COMPILATION OF ENGINEERING & CONSTRUCTION RISK CRITERIA

Design Development

Inadequate or unclear project brief.
Unclear *design team* responsibilities.
Unrealistic design program.
Ineffective quality control procedures.

Inadequate site investigation.

Planning constraints/requirements.

Soundness of design data.
Insufficient time allocated for planning
Lack of gate reviews

Groupthink during design process - Lack of dissenting voices

Too much control by one person (usually the general partner)
Late assignment of key design professionals - such as the interior designer
Lack of strong design leadership by design team leader

Poor sequencing of design activities / Lack of prioritization

Incomplete assemblage

Appropriateness of design (constructability).

Degree of novelty (i.e. design novelty).

Ineffective design co-ordination.

Reliability of area schedules.

Reliability of estimating data:

changes in labor, materials, equipment and plant costs; and

Reliance on single data source
inflation (i.e. differential inflation due to market factors and/or timing).
Use of provisional sums (i.e. do not give price certainty).

Construction

Inadequate site investigation.

Archaeological remains.

Underground obstructions.

Contaminated ground.

Adjacent structures (i.e. requiring special precautions).

Geotechnical problems (e.g. mining and subsidence).

Ground water.

Asbestos and other hazardous materials.

Invasive plant growth.

Tree preservation orders.

Ecological issues (e.g. presence of endangered species).

Environmental impact.

Physical access to site (i.e. restrictions and limitations).

Existing occupancies/users.

Restricted working hours/routines.

Maintaining access.
Coordination with utilities / gas, electric, water, sewerage

Maintaining existing services.

Additional infrastructure.

Existing services (i.e. availability, capacity, condition and location).

Location of existing services.

Relocation of existing services.

Statutory undertakers (i.e. performance).
Uncertainty over the source and availability of materials.

Appropriateness of specifications.

Incomplete design.

Weather and seasonal implications.

Technology

Availability of materials/technologies/equipment
Experience of working with materials/technologies/equipment
Lead times for orders of materials/technologies/equipment
Stability of design, design changes etc.

Availability of key components and spares

Equipment reliability/safety/productivity

Innovation – need for further development
New & Untested techologies
Lack of team experience in new technology

Quantity of Interfaces

Complexity of technical interfaces

Untested third-party interfaces

Maintenance and spare parts costs

Reliability, maintainability, availability, support availability

Specification completeness and accuracy
Clarity of technical performance, standards or regulations
Technological change, updates, obsolescence

Materials quality/safety

Workmanship

Productivity of equipment
Availability of critical plant/equipment/spare parts, fuel, skills for operating etc.
Sampling/testing
Ground conditions (mining activities, rock, services, antiquities, contamination etc.)
Suitability, availability and supply of materials
Specialist equipment (knowledge of, skills, training, difficulty of use, consistency of use, cost etc.)
Transport (difficulties, availability, suitability, police and liaison requirements, usage constraints, site access, noise, pollution, weather impact, etc.)
Control over design process (opportunities for influence over design decisions, designers' understanding of issues, communication with designers)
Availability of design information/design changes
Quality of design (constructability, omissions, incompatibility between different designs, details, components, sub-standard performance when built, difficult to build, etc.)
Innovation in design (level of standardization, newness of technology/details/materials etc.)
New technology (unfamiliarity, application, feasibility, specialist controls/monitoring needed)
Software (theft, misuse, database size and complexity, development required, training required, etc.)

Security

Product contamination

Product safety, safety guidelines, hazardous materials etc.

Overseas voltage compatibility

Human Factor

Effectiveness of communications (language difficulties, use of translators, accuracy of translators, etc.)
Working and living conditions for staff
Crimes against people, property vandalism, bribery, espionage, terrorism and extortion
Security and safety of staff, personnel and public
Industrial relations
Labor sickness/absenteeism
Quality, capability, reliability, productivity and availability of labor (operatives (subcontractors) and managers)
Attitudes of staff towards quality, costs, environment, safety, trust, opportunities etc.
Staff reliability, skills, capability etc.
Culture (compatibility, different ways of working, different standards, different priorities, cultural assimilation, etc.
Personality conflicts
Skills and staffing issues (adequate prior experience, availability and mix of skills staff, learning curve effects, loss of critical skills/staff, staff turnover, recruitment, induction, training needs/timeframe/effectiveness, willingness of key staff to relocate, etc.
Intimidation/racism/discrimination
Malicious damage/sabotage to property/vandalism

Theft

Bribery

Corruption

Organizational and Project Management Risks

Project purpose and objectives are poorly defined
Project scope definition is poor or incomplete
Project schedule in question
No control over staff priorities
Project competing with other projects, funding, and resources
Functional and technical labor units not available or overloaded
Losing critical staff at crucial point of the project
Poor configuration management
Improper organizational structure
Poor alignment between project structure and contract delivery methodology
Wrong project structure

Multiple reporting / Lack of clarity
Inexperienced or inadequate staff assigned
Product development by several sources or entities (virtual or remote efforts)
Coordination/communication difficulties
Communication breakdown with project team
Insufficient time to plan
Timely response to critical decisions by project manager and/or management

Architect-engineer and Construction Consultant or contractor delays
Pressure to deliver project on an accelerated schedule

Unanticipated project manager workload
Internal red tape causes delay getting approvals, decisions

Unplanned work that must be accommodated
Local agency/regulator issues

Priorities change on existing program

Contract Acquisition

Undefined acquisition strategy
Lack of acquisition planning support/involvement

Preference to Small Business Development and 8(a) contracts
Acquisition planning to accommodate funding stream or anticipated strategy

Numerous separate contracts

Acquisition strategy decreasing competition
Acquisition strategy results in higher scope risk (Design Build)

Technical

Design development stage, incomplete, or preliminary
Confidence in scope, investigations, design, and critical quantities:

Geotechnical

Understaffed design firm
Cash flow problems at design firm

Economically stretched design firm
Civil
Structural
Mechanical

Electrical

Architectural
Environmental

Controls
Other Specialized Disciplines

Design confidence in products by others
Consultant design not up to department standards
Inaccurate or risky design assumptions on technical issues
Innovative designs, highly complex, first of a kind, or prototypes
Incomplete studies (geotech, hydrology and hydraulic, structural, HTRW, etc.)
Surveys late and/or surveys in question

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Industrial relations.
Remote site.
Competence of contractor and subcontractors.
Health and safety.

Ineffective quality management procedures.

Phasing requirements (e.g. occupation and decanting).
Ineffective handover procedures.
Disputes and claims.
Effect of changes/variations on construction program.
Cumulative effect of numerous changes/variations on construction program.
Defects.

Accidents/injury.

Sponsor Changes

Specific changes in requirements (i.e. in scope of works or project brief during design, pre-construction and construction stages).
Changes in quality (i.e. specification of materials and workmanship).

Changes in time.

Sponsor driven changes/variations introduced during the construction stage.

Effect on construction duration (i.e. impact on date for completion).
Cumulative effect of numerous changes…Cardinal change?

Sponsor Other

Project brief:
End user requirements.
Inadequate or unclear project brief.
Sponsor's specific requirements (e.g. functional standards, site or establishment rules and regulations, and standing orders).
Timescales:

Unrealistic design and construction programs.

Unrealistic tender period(s).

Insufficient time allowed for tender evaluation.

Contractual claims.

Effects of phased completion requirements (e.g. sectional completion).
Acceleration of construction works.
Effects of early handover requirements (e.g. requesting partial possession).
Postponement of pre-construction services or construction works.
Timescales for decision making.
Financial:
Availability of funds.

Unavailability of grants/grant refusal.

Cash flow effects on timing.

Existing liabilities (i.e. liquidated damages or premiums on other contracts due to late provision of accommodation).

Changing inflation.
Changing interest rates.
Changing exchange rates.
Changes in taxation
Unsuitable contract strategy.
Incomplete design before construction commences.

Unconventional contract strategy.
Unconventional bidding action.
Amendments to standard contract conditions and/or supplementary contract conditions.
Acceptance of use of provisional sums (i.e. do not give price certainty).
Liquidation/insolvency of *main contractor* .
Liquidation/insolvency of consultant.
Delay in payment.
Management:
Unclear project organization and management.
Competence of *project/design team* .
Unclear definition of project/team responsibilities.
Inadequate or no risk management strategy.
Ineffective or no cost control procedures.
Inadequate or no design review procedures.
Ineffective or no procedures for procurement.
Ineffective or no time control procedures.
Ineffective change control procedures (for both pre-construction and construction stages of building project).
Ineffective reporting systems.
Phasing of decanting and occupation.
Third party:

Malicious attacks on individuals/personal conflicts
Sabotage
Mistakes/errors/incompetence
Stupidity

Inefficiency

Personality conflicts
Negligence
Differing professional/personal values and beliefs
Different ways/methods of working

Interference between trades

Communication effectiveness

Misunderstandings/misinterpretation

Cultural differences (language, traditions, food, beliefs, religious etc.)

Indecisiveness

Unreasonableness

Environmental

Force majeure (acts of god) – heatwave, rain, wind, heat, cold, humidity, fire, tidal wave, volcanic, earthquake, flood, storms/cyclones/hurricanes, landslide, lightning strike etc.)

Pest/vermin infestation

Industrial/environmental disaster

Pestilence

Disease and health risks
Pollution
Ecological damage
Endangered species

Contamination of land, water or air

Conservation

Hazardous gas or chemical release

Hazardous sites and materials

Legislative and regulatory constraints

Noise

Waste, recycling etc.

Sufficiency/availability of as-built data/base map data
Borrow/fill sources identified/secured
Sufficiency/condition of borrow/fill sites
Right-of-way analysis in question
Lacking critical subsurface information for under-water/in-water work
Hazardous waste concerns
Need for design exceptions or waivers
Dredge estimate scope, quantities, and equipment:
Correct dredge equipment decisions

Consideration for adequate pumping for long pipeline runs
Adequate disposal facilities in size and number

Land

Real Estate plan defined

Status of real estate/easement acquisition
Objections to right-of-way appraisal take more time and/or money

Ancillary owner rights, ownerships in question

Freeway agreements

Railroad involvement
Relocations identified

Records/as-built availability/inaccuracies
Known and unknown utility impacts
Relocations may not happen in time
Environmental mitigation needs identified
Adverse possession
Quality of lands and damages estimates as "Most Likely" case
Hidden estimate/schedule contingencies

Regulatory and Environmental

Established requirements for initial project studies and potential impacts
Environmental and Water quality issues
Conforming to the state implementation plan for air quality
Historic/cultural site, endangered species, or wetlands present
Project in an area of high sensitivity for paleontology

Project in an area of high sensitivity for cultural artifacts
Numerous exclusion zones in project area/vicinity
Hazardous waste preliminary site investigation required
Status of critical environmental and regulatory studies
Status of permits
Lack of specialized staff (biology, anthropology, archeology, etc.)
Reviewing agency requires higher-level review than assumed
Permits or agency actions delayed or take longer than expected
Reviewing agency requires higher-level review than assumed
Potential for critical regulation changes
New permits or new information required
Project in the coastal zone
Project on a scenic highway, state, or national park
Negative community impacts expected
Pressure to compress the study and permitting activities

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Requirements relating to planning (e.g. public enquiries, listed building consent and conservation area consent).
Opposition by local Township.
Planning refusal.
Legal agreements.
Works arising out of party wall agreements.
Requirements relating to existing rights of way, rights of light, way leaves and noise abatement.
Requirements relating to listed buildings and/or conservation areas.
Requirements relating to sites of scientific interest (SSI).
Requirements relating to environmental impact assessments.
Requirements relating to social matters (e.g. pressure groups and local protests).
Public enquiries.

Other:

Insistence on use of local work people.
Availability of labor, materials and plant.
Statutory requirements.
Market conditions.
Political change.
Legislation.
Force majeure.