
EQUILIBRIUM
VANCOUVER, CANADA
Art Gallery of Ontario
AGO


INTRODUCTION

1989
2014
2039


1989

1989

2014

2039

25

50

75

MANUAL

POTS & PANS


FITS?

HAVE CHAIN SAW WILL TRAVEL


FUTURE ?

Prof. Borg Madsen, P.Eng.

1926-2008

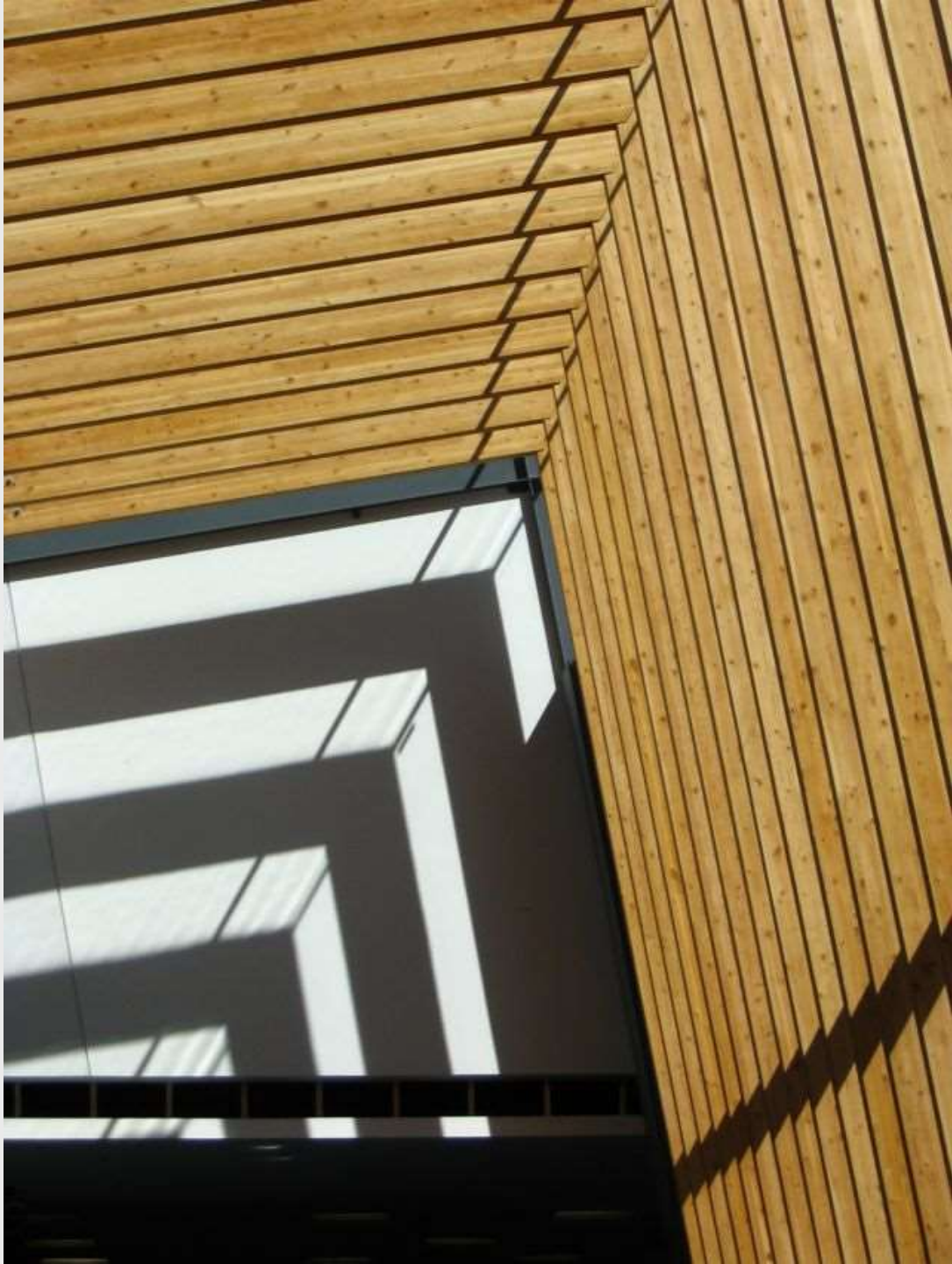
Las Vegas
Montreux
Whistler
Lahti
Portland
Auckland


2014

1989

2014

2039



25

50

75

STATIC
LINEAR
CAD/CAM
CNC

BIGGER
TALLER

FITS

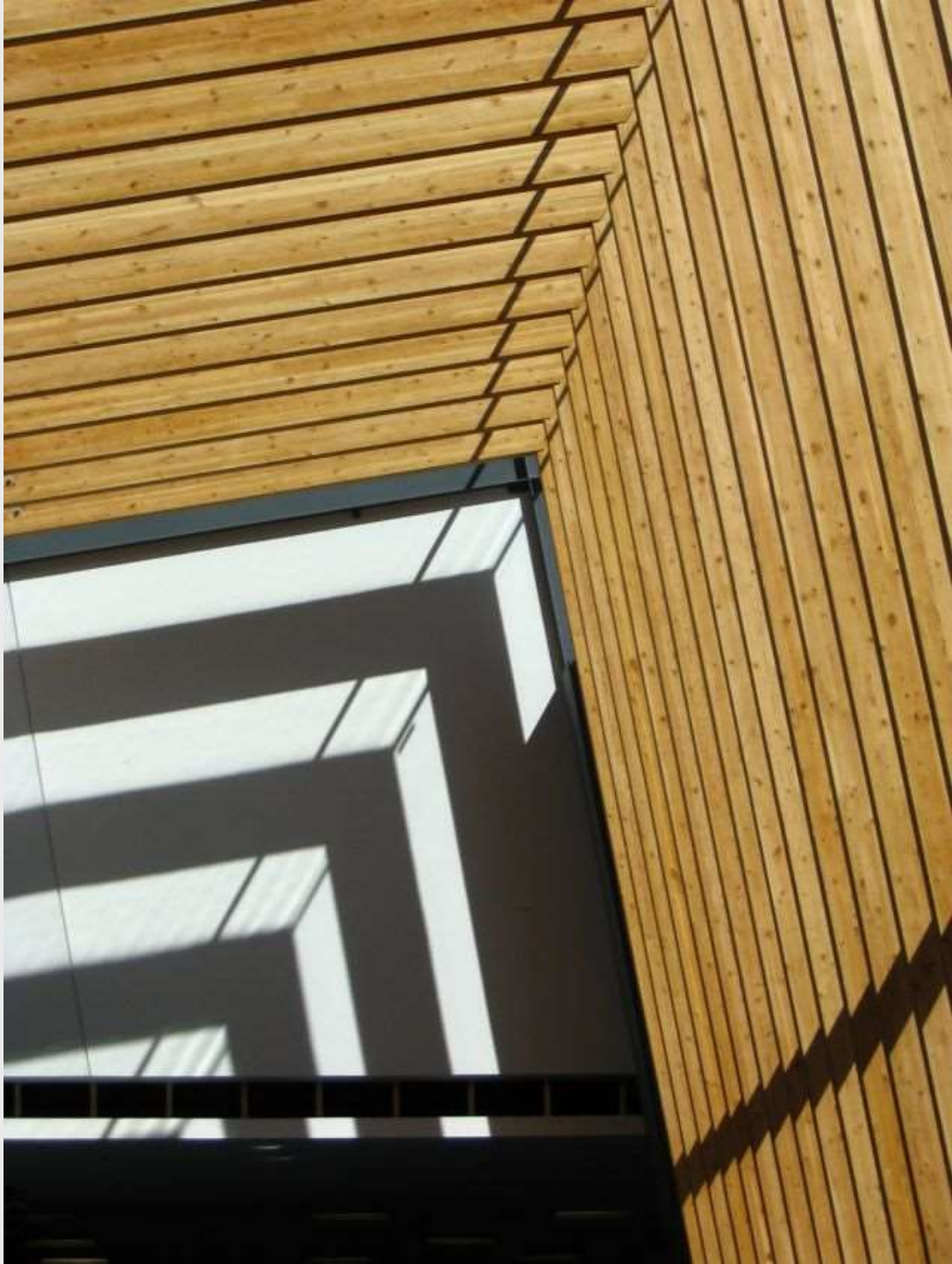
NOTCHES


NVIT

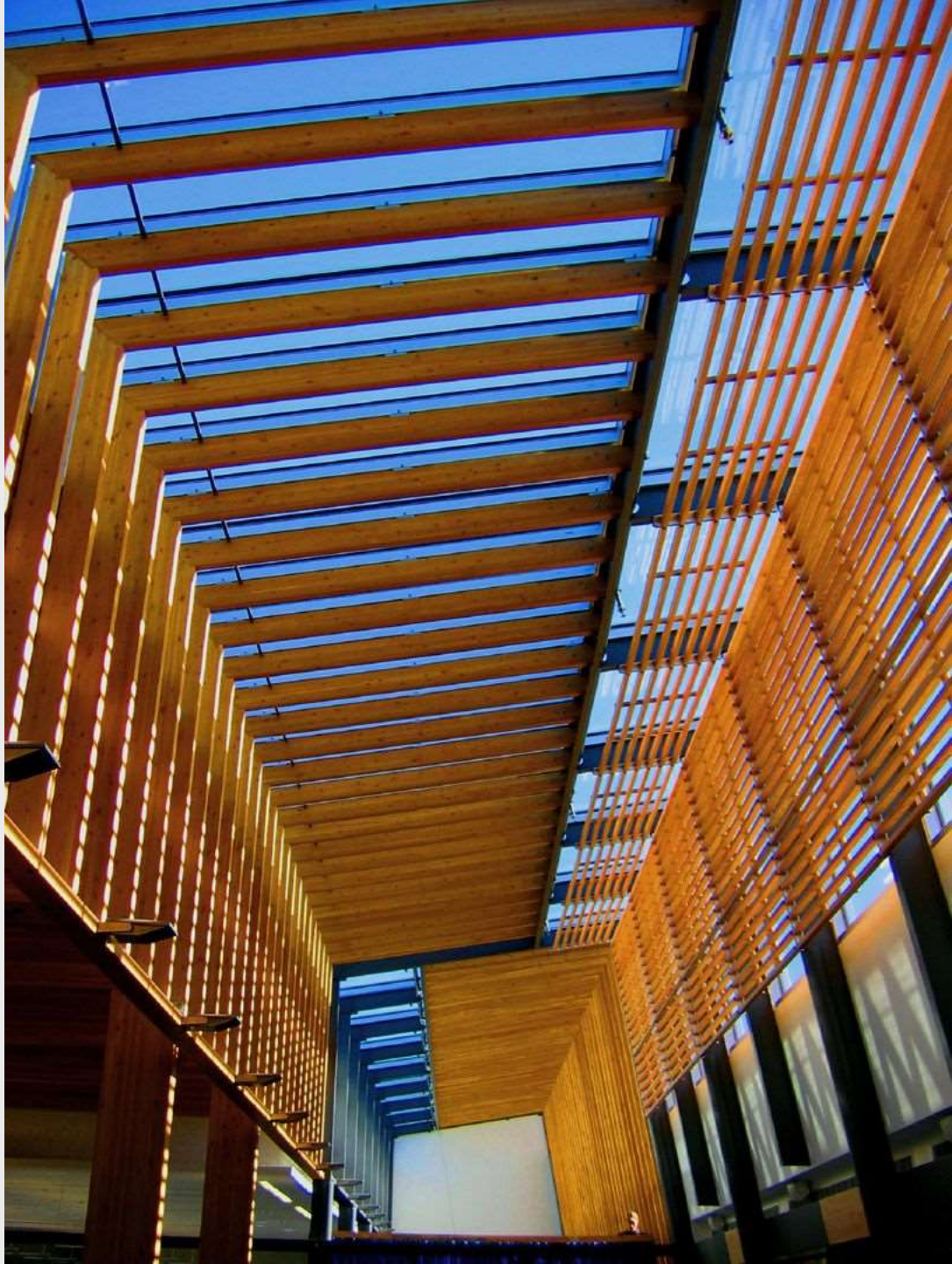
WHY NOT?


GOVERNMENT
PUBLICATIONS

PG



ATRIUM

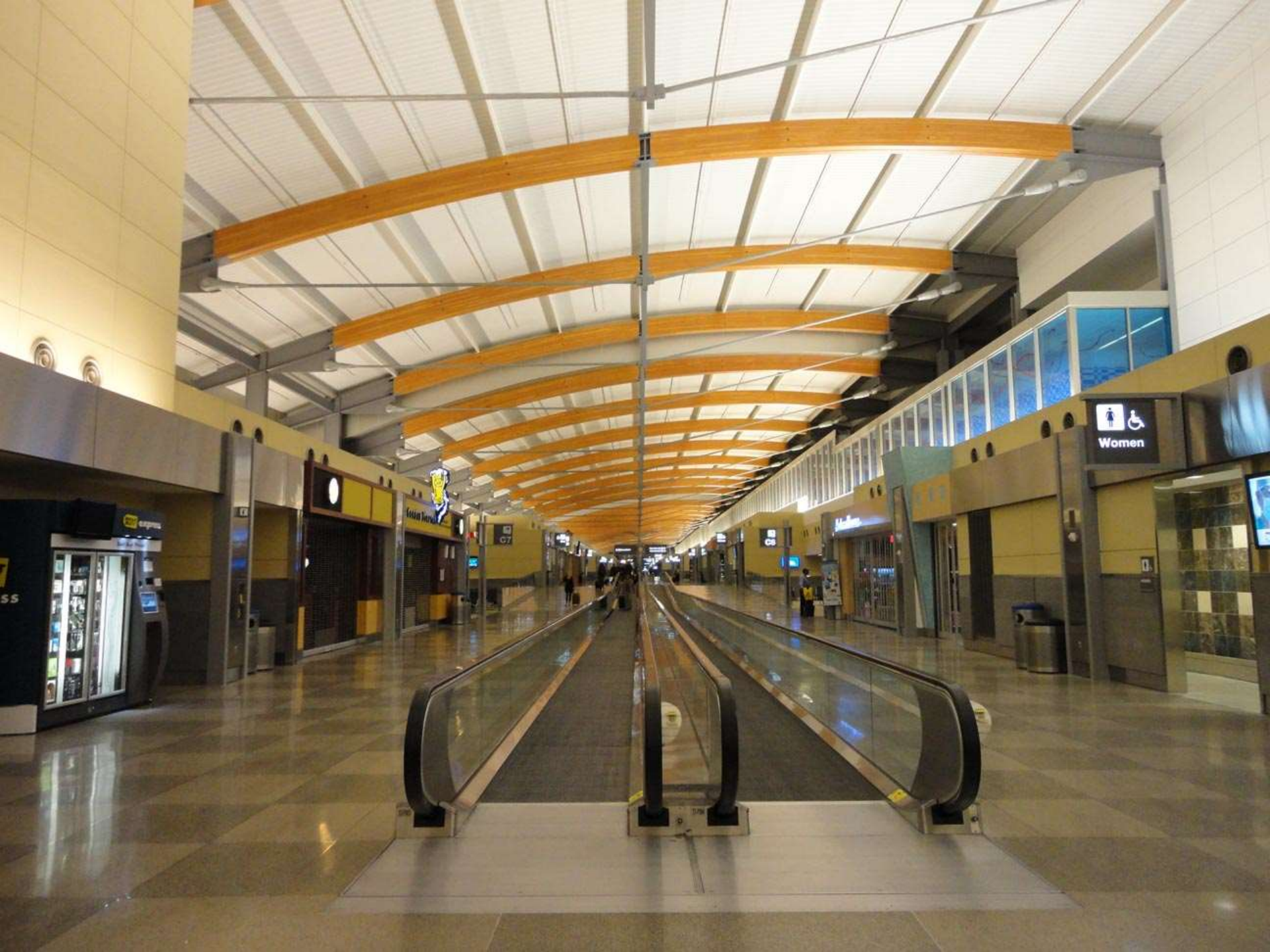


OVAL GLULAM

PINS

RDU


Hertz


Women

LARGE WOOD AIRPORT

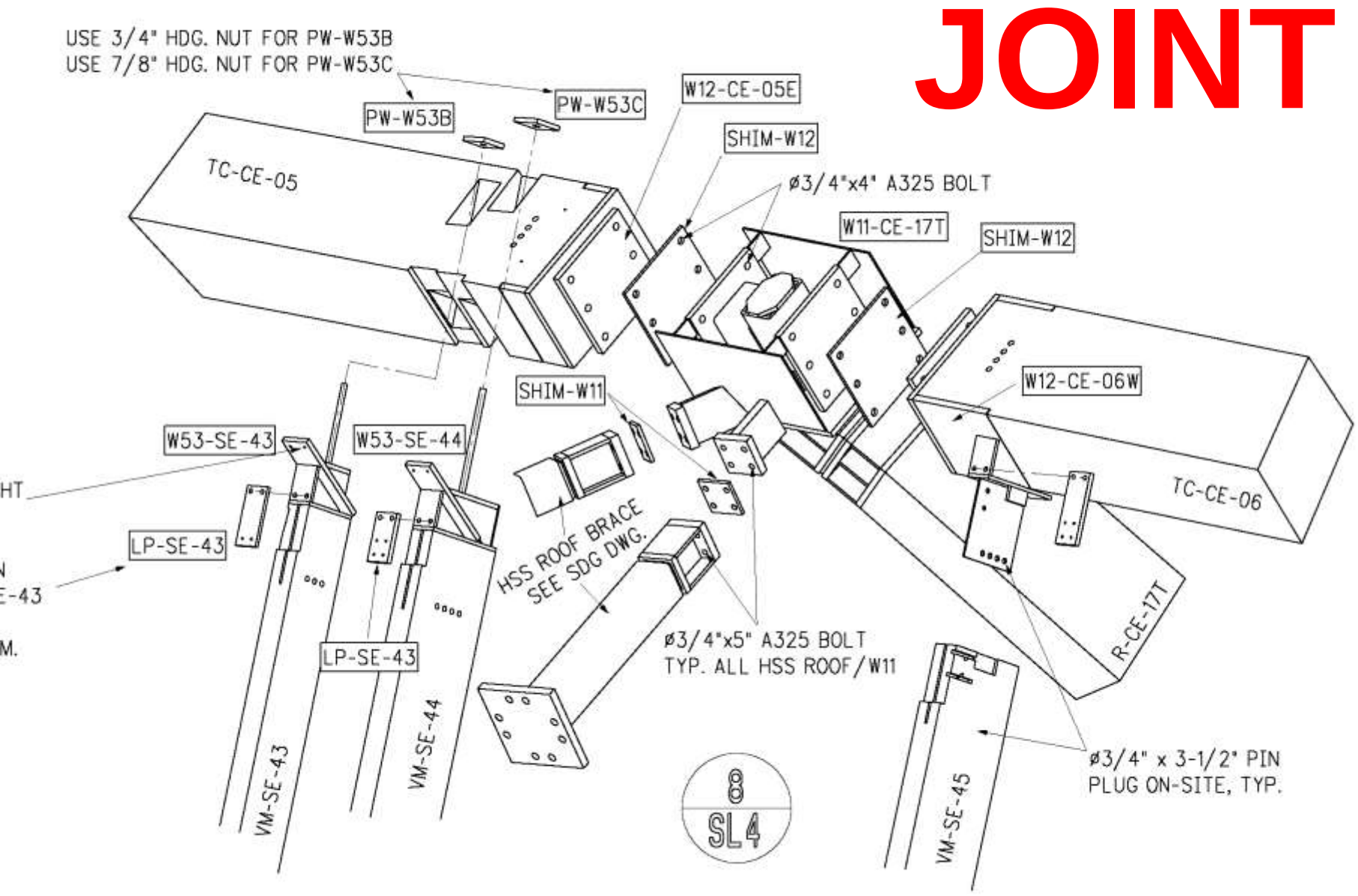

AGO
Art Gallery of Ontario
AGO

CITY BLOCK LONG


ART GALLERY OF ONTARIO MUSÉE DES BEAUX-ARTS DE L'ONTARIO
AGO

AGO
GEHRY
HYOLLES
EQUILIBRIUM
STRUCTURLAM
CONTRACTORS
ERECTORS
PUBLIC
ME

JOINT


USE 3/4" HDG. NUT FOR PW-W53B
USE 7/8" HDG. NUT FOR PW-W53C
PW-W53B
PW-W53C
W12-CE-05E
SHIM-W12
TC-CE-05
ø3/4"x4" A325 BOLT
W11-CE-17T
SHIM-W12
W12-CE-06W
SHIM-W11
W53-SE-43
W53-SE-44
TC-CE-06
LP-SE-43
HSS ROOF BRACE
SEE SDG DWG.
R-CE-17T
ø3/4"x5" A325 BOLT
TYP. ALL HSS ROOF/W11
LP-SE-43
VM-SE-43
VM-SE-44
VM-SE-45
ø3/4" x 3-1/2" PIN
PLUG ON-SITE, TYP.
8
SL4

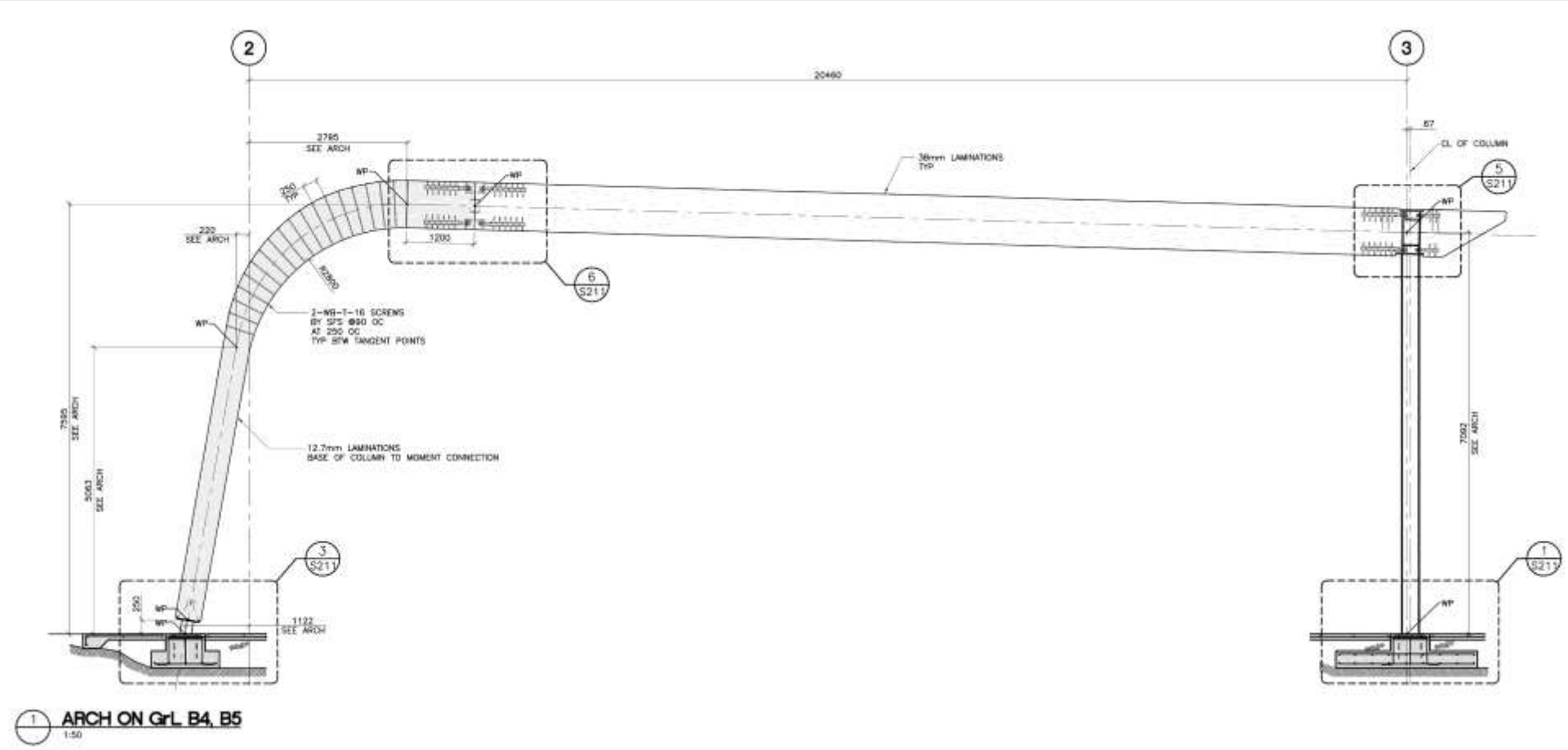

GALLERIA

CAP-U


CAP-U

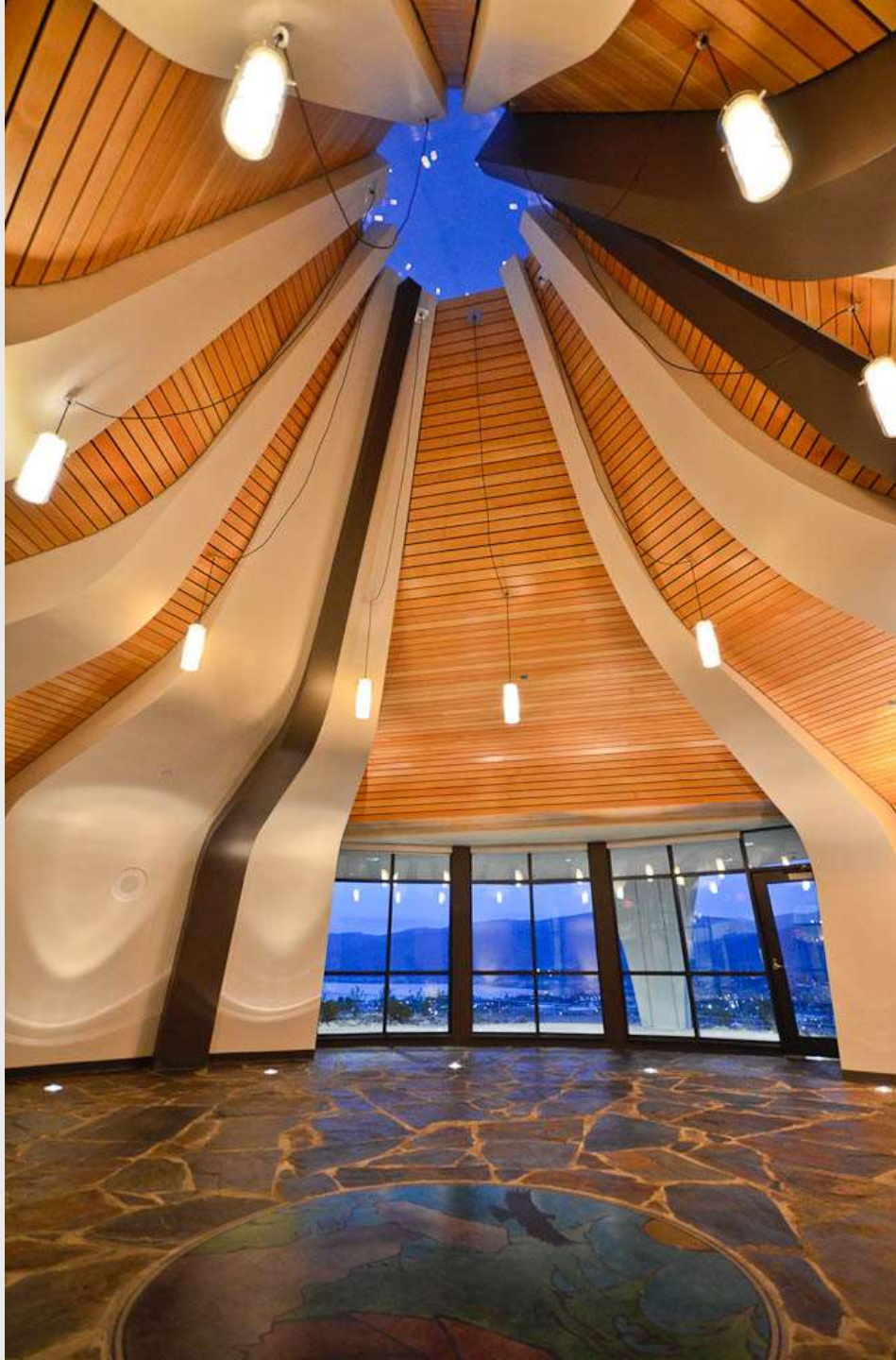

OUTMA

GLULAM STEEL FRAME



1 ARCH ON GrL B4, B5
1:50

WOOD FRAMING



UBC GAS. PLANT


DANGER
UBC
HARD LANDSCAPE DEPT.


UBC

GLULAM BRACES

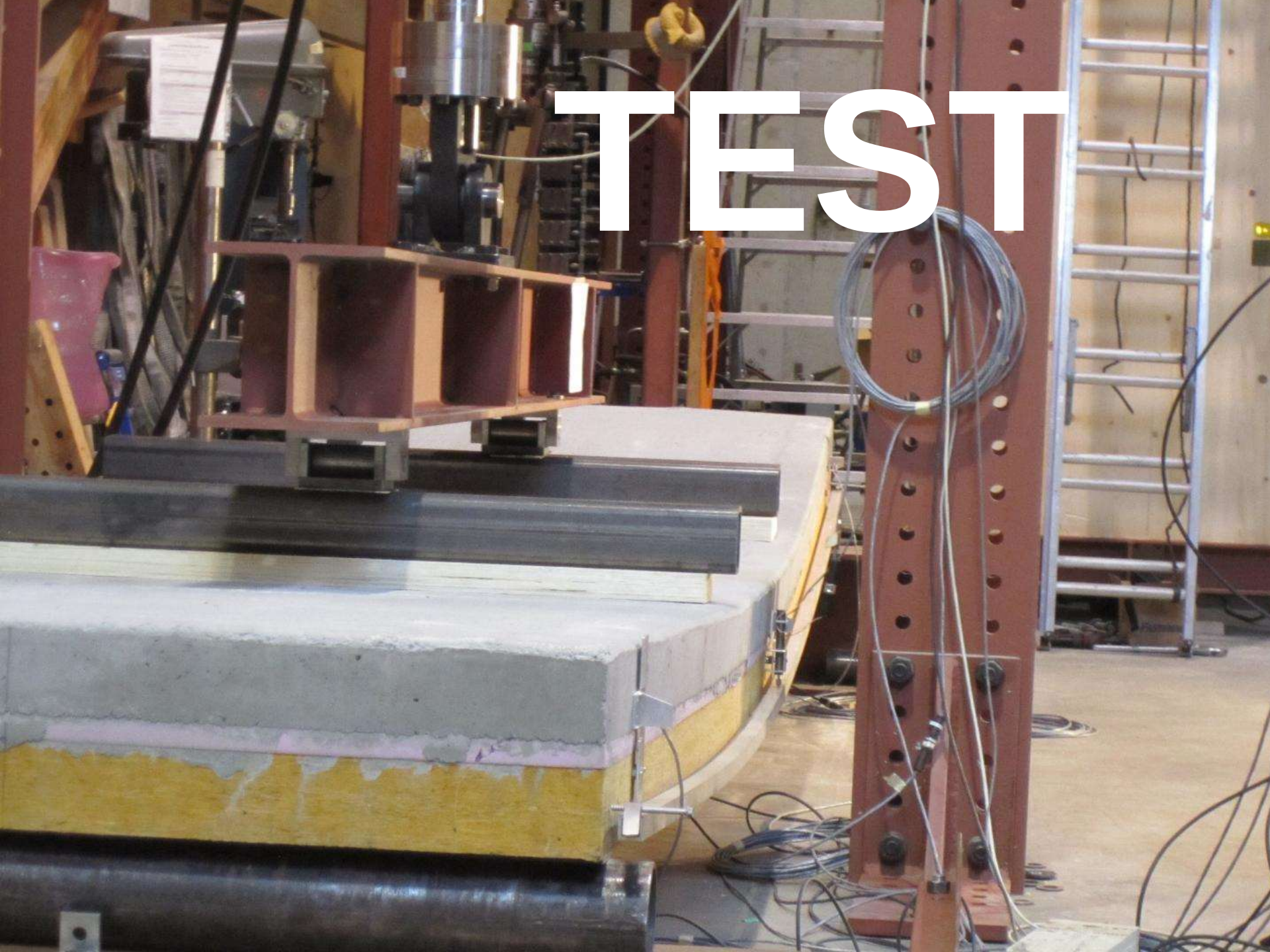

CLT ROOF


TESTING


CONCRETE+WOOD


STEEL+WOOD


ACOUSTICS


TEST

STRUCTURAL ADVANTAGE

FLOOR SLAB COMPARISON CLT VS CONCRETE

MAX SPANS (m)	VIBRATION CONTROLLED SPAN (m)	CONCRETE SLAB-A ONE END CONT dx24 (m)	CONCRETE SLAB BOTH ENDS CONT dx28 (m)	A-SLAB THICKNESS REQUIRED (mm)	RATIO CLT/CONC THICKENESS (%)
SLT 99	**3.5**	2.4	2.8	150	**66**
SLT169	**4.9**	4.1	4.8	200	**85**
SLT 239	**6.2**	5.8	6.7	260	**92**
SLT 309	7.4	7.4	8.7	310	100

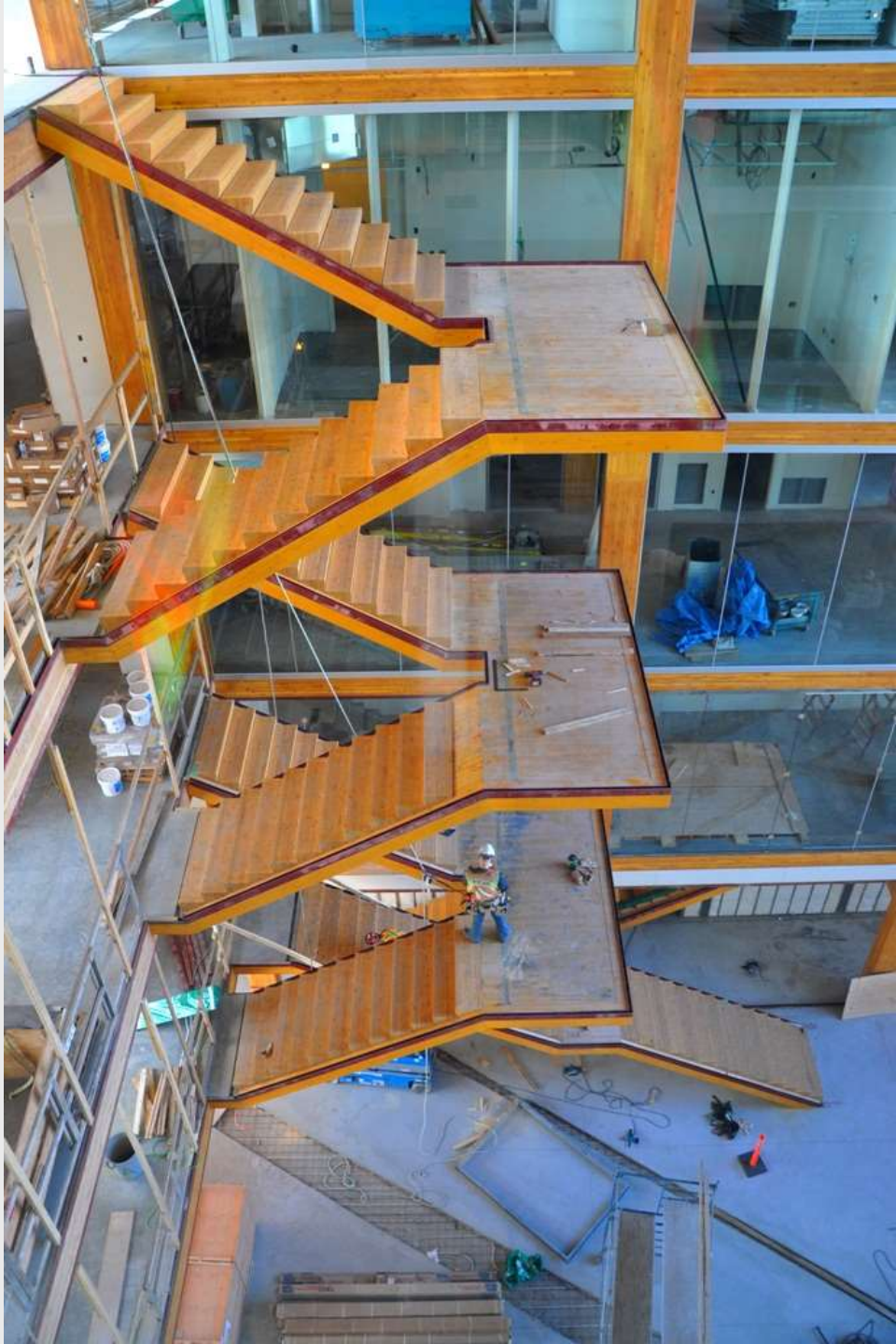
TEXT IN RED INDICATES CLT THICKNESS ADVANTAGE

GLULAM STAIR

DESIGN

GLULAM STAIR

CONSTRUCTION




FIRST AID
FIT!

PART 9

NO LATERAL DESIGN UNTIL 2012

DREAM BED


DBSD


DRIFT NOT FORCE


DRIFT=DAMAGE

PERFORMANCE

PROBABILITY

DEATH

DOLLAR

DOWNTIME

STEEL

DUCITLE FUSES

BASE ISOLATORS

NON- BUCKLING BRACES-DAMPERS

ROCKING FOUNDATIONS

STEEL PLATE SHEAR WALLS

DBSD

CONCRETE

ADVANCED

CAPACITY DESIGN

CONFINEMENT

THICKER WALLS

CURVATURE

DUCTILITY

SHEAR +MOMENT

INTERACTION

DBSD

WOOD

DBSD HANDBOOK

1%

5/720 PAGES ON WOOD

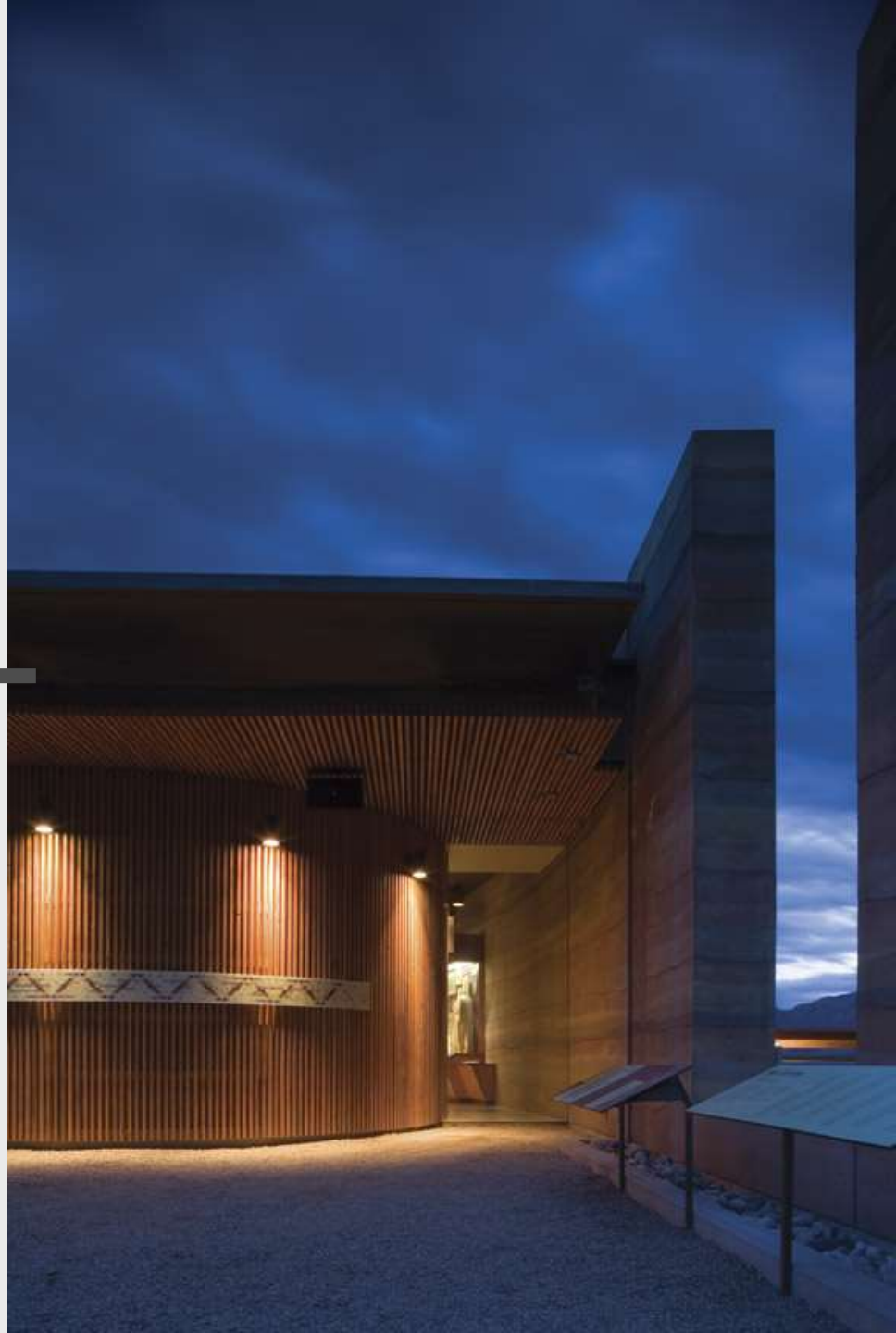

RESEARCH


ARE WE READY
FOR THE STORM?


WHY DOES
IT MATTER ?

70% CITY DWELLERS

3 BILLION NEW RESIDENTIAL UNITS



WORLD CARBON EMISSIONS:

AIRLINES 1%
SHIPPING 3%
CONCRETE 5-8%

Auckland

Sao Paulo

Shanghai

Capetown

Moscow

Luanda


2039

1989

2014

2032 1

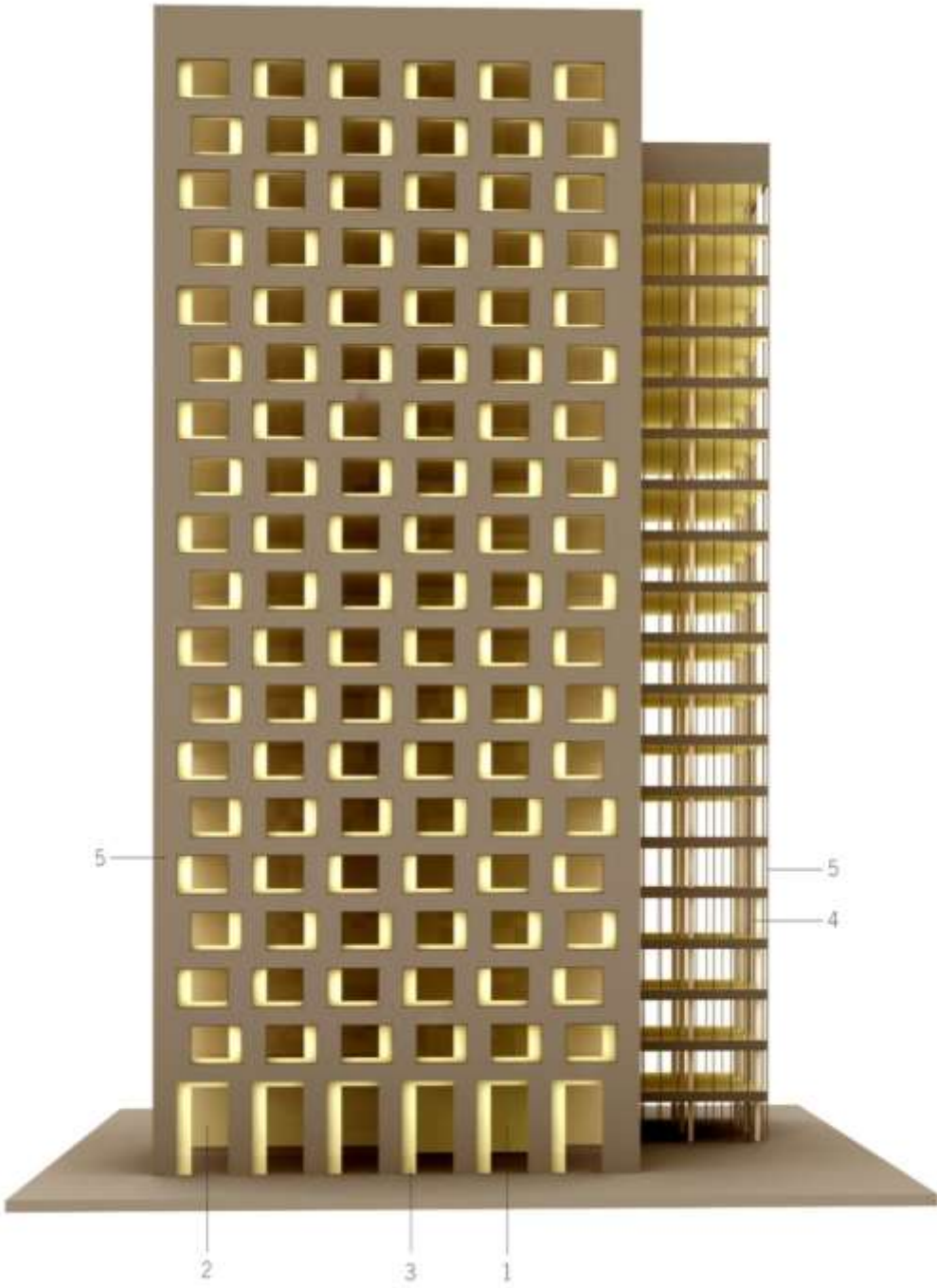
25

50

75


VANCOUVER 2032

DYNAMIC NON-LINEAR DUCTILE FUSES DBSD



30 STOREY WOOD TOWER

MOMENT FRAME

SHEAR WALLS

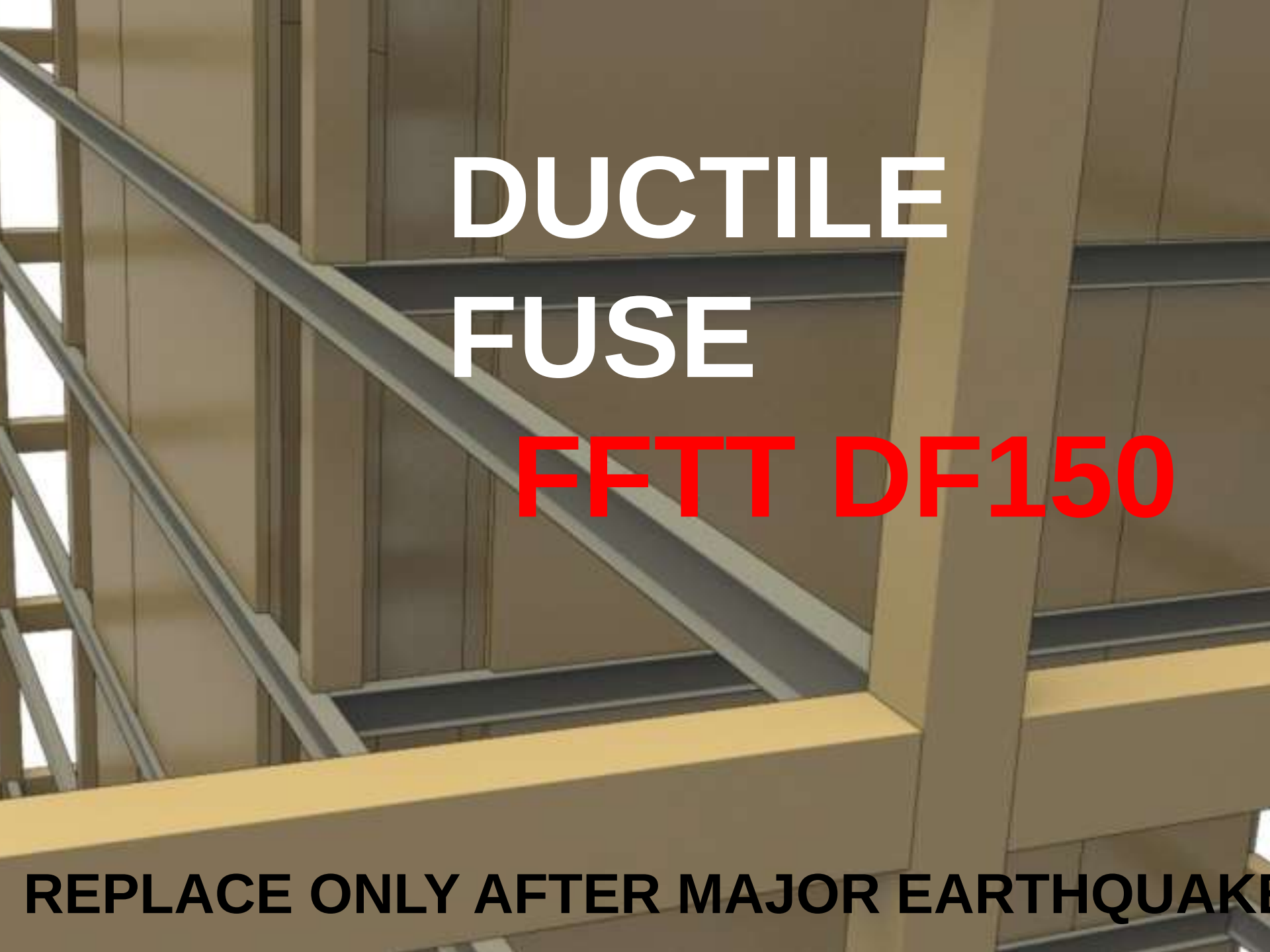
DBSD

DUCTILE FUSES:

BUCH B-20

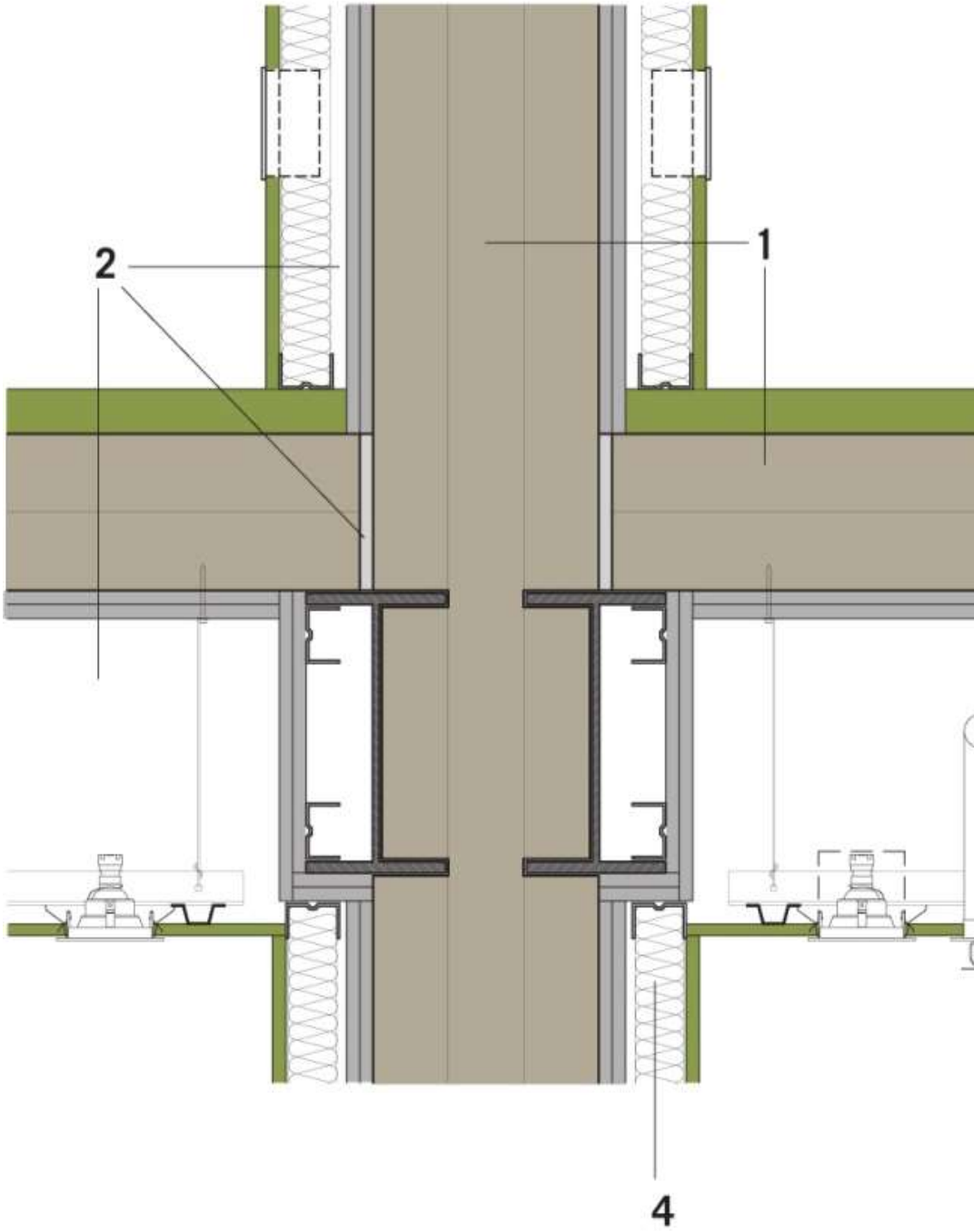
HDF SYSTEM

FFTT DF150

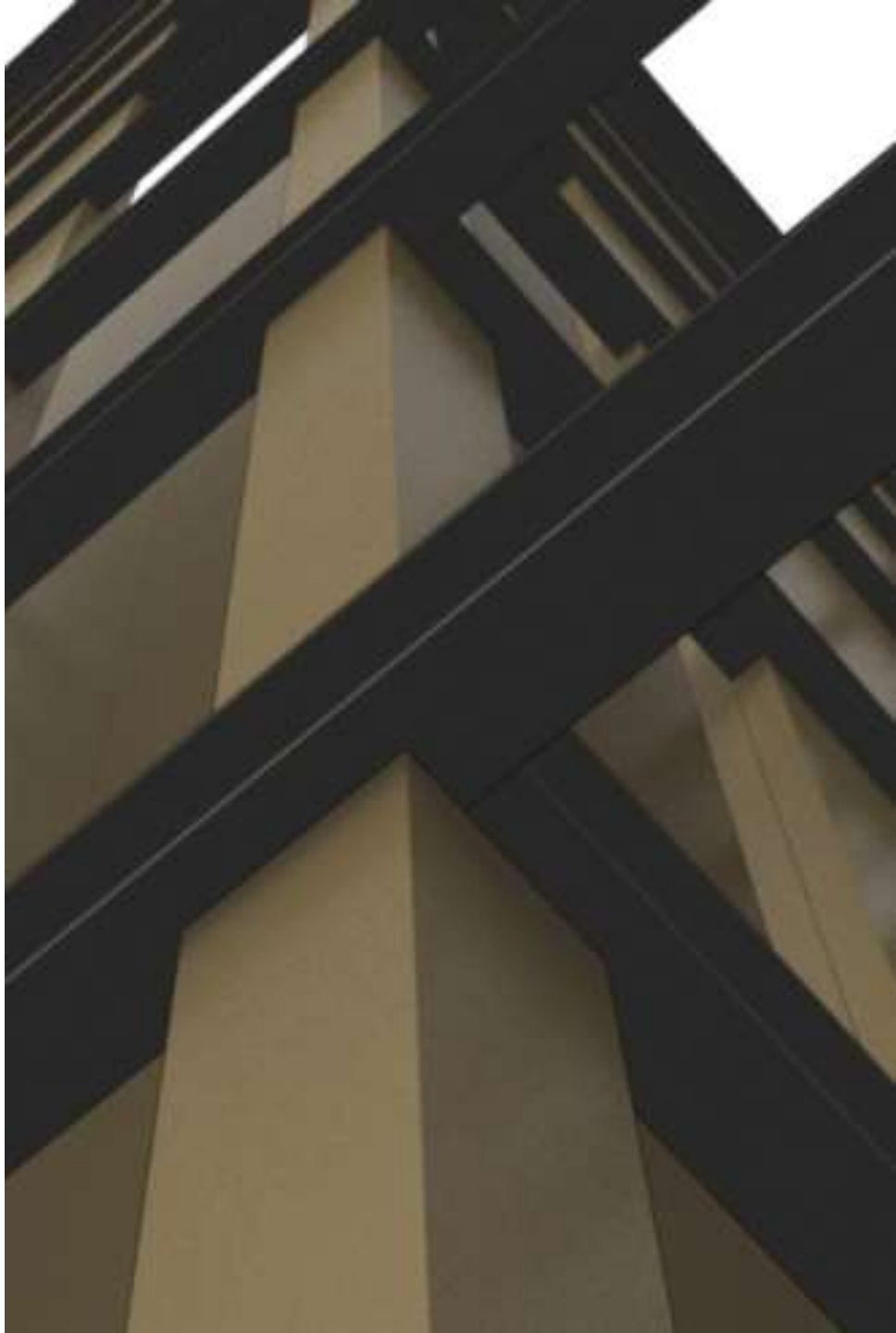

DUCTILE
FUSE
FFTT DF150
REPLACE ONLY AFTER MAJOR EARTHQUAKE

NEW:

HYSTRESIS LOOP FILES FOR DYNAMIC ANALYSIS

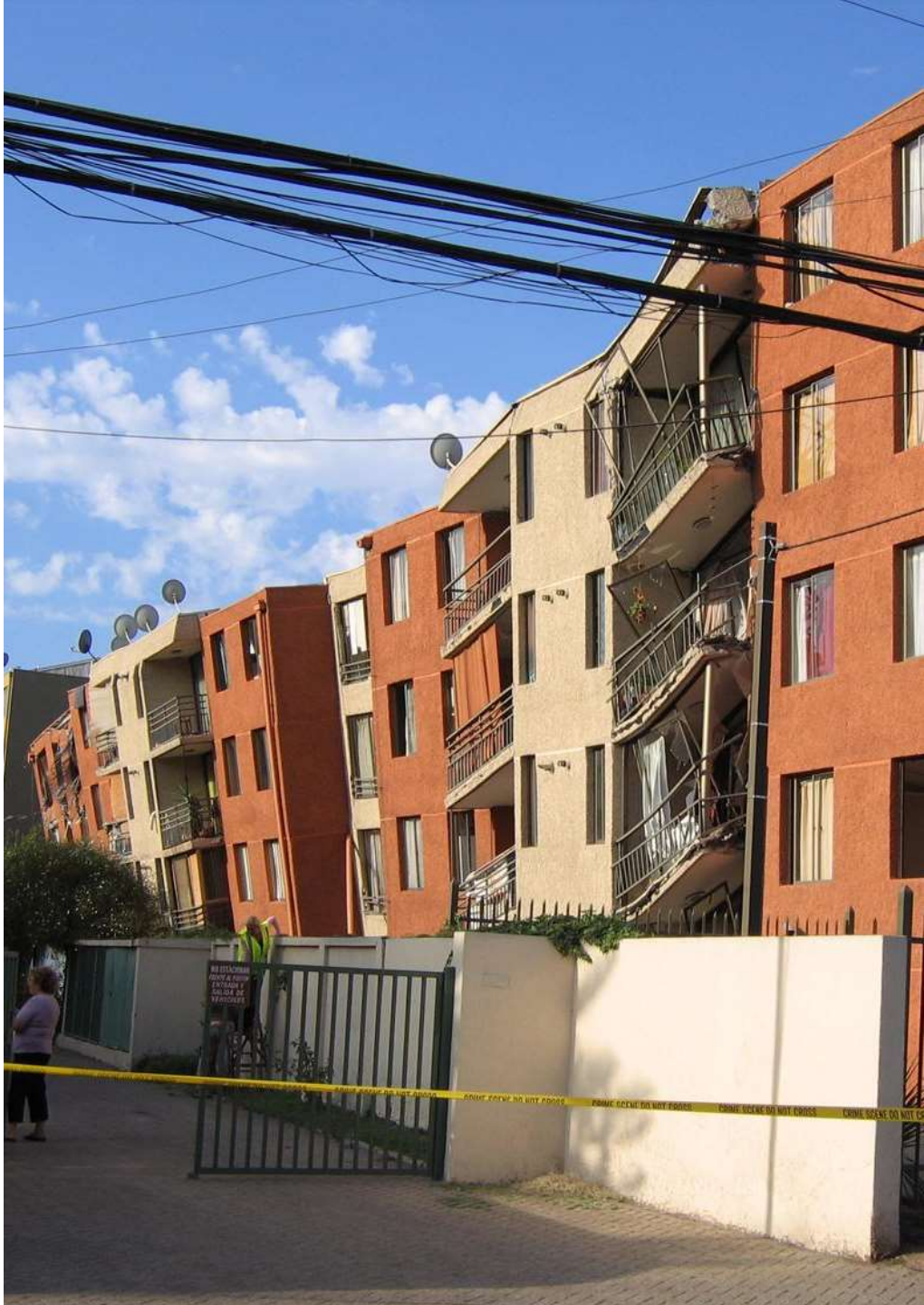


NEW:
SEISMIC DATA:
VANCOUVER 2028
OSAKA 2030
ISTAMBUL 2031



NEW BASE ISOLATION SYSTEM:

ELIMINATES RESIDUAL DISPLACEMENT




NO DAMAGE


IMMEDIATE
OCCUPANCY

COST

Building Model	Vancouver	Northern BC	Interior BC	Fraser	Vancouver Island
12 Storey Concrete Frame	**$283**	$320	$303	**$283**	$302
12 Storey FFTT Charring Method	**$283**	**$311**	**$297**	**$283**	**$297**
12 Storey FFTT Encapsulation	$288	$317	$303	$288	$303
20 Storey Concrete Frame	**$292**	$330	$312	**$292**	$311
20 Storey FFTT Charring Method	$294	**$323**	**$308**	$294	**$308**
20 Storey FFTT Encapsulation Method	$300	$330	$315	$300	$315


WIDC
WIDC

SUMMARY

1992
2012
2032

TEMPLE
32m HIGH

FAST

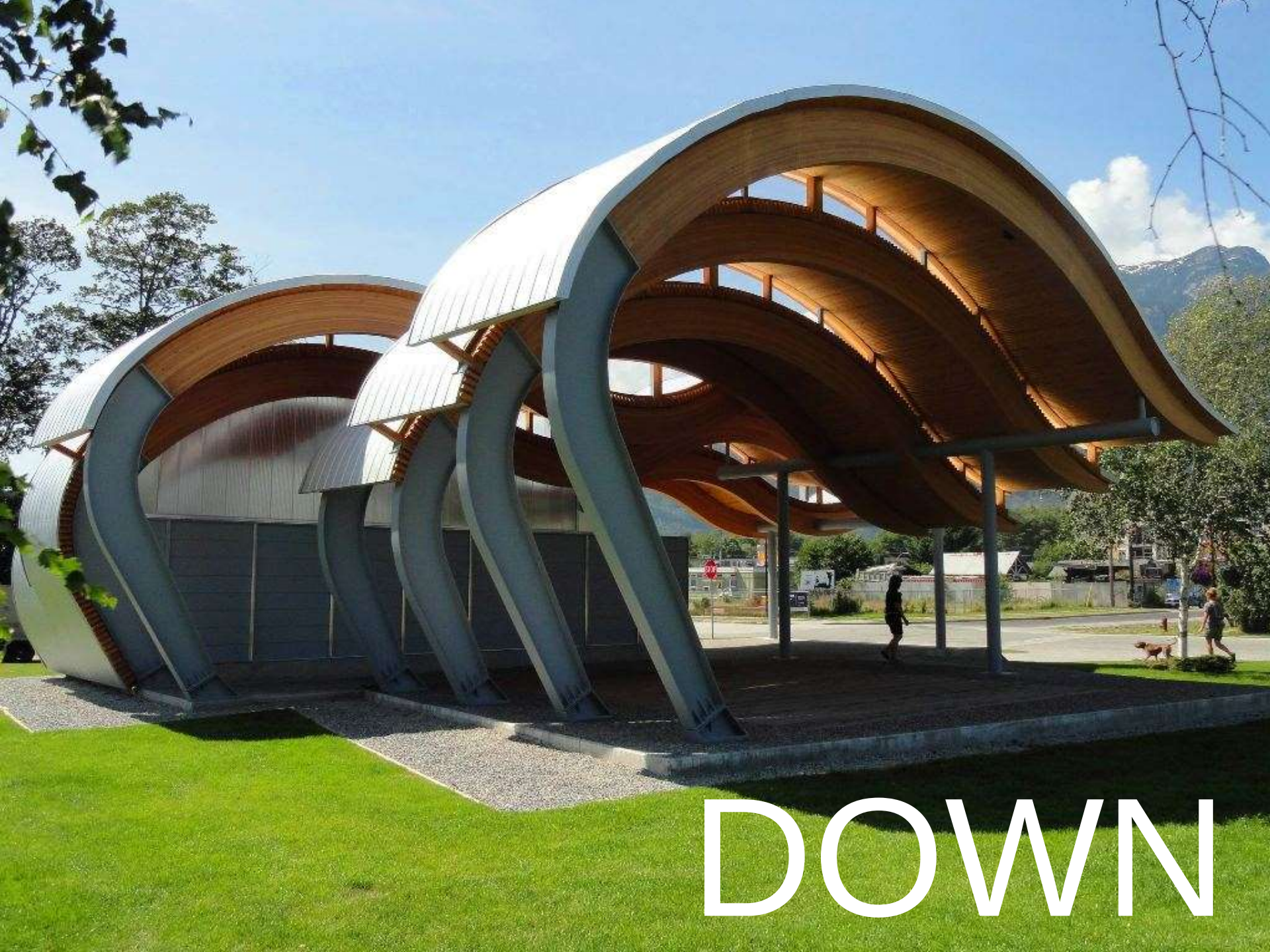
FAR


FUTURE?


MORE
:
:
STROMER
STROMER

LESS:


UP!


DOWN


LET THEM
GO!


THANK YOU

EQUILIBRIUM

VANCOUVER, CANADA