

INDIAN METAL BUILDING FORUM

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5C FRAMEWORK: CONNECT • COLLABORATE • CREATE • CONSTRUCT • CERTIFY+

RESOURCE CENTRE

Technical Knowledge Series

STEEL STRUCTURE FAILURE & LESSONS LEARNED

Suspended Steel Walkway Collapse: Hanger Rod Connection Failure after a Detail Change

Hyatt Regency Hotel, Kansas City, Missouri, USA | 17 July 1981

Learn from Failure
Improve the System
Prevent Recurrence

CASE STUDY NO:	IMBF-SF-002
COUNTRY:	United States of America
YEAR:	1981
STRUCTURE TYPE:	Steel walkways suspended by hanger rods from atrium roof framing
TECHNICAL CATEGORY:	Steel connections / Hanger rod and nut bearing on box beam / Design change control

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Rev 00 | 04 October 2026 | Educational / Technical Reference (Research Draft)

IMBF publishes this educational case study. IMBF was not the designer, builder or investigator of the structure.

A DOCUMENT CONTROL AND STATUS

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Technical review status

- ☒ Research Draft (compiled from referenced public sources; not yet reviewed)
- ☐ Technical Review
- ☐ IMBF Approved for Publication

This draft must not be marked approved until an authorised IMBF reviewer has checked it against the primary investigation report listed in the Source Register.

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The technical explanations and lessons presented are intended for general educational and professional-development purposes. They shall not be used as a substitute for: project-specific structural design; engineering calculations; site investigation; competent structural-engineering review; statutory approval; manufacturer instructions; applicable codes and standards; independent inspection; accredited testing or certification.

Readers must verify project-specific requirements with qualified professionals and the applicable statutory and code requirements. Where facts are uncertain or disputed, this document identifies them as such.

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How to read the references. Tags such as [S1] point to the Source Register on the last page. Text marked "IMBF interpretation" is engineering commentary by this series and is not a finding of the original investigators.

1 EXECUTIVE SUMMARY

Question	Answer
What happened?	Two suspended steel walkways, at the second and fourth floors of a hotel atrium, fell onto a crowded lobby floor. [S1] [S2]
Where?	Hyatt Regency Hotel, Kansas City, Missouri, USA.
When?	17 July 1981, at about 7:05 pm, during a public dance event. [S2]
What structure?	Walkways about 37 m (120 ft) long hung by steel hanger rods from the atrium roof framing. The second-floor walkway hung from the fourth-floor walkway directly above it. [S1] [S2]
What failed?	The connection between the fourth-floor box beams and the hanger rods to the roof: the nut and washer pulled through the box beam. [S2]
Why?	A change from one continuous rod to two offset rods about doubled the load on the fourth-floor connection, and the connection detail did not meet the building code even before the change. [S1] [S2] [S3]
Consequence?	114 people died and more than 180 were injured. [S2] The investigation report, written earlier, records 113 dead and 186 injured. [S5]
Main lesson	A connection is a design item, and a change to a connection is a design change. Both need calculation and formal review by a qualified engineer before fabrication.

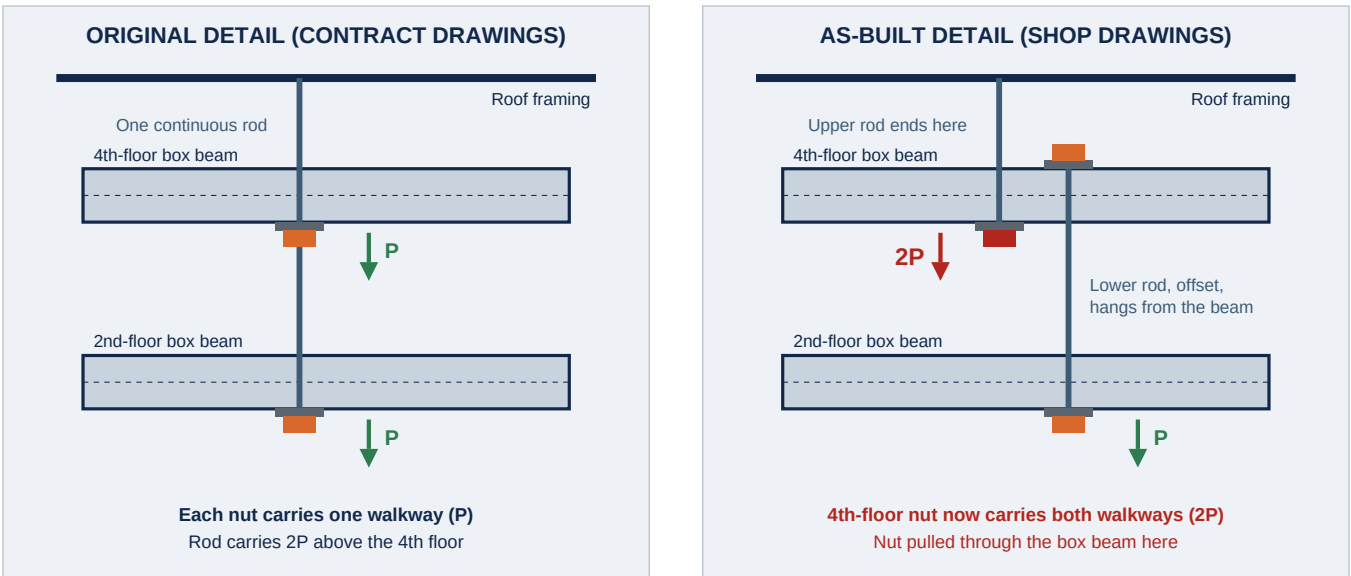


Figure 1. Original IMBF schematic of the hanger rod arrangement before and after the change. Conceptual, not to scale; one hanger line shown. P = load from one walkway at one hanger.

2 PROJECT BACKGROUND

Only data found in the consulted sources is listed. Missing data is stated as not established rather than estimated.

Item	Verified data	Source
Purpose	Pedestrian walkways across a hotel atrium, linking a 35-storey guest-room tower and a four-storey conference centre.	[S2]
Arrangement	Three walkways at second, third and fourth floors. Second and fourth floors on the same line, one above the other; third floor offset and hung separately.	[S1]
Span	About 37 m (120 ft), in four spans of about 9.1 m (30 ft).	[S2]
Framing	Two W16x26 longitudinal stringers per walkway; W8x10 floor beams; 89 mm (3.5 in) lightweight concrete on 38 mm (1.5 in) steel deck; walkway about 2.4 m (8 ft) wide.	[S2]
Hanger support	At each interior support, a built-up box beam of two MC8x8.5 channels welded toe to toe, hung on two hanger rods. Six rods carried the fourth-floor walkway from the roof.	[S1] [S2]
Hanger rods	32 mm (1.25 in) diameter, yield stress 248 MPa (36 ksi).	[S2]
Connection	Rod passed through holes in the box beam flanges; load transferred by nut and washer bearing under the beam. No bearing stiffeners or distribution plates.	[S2]
Project delivery	Fast-track. Planning began in 1976. Design of typical steel connections was customarily delegated to the fabricator in that area at the time.	[S2]
Stage at failure	In service. Opening reported as July 1980 in a tertiary source; to be verified at review.	-
Occupancy at failure	Fewer than 10 people on the fourth-floor walkway and fewer than 60 on the second-floor walkway; a crowd on the floor below.	[S2]
Height of atrium, steel grades of beams	Not established in the available source.	-

3 FAILURE TIMELINE

DESIGN	Planning from 1976 on a fast-track programme. Walkways first planned on columns, later hung from the roof. The box beam to rod detail on the contract drawings did not satisfy the building code even with a continuous rod. [S2] [S3]
PROCUREMENT	Design of typical steel connections was customarily left to the fabricator. Key design staff left the engineering firm early in the project. [S2]
FABRICATION	Shop drawings passed to an outside detailer, who took the connection as already designed. The continuous rod was changed to two offset rods. A formal change request was asked for but not submitted. [S2]
ERECTION	Walkway erection details: Not established in the available source. An atrium roof bearing failure during construction led to an internal design check; a question on rod steel grade was not followed up. [S2]
DEFECT / CHANGE	As built, the fourth-floor connection carried both walkways: its load was about doubled. [S1] [S2]
TRIGGER EVENT	17 July 1981, about 7:05 pm: people gathered on the walkways during a dance event. The loads were substantially less than code design loads. [S2] [S3]
LOCAL FAILURE	The weld joining the channel toes in the bottom flange of a fourth-floor box beam ruptured under the nut; the flanges rotated and the nut and washer pulled through. [S2]
PROGRESSIVE FAILURE	The fourth-floor walkway lost its support from the roof rods. All fourth-floor connections were candidates for initiation. [S2] [S3]
COLLAPSE	Both walkways fell to the atrium floor, the fourth-floor walkway landing on the second. 114 dead, more than 180 injured. [S1] [S2]
INVESTIGATION	National Bureau of Standards (NBS, now NIST), at the request of the city mayor; team on site from 21 July 1981; final report May 1982. [S1] [S5]
CORRECTIVE ACTION	Rebuilding details: Not established in the available source. Two engineers lost their licences. A US House report followed, and inspection of critical structural components entered later building codes. [S2]

4 WHAT FAILED?

Element	Identification
Primary failed component	Fourth-floor box beam at its connection to the roof hanger rod. [S1] [S2]
Secondary failed components	Remaining fourth-floor connections; then both walkway decks. The hanger rods themselves did not cause the collapse. [S2]
Connection involved	Threaded rod through a box beam of two channels welded toe to toe, with nut and washer bearing on the bottom flange at the weld line. [S2]
Load path involved	Deck -> stringers -> box beam -> nut and washer -> hanger rod -> roof framing. As built, the second-floor load also passed through the fourth-floor box beam.
Failure mode	Local bearing and bending failure of the box beam flanges and rupture of the toe weld, letting the nut pull through; no redundancy to arrest it. [S2]

5 ENGINEERING FAILURE MECHANISM

Load doubling. With one continuous rod, the nut under the fourth-floor beam carries only the fourth-floor walkway; the second-floor load stays in the rod. With two offset rods, the second-floor walkway hangs from the fourth-floor beam, so the nut under that beam carries both. The rod force above is the same in both cases; the connection force is not. [S1] [S2]

Weak detail. The rod load was applied at the toes of the channel flanges, on the weld line, with no bearing stiffener or distribution plate. The flanges had to resist it by bending, away from the plane of the webs. [S2]

Numbers from the investigation. Tested ultimate capacity of the as-built fourth-floor connection was about 83 kN (18.6 kips). The code-required load on it was about 181 kN (40.7 kips). The rods, at 248 MPa yield, had an allowable capacity of about 93 kN (20.9 kips), also below the code demand. [S2]

What did not cause it. Dynamic effects of walking or dancing did not significantly raise the load. Workmanship and material quality did not contribute. [S2]

Mechanism considered	Role in this case
Connection failure (bearing / flange bending / weld rupture)	Initiating failure (reported). [S1] [S2]
Progressive collapse	Loss of one connection led to loss of both walkways (reported). [S2]
Under-strength hanger rods	Under-designed but not the cause (reported). [S2]
Fatigue, corrosion, buckling, wind, snow, erection instability	Not reported as factors in the consulted sources.

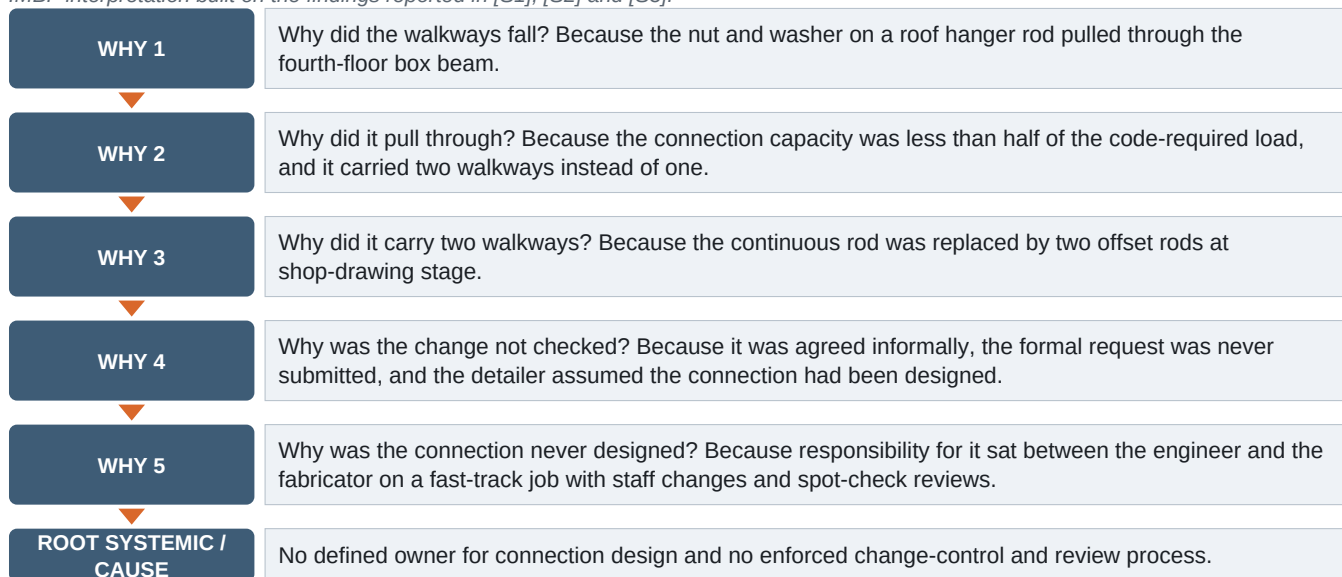
6 ROOT-CAUSE ANALYSIS

Area	Finding	Basis
Design	Connection detail on contract drawings did not meet code; no stiffeners or bearing plates; not a standard detail a fabricator could design from tables.	Reported [S2] [S3]
Material	Rod yield stress questioned twice during the project and not followed up. Material quality did not contribute to the collapse.	Reported [S2]
Fabrication	Detail changed to two offset rods at shop-drawing stage; connection never calculated for the new load.	Reported [S2]
Welding	Toe weld between channels ruptured, but workmanship was not a contributing cause; the weld was placed where it had to resist the rod load.	Reported [S2]
Bolting	Nut and washer bearing directly on thin flanges at a weld seam.	Reported [S2]
Erection	Not reported as a factor.	-
QA/QC	Shop-drawing review did not catch the change in load path; design quality review was by spot check.	Reported [S2]
Operation	Crowd loading well within what a public walkway must carry.	Reported [S3]
Maintenance	Not reported as a factor.	-
Management / communication	Fast-track pressure; staff turnover; change agreed informally; no one party held clear responsibility for the connection design.	Reported [S2]

Level	Statement
Immediate cause	Insufficient load capacity of the fourth-floor box beam to hanger rod connections. [S1]
Contributing causes	Rod arrangement change that doubled the connection load; original detail already below code; under-strength rods; questions not followed up. [S2] [S3]
Root cause	No qualified engineer designed or checked the connection at any stage, and a change to the load path was accepted without formal engineering review. (IMBF interpretation of [S2])

7 FIVE-WHY ANALYSIS

IMBF interpretation built on the findings reported in [S1], [S2] and [S3].



8 CORRECTIVE ACTION

Immediate corrective action (as reported)

- Independent investigation by NBS at the request of the city, with on-site inspection, laboratory tests and analysis. [S1]
- Professional licences of the engineer of record and the project manager were revoked. [S2]
- Details of how the atrium crossing was rebuilt: Not established in the available source.

Permanent corrective action (engineering remedy, IMBF interpretation)

- Design every hanger connection for its real load, with bearing plates or stiffeners so that load enters the webs, not the flange toes.
- Prefer a load path in which loss of one connection does not drop the whole structure: support from below, or independent hangers for each level.
- Show connection design forces on the drawings whenever connection design is delegated.
- Treat any change of rod, bolt or support arrangement as a design change needing calculation and written approval.

9 PREVENTIVE ACTION (CAPA)

Problem	Root cause	Corrective action	Preventive action	Responsible party
Connection under-capacity	Detail never calculated	Redesign with stiffeners or bearing plates	Connection calculations required for every non-standard detail	Engineer of record
Load doubled by change	Informal change at shop-drawing stage	Re-check the changed load path	Written change-control procedure; no fabrication on unapproved changes	Fabricator; engineer of record
Detailer assumed design was done	No forces on drawings	Issue design forces	Connection design responsibility stated in contract and on drawings	Engineer of record; fabricator
Questions not followed up	Workload and schedule pressure	Close each query in writing	Technical query log reviewed weekly until closed	Project manager
Review missed the error	Spot-check review only	Full check of critical details	Independent review of all tension and hanging connections	Design firm; third-party reviewer

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QA/QC FAILURE ANALYSIS: WHAT SHOULD QA/QC HAVE DETECTED?

QA/QC area	Check relevant to this type of failure
Material certificates	Rod grade on the certificate matches the grade assumed in design. The grade question was raised twice here. [S2]
Traceability	Rods and nuts traced to each hanger position.
WPS / PQR and welder qualification	Qualified procedure for the channel toe welds; note that sound welding could not make this detail adequate.
Welding inspection and NDT	Welds in a tension or bearing load path inspected to the specified extent.
Bolt and nut installation	Washer type and bearing area as detailed; plate washers or bearing plates present where shown.
Dimensional inspection	As-fabricated arrangement compared with the contract drawing, not only with the shop drawing.
Shop-drawing review	Any difference in load path from the contract drawing flagged and returned to the engineer.
Erection sequence	Hangers and beams installed as designed; no site substitution.
As-built verification	Structural observation of critical connections by the design engineer. This was requested three times on this project. [S2]
Alignment, bracing, coating, drainage	Not reported as factors in this case.

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IMBF OPTIMIZATION STRATEGY

Area	Optimisation
Design	State on every drawing who designs each connection and give the forces. Avoid details that load flange toes or weld seams in bending.
Fabrication	Detailers raise a technical query for any connection shown without forces; no "assumed designed" details.
QA/QC	Compare fabricated assemblies with the approved design intent; add a hold point for hanging and tension connections.
Erection	No change of rod, bolt or sequence on site without written engineering approval.
Digital traceability	Change requests, approvals and revisions linked to the member in the model.
Inspection	Independent check of all single-load-path connections before the structure is opened to the public.
Maintenance	Critical connections listed for periodic inspection by the owner.
Cost	A bearing plate or stiffener costs almost nothing against the liability of a public structure.
Safety	Structures over public areas get a higher review level and a robustness check.
Productivity	A standard library of pre-engineered hanger details removes the need for ad hoc changes.

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DIGITALIZATION

- Model-based change control: a changed connection cannot be released to fabrication until the revision is approved.
- QR code on each hanger and box beam linking to the approved detail and its calculation reference.
- Technical query and change-request log in the cloud, visible to designer, detailer, fabricator and client.
- Photo records of each critical connection before it is covered by finishes.
- Digital as-built model handed to the owner with the list of critical connections.

DESIGN

Connection forces and design responsibility recorded in the model.

FABRICATION

Shop detail compared with design intent; changes raised as formal requests.

INSPECTION	Critical connections checked against the approved revision; photo evidence.
DISPATCH	Only approved-revision parts released.
ERECTION	Scan-in; no substitution without approval.
FINAL INSPECTION	Structural observation of hanging connections by the design engineer.
DIGITAL AS-BUILT / RECORD	Handed to the owner with inspection schedule.

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INDIAN CONTEXT: WHAT SHOULD INDIA LEARN FROM THIS FAILURE?

- In PEB and structural steel contracts, connection design is often done by the supplier or detailer. The contract must say who designs, who checks and who approves each connection.
- Suspended mezzanines, skywalks, hanging platforms, false-ceiling and services support steel, and crane or monorail hangers use the same kind of rod and nut detail and deserve the same scrutiny.
- Site and shop changes for ease of fabrication are routine. Each one that alters a load path needs a calculation and a signature, however small it looks.
- Shop-drawing approval stamps should state what was checked. Approval for dimensions is not approval of connection strength.
- Third-party inspection should cover design intent as well as workmanship.

Reference	Subject	Relevance to this case
IS 800	General construction in steel: code of practice	Design of tension members, connections, bearing and local web or flange effects.
IS 875 (Part 2)	Imposed loads	Crowd loading on walkways and assembly areas.
IS 2062	Hot-rolled structural steel	Material grade assumed in design must match what is supplied.
IS 816 and IS 9595	Welding of mild and structural steel	Weld design and procedure for built-up members.
IS 1367 and IS 4000	Threaded fasteners and high-strength bolting practice	Product requirements for rods, nuts and washers and their installation.
Project specification and ITP	Contract documents	Connection design responsibility, change control and hold points.

Clause numbers are deliberately not cited. Standard titles and current editions must be confirmed against Bureau of Indian Standards publications at technical review.

14 IMBF PREVENTION CHECKLIST

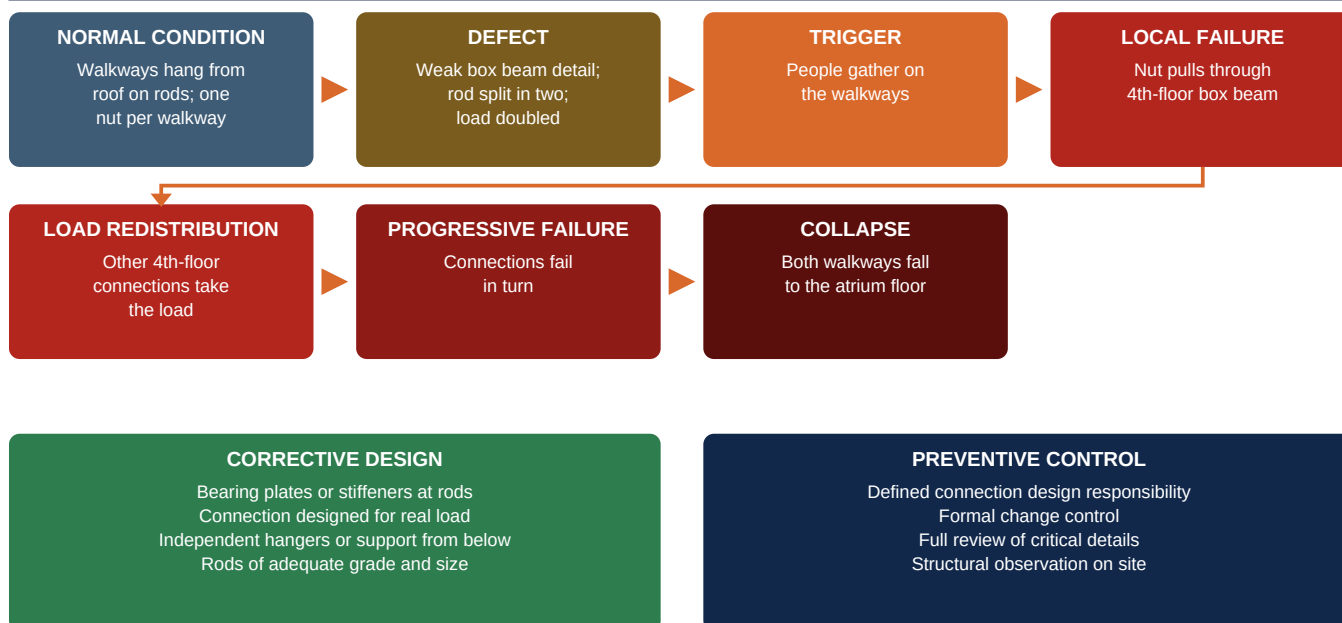
Inspection point	Required check	Status	Remarks
Design review	Every hanging or tension connection has a calculation; independent review for structures over public areas	☐	
Connection review	Load enters webs through plates or stiffeners; no bearing on flange toes or weld seams	☐	
Material traceability	Rod, nut and plate grades match design; certificates on file	☐	
Welding	Qualified WPS and welders for built-up members	☐	
NDT	Load-path welds tested to the specified extent	☐	
Bolting	Nuts, washers and bearing plates as detailed	☐	
Dimensional inspection	Fabricated arrangement matches the approved contract detail	☐	
Bracing	Lateral stability of suspended structure as designed	☐	
Erection sequence	No change of hanger arrangement without written approval	☐	
Coating	Connections protected and still inspectable	☐	
Drainage	Not applicable to this case type; check where water can collect	☐	
Final inspection	Structural observation by the design engineer before opening	☐	
As-built documentation	All changes recorded, approved and reflected in as-built drawings	☐	

15 PHOTOGRAPHS

No third-party photograph is reproduced in this document. Published photographs and report figures exist, but their copyright and publication permission were not established for this series, so they are not used. All figures here are original IMBF schematics.

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None reproduced	Not applicable	Not applicable	Not applicable

16 ORIGINAL IMBF FAILURE DIAGRAM



Original IMBF schematic. Conceptual, not to scale.

17 LESSONS LEARNED

5 engineering lessons

1. Follow the load through every connection, not only through members.
2. A small change in arrangement can double a connection force.
3. Do not bear concentrated loads on flange toes or weld seams.
4. Provide redundancy where a structure hangs over people.
5. Check non-standard details by calculation; tables do not cover them.

5 management lessons

1. Assign connection design responsibility in the contract.
2. Do not let fast-track schedules replace review.
3. Manage handover when key staff leave.
4. Insist on formal change requests.
5. Fund site observation by the design engineer.

5 QA/QC lessons

1. Review shop drawings against design intent and load path.
2. Verify material grade against the design assumption.
3. Close every technical query in writing.
4. Inspect critical connections before finishes hide them.
5. Record and approve every deviation.

5 preventive actions

1. Adopt a written change-control procedure.
2. Mark single-load-path connections on drawings.
3. Require independent review for public structures.
4. Keep a live query and change log.
5. Use this case in induction training for detailers and engineers.

18 IMBF KEY MESSAGE

"At the Hyatt Regency, nothing was badly welded and nothing was overloaded by the crowd. A connection that no one had designed was changed in a way that no one checked. Every connection needs an owner, a calculation and a controlled change process."

19 SOURCE REGISTER

Ref	Source and organisation	Date	Used for	Consulted?
S1	Investigation of the Kansas City Hyatt Regency Walkways Collapse, NBS Building Science Series 143. R. D. Marshall, E. O. Pfrang, E. V. Leyendecker and others. National Bureau of Standards (now NIST). DOI 10.6028/NBS.BSS.143 https://www.nist.gov/publications/investigation-kansas-city-hyatt-regency-walkways-collapse-nbs-bss-143	May 1982	Arrangement of walkways and hangers; most probable cause	Abstract and record only
S2	Hyatt Regency Skywalk Collapse Remembered. R. P. Bernhardt. STRUCTURE magazine (NCSEA). Summarises Marshall et al. (1982) and Luth (2000). https://www.structuremag.org/article/hyatt-regency-skywalk-collapse-remembered/	Aug 2016	Dimensions, sections, chronology, capacities, casualty figures, lessons	Yes, in full
S3	Summary of conclusions by the National Bureau of Standards. UPI Archives. https://www.upi.com/Archives/1982/02/26/Here-is-a-summary-of-conclusions-by-the-National/6635097243860/	26 Feb 1982	NBS conclusions on code compliance and load at collapse	Search extract only

Ref	Source and organisation	Date	Used for	Consulted?
S4	Chronology and Context of the Hyatt Regency Collapse. G. P. Luth. ASCE Journal of Performance of Constructed Facilities, pp. 51-61.	2000	Cited by S2 for the project chronology	No
S5	Investigation of the Kansas City Hyatt Regency Walkways Collapse, NBSIR 82-2465. National Bureau of Standards. https://nvlpubs.nist.gov/nistpubs/Legacy/IR/nbsir82-2465.pdf	1982	Casualty figures at time of report; start of investigation	Search extract only

Limits of this draft: the full NBS report [S1] [S5] and the Luth paper [S4] were not read; figures are taken from the secondary summary [S2] and should be checked against the report at technical review. Imperial values in [S2] were converted to SI by IMBF and rounded.

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