Criteria | Corporates | Project Finance:

Key Credit Factors For Road, Bridge, And Tunnel Project Financings

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*(**Editor's Note:** This article has been superseded by "Sector-Specific Project Finance Rating Methodology," published Dec. 14, 2022, except in jurisdictions that require local registration.)*

1. These criteria present S&P Global Ratings' methodology and assumptions for its Key Credit Factors (KCF) for rating road, bridge, and tunnel project financings.

2. This paragraph has been deleted.

SCOPE OF THE CRITERIA

3. These criteria apply to road, bridge, and tunnel project financings whose revenues come from real toll, "shadow" toll, or availability payments. Roads, bridges, and tunnels set up as non-profit public authorities continue to be rated under "Governments: Toll Road And Bridge Revenue Bonds In The U.S. And Canada," published Feb. 25, 2014.

SUMMARY OF THE CRITERIA

4. These criteria specify the key credit factors relevant to analyzing the construction phase stand-alone credit profile (SACP) and the operations phase SACP for road, bridge, and tunnel projects, which we rate in accordance with "Project Finance Construction Methodology," published Nov. 15, 2013, and "Project Finance Operations Methodology" published Sept. 16, 2014. For simplicity, this article uses the word "road" instead of "road, bridge, or tunnel." Where relevant, any references to "road" should be construed as also applying to bridges and tunnels.

5. As indicated in tables 1 and 2, factors marked with an "X" in the "key credit factor" column provide additional guidance on the sections of the construction phase criteria and the operations phase criteria. For factors not marked with an "X" in the "key credit factor" column, only the information provided in the construction phase criteria and the operations phase criteria apply. This KCF also provides assumptions for determining our base and downside cases specific to road projects.

Table 1

Road Construction Phase: Areas Of Additional Guidance

	Where assessed	
Factors	**Construction phase criteria**	**Key credit factor**
A. Construction phase business assessment		
1. Technology and design risk		
a) Technological risk		
i) Technology track record in this application	X	X
ii) Technology performance match to contract requirements and expectations	X	X
b) Design cost variation risk		
i) Degree of design completion and costing	X	
ii) Design complexity	X	X
2. Construction risk		
a) Construction difficulty	X	X
b) Delivery method		
i) Contractor experience	X	
ii) Degree of contract risk transfer	X	
3. Project management	X	
4. Adjusting the preliminary construction phase business assessment	X	
B. Financial risk adjustment		
1. Funding adequacy (uses of funds)	X	X
2. Construction funding (sources of funds)	X	X
C. Construction phase SACP	X	
1. Construction counterparty adjustment	X	
D. Other factors	X	

SACP--Stand-alone credit profile.

Table 2

Road Operations Phase: Areas Of Additional Guidance

	Where assessed	
Factors	**Operations phase criteria**	**Key credit factor**
A. Operations phase business assessment		
1. Performance risk		
a) Asset class operations stability	X	X
b) Project-specific contractual terms and risk attributes	X	
- Performance redundancy	X	
- Operating leverage	X	
- O&M management	X	

Table 2

Road Operations Phase: Areas Of Additional Guidance (cont.)

	Where assessed	
Factors	**Operations phase criteria**	**Key credit factor**
- Technological performance	X	
- Other operational risk factors	X	
c) Performance standards	X	
d) Resource and raw material risk	X	
2. Market risk		
a) Market exposure (including base-case guidance)	X	X
b) Competitive position	X	X
3. Country risk	X	
B. Determining the operations phase SACP		
1. Preliminary operations phase SACP (including base-case guidance)	X	X
2. Adjusted preliminary operations phase SACP		
a) Downside analysis	X	X
b) Debt structure (and forecast avg. DSCRs)	X	
c) Liquidity	X	X
d) Refinance risk	X	
e) SACPs in the 'ccc' or 'cc' categories	X	
3. Final adjustments to arrive at the operations phase SACP	X	
a) Comparable ratings analysis	X	
b) Counterparty rating adjustments	X	

O&M--Operations and maintenance. SACP--Stand-alone credit profile. DSCR--Debt service coverage ratio.

6. [This paragraph has been deleted.]

7. The information in this paragraph has been moved to the Appendix.

METHODOLOGY

Part I: Construction Phase SACP

A. Technology And Design Risk

8. The key challenges in building a road project mainly relate to design considerations and construction techniques. Technologies that are used for the asset itself (rather than its construction) have not materially changed over the years and, as such, we believe that road projects typically have limited exposure to technology. For most assets in the sector, the main technology risks include:

- Road surface (e.g., asphalt);
- Structural integrity;
- Drainage;
- Traffic-management systems;
- Ventilation and other mechanical systems (mainly for tunnels);
- Tolling systems; and
- Noise control.

1) Technology track record in this application

9. Regarding construction of road projects, advances in technology are mainly linked to construction techniques. For example, the introduction of boring machines revolutionized tunnel building, but the result--the tunnel--has not changed significantly in the past 30 years. The only significant change concerns tolling and traffic-management systems, with the introduction of free-flow tolling systems (using electronic tags rather than manned toll booths) and satellite tracking systems.

10. In most road-building cases, we typically assign a "commercially proven" assessment because construction contractors have used many of the technologies for road infrastructure in their current form for at least 15 years and significant data are available regarding their expected performance. This type of technology typically includes simple tolling equipment that relies on electronic tags that predetermine the price that users pay.

11. We assign an assessment of "proven" or "proven but not in this application or arrangement" if the project uses certain technologies that do not have a long track record of performance under a wide range of operating conditions. The election of either of these two assessments largely stems from the technology's expected life and how frequently that technology is replaced. For example, we are likely to assess latest-generation pavements with high drainage performance but limited operating data as "proven" if the project assumes that the road will be resurfaced every five years. In this case, a faster-than-expected deterioration will likely result in only a marginally compressed replacement frequency compared with our base case. However, we assign an assessment of "proven but not in this application or arrangement" if the project assumes no or limited replacement.

12. Complex electronic tolling systems that rely solely on license plate recognition or dynamic toll rates (where the toll that users pay is a function of traffic conditions) are likely to receive an assessment of "proven" or, in cases of significant project-specific requirements, "proven but not in this application or arrangement." The assessment of a tolling system is ultimately driven by the extent to which "off-the-shelf" systems are being used and assembled and to what degree the system needs to be tailored to the project.

13. New or unproven technology is rarely seen in road projects. However, because we adopt a weak-link approach to assessing technology risk, we assess an application to be "new or unproven" if a critical system has not been tested in an operational environment similar to one in which the project operates.

2) Technology performance match to contract requirements and expectations

14. In most cases, we assign an assessment of "matches all" if a sponsor's project bid sets out how its

technical proposals meet the contracted output requirements. The contracting authority evaluates each bid to confirm whether it fully meets the contract requirements; any deviation is generally a condition for the contracting authority to accept the offer. However, in limited circumstances, an assessment of "falls short of minor" or "exceeds" may apply under these criteria, as outlined in paragraphs 15 and 18 below, respectively. It is unlikely that we will assess a technology as "falls short of material" in this asset class, given the limited exposure to technology risk and the contracting authority's significant oversight before contract execution.

15. We assess the technology performance match to contract requirements as "falls short of minor" in cases when the project will not fully meet the contractual requirements in abnormal conditions. This could include speed restrictions during inclement weather (e.g., high wind or heavy snow) or on certain types of vehicles with heavy loads, unless allowed under the concession agreement.

16. Where a contract requires a road to consistently operate at a level below its design capacity, we assign an assessment of "matches all" even if the contract requires that additional lanes be built in the future, provided that adequate provisions are made (in terms of time and costs) in our base-case forecast and these additional lanes can be built (i.e., the land corridor set aside for the project can accommodate these lanes).

17. We believe that an assessment of "falls short of material" is unlikely under these criteria unless the technology falls short of some material contract or performance expectation. This could include building a project in an area with high seismic activity that would likely sustain significant damage--and face extended closures--if an earthquake occurs of a magnitude previously seen in the area, unless the project does not bear that risk. This could also be the case if the traffic forecast is such that the road could not operate at the flow rates (i.e., the number of cars travelling in each lane over an hour) required under the contract. In cases where the road may not meet the contractually required flow rates in materially higher-than-forecast traffic and for a limited time period, we are likely to assess the project as "falls short of minor."

18. An assessment of "exceeds" requires that the contractor design the project with technologies exceeding each contractual requirement. Although this could be the case in certain circumstances (e.g., when a project elects to run a section of the road undercover to avoid noise pollution when keeping the road section in open air and using walls could achieve the same result), we expect this to remain the exception under these criteria given the likely significantly higher capital cost of implementing solutions that exceed the contract requirements.

19. We assess the technology performance match to contract requirements and expectations using a weak-link approach, whereby we assess each technology separately and the assessment of the project will be equal to that of the weakest technology.

3) Design complexity

20. Road designs are unique by nature in that they are typically tailored to and cannot be dissociated from the landscape, as well as the ground and soil conditions, on which the road is built. However, given the extensive range of cost and building performance data that are often available globally, an appropriate degree of certainty exists regarding how the roads are likely to perform once they are properly built and operational.

21. Many project grantors retain certain risks where it is difficult to quantify the likelihood of such risks materializing and their potential impact. For example, this could cover risks such as archaeological findings or native title claims. In these cases, we assign the "design complexity" assessment after excluding those risks that such contractual mitigants cover.

22. The main drivers that we believe can affect a road's design complexity are:

- Quality-of-site surveys: Inadequate site surveys can create uncertainty. Also, our experience shows that one of the key drivers of construction delays and cost overruns are unforeseen ground and subsurface conditions. Typically, a high correlation exists between cost overruns and insufficient/poor subsurface investigations. Site surveys, including extensive drilling exploration holes and seismic mapping, are also critical in building tunnels.
- Soil and ground conditions: Soil and ground with a limited ability to support structural loads or that suffer from poor drainage, in our experience, are typically more prone to significant design variations.
- Environmental conditions: This includes contamination and archaeological findings, which may also delay construction and increase costs.
- Utilities: Sites that have a large number of utility services, such as power, gas, or water lines, may restrict working conditions and increase the risk of cable strikes, which can delay construction. Sites with limited records of utilities services are particularly exposed to this risk.
- Site congestion: Roads in congested areas can be more susceptible to utility relocation and latent conditions. Furthermore, site access can become a problem in that obtaining construction approval from local authorities can be more challenging and social opposition more likely, both of which can delay construction and increase costs. To avoid doubt, we include in this section the effect of site congestion on the design complexity. If material, we will factor the execution difficulty associated with construction in congested sites into the "construction difficulty" assessment.
- Upgrade work: This can create uncertainty in terms of any effect on the upgraded road's construction time and cost schedule because the existing road's or structure's condition may also be uncertain. The upgraded pavement's or structure's long-term performance may also be less certain than for new construction work. Key considerations in determining the level of risks involved in such work include the degree of risks retained by the contracting authority and detailed knowledge of the pavement and structures to be upgraded (e.g., structural drawings).

23. We assess these factors to determine the design complexity as follows:

- "Proven design." This applies when the design and construction sequencing does not require any material modification from that of similar roads. In addition, only minor modifications are required to account for site conditions and limited upgrade works. The road also displays no particular interfaces, with all of them being carried out in parallel, and have good soil and ground conditions. An example includes greenfield roads with no complex structures on relatively flat terrain.
- "Modified proven design." This is generally a road with a straightforward design that the construction contractor has tailored to meet specific site conditions. Most roads typically receive this assessment because they are tailored to and cannot be dissociated from the ground and soil conditions on which they are built.
- "Established design modified for site conditions." We assign this assessment to complex road designs that require significant tailoring to meet site requirements and ground conditions or roads with extensive structural upgrades. An example is a complex tunnel in an urban area, which needs to address the presence of existing utility services and building foundations.
- "Simple first of a kind" and "complex first of a kind." We are unlikely to assign these assessments to road projects because the facility's linearity normally allows for construction tasks running in parallel, rather than sequentially. This assessment potentially applies to long tunnels or bridges that require a design that specifically addresses the challenges of that

particular project. The assessment of "simple first of a kind" or "complex first of a kind" is then typically driven by site conditions (e.g., we are likely to assess the construction of a long tunnel in an area of high seismic activity as "complex first of a kind").

B. Construction Risk

1) Construction difficulty

24. Our assessment of "construction difficulty" focuses not only on the relative difficulty of construction tasks, but also on construction techniques. As such, two identical bridge projects could receive a different assessment if one uses well-known and understood techniques and the other uses state-of-the-art processes that could significantly reduce the construction phase's length, but that are inherently more risky given their lack of a track record. In this example, we are likely to assess the first project as a "civil or heavy engineering task" and the second as a "heavy engineering to industrial task." Our approach adopts a weak-link methodology. As such, the assessment reflects the most difficult component of the works--even in situations where the most complex part of the works reflects only a small component of the overall capital cost.

25. For most roads with few bridges or underpasses, we assess the construction difficulty as either a "moderately complex building or simple civil engineering task" or a "civil or heavy engineering task." We differentiate between these assessments based on several factors, such as topography (the flatter the ground, the easier to build), location (rural locations are easier to build on than urban ones), and site congestion (the presence of existing traffic).

26. We start our assessment for tunnels and bridges at a "heavy engineering to industrial task" and we move up or down one category based on similar factors, as listed in paragraph 25. Examples of projects that we assess as a "civil or heavy engineering task" include tunnels that are being duplicated (the site/ground condition will be known due to the presence of an existing tunnel) and short-span/low-height bridges in sheltered locations. At the other end of the scale, we are likely to assess long tunnels under residential areas/deep water (and the associated risks of collapse) or long-spanning bridges built in demanding weather or site conditions as an "industrial task complex building task."

27. Assessments of "simple building task" are rare in road projects unless the project includes the construction of a road on relatively flat terrain with simple bridges and underpasses, such as simply supported structures over a single or dual carriageway, and ground condition risks are considerably lower than other projects (either because the project does not bear the risk or available data are comprehensive).

C. Financial Risk Adjustment

1) Construction base case

28. Most road projects typically use engineering, procurement, and construction (EPC) contracts to mitigate construction costs and delay risk. Furthermore, risks that are not typically transferred to the project, such as force majeure risk or delays in achieving planning permission, are in many cases retained by the public sector concession grantor. Projects may also be exposed to delay due to variations that are agreed to during the construction process. If the concession agreement does not adequately mitigate the risk of cost increases or delays, then we may make provisions for

these risks in our base case.

29. In rare circumstances where a project does not use fixed-price contracts and it undertakes construction on a "cost-plus" basis or uses a schedule of rates, we use, for determining our base case, information that the project and its contractors provide and supplement it with data gathered from similar projects in the sector.

2) Construction downside case

30. A primary risk exposure for a road project is the failure and subsequent timely replacement of the project's building contractor. We calculate the forecast costs for replacing the contractor according to our "Project Finance Construction And Operations Counterparty Methodology," published Dec. 20, 2011 although our downside scenario may also include additional allowances to replace a replaceable builder not already covered under that analysis (see paragraph 76 of "Project Finance Construction Methodology," Nov. 15, 2013). In cases where our issuer credit rating or credit estimate on the construction contractor is equal to or higher than the construction phase SACP before counterparty adjustment, the construction phase SACP will not be weak-linked to the construction counterparties. As a result, the available liquidity can be allocated entirely to fund the downside scenario or we will complete a counterparty dependency assessment for the contractor.

31. Factors that could increase the EPC contract price, which we include in the construction downside case, may include the residual risks to a project--where the project retains the risks--after any contractual mitigants due to delays or cost increases due to variations, planning consents, ground contamination, or delays and cost increases linked to land acquisition. We also assess potential delays related to inclement weather against provisions that have been incorporated into the construction program. Our downside scenario may incorporate further weather-related delays if the weather-related time contingency allowance is sized based on mild to normal weather conditions with no additional buffer.

32. The construction downside cost scenario includes our assessment of likely cost increases or a revenue shortfall as follows:

- Project operating costs, including project salary allowances, office availability, insurances, and additional lender-related costs (e.g., increased monitoring fees, higher margins, etc.);
- Operations and maintenance costs incurred during construction, when the project takes over an existing road when the project starts;
- Toll revenues that the project collects during construction; and
- Additional costs that the project directly incurs in relation to risks that the construction contractor does not bear. This could include land-acquisition costs.

Part II: Operations Phase SACP

A. Asset Class Operations Stability

33. Operations stability varies across different road projects. In assessing the asset class operations stability for a road project, the following guidance applies under these criteria:

- We typically assess roads on relatively flat terrain with no bridges or tunnels as a '1' under the criteria. In those cases where it's difficult to forecast operating costs--for example, due to extreme weather conditions--or more complex operations, such as a managed lanes project, we typically assess such road projects as a '2'.

- Large-span bridges or tunnels typically receive a '3' or '4' if these same roads have above-average complexity or have associated lifecycle costs that prove difficult to forecast.

34. We assess a project's asset class operations stability using the weakest-link approach. For example, we typically assess a large-span bridge at the end of a long and flat road as a '3' or '4' despite the fact that we assess most of the project (by length) as a '1'.

B. Market Risk

1) Market exposure (including base-case guidance)

35. Under these criteria, when we assess market exposure, we base the projected decline in the cash flow available for debt service on our market downside case using the following key assumptions, which are correlated to the road's operating history:

- For roads with established traffic (defined as a road where recent traffic growth closely correlates with GDP, population growth, and employment), we generally assume an annualized traffic growth rate of 3% below our base case assumptions for two consecutive years, followed by a reduction of 1.5% below our base case growth assumptions for a subsequent three years. We then assume that traffic growth resumes in line with our base case thereafter.
- Table 3 shows an example of an annualized traffic growth rate in the base case and market downside case, assuming the market downside starts in Year 1.

Table 3

Traffic Growth

(%)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Base case	2.5	2.5	2	2	2	2
Market downside case	(0.5)	(0.5)	0.5	0.5	0.5	2

- With roads that mostly rely on commuter traffic (more correlated with population and employment), we adjust the magnitude of the stress applied to the initial two years in line with these factors (in particular, we consider a likely rise in unemployment and the effect on the related demographic during the period of our market downside). For managed lanes, we focus on total revenue and typically assume a longer period of no growth given their reliance on high levels of congestion on alternative free roads. As the rate of traffic growth along the corridor the project covers recovers to levels in line with growth before the downturn, the toll-free alternative road--rather than the managed lanes--will initially benefit. The reduction would generally be five years in duration and typically include a reduction of 5% to 15% for the initial two years, with a revenue drop being then halved for the subsequent three years (e.g., if an 8% drop was selected for the initial two years, revenue would go down by 4% against the base case in the next three years). The selection of the revenue decrease in the suggested range will take into account the characteristics of the road and its users, such as local wealth, employment, and prevalence of free alternatives in the corridor. For example, a managed lane project in an area of relative high wealth and low unemployment will likely perform more robustly in an economic downturn. For managed lane projects already in operation where we have more accurate data on traffic behavior, we may apply a lower stress in the project's early years to take into account some of the project's current strengths (e.g., such as a relatively low toll rate), we will revert to the above range in subsequent downside cycles (as described in paragraph 53) as reliance on historical data becomes less relevant.

- For greenfield roads and roads still in ramp-up, we generally assume an extension of the ramp-up phase by three to five years (except for managed lanes or congestion relievers that have extensive operating history) and a traffic level following the ramp-up phase of 10% to 20% lower than our base case. We also remove any induced traffic (defined as traffic that will not otherwise exist but for the new road, which typically comes from assumed residential, commercial, or industrial properties being developed on the back of the road's construction).

36. The extent of the traffic reduction for roads without established traffic is driven by the nature of the traffic (a higher level of commercial vehicles generally results in higher traffic volatility in an economic downturn, whereas a high level of commuter traffic shows better resilience) and the roads. Managed lanes and congestion relievers (which, by their nature, rely heavily on commuter traffic) are somewhat potentially more exposed to an economic downturn during their ramp-up because they are competing against free alternatives (generally co-located with the project) and they rely on heavy congestion during peak hours to gain pricing power. When unemployment is high and commuter traffic decreases, traffic on the competing free alternative will likely drop, creating capacity on that road that will be filled by commuters that will otherwise have used the project. This reduction in traffic will then remove that pricing power and lower tolls, compounding the effect on revenue. Therefore, we expect this type of project to have a more severe revenue drop than roads with limited competition when unemployment is high.

37. When assessing our market downside case, we reduce the level of stress applied to a "shadow" toll road, reflecting the lower exposure in an economic downturn (compared with a real toll road) because road users do not pay to use the road.

38. We assume that toll rates increase by the maximum allowed under contract except for countries or regions where the toll culture is not established or is uncertain, in which case we generally assume no toll increase for the initial two years of our downside case.

2) Competitive position

39. Road projects' capacity to attract vehicles from other roads and achieve expected traffic growth, in our view, generally depends on the road's rationale (i.e., the reason it was built), its competitiveness, and its user characteristics. We make an assessment of the project's "competitive position" (see tables 4 and 5). We assess a factor that does not match most of the descriptors for either "positive" or "negative" as "neutral."

Table 4

Competitive Position Factors

Competitive factor	Positive – "high predictability" attributes	Negative – low "predictability" attributes
Road rationale	Point of origin and destinations are linked to roads and their major economic or population centers	Point of origin and destinations are not linked to major economic or population centers
	Interurban radial facilities (e.g., a river crossing) with defined single-purpose traffic	The road represents a small proportion of the total end-to-end average journey and time saving is insignificant compared to alternative routes

Table 4

Competitive Position Factors (cont.)

Competitive factor	Positive – "high predictability" attributes	Negative – low "predictability" attributes
	The road represents a significant proportion of the total end-to-end average journey and time saving is significant compared to alternative routes	The road is a stand-alone facility with no link to any other major network
	The facility is part of a national or regional network	
Competitiveness (value proposition compared to competing facilities)	No, or bad-quality, alternative free routes	At least one alternative quality free route during peak usage periods, unless the alternative is heavily congested
	Time and operating cost savings are clear and significant	Time and operating cost savings are unclear or not significant and/or the time savings enjoyed while traveling on the facility may be eroded or eliminated at one or both termini ("hurry up and wait")
	No multimodal competition	Multimodal competition exists, with no clear value for money advantage provided by the road
	Roads have short and intuitive access from other road facilities	Roads have long and/or no intuitive access from other road facilities
	Track record and strong contracts ensuring passive protection (competing facilities will not be built or upgraded) and active protection involving government action (traffic-calming)	Track record of a lack of passive or active protection. Several layers of autonomous governments that may take conflicting actions, such as granting competing routes
Organic growth drivers	Developed, stable, and diversified local economy; high income per capita (more than $30,000); low unemployment; observed low, but stable, close correlation to GDP	Developing, volatile, and/or undiversified local economy; high unemployment; observed divergence between GDP and traffic growth
User characteristics	High reliance on commuters (more than 80%-90%) or single-journey purpose; low reliance on commercial vehicles (maximum 10%-15% of revenues); high-income, time-sensitive market; steady traffic profile through day and week	High recreational traffic and/or high reliance on commercial vehicles (more than 60% of revenues)
	Few clear dominant market segments constituting the bulk (more than 70%) of all trips	Multiple, atomized user segments (no group accounting for more than 50% of all trips)
	Key origins and destinations (more than 70% of all trips)	No clear market or a multitude of less-dominant origins and destinations
	Flat-demand profile (time of day, day of week)	High seasonal or peak demand profile, except for managed lanes
	Simple route-choice decision making and strong compliance with weight restrictions	Complicated route choice decision making and/or frequent overload of trucks

Table 5

Competitive Position Assessment

Competitive assessment	Typical characteristic
Strong	All four factors in table 4 are assessed as positive.

Table 5

Competitive Position Assessment (cont.)

Competitive assessment	Typical characteristic
Satisfactory	Two or more factors in table 4 are assessed as positive (with at least one of these positive assessments relating to road rationale or competitiveness) and the remaining factors are neutral.
Fair	Does not meet the requirements for strong, satisfactory, or weak.
Weak	At least two factors in table 4 are assessed as negative.

C. Preliminary Operations Phase SACP (Including Base-Case Guidance)

1) Traffic growth assumptions

40. S&P Global Ratings' base case for a road project varies depending on the road's maturity. Roads with established traffic have a good level of historical traffic data that we can reliably use to determine our base-case assumption. However, a greenfield road has no data and, in that case, we rely on a traffic forecast that an independent, reliable third-party expert prepares.

41. For roads with established traffic, we assume that the historical correlation among traffic growth and GDP, population, and employment continues. However, as traffic increases to the road's full capacity, we temper and eventually flatten our growth assumption. At that stage, revenue growth is solely driven by increases in the toll rate. In cases where we believe toll rates are high relative to the area's socio-economic levels, we may reduce the rate of revenue growth when we expect congestion increases as the road's economic value for the users diminishes.

42. When considering correlation among traffic growth and GDP, population, and employment, we do not seek to determine a specific formula linking all of these parameters. Instead, we rely on historical trends and compare variations of each variable. For example, if a road's historical annual traffic growth over 10 years has been consistently one to two percentage points less than GDP, we retain the same difference in our forecast. Similarly, if historical growth appears to be a function of population growth and GDP, we reflect those characteristics in our forecast.

43. For greenfield roads, we initially establish our base case using a third-party traffic forecast. To validate this forecast, we typically complete the following assessments of the traffic model and make the appropriate adjustments where required:

- Validation of the network model, assuming the road is not built. This process allows us to validate the traffic growth on existing roads with known traffic. Any significant growth on existing roads at rates significantly higher than historical traffic growth generally indicates issues with the base network model.
- Validation of historical induced traffic. This means looking at the network model from a past date to determine if the model's assumed induced traffic between that date and today correlates with actual induced traffic.
- Validation of the multipliers used to derive annual traffic. Traffic models that focus solely on morning peak usage, for example, will vary significantly because total traffic will be derived by applying multipliers to that morning peak level.
- Validation of the assumptions used that could result in material and sudden changes in traffic growth (i.e., when traffic grows a certain percentage every year but then suddenly jumps

significantly in one year). This could include assumptions about new large property developments adjacent to the road or the development of the road network in the project's vicinity. We typically discount these assumptions (or at least revise the timing for when those projects are completed) unless we have an appropriate degree of comfort about the validity of those assumptions. For example, we may include a new road that will feed additional traffic onto the project if there are clear government policies and public support, whereas we are likely to discount it if the project is highly uncertain.

- Review of the ramp-up assumptions: the traffic forecast typically seeks to establish the base traffic level from the point when traffic growth is driven primarily by GDP, demographics, and employment. To reflect the time it will take for users to become familiar with the new road, we factor in a time period (or ramp-up) when traffic will gradually increase to this consistent level. This transition period varies depending on the project's location and nature. For example, we expect a longer ramp-up for a project established in an area with few other toll roads (because users are not accustomed to paying for using roads) compared with a project that is expanding an existing toll road (because user knowledge and acceptance is already high). We use our experience on similar roads to ensure that the assumptions are appropriate given the project's characteristics.
- Validation of the extent to which another independent expert has reviewed the traffic forecast.
- Use of key macroeconomic assumptions (including inflation, GDP, employment, and population growth) and, where relevant, our assessment of the project's share of the corridor traffic.
- Review of the forecast outputs to ensure that the project can accommodate traffic growth. It is not uncommon to see forecasts assuming traffic levels that are beyond the road's capacity or peak commuting hours extending well beyond reasonable hours. This also includes a review of forecast traffic growth against actual growth on similar roads.

44. Once we establish our initial base-case traffic forecast, we adjust our traffic growth assumptions based on actual traffic data and revised macroeconomic assumptions.

45. Although a detailed traffic forecast is not critical for availability-based roads (because revenue paid to the project is not a function of the total number of users), we still seek to establish likely traffic levels given the implications on operations and maintenance costs, as well as lifecycle replacement.

2) Other assumptions

46. In addition to traffic forecasts, our base case reflects the other key assumptions that affect cash flows. They include: toll rates, operations and maintenance costs, lifecycle replacement costs, general administration costs, and, where relevant, revenue abatements for failure to comply with contract requirements (typical for availability-based road projects).

47. To establish forecast revenue, we assume that toll rates vary as permitted or imposed (if a toll rate reduction is required) under the concession agreement. To the extent toll rate increases are subject to a third party's approval, we may assume they will increase at intervals greater than allowed for countries or regions with no established toll culture or where we have concerns about timeliness of approval. We also assume a level of toll evasion in line with similar toll road facilities in the region.

48. We typically assume operations and maintenance costs, and lifecycle replacement costs in line with the sponsor's base case. We may, however, adjust the timing of lifecycle replacement so that it is in line with our traffic forecast (e.g., the traffic level significantly influences the resurfacing of

a road).

49. Projects that are exposed to revenue abatement/financial penalties for failure to comply with contractual requirements typically pass on this risk to the project's operations and maintenance operator. Accordingly, S&P Global Ratings' base case generally does not include deductions. However, we assess the impact of the operator's failure to meet its contracted service obligations and the consequences this could have under its contractual agreements. If an availability-based project is performing road operations itself, then S&P Global Ratings' base case includes expected deductions depending on the payment mechanism's terms.

50. Because some projects in this sector have long concessions (up to 99 years), we may have limited confidence in certain operating and traffic assumptions beyond a reasonable timeframe that will not be adequately mitigated through appropriate contractual protections. In this case, we limit the actual assumed project life even if it is shorter than the actual concession period. Typically, this means that we do not look beyond 40 years and assume that the project will not carry any debt beyond this date. As time passes, we maintain this 40-year window until such time it becomes constrained by the actual concession expiry date.

D. Adjusted Preliminary Operations Phase SACP

1) Downside analysis

51. S&P Global Ratings' downside case combines our market downside case with our operational downside assumptions and financial stresses linked to any refinancing, where relevant. We describe our market downside case assumptions in paragraphs 35-38.

52. Although we traditionally start the market downside case from the first year of our forecast, we may delay it by up to five years if our base-case forecast shows a release of cash reserves to equity during that period and the project's ramp-up is completed. In this circumstance, we start our market downside case in the year immediately following the cash release.

53. When establishing our downside case, we apply the operational downside assumptions for the project's life. We also apply the market downside case at regular intervals of typically 15 years, taking into account the timing of major asset replacement works and the concession's actual expiry (see paragraph 52 for the timing of the first market downside).

54. Unlike real estate projects, it is not uncommon for road projects to operate and maintain the road without recourse to long-term operations and maintenance contracts that do not transfer price and operational risks to a third party. This partly reflects the lower operating costs as a percentage of revenue compared with real estate projects--mature roads generally demonstrate high profitability, with an EBITDA margin often higher than 80%.

55. In our downside case, we assume moderate cost increases (typically 10% for operations and maintenance and lifecycle costs). We also increase the frequency of road resurfacing by reducing the length of time between two scheduled resurfacing dates by 12 months compared with our base-case forecast (although the timing also takes into account the lower traffic volumes our market downside case establishes). For example, if our base case assumes the first resurfacing at Year 10 and then every 10 years thereafter, our downside will assume the first resurfacing will occur at Year 9 and then every nine years after that. Structural changes in the market for the contracted services, economic conditions, contractor- or issue-specific factors, and projects in less-well-developed markets may prompt us to impose higher downside cost scenarios in the downside than specified above.

56. We also assume higher energy usage and prices (mainly relevant for tunnels) of typically 10%

(applied to both usage and price). Finally, we usually assume increases in project management costs of 5%.

57. For projects exposed to abatements (which typically is the case for availability-based roads), S&P Global Ratings' downside case generally includes deductions that reflect poor performance, as determined by the project's independent expert (if available) and our experience with the sector. We also rely, where relevant, on historical abatement levels and generally double those levels in our downside case.

58. The key operational downside assumptions highlighted above under these criteria represent the typical level of stress we apply to a project's cash flows. In certain cases, we increase the level of stress to reflect that our base-case assumptions may be subject to greater variability (e.g., a project required to maintain aging infrastructure that has been subject to a superficial condition survey warrants a higher lifecycle stress). Similarly, we adjust our energy usage and price stress for projects with larger-than-average mechanical and electrical systems given that the aging of those systems will reduce energy efficiency (e.g., this applies to long tunnels that typically have high energy requirements from ventilation systems compared with open-air roads).

2) Liquidity

59. Under these criteria, we expect road projects to have adequate fungible liquidity to fund debt service if traffic is temporarily disrupted. Some projects may be exposed to longer periods of cash flow disruptions caused by economic cycles and have little ability to adjust fixed costs. Such risks may be mitigated by higher-than-average liquidity. For example, greenfield toll roads, particularly managed lanes, have additional reserves available during the critical ramp-up period. These reserves are available to cushion a longer ramp-up, while the users become accustomed to using the facility until the project becomes stable. The additional reserves outside of the debt service reserve fund are available during the critical ramp-up period and throughout the debt's term to withstand the expected downturns in economic cycles and provide more resilience to the downside conditions. Although the absence of these reserves does not typically translate into a "less-than-adequate" liquidity assessment, they can lead to less-favorable results under our downside case.

60. Typically, we expect the aggregate of all fungible reserves available to support debt service to represent more than 12 months of debt service during ramp-up and until traffic growth becomes more stable and predictable. At this stage, a project can generally accommodate a reduction of the reserves to a level equivalent to at least six months of debt service, provided the project otherwise incorporates appropriate lock-up and release mechanisms to ensure that cash is trapped as required as traffic starts to deteriorate.

61. When considering the reserves available for debt service, we generally exclude any cash reserve or cash-trapping mechanism included in the project's structure that ensures sufficient cash resources are available to undertake large asset-replacement work. For example, we do not rely on gradual cash trapping to cover the cost of resurfacing, together with lost revenue while the work is being completed, as a debt service-dedicated reserve.

62. [This paragraph has been deleted.]

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REVISIONS AND UPDATES

This article was originally published on Sept. 16, 2014. These criteria became effective on the date of publication.

This article followed our Request for Comment, where S&P Global Ratings solicited public feedback to the proposed criteria "Request for Comment: Key Credit Factors For Road, Bridge, And Tunnel Project Financings," published Dec. 16, 2013. The comments we received contributed to changes that we included in these criteria and are outlined in the article "RFC Process Summary: Standard & Poor's Summarizes Request For Comment Process For New Project Finance Methodology," published Sept. 16, 2014.

This article was published to help market participants better understand the key credit factors in this sector and relates to our global project finance criteria (see "Project Finance Framework Methodology," published on Sept. 16, 2014) and to our criteria article "Principles Of Credit Ratings," published Feb. 16, 2011.

Changes introduced after original publication:

- On March 31, 2015, we added a section on a frequently asked question.
- Following our periodic review completed on Sept. 15, 2015, we updated criteria references and the contact list and deleted paragraphs 2, 6, and 7, which were related to the initial publication of our criteria and no longer relevant. We also clarified paragraph 35 to indicate that table 3 is an example of a traffic growth rate.
- On July 26, 2016, we clarified and updated the frequently asked question included in paragraphs 62-65 (formerly 62-66).
- Following our periodic review completed on Sept. 14, 2016, we updated the contact list.
- Following our periodic review completed on Sept. 11, 2017, we updated the contact list.
- On Sept. 27, 2019, we republished this criteria article to make nonmaterial changes. Specifically, we deleted paragraphs 62-65, which were superseded by "Methodology For Assessing Project Finance Debt Instruments With Deferrable Features, Such As Those Issued Under TIFIA," published Sept. 27, 2019. We also updated the contacts and the "Related Criteria" list.

RELATED CRITERIA AND RESEARCH

Related Criteria

- Methodology For Assessing Project Finance Debt Instruments With Deferrable Features, Such As Those Issued Under TIFIA, Sept. 27, 2019
- Project Finance: Project Finance Framework Methodology, Sept. 16, 2014
- Project Finance: Project Finance Transaction Structure Methodology, Sept. 16, 2014
- Project Finance: Project Finance Operations Methodology, Sept. 16, 2014
- Project Finance: Project Finance Construction Methodology, Nov. 15, 2013
- Project Finance Construction And Operations Counterparty Methodology, Dec. 20, 2011

- Principles Of Credit Ratings, Feb. 16, 2011

Related Research

- Credit FAQ: An Overview Of Standard & Poor’s Criteria For Assessing Project Finance Operating Risk, Sept. 16, 2014
- Credit FAQ: An Overview Of Standard & Poor’s Criteria For Assessing Project Finance Construction Risk, Dec. 16, 2013
- Credit FAQ: Provision Of Information For Assessing Project Finance Transactions, Dec. 16, 2013

These criteria represent the specific application of fundamental principles that define credit risk and ratings opinions. Their use is determined by issuer- or issue-specific attributes as well as Standard & Poor's Ratings Services' assessment of the credit and, if applicable, structural risks for a given issuer or issue credit rating. Methodology and assumptions may change from time to time as a result of market and economic conditions, issuer- or issue-specific factors, or new empirical evidence that would affect our credit judgment.

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