



**1-02.1 PURPOSE.** This section covers the initial steps necessary to identify transportation needs, properly scope solutions to those needs and develop commitments for inclusion in the Statewide Transportation Improvement Program (STIP). Guidelines are also included for the preparation of appropriate project cost estimates at various milestones and the required documentation of those estimates.

A project's scope can be defined as the set of design parameters that precisely satisfy the purpose and need of the project. A poorly identified scope that is broader than the purpose and need will result in an unnecessarily high project budget and lengthy schedule, while a scope which falls short will yield a project that accomplishes little of significance. Further, a construction program based on poorly scoped projects will eventually fragment, whether by expanding the scope to meet the need during the design process or through field adjustment to correct errors and additional needs during construction.

**1-02.2 GENERAL OVERVIEW.** When transportation needs arise, planning staff will prioritize them and present them to the project manager, marking the commencement of project development. The project manager will then assemble the core team and begin to analyze the need in search of a solution. As development proceeds, more and more aspects of the project will become apparent and the core team, acting through the project manager, will adjust the scope accordingly.

The complete project scoping process involves determining the root causes of the need, developing a range of possible solutions to address the need, choosing the best solution, setting the physical limits of the project, accurately estimating the cost of the project, and forecasting the delivery schedule of the project. The core team will use available data, meetings, field checks, and public input to accomplish these tasks.

When the appropriate level of confidence in the scope has been reached there is a point of concurrence where the proposed scope is submitted for approval as to whether or not it addresses the original need. The level of concurrence sought is dependant upon the nature and complexity of the project. Right of way and construction funds, as well as the delivery date, will only be publicly committed to a project subsequent to this approval and after having gone through the project prioritization process.

**1-02.3 NEEDS IDENTIFICATION.** Correctly identifying needed improvements to Missouri's transportation system is one of the essential elements that can help determine the success of MoDOT's transportation improvement program. Once the needs are identified they must then be prioritized to ensure MoDOT is addressing the most important needs first because the needs of the transportation system far outweigh the available funding. The compilation and prioritization of needs is a continuing process since the condition of the transportation system is continually changing.

Needs are identified in many ways across the state. Transportation Management Systems (TMS) are updated regularly with pavement and bridge condition data, which can be used to indicate rehabilitation and reconstruction needs. Area engineers, often working with local officials, are aware of specific needs within their area. Customer service operators note the number of calls regarding a specific problem or concern, such as an intersection. Citizens may approach their elected officials with concerns about a certain stretch of roadway. Metropolitan planning organizations conduct their own needs analyses as they develop their long-range transportation plans. There are many methods by which needs can be identified, however, it is much more difficult to actually define what constitutes a need.

Some argue using the term "need" gives legitimacy to a "want" before a determination is made regarding the necessity of the transportation improvement. Whether it is truly a need or simply a "perceived need" or a "want," MoDOT still has a responsibility to consider it and prioritize it on its merit against other needs. If it is not truly a need, then it will likely fall out as a low priority.

**1-02.3 (1) TYPES OF NEEDS.** Needs can be categorized into two main categories:

- Physical system needs
- Functional needs

A physical system need is best described as a need that can be determined by a condition rating. These needs will most likely be indicated by the condition data from the TMS. Pavement and bridge condition data can be used to indicate rehabilitation and reconstruction needs.

Functional needs are those categorized as improving an operational aspect of the transportation system. These needs may be indicated by items such as poor level of service on a section of roadway, inadequate capacity at an intersection, or poor roadway geometry that does not accommodate the type of vehicles present at the location.

Transportation planning maintains a needs database to track transportation needs in a coordinated effort. The database provides a mechanism through which MoDOT can track needs as they are identified in a useful format. A baseline level of detail is associated with each need and can be shared on a consistent basis between MoDOT and its planning partners.

**1-02.3 (2) FISCAL CONSTRAINTS.** Funding constraints make it increasingly important to evaluate and prioritize needs, so that the most important projects get built first. When MoDOT works with its partners to identify the needs, at least in the early stages, financial constraints are minimal. The desire is to develop a list of all possible needs to be evaluated. Constraining this list would not allow a full picture of all the needs that exist. It would also not be prudent to constrain the list financially at this stage because the solution has not been determined and there is no sound estimate of cost associated with it. Fiscal constraints are first employed in the needs prioritization process described in [Subsection 1-02.4](#).

**1-02.3 (3) DEFINING THE NEED.** An important element in MoDOT's project scoping process is the delivery of the data that defines the need to the project manager. One item that is purposely omitted from this data is any assumption of possible solutions of the need. Assumption of solutions at this early stage may limit or bias the search for root causes to the problem and the range of possible solutions considered.

Identified and prioritized needs are assigned to project managers at the beginning of the project scoping process. This will allow the project manager and the core team to determine the correct solution to satisfy the need and establish an accurate budget and reasonable project delivery schedule prior to making any STIP commitments.

Transportation Planning shall include data to indicate if this need will fall into the Major Projects category or not. In order to facilitate the measurement of the solution's success in satisfying the need, Transportation Planning will include success measures and expectations of the solution with the data provided to the project manager. As the scoping process is carried out for the need, the core team will also create a list of additional success measures as the project is developed.

The definition of exactly what data constitutes an identified and prioritized need may vary depending on the nature of the need. In any case all of the data that Transportation Planning has collected in the needs database will be provided to the project manager. From this data the project manager and core team will search for root causes and develop a range of solutions.

**1-02.4 NEEDS PRIORITIZATION.** Because the definition of transportation needs is broad and can encompass many things, the identification of needs will likely result in a very long list of items from which MoDOT will develop its projects. It is necessary to prioritize transportation needs to help MoDOT decide which needs to address first.

The prioritization of needs is related indirectly to the projected construction budget for future years. Because of the nature of transportation needs, the ultimate project specifics and costs are not known until much later in the project development process. However, most needs will lend themselves to a solution that can be matched with one of the various funding categories that MoDOT has available. Therefore, it is important to consider the funding levels of the various construction categories when selecting needs for initialization of the project scoping phase to identify

solutions.

- 1-02.4 (1) DESCRIPTION AND PURPOSE.** Needs prioritization is based on the goals in Missouri’s LRTP. MoDOT districts will work with planning partners to prioritize regional needs annually. Statewide needs will be prioritized when MoDOT’s LRTP is updated; however, emerging needs can be added to the needs priority list between updates. Both regional and statewide needs will be prioritized using the processes established in the planning framework Practitioner’s Guide in MoDOT’s LRTP, which are based primarily on objective data. The two categories of needs, physical system needs and functional needs, are prioritized using similar, but separate, evaluation criteria.

The prioritized list of needs is a tool used to help determine those needs that merit further study or engineering work. The prioritization process is not meant to be used as a “black box” to dictate the programming of major investment studies and engineering projects. Other factors such as funding availability, staff resources, preliminary engineering budget, and the practical potential to address the need are all part of the decision-making process for including funding for preliminary engineering and planning studies in the STIP. Using the results of the prioritization process as a starting point, MoDOT districts will work with planning partners to divide needs into three categories.

- High – Resources are focused on addressing these needs first. They are the first to be selected for preliminary engineering.
- Medium – These needs may be addressed as additional resources become available.
- Low – No work is in progress to address these needs at this time.

- 1-02.4 (2) PRIORITIZATION SCHEDULE.** MoDOT district planning staff, working with their planning partners, will conduct the needs prioritization process annually. The needs prioritization process will be conducted on a schedule that will allow the results to be incorporated into the annual schedule for completion of the STIP. At this point only funding will be placed in the STIP for preliminary engineering of selected high-priority needs. This will allow commencement of the scoping of possible solutions to the need.

- 1-02.4 (3) FISCAL CONSTRAINTS.** Needs prioritization is not constrained financially, but the high-priority needs list is constrained to approximately 10 years of construction funds. This constraint is intended as a guideline and not an exact figure. Districts will need to assume a probable solution for the need and order-of-magnitude costs to apply this financial constraint. (See [Subsection 1-02.5](#)) Needs selected for preliminary engineering will be taken from the high-priority needs list.

The number of needs selected for scoping is limited to an appropriate amount for district resources. Each time needs are prioritized existing needs will be re-evaluated. Some high-priority needs may never be designed or constructed due to prohibitive costs, changing priorities or other reasons.

Needs whose potential solutions are of a magnitude that cannot be funded within a five-year timeframe may not fit well into this constraint. A group called the Rural Major Projects Task Force will program these larger-scale needs. This group is discussed in the planning framework Practitioner’s Guide in MoDOT’s LRTP.

- 1-02.5 INITIAL PROJECT ESTIMATES.** Various sections of this chapter direct staff to make no public commitments of cost or delivery time until the project is fully scoped. This does not mean that staff should refrain making initial estimates of construction cost and right of way needs for internal planning and resource needs. It only means that these initial estimates should not be included in any public documents, agreements or primarily the STIP.

There is still a need to produce initial estimates early in the scoping process in order to determine the order of magnitude for the range of solutions to the need. These may include initial estimates of the construction cost and right of way needs well before the plans have reached the level of development that will allow and an estimate to be based on preliminary plan quantities and units costs.

Once a range of solutions is determined an initial project estimate for each can be developed in one of two ways. A previously constructed project of similar type and conditions may be used to develop cost per mile factors that are

applied to the estimated project length or the generic cost per mile factors included in [Figure 1-02.1](#) may be used. The generic cost per mile factors are derived from historic cost data and are updated periodically to reflect current prices. Should the estimator determine that deviations from the generic cost per mile factors are warranted, the reasons shall be well documented in the project estimate file.

Although this method of estimating project costs is acceptable for internal use, the estimated plan quantity and unit cost type estimate is the preferred method and should be used whenever there is sufficient plan detail available to allow its use. Estimates based on cost per mile factors shall in no case be considered to contain sufficient detail to allow their inclusion in the STIP.

**1-02.6 PROJECT SCOPING.** Project Scoping is a process that is used to clearly define transportation needs and to determine the appropriate means to address them. This involves determining the root causes of the need, developing a range of possible solutions to address the need, choosing the best solution, setting the physical limits of the project, accurately estimating the cost of the project, and forecasting the delivery schedule of the project.

The purpose of project scoping is to develop the most complete, cost effective solutions, as is practical, early in the project development process. This is foundational to avoiding major design changes, large estimate adjustments, and last minute project changes later in the project development process. With proper project scoping, such changes will be minimized and will have reduced impacts on the overall project. Proper project scoping of all needs leads to a more balanced, consistent construction program.

Project scoping should not be thought of as a separate, stand-alone process from the project development process. It is, instead, the initial stage of the project development process where the details of appropriate solutions are developed. Project scoping begins with the delivery of the need to the project manager and continues until the elements and limits of a project become so well-defined that accurate costs and project delivery schedules can be forecast. A flowchart depicting the project scoping process can be found in [Figure 1-02.2](#).

**1-02.6 (1) TIMELINE.** The determination of when the scoping is completed for a project will be based on the best combination of many factors and may vary for each individual project. The nature and complexity of the project, the requirements for showing STIP commitments, the time when project scoping begins and the timing of the yearly programming cycle will all help determine when right of way and construction dollars are first shown in the STIP for the project. However, the work to develop a project scope should not be tied to a specific programming deadline but rather, should be dependent on the nature and complexity of the need and proposed solution.

Solutions developed in the project scoping process can vary greatly in terms of timeline, costs, other agency involvement and public involvement. Some needs may be addressed by MoDOT field personnel in a relatively short time frame. Other needs may require years of conceptual engineering and environmental studies. With such varied degrees of time in scoping, a general project scoping timeline cannot be defined. If scoping yields projects to be included in the STIP, there will certainly need to be some coordination of timelines with the development of the construction program. Again however, the proper development of the project scope should be the driving factor rather than possibly compromising the completeness of the scope in order to meet a STIP timeline.

**1-02.6 (2) COMPLETION OF SCOPING.** The point at which the project becomes “well-defined” is not an absolute milestone and some amount of judgment must be exercised by the project manager and core team to determine the exact point at which the project has been developed to enough detail to predict accurate right of way costs, construction costs and delivery schedule. For example a project that has no right of way needs and a limited scope of work will reach the end of the project scoping process much quicker than a very complex project. However, the relative level of details developed through the project scoping process should be comparable. The ultimate goal of the project scoping process is to perform enough of the project development process that reasonably accurate STIP commitments can be made.

For most projects the minimum level of project development that is necessary to accurately identify the costs and delivery schedule of a project occurs at the Preliminary Plans stage. On the other extreme, the most accurate estimates that the core team can produce are made when there is the greatest project knowledge

available (completed final plans). However, MoDOT realizes that the practicality of obtaining the most accurate estimates possible is not feasible for the purposes of making STIP commitments. Commitments need to be made to the public prior to the investment of the level of effort needed to complete the project design.

The best balance between the degree of accuracy required to make the STIP commitments and the level of design effort that should be expended prior to making commitments generally occurs sometime after the Preliminary Plans have been developed. However, the Preliminary Plan stage is not an absolute milestone and it will be the responsibility of the project manager and core team to determine the exact point at which the project is detailed enough to predict accurate right of way costs, construction costs and delivery schedule. Until the proper amount of scoping has been performed to clearly define the project attributes, only preliminary engineering funds should be included in the STIP.

A preliminary plan is required for every project. The requirements for preliminary plans are contained in [Section 2-06](#). The plan is developed to show preliminary geometric details, and includes design criteria, proposed alignment, profile, tentative grade, tentative right of way, schematic intersection or interchange layouts, bypasses and pertinent topographic features. For some projects this minimum level of project development will be adequate to predict accurate right of way costs, construction costs and delivery schedule. Other more complex projects may require a greater level of development in order to achieve the desired level of accuracy.

- 1-02.6 (3) REQUIRED ITEMS TO BE CONSIDERED AND ADDRESSED.** At the completion of project scoping all of the items that could possibly affect the scope of the project will have been discussed by the core team. Decisions with regard to how each of these items will be handled shall be documented for future reference. These items not only include the concept of the project but also items such as consideration of how traffic will be handled during construction, any special working restrictions that may be placed on the contractor, incentive/disincentive clauses, contract acceleration clauses, environmental constraints, environmental mitigation commitments, etc. The project scoping checklists described in [Subsection 1-02.8](#) provide a summarization of the most common items that may be associated with a project. The items on each of the core team member's checklists and any others pertinent to the project should be addressed prior to completion of scoping.

Most importantly the project manager and core team should ensure that the need has been satisfied. The success measures and expectations of the solution provided by Transportation Planning as well as those additional success measures developed by the core team can be used as a measure of the solution's ability to satisfy the need.

- 1-02.6 (4) ESTIMATES.** Estimates based on cost per mile factors shall in no case be considered to contain sufficient detail to allow their inclusion in the STIP. This includes cost per mile factors derived from similar projects as well as the generic factors contained in the [Figure 1-02.1](#). In addition estimates of right of way costs based on generic land values will not be considered to provide the level of confidence that MoDOT requires to make STIP commitments.

The best type of estimate that can be produced at this stage of project development is a historic-based estimate. Based on the quantities calculated from the preliminary plans and historical data from previous bid openings, a fairly accurate estimate can be produced. The methodology of this type of estimate is the same as that used to produce the Engineer's Estimate described in [Subsection 1-02.13\(4\)\(a\)](#).

While this estimate is only based on preliminary quantities, the preliminary plans should provide enough detail to allow a fairly accurate estimate of the major project quantities. Generally, 80% of the cost of a project will be included in the 20% of the pay items that comprise the major items included in the project. Most typically these items will consist of the grading, drainage and paving quantities.

Tentative right of way lines included on preliminary plans will provide a reasonable estimate of the easements and right of way required for each project. These can then be combined with an estimated amount for each property to arrive at a fairly accurate right of way estimate.

By their nature some projects are not as complex as others and the determination of accurate cost estimates and schedules does not require the same level of effort to reach an acceptable level of project detail. These less complex projects typically also have a much smaller budget and overall project development timeline. In fact, the need may not be identified and delivered to the project manager until the anticipated construction year is within the first few years of the STIP. For these projects it will be acceptable to include a cost adjustment factor with the estimates to compensate for the unknown factors that may not be identified as a result of the short amount of time provided to scope the project. Typical examples of this type of project are minor resurfacing, contracted maintenance, or level course projects. Most projects will not fall into this category.

The majority of projects are more complex, typically include a much larger budget, and require a greater level of effort to achieve accurate estimates of cost and schedules. For these projects the inclusion of a cost adjustment factor is not an acceptable substitute for completing all the steps of the project scoping process necessary to properly define the parameters of the project.

All other anticipated construction costs should also be included in the project estimate. These may include adjustment costs for large utility relocations, incentive/disincentive clauses, contract acceleration clauses, major environmental mitigation costs, etc.

- 1-02.6 (5) PUBLIC INVOLVEMENT IN PROJECT SCOPING.** Another important element of effective project scoping is the inclusion of the appropriate type and amount of public involvement and outreach early in the process and specifically prior to the determination of the solution. Comments from the general public, land owners, local elected officials, other state and federal agencies, local planning agencies, etc may influence the direction that the core team is taking with regard to the scope of the project. Inclusion of this involvement prior to determining specific solutions and making STIP commitments should help change the misconception that MoDOT has already determined the solution to the need and is not receptive to public input at the time public input is solicited.

It is important to remember that key factors to the success of any public involvement efforts are the inclusion of the appropriate type and amount of public involvement. Early in the project scoping process the core team should develop a public involvement plan that is appropriate for each project. The nature and complexity of the project along with the core team's specialized knowledge of any sensitive issues within the area will determine the best course of action to gain public input into the development of the project's scope. Proper public input can be an effective tool to help verify that the correct need has been identified and an appropriate solution is being developed for it. The guidance found in [Section 2-03](#) provides a good background for what constitutes appropriate public involvement and should be consulted when developing a public involvement plan.

As recommended previously in this section, the minimum level of project development that should occur prior to completion of scoping occurs at the preliminary plan stage. This is also the level of development that marks the appropriate time to hold the design public hearing. Based on the nature of the project there may have also been previous public hearings or meetings held. This public input, in addition to the less formal input received throughout the scoping process, should all be included in the development of the correct solution to satisfy the need. STIP commitments should not be made until the concerns of the public are adequately addressed by the proposed solution.

- 1-02.6 (6) ENVIRONMENTAL CONSIDERATIONS.** By the time the scoping is completed for a given project, the appropriate environmental documentation will have been completed for the project. This is not to say that the project is clear and that additional work may not be necessary later in the process. However, the appropriate environmental document will be approved at this point. A location public hearing will be held and the location approved by the Commission, if necessary.

Therefore, any commitments that are required as a part of the environmental process shall be included in the scope of the project prior to the time that STIP commitments are made. [Section 2-04](#) contains the guidelines and requirements for preparing environmental documents and should be consulted for additional details.

- 1-02.6 (7) MANAGEMENT CONCURRENCE.** MoDOT management and planning staff must review and concur with the project concept, projected budget and timeline for implementation of the selected solution prior to

programming any right of way funds, construction funds, or prior to making any project-specific STIP commitments.

Since identified needs are delivered to the project manager, with no assumption of possible solutions, it is necessary to include a step in the project scoping process for MoDOT management and planning staff to concur in the recommended solution. This concurrence point will occur early enough in the process to ensure that MoDOT resources are not wasted developing solutions that do not solve the identified need or meet the expectations of MoDOT management. Documentation of this concurrence will be accomplished through completion of a Project Scoping Memorandum.

**1-02.7 PROJECT SCOPING MEMORANDUM.** Documentation of MoDOT management’s and planning staff’s concurrence in the recommended solution to a given need is documented through the use of a scoping memorandum. A Project Scoping Memorandum must be completed for each project prior to the inclusion of any right of way funds or construction funds in the STIP.

Since all projects do not involve the same level of complexity and design effort, there is an additional step associated with the memorandum for the more complex projects. Projects that are classified as Major Projects generally have a larger statewide impact, budget and level of effort associated with them. For this reason Major Projects require completion of a Draft Project Scoping Memorandum in addition to the Project Scoping Memorandum. All other projects (non-major) only require preparation of the Project Scoping Memorandum.

GHQ Transportation Planning will include data to indicate if this need will fall into the Major Projects category or not with the needs data supplied to the project manager.

**1-02.7 (1) DRAFT PROJECT SCOPING MEMORANDUM FOR MAJOR PROJECTS.** Certain projects will be identified by GHQ Transportation Planning as a Major Project. This designation may occur at the time the need is delivered to the project manager or after the initial review of the needs data by the core team.

Following approval of the conceptual plan and/or appropriate environmental document for Major Projects, the Draft Project Scoping Memorandum should be completed by the project manager and submitted to the Design Technical Support Engineer (DTSE) for review and comment. The Draft Project Scoping Memorandum can be found in the Project Scoping category of the design forms. An example of a completed form can be found in [Figure 1-02.3](#).

The memorandum summarizes the pertinent information of the project and certifies the scope is as complete as possible at that time. It also serves as an initial point of concurrence between the district and the Central Office.

After the DTSE has reviewed and commented on the memo, it will be returned to the project manager. The project manager will then submit the memorandum to the district engineer for approval. Following the district engineer’s approval, the project manager will return the memorandum to the DTSE. The DTSE will then submit the memorandum for approval by the directors of transportation planning and project development. Once approved, one copy will be transmitted to the district, one copy will be transmitted to GHQ Transportation Planning and GHQ Design will retain one copy.

**1-02.7 (2) PROJECT SCOPING MEMORANDUM.** Following approval of the preliminary plan and the public hearing and/or meeting, if required, the Project Scoping Memorandum should be completed by the project manager and submitted to the Design Technical Support Engineer (DTSE) for review and comment. The Project Scoping Memorandum can be found in the Project Scoping category of the design forms. An example of a completed form can be found in [Figure 1-02.4](#).

The memorandum summarizes the pertinent information of the project and certifies the scope is as complete as possible at that time. Upon approval of the memorandum, right-of-way and construction funds may be included in the STIP with a high level of confidence that neither the scope, budget nor schedule will change appreciably. Scope changes after the approval of the Project Scoping Memorandum are subject to approval as described in [Subsection 1-02.11](#).

After the DTSE has reviewed and commented on the memo, it will be returned to the project manager. The project manager will then submit the memorandum to the district engineer for approval. For projects that are not classified as Major Projects, the approval by the district engineer is all that is required. After approval one copy should be sent to both GHQ Transportation Planning and GHQ Design.

Following the district engineer's approval of a Major Project scope, the project manager will return the memorandum to the DTSE. The DTSE will submit the memorandum for approval by the directors of transportation planning and project development. Once approved, one copy will be transmitted to the district, one copy will be transmitted to GHQ Transportation Planning and GHQ Design will retain one copy.

GHQ Transportation Planning must receive a copy of the approved Project Scoping Memorandum prior to the inclusion of any right of way or construction funds in the STIP.

**1-02.8 PROJECT SCOPING CHECKLISTS.** Efficient use of the project core team is essential in identifying the design elements of the project. When the various disciplines represented by the core team work together and strive to consider as many project development factors as possible, an accurate scope can and will be achieved. There are two main items that can prevent the effective use of core teams: not having the proper members included in the decisions for which they should have input and the lack of knowledge by members of exactly what the expectations are of the functional unit that they represent.

In order to address these issues, two types of checklists have been developed to help ensure the proper factors are being considered through the project scoping process. The checklists are designed to represent the probable issues a core team will address through the process of scoping a project. These lists are not intended to be all-inclusive, but a good representation of the key issues. The checklists are also not intended to be static, but are intended to be flexible in the fact that they can be modified as issues arise and expectations of core team members change.

The checklists are designed to encourage thought upon common development factors as well as those elements that are often overlooked. Strong core team participation is another benefit of the checklists, as they cannot be properly completed without the full commitment of a multidiscipline core team. Finally, the completion of the checklists could act as a signal to the project manager that the project scope is nearing completion.

The Project Scoping Checklist has been developed to assist the project manager in determining the members who are required to be involved in various project decisions. This checklist summarizes the expectations that each type of core team member is trying to meet. In order to ensure the scope of a project is as fully defined as possible prior to programming right-of-way and construction funds, a Project Scoping Checklist is to be completed.

The other type of checklist that has been developed consists of a list of expectations that each functional unit has for the core team member who will be representing them. With these lists an individual core team member will know the areas of the project scoping process for which they are responsible to provide input to the core team.

All checklists should be filled out as completely as possible after the initial scoping meeting. This will help indicate the areas where the core team needs to focus its efforts. Remaining items on the checklists will be addressed as project development progresses. Space is provided on the checklists to document progress or completion of items. An electronic version of the Project Scoping Checklists can be found in the Project Scoping category of the design forms.

Each member of the project core team should maintain their respective Project Scoping Checklist relative to their functional unit. The project manager maintains the overall Project Scoping Checklist. The project manager may use the information from the individual checklists of the core team members to aid them in completing the overall Project Scoping Checklist.

The Project Scoping Checklist and copies of the individual core team member checklists should be available to district and GHQ management to serve as practical documentation of the scoping of the project. The project manager should be readily able to produce the checklist upon request. The project manager should retain copies of all the checklists as part of the project documentation file.

**1-02.9 PROJECT PRIORITIZATION.** Once a need has been adequately scoped and a project is developed to address it, there must be a way to determine how that project compares to other projects. The project prioritization processes are based primarily on data and serve as a starting place for determining the best candidates for funding. There are separate project prioritization processes for each category in MoDOT’s funding distribution method.

The project prioritization processes include the following.

- Safety (joint regional/district decision)
- Taking care of the system (joint regional/district decision)
- Regional and emerging needs (joint regional/district decision)
- Major projects – system expansion (regional input for statewide decision)
- Interstates (regional input for statewide decision)

Using the results of the prioritization process as a starting point, MoDOT districts will work with planning partners to divide projects into three categories.

- High – These projects are the first to be selected for commitment to right of way purchases and construction.
- Medium – These projects may be addressed as additional resources become available.
- Low – No work is in progress to address these projects at this time.

The high-priority project list is fiscally constrained to five years of funding and is not a commitment for construction. Each time projects are prioritized, existing projects not yet programmed for construction will be re-evaluated. Some high-priority projects may never be constructed due to prohibitive costs, changing priorities or other reasons. If MoDOT and its planning partners unanimously agree that a project no longer addresses a valid need, it will be removed from the priority-project list, freeing resources for projects important to Missouri.

MoDOT districts will work with local officials and planning partners to review the project prioritization processes each year. Every completely scoped project will be prioritized. Projects from the high-priority list will be selected for programming in the Statewide Transportation Improvement Program where it is committed for construction.

**1-02.10 STIP COMMITMENTS.** MoDOT, in accordance with state and federal law, annually prepares the Statewide Transportation Improvement Program, referred to as the STIP. The STIP includes all projects proposed for funding utilizing existing federal programs and state general revenue. The STIP sets forth the specific construction projects MoDOT is going to complete during a five-year period. It covers highways, bridges, transit, aviation, rail, waterways, enhancements and other projects. It is the project-specific product that tells Missourians what improvements to expect on their transportation system during this period, and it provides MoDOT accountability for the tax dollars spent annually.

When projects are identified in the STIP for anything beyond preliminary engineering only, they become commitments to the public that the described project will be delivered within the time frame and budgets that are included in the STIP. However, this commitment is limited to the category of funds included in the STIP. For example, a project that only includes for right of way funds does not indicate that there is a commitment to construct the project, only that the right of way will be obtained in that time frame. MoDOT’s accountability to the public will be measured by its ability to deliver the described project within the right of way and construction dollars included in the STIP as well as the planned fiscal year for the activities.

Once a transportation need has progressed through the needs prioritization process, the scoping process and the project prioritization process, the solution and associated project should be so well-defined that accurate costs and project delivery schedules can be forecast. Only projects that have been developed to this level of detail should include commitments of right of way or construction funds in the STIP. GHQ Transportation Planning must receive a copy of the approved Project Scoping Memorandum prior to the inclusion of any right of way or construction funds in the STIP.

MoDOT is required by law to produce a STIP that accounts for all of the funding that will be expended by MoDOT over the given time frame. This requirement, together with public expectations, will not allow MoDOT to produce a

STIP that only includes right of way and/or construction funds for a few projects while including preliminary engineering funds only for the remainder. MoDOT does not have the option to scope projects through four years of the STIP and include right of way and construction funds for projects in only the current year.

This does not rule out the possibility that some projects may require the programming of preliminary engineering funds only in the STIP for multiple years in order to allow the scoping process to be completed. Preliminary engineering funds should be included in the STIP prior to the first year that a project specific commitment of right of way and/or construction funds is required to be included. There must be a balance between the desire to produce the most accurate estimates possible and the requirements for producing the STIP.

As has been stated previously in [Section 1-02](#), for most projects the minimum level of project development that is necessary to accurately identify the costs and delivery schedule of a project occurs at the preliminary plans stage. For some projects this minimum level of project development will be adequate to predict accurate right of way costs, construction costs and delivery schedule. Other more complex projects may require a greater level of development in order to achieve the desired level of accuracy.

Preliminary plan quantities will be used together with historic unit cost data to produce the estimate of construction cost that is included in the STIP. A description of how the historic cost data is collected is described in [Subsection 1-02.13\(4\)\(a\)](#). Right of way estimates will be based on the tentative right of way lines identified in the preliminary plans and preliminary estimates of individual property values. At this point in the project development process any unusual conditions or costly items, such as major utility adjustments, how traffic will be handled during construction, any special working restrictions that may be placed on the contractor, incentive/disincentive clauses, contract acceleration clauses, environmental constraints, environmental mitigation commitments, etc., should also be identified and included in the project's estimate.

These estimates are then used to provide the initial costs that are included in the STIP. Adjustments for inflation are included on an annual basis and costs included in the STIP are updated as the design of the project progresses.

**1-02.11 SCOPE CHANGES.** Once right of way and/or constructions dollars are identified in the STIP for any given project, the described activities become MoDOT's commitment to the public that we will deliver the project in the identified time frames and budget. The integrity of the STIP can only be assured if the scopes, budget and delivery date of the projects contained within it do not change. Occasionally, however, the known parameters of a project can change unexpectedly, introducing variations that could not have been foreseen regardless of the amount of scrutiny given the project through the scoping process. In these cases, scope changes, even to publicly committed projects, may become necessary. These changes must be kept to an absolute minimum, however, and must be approved by the appropriate level of authority.

The project specific data included in the currently approved STIP is the basis from which MoDOT's accountability will be measured form year to year. The data contained in the currently approved STIP will also be the basis for measuring any changes in the project's scope. A scope change is defined as any modification to the elements or limits of a project that results in a deviation from the estimated cost for right of way and/or construction or the delivery schedule that is included in the currently approved STIP.

All references to projects costs are based on the total right of way and construction funding included in the STIP as compared to the new project cost. The individual elements of the project cost are not measured independently for purposes of determining the amount or percentage of cost increase.

Requiring approval of scope changes will ensure that MoDOT management is aware of the implications associated with the proposed modifications and understands how it will impact the STIP commitments. Scope modifications will be limited to only those that MoDOT management feels are critical. This will lead to less re-design during the final design stage of project development and allow project schedules to be met more consistently.

**1-02.11 (1) TYPES OF SCOPE CHANGES.** There are two kinds of scope changes: non-major scope changes which must be approved by the district engineer, and major scope changes which must be approved by the Director of Transportation Planning and the Director of Project Development. The two types of scope changes as well as the associated approval authority are defined in the following sections.

**1-02.11 (1) (a) NON-MAJOR SCOPE CHANGES REQUIRING APPROVAL BY THE DISTRICT ENGINEER.**

1. Any change(s) to the elements or limits of a project resulting in an increase or decrease in the total cost of the project (right of way and construction) included in the currently approved STIP that meets any of the following criteria will require completion of a non-major scope change memorandum:
  - Changes greater than 3% but less than or equal to 10% that do not exceed a total amount of \$5,000,000.
  - Changes greater than 10% that do not exceed a total amount of \$250,000.
2. Any change(s) to the elements or limits of a project that changes the delivery of a project in the currently approved STIP by a quarter within the same state-fiscal year will require completion of a non-major scope change memorandum.

Currently GHQ Transportation Planning provides a 3% inflation factor to account for increases in construction and right of way costs included in the STIP on an annual basis. Only scope changes that cause the total project costs to exceed the amount of right of way and construction funding included in the STIP by an amount greater than the 3% inflation factor (or another factor determined by GHQ) require the preparation and approval of a scope change letter. Likewise, cost decreases that are 3% or less of the right of way and construction funding included in the STIP do not require the preparation of a scope change letter.

The details of the proposed scope change, the reasons why the change is necessary, and the projected impacts to the project's budget and delivery schedule should be included in the form of a letter from the project manager and addressed to the district engineer. A signature line for approval by the district engineer should also be included. A signed copy of the letter should be provided to GHQ Design and GHQ Transportation Planning for documentation purposes. In addition, a copy of the project scope change approval letter shall also be retained in the project estimate file. A sample version of a completed non-major scoping change letter can be found in [Fig. 1-02.5](#).

After a scope change approval, the district must follow GHQ Transportation Planning's policy for modifying the STIP in order to have the project's letting/award date changed. Likewise a scope change that modifies the project cost will require the submittal of a revised PATS form. This process is described in [Sec. 1-02.12 \(9\)](#).

Any series or combination of multiple non-major changes that occur within the same fiscal year shall be measured against the preceding criteria as a single scope change. Since all projects are measured from the currently approved STIP commitment any combination of non-major scope changes that occur within the same fiscal year and cause the preceding criteria to be exceeded will, by definition, be considered a major scope change.

**1-02.11 (1) (b) MAJOR SCOPE CHANGES REQUIRING APPROVAL BY THE DIRECTOR OF TRANSPORTATION PLANNING AND THE DIRECTOR OF PROJECT DEVELOPMENT.**

1. Any change(s) to the elements or limits of a project resulting in an increase or decrease in the total cost of the project (right of way and construction) included in the currently approved STIP that meets any of the following criteria will require completion of a major scope change memorandum:
  - Changes greater than 10% that exceed a total amount of \$250,000.
  - Any change of \$5,000,000 or more regardless of the percentage

2. Any change(s) to the elements or limits of a project that changes the delivery of a project in the currently approved STIP by one or more state-fiscal years will require completion of a major scope change memorandum.

The details of the proposed scope change, the reasons why the change is necessary, and the projected impacts to the project's budget and delivery schedule should be included in the form of a letter from the district engineer and addressed to the directors of project development and transportation planning. A signature line for approval by both directors should also be included. A sample version of a completed major scoping change letter can be found in [Fig. 1-02.6](#).

The approval letters will be submitted to the Design Technical Support Engineer, who will facilitate the approval process by both directors. Once approved, one copy will be transmitted to the district, one copy will be transmitted to GHQ Design and GHQ Transportation Planning will retain one copy. In addition, a copy of the project scope change approval letter shall also be retained in the project estimate file.

After a scope change approval, the district must follow GHQ Transportation Planning's policy for modifying the STIP in order to have the project's letting/award date changed. Likewise a scope change that modifies the project cost will require the submittal of a revised PATS form. This process is described in [Sec. 1-02.12 \(9\)](#).

**1-02.12 PROJECT COST ESTIMATES.** Following identification of the correct solution to satisfy the need, producing accurate cost estimates for that solution is the next essential step toward producing attainable STIP commitments. Great care should be used in determining the estimated cost of projects since this will ultimately be used to measure our ability to meet the commitments that are included in the STIP. This section provides guidance on the preparation, documentation and review of project estimates and the transmittal of cost data to GHQ Transportation Planning.

**1-02.12 (1) PROJECT INITIALIZATION AND PLANNING ESTIMATES.** Various sections of this chapter direct staff to make no public commitments of cost or delivery time until the project is fully scoped. This does not mean that staff should refrain from making initial estimates of construction cost and right of way needs for internal planning and resource needs. It only means that these initial estimates should not be included in any public documents, agreements or primarily the STIP.

Once identified and prioritized needs are assigned to a project manager the project must be initialized in order to provide funding for preliminary engineering. Project initialization is accomplished through the submission of an initial Project Amendment Tracking System (PATS) form to GHQ Transportation Planning. This initial PATS form will only include an estimate of the initial preliminary engineering necessary to begin the project scoping process.

Soon after the core team has reviewed the data indicating the need and has some idea of the range of possible solutions, an order of magnitude estimate should be produced for the project. Once prepared, the order of magnitude estimate is transmitted to GHQ Transportation Planning through submission of a revised PATS form. Production of this estimate is not intended to limit the range of solutions that are considered to solve the need nor commit the core team to a firm budget that must be maintained.

The order of magnitude estimate is required in order to allow planning staff to gage the proper amount of needs that are proceeding through the scoping process based on the projected available funding. Along with the order of magnitude estimate a determination of the possible funding source will be made based on the range of possible solutions.

**1-02.12 (2) STIP ESTIMATES.** Only projects, that have been developed to the level of detail that accurate costs and project delivery schedules can be forecast, should be included in the STIP as commitments for expenditure of right of way or construction funds. In order to ensure that the project's scope has been fully developed prior to making STIP commitments, GHQ Transportation Planning must be provided a copy of the approved Project Scoping Memorandum prior to the project's inclusion in the STIP.

Estimates based on cost per mile factors shall in no case be considered to contain sufficient detail to allow their inclusion in the STIP. This includes cost per mile factors derived from similar projects as well as the generic factors contained in the [Figure 1-02.1](#). In addition estimates of right of way costs based on generic land values will not be considered to provide the level of confidence that MoDOT requires to make STIP commitments.

The procedures described in [Subsection 1-02.6\(4\)](#) are acceptable for producing the initial STIP estimate for the project. However, as the development of the project progresses the estimate should be revised as more project details are available and more finite quantities are identified. Estimates based on plan quantities and historic unit costs will produce the desirable level of accuracy, for most projects, that is required for STIP commitments. The level of detail and accuracy of each version of the STIP estimate should progressively approach and culminate in the PS&E estimate that is completed at the time when the final design is submitted to GQH Design for inclusion in the monthly lettings.

Likewise, the estimates of right of way costs should follow a similar progression towards the final right of way costs. Estimates based on the tentative right of way lines included on preliminary plans and an estimated amount for each property will provide a reasonable cost estimate for the initial STIP commitment. Then as the plans are developed in more detail and the final right of way requirements are known, the details of the estimated right of way costs should also be refined to provide a more accurate estimate.

While accurate estimates of right of way and construction costs are important for inclusion in the STIP, the projected delivery schedule for the project is equally important. The delivery schedule is indicated by the fiscal years that include funds for the right of way and/or construction of the project.

The project cost data and the associated delivery schedule are transmitted to GHQ Transportation Planning through submission of a Project Amendment Tracking System (PATS) form. Each time a revised estimate is prepared or changes in the project's cost data are known, a revised PATS should be prepared and submitted to GHQ Transportation Planning.

The most recent project cost estimate and supporting data documentation contained in the project estimate file should be in agreement and match the values included in the latest final PATS form submitted to GHQ Transportation Planning.

- 1-02.12 (3) PROJECT AMENDMENT TRACKING SYSTEM.** A Project Amendment Tracking System (PATS) form is prepared to initialize a project once the identified need is delivered to the project manager to begin the project scoping process. Submission of a subsequent PATS form provides GHQ Transportation Planning with an order of magnitude estimate. Thereafter, each time a new or revised project estimate is prepared, the cost data should be transmitted to GHQ Transportation Planning on a PATS form. The projected delivery schedule of the project will also be conveyed to planning staff through the submission of a PATS form.

Documentation of the most recent project cost estimate and supporting data documentation contained in the project estimate file should be in agreement and match the values included in the latest final PATS form submitted to GHQ Transportation Planning. This form is part of the Notes database "PL\Project Amendment Tracking."

[Figure 1-02.7](#) provides a generalization of the various stages at which atypical project would require submission of a PATS form. Project costs should be reviewed and/or revised at each stage of project development and at least once per year. Each time a new or revised cost estimate is prepared for the right of way and/or construction costs, a revised PATS form should also be prepared and submitted to GHQ Transportation Planning. [Subsection 1-02.12\(4\)](#) describes the only exception to this requirement. Please refer to that section for details.

- 1-02.12 (4) REVIEW OF ESTIMATES.** Project cost estimates should be reviewed and updated periodically. At a minimum, project cost estimates should be reviewed on an annual basis. A new or revised project estimate should be prepared at the following major milestones or stages of project development: project initialization, conceptual plan/environmental document completion, preliminary plan completion, right of way plan

completion, and contract plans completion (PS&E). The estimated project costs should be submitted to GHQ Transportation Planning at least annually, at the above noted project development milestones/stages, or when significant project scope changes are identified using a PATS form (see [Figure 1-02.7](#)).

If an annual review of the previous estimate is conducted and it is determined that no change is necessary, the project estimate file should include documentation to indicate that the previous estimate has been reviewed and remains valid.

Revised cost estimates submitted for projects that are scheduled for expenditure of funds within the current fiscal year of the STIP will not be reflected in the STIP or the approved PATS database. For example, if the project is to be awarded during the current fiscal year, the construction cost reflected in the STIP will not be revised to account for project estimates prepared after the beginning of the fiscal year. Similarly, if a project has right of way funds included in the current fiscal year of the STIP, the right of way amount will not be revised based on a revised estimate submitted in the same fiscal year. Even though these costs will not be reflected in the STIP, the revised project estimates should still be prepared in accordance with the recommended schedule. However, the submission of a PATS form to GHQ Transportation Planning will not be required in this situation. This is the only exception that that exists for not submitting a PATS form to GHQ Transportation Planning each time a revised estimate is prepared.

All estimated costs should be submitted in current dollars. GHQ Transportation Planning will make any necessary inflation adjustments. Estimate revisions will impact a district's funding balance and be used to calculate the current cost of the program, but not be used to determine any changes in the district funding distribution.

- 1-02.12 (5) DOCUMENTATION OF PROJECT ESTIMATES.** Each project will have an individual project estimate file that is separate from the general project file or the correspondence file. The purpose of this requirement is to ensure that each project has a well documented and easily retrievable history of the assumptions, methods and procedures used to estimate the right of way and construction costs associated with the specific scope of work identified for the project. Having this information contained in one location and separated from other project documentation will help ensure that the estimate information is readily accessible from a known location and uncluttered with other project information.

At a minimum the project estimate file should include any assumptions that have been made, the current project scope, maps, photos, as-built plans, functional classification, design criteria and a copy of or reference to the cost data used to support the estimate. This basic information should be included in each project estimate file regardless of the stage of project development. A sheet should be placed in the front of each estimate file so the project manager can record the date and current project milestone or project development stage each time the project estimate is changed, updated or reviewed. A signature line should also be included to document the project manager's review of the estimate file.

Depending on the level of project development that has occurred on the project, the amount and type of documentation contained in the project estimate file will vary. For projects that do not have clearly defined scopes and in the absence of other estimating methods, the cost-per-mile type of estimates described in [Section 1-02.5](#) are suitable and acceptable to develop the initial project estimate.

Cost-per-mile factors may be developed from a previously constructed project of similar type and conditions or the generic cost per mile factors included in [Figure 1-02.1](#) may be applied to the estimated project length to develop an initial project cost. Information used to develop the project specific cost per mile factors or the generic factors from [Figure 1-02.1](#) that are used should be well documented and included in the project estimate file. This information may consist of items such as estimate software, bid tabulation data from similar projects, unit bid price books, or some other reputable resource. Additionally any deviations from the generic cost per mile factors, that are determined to be warranted by the estimator, shall have well documented reasons included in the project estimate file.

The district may prepare a master reference file that contains the cost-per-mile, unit costs, accepted PE and CE cost as a percentage and other critical policy and procedures that are used to prepare project estimates on an

annual basis in order to avoid duplication of the information in multiple project estimate files. However, this master file must be kept as a permanent reference file that can be cited and reference to it must be included in each individual project estimate file.

Variations of the Miscellaneous and Utility Costs percentage (see [Figure 1-02.1](#)) should also be documented in the project estimate file. As discussed in [Subsection 1-02.6\(4\)](#) some projects that are not complex and have a small scope of work may warrant the inclusion of a cost adjustment factor to compensate for the short project development time and project uncertainties. These cost adjustment factors shall be well documented in the project estimate file and have a reproducible basis. These factors should only be applied to projects that fall into the small non-complex category. They shall not be applied to all project estimates as a matter of district practice. A cost adjustment factor will never be considered as an acceptable substitute for preparing a well-documented and accurate estimate if adequate project information is available.

Once the project scoping phase of the project is completed and estimates are being produced for inclusion in the STIP, cost-per-mile type estimates will no longer be acceptable. All estimates made beyond this stage of project development shall be based upon estimated pay item quantities and unit costs. Copies of all pertinent information related to the project estimate, including all documentation of the quantities and unit costs used, shall be included in the project estimate file. All estimate data sheets should include the date of preparation and the estimator's name.

Each time a final Project Amendment Tracking System (PATS) form is prepared for the project a copy should be placed and retained in the project estimate file. Another copy of the PATS form will be provided to the district transportation planning coordinator, who will be responsible for ensuring a copy is also immediately submitted to GHQ Transportation Planning. This procedure should be followed for all projects, whether designed internally or by a consultant. The documentation included in the estimate file must substantiate the latest final PATS form that has been submitted to GHQ Transportation Planning. In addition, any project scope change approval letters required by [Sections 1-02.11 and 1-02.12\(9\)](#) shall also be retained in the project estimate file.

The project estimate files for all projects under development in the district should be located in one central location. District management is responsible for establishing estimating procedures, within their district, that will indicate the person responsible for maintenance of the project estimate files and the central location for the files. The district estimating procedures should also establish general guidelines for the contents that should be maintained in the file.

The project estimate information should be retained in the central filing system from the time the initial project estimate is prepared until after the project has been included in the Accountability Report to the Legislature. The project estimate file should include all cost estimates prepared for the project up to and including the completed Contract Plans (PS&E) Estimate. Cost data following submission of Contract Plans to GHQ is not required in the project estimate file. Once the project data has been included in the accountability report, there is no requirement to archive the cost estimate files. However, the district may wish to retain cost data longer for purposes such as reconciling completed project cost with GHQ Transportation Planning, responding to additional inquiries related to the Accountability Report, or until there is a final payout on the project by FHWA, etc.

**1-02.12 (6) QUALITY CONTROL.** The district engineer is responsible for maintaining the consistency of the estimates and their documentation within each district. The district engineer should establish a district Cost Estimate Quality Control Review Team that will implement a plan to ensure quality control of all project estimates. It is recommended this team include the district's transportation planning coordinator, project development engineer, right of way manager, transportation project managers, and other personnel deemed necessary. This team is not expected to inspect each estimate in detail, but rather establish consistent procedures for the appropriate preparation and updating of the project estimates. The team should work to ensure these processes are applied to each project so the best possible estimate is obtained. The team should ensure that only projects with a clearly and completely defined scope of work are included as STIP commitments and that documentation supporting the commitments is included in the project estimate file.

**1-02.12 (7) QUALITY ASSURANCE.** The GHQ design technical support engineers will provide quality assurance to their assigned districts to ensure consistent cost estimates are produced throughout the department. This will be accomplished through periodic reviews of selected project estimate files, the district's project estimating process, the district's quality control plan, and the district's plan for review and updating of the STIP estimates. GHQ design technical support engineers will periodically, at least annually, inspect their respective district's cost estimate files, either independently or in conjunction with the district's Cost Estimate Quality Control Review Team.

The results of all quality assurance reviews should be reported on the quality assurance form, [Figure 1-02.8](#), and submitted to the district engineer and the Chief Engineer. Reviews may be conducted by the district review team, the GHQ design technical support engineer, or jointly performed by both parties. The participation of other GHQ personnel, including a bridge structural liaison engineer and structural project manager, a right of way field liaison, and other project core team members, should be required as appropriate.

**1-02.12 (8) ANNUAL INFLATION FOR STIP ESTIMATES.** Currently a 3% inflation factor is allowed to account for increases in construction and right of way costs included in the STIP on an annual basis. Updated project costs are compared to the amounts included in the latest approved version of the STIP. The currently approved version of the STIP will be the base line for measuring all cost increases even if more than one revised cost estimate has been prepared within a given fiscal year. If the total project costs exceed the total amount of right of way and construction funding included in the STIP by an amount greater than the 3% inflation factor (or another factor determined by GHQ), the procedures for approval of a scope change must be followed as indicated in [Subsection 1-02.11](#).

In this case the cost increase itself will be treated as a scope change, for the purposes of the documentation and approval process, even if there has not necessarily been a large change in the scope or limits of the project. The explanation and reasons for the cost increases should be documented in the same manner as the changes in scope. Further explanation of the documentation procedures for cost changes can be found in [Subsection 1-02.12\(9\)](#).

All references to projects costs are based on the total right of way and construction funding included in the STIP as compared to the new project cost. The individual elements of the project cost are not measured independently for purposes of determining the amount or percentage of cost increase.

**1-02.12 (9) COST INCREASES/DECREASES FOR STIP ESTIMATES.** Cost increases in excess of the allowable annual inflation factor will be treated as a scope change for the purposes of the documentation and approval process, even if there has not necessarily been a large change in the scope or limits of the project. The explanation and reasons for the cost increases should be documented in the same manner as the changes in scope. Details of the approval process for scope changes are included in [Subsection 1-02.11](#).

Non-major cost increases/decreases, as defined in [Subsection 1-02.11\(1\)\(a\)](#), require the submittal of a copy of the approval letter to GHQ Transportation Planning when the revised PATS form is submitted. The revised costs will not be included in the STIP without receipt of this approval letter. A copy should also be sent to GHQ Design for documentation purposes. In addition, a copy of the project scope change approval letter shall also be retained in the project estimate file.

Major cost increases/decreases, as defined in [Subsection 1-02.11\(1\)\(b\)](#), require the approval by the Director of Transportation Planning and the Director of Project Development. These approval letters will be submitted to the Design Technical Support Engineer, who will facilitate the approval process by both directors. Once approved, one copy will be transmitted to the district, one copy will be transmitted to GHQ Design and GHQ Transportation Planning will retain one copy. The revised PATS form may be submitted prior to approval of the change. However, the revised costs will not be included in the STIP until the approval is finalized. In addition, a copy of the project scope change approval letter shall also be retained in the project estimate file.

Cost increases/decreases associated with the PS&E submittal will also be reviewed by the Design Project Reviewer. Upon submittal of the district project estimate the Design Project Reviewer will compare the estimate to the amount included in the current STIP. If this comparison results in a cost increase/decrease that meets the

previously described conditions, then the Design Project Reviewer will verify that the proper approval process has been followed for the project. The project will not be allowed to proceed through the letting process until this verification has occurred.

Cost increases/decreases will impact a district's funding balance regardless of the category of funds used. An important part of the approval letters described above, will be to include a description of how the change will impact the other projects that are included in the STIP. In the case of a cost increase, the approval letter should identify the source of any additional funds that are required. This might include a description of other projects that may be delayed or that include a cost reduction to offset the increase.

All references to projects costs are based on the total right of way and construction funding included in the STIP as compared to the new project cost. The individual elements of the project cost are not measured independently for purposes of determining the amount or percentage of cost increase.

**1-02.12 (10) STIP ESTIMATE PREPARATION.** Each estimate that is prepared for a project should begin with documentation of an accurate and complete description of the scope of work involved and the stage of project development. The major items of work included in the project should also be listed. (i.e. grading, paving, drainage, bridge, widening, resurfacing, relocation, signals, etc.).

The following considerations are guidelines and should not be considered a complete list of items needed to define a project. They are provided a reminder of the major elements that must be considered in order to arrive at an accurate cost estimate. The core team should use the best resources available in creating an estimate. It is the responsibility of the estimator and core team to provide an accurate and complete cost estimate for every project.

**1-02.12 (10) (a) PRELIMINARY ENGINEERING / CONSTRUCTION ENGINEERING.** The STIP should contain adequate funding for preliminary engineering to cover the actual expenditures that will be made. This includes the cost of internal and external (contracted consultant services) engineering services that will be performed to develop the project. The funds should be included within the fiscal years of the STIP that the expected expenditures will occur.

Preliminary engineering cost estimates may be based upon historical data for projects from the same work type (add lanes, high type resurfacing, bridge replacement, etc.). However, known costs such as an executed engineering services contract should also be factored into the amount of preliminary engineering included in the STIP. Additionally, do not overlook the fact that projects that utilize contracted services must also include costs for internal preliminary engineering to cover reviews and project management.

The total of construction engineering costs (comprised of construction engineering and construction contingency) has been established at a set rate of 10% of the construction costs included in the STIP. This amount is divided between construction engineering and construction contingency at 7% and 3%, respectively.

**1-02.12 (10) (b) DESIGN CONSIDERATIONS.** Below is a partial list of design items. Other items may be considered and included in the estimate, as necessary.

- Grading (Class A, Class C Excavation, Borrow)
- Pavement design - include curb and gutter if applicable. (See [Section 6-03](#) for pavement design considerations) For alternate bid projects on pavements, it is recommended that job cost estimations during the early scoping stages of the project be based upon the following:
  - For projects involving new construction, base costs on the construction of concrete pavement, using the appropriate design thickness provided in [Figure 6-03.12](#).
  - For projects involving a concrete unbonded overlay, base costs on the construction of a 8-inch [200 mm] concrete unbonded overlay as the design thickness plus an additional one inch [25 mm] thickness to allow for adjustment of the existing profile in order to eliminate existing undulations in the pavement and to re-establish a smooth profile grade. See [Subsection 6-05.18](#) for guidance on reestablishing a smooth profile grade on concrete unbonded overlay

projects.

- Drainage - stream crossings, closed systems, open channel
- Detention storage basins
- Shoulder widening
- Resurfacing
- Signals, lighting, signing (include temporary signals)
- Temporary by-pass
- Traffic control, detours, etc.
- Construction Incentives
- Pavement edge treatment
- Guardrail items
- Urban contingencies (i.e. enhancements, landscaping, etc.)
- Erosion control (seed and mulch, rock ditch liner, paved ditch, rock blanket)
- Temporary erosion control
- Mobilization

**1-02.12 (10)(c) RIGHT OF WAY CONSIDERATIONS.** If right of way acquisition is involved, a written request for an estimate should be made to the district right of way manager with the following information:

- Latest available plans
- Tentative or actual right of way required
- Access controls
- Anticipated improvements to be taken
- Proposed borrow areas
- Proposed mitigation sites for parklands, wetlands, etc.

Right of Way personnel should develop the estimate according to the guidelines and policies of the Right of Way Manual.

**1-02.12 (10)(d) ENVIRONMENTAL CONSIDERATIONS.** The Environmental Section of GHQ Design should be consulted to determine if there are any environmental or cultural resource issues that may affect the cost of the project. They will also be able to provide assistance in determining any associated costs.

The Environmental Section should be furnished with the following applicable items:

- Request for Environmental Studies (RES) form (see [Subsection 2-03.2](#))
- Latest available plans
- Location layout of structures, suspected wetlands and unusual features
- Photographs

Environmental staff should give consideration to how the following items will impact the project costs:

- Parklands
- Wetlands
- Historic structures (include bridges)
- Hazardous waste sites
- Threatened and endangered species
- Archeological sites
- Noise mitigation
- Socio-economic impacts

**1-02.12 (10)(e) UTILITIES CONSIDERATIONS.** The district utility engineer should be furnished with the following applicable items:

- Latest available plans
- Photographs

The district utility engineer should consider the following in developing the associated utility cost estimate for the project:

- Known major utilities
- Railroad crossings
- Determine if existing utilities are on existing highway right of way or private easement
- Coordinate with appropriate utility companies

**1-02.12 (10)(f) BRIDGE CONSIDERATIONS.** GHQ Bridge will provide cost estimates for the bridge structures associated with a project. Upon receipt of the bridge survey, GHQ Bridge will review the bridge survey data and make an in-depth analysis of the proposed crossing. The analysis will include hydraulic design of the waterway opening for stream crossings, geometric layout for grade separations, economic analysis of structure types and span lengths and investigation of any special features evident from the bridge survey data. A tentative bridge layout will be prepared.

The following bridge related items should be considered by the core team when developing costs for bridges and other drainage structures:

- Number of major stream crossings
- Flood plain proximity to crossing location
- Earthquake design necessity
- Nearby structures that are similar
- Number of bridge rehabilitations
- Clearance requirements
- Enhancements (Special aesthetics – railing, lighting, girders, concrete surface texture, etc.)

**1-02.13 ENGINEER'S ESTIMATE.** The previously described STIP estimates are prepared by MoDOT staff located in the various district offices located throughout the state. Upon completion of the project design plans, the core team prepares one last cost estimate for the project prior to submittal of the Plans, Specification and Estimate (PS&E) to GHQ Design for advertisement, letting and award of a construction contract. This estimate is prepared using the bid items and plan quantities derived from the completed plans and applying the applicable historical unit cost data to them.

This estimate becomes the basis for the Engineer's Estimate that is prepared by GHQ Design staff. GHQ Bridge estimators prepare the bridge related elements of the Engineer's Estimate. The Engineer's Estimate is a tool that will be used to analyze the bids received on the project. The Engineer's Estimate is completed immediately before receiving bids on the project, and therefore considers the most current price data.

**1-02.13 (1) BIDDING AND DOCUMENT REVIEW.** The estimator looks at the bidding documents from the perspective of a contractor/bidder; both the method and sequence of construction must be considered, and the costs involved with each item of work. The plans and specifications should accurately reflect the work to be done, however the estimator must scrutinize the bidding documents for errors that may give a knowing bidder an advantage over other bidders. The major items, generally grading and paving, are looked at more closely than other items.

**1-02.13 (2) CONTRACT TIME.** Contract time is an overriding factor in estimating, particularly where other constraints such as tight working conditions, heavy traffic, multiple traffic shifts, complex staging, or weather dependent items are included. Tight time frames, especially where tied to liquidated damages, have a tremendous effect on bid prices.

**1-02.13 (3) CONSTRUCTION INDUSTRY TRENDS.** Knowledge of statewide or even nation-wide trends is crucial in estimating. The availability of contractors and construction materials for any given area has a big impact on the expected bid prices. Additionally, work, which is likely to be subcontracted, will influence the estimated cost.

**1-02.13 (4) ESTIMATING METHODS.** The two types of estimating used are historic-based and cost-based estimating. Historic-based estimating is the method commonly used by the district staff. Most of the Engineer's Estimates are a combination of the two methods. Generally, 80% of the cost of a project is in 20% of the pay items: the biggest cost items in a contract are typically estimated with cost-based methods for the Engineer's Estimate, while the remaining items are estimated with historic-based methods.

**1-02.13 (4) (a) HISTORIC-BASED ESTIMATING.** Historical data from previous bid openings can be sorted and accessed through the BAMS/DSS computer software. The estimating programs (SAS programs, used by the GHQ, and the "Estimate2000" program, used by the district staff) give the ability to produce a weighted average of a unit bid price for a particular item. The weighted average uses several parameters including geographical location, type of work involved, and the quantity to be constructed. A construction price index can be applied to historical data to give an updated cost.

Historic-based estimating is a quick and accurate method for many items. An average price, however, may not accurately fit the conditions given. Additionally, sudden increases in the price of construction materials such as oil or cement make past data obsolete. Some items such as mobilization appear not to follow any historical trend. One other concern with using historic data is the reliability of that data. As an example, asphaltic concrete may be bid as a mix (\$20 cement and \$20 aggregate), or it may be bid as components (\$150 cement and \$15 aggregate). The average bid price for asphaltic cement would then be taking averages of \$20 and \$150, which is not truly reflective of the cost. Unbalanced or excessive bids on individual items are also part of the item history. Only an experienced estimator will readily recognize these price variations for what they are. In any case, regardless of how complete the history of an item may be, engineering judgment must still be applied.

**1-02.13 (4) (b) COST-BASED ESTIMATING.** Certain items such as Removal of Improvements, or specialty items such as utility work, enhancement work, etc., cannot be estimated using historic bid prices. For these items a cost-based method or Means catalog is used. Cost-based estimating relies on the actual costs associated with the individual components of a particular pay item in the contract. First, the estimator must make an assumption, based on experience and engineering judgment, regarding the likely method of construction the contractor will use.

As an example, when estimating concrete paving, a typical paving train is assumed, with all of the associated equipment and personnel. Rental rates for that equipment are obtained from the "Rental Rate Blue Book". Operator and laborer rates are obtained from the required federal or state wage rates. A decision is made whether a ready-mix plant is available, or a portable plant has to be moved in. A materials source is then assumed, and haul distance calculated. Quotes are sometimes obtained from that materials supplier, although it is recognized that these quotes may not reflect the price quoted to a prime contractor. Other sources are also consulted. The estimator decides on a production rate, or how many square yards of pavement can be constructed in a day. Production rate tables have been developed for many construction items using data from all districts and the Association of General Contractors. All of these factors are inserted in a spreadsheet, which then calculates the cost per square yard of concrete pavement.

The cost-based Engineer's Estimate for these items, given the correct assumptions, has proven to be extremely accurate when compared to the bids. Cost-based estimating spreadsheets have been developed for other items as well. This cost is then compared with historical costs, and a final estimate derived. This method uses current day prices, and can be tailor made to fit the specific situation for any project. The biggest disadvantage to this method is that it is very time consuming, and requires a lot of assumptions on the part of the estimator.

**1-02.13 (5) BRIDGE ESTIMATING PROCESS.** Every project that GHQ Bridge staff estimates is unique and treated individually. There are many factors and variables that affect the cost of a project. Below is a brief description of major factors and variables that are considered and used to determine the final cost estimate for bridge related items.

- Bid History - The bid history is reviewed for similar projects, bid items and locations, to help establish market trends and a starting point for the cost of each bid item.
- Sizes of the Project - The size, scope of work and type of construction project have a significant impact on cost. Unit costs for small projects can often run higher.
- Time Frame - The time allowed for the completion of a project has an effect on the cost. A project with less time than normal to complete can cause the unit costs to increase due to the possible need for overtime, extra crews and nighttime construction.
- Availability of Material - The availability of material can affect the unit cost. A limited supply of a material, high demand for a certain material, heavy workload of the material supplier or a material that is only available from a distant location can all cause an increase in the unit cost.
- Location of Project - The location of a project has a significant effect on the project cost. Projects that are located in areas with union restrictions, stricter building code requirements and long distances from suppliers and materials can cause the unit cost to increase. The availability of skilled workers and any environmental conditions can also affect the unit cost.
- Season of the Year - The season of the year when construction of the project begins can affect the cost. Based on the season of the year when the project is started and the time line for the project, critical phases of that project may occur during undesirable weather conditions. Certain work during cold weather can cause the unit costs to increase due to delays or the need for special construction methods.
- Plans and Special Provisions - The plans and special provisions have a significant impact on the cost. Special restrictions or requirements, traffic control plans, staged construction can all increase the unit cost.
- Work Effort - On certain unique bid items the actual work effort is determined and a cost based analysis is used to calculate the unit cost utilizing the Means Heavy Construction Cost Data book and the federal wage rates.
- Constructability Constraints - The actual construction site conditions have an effect on the unit cost. Construction sites with overhead conflicts, existing utilities, limited right of way, next to traffic, 2 or more contractors active at the same time and 404 permit restrictions, all can cause the unit cost to increase.

All the above factors are taken into consideration along with input from the core team, consultants, fabricators, and suppliers, in determining the final cost estimate for the bridge items included in every project.

Before every letting, there is a minimum of two group meetings. The Bridge Review group has a meeting to discuss and review the bridge cost estimate for every project. In this meeting, the above-mentioned factors are discussed in detail. Then the Bridge Review group meets with the GHQ Design staff to further discuss, review and finalize the cost estimate. On more complex projects, additional estimate review meetings are held with the district staff and consultants involved with the project, including representatives from Design, Construction, Materials and the consultant.

**1-02.13 (6) CONFIDENTIALITY.** At MoDOT, the Engineer's Estimate is kept confidential forever. Only the estimators, State Design Engineer, Director of Project Development, Chief Engineer, Chief Operating Officer, Chief Financial Officer, Inspector General, Chief Counsel, Commissioners, and FHWA are given the Engineer's Estimate.

**1-02.13 (7) ACCURACY OF ESTIMATES.** The Engineer's Estimate does not attempt to forecast the low bid, but attempts to establish a reasonable price for the project. Because a typical contractor, average production rates, average materials prices, and an available materials source must be assumed, the Engineer's Estimate by its very nature will be more representative of an average bid than it is representative of the lowest possible bid. When all of the bids are examined, normally there is a greater disparity among the bidders than there is between the Engineer's Estimate and the low bid. Unless one assumes that all bids other than the low bid are complementary, the contractors are all submitting their fair market value for the work from their own perspective. No two projects are alike, and no two contractors are dealing from identical circumstances.

**1-02.14 BID ANALYSIS PROCESS.** The Engineer's Estimate is the primary tool used to analyze bids. Bids will deviate from the estimate for many reasons. Consideration of the number and quality of bidders, and the disparity among

the bidders is the first step of the overall analysis. After this step, the low bidder's price for each individual item is compared to the Engineer's Estimate for these items. Major deviations are noted and irregularities are researched.

The estimator must make many assumptions from the source of materials, to the likely method of construction and the production rates. All of these factors vary from bidder to bidder. Bidders take into account factors known only to the bidder. These factors can include:

- Amount of work already under contract, and how much more work can be handled
- Anticipated future supply of work
- Amount of work that would have to be sub-contracted to DBE or other firms
- Methods chosen to prosecute the work
- Production rates
- Equipment already owned, or that would have to be leased or purchased for that particular job
- Labor rates, union/non-union work agreements
- Proximity of the labor force, equipment, and materials to the project
- Source and availability of materials, and who controls that source
- Costs to mobilize to the project site, including insurance and bonding
- Overhead costs, current financial status, and needed profit
- Anticipated competition
- Speculation on future contiguous projects

As an example, when bids are analyzed it may become apparent that because of the low bidder's location, a materials source different than that assumed by the estimator will be used, and this may explain the variance in price. Besides differences between assumed and real values, there are other reasons why a bid varies from the estimate including:

- Anticipated errors to or changes in the plans
- Anticipated contract administration practices contrary to bidding documents
- Mistakes on contractor's bid
- Collusion among bidders

The only items within MoDOT's control are the quality of the bidding documents and uniformity of contract administration. Collusion detection is currently the responsibility of MoDOT's Audit and Business Analysis Division and the Office of Inspector General.

**1-02.15 RECOMMENDATION FOR AWARD OR REJECTION OF BIDS.** After a thorough review of the bids, the estimators meet with the State Design Engineer to discuss any bid problems and pass on their recommendations for project awards. Next, the State Design Engineer takes the bid information to a meeting of functional unit leaders and senior managers where the final recommendation for award or rejection of the project is decided. This recommendation is presented to the Commission at its monthly meeting, generally one to two weeks following the construction bid opening.

Commissioners are provided with all pertinent information from the bid opening including the Engineer's Estimate. After the recommendations are presented the commissioners vote whether to award or reject individual projects. Generally, only projects that exceed the Engineer's Estimate by more than a certain percentage are rejected. If the low bid is significantly higher than the Engineer's Estimate the estimating staff may contact the bidders, between the time of bid opening and the Commission Meeting, to determine if all cost driving factors were considered in the Engineer's Estimate. Specific prices are not negotiated but the project environment such as material availability, safety concerns and site conditions are discussed. Department staff will recommend award of an apparently excessive bid if justification for award is found due to factors that were not originally considered in the Engineer's Estimate. This justification is used to defend the project's bid price to the Commission. The Commission reserves the right to award or reject any or all bids.

In some cases, a follow-up meeting with the low bidder is held on projects that are rejected. The meeting involves GHQ estimators, district staff, and the contractor discussing any items that were bid excessively or ways to improve

the constructability of the project. These ideas are then incorporated into the plans for the next time bids are received on the project.