Section 1
Appendix A
Case Studies
For those who are considering using the DRB process it is of interest to learn of specific examples of previous application of the method. A wide variety of applications and locations are presented in this appendix to allow a prospective user to appreciate the extent of use of the process on various types, sizes and locations of projects.

While it is normal for the DRB process to be conducted under a veil of confidentiality, there are a number of owners and contractors who have allowed publication of details concerning the use of this method. This section makes use of DRB examples which have been freed of the confidentiality requirement to some extent. Specific details of disputes brought to DRBs are presented where possible, however confidentiality reasons limit the amount of detail which can be presented. Information available for publication varies from example to example and therefore a rigid format is not followed.

It will be noted that on some projects the DRB was not called upon to provide recommendations while in other projects several recommendations were issued. Both situations are indicative of a successful DRB. Prevention of disputes is the first objective, while the second objective is to provide recommendations upon those disputes which do arise to assist the parties to avoid further dispute procedures.

The following examples are presented in order of project commencement date.
CASE STUDY 1

PROJECT: SAN ANTONIO RIVER AND SAN PEDRO CREEK TUNNELS,
PHASE II, San Antonio, Texas USA

DESCRIPTION: Two, 25 foot lined diameter siphon tunnels with inlet, outlet, maintenance,
ventilation and instrumentation shafts (each about 140 feet deep).
San Antonio River Tunnel: 16,000 feet, 9 shafts
San Pedro Creek Tunnel: 5,900 feet, 7 shafts

CONSTRUCTED: 1987 - 1993

PROVISIONS: 1989 ASCE DRB specification modified for the owner to require the contractor
to submit a fully documented and quantified claim to the owner before going to
DRB. Agreement of both parties required prior to appeal dispute to DRB.

RECORD: Disputes Heard: 13
Recommendations Accepted: 13
Disputes Litigated: 0

COSTS: Estimate: $53 million
Bid: $48 million
Final: $71 million

OWNER: San Antonio River Authority/City of San Antonio
DESIGNER: Parsons Brinckerhoff, Chicago, Illinois
CM: Corps of Engineers, Fort Worth District
CONTRACTOR: Obayashi Corporation

DRB COST: $135,000; 0.19% of final cost.

REFERENCES: CM: Keith M. Allen, San Antonio, Texas
Contractor: Paul Zick, Boston, Massachusetts
DRB: Robert J. Smith, Esq., Madison, Wisconsin

REMARKS: The project initially experienced problems with erection tolerances and damage
of the precast concrete segmental lining, and encountered unanticipated
ground conditions. DRB first met nine months after notice to proceed. Two
disputes concerned interpretation of the front documents, seven interpretations
of the technical specifications, and four were changed conditions. Two
recommendations were appealed back to the DRB for reconsideration.
CASE STUDY

PROJECT: BRADLEY LAKE HYDROELECTRIC, Homer, Arkansas USA GENERAL CIVIL CONTRACT

DESCRIPTION: 125 foot high by 610 foot long concrete-faced rock fill dam, diversion tunnel completion, excavation and lining of 18,600 foot by 13 foot diameter power tunnel, 720 foot power shaft, gate shaft, penstock bifurcations, and excavation for surface powerhouse.


PROVISIONS: 1989 ASCE DRB specification modified to require the contractor to submit a fully documented and quantified claim to the construction manager. Contractor may appeal CM's finding to the DRB.

RECORD:
- Disputes Heard: 0
- Disputes Litigated: 0

COSTS:
- Estimate: $118 million
- Bid: $91 million
- Final: $89 million

OWNER: Alaska Energy Authority, Anchorage

DESIGNER: Stone & Webster Engineering Corp., Denver

CM: Bechtel Civil, San Francisco

CONTRACTOR: Ensearch Constructors JV

DRB COST: $140,000; 0.16% of final cost

REFERENCES:
- Owner: Dave Eberle, Anchorage
- CM: Harvey Elwin, San Francisco
- Contractor: Jay Carlson, Chicago
- DRB: Norman Nadel, Brewster, New York

REMARKS: There were many disagreements; and except for two they were routinely settled. Disputes involving water inflows and welding of the steel tunnel liners, totaling over $8 million, were settled without going to the Board. The owner's manager stated, "Although the DRB was never called upon to hear a dispute, I believe they were instrumental in the successful resolution of claims. The DRB was a catalyst which helped both the owner and the contractor to more objectively assess their relative positions. It also fostered an attitude of 'let's resolve our differences in the field!'"
A dispute brought before the DRB regarded eligibility for compensation in regard to costs incurred in dewatering noise wall spread footings which were in proximity to a canal.

- Contract plans and specifications called for construction of reinforced concrete spread wall footing foundations for the noise wall, including dewatering where necessary. The contractor was required to design, install and operate an adequate dewatering system so as to maintain water table a minimum of three feet below footer foundation level.

- The contract documents included soil boring data sheets showing core logs.

- Addendum No. 2 issued during the bid process provided answers to queries raised by bidders and formed part of the contract documents.

**Contractor MCS contended** that FDOT did not properly address dewatering requirements in Addendum No. 2 nor did FDOT adequately inform the bidders of the geological conditions. In light of FDOT responses it had been decided to exclude from its bid any dewatering costs other than minor pumping. Contractor stated that:

  - in response to a contractors description of the problems of dewatering barrier wall footings to the specification requirements, FDOT had stated in question no. 4 that they “also believe that the construction could be performed without dewatering if done in the dry season. Pumping of water from the excavation should be expected.”

  - In response to a contractor expressing concern regarding post footings being in close proximity to the right of way line, FDOT had responded “There is no easement. Dewatering below the level of construction is not anticipated.”

**FDOT responded** that question no. 4 specifically addressed dewatering for the traffic barrier foundation and not the noise wall spread footings. The contract documents did not define the amount of water that would have to be removed to comply with the specification. Nor did the documents define the geological layers. The only information provided with the borings was a general description and relative density of the materials.

FDOT maintained that MCS did not encounter any site conditions that were different from those described in the contract documents (including the addenda). The contractor was responsible for design and implementation of an adequate dewatering system. Cost and time impacts are due to the fact that the dewatering system was not adequate.
The DRB reviewed all the information provided and based its recommendation on the contract and the following facts:

- It is incumbent upon the contractor to examine the plans and the site of the proposed work.
- The contractor did in fact visit the site as he stated in the hearing.
- The contractor is required to construct the noise wall spread footings according to the plans and specifications.
- The contractor stated in the hearing that he was familiar with doing work in south Florida.
- The soil boring data sheets did show some cores having brown and gray sandy limestone present.
- The contractor had stated in the hearing that he observed the presence of rock (limestone) on the west bank of the canal. He said that they encountered rock in the excavations.

The DRB’s unanimous recommendation was that there is no entitlement to the contractor. Having observed limestone like rock on the west bank of the canal and due to borings showing limestone in some cores the contractor should have expected lime rock to be present in the noise wall spread footings area. In view of the contractors stated familiarity with south Florida he should have known that dewatering would be necessary for the placement of concrete in the noise wall spread footings. Evidently he overlooked the relationship between water level in the canal and the elevation of the footers.
CASE STUDY 4

PROJECT: HANGING LAKE VIADUCT, Glenwood Canyon, Colorado USA

DESCRIPTION: Construct two bridges on Highway I-70, total length 8,428 feet. Consisted of 34 foot wide by 10 feet deep precast concrete segments erected by balanced cantilever from the top using an overhead launching truss.

CONSTRUCTED: 1989 - 1993

PROVISIONS: Generally followed 1989 ASCE DRB specification

RECORD: Disputes Heard: 12
Recommendations Accepted: 12
Disputes Litigated: 0

COSTS: Estimate: $40 million
Bid: $34 million
Final: $39 million

OWNER: Colorado Department of Transportation

DESIGNER: Figg Engineering

CONTRACTOR: Flatiron /Prescon Corp, JV

DRB COST: $50,000; 9 DRB meetings, 0.13% of final cost

REFERENCES: Owner: Glenn Violette, Glenwood Springs, Colorado
Contractor: Ray Schmahl, Longmont, Colorado
DRB: Raymond J. Dodson, Woodside, California

REMARKS: An extremely complicated project executed in very limited work area over the Colorado River while maintaining traffic on the existing two lane highway on one side of the canyon and a mainline railroad on the other side. Coordination was required with contractors on adjacent projects.
CASE STUDY 5

PROJECT: INTER-ISLAND TERMINAL, HONOLULU INTERNATIONAL AIRPORT, Honolulu, Hawaii USA

DESCRIPTION: Fast track construction schedule with airport remaining fully operational at all times.

CONSTRUCTED: 1990 - 1993


RECORD: Disputes Heard: 2
Recommendations Accepted: 2
Disputes Litigated: 0

COSTS: Bid: $119 million
Final: $131 million

OWNER: Hawaii Department of Transportation

DESIGNER: Inter-Island Terminal Associates and MNS Associates, JV

CM: KFC Airport Inc.

CONTRACTOR: Kiewit-Pacific

DRB COST: $50,000; 0.04% of final cost

REFERENCES: CM: Brian Bowers, Honolulu
Contractor: Gordon Adkinson, Honolulu
DRB: Richard Elstner, Honolulu

REMARKS: HDOT Director: "One of the greatest strengths of the DRB has been its deterrent value to help the owner, project manager and contractor resolve problems at the lowest level." As a result of the success of this DRB the owner now has a DRB on the adjacent project and recommends use on all future large projects.

Escrow bid documents were key to settling several disputes. Information in the escrow bid documents was used to convince the owner to allow the contractor to subcontract a portion of the work that had inadvertently been omitted from the bid form listing.
CASE STUDY

PROJECT: ERTAN HYDROELECTRIC PROJECT, People’s Republic of China

The Erta DRB with employer and contractor representatives

DESCRIPTION: The project consists of a concrete dam and underground Hydropower Plant located on the Yalong River in Szechuan Province of southwest China (nearest city Kunming), over 900 miles from its source in the mountains of Tibet.

The dam is a double curvature arch dam over 800 feet high (6th highest in the world), with a concrete lined plunge pool over 1300 feet long with a 120 foot high plunge pool dam. Total concrete placed on surface installations exceeded 6.5 million cubic yards. Reservoir is over 90 miles long with an active storage of 3.37 billion cubic meters. The underground power plant consists of six 550 MW units constructed in a cavern through challenging geology.


PROJECT COST: Approximately $2 Billion US

OWNER: Chinese State Hydropower Organization (EHDC)

CONTRACTORS: Two separate Chinese/foreign joint ventures were involved in the main civil works and in all comprised five continental European constructors together with two Chinese constructors. The dam joint venture was headed by Impregilo Spa of Italy. The underground joint venture was headed by Philip Holzmann AG of Germany.

ENGINEER/CM: The design was by a Chinese Design Institute (CHIDI). The joint ventures were supervised by a Chinese engineer while the employer was advised by international engineering firms.

CONTRACT PROVISIONS: Modified FIDIC 4 conditions were employed. One three person DRB was installed for the two main civil contracts consisting of members from the United Kingdom, Colombia, and Sweden. The parties each chose one member, and the members chose a chair.
DRB FREQUENCY OF VISITS: On average, every four months with three days for site visits totaling over 20 visits.

SPECIAL FACTORS: This was the first DRB to be established in China. After an initial wariness of the DRB process, the parties grew to realize that the DRB could help the project by resolving difficult disputes. As confidence in the DRB and the process grew, the DRB became more proactive and assisted the project in an informal capacity resolving potential disputes.

DRB RECORD: Proceedings were conducted in English and Chinese. All referrals to the DRB were the subject of hearings on site which generally required two or three days, although the more complex matters such as extension of time lasted longer. Several disputes were heard by the DRB during many of the on-site sessions for hearings. Recommendations were typically rendered in writing several weeks later.

No restriction existed on the scope of the disputes brought to the DRB and disputes were heard on a wide variety of technical and contractual matters. The DRB appointed specialist advisers if it was found necessary, for example when local taxation was the subject of one dispute.

NUMBER OF DISPUTES REFERRED TO DRB: 40

NATURE OF DRB’S DETERMINATIONS: Recommendations were binding unless a party gave notice of referral to arbitration within set time limit. Where notice of referral was given by a party the recommendations were not binding in the interim, however recommendations were admissible in arbitration.

FINAL RESULT: No arbitration took place. All of the disputes were resolved in amicable settlements between the parties either immediately following publication of the recommendation or in final settlements following construction. The DRB was instrumental in gaining the parties consent to final settlement which was based on the DRB recommendations.

REFERENCES: Carlos S. Ospina – Chair of DRB
Sven-Erik Frick-Meijer
Peter H. J. Chapman
CASE STUDY

PROJECT: SR-90 BELLEVUE TRANSIT ACCESS and HOV LANES, Bellevue, Washington USA

DESCRIPTION: Construction of a 1,100 foot long high occupancy vehicle (HOV) overpass through an extremely sensitive environmental area. The project also included the construction and widening of other bridges, retaining walls, mitigation ponds, major utility relocations, etc.


PROVISIONS: Generally followed 1989 ASCE DRB specification, included partnering.

RECORD:
- Disputes Heard: 2
- Recommendations Accepted: 2
- Disputes Litigated: 0

COSTS:
- Estimate: $15 million
- Bid: $17 million
- Final: $19 million

OWNER: Washington State Department of Transportation

DESIGNER: Washington State Department of Transportation

CONTRACTOR: General Construction and 3A Industries, JV

DRB COST: $50,000; 4 DRB meetings, 0.26% of final cost

REFERENCES:
- Owner: Phil Fordyce, Seattle, Washington
- Contractor: Robert McClure
- DRB: Raymond J. Dodson, Woodside, California

REMARKS: The project had several unique milestones and restraints, which included construction restrictions during a fish window, limited construction during Kingdome activities and University of Washington football games, and erection of structural steel over Interstate 90. The project partnering agreement was instrumental in resolving several disputed issues.
CASE STUDY

PROJECT: AMERICA WEST ARENA, Phoenix, Arizona USA

DESCRIPTION: The Concert Hall and Phoenix Suns basketball arena seats 19,400. Steel frame roof is a two way truss system. Bottom chord of the 330 feet long primary trusses were braced with 1.4 inch cable spreaders until truss was placed in tension on the ring beam. The construction schedule was tight.

CONSTRUCTED: 1991 - 1993

PROVISIONS: AIA 201 (1987) General Conditions used. DRB substituted for arbitration. 1989 ASCE DRB specification used. Standby DRB was in place; members did not receive progress reports. All members were local.

RECORD:
Disputes Heard: 0
Recommendations Accepted: 0
Disputes Litigated: 0

COSTS:
Bid: $47 million

OWNER: City of Phoenix

DESIGNER: Ellerbe Becket Inc., Kansas City, Kansas

MANAGER: Huber, Hunt & Nichols, Phoenix, Arizona

CONTRACTOR: Mardian Construction, Phoenix, Arizona

DRB COST: $0

REFERENCES:
Owner: Richard Mace, Phoenix, Arizona.

REMARKS: Absence of disputes was attributed to having a standby DRB in place. Attorney recommended that DRBs be included in all City of Phoenix construction contracts. DRBs are currently in place on contracts for the Central Library and for a 450,000 square foot city office complex.
The first dispute regarded quantity overrun on disposal of contaminated material. Contract plans and specifications called for disposal of 10,000 tons of contaminated material. KPAC had bid the item at $200/ton.

The Contract Quantity Variation Clause contained a trigger at 120% and provided for negotiation of equitable adjustment strictly based on increase or decrease due solely to variation of quantity.

The contract differing site condition provided that an equitable adjustment was called for if the actual subsurface conditions encountered differed substantially or materially from those shown on the plans or indicated in the contract documents.

Six months after the trigger was passed, MHD unilaterally lowered the unit price to $75/ton and adjusted the periodic pay requisitions accordingly. The final quantity reached 85,000 tons but no negotiations took place.

Contractor KPAC requested the DRB to hear a dispute on entitlement in which they claimed that the overrun was a differing site condition. KPAC relied on a Federal Board of Appeals decision which maintained that no price negotiation was necessary unless the contractor had experienced economies of scale. KPAC stated no such economies existed as their records would substantiate.

MHD responded that Massachusetts courts were not bound by federal precedent in this case and that renegotiation of unit price was not limited to a consideration of economies of scale. At the hearing the DRB learned that the owner did not know what the contractor’s actual costs were but felt that there must have been a savings.

The DRB concluded that both contract provisions provided for equitable adjustment but neither the DRB nor the parties had all of the relevant facts. A recommendation as to which clause governed would not resolve the dispute but would merely advance it to court.

The DRB’s recommendation was that MHD exercise its audit rights under the contract, examine the contractor’s costs, and proceed from there. The parties complied and were then able to negotiate a settlement themselves as part of a global settlement.

The DRB therefore promoted an amicable settlement of the dispute by recommending the parties follow the contract provisions more closely.
CASE STUDY

PROJECT: AKRON CONVENTION CENTER, Akron, Ohio USA

DESCRIPTION: 122,000 square foot building with meeting rooms and exposition hall

CONSTRUCTED: 1992 - 1994

PROVISIONS: 1991 ASCE DRB specification modified to exclude disputes less than $5,000; for the American Subcontractors Association to choose one member on behalf of all the contractors, for owner to pay all costs of regular DRB meetings, and for owner to determine which contractor is responsible for costs of dispute hearings and split that cost with them. Each contractor signed a separate three-party agreement.

RECORD: Disputes Heard: 1
Recommendations Accepted: 1
Disputes Litigated: 0

COSTS: Estimate: $26 million
Bid: $19 million
Final: $21 million

OWNER: City of Akron, Ohio

DESIGNER: URS Consultants, Cleveland, Ohio

CM: The Ruhlin Corporation, Akron, Ohio

CONTRACTOR: 19 Prime Contractors

DRB COST: $12,000; 0.06% of final cost

REFERENCES: Owner: Brad Beckert, Akron, Ohio
Contractor: John Dies, American Subcontractors Association,
Akron-Canton Chapter, Akron, Ohio
CM: Tom Reynolds, Akron, Ohio
DRB: Ted Greive, Copley, Ohio

REMARKS: All DRB members resided in the Akron area; two were professional engineers retired from rubber companies, one was the former owner of an asphalt company.

The owner is extremely pleased with the DRB. They will use the same DRB for their next contract, a parking structure for the Convention Center.
CASE STUDY

PROJECT: Washington Area Metropolitan Transit Authority (WMATA), Washington, D.C. USA
SCOPE: 103 mile heavy rail rapid transit system and 83 stations, including 47 underground
CONSTRUCTED: 1988 - 2001
PROJECT COST: Over $10 billion
OWNER: WMATA
ARCHITECT: Harry Weese and Associates
ENGINEER: DeLeuw, Cather and Co. (Parsons Corp.)
CONTRACTORS: US and international contractors

WMATA looked to the U.S. Army Corps. of Engineers prior to 1985 to model their contract forms and construction oversight practices and utilized the Engineer Board of Contract Appeals (EBCA) as the adjudicator of its cases. However the EBCA process was very drawn out, and in 1985, 350 cases awaited hearing by the EBCA. EBCA decisions typically were not issued until five years after the hearings, which was costly, time consuming and distracting to all concerned.

WMATA attempted to insert expedited processes into its specifications over the next seven years, but were unsuccessful until the Federal Government enacted alternative dispute resolution (ADR) legislation in 1992. Shortly thereafter and with $1 billion remaining in the capital construction program, WMATA decided to include DRBs on nine of ten projects set to bid in the upcoming year. WMATA also added to its contracts ADR provisions that allowed the parties to entertain and agree on any ADR process to settle issues arising out of the performance of the contract.

Since 1993, DRBs have been included on fifteen WMATA contracts with a value of $800 million. The use of DRBs is coupled with a partnering requirement. There have been six DRB hearings (five formal and one informal) that have considered collectively 50 issues. All issues have been settled and none have gone to BCA (now the Armed Services Board of Contract Appeals). One case did go to litigation when a contractor elected not to use a DRB. After trial and contractor’s appeal, the U.S. Supreme Court denied the contractor’s case four years later.

WMATA is convinced that DRBs have served it well. In addition to heard issues, all other issues have been settled before the end of the job. The total cost of DRBs between 1993 and 2003 has been less than $2 million for $800 million in contract value. The litigation fee in one of WMATA’s past non-DRB cases alone was $3 million. WMATA’s experience is that the DRB recommendations were always fair and thus were adopted by WMATA in all instances. WMATA believes the use of DRBs has presented a favorable image of the agency to the construction industry and probably has resulted in lower bid prices to WMATA. It certainly has resulted in many less distractions for its staff. WMATA continues to utilize DRBs on all its construction projects.
PROJECT: XIAOLANGDI MULTIPURPOSE DAM, People’s Republic of China

DESCRIPTION: The project is located in the mouth of the most downstream gorge of the middle reach of the Yellow River about 40 kilometers north of Luoyang, Henan Province. The purpose of the project is to raise flood protection from 60 years to 1000 years return frequency, reduced sediment buildup downstream, prevent ice accumulation, and provide irrigation, water supply and power generation.

Reservoir capacity is 694,000 square kilometers created by a rock fill dam with clay core over 500 feet high and containing over 87 million cubic yards of fill material making it the largest of its type in the People’s Republic of China. A cutoff wall over 265 feet deep underlies the fill dam and is the deepest and thickest such wall in China.

The 10 intake towers have a leading edge width of 910 feet and a height of 372 feet and are the largest and most complicated in the world. More than 100 tunnels of various sizes arranged in the left bank thin rock mass, about one kilometer in surface area, comprise some of the most concentrated caverns in the history of global water and hydropower project construction.

The plunge pool, 700 feet in length and 1180 feet wide by 92 feet deep, is the largest and most concentrated plunge pool in the world.

The underground powerhouse is over 830 feet long and 85 feet wide containing six 300 MW Francis turbines and is the largest powerhouse in China constructed under adverse subsurface conditions of sandy shale.


PROJECT COST: Over $4.2 billion US including $1.2 billion US in foreign funding

OWNER: Yellow River Water and Hydropower Development Corporation (Ministry of Water Resources of the People’s Republic of China)

CONTRACTORS: Three Chinese/foreign joint ventures were involved in the main civil works and in all comprised 10 continental European constructors together with four Chinese constructors.

The dam joint venture was headed by Impregilo Spa of Italy.

The underground powerhouse joint venture was headed by Dumez International of France.
The intake, tunnels and spillway joint venture was headed by Zueblin of Germany.

ENGINEER/CM: Each joint venture was supervised by a Chinese engineering company while the employer was advised by a Canadian joint venture consulting engineering firm.

CONTRACT PROVISIONS: Main contracts were in accordance with World Bank requirements utilizing modified FIDIC conditions. Three separate contracts were let for the main civil works. Originally no DRB was called for but during the construction of the works the owner and the three main civil works joint venture contractors agreed to introduce a single DRB for the three contracts.

REMARKS: Under the leadership of Vice Minister of Water Resources Mr. Zhang Jiyao and the employers executive General Manager Mr. Lu Chengji, and with admirable collaboration of all participants, the project was completed in the summer of 2001, ahead of schedule.

Despite many unforeseen events and problems occurring initially, river diversion was achieved on schedule in October 1997. A massive acceleration program had to be undertaken to achieve timely river diversion and avoid a years delay to project completion.

DRB RECORD: Following river diversion, a single DRB was established for the three main civil works contracts. This DRB was presented with a wide assortment of disputes concerning the underground works amounting to some $500 million US.

All of the disputes were resolved amicably by the completion date. Successful completion of construction was therefore achieved with no claims outstanding.

REFERENCES:
Gordon L. Jaynes – Chair of DRB
Peter L. Booen
Pierre M. Genton