Agency/Project	Best/Worst Practice Type	Best/Worst Practice Summary
Marron Institute: The Boston Case - The Story of the Green Line Extension (MBTA)		https://transitcosts.com/city/boston-case-the-story-of-the-green-line-extension/
	Organizational Cost Control Stakeholders	Establish a focused agency capital construction team. Discipline the budget and stick to the core goal: • Do not routinely "push the yes button" for stakeholder requests to add an element. • With so much emphasis on outreach, scope was added every time someone complained, rather than someone with power saying no and explaining why scope couldn't be added. • Eliminate iconic headhouses, personnel rooms, fare vending, escalators, and redundant elevators (less ornate and less bespoke stations). Push back on politically driven restrictions on construction operations: lane closures, construction windows, and haul routes.
Massachusetts Legislature Joint Committee on Transportation: The Safety Management Practices of the MBTA		https://www.masstransitmag.com/management/news/21291546/ma-legislators-favor-paring-down-mbta-to-subway-bus-operator-only-report-says
	Organizational	For large, complex capital projects, consider the use of the newly created High Performance Project Office within MassDOT: • The MBTA should no longer be viewed as a "construction company."
Eric Goldwyn: Why Can't America Build Trains?		https://noahpinion.substack.com/p/why-cant-america-build-trains
	Stakeholders Scope Control	Remove difficult utility relocations from contractors' scopes of work to reduce risk exposure. Transit agency operating departments often slow down projects and add scope (e.g., MTA & MBTA).
Governing: Why Are U.S. Transit Projects So Costly?		https://www.governing.com/finance/why-are-u-s-transit-projects-so-costly-this-group-is-on-the-case
	Planning Project Delivery	Elected officials, who feel the heat, might say: • "Let's study this alternative." • "Let's not make a decision on this for another three months." • "Let's extend the comment period so people can air whatever they want to air." Sound Transit's West Seattle Ballard is an example of an extended comment period which postponed the decision on a locally preferred alternative. Agencies should self-perform some of the design, planning, and early engineering.
UC Berkeley: Getting Back on Track, Policy Solutions to Improve California Rail Transit Projects		https://escholarship.org/uc/item/3xq7q69t
	Organizational Scope Control Stakeholders Project Delivery Project Delivery	Build megaproject management capacity and expertise: • Create transit megaproject delivery teams. Maintain project scope and right-size design: • Work with contractors and stakeholders to identify necessary project enhancements and high cost items during planning and avoid unnecessary enhancements during construction. • Avoid adding significant, non-essential betterments and limit bespoke design for extraneous station elements. External coordination: • Develop permanent, ongoing structures to communicate and coordinate among multiple agencies. • Form an early stakeholder coalition to build support for the route/design, streamline negotiations, and minimize the risk of costly delays. Early collaboration: • Use delivery methods that emphasize early collaboration and place greater risk on contractors to deliver greater accuracy in designs and timelines. • Split project tasks among multiple, smaller contractors where possible to avoid ceding too much leverage to one contractor. • Consider advance utility relocation contracts. Systems design, procurement, and testing should be separate from other contracting and the direct responsibility of the agency (i.e., not the design-builder).
McKinsey: Megaprojects - The Good, The Bad, and The Better		https://www.mckinsey.com/capabilities/operations/our-insights/megaprojects-the-good-the-bad-and-the-better
	Planning Scope Control Execution	Avoid overoptimism and overcomplexity: • Costs and timelines are systematically underestimated and benefits systematically overestimated. • Use "reference-class forecasting," which addresses confirmation bias by forcing decision-makers to consider cases that don't necessarily justify the preferred course of action. Poor execution: • With an unrealistically low budget, the temptation is to cut corners to maintain cost assumptions and protect the (typically slim) profit margins for the firms contracted to deliver the project. • Problems from planning and design through construction include incomplete design, lack of clear scope, and ill-advised shortcuts. While manufacturing sector productivity has approximately doubled over the past 20 years, construction productivity has remained flat or even declined.

	Organizational	Weakness in organizational design and capabilities: • Many entities building megaprojects have an organizational structure where the project director sits four or five levels down from the top leadership. • Megaprojects may have to create organizations of several thousand people in 12 to 18 months -- a significant operational and managerial challenge equivalent to creating a new start-up company.
	Cost Control	Lack of adequate controls: • Need for robust risk-analysis or risk-management protocols. • Provide timely reporting on progress relative to budgets and timelines.
	Stakeholders	Streamline permitting and land acquisition with best practices: • Prioritizing projects. • Defining clear roles and responsibilities. • Establishing time limits including on public review. • Providing “one stop shop” permitting.
The Boston Globe: For Infrastructure Projects to Succeed, Think Slow and Act Fast		https://www.bostonglobe.com/2021/04/01/opinion/bidens-transportation-projects-succeed-think-slow-act-fast/
	Planning	Rigorous planning: • Use proven, scalable, and modular technologies. • Accurately forecast costs and timelines, spot problems, and mitigate risks.
Project Management Institute: Bent Flyvbjerg, What You Should Know About Megaprojects and Why: An Overview		https://www.pmi.org/-/media/pmi/documents/public/pdf/research/research-summaries/flyvbjerg_megaprojects.pdf
	Planning	Four drivers explain megaprojects' growth and development: • “Technological” describes the excitement engineers get in pushing the envelope in “longest-tallest-fastest” type projects. • “Political" is the tendency politicians have for constructing monumental infrastructure. • “Economic" describes the delight business people and trade unions get from making lots of money and jobs. • “Aesthetic" is the pleasure designers and people who appreciate good design derive from building and using iconic and beautiful megaprojects.
	Planning	Poor performance in terms of actual costs and benefits results because the following characteristics are overlooked: • Megaprojects are inherently risky due to long lead-times and complexity. • Often the managers and planners in charge do not have deep domain experience. • The decision process typically involves multiple actors and stakeholders with conflicting interests. • Technology and design are usually non-standard, leading to “uniqueness bias” with managers. • Frequently there is early lock-in of commitment to a certain project concept, leaving analysis of alternatives weak or absent. • Megaprojects involve large budgets, encouraging rent-seeking behavior. • The scope typically changes significantly over time. • Delivery is a high-risk activity with overexposure to massive negative outcomes. • Statistical evidence shows that complexity and unplanned events are often unaccounted for in the budget. • Misinformation about costs, schedules, benefits, and risks cause cost overruns, delays, and benefit shortages; and undermine project viability.
	Execution	Break-Fix Model: • Managers and planners do not know how to, or have the incentive to, deliver successful megaprojects. Consequently, projects tend to break sooner or later. • After a major “break,” projects are usually paused and reorganized in an attempt to “fix” problems and deliver some version of the initially planned project with a semblance of success. • The break-fix model is wasteful and leads to misallocation of resources.
Eno Center: A Blueprint for Building Transit Better		https://projectdelivery.enotrans.org/report/
	Organizational	Define a clear structure for organizational decision-making: • Small, multi-disciplinary internal management teams with experienced executives can deliver projects effectively when empowered to address issues and make on-the-spot decisions. • Temporary, independent, special purpose delivery vehicles (SPDV) have the ability to manage and focus on complex projects before handing the ownership and operation back to the public agency. • Invest in better training and support for staff who are responsible for overseeing, monitoring, and managing projects.
	Project Delivery	Contracts should not be too large to be effectively managed and procurement goals should be realistic.
	Stakeholders	Dedicate enough staff with utility relocation expertise: • Utility expertise should be brought in early during the planning phase and remain through the duration of construction. • Sign agreements early in the development process. • Relocate or identify as many utilities as practical prior to construction (reportedly, every $1.00 invested in early utility identification saves $4.62 in future delays, scope changes, and re-excavation).

	Cost Control	Deemphasize customization: • Standardize sizes, materials, and components. • Use a modular "kit of parts" to save on construction costs and speed up delivery. • Allow for customization and variation in station layout while maintaining durability, consistent appearance, and cost-effective construction and repairs across the
	Stakeholders	Enact a policy that clearly outlines when and how stakeholders can request project betterments: • Formalize a process to evaluate whether to grant the request. • Require the requesting entity to cover the cost in most circumstances. • Use community benefit agreements to address community concerns which are useful if conducted early in the process.
	Organizational	Change orders should only require formal board approval if they exceed the project budget (LA Metro): • This greatly expedites project decision making. • Regular reporting on change order status is still required, providing a high level of transparency while also enabling an efficient process.
Ottawa LRT Commission: Report of the Ottawa LRT Public Inquiry		https://www.ottawalrtpublicinquiry.ca/files/documents/Report-of-the-Ottawa-Light-Rail-Transit-Public-Inquiry.pdf
	Planning	The introduction of new technology inevitably causes start-up problems: • The City's technical demands strained the limits of an LRT. • Introducing new or untested project elements (including technology and workforce) increases project risks. • Where possible, public entities should give preference to service-proven designs, components, labor markets, and supply chains.
	Project Delivery	By using a P3 delivery model: • The City avoided significant financial liability during the construction phase. • It also diverted the parties' attention into protecting their legal rights instead of opening a reliable LRT when problems arose. • One of the primary rationales for using a P3 is to transfer risk; however, the City traditionally had a hands-on, leading role in their projects. • Under this model, the City was in a position where it had limited insight or control over the project.
	Project Delivery	It may not always be helpful to structure the P3 relationship to create a zero-sum game whereby one party bears all the risk and "loses" if that risk materializes. A true partnership may be more effective.
	Execution	The system was rushed into operations due to considerable political pressure. Even though significant operating issues remained, the work was declared Substantially Complete. To begin operations, compromises were made, including: • Deferring work. • Waiving requirements. • Delaying addressing known problems.
	Execution	Early attention must be paid to systems integration: • A single, qualified systems integrator should be involved in the project from design through construction. • Integration roles, responsibilities, and deliverables should be properly defined. • Required systems integration was compromised by subcontractors operating in silos. These decentralized arrangements made it essential for the parties to integrate their efforts and engage in near-constant communication, which did not occur.
	Planning	Optimism bias in project planning leads people to underestimate project costs and risks. Public entities should use established approaches such as reference- class forecasting, which uses data about prior projects and their outcomes to account for unconscious biases and unanticipated risks.
	Planning	Public entities should avoid, wherever possible, introducing complexity into the major project components. For example, the differences between stations should be kept to a minimum.
	Project Delivery	Early resolution of disputes should be incentivized in project agreements. Resolving operational problems and providing reliable operations must take precedence over all other priorities, including contract enforcement.
	Execution	The handover process between the entities responsible for construction, and for operations and maintenance must be clearly and formally defined.
Eno Center: Case Studies, Denver		https://projectdelivery.enotrans.org/home/case-studies/
	Organizational	T-REX was an RTD/CDOT joint effort: • It allowed the project to benefit from existing institutional capacity at CDOT. • The ROW acquisition process used in-house CDOT appraisers and existing CDOT ROW forms.
	Planning	Frequent reflection through lessons-learned documents enabled the agency to learn from its missteps.
	Project Delivery	Public-Private Partnerships: • RTD filled senior and key staff management positions with professionals who were highly-experienced in P3s. • P3 models transfer much of the control over project details to the private consortium, which may help expedite procurement and delivery. • With a P3, much project risk is transferred to the private sector, but project sponsors must still do due diligence to understand the level of risk transfer and provide proper oversight. • RTD had little prior experience with many processes and the agency held pre-construction meetings with stakeholders like vendors, financiers, and railcar providers to get a better understanding of the project's risk. • RTD determined that a strong legal and financial counsel team was a necessary component of a P3 since "it is at the core a business deal rather than a traditional construction contract."

	Project Delivery	Project delivery results varied: • DB and DBFOM project delivery maximized contractor innovation and helped projects get completed faster. • CM/GC project delivery required early buy-in from RTD as the designer, but in practice RTD and the contractor were not always in agreement about project details. Also, negotiations were challenging and "there is no substitute for the discipline of the marketplace under a competitive bidding environment." • DBB was found to be best used for smaller projects or those that involve high levels of risk.
	Organizational	RTD adopted a delegated authority approach for management: • Major decisions were approved by designated managers rather than going through all of the levels in the chain of command which resulted in faster turnarounds on key decisions and thus fewer project delays. • Change orders did not require board approval unless the amount exceeded the overall project budget. This enabled quick decision making and expedited the work.
	Operations	Cost-Benefit Analysis: • Elements such as double tracking and additional crossovers were determined not to provide a positive cost-benefit ratio and were deleted. • Items such as the incorporation of a redundant substation were retained.
USDOT Build America Bureau: P3 Project Highlights		https://www.transportation.gov/buildamerica/projects/project-highlights
	Project Delivery	Project profiles provided for twenty P3 transportation projects.
Harvard Business Review: Bent Flyvbjerg, Make Megaprojects More Modular		https://hbr.org/2021/11/make-megaprojects-more-modular
	Execution	Two factors play a critical role in determining whether an organization will meet with success or failure: replicable modularity in design and speed in iteration: • If a project can be delivered fast and in a modular manner, it is likely to succeed. • If it is undertaken on a massive scale with one-off, highly integrated components, new technologies, and customized designs, speed and modular scale-up are hindered.
	Execution	Madrid Metro: • No new technology: The project eschewed new construction techniques, designs, and train cars. They cared only for what worked and could be done fast, cheaply, safely, and at a high level of quality while taking existing, tried-and-tested products and processes and combining them in new ways. • Speed: The more time allowed, the more bad stuff could occur including unpredictable catastrophic events, or so-called black swans. Tunneling work was organized for speed using multiple tunnel-boring machines. • A feedback system was set up to avoid time-consuming disputes with community groups, and they were persuaded to accept tunneling 24/7, instead of the usual daytime and weekday working hours, by asking openly if they preferred a three-year or an eight-year tunnel construction period.
Legislative Assembly of Ontario: Building Transit Faster Act, 2020		https://www.ola.org/en/legislative-business/bills/parliament-42/session-1/bill-171
	Stakeholders	Metrolinx, Toronto: • Corridor Control: Along transit corridors or in their vicinity, development requires a permit, with some exception for already approved projects. Things that pose an obstruction to construction or pose an immediate danger can be removed. Also, preview inspections may take place, in which property is entered and tested for due diligence in planning and construction. • Utility Company Cooperation: A mechanism is provided by which utility companies may be required to move utility infrastructure, if necessary for transit. • Municipal Service and Right-of-Way Access: A mechanism is provided for municipal service and right-of-way access as required for transit. The process is based around negotiation, with the possibility for an order if negotiation fails. • Administration and Enforcement: Many of the powers of the Minister may be delegated to Metrolinx or to prescribed public bodies, and Metrolinx's powers in respect of utility company cooperation may be delegated to other entities engaged by Metrolinx. Enforcement tools include stop-work orders, inspections, administrative penalties, and offences.
Australia: Model Work Health and Safety Bill		https://www.safeworkaustralia.gov.au/sites/default/files/2022-06/model_whs_bill_-_14_april_2022.pdf
	Planning	The designer must ensure structures are designed to be safe when used as a workplace during its lifecycle. This includes during construction and for its intended use, as well as for maintenance, cleaning or repair of the structure, and its eventual demolition at end of life.
WMATA: 10-Year Strategic Plan for Joint Development		https://wmata.com/business/real-estate/upload/WMATA-10-Year-Strategic-Plan-for-Joint-Development.pdf
	Planning	The 10-year Strategic Plan for Joint Development on Metro-owned property is focused on existing stations and includes housing, retail, offices, and hotels. Strategies include: • Partner with local jurisdictions. • Right-size transit facilities. • Increase development readiness. • Minimize implementation risks.
Construct Connect: Communications Providers Bypass Big Dig's Hidden Duct System		https://canada.constructconnect.com/dcn/news/others/2008/05/communications-providers-bypass-big-digs-hidden-duct-system-dcn027857w
	Scope Control	Question all design criteria: simple things like "future" conduits and spares add up over many miles.