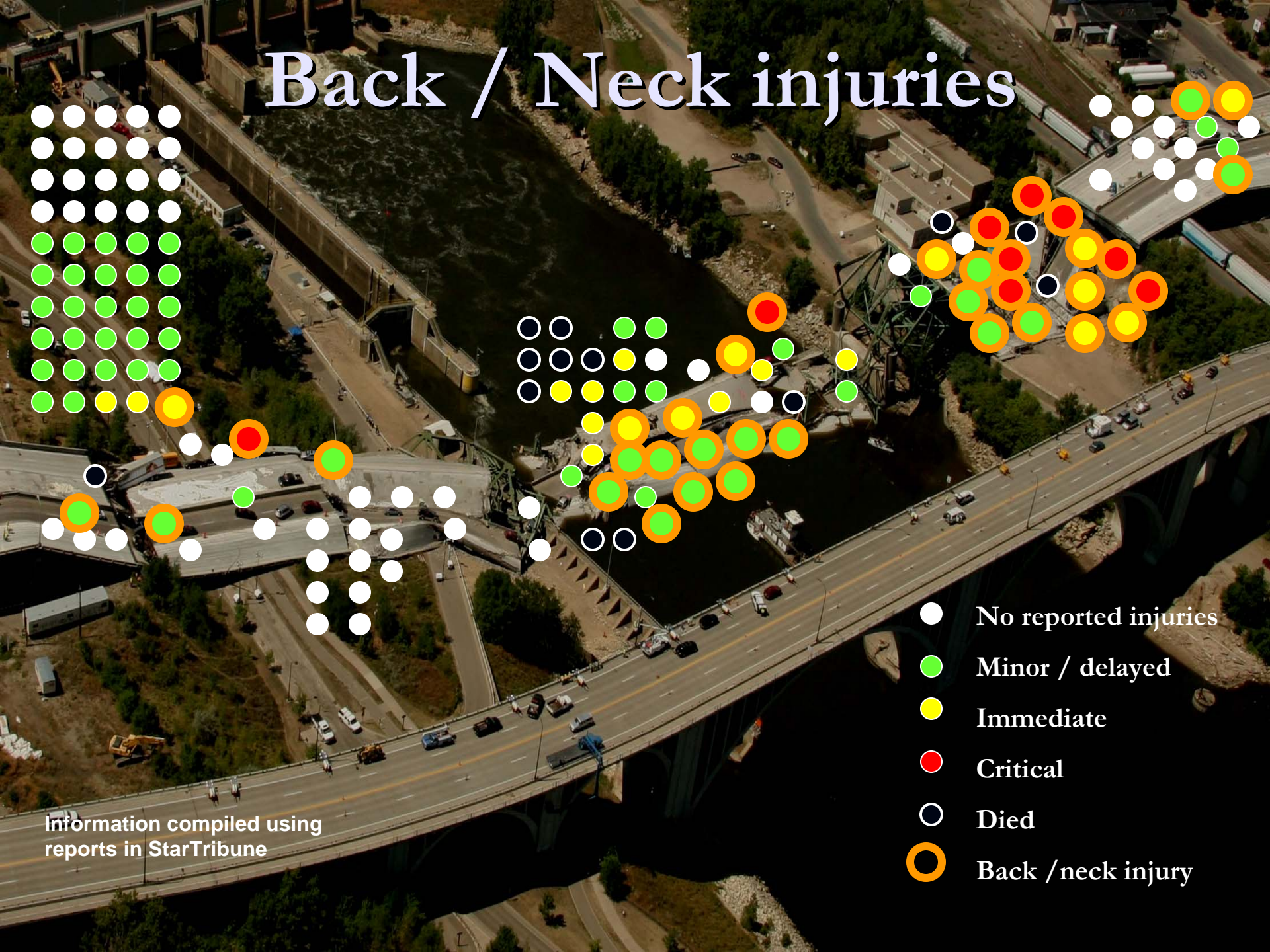
Injuries by Location



- No reported injuries
- Minor / delayed
- Immediate
- Critical
- Died

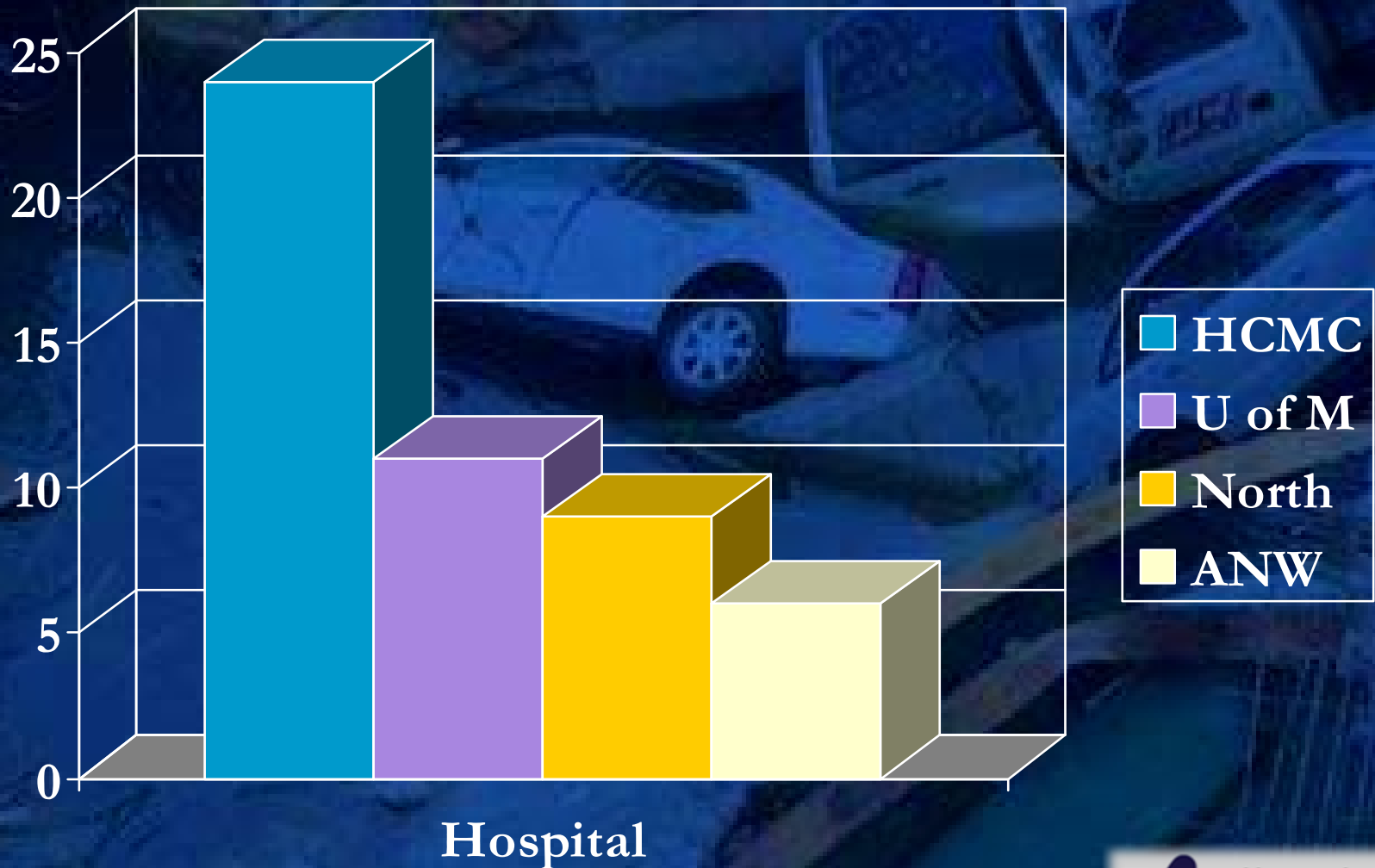
Information compiled using
reports in StarTribune

Back / Neck injuries

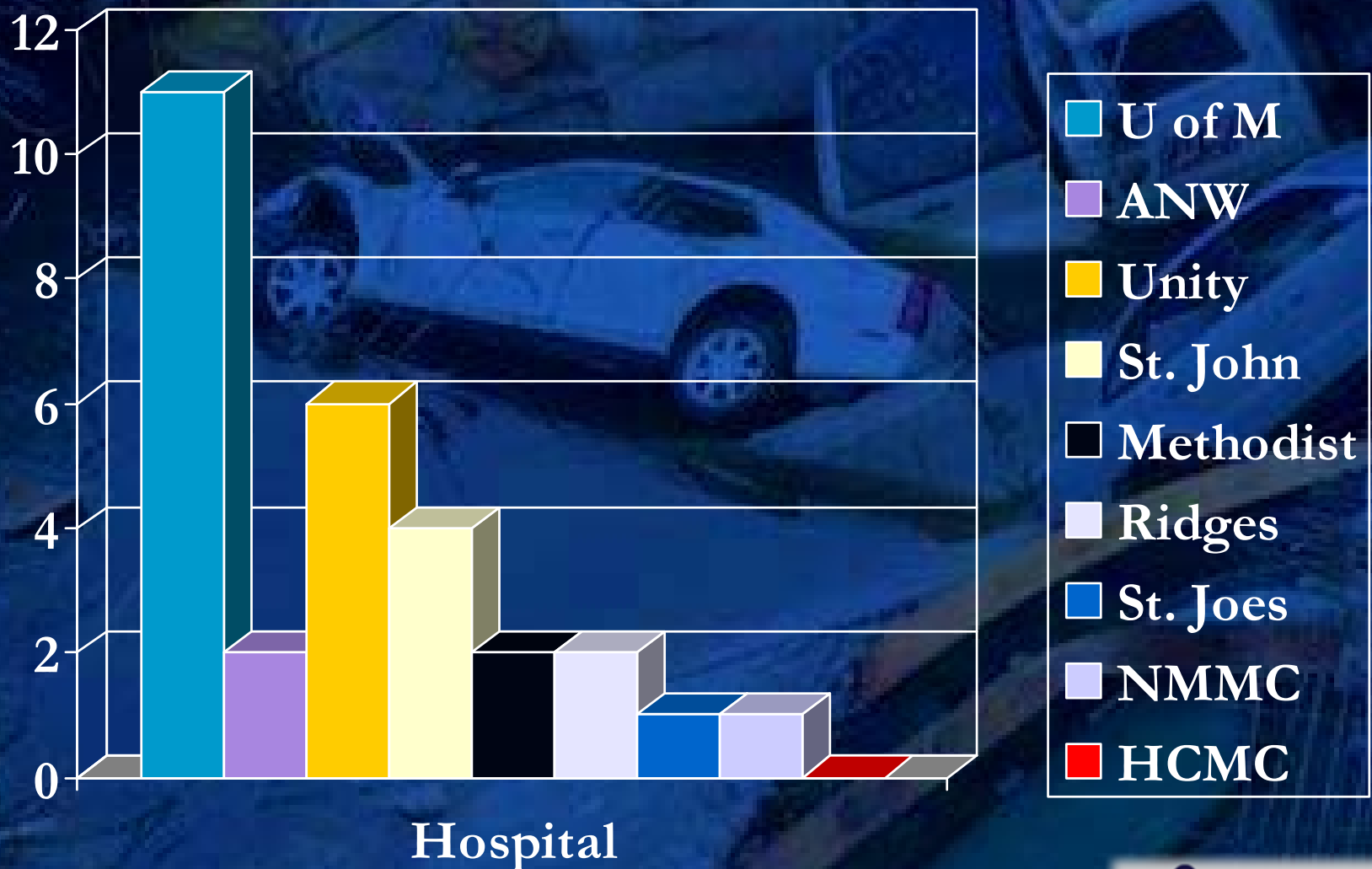


Information compiled using
reports in StarTribune

Destination Hospitals - EMS



Destination Hospital – Walk-ins





Delayed Patient Presentations

- Significant numbers following day, tapering next 2 days
- Total 48 additional patients = 127
- 1 admission in this group
- Mainly muscular back / neck pain
- Often behavioral health related (headaches, behavioral issues especially children)

Mitigating Factors

- Weather
- Traffic / lack of forward motion of vehicles
- Use of automobile restraints
- ‘Cushion’ of bridge collapsing under vehicles and shocks, seats
- Location of event (proximity to hospitals and resources)
- Luck!

Worked well

- Regional EMS response plan / mutual aid
- TF-1 collapse rescue team deployment
- Incident management overall
- Civilian assistance (early)
- Public Safety teamwork
- Adaptation to challenges (pickups)
- Communications systems
- Rapid patient care and transport

Could improve

- Situation status / information flow
- Patient tracking
- Ambulance tracking
- Coordination / staging
- Victim tracking and coordination of lists
- Coordination with EOC and multiple agencies needing information
- Crowd control / scene hazard mitigation
- PIO / Media

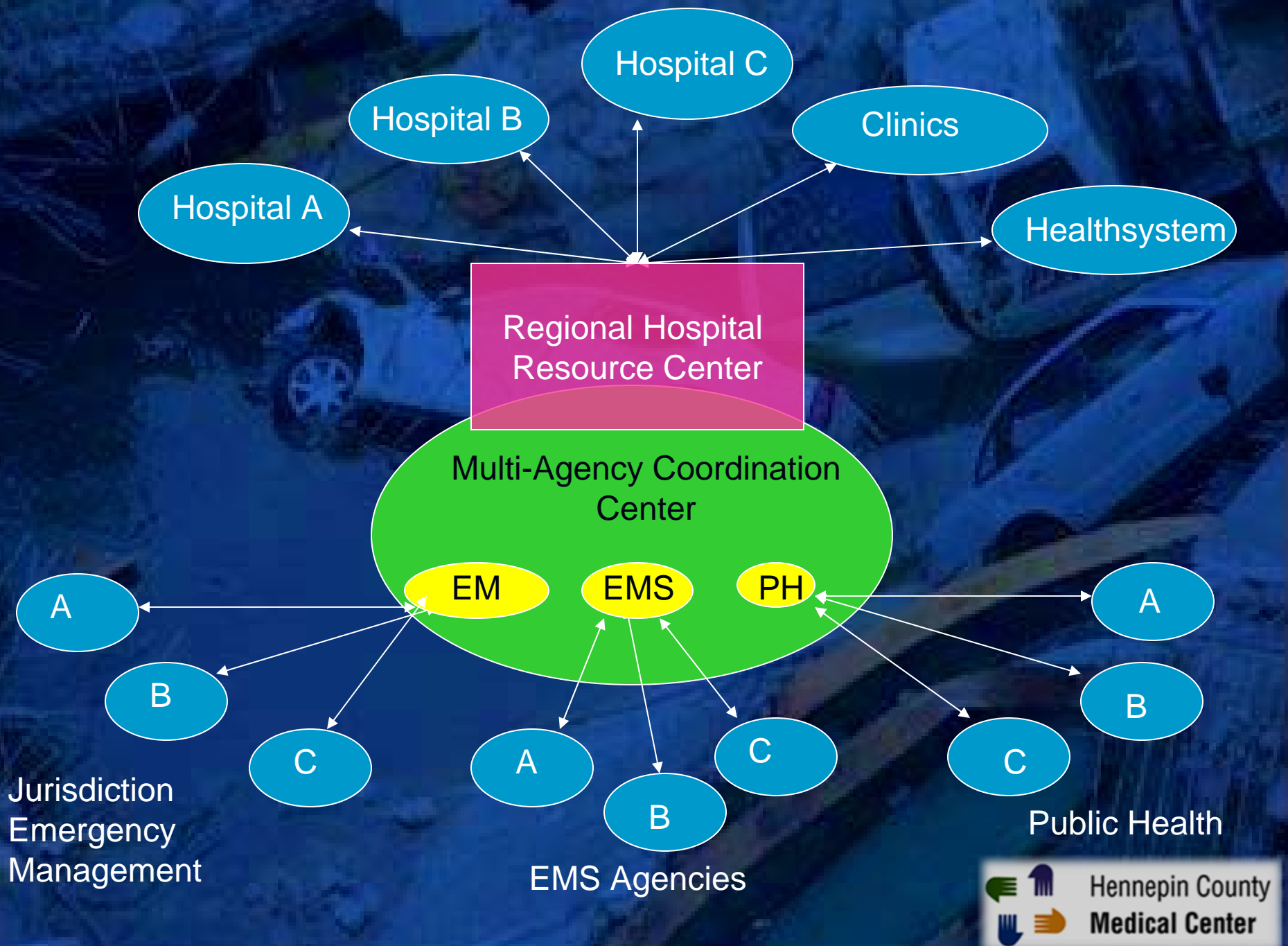


Hennepin County Medical Center
HMC

EMERGENCY

Regional Baseline

- 2.6 million population
- 24 EMS agencies, 29 hospitals
- HCMC is Regional Hospital Resource Center
- 3 Level 1 trauma centers
- Approximately 5000 acute care hospital beds



HCMC Response

- Initial information at 6:10pm
 - Hospital near capacity – 5 ICU beds available
 - 2 current critical cases in resuscitation area
- Charge RN turned on TV
- Alert Orange declared at 6:15
- ED staff paged: ‘get to HCMC now’
- Initial patients received (critical) at 6:40

Lack of Information

- Most difficult issue in ED was lack of information
- Public saw images before we did
- MRCC was not clear on the extent
- No direct contact with EMS supervisors/MD's from scene to ED
- Unsure if orange alert was needed

Clearing the ED

- Charge Nurse and Staff Physician went to each treatment area and cleared
- Special care used as triage area
- Cleared all of Team A -15 beds
- Cleared all of Team B- 13 beds
- Used Team C and express care for ongoing patients
- Admissions went straight up without delay

Initial 7 Patients at HCMC

	Key Injuries	ISS	Disposition
1	Cardiac arrest	34	Expired
2	Head and abdominal injury	30	OR
3	Abdominal injury	34	OR
4	Head and spinal injury	50	CT - OR
5	Head and spinal injury	17	CT - ICU
6	Abdominal injuries	12	CT - ICU
7	Abdominal injuries	22	OR



HCMC Response

- 25 patients received in 2 hours
 - 1 dead on arrival
 - 6 intubated
 - 5 emergently to OR
 - 16 total admissions (60%)
- By 7pm:
 - 25 ICU beds open
 - 10 OR open and staffed
 - 3 CT scanners running



ICU Capacity

- Additional 22 beds opened
 - Transfers from MICU / CCU to stepdown (none required re-transfer)
 - Post-Anesthesia Care Unit beds
 - Cardiac Short Stay unit cleared by discharges or transfers
 - Same-day Surgery (12 beds) was **NOT** activated – next step in plan
- About 25% of usual capacity added – likely a good initial goal

HCMC Surgical Response

■ Nursing

- Nurse got only halfway through phone list
- More staff showed up than needed

■ 10 OR opened (vs. usual 2-3 on evening/night)

■ Surgeons:

- Surgeons not paged but went to Stabilization Room
- On-call surgeon was quarterback in Stab Room
- Junior surgeons operated



Hennepin County
Medical Center

Surgical Learning

- Drills are important!!!
- Hierarchy and leadership are important
- Communication
 - Difficult (cell phones broke down)
 - Important!
 - ED to OR, Radiology, SICU
 - OR to SICU, Radiology
- Operations: damage control vs. definitive care
 - Rely on knowing what else is happening
 - Developing alternative communication techniques
- Supplies



Hennepin County
Medical Center

[illegible]

Montgomery Regional Hospital

HCA Virginia

Key Injuries Across All Hospitals

- Back / neck muscular injury – multiple
- Lumbar compression and burst fractures – multiple
- Cervical spine fractures - multiple
- Extremity fractures – multiple including open fractures
- Rib fractures – multiple
- Closed head injury - multiple
- Diaphragm disruption – two patients
- Pregnancy complications – two patients
- Liver laceration with hemoperitoneum
- Intestinal perforation, splenic rupture, traumatic abdominal hernia
- Open chest wound
- Shoulder dislocation

Injury Severity Scores

	Discharged	Admit	Admit ISS range	Admit ISS avg.
HCMC	9	16	1- 50	17
UMMC	14	12	3-14	6
NMMC	6	4	4-14	9.5

Spine Injuries*

- 7/16 patients admitted
 - Three treated operatively
 - Four non-operatively treated
- U of M
 - 7/11 patients
- Mechanism felt to be axial load
- No patients had neurologic deficit

*Greg Sherr, M.D.: personal communication



Hennepin County
Medical Center

HCMC Communication Issues

- Telephone system
 - External switchboard jammed
 - Internal lines available, but educational issues
- Runners used
- Internet experienced no failures
- Paging
 - Mis-understanding about surgery MD group pagers
 - No provision to page surgical RNs / OR staff as group
- Vocera
- Family radios

HCMC Other issues

- Policy about ICS and alcohol use prior to event
- Charting solutions and patient location in EHR
- Supply delivery systems
- Media monitoring
- PIO role and issues
- Situational awareness

North Memorial

- Next-closest Level 1 trauma center
 - 425 beds, 47 ED beds
- Did not activate HICS
- 66 minutes until first patient
- Key issues:
 - Few patients but lots of interest / calls / staff reporting
 - Phone lines overwhelmed – mainly by staff calling
 - ED Charge RN overwhelmed by family calls
 - PIO not identified early on (ICS not activated)

University Hospital

- Closest hospital on North bank
 - 550 beds, 21 bed ED – not a trauma-receiving hospital
- 24 minutes from collapse to initial patient
- HICS activated
- Over-reporting of staff
- Phone lines jammed – staff and family calls
- Shortage of c-collars

University Hospital

■ Temporary numbers

- Began at '1' and thus confused with ED cubicle numbers at times
- Did not integrate into medical records system (xray, lab)
- Unable to track location of patients

■ Patient care

- In-house staff reported to ED and accompanied patients, but not generally ED trained thus no definitive care or assessment until later



Andrew Worrall





St. Paul
Pioneer Press

Learning and applying

- Structured process
 - Hotwash
 - After-action review
 - Issue identification
 - Issue analysis
 - Corrective Action Plan
 - Follow-up / review plan
 - Exercise

Formal Review / After Action

I-35W Bridge Collapse and Response Minneapolis, Minnesota August 1, 2007

Reported by: Hollis Stambaugh
Harold Cohen

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Department of Homeland Security
United States Fire Administration
National Fire Programs Division

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MINNEAPOLIS



W Bridge

I-35W





StarTribune

