



Source: Colorado Department of Transport



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TRANSPORT CASE STUDY: UNITED STATES

Central 70 (I-70) Managed Lanes

Location

Denver, Colorado, USA

Owner

Colorado High Performance Transportation Enterprise (HPTE) and Colorado Department of Transport (CDOT)

Private Partner

Kiewit-Meridiam Partners, LLC (Meridiam, Kiewit Development Co.)

PPP Model

Design-build-finance-operate-maintain (DBFOM)

Operating Term

5-year construction period which includes operations and maintenance (O&M) plus a 30-year O&M period

Contract Value

USD 1.2 billion

Asset Class

Transportation (Highway and Bridge)

Awards

- P3 Bulletin Best Road/Bridge/Tunnel Project 2018
- P3 Bulletin Best Project Financial Structure 2018

The existing I-70, between I-25 and Chambers Road, is one of Colorado’s economic backbones with 1,200 businesses, and a regional connection to Denver International Airport accommodating 200,000 vehicles per day.

According to Colorado Department of Transportation, by 2040 the number of people living in the Denver metropolitan region is expected to soar to eight million people, thus making trips taken on the I-70 twice as long as they are now. The Central 70 Project involved upgrades to 10-miles of highway between Brighton Boulevard and Chambers Road, including one toll managed lane in each direction. There will be up to five lanes in each direction and there is the potential to add a further tolled lane at a future date. In addition, an existing ageing viaduct will be removed and the new highway will be constructed in a ‘cut and cover’ trench, which will allow for the development of a new sports area for a local school, as well as a four acre public park for the community.

The project commenced construction in 2018 and is scheduled to be completed in 2022. Revenue risk is retained by the Owner and the payment regime is availability-based.

Output Specifications Development Approach Used

The design and construction requirements in the specifications take a prescriptive approach and are based on existing CDOT Standards and Specifications, which are used by CDOT on its traditional design-bid-build projects. The output specification then incorporates performance measures, which align with the CDOT Standards and Specifications and reflect the project priorities, in order to administer an availability-based payment regime. The operation and maintenance requirements take more of an output specification approach than the prescriptive approach in the design and construction requirements. Failure to comply with these output specifications is classified as a “defect” which must be remedied to the required standard by the Private Partner within a certain period of time depending on the severity of the defect.

The Owner has made several commitments to the local community as part of the Central 70 Project and these are reflected in the output specifications.

These cover a range of issues, from mitigating the impacts of construction noise and dust, to contributing funding to affordable housing and fresh food access and local business opportunities. The output specification reflects these commitments, for example, there are performance measures for local business/employment opportunities (small business, disadvantaged business enterprise, emerging small business and on-the-job training) that result in financial deductions if not achieved.

The Private Partner is responsible for the operations and maintenance of the asset during the construction period as well as the subsequent operating term. The standard to which the asset must be maintained during construction is based on the existing condition of the asset as detailed in a baseline asset condition report (BACR) which the Private Partner must produce prior to commencement of the work. The BACR is subject to approval by CDOT.

Alignment to QI Focus Areas	Mechanisms used to achieve QI alignment	Market Comparison Analysis
<p>Sustainability and longevity of an infrastructure asset</p> <p>Ability of the asset to address the needs and meet the expectations of end users</p> <p>By transferring the operations and maintenance of the existing road to the Private Partner during the construction period, the Private Partner was enabled to balance construction phasing and schedules with the need to maintain an operational asset and minimise traffic disruption. The Owner established different performance measures for the construction period and the operating period to reflect the maintenance goals (short-term maintenance vs. long-term asset life). This was implemented through the Baseline Asset Condition Report (BACR) methodology described further below. By the end of the construction period, the whole asset was required to meet the operating period output specifications. Large amounts of the existing asset were demolished or upgraded as part of the construction work, therefore the Owner did not want the Private Partner undertaking redundant maintenance work during construction on parts of the asset that were identified for removal.</p> <p>Operations and Maintenance During Construction</p> <p>Prior to commencing construction, the Private Partner produced a BACR. The BACR formed the basis in determining the performance standards to which the existing asset would be maintained during construction and was translated into output specifications in the contract. Although the BACR was developed by the Private Partner, it was subject to Owner review. Here is an example of the measurable O&M requirements during construction and how they relate to the BACR:</p> <ul style="list-style-type: none"> • “Element: Pavement: All roadways, including ramps, detours, and shoulders (mainline including the bridge deck, covers, gratings, frames, expansion joints and boxes) <ul style="list-style-type: none"> – General Requirement: Smooth and quiet surface course with adequate skid resistance and free from Defects. – Category 1 Defect Remedy Period: 2 hours. – Category 2 Defect Remedy Period: 12 hours – Measurement Criteria: a) Localized deficiencies: Physical measurement, [...] d) Instances of pavement failures: Visual Inspection of roadway surfacing, e) Edge drop-offs: Physical measurement of edge drop-off level to adjacent surface. – Target: Maintain or exceed condition as identified in the BACR; No instances of drop-off greater than 1.0 inch; No instances of failure, including potholes, greater than 1.0 sq ft and 1.5 inch in depth; No instances of base failures, punch-outs and jointed concrete pavement failures; Maintained roadway (including shoulder) free from instances greater than 2”. <p>Operating Period Output Specification</p> <p>The output specification requirements for the operating period require a higher standard of maintenance to maintain the longevity of the asset. It is also a new asset being maintained, so instead of referring to the BACR, industry recognised standards are used as the baseline.</p> <ul style="list-style-type: none"> • Element: Pavement - All roadways, including ramps, detours, and shoulders (mainline including the bridge deck, covers, gratings, frames, expansion joints and boxes) <ul style="list-style-type: none"> – General Requirement: Smooth and quiet surface course with adequate skid resistance and free from Defects. – Category 1 Defect Remedy Period: 2 hours. – Category 2 Defect Remedy Period: 12 months. – Measurement Criteria: a) Ruts: Percentage of wheel path length with ruts greater than 0.40 inches in depth. Depth of rut at any spot location b) Ride quality: Measured International Roughness Index (IRI) calculated according to ASTM E-1926 using equipment meeting AASHTO M-328 and operated in accordance with AASHTO R-57, using equipment verified and operators certified according to AASHTO R-56. Localized roughness [...] c) Instances of Pavement Failures: Visual Inspection of roadway surface. Specific Defects are defined in Publication No. FHWA-RD-03-031, Long-Term Pavement Performance Program’s Distress Identification Manual. – Target: 80% of project has ruts less than 0.40 inches; Not greater than 0.55 inches; Throughout 80% of maintained roadway area less than or equal to 95 inches per mile on a contiguous 1/10th mile basis; [...] No instances of failure including potholes, base failures, delamination of pavement layers, blow-ups, faulting (> 0.12”), punchouts; [...].” 	<p>Financial deductions (Non-compliance Points): The performance measures are combined with a payment mechanism that assigns non-conformance points for defects to calculate financial deductions for defects. Non-compliance points are only incurred where the defect is not rectified within the remedy period.</p> <p>There are two classifications of output specification defects which have corresponding defect remedy periods depending on how significant or severe the defect is:</p> <ul style="list-style-type: none"> • Category 1 Defects – which require “Immediate Action” to address an immediate hazard, risk and/or nuisance. • Category 2 Defects – which require “Permanent Repair” which relates to rehabilitation work and has a longer response time, however must not progress to a Category 1 Defect. 	<p>Large-scale urban transportation PPP projects around the world often have to contend with the best way to transfer operations risk during construction. The risks will depend on the project and whether it is a new asset or an extension or replacement of an existing asset. Typically, at a minimum, there would be a requirement to manage traffic during construction. Mechanisms have their trade-offs, for example, a maximum queue length could be specified, however this requires a high level of administration. Alternatively, work hours could be limited, resulting in less disruption and lane closures, which can increase cost and impact on the schedule. Project-specific requirements should be considered during the planning phase and included in the cost estimate.</p>

Alignment to QI Focus Areas	Mechanisms used to achieve QI alignment	Market Comparison Analysis
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Handback and Inspections

The Private Partner is required to handback the asset to the Owner on the expiry of the contract such that the applicable output specification for each respective part of the asset is met or exceeded; the residual life for the various elements within the asset must meet or exceed their residual life minimum requirement; all renewal work identified as needing to be performed in accordance with the most recently accepted renewal work plan has been completed; and all associated inspections have been completed to verify the asset meets the various performance requirements.

For example, specific handback requirements for bridge decks include a prediction of deterioration due to reinforcement corrosion over time based on the various regularly scheduled mandatory bridge inspections undertaken over the course of the contract. Such inspections are undertaken by independent consultants who must be approved by the Owner.

Social impacts and inclusiveness

The project applied lessons learned which were identified through audits of two previous PPP projects (the US 36 P3 Project and the Eagle P3 Rail Project) to improve community engagement through project delivery. The Owner of this project aimed to reconnect communities by removing the viaducts and replacing them with a community park, and promoting corridor-wide economic and community vitality. To achieve these benefits, the output specification requires the Private Partner to deliver community development programs.

Community development program requirements:

- *“Establish a college scholarship program that will benefit students enrolled during the Construction Period as students of good standing at Swansea Elementary school. The scholarship program shall be designed for students who go on to successfully obtain a high school degree or equivalent, and who subsequently are accepted to and enrol in a two- or four-year associates or bachelors degree program. The Developer may partner with a foundation or other non-profit in the management and allocation of such scholarships;*
- *In partnership with Swansea Elementary school, develop and/or fund a construction education curriculum for the school designed to impart math and engineering concepts relevant to the construction of the Project; and*
- *Establish any other programs that it considers appropriate for the purposes of achieving the community development objective referred to above in relation to such neighbourhoods.”*

In addition, the Private Partner shall *“provide a full-time Spanish/English bilingual Community Liaison with experience in and knowledge of the Swansea-Elyria neighborhoods [...] and be responsible throughout the CC Term for ensuring that local residents, businesses and non-profit groups are informed about the Project and have a single point of contact for all questions and concerns”.*

Financial deductions (Non-compliance Points): The Private Partner is required to develop plans that detail how the work will be delivered in compliance with the output specifications. They are then required to implement the works in accordance with the plans. Failure to do so would result in a Non-compliance Event (with associated Non-compliance Points). For example, the Non-compliance Event for communications does not specifically mention the requirement for the “Spanish/English bilingual Community Liaison”, however the Communications Plan is specifically mentioned and the “Community Liaison” requirement is included in this plan. Therefore, this requirement is captured in the following non-compliance event:

- *“Prepare, maintain and implement the Construction Period Communications Plan (the requirements for which are detailed in Section 5 of Schedule 14 (Strategic Communications) or the Crisis Communications Plan (the requirements for which are detailed in Section 7 of Schedule 14 (Strategic Communications)).”*

The National Environmental Policy Act (NEPA) in the United States typically requires a comprehensive assessment of the project development be conducted with respect to its environmental and social impact on the local community. This also can include a public engagement exercise which can result in particularly prescriptive commitments being generated which need to be adhered to. This is not always the case and will largely depend on the location and scale of the project.

Job creation, capacity building and transfer of knowledge and expertise

As part of the community development program (refer to ‘Social impacts and inclusiveness’), the Private Partner is required to “establish an organized program to assist businesses in taking advantage of the significant business opportunity provided by the local workforce during the Construction Period”. This is in part due to the lessons learned from previous projects and the need to improve community engagement.

- **Community development program:** The program includes *“a commitment to work with restaurants, food vendors and catering businesses that are located within such neighbourhoods and are likely to be impacted by the Construction Work. (The) program may include the following elements:*
 - *Business investment revolving loans and/or grant programs;*
 - *Property access agreements for food carts and food trucks;*
 - *Coupon programs;*
 - *Advertisements; and/or*
 - *Partnerships with food-access non-profits.”*

Financial deductions: The Private Partner is exposed to financial deductions if the local business targets are not met. The deductions are calculated per Work Category and are different for the construction period and operating term to reflect the relative value of the opportunity lost. During the operating period, the deduction refers to an independent source of labour rates to determine the value of the deduction.

Construction Period

- *Failure to Achieve Construction Work Small Business Goals “Relevant Construction Work Small Business Goal Percentage less Actual Percentage of Relevant Participation Achieved) x (Total Dollar Value of, as applicable to the relevant goal [...]”*
- *Failure to Achieve Construction Period On-The-Job-Training (OJT) Goal deduction = (Construction Period OJT Goal less Actual OJT Employment Hours on Other Construction Work during the Construction Period) x \$28.50*

Quantifiable performance measures are the typical way for projects with job creation objectives to align the Owner and Private Partner priorities. There are similarities in approach between this project and the Gautrain Rapid Rail Link project case study, found below. Good practice is to include requirements for both the construction and operating term.

Alignment to QI Focus Areas Mechanisms used to achieve QI alignment Market Comparison Analysis

The State of Colorado also wanted to use the project to improve job opportunities in the area, which historically has had low-income levels and high unemployment. To achieve this, the Owner specified measurable local business targets for both the construction and operations phases.

- **Local business targets:** The percentages identified in the table below are a percentage of the total value of the work associated with the project under the particular Work Category.

Work Category	Disadvantaged Business Enterprise	Emerging Small Business	On-the-Job-Training	Local Hiring
Construction Period				
Design Services	11.6%	3%	N/A	760,000 total employment hours with 380,000 employment hours performed by new hires
Other Construction Work	12.5%	3%	200,000 employment hours	
Routine O&M Work	N/A	3%	N/A	
Operating Period				
Routine O&M Work	N/A	\$. (indexed) for each five Contract Year period	N/A	N/A
Renewal Work	% to be established for each five Contract Year period	N/A	Number of employment hours to be established	N/A

Operating Term

- Failure to Achieve Routine O&M Work Emerging Small Business (ESB) Goal
- Failure to Achieve Renewal Work Disadvantaged Business Enterprise (DBE) Goal
- Failure to Achieve Renewal Work OJT Goal = $(\text{Renewal Work OJT Goal} - \text{less Actual OJT Employment Hours on Renewal Work during applicable Contract Year}) \times ((\text{the then-current Davis-Bacon Minimum Wage (Basic Hourly Wage + Fringe Benefit) for a "Power Equipment Operator, Backhoe/Loader combination" in Denver County}))$

Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology

During the planning phase, the Owner recognised that the requirements, and what is considered good practice, will likely change over the operating term. There is a mechanism in the contract for either the Private Partner or Owner to propose changes to the performance requirements.

- **Updates to the performance requirements:**
 - “Developer may submit to the Department for Approval proposed updates, if any, to the Performance and Measurement Table no later than 90 Calendar Days before the then anticipated Substantial Completion Date to reflect Good Industry Practice and specific attributes of Developer’s final plan set (for example, where the final plan set incorporates a feature that is not included as an Element in such Performance and Measurement Table). Developer may thereafter submit to Department for Approval any proposed updates no later than 60 Calendar Days before the start of each subsequent Contract Year to reflect Good Industry Practice.
 - “The Department shall be entitled at any time to require the Developer to adopt amendments to any of the Performance Requirements in such Performance and Measurement Table where such amendments are required to comply with then-current Good Industry Practice and under the following conditions:
 - o The measurement scale associated with the original Measurement Criteria is superseded and no longer complies with Good Industry Practice; and
 - o The new Target shall be determined using the principle that compliance with the new Target shall achieve the same standard of performance, frequency of O&M Work and User satisfaction as would have been achieved through Developer’s compliance with the original Measurement Criteria and Target.”

There is no performance measure associated with this requirement. However, the contractual process is time-bound and specifies when and how often (no later than 60 days before the end of the contract year) the changes can be considered.

Incorporating a mechanism to review and update the performance requirements over the operating term is good practice. The first review is typically done during the operational readiness phase where the requirements are updated to reflect the constructed asset, then updates are typically done annually or because of a change.