NOMENCLATURE

a, b, c, d	–	Failure parameters
A	–	Area of pipe, m^2
A_{wall}	–	Cross-section area of the pipe wall, m^2
b_w	–	Cross-section width, m
d_p	–	Inner diameter of the pipe, m
D_p	–	Outer diameter of the pipe, m
D_{eng}	–	Equivalent diameter of the engine, m
D	–	Reference strain-rate, 1/s
E_{red}	–	Reduced modules of elasticity, MPa
E_c	–	Initial elasticity of the concrete, MPa
E_s		Initial elasticity of the steal, MPa
f_c	–	Uniaxial compressive strength of concrete, MPa
f_t	–	Uniaxial tensile strength of concrete, MPa
f_{bc}	–	Equal biaxial compressive strength of concrete, MPa
f_{pc}, f_{cc}	–	Combined triaxial compression of concrete, MPa
f_y		Yield strength of reinforcement, MPa
f_{dc}	–	Dynamic compressive strength, MPa
f_{cs}	–	Static compressive strength, MPa
f_{dt}	–	Dynamic tensile strength, MPa
f_{ts}	–	Static tensile strength, MPa
F_c	–	Load contribution from aircraft crushing strength, N
f_{iI}^{int}	–	Internal nodal forces of node I in the i-th direction, N
f_{iI}^{ext}	–	External nodal forces of node I in the i-th direction, N
h_o	–	Thickness of the wall, m
h	–	Thickness of the spacing of reinforcement layers in the respective directions, m
h_1	–	Thickness of the reinforcement layer, m
I	–	Moment of inertia, m^4
I_1, J_2	–	Stress invariants, MPa, $(MPa)^2$

l – Length of the straight pipe, m

m_{iI} – Diagonal mass matrix of node I in the i-th direction

M – Mass of the missile, kg

M_2 – Bending moment with respect to axis 2, N-m

M_3 – Bending moment with respect to axis 3, N-m

n – Step number

P – Axial force, N

p_k – Pressure at the break location, Pa

p_a – Outside (atmospheric) pressure, Pa

p_{wall} – Pressure straight after the break location, Pa

p – Reinforcement ratio

q – Steel strain-rate amplitude parameter

Q_x – Reaction force, N

S_2 – Sectional modulus with respect to axis 2, m^3

S_3 – Sectional modulus with respect to axis 3, m^3

t Wall thickness, m

t_c – Thickness of reinforcement with prevailing compression, m

t_p – Minimum wall thickness to prevent perforation, m

t_{pd} – Minimum design thickness to prevent perforation, m

t_s – Minimum wall thickness to prevent scabbing, m

t_{sd} – Minimum design thickness to prevent scabbing, m

t_t – Thickness of reinforcement with prevailing tension, m

Δt – Time increment, s

U – Reference velocity, m/s

u_{iI} – Nodal displacement of node I in the i-th direction, m

$\dot{u}_{iI}$ – Nodal velocity of node I in the i-th direction, m/s

$\ddot{u}_{iI}$ – Nodal acceleration of node I in the i-th direction, m/s^2

v – Velocity of the uncrushed part of the plane relative to the wall, m/s

V – Velocity of the engine, m/s

w_k – Fluid velocity at the break location, m/s

x – Thickness of a concrete layer under compression in the corresponding part of the reinforcement, m.

Greek letters

$\alpha, \alpha_{fy}, \alpha_{fu}$	–	Parameters
β, δ	–	Parameters
$\dot{\varepsilon}$	–	Strain-rate, 1/s
$\dot{\varepsilon}_s$	–	Static strain-rate, 1/s
μ	–	Mass per unit length, kg/m
ρ_k	–	Fluid density at the break location, kg/m^3
σ_a	–	Axial stress, MPa
$\sigma_{b2/3}$	–	Bending stress with respect to axis 2 and 3, MPa
σ_{dyn}	–	Dynamic flow stress, MPa
σ_1	–	Maximum principal stress, MPa
σ_y	–	Normal stress, MPa
σ_{static}	–	Static flow stress, MPa
σ_{worst}	–	Worst stress, MPa
τ_u	–	Transverse shear failure, MPa

Abbreviations

ALS	–	Accident Localisation System
BSRC	–	Bottom Steam Reception Chamber
BWR	–	Boiling Water Reactor
CFAIL	–	Concrete Failure
DIF	–	Dynamic Increase Factors
DS	–	Deterministic Software
FC	–	Fuel Channel
FE	–	Finite Element
FOSM	–	First Order-Second Moment
FORM	–	First Order Reliability Method
GDH	–	Group Distribution Header
IS	–	Importance Sampling,
LOCA	–	Loss of Coolant Accident
LWC	–	Lower Water Communication
MCC	–	Main Cooling Circuit
MCP	–	Main Circulation Pump
MCS	–	Monte Carlo Simulation
MDBA	–	Maximum Design Basis Accident
MSRV	–	Main Steam Relief Valve
NPP	–	Nuclear Power Plant
PS	–	Probabilistic Software

PWR	–	Pressurized Water Reactor
RBMK	–	Russian abbreviation for “Large-power channel-type reactor”
RC	–	Reinforced Concrete
RS	–	Response Surface
SDH	–	Steam Distribution Header
SDD	–	Steam Distribution Device.